Macroprudential policy shocks, non-bank financial intermediation and systemic risk in Europe

EBA Policy Research Workshop, Paris

Johanna Krenz (UHH) and
Akhilesh K Verma (ESRI & Trinity College, Dublin)

November 6, 2024

Motivation

- Aim of macroprudential policy (MaP) is to safeguard the financial system as a whole.
- Most existing MaPs are targeted at traditional banks.
- However, the financial system is changing...

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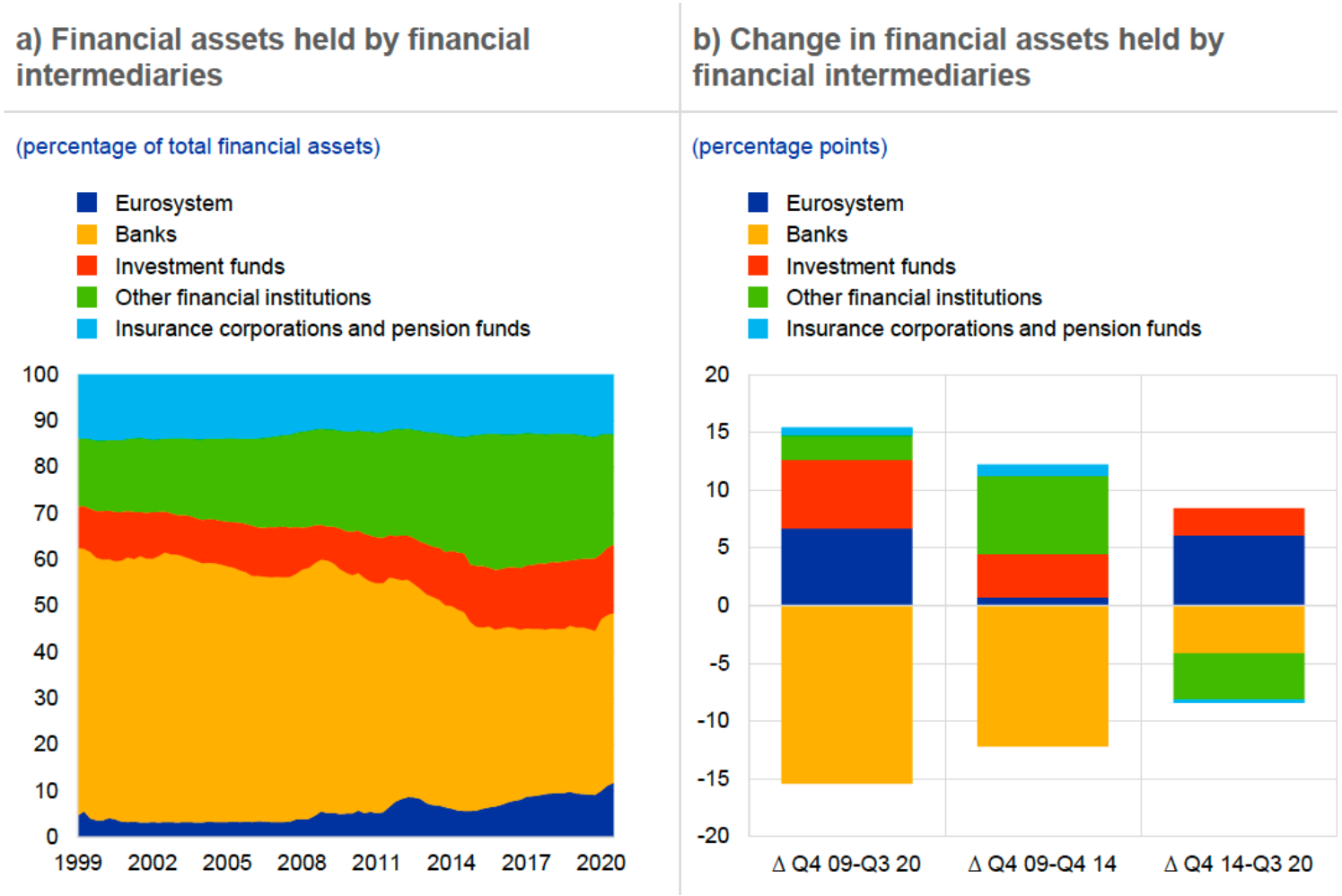

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Non-bank financial intermediaries (NBFIs)

Entities or activities involved in the process of credit intermediation, however, without any oversight or with significantly less stringent prudential oversight (EU Parliament, 2021). GICS

Why should we care?

- \+ further funding sources and diversified financing options
- ↯ regulatory arbitrage
- ↯ complex securitization processes, high leverage, pro-cyclical risk-taking
- ↯ reliance on volatile funding sources $\rightarrow$ increased financial instability during stress periods
- ↯ ties of NBFIs to traditional banks make a way for "spillover risk"

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→ **Leakage from regulated to unregulated actors can mute the effects of macroprudential policy, and, in the worst case, create new sources of systemic risk.**

Research questions

- How effective is macroprudential policy in reducing systemic risk in the *entire* financial system?
- Is there a case of regulatory leakage to non-bank financial intermediaries (NBFI), hampering the efficiency of macroprudential policy with respect to reducing systemic risk?

Our contribution

Estimation of the effects of **macroprudential policy shocks** on the **systemic risk contributions of banks and non-banks**, respectively.

- Dataset covers approx. 600 financial institutions (160 banks, 440 NBFIs) per quarter, 20 European countries, 2005q1 to 2018q4.
- **Systemic risk**: ΔCoVaR = change in the value at risk of the entire financial system, conditional on single financial institutions being under distress (Adrian/Brunnermeier, 2016, AER).

$\rightarrow$ Allows to analyze the risk contributions of different types of financial intermediaries.

- **Country-specific MaP shocks**: part of the change in the MaP stance which cannot be explained by fundamentals (Chari et al., 2022, JIE); different categories, e.g., shocks to borrower-based measures, shocks to lender-based measures.

$\rightarrow$ Supposed to capture exogenous variation in MaP.

descr. stats | GICS | assets | no. | entities per country

Preview of results

- Loan-demand targeted MaP measures significantly *reduce* systemic risk in the **entire financial system** over the first 1.5 years.
- Loan-supply targeted MaP measures significantly *raise* systemic risk for a year in **the entire financial system**; *reduces* systemic risk thereafter.
- Liquidity- and capital-targeted MaP measures also *increase* systemic risk in the **entire financial system**.
- Increased systemic risk driven by non-banks.

$\rightarrow$ Unintended effects of most MaP measures seems to be driven by leakage to unregulated actors.

- Different effects for different types of NBFIs.

Related literature

- Empirical analyses of shifts of activities from banks to non-banks after MaP tightenings (= leakages): Acharya et al. (2013), Cizel et al. (2019), Acharya et al. (2020), Claessens et al. (2021), Irani et al. (2021), Braggion et al. (2022), Karapetyan et al. (2023) ...
- Theoretical analyses of leakages: Fève et al. (2019), Begenau and Landvoigt (2022), Gebauer and Mazelis (2023)

→ We explicitly analyze the systemic risk implications of such leakages.

- Empirical analyses of the effects of macroprudential policies on (systemic) risk in the banking sector: Altunbas et al. (2018), Meuleman/van der Vennet (2020), Ely et al. (2021)

→ We consider the role of MaPs for risk substitution/spillovers between banks and non-banks.

Outline of presentation

- Introduction
- Dataset
- ΔCoVaR
- MaP Shocks
- Main Estimations
- Results
- Conclusion and outlook

Dataset

- Approx. 600 financial institutions (160 banks, 440 NBFIs) per quarter, 20 European countries, 2005q1 to 2018q4
- Banking sector mean size at 30 trillion, NBFI sector mean size at 7.5 trillion.
- Daily intermediary-level market return data and yearly balance sheet data sourced from Compustat Global. GICS
- MaP measure (constructed from iMaPP database) and identified MaP shocks are at monthly frequency; data used in the estimation was provided by Chari et al., 2022.
- Macroeconomic and financial market data (quarterly frequency) from International Financial Statistics database of the IMF and Datastream Refinitiv.
- Mixed frequency of data is handled by aggregating or, respectively, extrapolating the data to *quarterly* frequency and running main estimation at quarterly frequency. descr. stats

ΔCoVaR estimation (Adrian/Brunnermeier, 2016)

1. Quantile regression of

$$\begin{aligned} x_t^i &= \alpha^i + \gamma^i M_{t-1} + \varepsilon_t^i \\ x_t^{system} &= \alpha^{system|i} + \beta^{system|i} x_t^i + \gamma^{system|i} M_{t-1} + \varepsilon_t^{system|i}, \end{aligned}$$

   where M_{t-1} – vector of state variables; x_t^i – daily market-valued asset returns of institution i; x_t^{system} – weighted average of all x_t^i.

2. Generate predicted values from these regressions to obtain

$$\begin{aligned} VaR_t^i(q) &= \hat{\alpha}^i + \hat{\gamma}^i M_{t-1} \\ CoVaR_t^i(q) &= \hat{\alpha}^{system|i} + \hat{\beta}^{system|i} VaR_t^i(q) + \hat{\gamma}^{system|i} M_{t-1}. \end{aligned}$$

3. Compute $\Delta CoVaR_t^i$ for each institution as

$$\begin{aligned} \Delta CoVaR_t^i(q) &= CoVaR_t^i(q) - CoVaR_t^i(50) \\ &= \hat{\beta}^{system|i}(VaR_t^i(q) - VaR_t^i(50)). \end{aligned}$$

more details | GICS | CoVaR across countries | CoVaR across time

MaP shock identification (Chari et al., 2022)

1. Obtain MaP stance of country j at quarter t from Integrated Macroprudential Policy (iMaPP) Database, for different categories
2. Regress stance on a group of variables which potentially explain MaP decision, i.e.,

$$\begin{aligned} MaP_{jt} = \quad & \alpha_j + \beta_1 Crisis_{jt-1} + \beta_2 Credit_{jt-1} + \beta_3 Growth_{jt-1} \\ & + \beta_4 Controls_{jt-1} + \epsilon_{jt}, \end{aligned}$$

   where α_j – country-fixed effects. Start with 18 explanatory variables and reduce set of variables to a combination which meets certain significance threshold.
3. Based on set of significant variables and estimated coefficients, predict macroprudential stance ($\widehat{MaP_{jt}}$) and subtract it from the actual stance. Difference yields the macroprudential policy shock for country j at time t,

$$\widetilde{MaP_{jt}} = MaP_{jt} - \widehat{MaP_{jt}}.$$

first stage results

MaP categories

Not all MaP measures might be equally prone to leakage, hence, we follow common practice and classify measures into

- **Demand measures – loan-targeted**, e.g., loan-to-value limits (LTV), debt-service-to-income ratios (DSTI),
- **Supply measures – loan-targeted**, e.g., limits on credit growth, loan-loss provisions, loan restrictions,
- **Supply measures – liquidity-targeted**, reserve and liquidity requirements, and
- **Supply measures – capital-targeted**, e.g., conservation buffers, capital surcharges for SIFIs, CCyBs.

MaP types per country | MaP types over time

Unconditional regression for the entire system

Two-way panel fixed effects estimations; local projections at horizons $h = 0, ..., 12$ (Jorda, 2005)

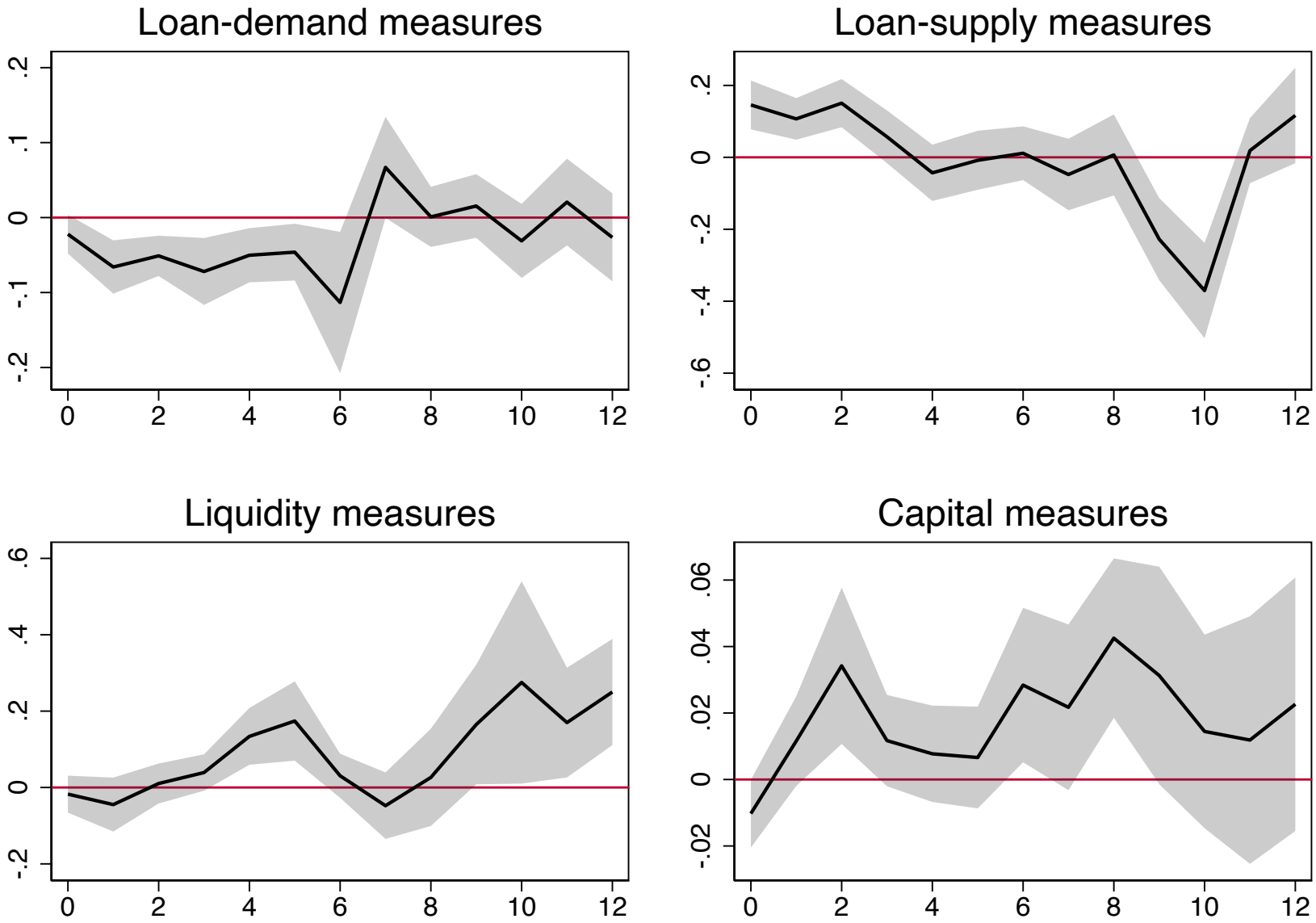
$$\Delta CoVaR_{ijt+h} = \beta_0^h + \beta_1^h \widetilde{MaP}_{jt-1} + \beta_i^h X_{ijt-1} + \beta_j^h Z_{jt-1} + FE + \epsilon_{it+h},$$

- $\Delta CoVaR_{ijt}$ – systemic risk for bank i and country j in time period t
- $\widetilde{MaP}_{jt}$ – country-specific MaP shock (first lag to account for implementation lags)
- X_{ijt} – bank-level balance sheet controls
- Z_{jt} – country-level macroeconomic controls
- FE: intermediary-, country- and time-fixed effects
- Bootstrapping is used to account for the fact that $\widetilde{MaP}_{jt}$ is an estimated regressor.

Unconditional results for the entire system ($h = 0$)

	MaP Demand shock	MaP Supply shock	MaP Supply shock	MaP Supply shock
	(Loan)	(Loan)	(Liquidity)	(Capital)
L.CoVaR	0.6214***	0.6213***	0.6262***	0.6212***
	(0.0122)	(0.0113)	(0.0129)	(0.0116)
L.MaP_shock	-0.0221	0.1457***	-0.0174	-0.0103*
	(0.0157)	(0.0412)	(0.0293)	(0.0062)
L.VaR	0.0030***	0.0030***	0.0031**	0.0030***
	(0.0008)	(0.0009)	(0.0013)	(0.0008)
L.ROA	-0.0072	-0.0072	-0.0093	-0.0072
	(0.0057)	(0.0058)	(0.0098)	(0.0053)
L.Size	-0.0321	-0.0325	-0.0224	-0.0525
	(0.0878)	(0.0872)	(0.0919)	(0.0866)
L.Leverage	0.0002	0.0002	0.0001	0.0002
	(0.0003)	(0.0003)	(0.0005)	(0.0003)
L.MB ratio	-0.0005	-0.0004	-0.0006	-0.0005
	(0.0007)	(0.0006)	(0.0011)	(0.0007)
L.GDP growth	0.5500***	0.5611***	0.4123***	0.5512***
	(0.1374)	(0.1352)	(0.1337)	(0.1341)
L.Inflation	0.0133***	0.0130***	0.0137***	0.0134***
	(0.0032)	(0.0032)	(0.0035)	(0.0033)
Firm fixed effect	Yes	Yes	Yes	Yes
Time fixed effect	Yes	Yes	Yes	Yes
Country fixed effect	Yes	Yes	Yes	Yes
R-squared	0.4082	0.4091	0.4155	0.4080
No of obs.	33519.0000	33519.0000	33519.0000	33519.0000

Unconditional effects over time



Gray areas represent 90% confidence intervals. cond. results

Main regression equation

$$\Delta CoVaR_{ijt+h} = \beta_0^h + \beta_1^h \widetilde{MaP_{jt-1}} + \beta_2^h Shadow_{ijt} + \beta_3^h \widetilde{MaP_{jt-1}} \cdot Shadow_{ijt} + \beta_i^h X_{ijt-1} + \beta_j^h Z_{jt-1} + FE + \epsilon_{it},$$

- $Shadow_{ijt}$ – dummy variable $= 1$ if entity is an NBFI and 0 otherwise
- FE: intermediary-, country-, time- and industry-time-fixed effects

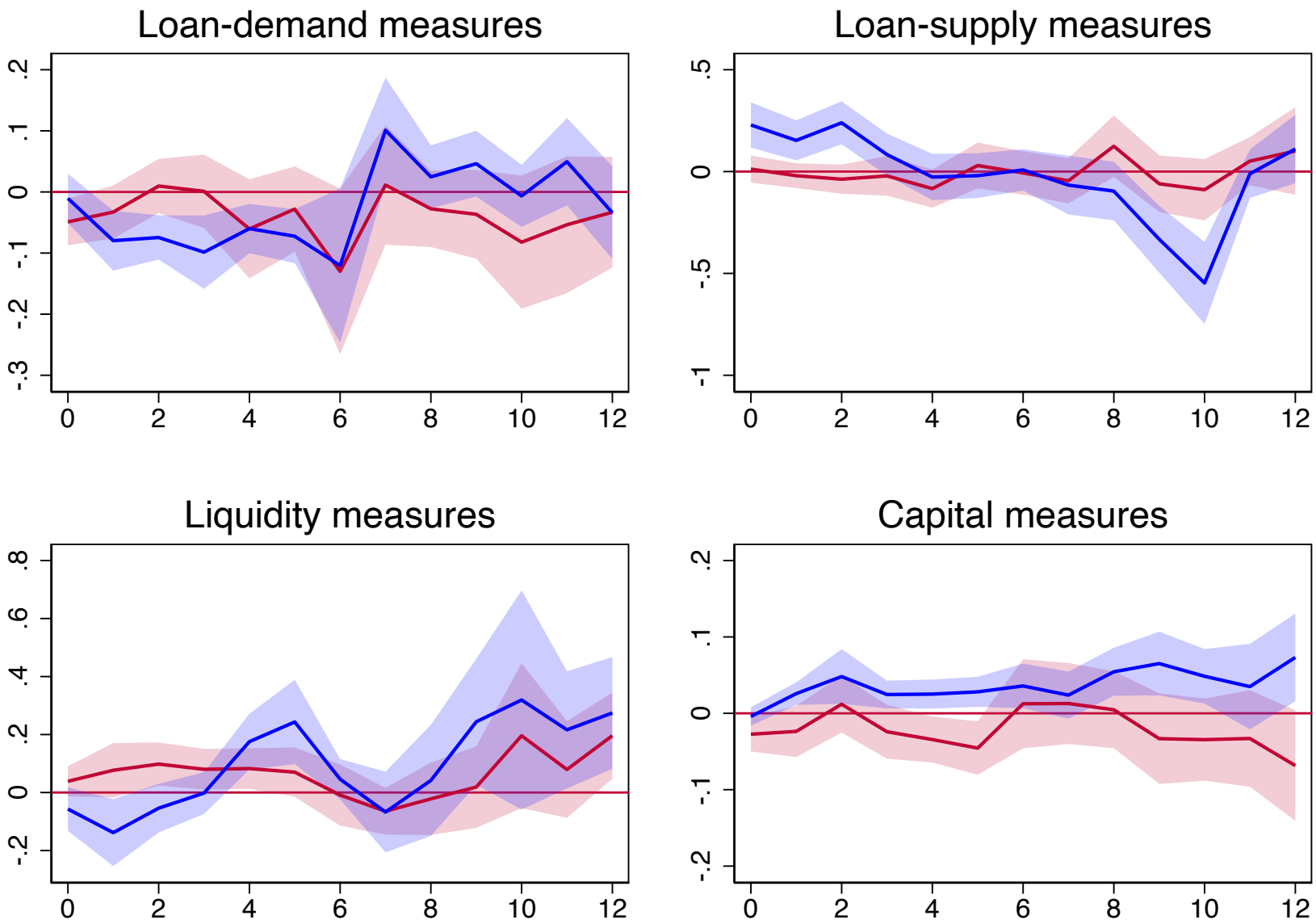
$\rightarrow$ β_1^h yields mean effect of the MaP shock on the systemic risk contribution of a bank h quarters ahead

$\rightarrow$ $\beta_1^h + \beta_3^h$ yields mean effect of the MaP shock on the systemic risk contribution of an NBFI h quarters ahead

Results for banks and NBFIs ($h = 0$)

	MaP Demand shock (Loan)	MaP Supply shock (Loan)	MaP Supply shock (Liquidity)	MaP Supply shock (Capital)
L.CoVaR	0.6219***	0.6217***	0.6260***	0.6217***
	(0.0122)	(0.0112)	(0.0129)	(0.0116)
L.MaP_shock	-0.0491**	0.0123	0.0388	-0.0274**
	(0.0232)	(0.0404)	(0.0314)	(0.0136)
Shadow bank x L.MaP-shock	0.0385	0.2166***	-0.0957*	0.0233
	(0.0362)	(0.0782)	(0.0546)	(0.0150)
L.VaR	0.0028***	0.0028***	0.0028**	0.0028***
	(0.0008)	(0.0009)	(0.0013)	(0.0008)
L.ROA	-0.0108*	-0.0107*	-0.0133	-0.0109**
	(0.0057)	(0.0059)	(0.0100)	(0.0052)
L.Size	-0.0405	-0.0420	-0.0300	-0.0604
	(0.0896)	(0.0883)	(0.0932)	(0.0884)
L.Leverage	0.0001	0.0001	0.0002	0.0001
	(0.0003)	(0.0003)	(0.0005)	(0.0003)
L.MB ratio	-0.0004	-0.0003	-0.0006	-0.0004
	(0.0007)	(0.0006)	(0.0010)	(0.0006)
L.GDP growth	0.5579***	0.5616***	0.4115***	0.5587***
	(0.1424)	(0.1392)	(0.1337)	(0.1388)
L.Inflation	0.0131***	0.0128***	0.0136***	0.0133***
	(0.0034)	(0.0033)	(0.0036)	(0.0035)
Firm fixed effect	Yes	Yes	Yes	Yes
Time fixed effect	Yes	Yes	Yes	Yes
Country fixed effect	Yes	Yes	Yes	Yes
Sector fixed effects	Yes	Yes	Yes	Yes
Sector-time fixed effect	Yes	Yes	Yes	Yes
R-squared	0.4082	0.4094	0.4145	0.4080
No of obs.	33519	33519	33519	33519
p-value of F-test	0.6663	0.0007	0.2115	0.5739

Effects on banks (red) and NBFIs (blue) over time



Shaded areas represent 90% confidence intervals. uncond. results

Heterogenous NBFIs

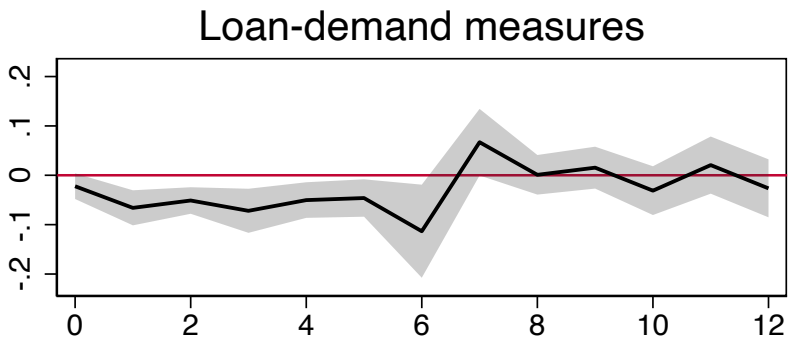
NBFIs are very heterogenous. Not all types might be equally prone to leakage, hence, we distinguish between the following NBFIs:

- **Financial Services** (FS): predominantely engaged in providing loans, leases and mortgages to borrowers, large fraction is consumer finance
- **Asset Management & Custody Banks** (AMC): collect funds from savers and invest them into the liabilities of other financial intermediaries (e.g. Money Market Mutual funds)
- **Investment Banking & Brokerage** (IBB): mainly involved in the securitization and collateralization process (e.g. broker-dealers)
- **Insurers** (INSR): mainly involved in investment of insurance fees; closely monitored by ECB due to their large and increasing weight in the European financial system

descr. stats | assets | no. | entities per country | GICS

Results for disaggregated NBFIs ($h = 0$)

	MaP Demand shock (Loan)	MaP Supply shock (Loan)	MaP Supply shock (Liquidity)	MaP Supply shock (Capital)
L.CoVaR	0.6225***	0.6222***	0.6260***	0.6222***
	(0.0122)	(0.0111)	(0.0128)	(0.0116)
L.MaP_shock	-0.0486**	0.0123	0.0386	-0.0268*
	(0.0236)	(0.0405)	(0.0308)	(0.0141)
FS x L.MaP-shock	0.0915**	0.3657*	0.0469	0.0251
	(0.0422)	(0.1910)	(0.0803)	(0.0205)
AMC x L.MaP-shock	0.0066	0.2159**	-0.2083***	0.0171
	(0.0457)	(0.0928)	(0.0736)	(0.0167)
IBB x L.MaP-shock	0.0947	0.1851	-0.1194	0.0175
	(0.0598)	(0.1296)	(0.0913)	(0.0187)
INSR x L.MaP-shock	0.0100	-0.0056	0.1056	0.0407
	(0.0430)	(0.0618)	(0.0820)	(0.0254)
Controls	Yes	Yes	Yes	Yes
Firm fixed effect	Yes	Yes	Yes	Yes
Time fixed effect	Yes	Yes	Yes	Yes
Country fixed effect	Yes	Yes	Yes	Yes
Sector fixed effects	Yes	Yes	Yes	Yes
Sector-time fixed effect	Yes	Yes	Yes	Yes
R-squared	0.4078	0.4092	0.4141	0.4076
No of obs.	33519.0000	33519.0000	33519.0000	33519.0000
p-value of F-test (FS)	0.1534	0.0427	0.2495	0.9126
p-value of F-test (AMC)	0.2651	0.0062	0.0122	0.3362
p-value of F-test (IBB)	0.3918	0.1190	0.3450	0.4744
p-value of F-test (INSR)	0.2560	0.8765	0.0628	0.5176


Loan-demand measures
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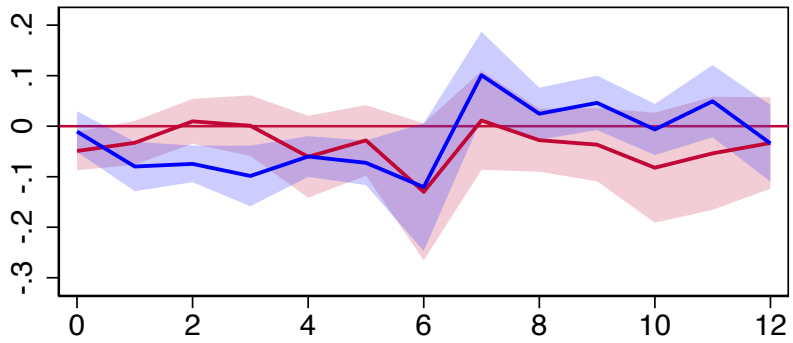
0 2 4 6 8 10 12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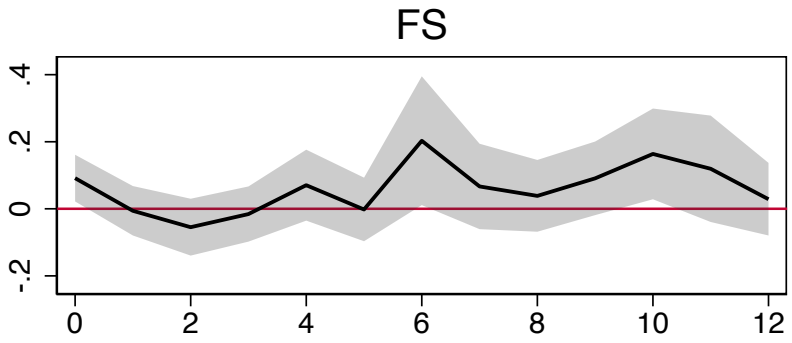
FS
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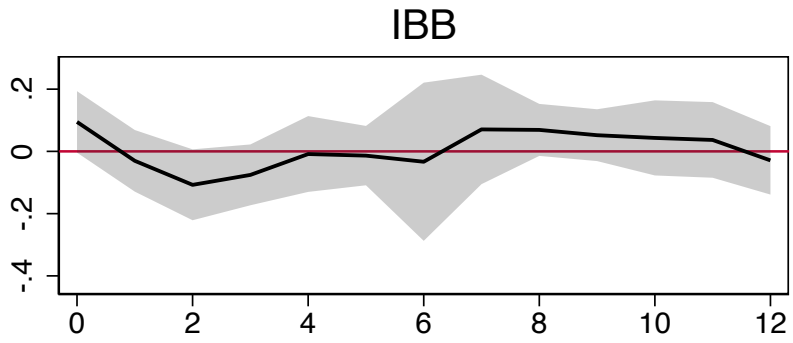
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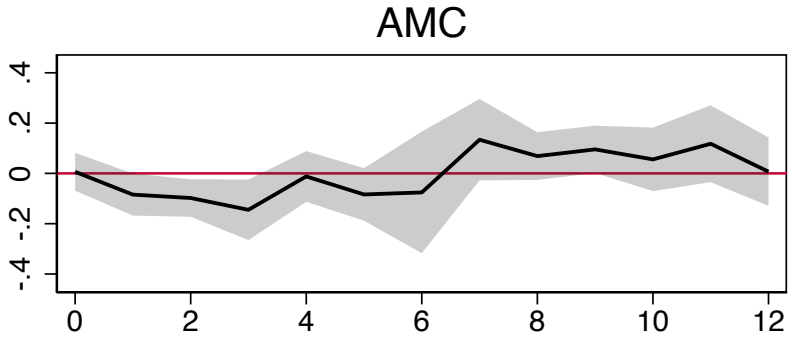
AMC
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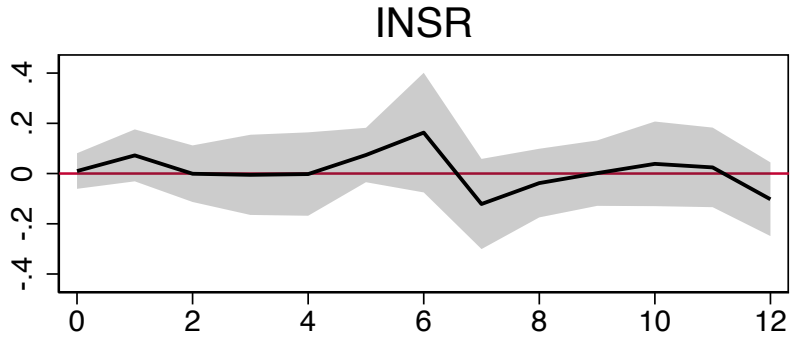
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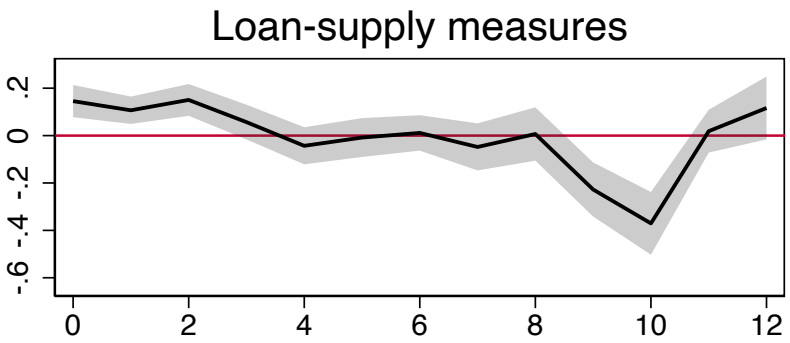
Loan-supply measures
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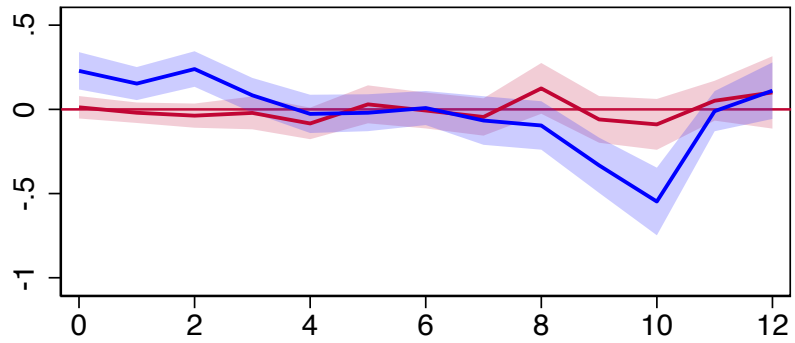
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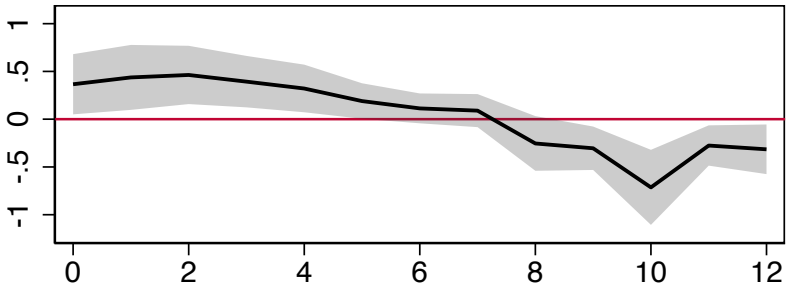
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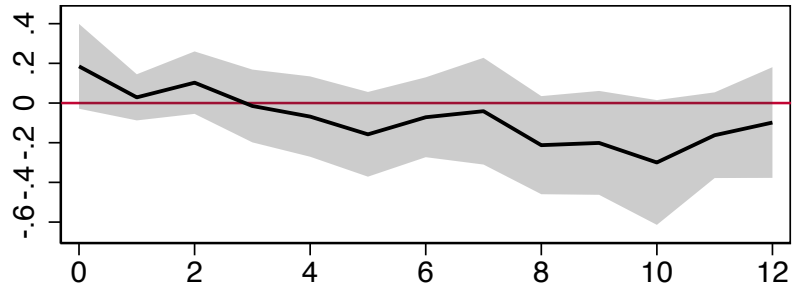
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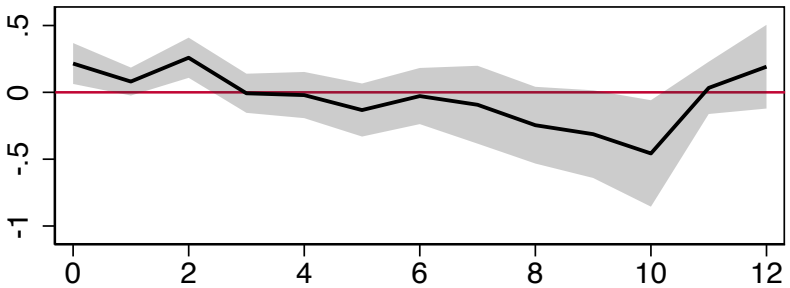
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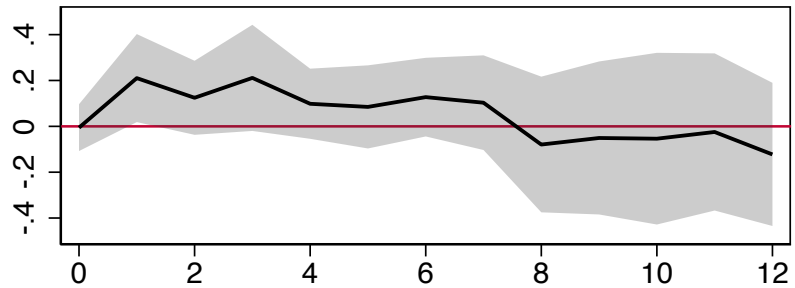
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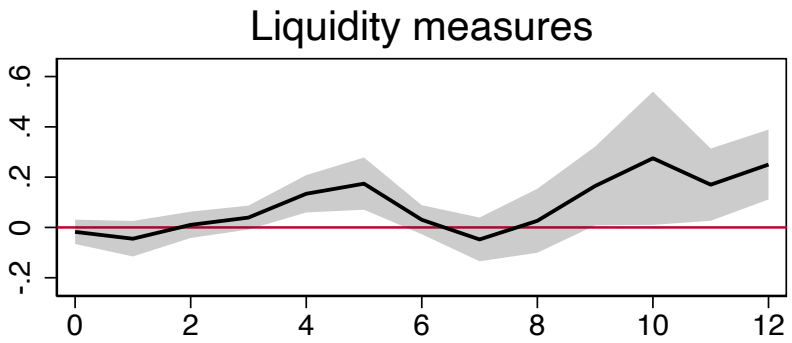
Liquidity measures
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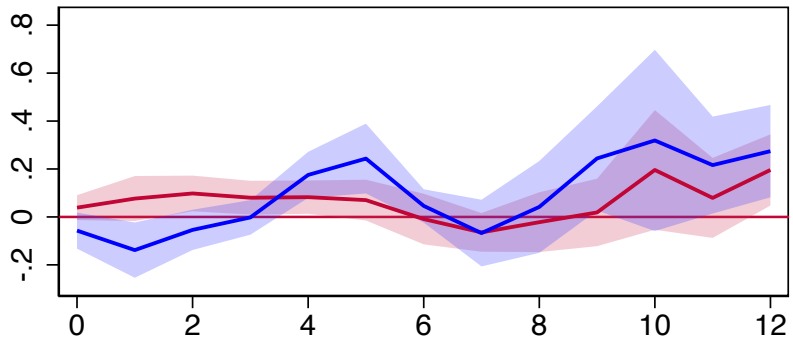
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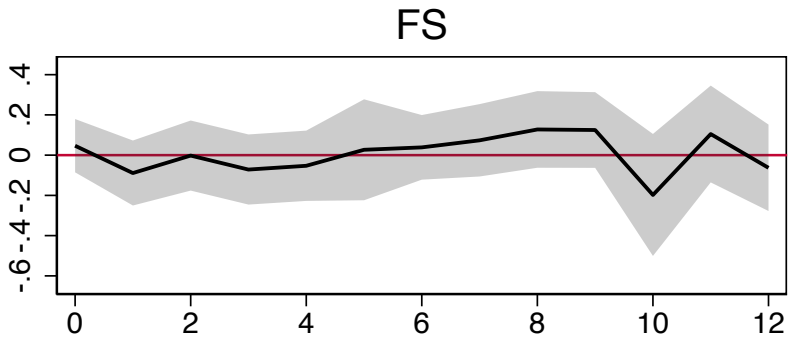
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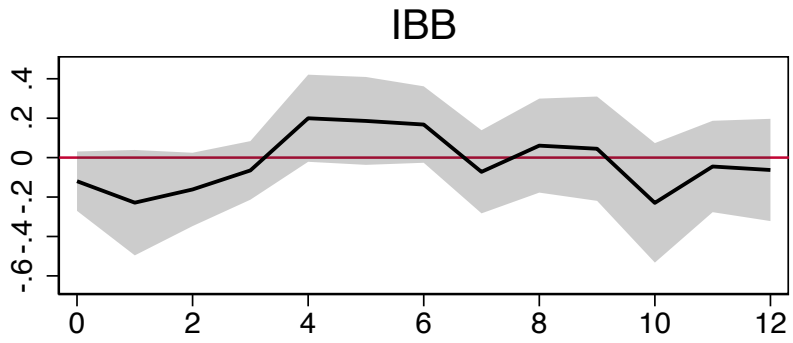
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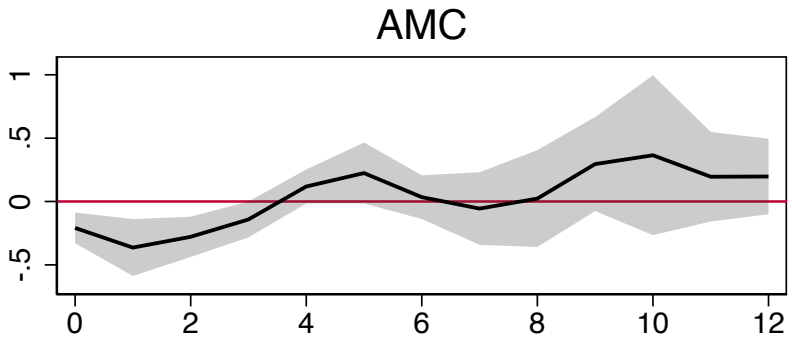
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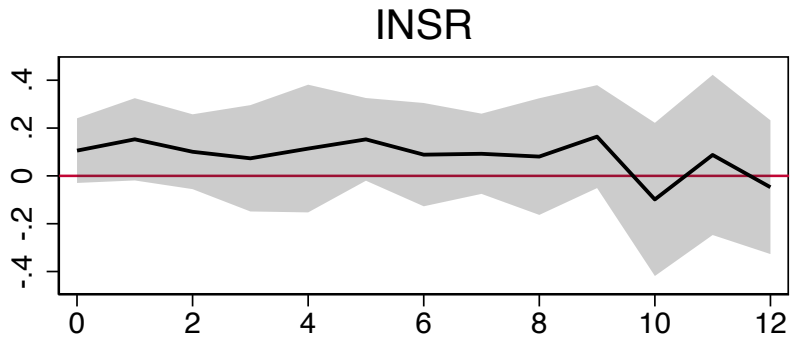
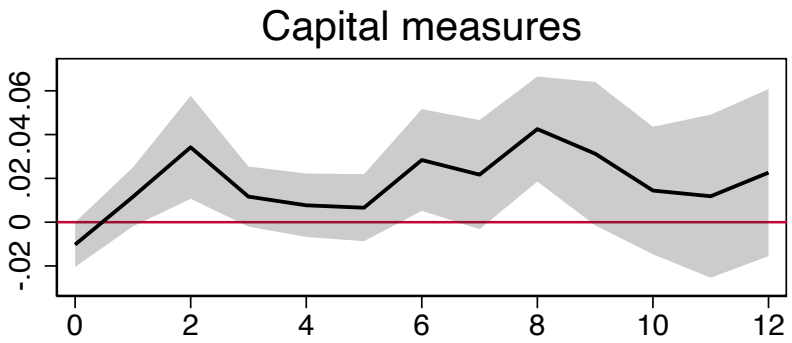

INSR
-.4 -.2 0 .2 .4
0 2 4 6 8 10 12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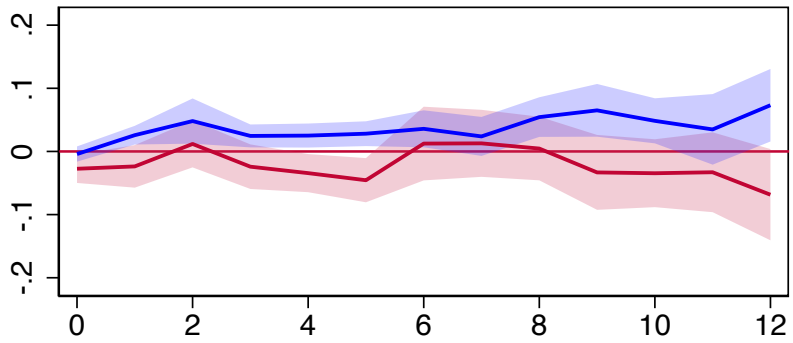
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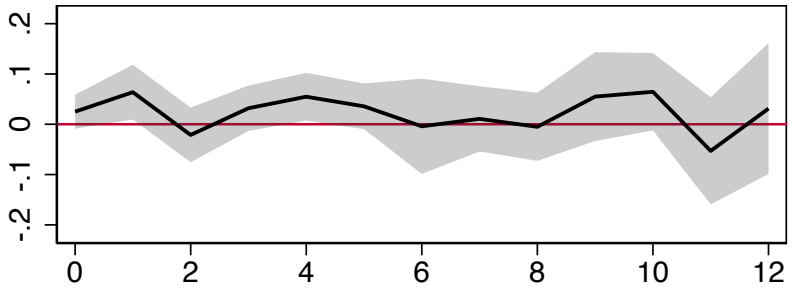
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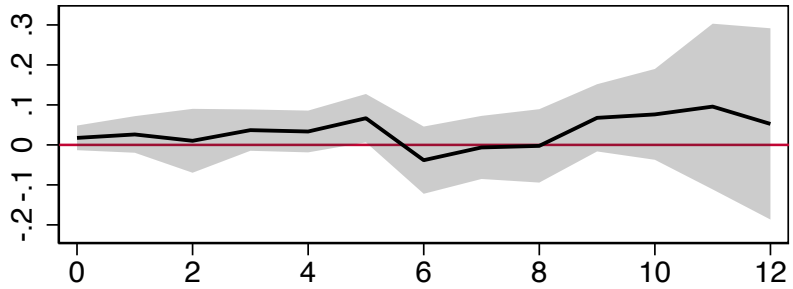
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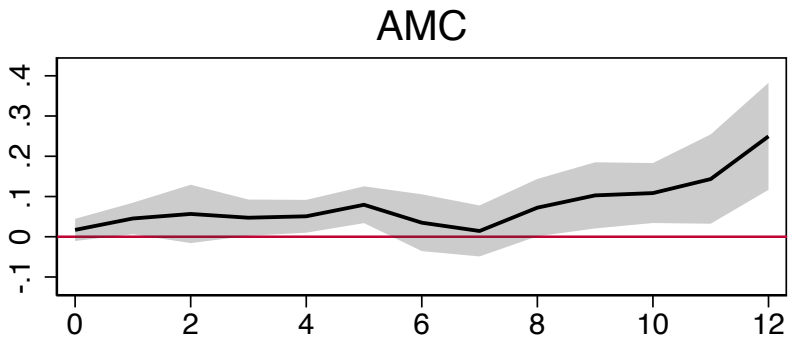
0 2 4 6 8 10 12


AMC
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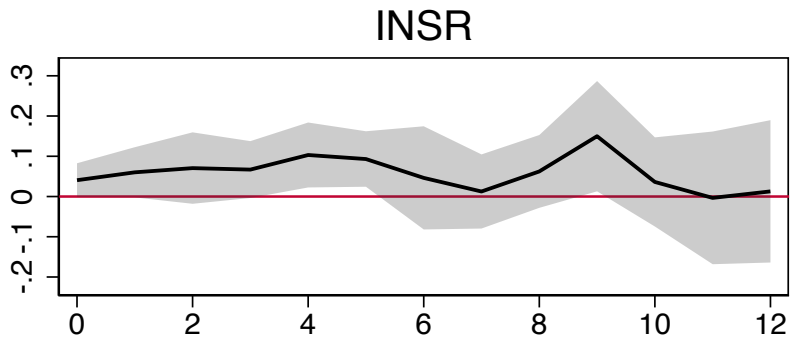
0 2 4 6 8 10 12


INSR
-.2 -.1 0 .1 .2 .3
0 2 4 6 8 10 12

Summary of results

- **Loan-demand-targeted measures**: significant reduction in overall systemic risk and systemic risk contribution of NBFIs over the first 1.5 years; reduction for banks only at few horizons

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- **Capital-targeted measures**: significant increase in overall systemic risk and systemic risk contribution of NBFIs at (almost) all horizons; reduction for banks only at few horizons

(Planned) robustness checks and sensitivity tests

- Including house price growth and credit growth among macro controls hpgr & crgr
- Core versus peripheral countries core vs. periph.
- Alternative measures of systemic risk - SRISK and MES (Acharya/Browlees, 2017)
- Alternative classification of entities
- Further MaP measures, e.g., exposure limits

Conclusion and outlook

- We provide evidence that leakage to NBFIs hampers the effectiveness of MaP with respect to reducing systemic risk.
- Leakage to the NBFI sector might even increase systemic risk in the entire financial sector (capital measures).
- Results stress the importance of distinguishing between different types of measures and financial intermediaries when assessing the effectiveness of MaP.
- Results show the pressing need to find ways to broaden the regulations to also cover the NBFI sector, or, at least, certain parts of it.
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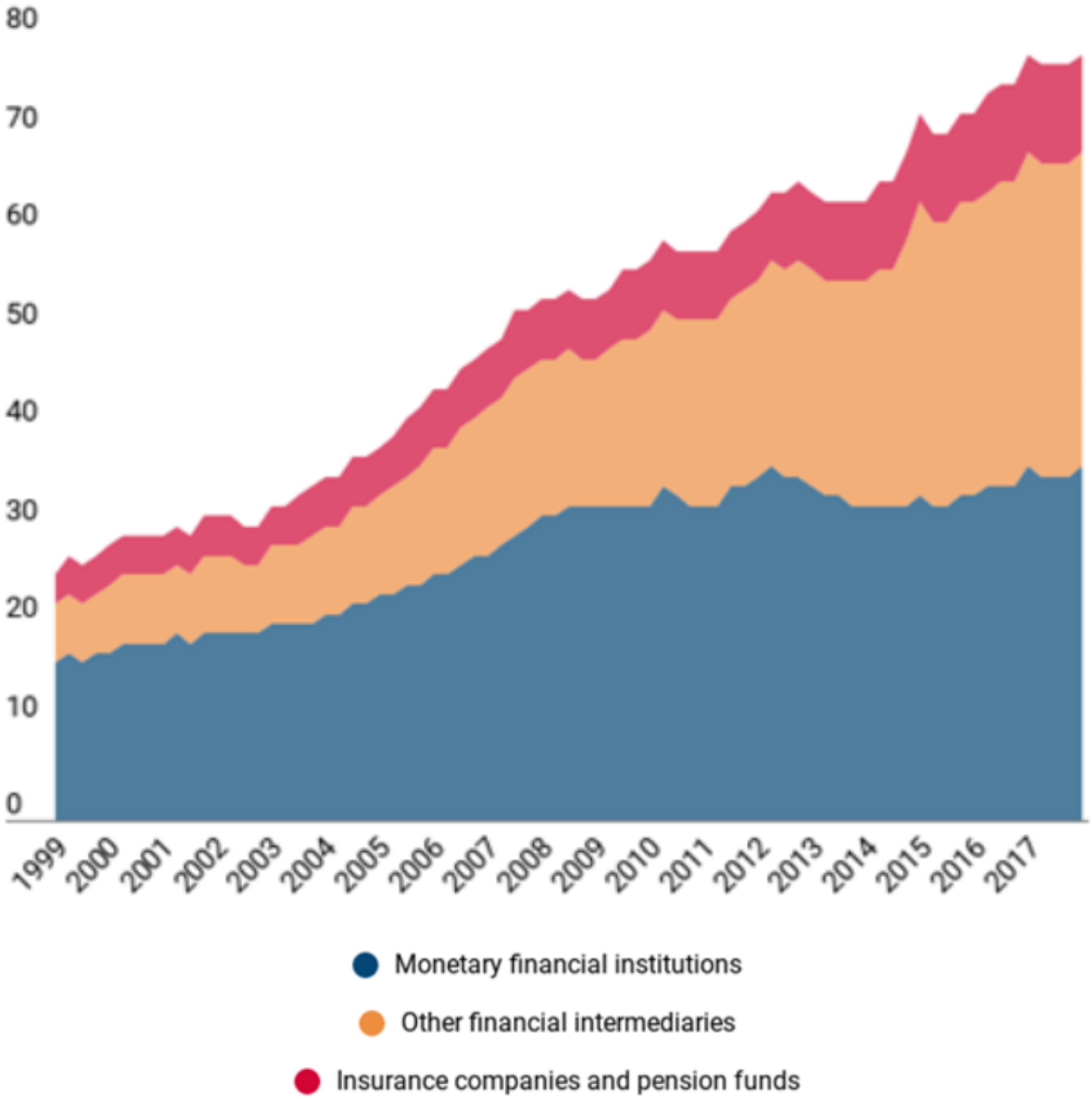
Thank you for your attention!

Appendix

Financial assets by European institutions



Source: IMF

back

ΔCoVaR – Definition

$\Delta CoVaR_q^i$ is the difference between the value at risk of a country's financial system conditional on financial institution i in that country being in a distressed state and the same financial institution being in a "normal" state,

$$\Delta CoVaR_q^i = CoVaR_q^{j|x^i=VaR_q^i} - CoVaR_q^{j|x^i=VaR_{50}^i},$$

i.e., the marginal contribution of institution i to overall systemic risk of its country.

back to main

ΔCoVaR – Additional information

Value at Risk (VaR_q^i) is the maximum expected loss of a financial institution (i) at a certain quantile (q),

$$Pr\left(x^i \leq VaR_q^i\right) = q,$$

where x^i represents the variable for which the VaR is calculated.

$CoVaR^{j|x^i=VaR_q^i}$, is the VaR of the entire financial system (j) given the conditioning event $x_i = VaR_q^i$. It is implicitely defined by the qth quantile of the conditional probability distribution,

$$Pr\left(x^j \mid (x^i = VaR_q^i) \leq CoVaR_q^{j|x^i=VaR_q^i}\right) = q.$$

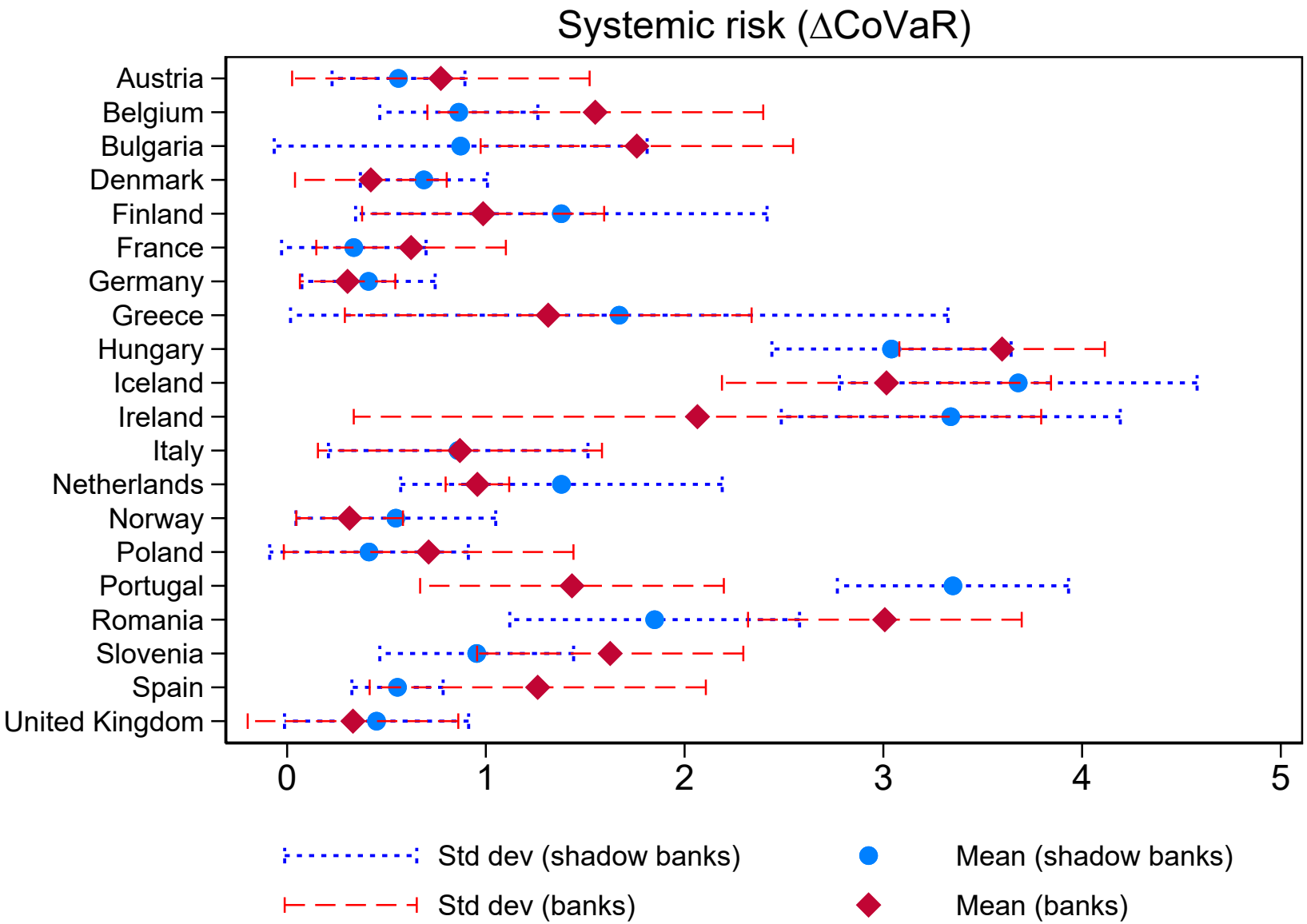
back to main

Classification along GICS Codes

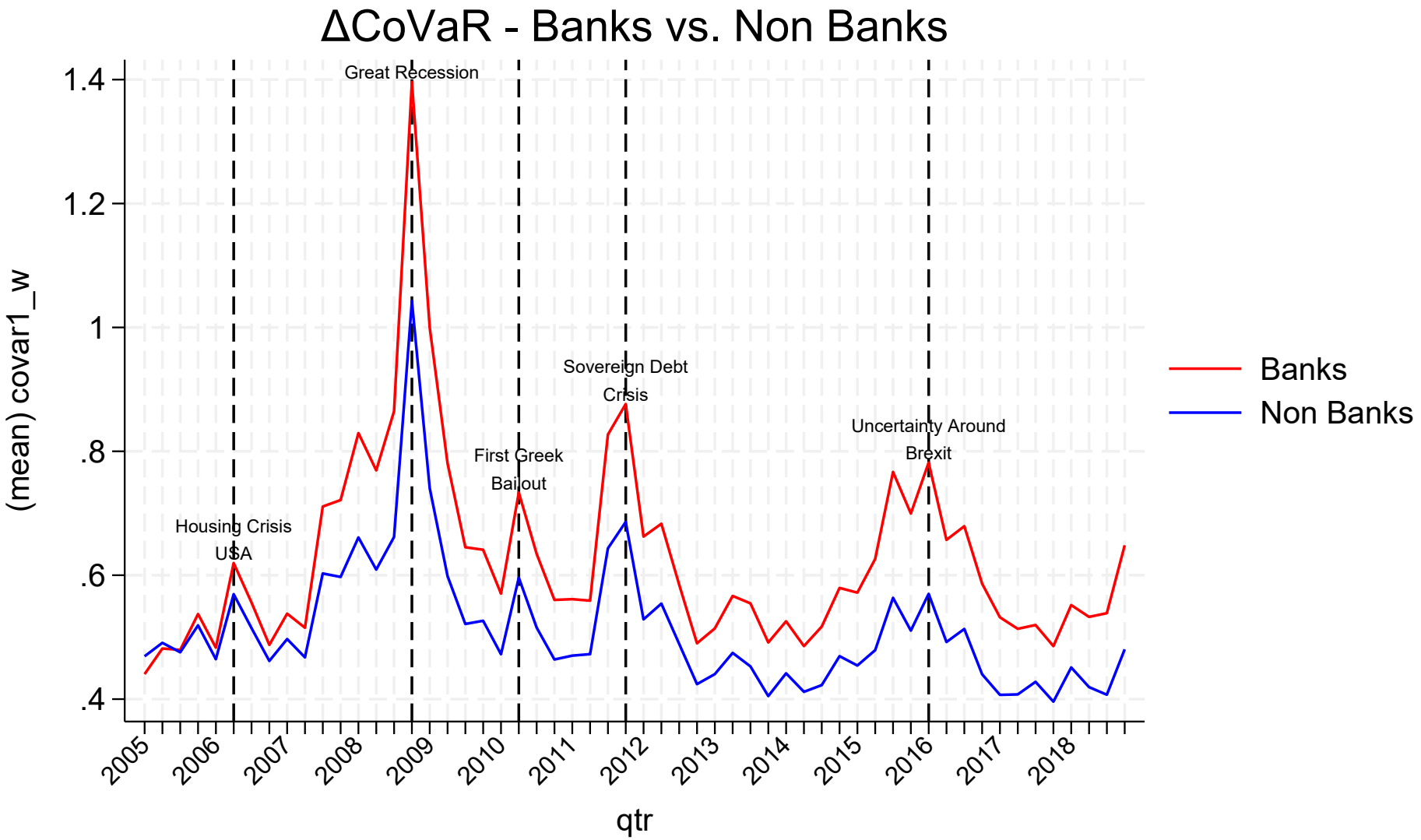
Industry	Sub-Industry	GICS Code	Classification
Banks	Diversified Banks	40101010	Banks
	Regional Banks	40101015	Banks
Financial Services	Consumer Finance	40202010	FS
	Diversified Financial Services	40201020	FS
	Multi-Sector Holdings	40201030	FS
	Specialized Finance	40201040	FS
Capital Markets	Asset Management Custody Banks	40203010	AMC
Capital Markets	Investment Banking Brokerage	40203020	IBB
Insurance	Life Health Insurance	40301020	INSR
	Multi-line Insurance	40301030	INSR

back to motivation back to CoVar back to dataset back to contribution

ΔCoVaR across countries

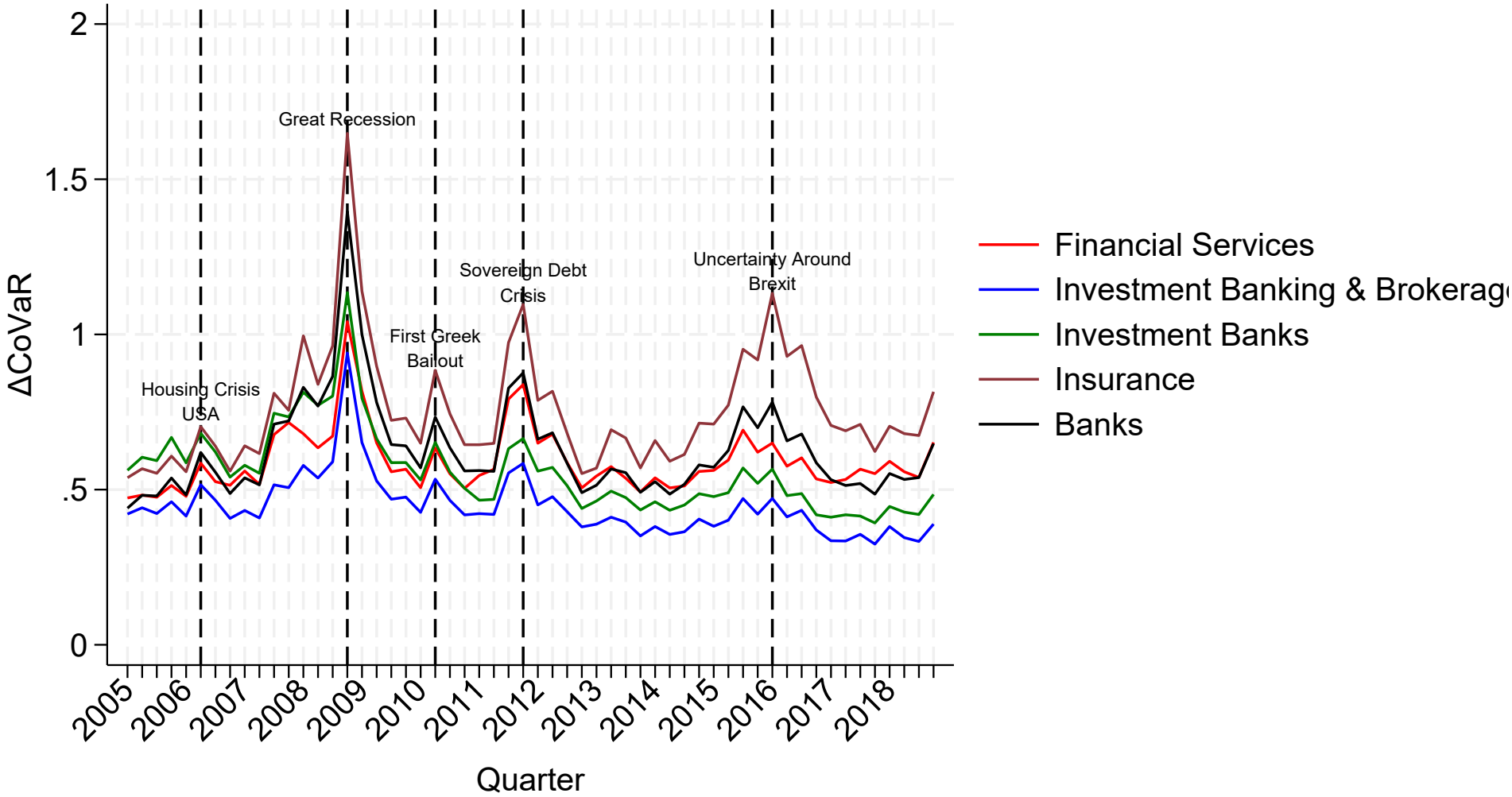


back to ΔCoVaR



back to ΔCoVaR

ΔCoVaR - Banks vs. FS vs. AMC vs. INS vs. IBB



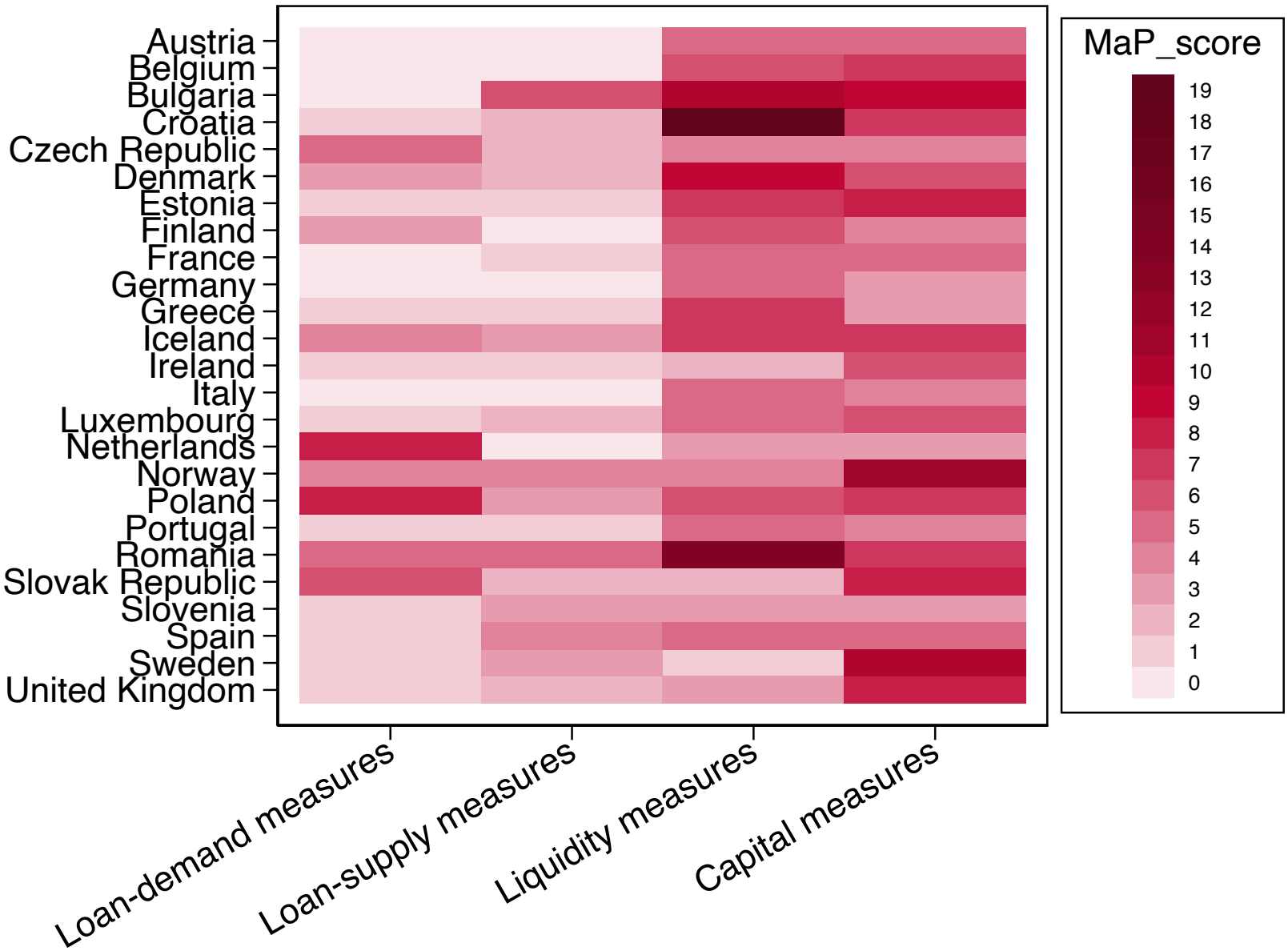
back to ΔCoVaR

ΔCoVaR – Data sources

- Profit and loss data and financial statement data from Compustat
- Macroeconomic and financial data used in the estimations from Refintiv Datastream, International Financial Statistics (IMF), and FRED St. Louis data
- Identification of Banks and NBFIs via the Global Industry Classification Standard (GICS) code. GICS

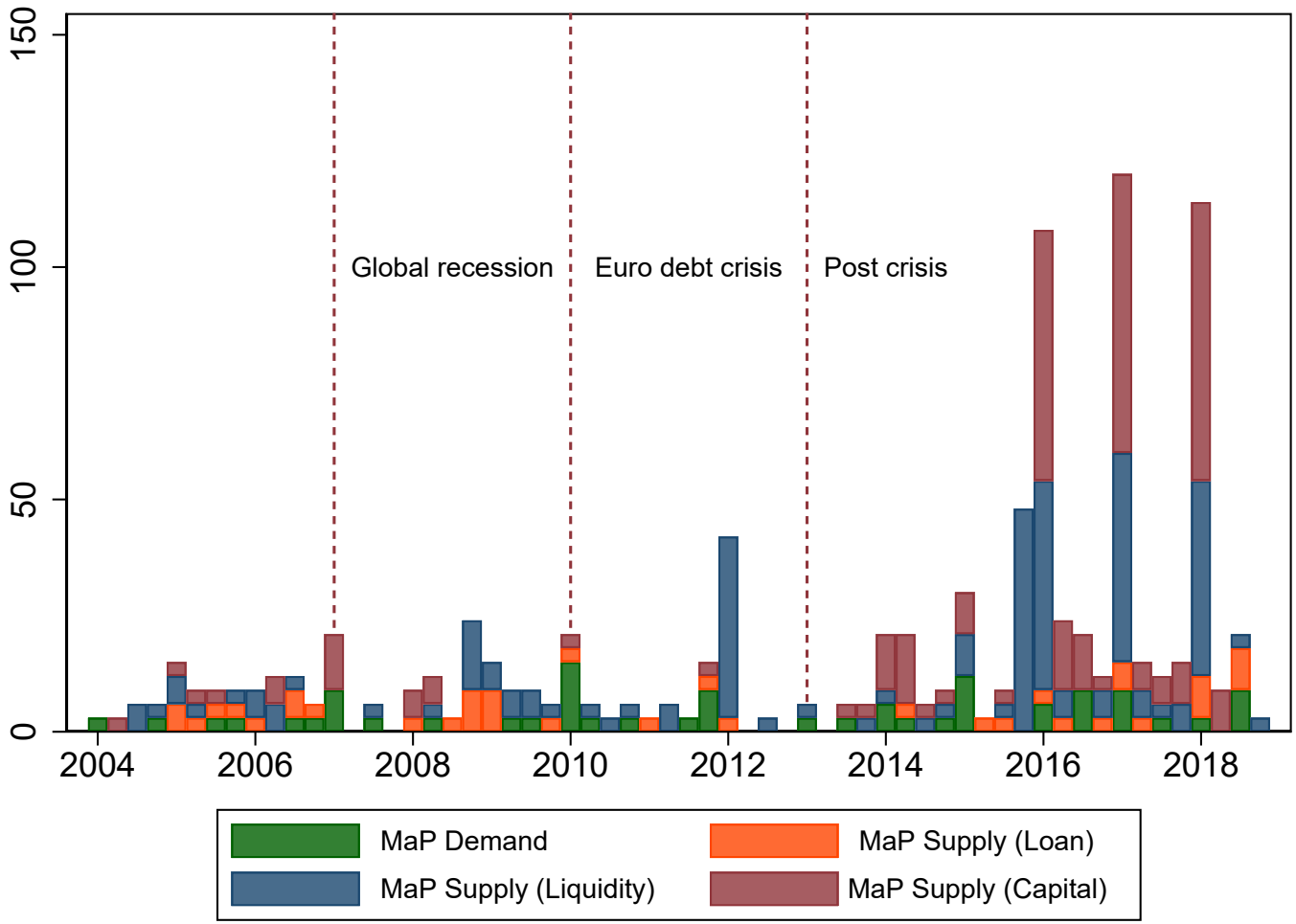
CoVaR across countries CoVaR across time

MaP types per country



back to MaP measures
back to core vs. periph.

MaP types over time



back to MaP measures

	All		Banks		Shadow Banks	
	mean	sd	mean	sd	mean	sd
Delta CoVaR	0.56	0.73	0.64	0.72	0.52	0.73
MB ratio	10.33	501.26	24.30	925.81	5.34	186.27
Leverage	7.12	32.45	13.32	48.31	4.91	24.01
Return on assets	-0.14	5.73	0.00	0.12	-0.19	6.67
Relative size	0.03	0.11	0.09	0.18	0.01	0.07
Observations	33506		8804		24702	

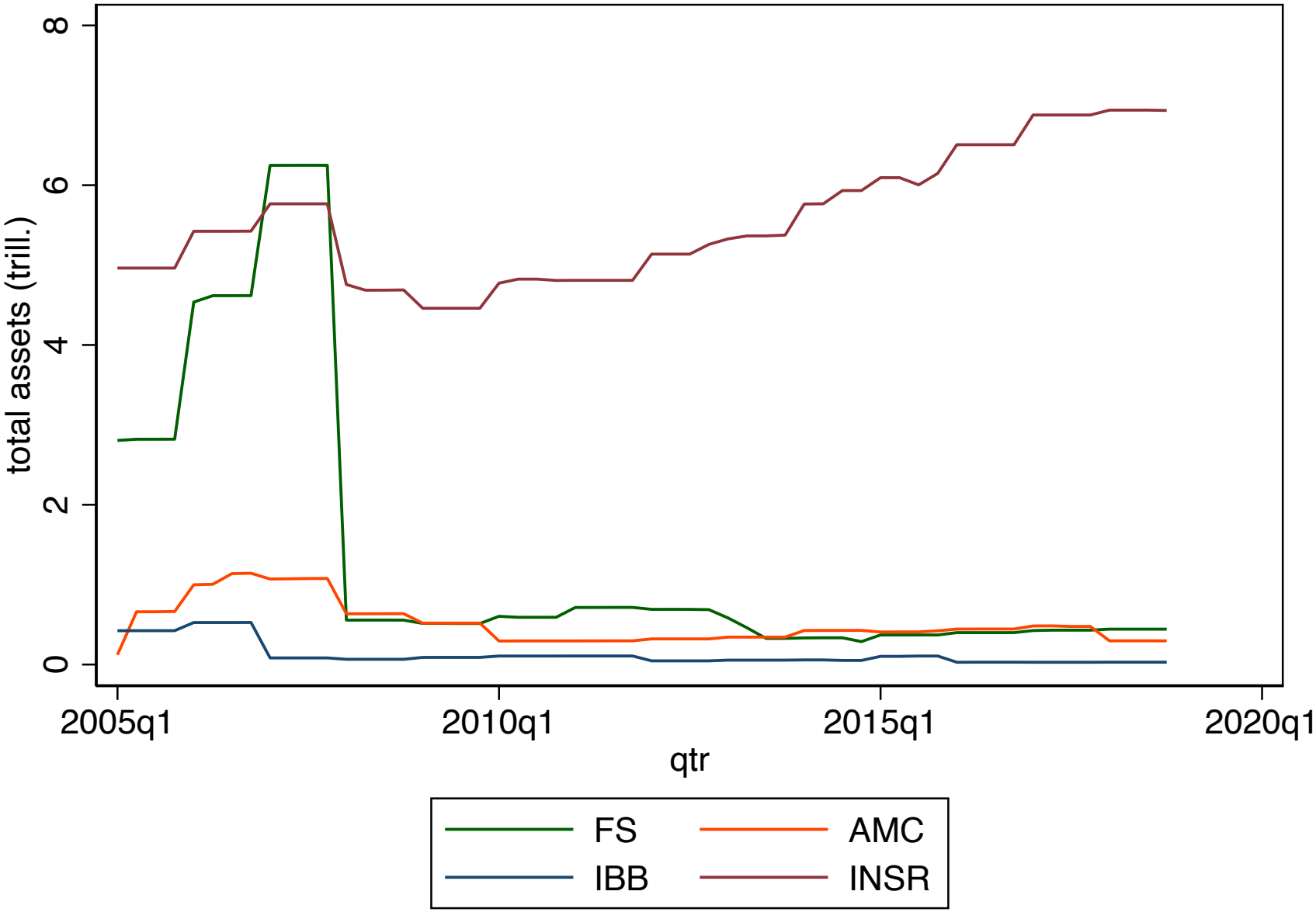
	All	
	mean	sd
MaP demand	0.01	0.08
MaP supply	0.06	0.24
MaP supply (Loan)	0.01	0.06
MaP supply (Liquidity)	0.02	0.10
MaP supply (Capital)	0.04	0.17
GDP growth	0.01	0.03
Inflation	1.92	1.44
Observations	33506	

back back to contr.

	FS		AMC		IBB		INSR	
	Mean	Std dev	Mean	Std dev	Mean	Std dev	mean	Std dev
Delta CoVaR	0.60	0.71	0.46	0.70	0.57	0.82	0.77	0.80
MB ratio	2.10	12.70	2.58	159.18	26.24	394.93	1.83	13.67
Leverage	6.98	30.24	2.38	6.18	5.33	15.24	16.92	60.83
Return on assets	-0.05	0.71	-0.24	8.37	-0.12	2.08	-0.17	3.86
Relative size	0.01	0.07	0.00	0.01	0.00	0.05	0.09	0.17
Observations	4387		14973		3053		2289	

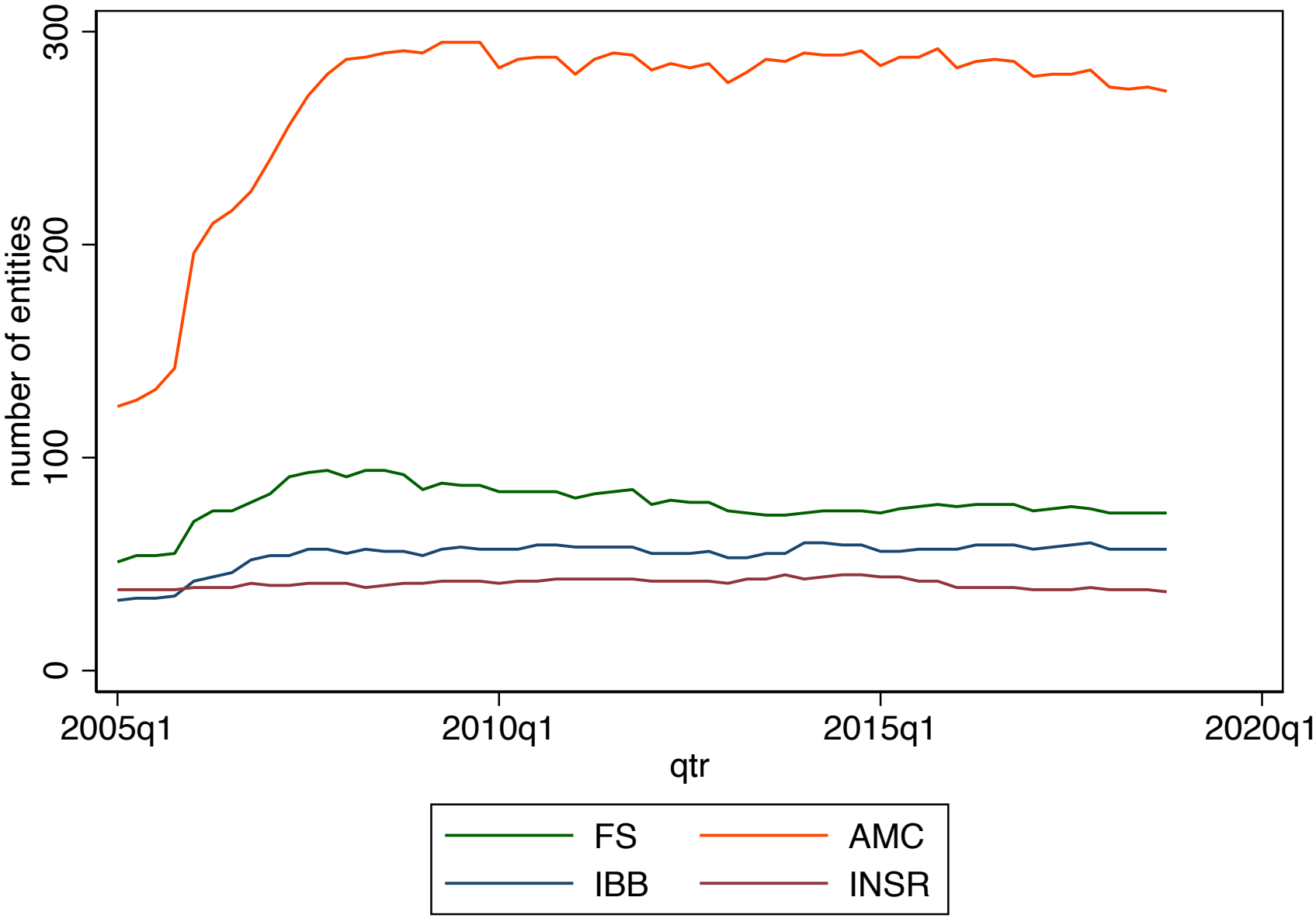
back

Total assets NBFIs



back back to contr.

Number of NBFIs



back back to contr.

Financial intermediaries in individual countries

Country	Banks	Shadow banks	FS	IBB	AMC	INSR
Austria	8	4	0	0	4	0
Belgium	3	17	7	1	8	1
Bulgaria	5	10	4	0	3	3
Denmark	46	15	2	0	12	1
Finland	3	13	3	2	7	1
France	20	32	7	3	20	2
Germany	16	121	14	20	77	10
Greece	10	11	3	2	4	2
Hungary	1	5	0	0	4	1
Iceland	2	5	2	1	1	1
Ireland	5	4	1	1	1	1
Italy	23	47	14	5	18	10
Netherlands	2	22	5	3	11	3
Norway	31	13	7	1	3	2
Poland	18	76	19	14	41	2
Portugal	5	1	0	1	0	0
Romania	3	6	0	1	5	0
Slovenia	2	4	1	0	2	1
Spain	18	10	1	2	4	3
United Kingdom	19	278	45	27	190	16
Total	240	694	135	84	415	60

back to contr.

Total assets of financial intermediaries in individual countries (billions per quarter)

Country	Banks	Shadow banks	FS	IBB	AMC	INSR
Austria	221.80	0.35	0.00	0.35	0.00	0.00
Belgium	691.06	549.18	122.72	179.21	0.01	247.25
Bulgaria	12.80	2.14	0.59	0.36	0.00	1.19
Denmark	4055.08	72.02	0.89	10.63	0.00	60.49
Finland	561.18	60.95	24.68	0.56	0.33	35.39
France	3440.47	1156.03	32.54	6.74	4.59	1112.16
Germany	1212.46	1185.12	3.79	7.33	4.45	1169.55
Greece	325.92	110.28	108.28	0.22	1.04	0.74
Hungary	10083.13	111.54	0.00	40.73	0.00	70.81
Iceland	4434.48	4544.85	4253.79	78.83	170.52	41.71
Ireland	385.83	1.58	0.14	0.11	0.05	1.28
Italy	1663.55	711.24	46.95	12.27	5.95	646.07
Netherlands	397.87	563.81	91.62	11.32	4.77	456.10
Norway	613.63	502.44	7.55	0.21	2.89	491.78
Poland	869.86	91.39	2.57	3.65	0.71	84.45
Portugal	69.04	0.10	0.00	0.00	0.10	0.00
Romania	80.38	5.95	0.00	5.85	0.10	0.00
Slovenia	9.02	4.02	0.10	0.67	0.00	3.26
Spain	1945.84	67.31	3.43	0.43	0.97	62.48
United Kingdom	2853.49	1411.64	8.88	239.65	51.10	1112.02
Total	33926.89	11151.94	4708.52	599.13	247.57	5596.72

Mean size of financial intermediaries in individual countries (billions)

Country	Banks	Shadow banks	FS	IBB	AMC	INSR
Austria	36.83	0.12	0.00	0.12	0.00	0.00
Belgium	240.29	43.90	29.39	29.82	0.01	247.25
Bulgaria	3.20	0.30	0.24	0.18	0.00	0.51
Denmark	145.05	10.02	0.54	1.49	0.00	60.49
Finland	213.33	11.42	19.05	0.16	0.33	35.39
France	221.64	49.92	5.76	0.51	1.67	556.08
Germany	113.11	15.11	0.42	0.14	0.32	198.96
Greece	47.45	15.80	46.25	0.07	0.79	0.74
Hungary	10083.13	35.75	0.00	11.55	0.00	70.81
Iceland	2217.24	304.45	2126.89	78.83	170.52	41.71
Ireland	128.26	0.59	0.14	0.11	0.05	1.28
Italy	108.95	25.00	6.34	1.01	2.18	98.45
Netherlands	204.89	45.17	28.55	1.61	3.13	262.74
Norway	29.02	62.18	1.89	0.14	2.89	311.53
Poland	66.85	1.65	0.21	0.17	0.09	79.13
Portugal	33.22	0.10	0.00	0.00	0.10	0.00
Romania	29.75	1.07	0.00	1.25	0.10	0.00
Slovenia	4.85	1.05	0.10	0.34	0.00	3.26
Spain	240.96	8.78	3.43	0.15	0.51	30.02
United Kingdom	311.62	8.11	0.40	1.90	2.79	111.55
Total	193.56	17.12	17.44	1.91	2.30	135.82

Further extensions: MaP shocks in core and periphery

	MaP Demand shock	MaP Supply shock	MaP Supply shock	MaP Supply shock
	(Loan)	(Loan)	(Liquidity)	(Capital)
L.CoVaR	0.6263***	0.6263***	0.6290***	0.6259***
	(0.0128)	(0.0134)	(0.0152)	(0.0130)
L.MaP_shock	-0.0387	-0.0253	0.0795**	0.0024
	(0.0284)	(0.0186)	(0.0312)	(0.0153)
Shadow bank x L.MaP-shock	0.0525*	0.0634**	-0.0057	0.0052
	(0.0308)	(0.0249)	(0.0246)	(0.0119)
Firm fixed effect	Yes	Yes	Yes	Yes
Time fixed effect	Yes	Yes	Yes	Yes
R-squared	0.4056	0.4057	0.4196	0.4051
No of obs.	24103	24103	13925	24099
p-value of F-test	0.4339	0.0223	0.0148	0.2733

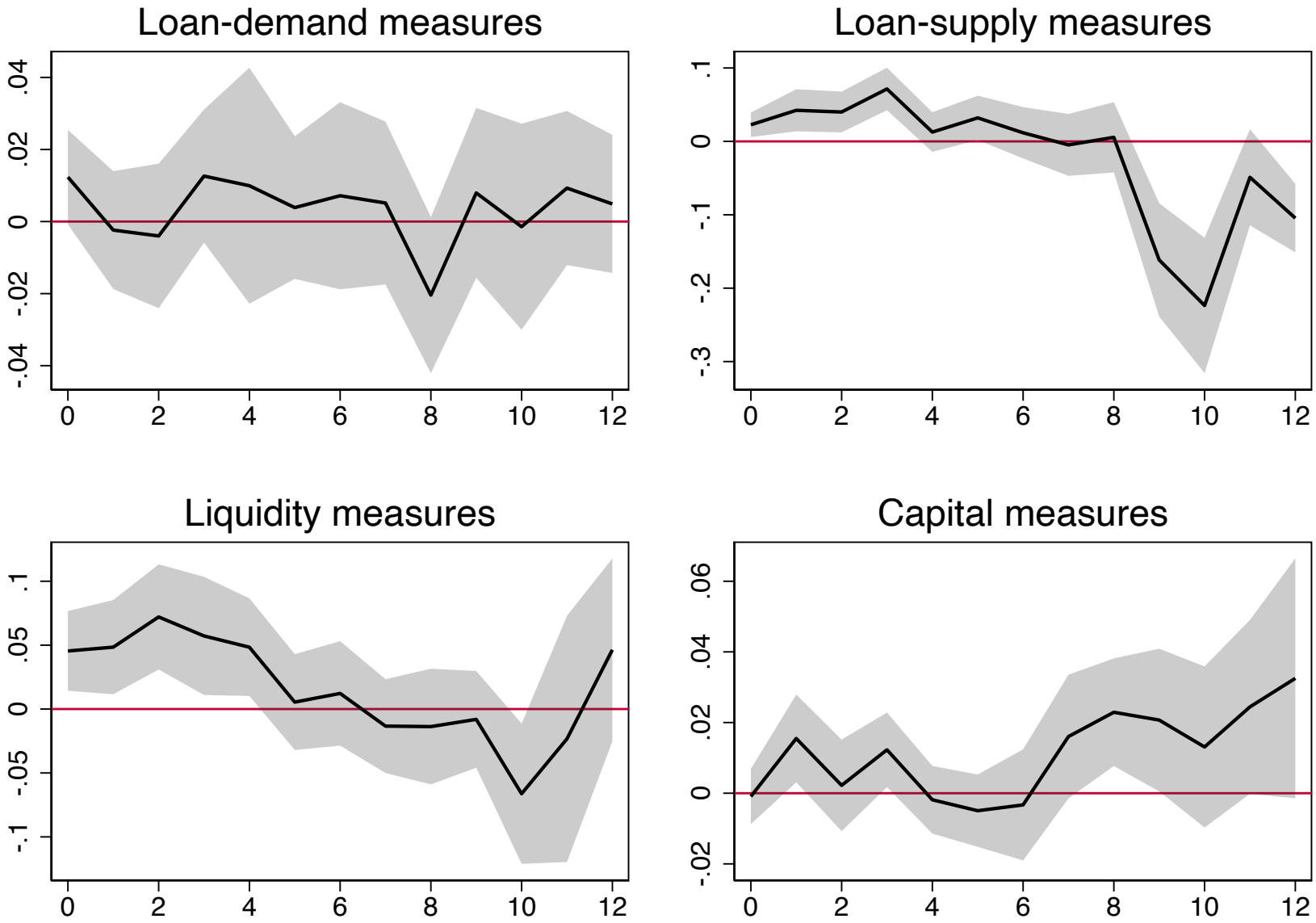
	MaP Demand shock	MaP Supply shock	MaP Supply shock	MaP Supply shock
	(Loan)	(Loan)	(Liquidity)	(Capital)
L.CoVaR	0.6452***	0.6445***	0.6446***	0.6452***
	(0.0221)	(0.0225)	(0.0225)	(0.0225)
L.MaP_shock	-0.0444**	0.0409	0.0078	-0.0751***
	(0.0197)	(0.0322)	(0.0479)	(0.0222)
Shadow bank x L.MaP-shock	0.0787***	0.1211**	-0.0490	0.0393
	(0.0249)	(0.0580)	(0.0509)	(0.0296)
Firm fixed effect	Yes	Yes	Yes	Yes
Time fixed effect	Yes	Yes	Yes	Yes
R-squared	0.4543	0.4549	0.4541	0.4547
No of obs.	8212	8212	8212	8212
p-value of F-test	0.0849	0.0045	0.3022	0.0566

back

Unconditional results for the entire system ($h = 0$)

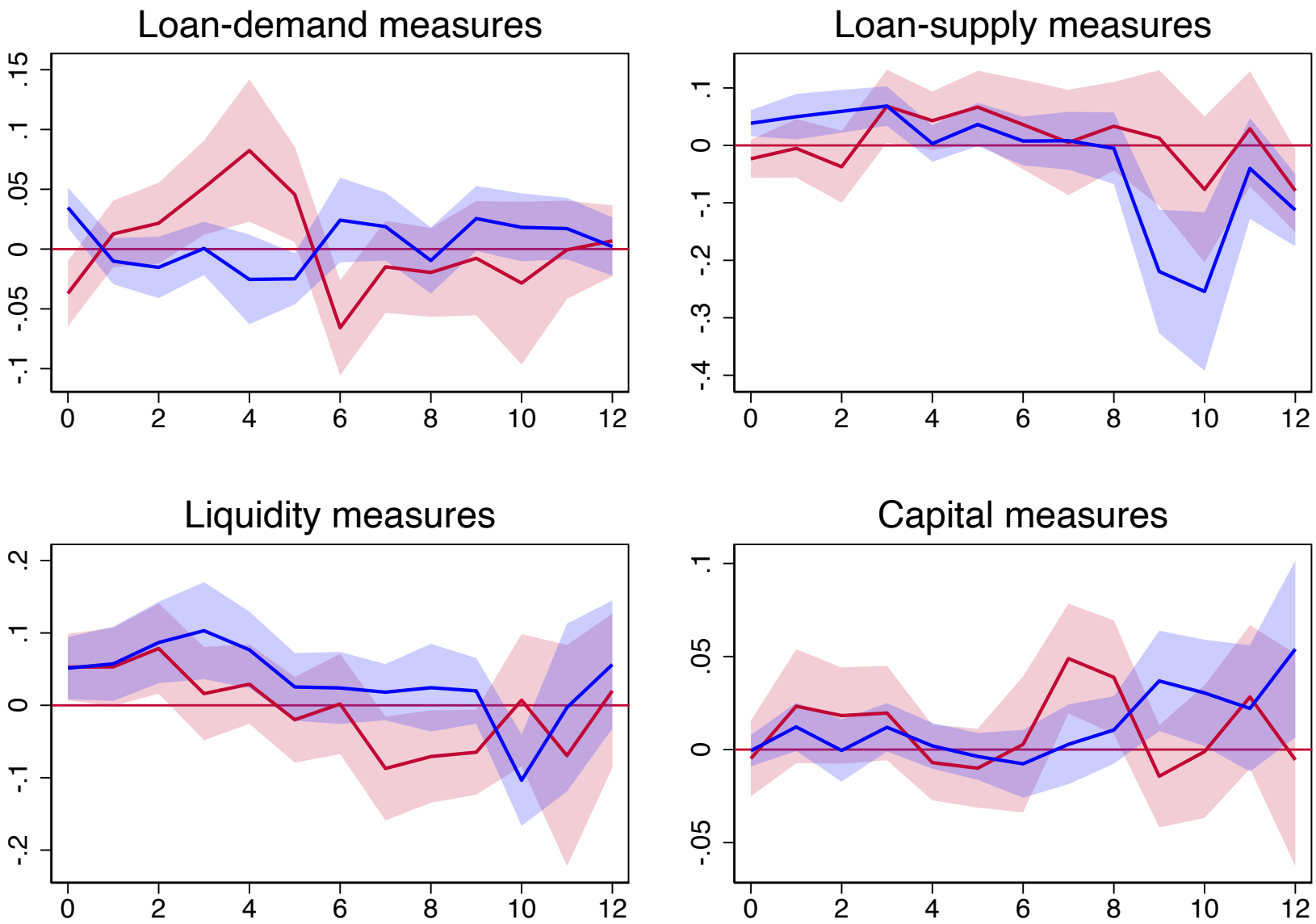
	MaP Demand shock	MaP Supply shock	MaP Supply shock	MaP Supply shock
	(Loan)	(Loan)	(Liquidity)	(Capital)
L.CoVaR	0.6056***	0.6056***	0.6047***	0.6055***
	(0.0140)	(0.0142)	(0.0185)	(0.0144)
L.MaP_shock	0.0123	0.0226**	0.0455**	-0.0009
	(0.0079)	(0.0101)	(0.0189)	(0.0048)
L.VaR	0.0033***	0.0033***	0.0049***	0.0033***
	(0.0007)	(0.0007)	(0.0010)	(0.0007)
L.ROA	-0.0151***	-0.0151***	-0.0216***	-0.0151***
	(0.0048)	(0.0051)	(0.0077)	(0.0045)
L.Size	-0.2124**	-0.2116**	-0.1959**	-0.2115**
	(0.1027)	(0.0988)	(0.0965)	(0.0979)
L.Leverage	0.0004	0.0004	0.0004	0.0004
	(0.0003)	(0.0003)	(0.0004)	(0.0003)
L.MB ratio	-0.0006	-0.0006	-0.0010	-0.0006
	(0.0005)	(0.0005)	(0.0009)	(0.0005)
L.GDP growth	0.2568***	0.2558***	0.1041	0.2571***
	(0.0862)	(0.0872)	(0.1048)	(0.0861)
L.Inflation	0.0024	0.0023	0.0024	0.0024*
	(0.0015)	(0.0015)	(0.0020)	(0.0014)
L.Year-on-year house price growth	0.0003	0.0004	0.0001	0.0003
	(0.0002)	(0.0002)	(0.0003)	(0.0002)
L.Year-on-year credit-to-gdp growth	0.0290	0.0285	0.1120**	0.0284
	(0.0183)	(0.0182)	(0.0541)	(0.0179)
Firm fixed effect	Yes	Yes	Yes	Yes
Time fixed effect	Yes	Yes	Yes	Yes
Country fixed effect	Yes	Yes	Yes	Yes
R-squared	0.3897	0.3897	0.4022	0.3897
No of obs.	33519	33519	33519	33519

Unconditional effects over time



Gray areas represent 90% confidence intervals. back

Effects on banks (red) and NBFIs (blue) over time



Shaded areas represent 90% confidence intervals. back

First-stage regression

	Demand shock (Aggregate)	Supply shock (Loan)	Supply shock (Liquidity)	Supply shock (Capital)
REER growth	0.203***	0.010		
	(0.074)	(0.049)		
Real GDP growth	-0.225**			0.334*
	(0.099)			(0.187)
Crisis in last 12 months	-0.025**			
	(0.013)			
Currency crisis count	0.002**	-0.002**	0.003**	0.003
	(0.001)	(0.001)	(0.001)	(0.002)
Distance to default		0.001*		0.003**
		(0.001)		(0.001)
Policy rate		-0.004***	-0.015***	-0.023***
		(0.001)	(0.002)	(0.005)
Cross border borrowing ratio			-0.023*	
			(0.012)	
Romer and Romer count			0.003***	
			(0.001)	
Banking crisis count			0.008***	
			(0.002)	
Growth forecast			0.008**	
			(0.003)	
Romer and Romer crisis intensity			-0.003***	-0.001***
			(0.001)	(0.000)
Sovereign currency count				0.013**
				(0.006)
Domestic credit growth				0.002***
				(0.001)
$i - i^*$				0.011**
				(0.005)
Constant	0.009	0.013	0.051**	0.051*
	(0.013)	(0.010)	(0.021)	(0.027)
Country fixed effect	Yes	Yes	Yes	Yes
R-squared	0.054	0.050	0.155	0.085
No of obs.	1056.000	1056.000	1000.000	1052.000

back