

Identifying Heterogeneous Bank Responses to US Monetary Policy Shocks

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Research Questions

How does bank liquidity affect bank responses to monetary policy shocks?

Specifically: Do banks' reactions to monetary policy shocks depend on their cash-liquidity levels?

- As the (broad) **bank lending channel** would predict

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- As the (broad) **bank lending channel** would predict

What is the role of the information effect of monetary policy announcements?

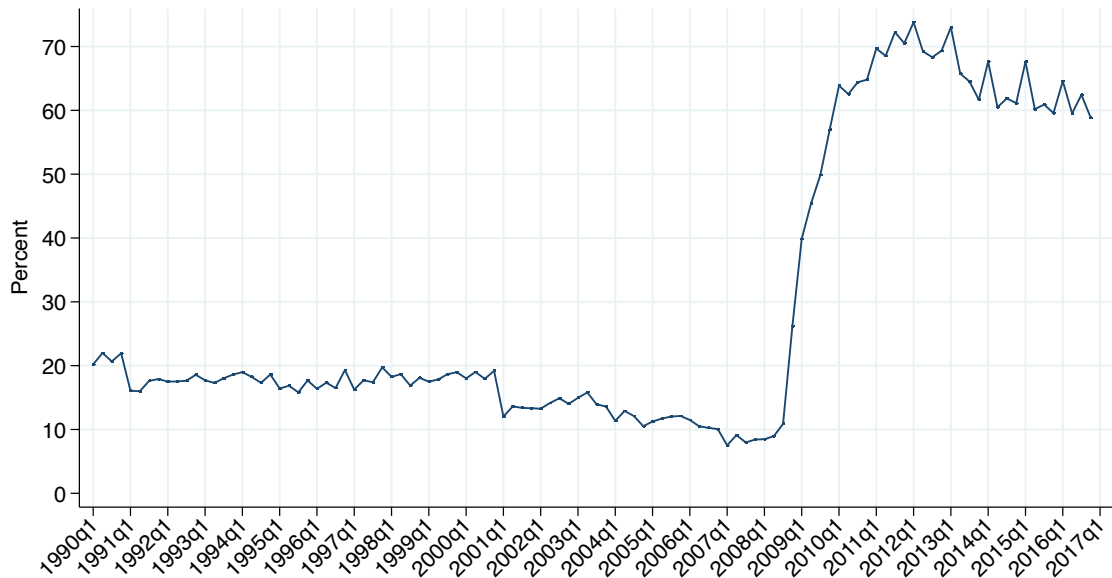
Specifically: How does the **information channel** of monetary policy influence banks' responses to monetary shocks?

Motivation

Under 1%

By Size

Share of **Cash-Liquid Banks** ($ER_t/TA_t > 1\%$) low and falling until GFC. LSAPs reverted this trend.



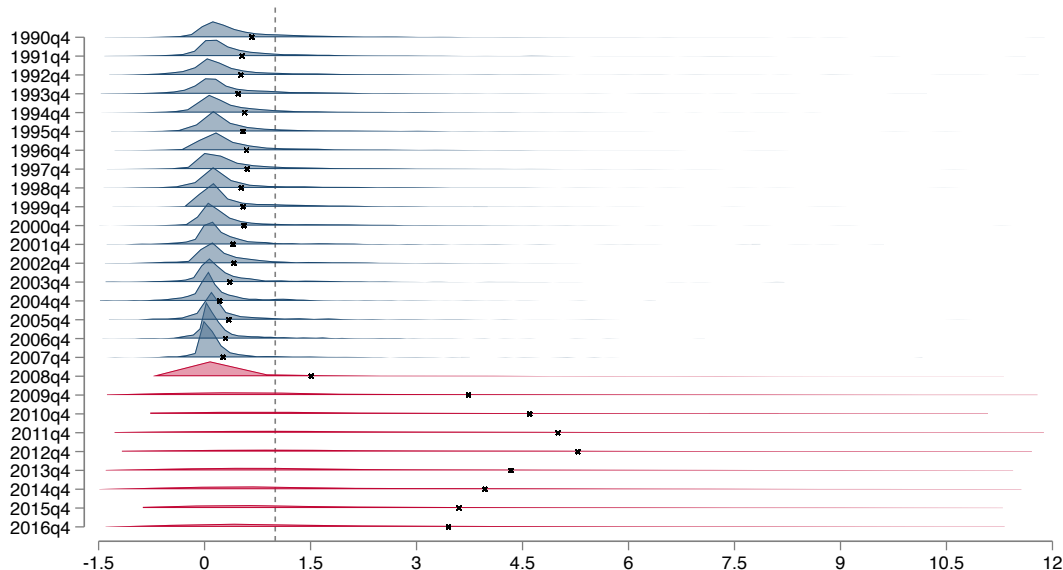
Motivation (cont.)

The ER_t/TA_t distribution “flattens out” after the introduction of LSAPs.

Q2-Dist.

Pre-GFC by Size

Post-GFC by Size



This Project

Analysis

- Effects of cash-liquidity on banks' dynamic responses to MP shocks
 - ▶ Focus on banks' credit supply
 - ▶ And whether MP shocks have symmetric effects

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Setup

- Construct informationally-robust monetary policy instruments (MPIs)
- Estimate dynamic responses using Local Projections Instrumental Variables (LP-IV) models

Preview of Results

Bank-Lending Channel (BLC)

Pre-GFC Sample:

- Active BLC & homogeneous bank responses
 - ▶ 100bp policy tightening → lending contraction of 3% after 12 quarters
 - ▶ Symmetric lending reactions (contractionary vs. expansionary shocks)

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Full Sample:

- Inactive BLC & heterogeneous bank responses
 - ▶ 100bp policy tightening:
 - ★ **liquid banks**: Credit supply increases by 12% after 10 quarters
 - ★ **illiquid banks**: Show a largely muted impulse response
 - ▶ Asymmetric lending reactions:
 - ★ **liquid banks**: React with a credit expansion after monetary expansion & after monetary contraction

Preview of Results

Information Channel

Fed Information Effect:

- Disregarding of the information effect leads to qualitatively different results
 - ▶ Using a high-frequency identified shock series, we find:
 - ★ MP Contraction: Weaker loan reduction for **illiquid banks**
 - ★ MP Expansion: Loan reduction for **liquid banks**
 - ▶ Results not in line with BLC

The (Broad) Bank-Lending Channel

The Fed can shift a bank's loan supply schedule since:

policy shocks \approx "funding costs shocks"

- Stylized balance sheet: $L_t + S_t = D_t + N_t - \varepsilon_t^{MP}$

- **Intuition** after a contractionary shock:

$$\underbrace{\varepsilon_t^{MP} \uparrow \rightarrow N_t \text{ constant} \ \& \ D_t \downarrow}_{\text{Liabilities} \downarrow} \rightarrow \underbrace{S_t \text{ constant} \ \& \ L_t \downarrow}_{\text{Assets} \downarrow} \rightarrow \text{Output} \downarrow$$

Data

- **MPIs:** Swanson (2021)'s HF Factors, and Fed's Greenbook
- **Balance Sheet** data: "Call Reports"
 - ▶ **Excess Reserves** information: Using and extending data set from Afonso et al. (2019)

Full Sample:

- 1990q1 - 2016q4 → 248k bank-quarter observations

Informationally-Robust MPI

à la Miranda-Agrippino & Ricco (2021, AEJ:Macro)

- 1 **High-frequency market based surprises in the FF4 around FOMC announcements** is projected on the Fed's Greenbook forecasts and forecast revisions for real output growth, inflation and the unemployment rate

$$FF4_m = \alpha_0 + \sum_{j=-1}^3 \theta_j F_m^{cb} x_{q+j} + \sum_{j=-1}^2 \varphi_j [F_m^{cb} x_{q+j} - F_{m-1}^{cb} x_{q+j}] + MPI_m^D. \quad (1)$$

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- 2 We aggregate the daily MPI_m^D to a monthly frequency MPI_t^M .
- 3 We **account for the slow absorption of information** by the agents by removing the autoregressive component in the monthly surprises

$$MPI_t^M = \phi_0 + \sum_{j=1}^{12} \phi_j MPI_{t-j}^M + MPI_t^N. \quad (2)$$

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- 4 Finally, aggregating the residuals of equation (2) to the quarterly frequency denotes our monetary policy instrument, MPI_t .

LP-IV Linear Model

The **dynamic average cumulative response** of the variable of interest z_t at horizon h is computed by **estimating the following panel regressions**

$$z_{i,t+h} - z_{i,t-1} = \alpha_{i,h} + \beta_h^{IV} \Delta r_t + \sum_{\ell=1}^L \Gamma_{h,\ell} X_{i,t-\ell} + \mu_{j,h} + \gamma_h t + \varepsilon_{i,t+h},$$

for $h = 0, 1, \dots, H$ and where

- Δr_t : change in EFFR, **instrumented by MPI_t** .
- $\alpha_{i,h}$ bank-fixed effects, $\mu_{j,h}$ region-fixed effects j , and t time trend.
- $X_{i,t}$: Controls
 - ▶ Bank controls: capitalization ratio, Securities/Total Assets, $z_{i,t-1}$
 - ▶ Macro controls: change in log GDP, unemployment rate, log IP and MPI_{t-1}

LP-IV State Dependent Model

The **share of excess reserves determines our two states** for **cash-liquid** and **cash-illiquid** banks. Let $\mathbb{1}_t = 1$ if $ER_t/TA_t < 1\%$, and $\mathbb{1}_t = 0$ otherwise.

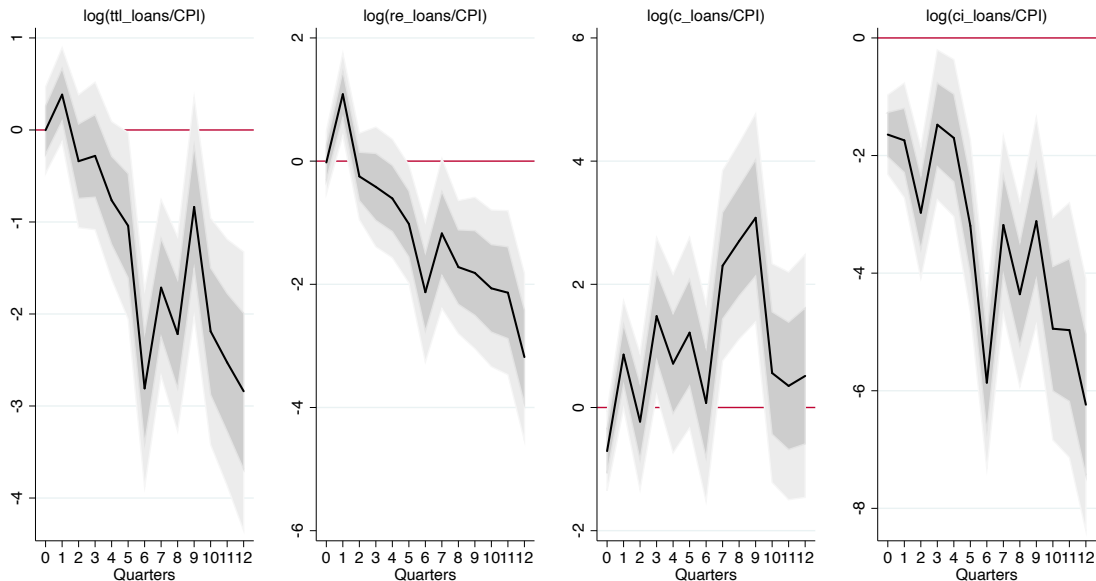
$$z_{i,t+h} - z_{i,t-1} = \alpha_{i,h}^R + \beta_h^{R,IV} \Delta r_t + \sum_{\ell=1}^L \Gamma_{h,\ell}^R X_{i,t-\ell} + \mu_{j,h}^R + \gamma_h^R t + \dots$$
$$\dots + \mathbb{1}_{t-1} \left[\alpha_{i,h}^B + \beta_h^{B,IV} \Delta r_t + \sum_{\ell=1}^L \Gamma_{h,\ell}^B X_{i,t-\ell} + \mu_{j,h}^B + \gamma_h^B t \right] + \varepsilon_{i,t+h},$$

for $h = 0, 1, \dots, H$ and where

- Δr_t : change in EFFR, **instrumented by** MPI_t .
- Coefficients $\{\beta_h^{R,IV}\}_{h=0}^H$ and $\{\beta_h^{R,IV} + \beta_h^{B,IV}\}_{h=0}^H$ trace out the response in the **liquid** (R:red) and **illiquid** (B:blue) state, respectively.

Active Bank-lending Channel, pre-GFC

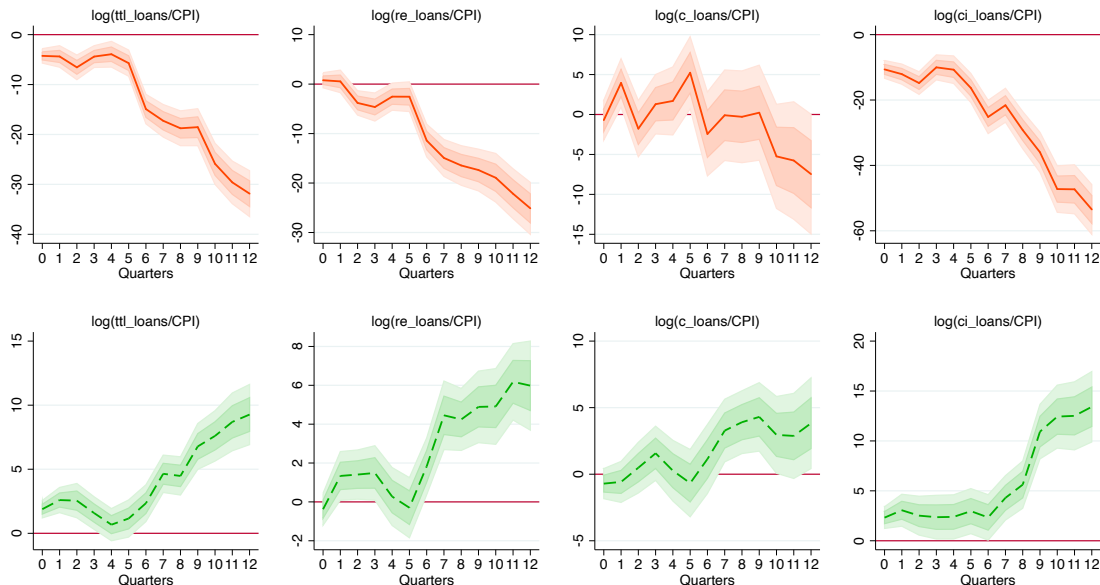
Cumulative Responses (in %) to a +100bp Shock (1990Q1-2007Q4) [More](#)



90% and 65% confidence bands

Symmetric Bank Responses, pre-GFC

Cumulative Responses (in %) to a 100bp Shock (1990Q1-2007Q4) [Details](#)



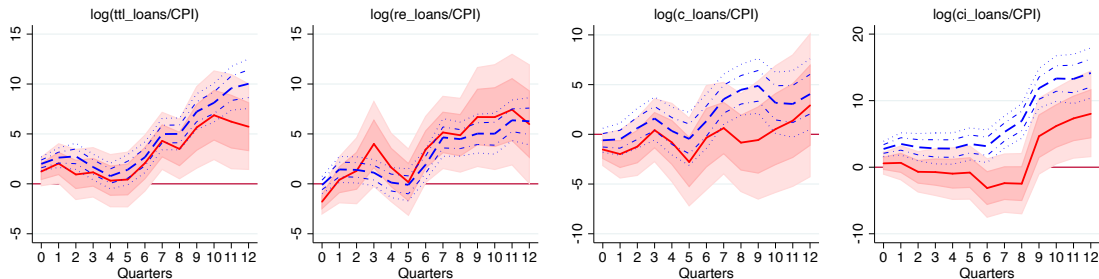
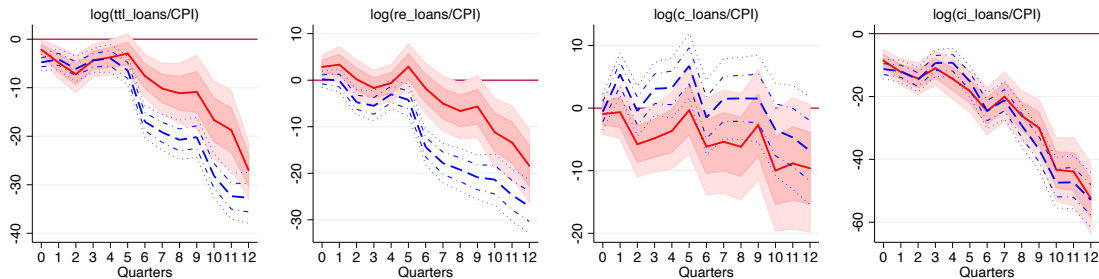
IRFs to contractionary (1st row) & expansionary (2nd row) shocks, with 90% and 65% confidence bands.

Homogeneous (and Symmetric) Bank Responses, pre-GFC

Cumulative Responses (in %) to a 100bp Shock (1990Q1-2007Q4)

Homogeneous IRFs

Details



IRFs to **contractionary (1st row)** & **expansionary (2nd row)** shock, for **Liquid (solid)** & **illiquid (dash)** banks, with 90% and 65% confidence bands.

Taking Stock: Pre-GFC Results

⇒ **Active Bank-lending channel**

- ▶ Linear model suggests the average bank reduces total lending by 3% after three years following a 100bp contractionary shock.

⇒ **Symmetric responses**

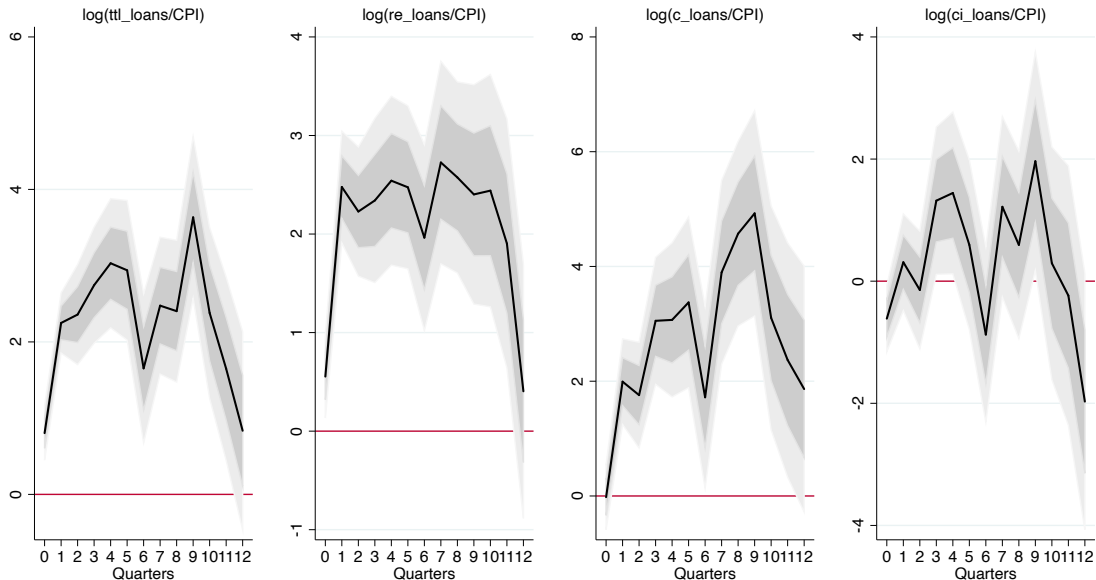
- ▶ To expansionary and contractionary shocks
- ▶ But **the latter** affects lending approximately three-times as much as the former shock.

⇒ **Homogeneous bank reactions**

- ▶ Similar reactions of **liquid** & **illiquid** banks

Inactive Bank-lending Channel

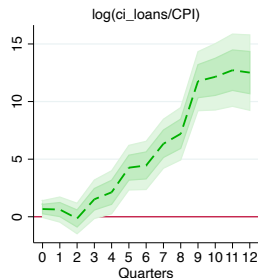
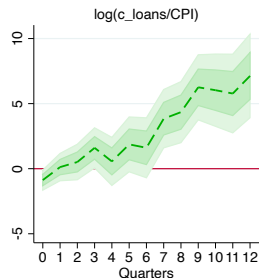
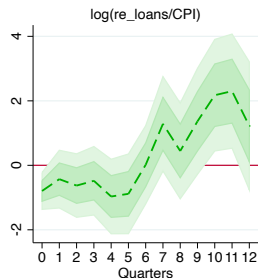
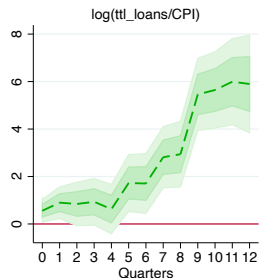
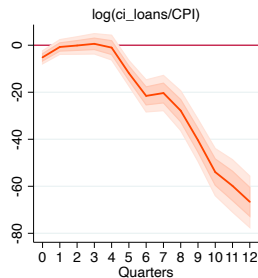
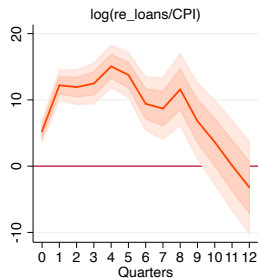
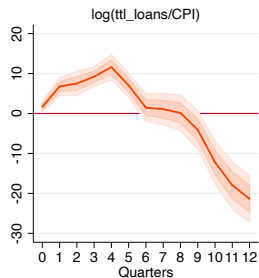
Cumulative Responses (in %) to a +100bp Shock (1990Q1-2016Q4) [More](#)



90% and 65% confidence bands

Asymmetric Bank Responses

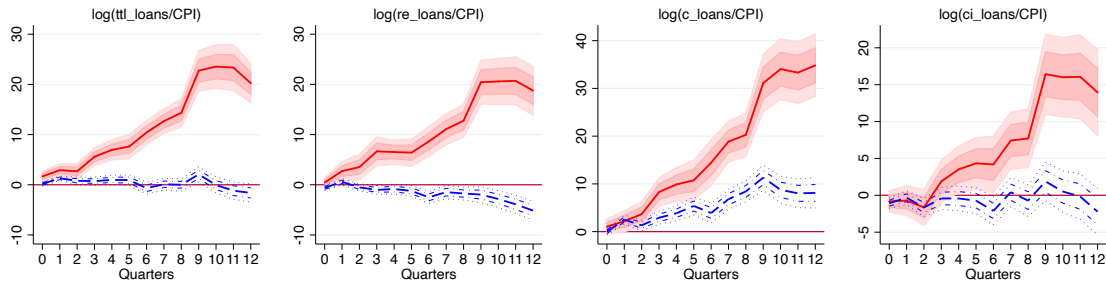
Cumulative Responses (in %) to a 100bp Shock (1990Q1-2016Q4) [Details](#)



IRFs to **contractionary** (1st row) & **expansionary** (2nd row) shocks, with 90% and 65% confidence bands.

Heterogeneous Bank Responses

Cumulative Responses (in %) to a 100bp Shock (1990Q1-2016Q4)



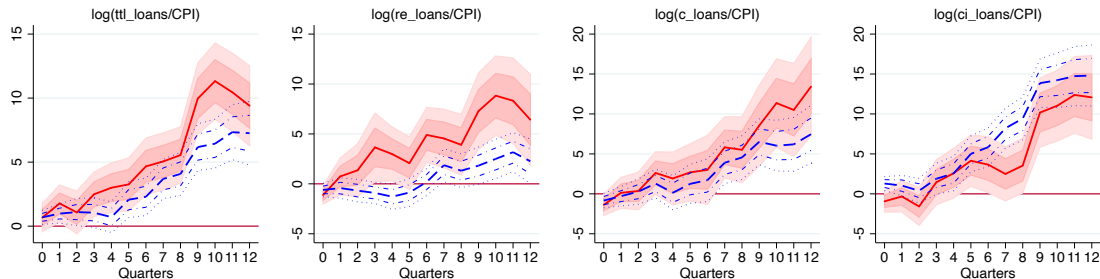
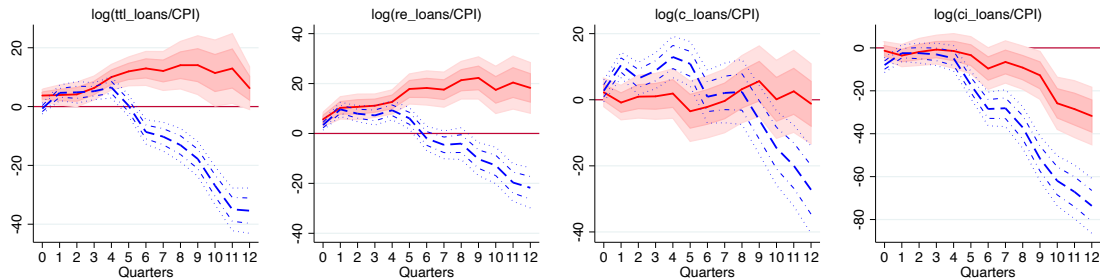
IRFs for **Liquid** (solid) & **illiquid** (dash) banks, with 90% and 65% confidence bands.

Heterogeneous (and Asymmetric) Bank Responses

Cumulative Responses (in %) to a 100bp Shock (1990Q1-2016Q4)

Heterogeneous IRFs

Details



IRFs to **contractionary** (1st row) & **expansionary** (2nd row) shock, for **Liquid** (solid) & **illiquid** (dash) banks, with 90% and 65% confidence bands.

Taking Stock: Full Sample Results

⇒ **Active Bank-lending channel**

- ▶ linear model suggests the average bank **increases** total lending by 3% after two years following a 100bp contractionary shock.

⇒ **Asymmetric responses**

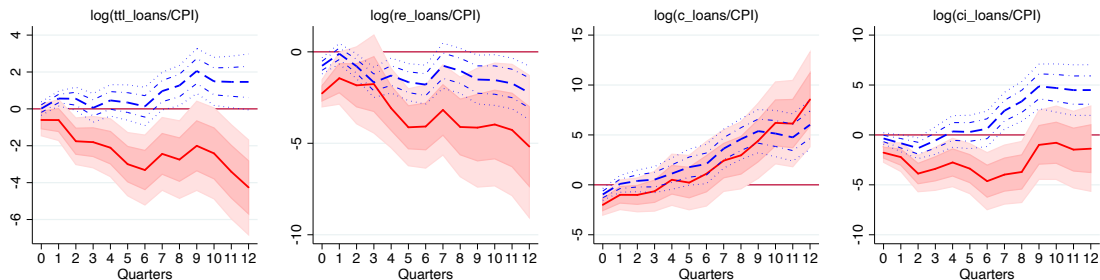
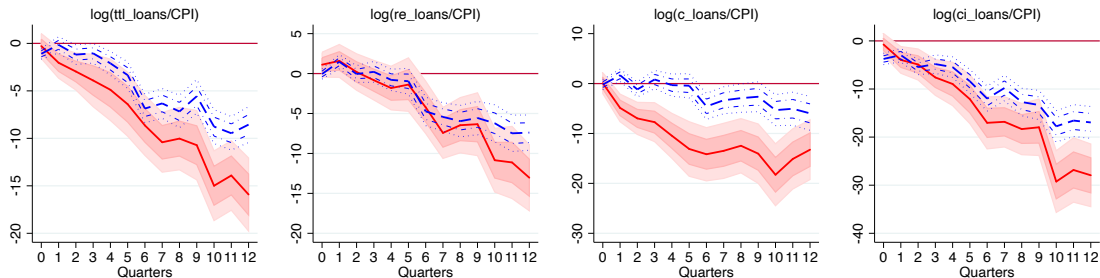
- ▶ To expansionary and contractionary shocks
- ▶ Again, **contractionary** shocks are (slightly) stronger

⇒ **Heterogeneous bank reactions**

- ▶ **Cash-illiquid** banks' responses still in line with an active bank-lending channel,
- ▶ **Cash-liquid** banks increase real estate (and, thus, total) lending after a monetary contraction.

The Fed's Information Effect on Bank Lending

Cumulative Responses (in %) to a 100bp Shock (1990Q1-2016Q4) 1990-2007



IRFs to **contractionary (1st row)** & **expansionary (2nd row)** shock, for **Liquid (solid)** & **illiquid (dash)** banks, with 90% and 65% confidence bands.

Robustness and Extensions

Samples:

- Alternative Pre-GFC (1990-2005)
- Post-GFC (2009Q1-2019Q3) vs. Pre-GFC (1994Q1-2007Q4) using BRW

Policy Dimensions:

- Conventional shock vs. Unconventional (forward guidance & LSAPs) shock
- Kitagawa-Blinder-Oaxaca Decomposition

Policy Indicator:

- One-Year Treasury Yield vs. Wu & Xia (2016)'s Short-term Shadow Rate

ER/TA Thresholds:

- Lower threshold $ER_t/TA_t < 0.5\%$ vs. Higher threshold $ER_t/TA_t < 2\%$

Lag Specifications:

- $L=1$ vs. $L=6$

HF-Shocks Time Aggregation:

- Smooth-Time Aggregation a la Ottonello & Winberry (2020)

Conclusion

⇒ Pre-GFC estimates

- ▶ Supporting evidence for an **active Bank-Lending Channel**
- ▶ **Homogeneous** responses across liquidity states
- ▶ **Symmetric** reactions to contractions & expansions

⇒ Full sample estimates

- ▶ Less support for BLC
- ▶ **Heterogeneous** responses, following an MP tightening:
 - ★ **liquid banks** → Real Estate & Total loans increase
 - ★ **liquid banks** → Real Estate & Total loans decrease
- ▶ **Asymmetric** reactions to contractions & expansions

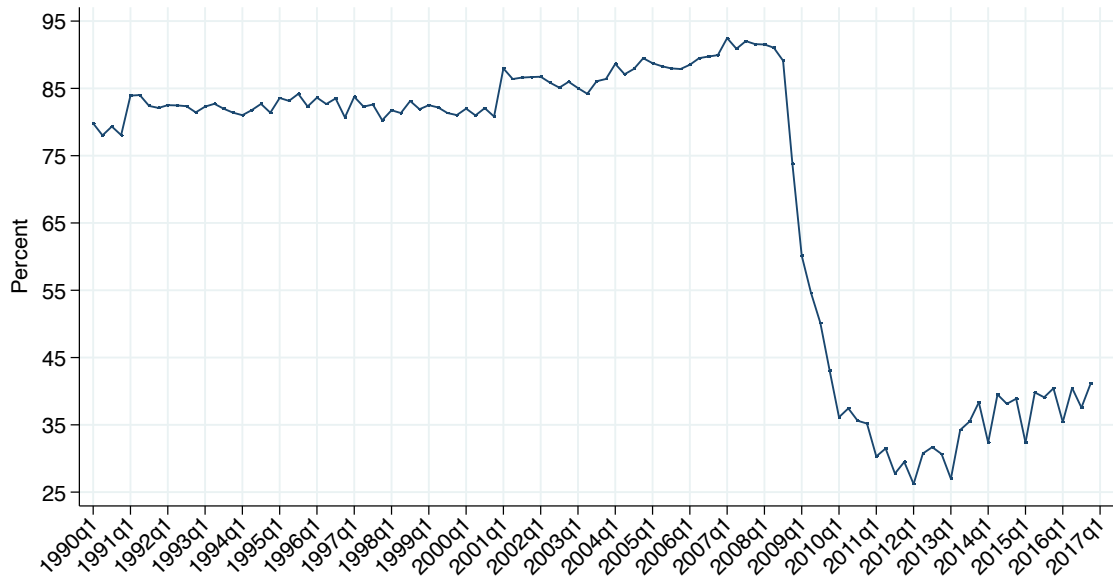
⇒ Information Effects

- ▶ Yield strong qualitative implications that cannot be ignored

Appendix

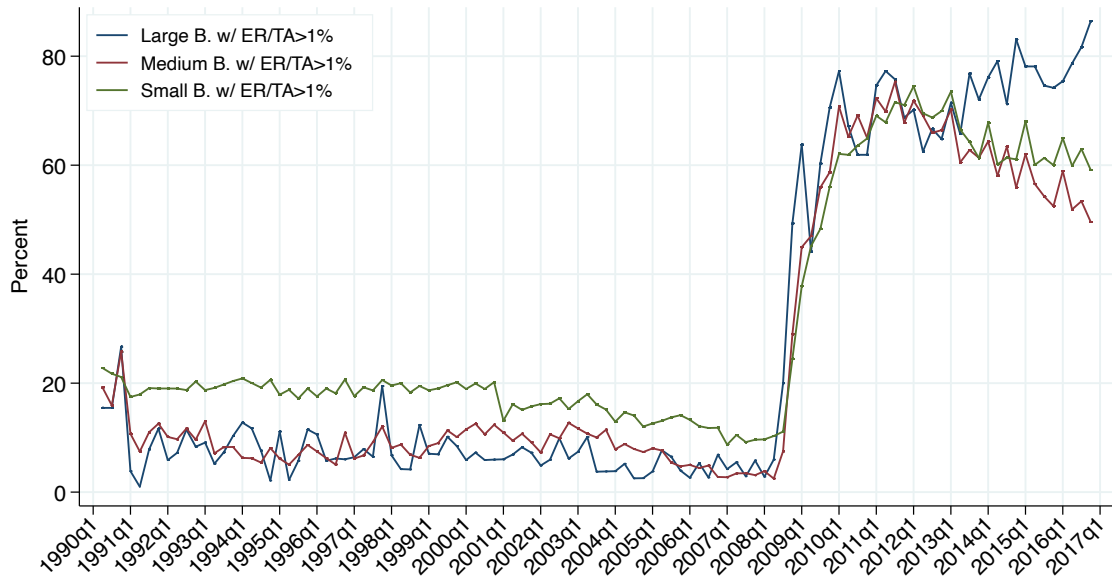
Motivation

Share of Cash-Illiquid Banks ($ER_t/TA_t \leq 1\%$) [Back to Main](#) [By Size](#)



Motivation

Share of **Cash-Liquid Banks** ($ER_t/TA_t > 1\%$) by Size Category [Back to Main](#) [Under 1%](#)

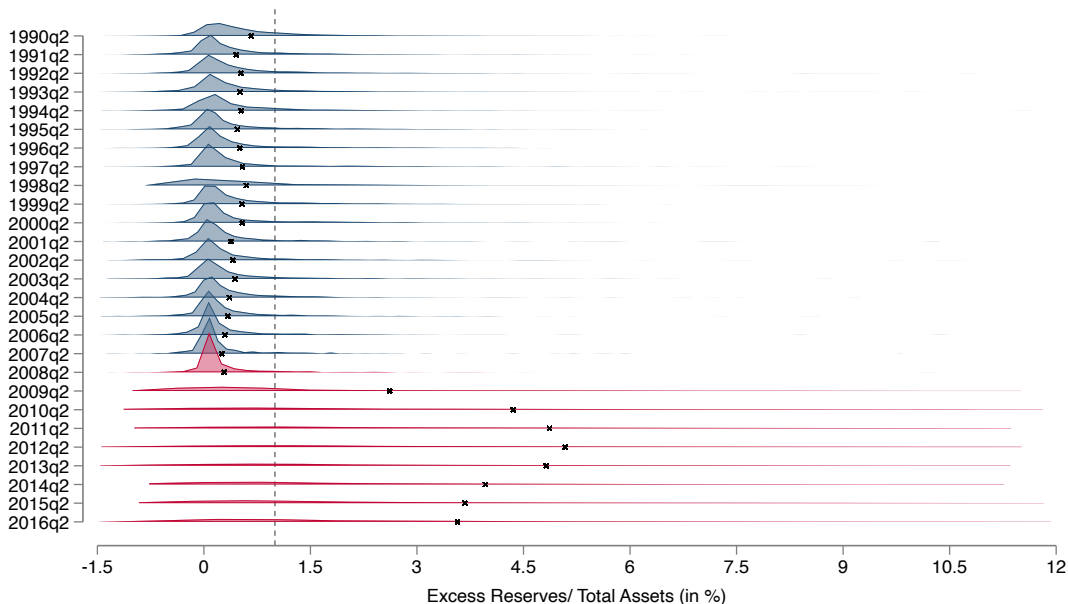


- We follow the approach from Afonso et al. (2019) to calculate bank-level excess reserves: $ER_t = TR_t - RR_t$.
- Total Reserve balances, TR_t , directly from item RCFD0090¹.
- Required reserve balances, RR_t , is defined as the difference between required reserves and vault cash.
 - ▶ Required reserves is obtained as an increasing function of a bank's net transaction accounts minus amounts due from other depository institutions and cash items in the process of collection.
 - ▶ "To calculate net transactions, we take from the Call item RCON2215 (the bank's "Total Transaction Accounts" (including "Total Demand Deposit" in domestic offices, which also includes ATS and NOW accounts)) to estimate total transaction accounts, and subtract from it our estimate of amounts due from other depository institutions (the sum of item RCFD0083 ("Balances due from depository institutions in the U.S.: U.S. branches and agencies of foreign banks (including their IBFs)") and RCFD0085 ("Balances due from depository institutions in the U.S.: Other depository institutions in the U.S. (including their IBFs)")) and cash in the process of collection, item RCON0020 ("Cash items in process of collection and unposted debit")."
 - ▶ Finally, required reserves are obtained using reserve requirement information from the Federal Reserve Board.

¹Afonso et al. (2019) limit their sample to banks that report this item, which considerably reduces the amount of observations in the Call Reports, since only banks with at least \$300 million in assets need to report this item.

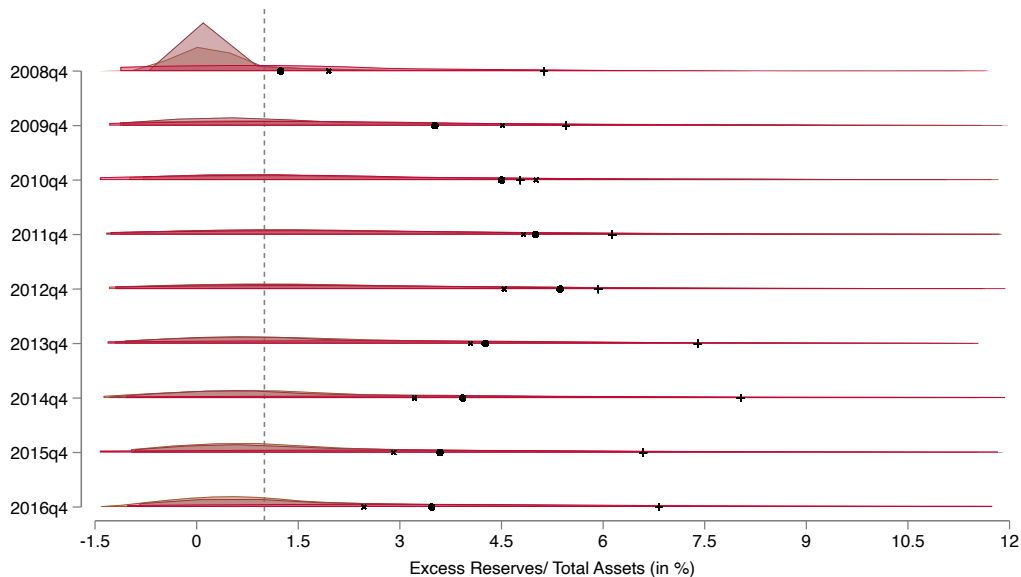
ER_t / TA_t Mid-year Distributions

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ER_t/TA_t Distributions by Size, post-GFC

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Large banks (top 1 percentile): Cranberry; Medium banks (95-99 percentiles): Sienna; Small banks (below 95 percentile): Maroon. Distribution's means are marked by "+" for large banks, by "x" for medium banks, and by "●" for small banks.

The Fed's Information Effect Details

Nakamura & Steinsson (2018, QJE)'s Test [Back to main](#)

The dependent variable $\Delta y_{t,t-1}$ is defined as:

$$\Delta y_{t,t-1} = \frac{gy_{t,q(t)+1} + gy_{t,q(t)+2} + gy_{t,q(t)+3}}{3} - \frac{gy_{t-1,q(t)+1} + gy_{t-1,q(t)+2} + gy_{t-1,q(t)+3}}{3}$$

Where $gy_{t,q(t)+j}$ denotes the average Blue Chip forecast made in month t about output growth for quarter $q(t) + j$. $q(t)$ refers to the quarter that month t belongs to. Accordingly, if t is March 2001, $q(t)$ is the first quarter of 2001, and the forecast for $q(t) + 1$ refers to the forecast for the second quarter of 2001.

In compact notation:

$$\Delta y_{t,t-1} = \bar{y}_{t,\bar{q}} - \bar{y}_{t-1,\bar{q}}$$

Hence, $\Delta y_{t,t-1}$ is defined as the change in the average forecasts between the current month, t , and the previous month, $t - 1$, for the averaged upcoming three quarters.

Responses of Interest Rates to the Monetary Policy Instrument

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	Instrumenting 1 Year Treasury Rate			Instrumenting EFRR		
	MPI (Total)	MPI (Conv.)	MPI (UMP)	MPI (Total)	MPI (Conv.)	MPI (UMP)
EFFR	0.667 (0.787)	0.536 (0.737)	7.807 (15.201)			
3M Treasury Yield	0.959 (0.257)	0.922 (0.253)	2.196 (2.674)	1.438 (1.523)	1.720 (2.180)	0.281 (0.238)
6M Treasury Yield	1.127 (0.146)	1.104 (0.137)	1.888 (1.858)	1.690 (1.817)	2.059 (2.647)	0.242 (0.229)
1Y Treasury Yield				1.499 (1.641)	1.865 (2.431)	0.128 (0.214)
2Y Treasury Yield	0.717 (0.174)	0.741 (0.164)	0.152 (1.680)	1.074 (1.201)	1.382 (1.820)	0.019 (0.270)
3Y Treasury Yield	0.713 (0.171)	0.751 (0.164)	-0.085 (2.047)	1.069 (1.207)	1.402 (1.855)	-0.011 (0.299)
5Y Treasury Yield	0.506 (0.214)	0.584 (0.191)	-1.248 (3.747)	0.759 (0.907)	1.090 (1.474)	-0.160 (0.369)
10Y Treasury Yield	0.169 (0.216)	0.233 (0.191)	-1.125 (3.460)	0.254 (0.487)	0.435 (0.730)	-0.160 (0.333)

Note: Results of separate 2SLS regressions of the dependent variables (left column) on the instrumented independent variable (columns 2-4: 1Y treasury rate, columns 5-6: EFRR), using the MPI. Robust standard errors in parentheses. Number of observations 176 meetings over the whole sample period.

Correlations of our MPIs with Other Shock Series

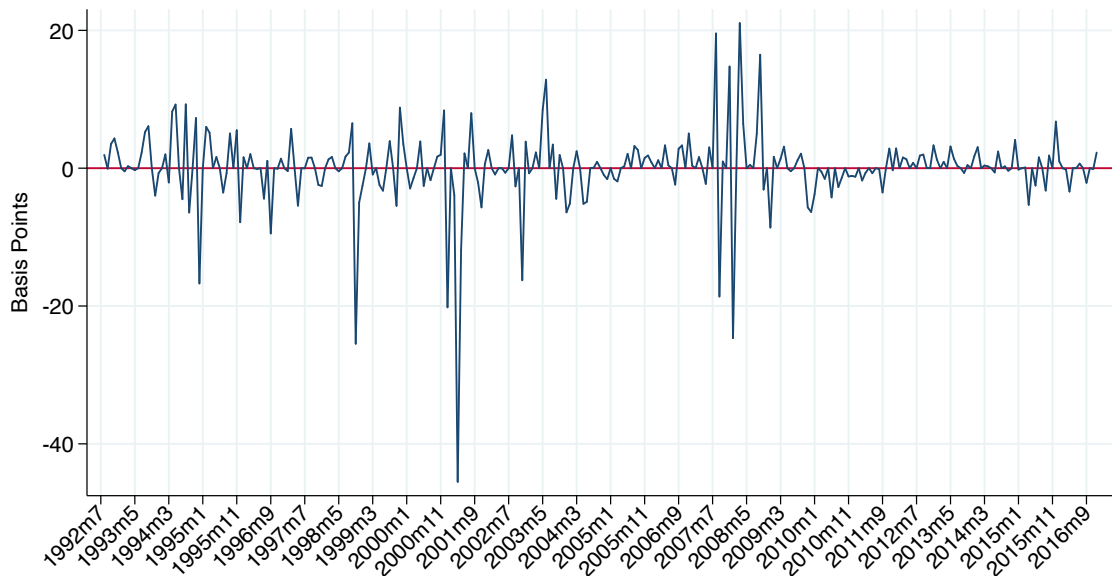
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	MPI (Total)		MPI (Conv.)		MPI (UMP)		Common Period
	Full	ZLB	Full	ZLB	Full	ZLB	
MPI MA-R	0.818	0.674	0.828	0.610	0.037	0.217	1992m8 - 2009m12
Swanson (Total)	0.915	0.695	0.891	0.626	0.209	0.290	1992m8 - 2016m12
FF4GK	0.502	0.356	0.485	0.368	0.154	0.058	1992m8 - 2012m6
MPS GSS	0.786	0.662	0.803	0.704	0.017	-0.047	1992m8 - 2012m6
BRW	0.221	0.171	0.228	0.183	-0.001	-0.004	1994m2 - 2016m12
NS 95	0.688	0.478	0.704	0.497	0.006	-0.003	1995m2 - 2014m3
NS FFR 95	0.839	0.579	0.852	0.586	0.013	-0.007	1995m2 - 2014m3
MPI (Total)	1	1					1992m8 - 2016m12
MPI (Conv.)	0.978	0.934	1	1			1992m8 - 2016m12
MPI (UMP)	0.219	0.339	0.016	-0.007	1	1	1992m8 - 2016m12

Note: **MPI MA-R** (Miranda-Agrippino & Ricco (2021)), **Swanson (Total)** ((Swanson (2021)), **FF4GK** (Gertler & Karadi (2015)), **MPS GSS** (Gürkaynak et al. (2005), extended series from the authors), **BRW** (Bu et al. (2021)), **NS 95** (Nakamura & Steinsson (2018)), **NS FFR 95** (first factor of Nakamura & Steinsson (2018)). Common Period refer to the maximum overlapping period (ZLB period starting in 2008m7).

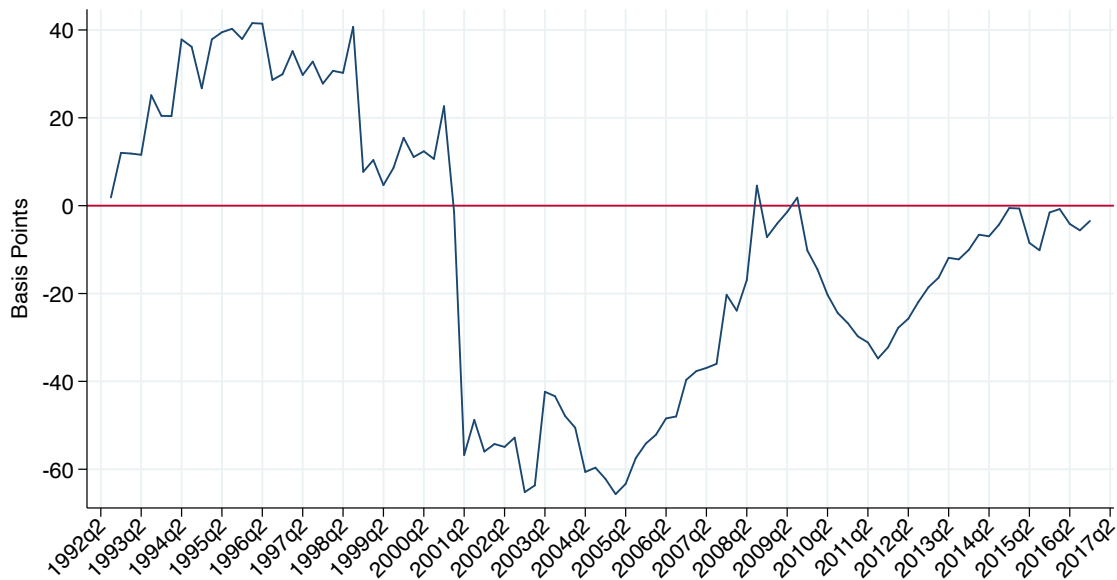
Monthly Informationally-Robust MPI

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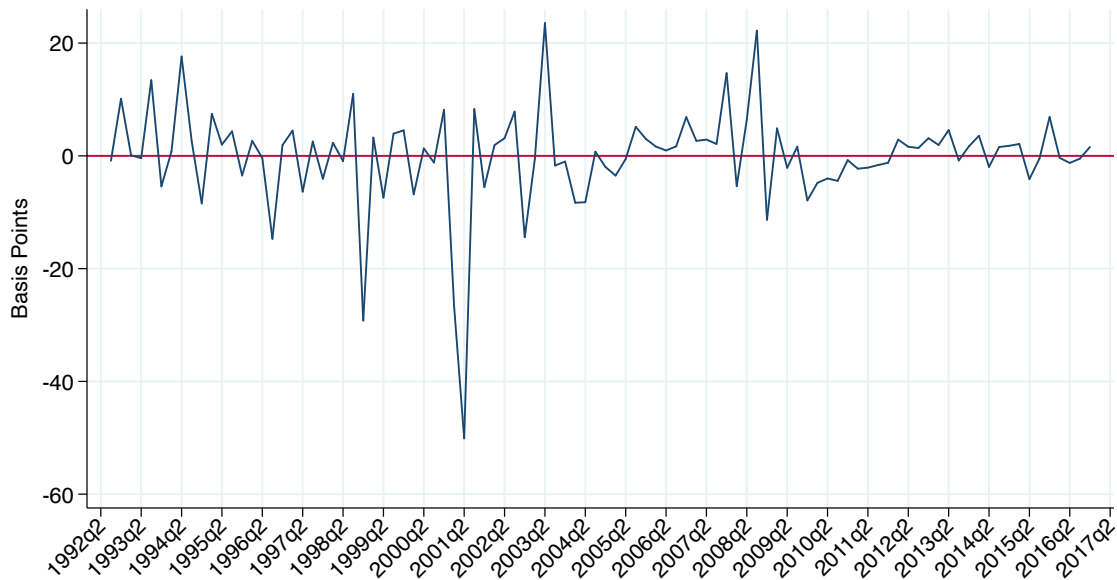
Cumulative Informationally-Robust MPI

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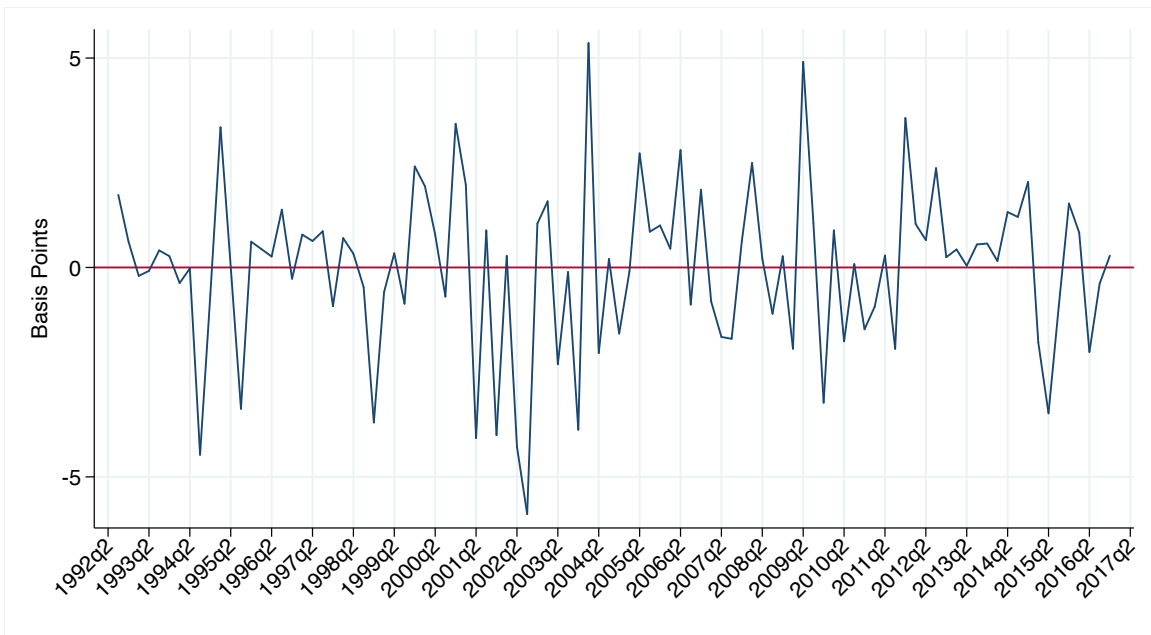
Conventional Informationally-Robust MPI

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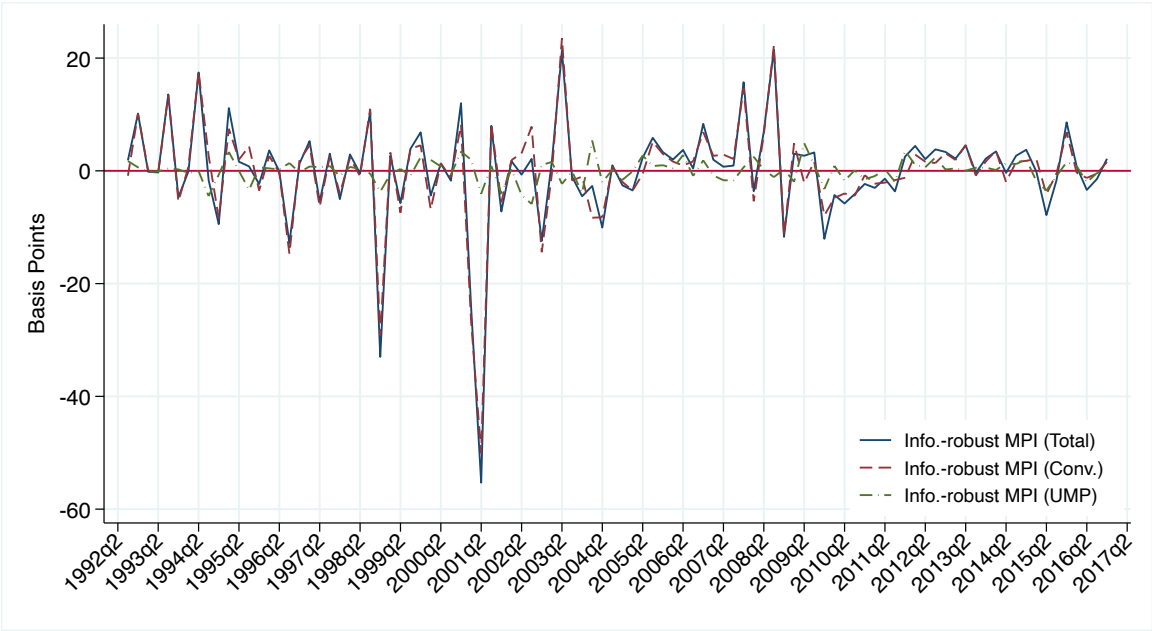
Unconventional Informationally-Robust MPI

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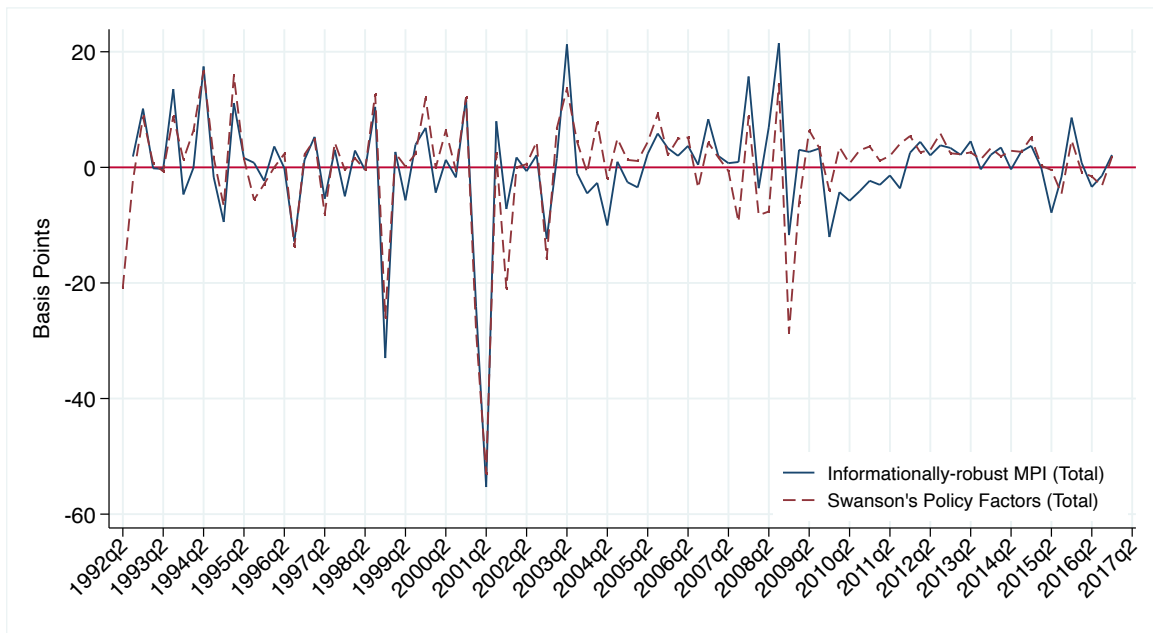
All Informationally-Robust MPIs

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MPI (Total) vs. Swanson's Raw Shocks

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LP-IV Linear Model with Asymmetric Shocks

Linear M.

Back pre-GFC

Back full sample

The **dynamic average cumulative response** of the variable of interest z_t at horizon h is computed by **estimating the following panel regressions**

$$z_{i,t+h} - z_{i,t-1} = \alpha_{i,h} + \beta_h^{IV} \Delta r_t + \lambda_h^{IV} \Delta r_t \cdot hike_t + \sum_{\ell=1}^L \Gamma_{h,\ell} X_{i,t-\ell} + \mu_{j,h} + \gamma_h t + \varepsilon_{i,t+h},$$

for $h = 0, 1, \dots, H$ and where

- $hike_t$ is a dummy that takes the value 1 for contractionary shocks and 0 otherwise.
- Coefficients $\{\beta_h^{IV}\}_{h=0}^H$ and $\{\beta_h^{IV} + \lambda_h^{IV}\}_{h=0}^H$ trace out the response of the dependent variable z_t to a +100bp expansionary shock and to a contractionary shock, respectively.

LP-IV State Model with Asymmetric Shocks

State Dep. M.

Back pre-GFC

Back full sample

The **dynamic average cumulative response** of the variable of interest z_t at horizon h is computed by **estimating the following panel regressions**

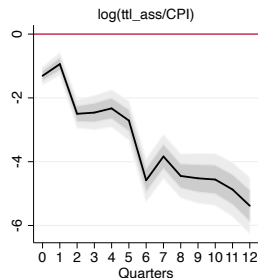
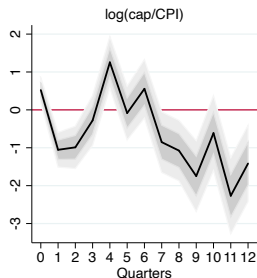
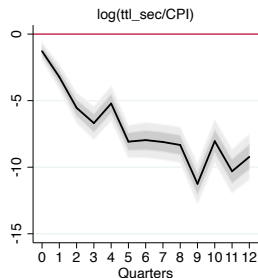
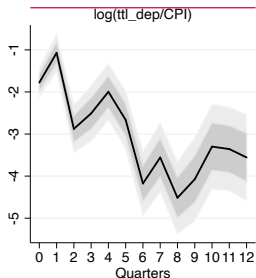
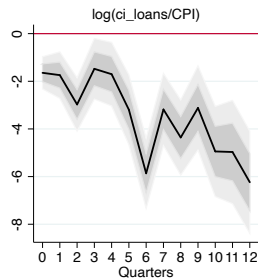
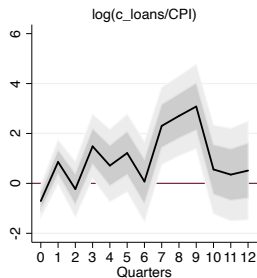
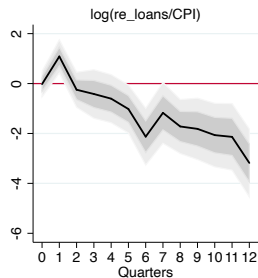
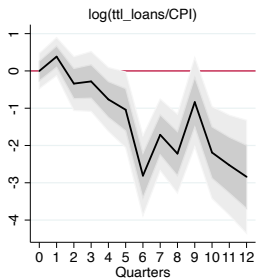
$$z_{i,t+h} - z_{i,t-1} = \alpha_{i,h} + \beta_h^{IV} \Delta r_t + \lambda_h^{IV} \Delta r_t \cdot hike_t + \sum_{\ell=1}^L \Gamma_{h,\ell} X_{i,t-\ell} + \mu_{j,h} + \gamma_h t + \dots$$
$$\dots + \mathbb{1}_{t-1} \left[\alpha_{i,h}^B + \beta_h^{B,IV} \Delta r_t + \lambda_h^{B,IV} \Delta r_t \cdot hike_t + \sum_{\ell=1}^L \Gamma_{h,\ell}^B X_{i,t-\ell} + \mu_{j,h}^B + \gamma_h^B t \right] + \varepsilon_{i,t+h}$$

for $h = 0, 1, \dots, H$ and where

- Δr_t denotes the change in the EFFR, which is **instrumented by** MPI_t .
- There are four relevant cases:
 - ▶ Expansionary & Liquid: $\{\beta_h^{IV}\}_{h=0}^H$
 - ▶ Contractionary & Liquid: $\{\beta_h^{IV} + \lambda_h^{IV}\}_{h=0}^H$
 - ▶ Expansionary & Illiquid: $\{\beta_h^{IV} + \beta_h^{B,IV}\}_{h=0}^H$
 - ▶ Contractionary & Illiquid: $\{\beta_h^{IV} + \beta_h^{B,IV} + \lambda_h^{IV} + \lambda_h^{B,IV}\}_{h=0}^H$

Active Bank-lending Channel, pre-GFC

Cumulative Responses (in %) to a +100bp Shock (1990Q1-2007Q4) [Back](#)



90% and 65% confidence bands

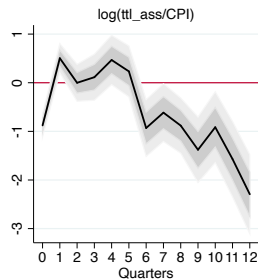
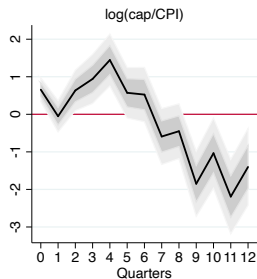
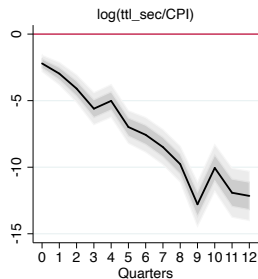
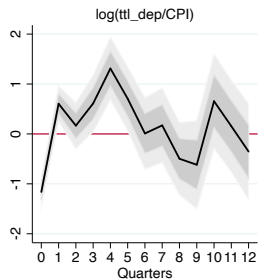
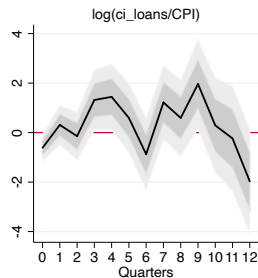
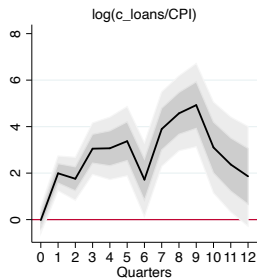
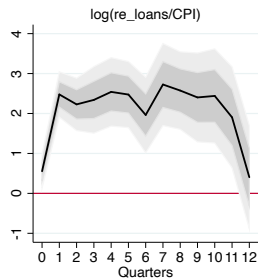
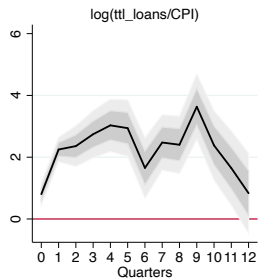
Inactive Bank-lending Channel

Cumulative Responses (in %) to a +100bp Shock (1990Q1-2016Q4)

Back

Loans

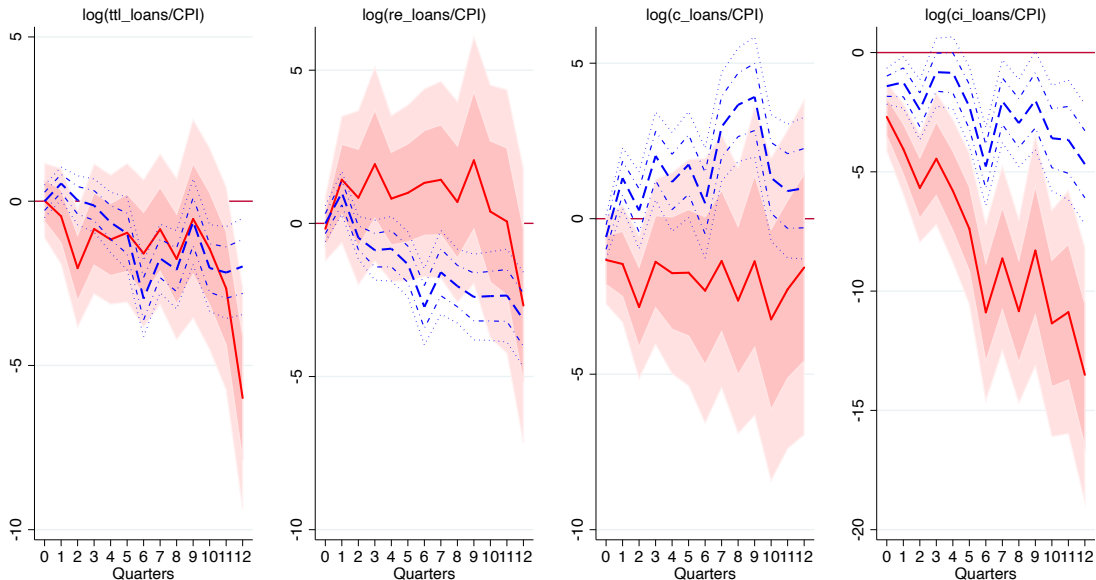
Reserves



90% and 65% confidence bands

Homogeneous Bank Responses, pre-GFC

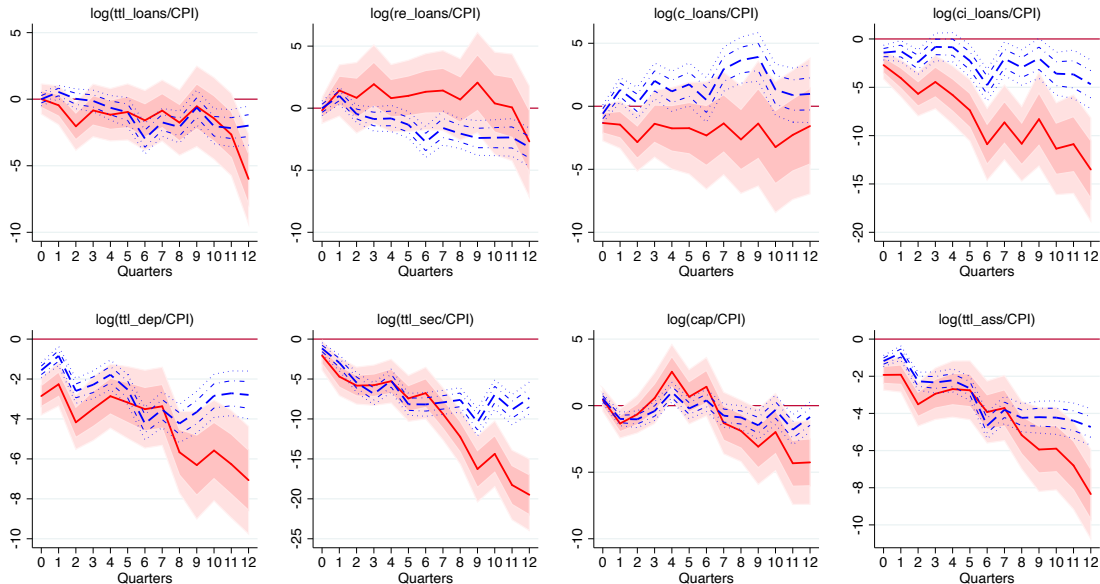
Cumulative Responses (in %) to a +100bp Shock (1990Q1-2007Q4) [More](#) [Back](#)



IRFs after a contractionary shock for **Liquid** (solid) & **illiquid** (dash) banks, with 90% and 65% confidence bands.

Homogeneous Bank Responses (detailed), pre-GFC

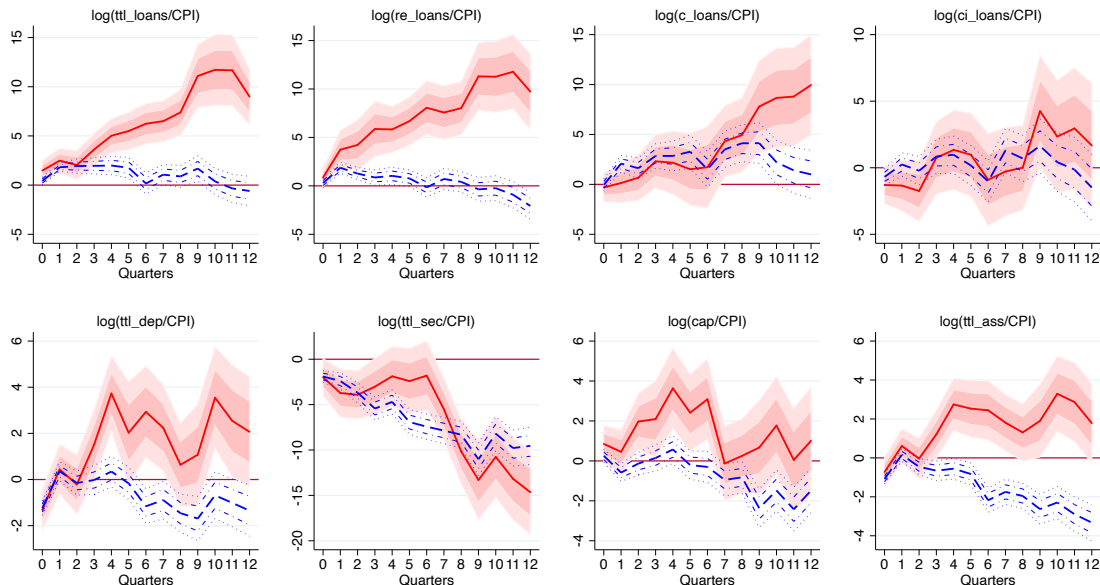
Cumulative Responses (in %) to a +100bp Shock (1990Q1-2007Q4) [Back](#)



IRFs after a contractionary shock for Liquid (solid) & illiquid (dash) banks, with 90% and 65% confidence bands.

Heterogeneous Bank Responses

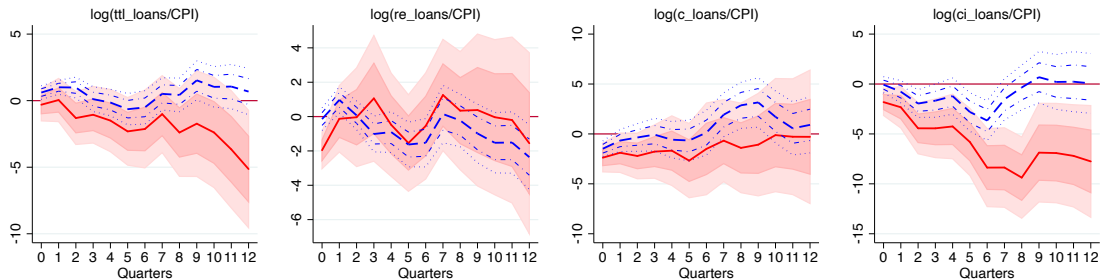
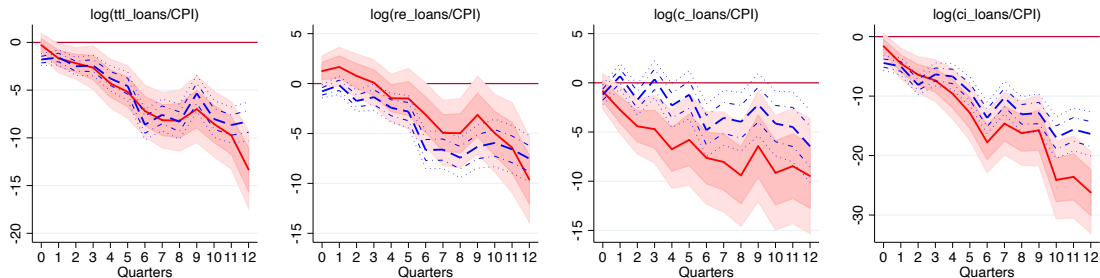
Cumulative Responses (in %) to a +100bp Shock (1990Q1-2016Q4) [Back](#)



IRFs after a contractionary shock for **Liquid** (solid) & **illiquid** (dash) banks, with 90% and 65% confidence bands.

Information Effect (Raw Shock Series) (cont.)

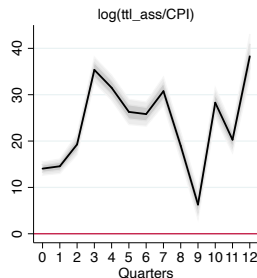
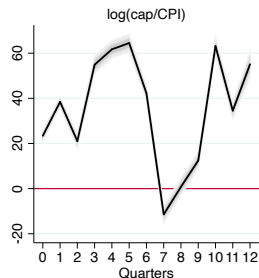
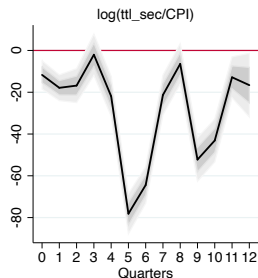
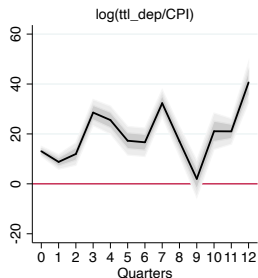
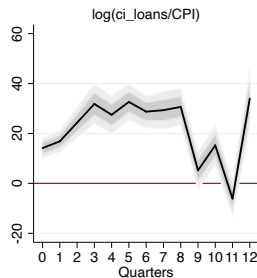
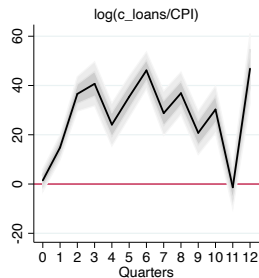
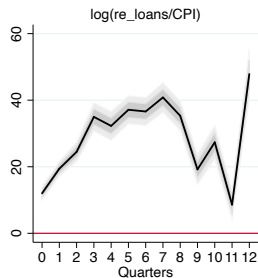
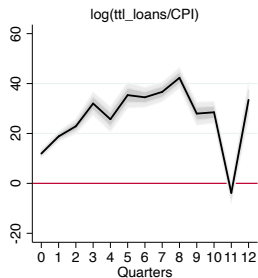
Cumulative Responses (in %) to a +100bp Shock (1990Q1-2007Q4) [Back full sample](#)



IRFs to contractionary (1st row) & expansionary (2nd row) shock, for **Liquid** (solid) & **illiquid** (dash) banks, with 90% and 65% confidence bands.

Post-GFC with Bu et al. (2021)'s Shock Series

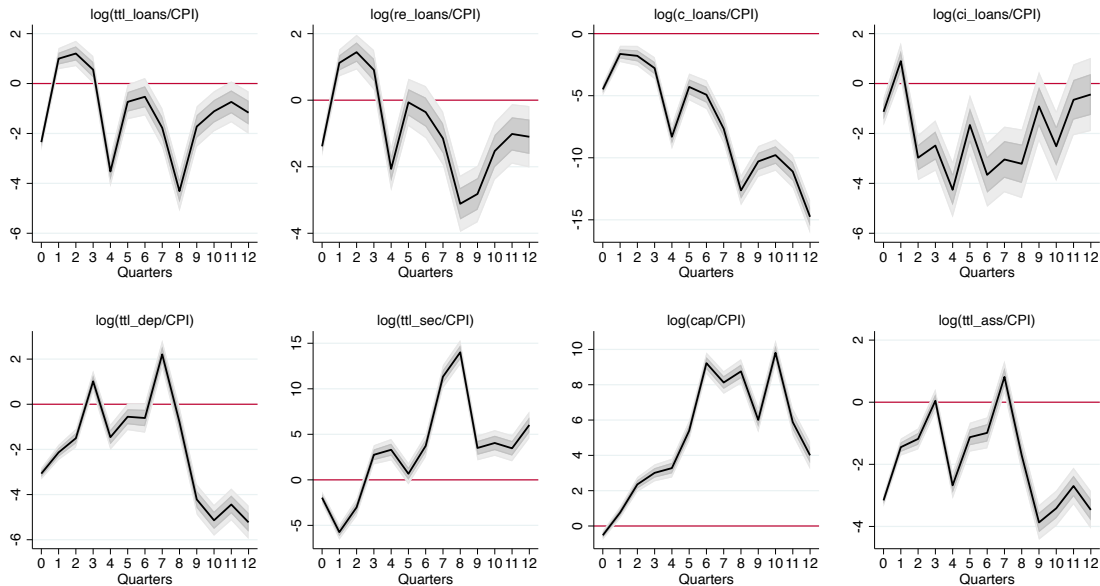
Cumulative Responses (in %) to a +100bp Shock (2009Q1-2019Q3) [Back to Main](#)



90% and 65% confidence bands

Pre-GFC with Bu et al. (2021)'s Shock Series

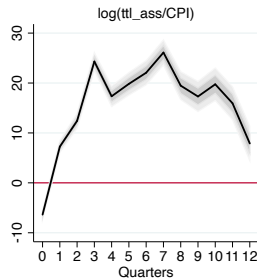
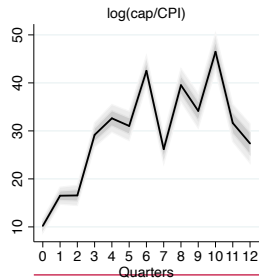
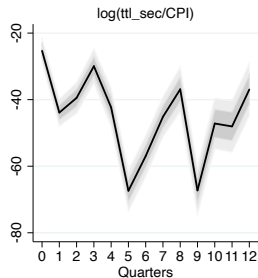
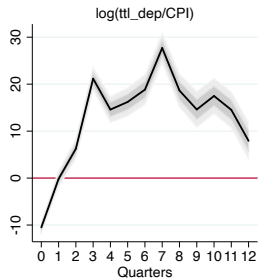
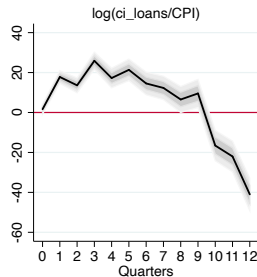
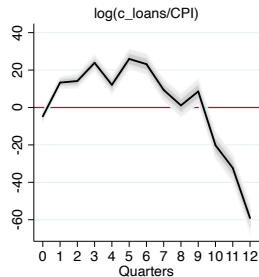
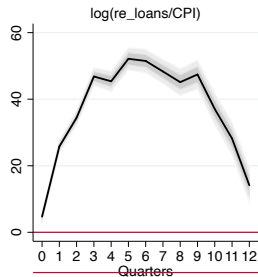
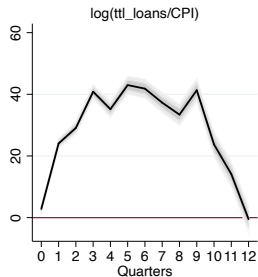
Cumulative Responses (in %) to a +100bp Shock (1994Q1-2007Q4) [Back to main](#)



90% and 65% confidence bands

Full Sample with Bu et al. (2021)'s Shock Series

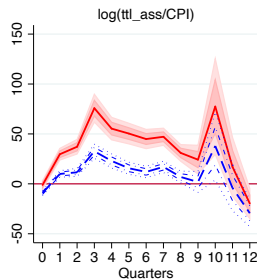
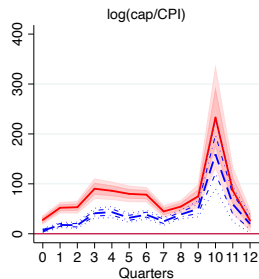
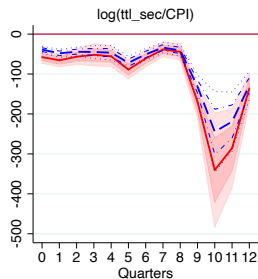
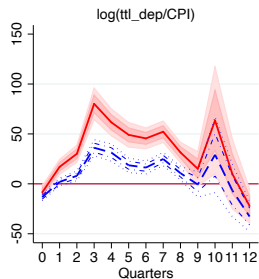
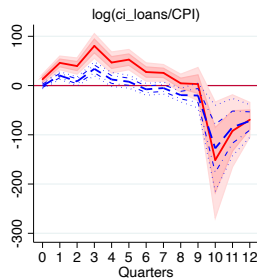
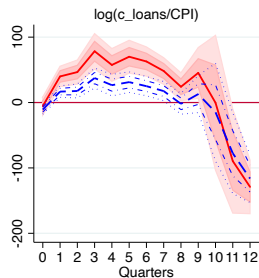
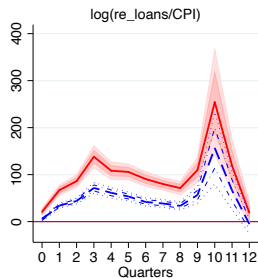
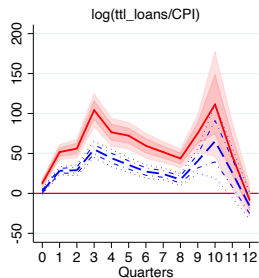
Cumulative Responses (in %) to a +100bp Shock (1994Q1-2019Q3) [Back to main](#)



90% and 65% confidence bands

Baseline Sample with Bu et al. (2021)'s Shock Series

Cumulative Responses (in %) to a +100bp Shock (1994Q1-2016Q4) [Back to main](#)



90% and 65% confidence bands

Kitagawa-Blinder-Oaxaca Decomposition

a la Cloyne, Jorda & Taylor (2020) [Back to main](#)

Idea: Decomposition to “unpack the heterogeneity behind the average effects.”
Estimate the following sequence of LPs

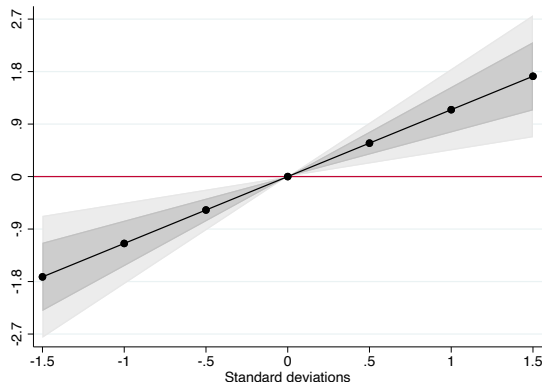
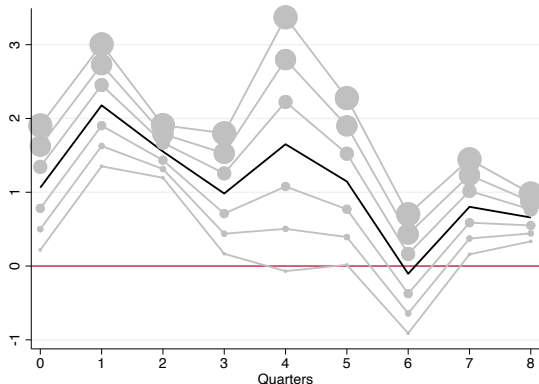
$$z_{i,t+h} - z_{i,t-1} = \alpha_{i,h} + \beta_h^{IV} \Delta r_t + \sum_{\ell=1}^L \Gamma_{h,\ell} X_{i,t-\ell} + \mu_{j,h} + \gamma_h t \dots$$
$$\dots + \sum_{\ell=1}^L \Xi_{h,\ell} (X_{i,t-\ell} \cdot \Delta r_t) + \theta_h (\Delta r_t \cdot MPI_t^{ump}) + \varepsilon_{i,t+h}.$$

The **direct effect** from conventional shocks on total bank lending by tracing the coefficient $\{\beta_h^{IV}\}_{h=0}^H$, and the **indirect effects** from the interaction with UMP, i.e., $\theta_h \cdot MPI_t^{ump}$.

Conventional Policy experiments varying the response of UMP

[Back to main](#)

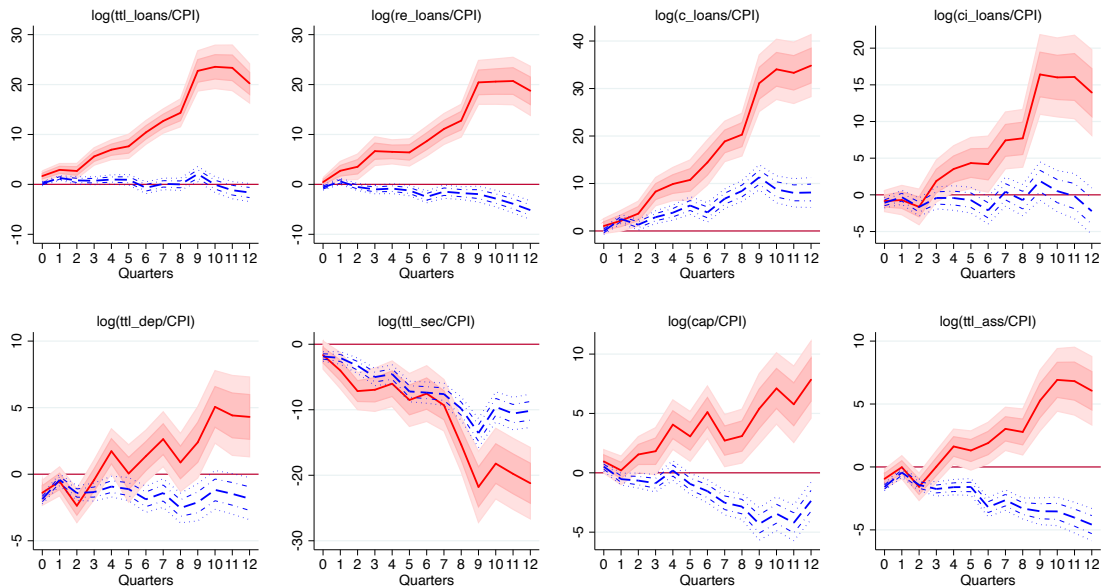
Direct Effect of a 100bp Conventional Policy Shock (left panel) and Indirect Effects of UMP (right panel)



Note: The left panel shows the direct effect of Total Loans and how it varies with the degree of UMP accommodation. The black lines report the direct effect, which should be compared to the average effect in the linear model. The gray lines consider experiments which vary the degree of UMP accommodation. A larger marker indicates a tighter unconventional monetary policy scenario. The right panel plots the indirect effect on Total Loans for the effect at $h = 4$. The figure illustrates the effect of the interaction between conventional and unconventional relative to the average response in the full sample. This also allows us to formally test whether the indirect effect is statistically significant. Dark and light shaded areas are 65% and 90% confidence bands, respectively.

Robustness: $L=1$

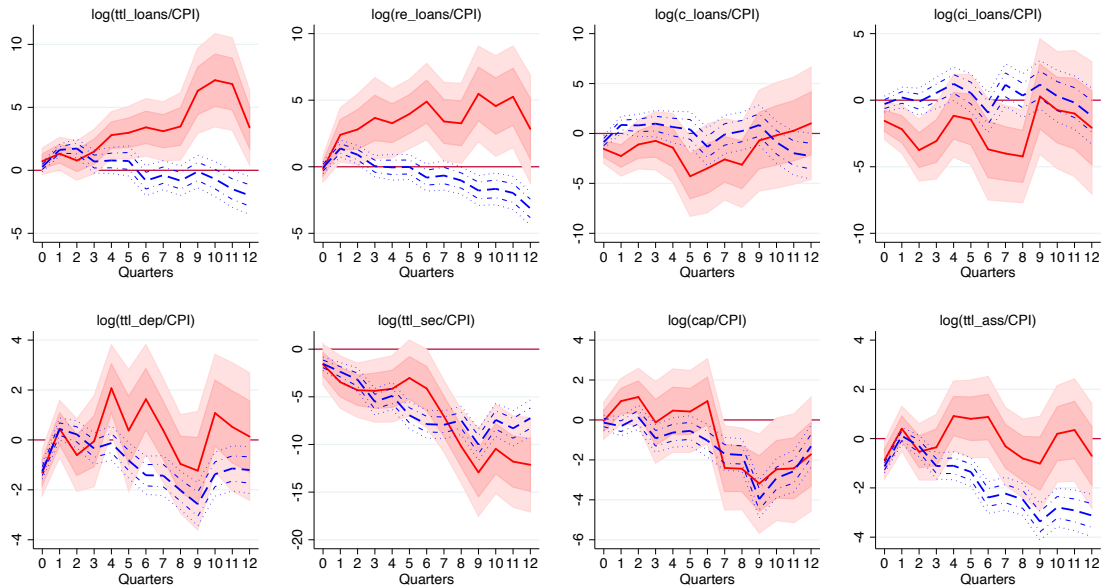
Cumulative Responses (in %) to a +100bp Shock (1990Q1-2016Q4) [Back](#)



IRFs after a contractionary shock for Liquid (solid) & illiquid (dash) banks, with 90% and 65% confidence bands.

Robustness: L=6

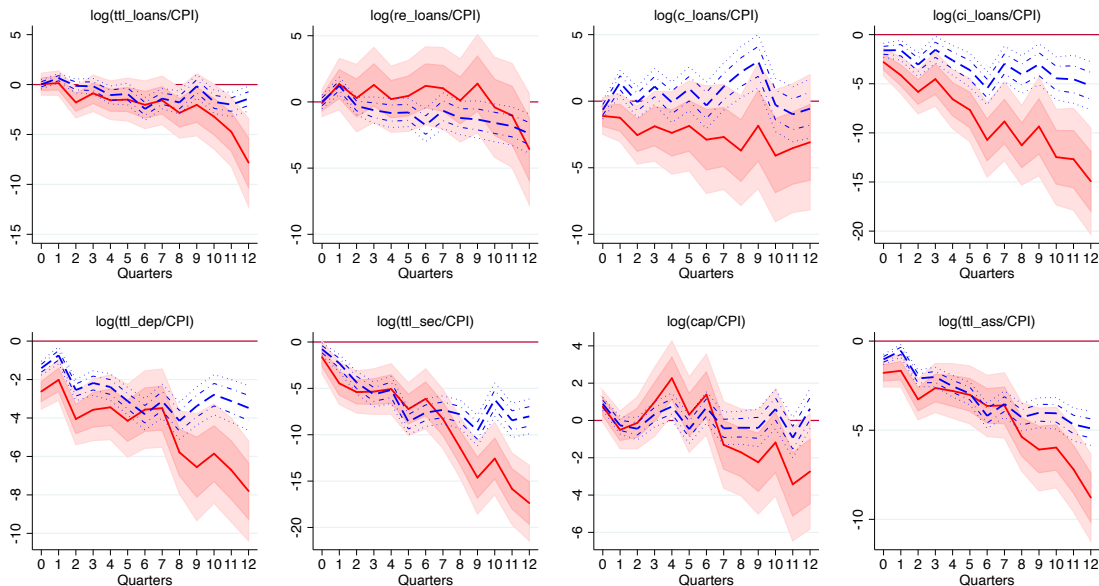
Cumulative Responses (in %) to a +100bp Shock (1990Q1-2016Q4) [Back](#)



IRFs after a contractionary shock for Liquid (solid) & illiquid (dash) banks, with 90% and 65% confidence bands.

Robustness: Pre-GFC (1990-2005)

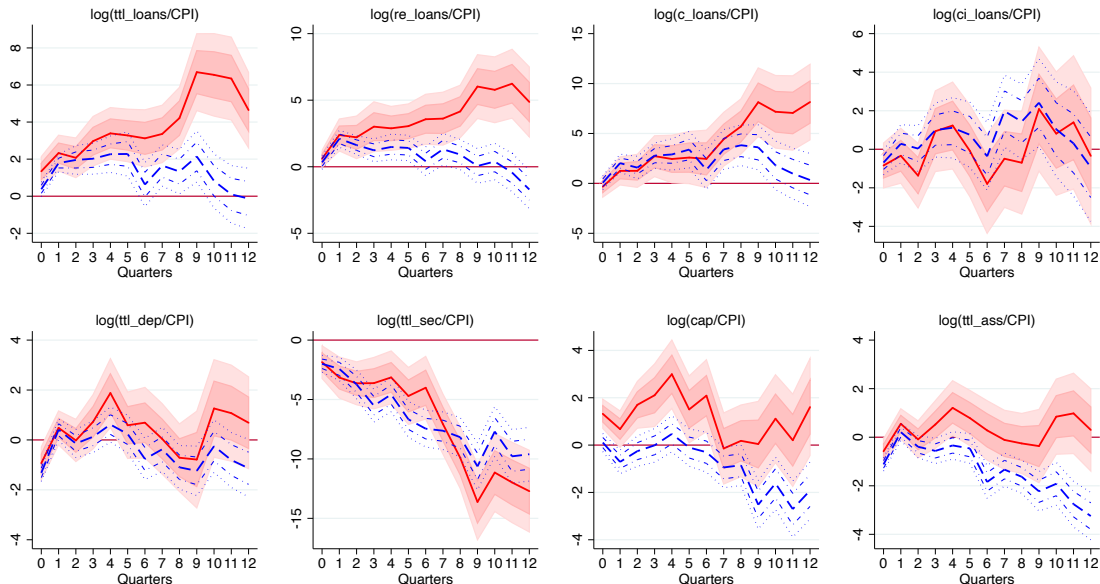
Cumulative Responses (in %) to a +100bp Shock (1990Q1-2005Q4) [Back](#)



IRFs after a contractionary shock for Liquid (solid) & illiquid (dash) banks, with 90% and 65% confidence bands.

Robustness: Lower threshold $\mathbb{1}_t = 1$ if $ER_t/TA_t < 0.5\%$

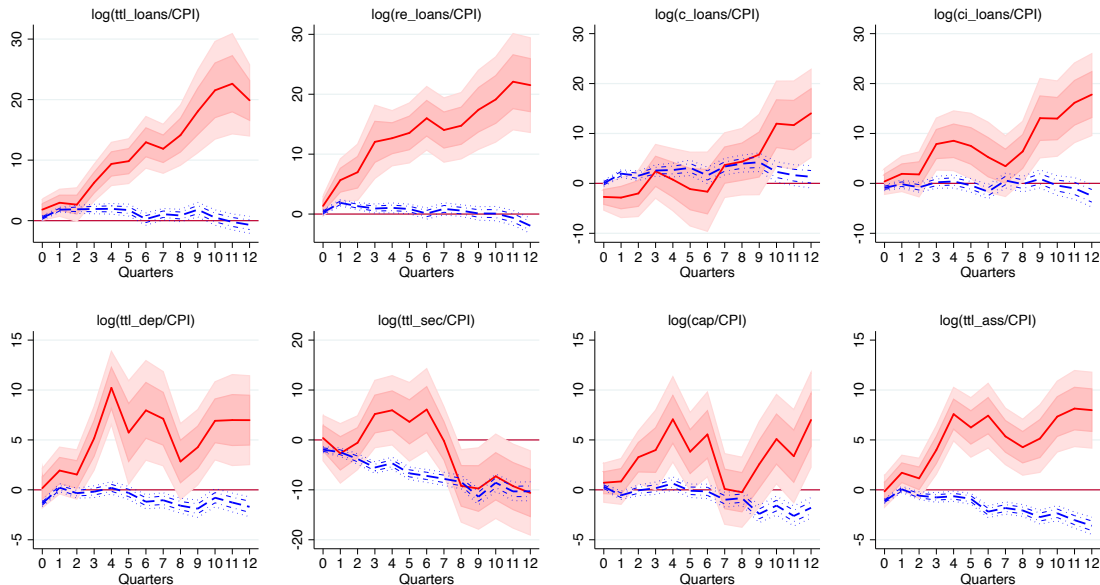
Cumulative Responses (in %) to a +100bp Shock (1990Q1-2016Q4) [Back](#)



IRFs after a contractionary shock for Liquid (solid) & illiquid (dash) banks, with 90% and 65% confidence bands.

Robustness: Higher threshold $\mathbb{1}_t = 1$ if $ER_t/TA_t < 2\%$

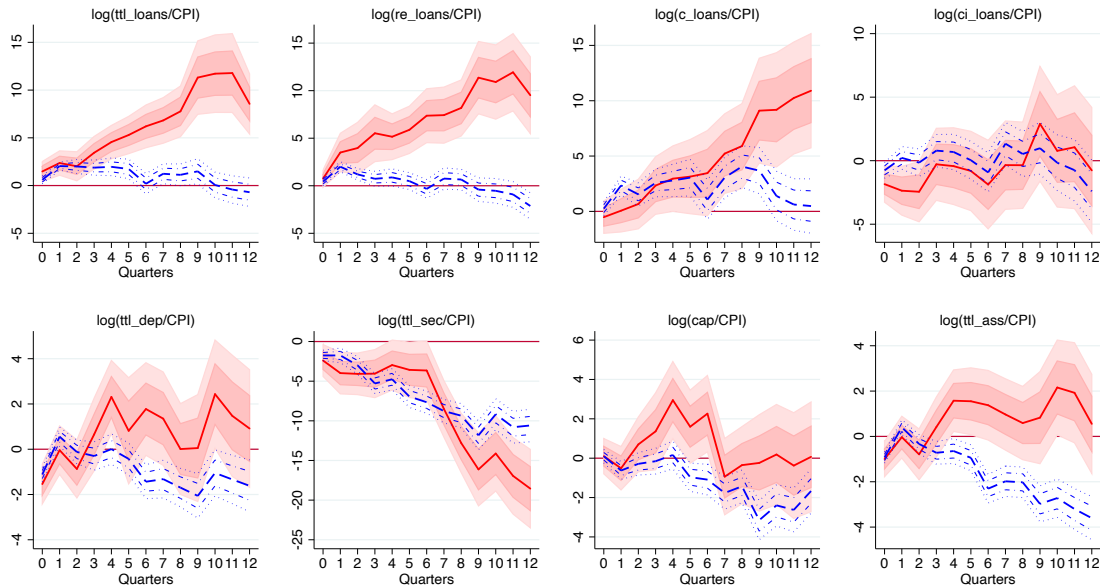
Cumulative Responses (in %) to a +100bp Shock (1990Q1-2016Q4) [Back](#)



IRFs after a contractionary shock for Liquid (solid) & illiquid (dash) banks, with 90% and 65% confidence bands.

Robustness: Conventional MPI only

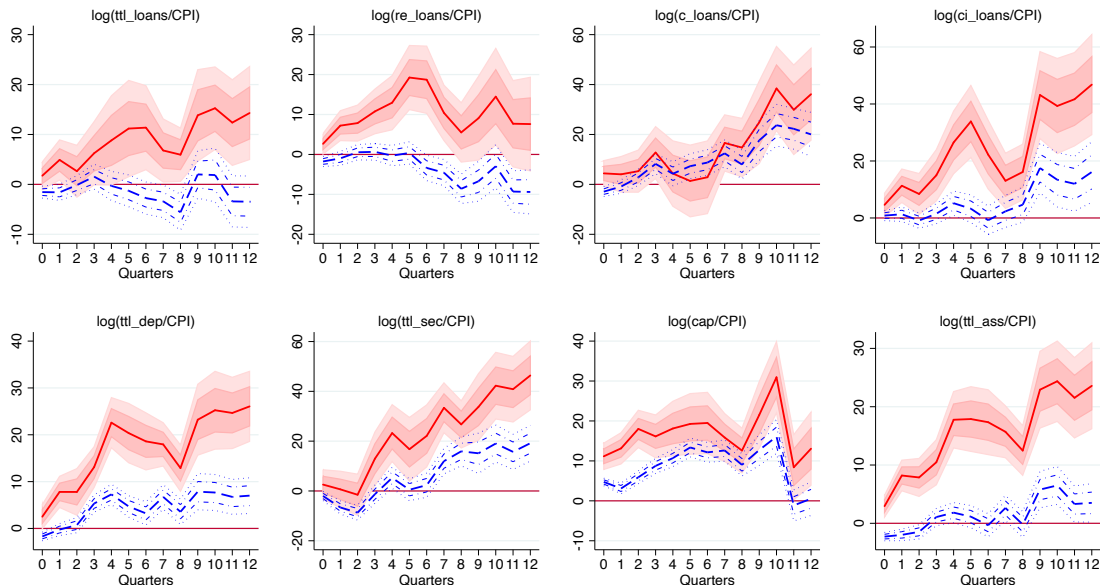
Cumulative Responses (in %) to a +100bp Shock (1990Q1-2016Q4) [Back](#)



IRFs after a contractionary shock for **Liquid** (solid) & **illiquid** (dash) banks, with 90% and 65% confidence bands.

Robustness: Unconventional MPI only

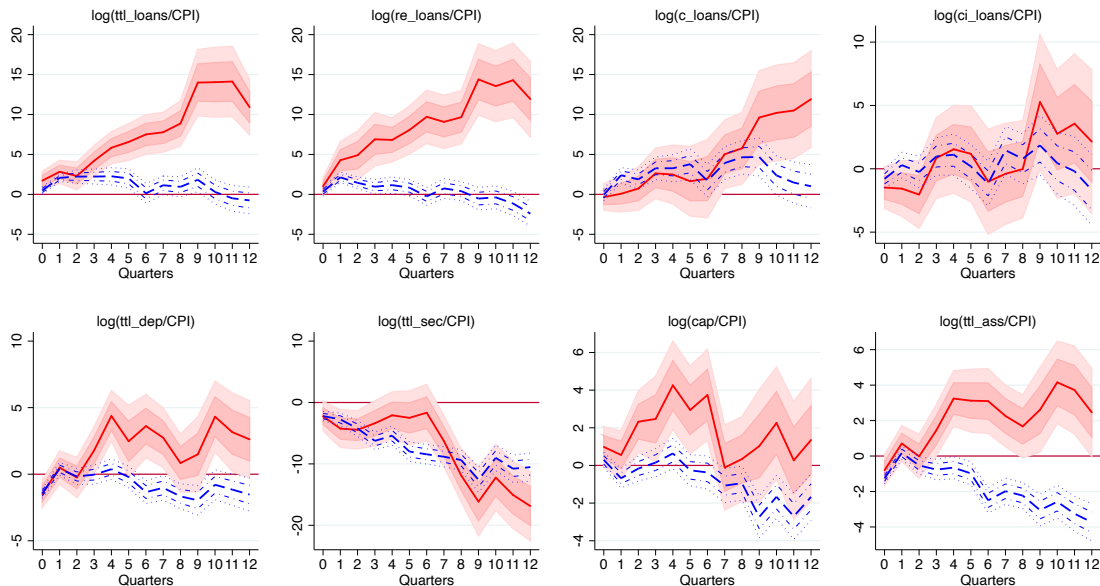
Cumulative Responses (in %) to a +100bp Shock (1990Q1-2016Q4) [Back](#)



IRFs after a contractionary shock for Liquid (solid) & illiquid (dash) banks, with 90% and 65% confidence bands.

Robustness: One-Year Treasury Yield as MP Indicator

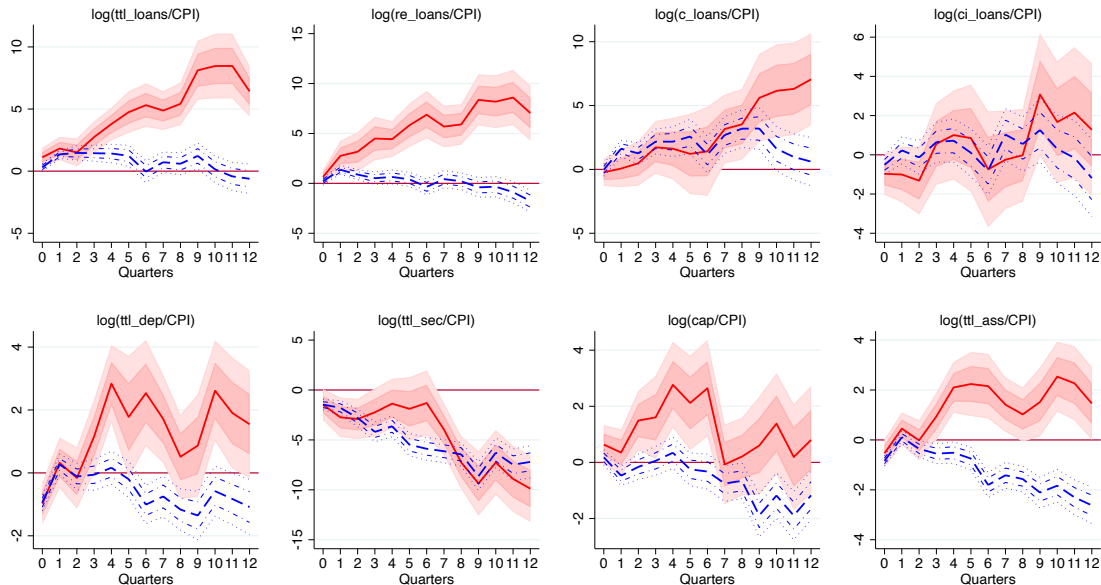
Cumulative Responses (in %) to a +100bp Shock (1990Q1-2016Q4) [Back](#)



IRFs after a contractionary shock for Liquid (solid) & illiquid (dash) banks, with 90% and 65% confidence bands.

Robustness: Wu & Xia (2016)'s Shadow Rate as MP Indicator

Cumulative Responses (in %) to a +100bp Shock (1990Q1-2016Q4) [Back](#)



IRFs after a contractionary shock for **Liquid** (solid) & **illiquid** (dash) banks, with 90% and 65% confidence bands.

Smooth-Time Aggregation

From HF-shocks to Quarterly Time Series [Back](#)

“Our time aggregation strategy ensures that we weight shocks by the amount of time firms have had to react to them.” Ottonello & Winberry

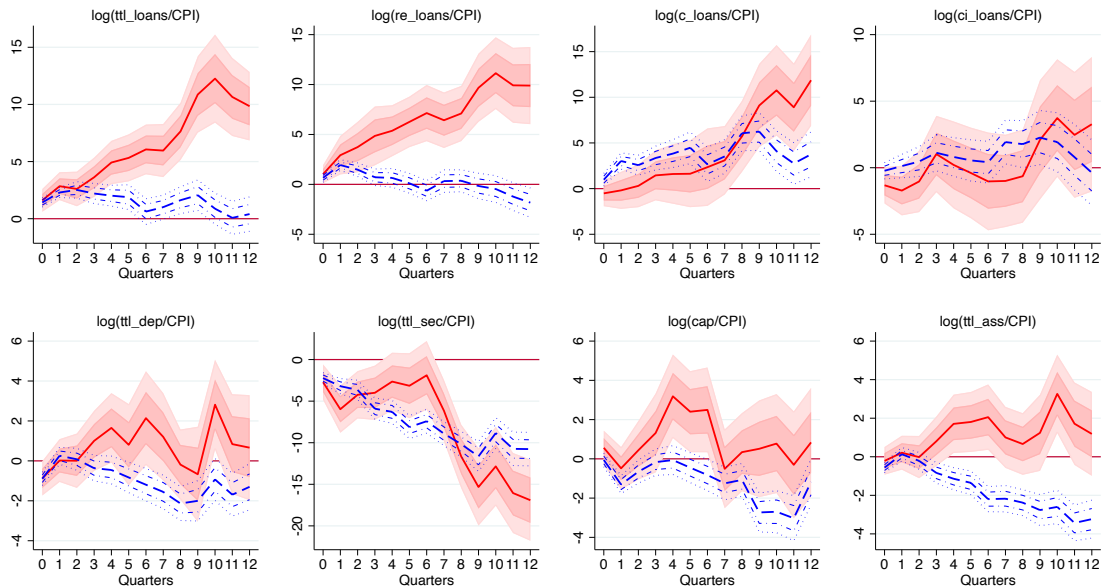
Formally, the monetary-policy shock in month t is defined as

$$\overline{MPI}_t = \sum_{i \in J(t)} \omega_t^a MPI_{i,t} + \sum_{i \in J(t-1)} \omega_t^b MPI_{i,t}$$

where $\omega_t^a \equiv \frac{d_t - d_{i,t}}{d_t}$, $\omega_t^b \equiv \frac{d_{i,t}}{d_t}$, and $d_{i,t}$ denotes the day of $MPI_{i,t}$ in month t and d_t the total number of days in month t . $J(t)$ refers to the set of MPIs in any given month t .

Robustness: Smooth-Time Aggregated MPI

Cumulative Responses (in %) to a +100bp Shock (1990Q1-2016Q4) [Back](#)



IRFs after a contractionary shock for **Liquid** (solid) & **illiquid** (dash) banks, with 90% and 65% confidence bands.