The trade-off between monetary policy and bank stability

National Bank of Belgium, 14th October 2016

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Motivation and research questions

Motivation

- Monetary policy faces trade-off
  - Monetary policy decisions not only affect price stability ...
  - ... but also have consequences for financial stability
    - Bank risk-taking channel: Ioannidou et al. (2015, Rev. Financ.), Jiménez et al. (2014, Econometrica)
    - This paper: bank systemic risk
- Role for macroprudential policy
  - Prevent buildup of vulnerabilities *conditional* on monetary policy

Contribution

1. Transmission of monetary policy actions to bank systemic risk
    - Is there a trade-off between price stability and financial stability?
2. Heterogeneity of impact across bank business models
    - Which banks are more affected?
    - Which transmission channels are operating?

Methodology

Model

- Panel analysis of listed banks
    - Euro Area: 63 banks (26 core, 37 periphery)
    - United States: 438 banks
- Monthly frequency
    - October 2008 to December 2015

Model

$$\Delta Y_{i,t} = \alpha_i + \left(\beta_0 + \sum_{k=1}^{K} \beta_k BM_{k,i,t} \right) \times Shock_t + \sum_{k=1}^{K} \gamma_k BM_{k,i,t} + \varepsilon_{i,t}$$

- $MP\ Shock_t$: identification-through-heteroskedasticity
- $Y_{i,t}$: stock market-based measures of bank systemic risk
- $BM_{k,i,t}$: bank-specific characteristics

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- **MP Shock$_t$: identification-through-heteroskedasticity**
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Monetary Policy Shock: Identification

- Structural vector autoregression (*VAR*)
- Identification-through-heteroskedasticity
    - Rigobon and Sack (2003, QJE; 2004, JME)
    - Announcement dates
        - Monetary policy news dominates
        - Other news becomes relatively less important
    - Some monetary policy actions are expected
        - Anticipation

Monetary Policy Shock: Identification

- Main advantages
  - Requires weaker set of assumptions than event-study analysis
  - Does not require a choice of a specific monetary policy instrument
- Main disadvantage
  - The structure of the model itself is time invariant
  - Hence, unable to compare different types of monetary policy

Monetary Policy Shock: Identification

- A VAR of financial variables at daily frequency
  - Period of unconventional monetary policy: 01/10/2008 until 31/12/2015
  - Variables incorporate the pass-through of monetary policy to the financial sector

	Euro area	***United States***
Long term bond yield	German 10Y bund yield	Treasury bill 10Y yield
Medium term bond yield	German 2Y bund yield	Treasury bill 2Y yield
Volatility	VSTOXX	VIX
Inflation expectations	5Y forward 5Y inflation expectation	5Y forward 5Y inflation expectation
Stock market	Datastream EMU broad index return	S&P 500 return
Sovereign bond market	Spanish 5Y CDS spread	

Monetary Policy Shock: Euro Area IRFs

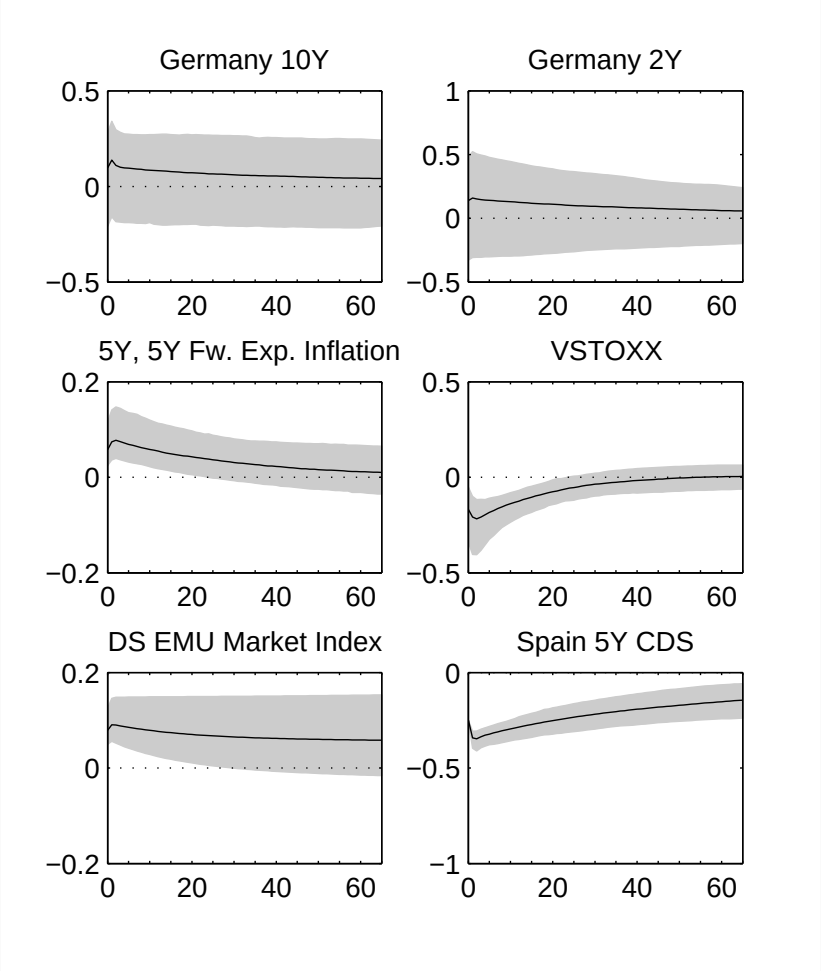

Figure 1: Euro area impulse response functions to a monetary policy shock.

Monetary Policy Shock: U.S. IRFs

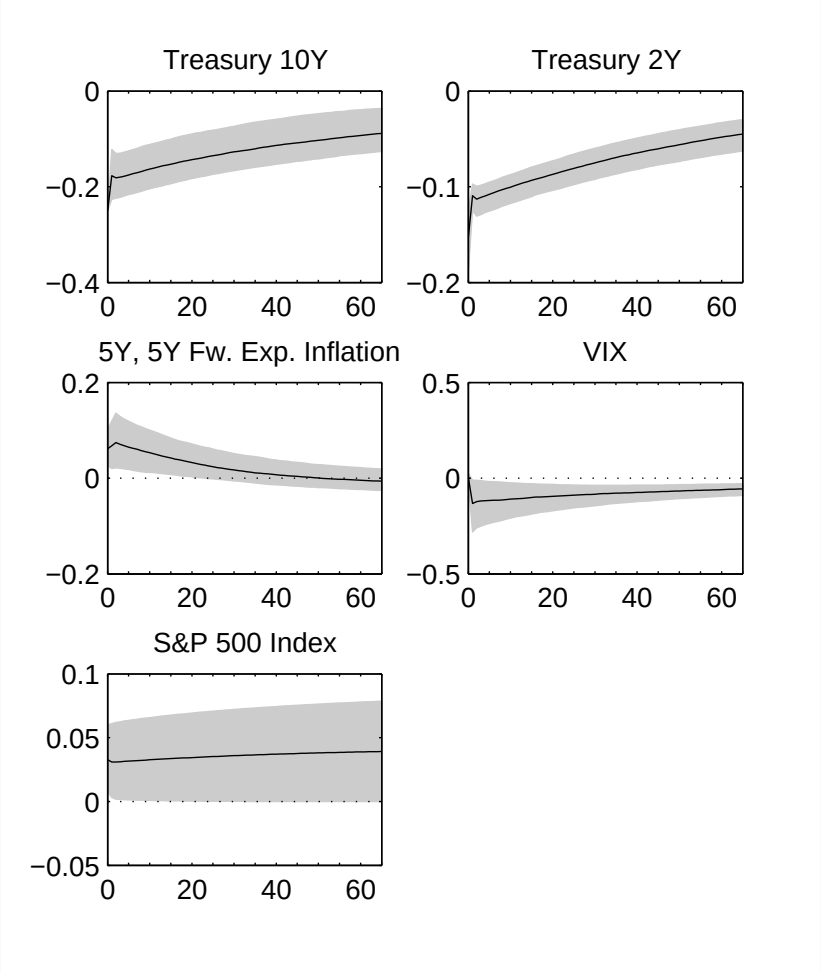

Figure 2: United States impulse response functions to a monetary policy shock.

Monetary Policy Shock: Euro Area Shock

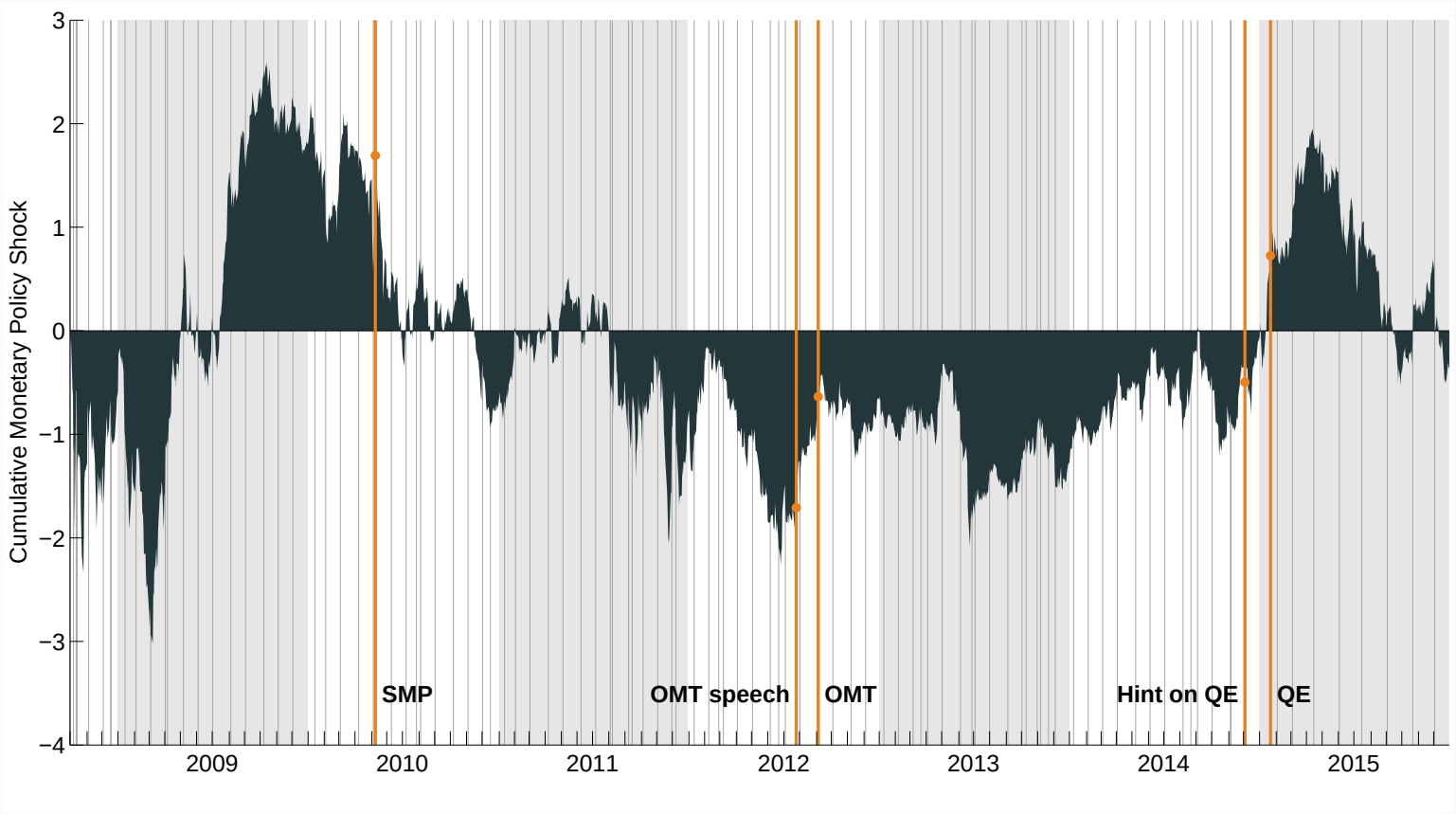

Figure 3: Euro Area cumulative monetary policy shock.

Monetary Policy Shock: U.S. Shock

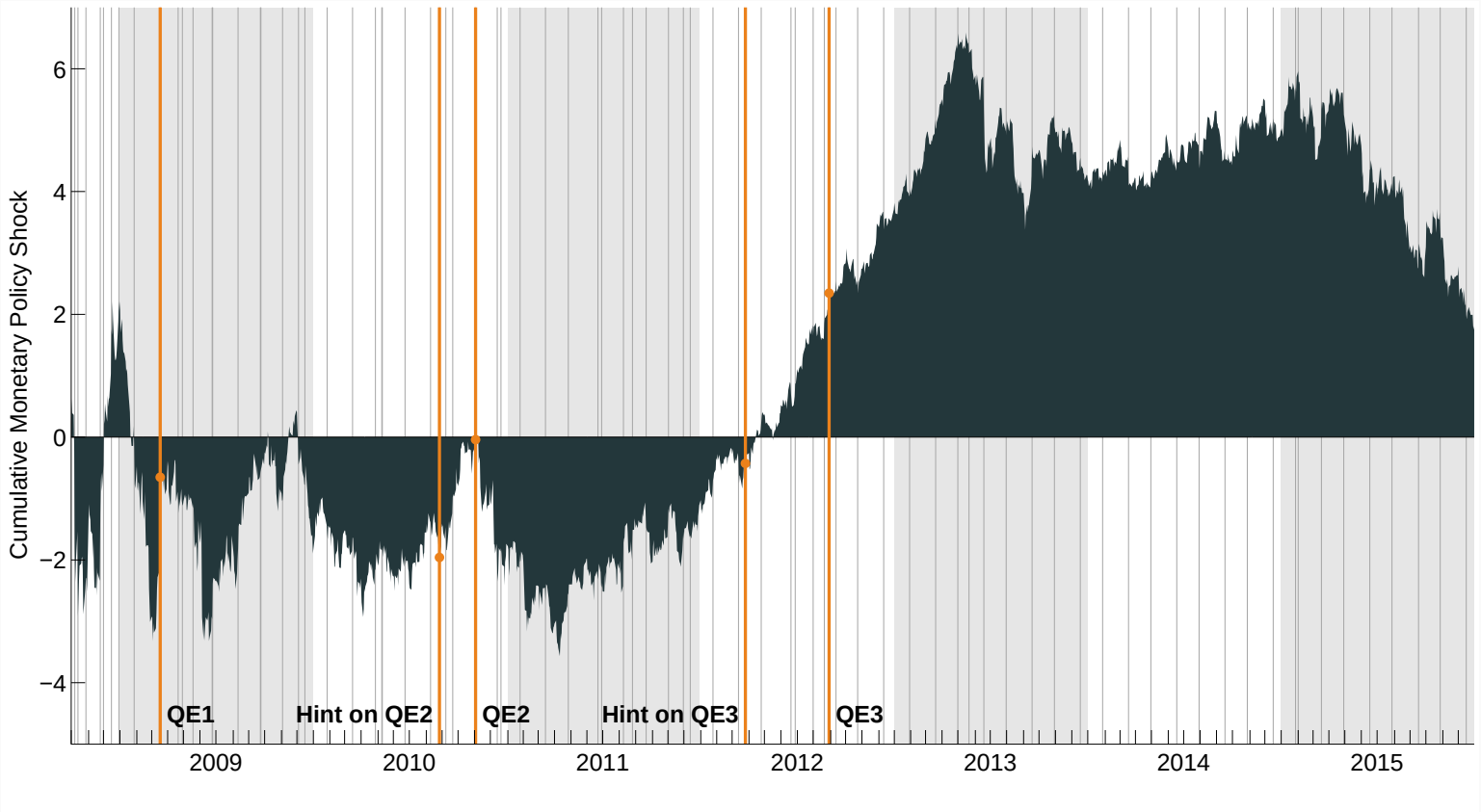

Figure 4: United States cumulative monetary policy shock.

Model

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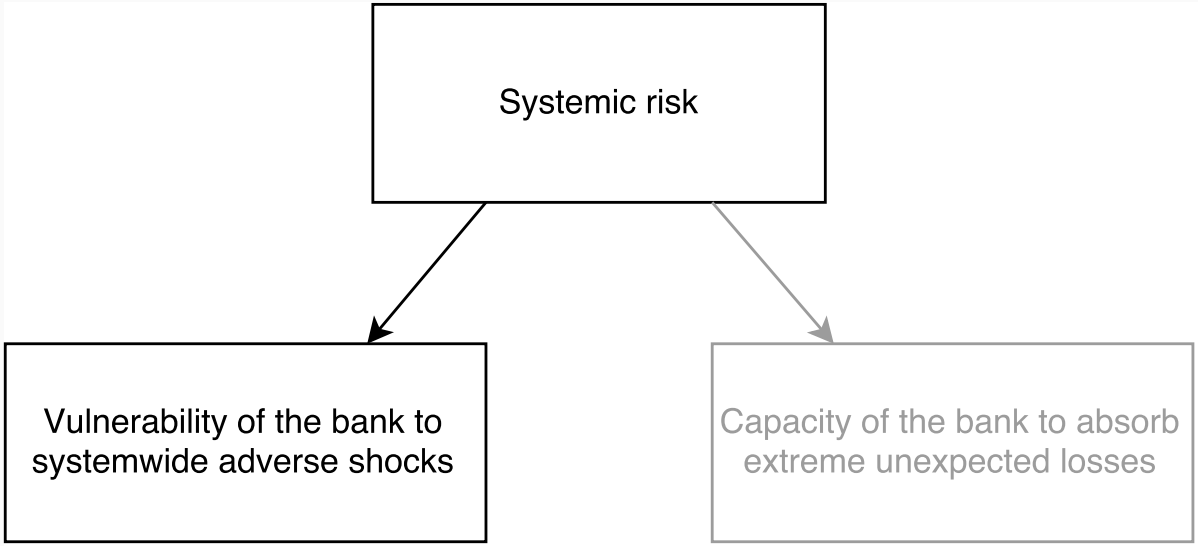
- $MP\ Shock_t$: identification-through-heteroskedasticity
- $\mathbf{Y_{i,t}}$**: stock market-based measures of bank systemic risk**
- $BM_{k,i,t}$: bank-specific characteristics

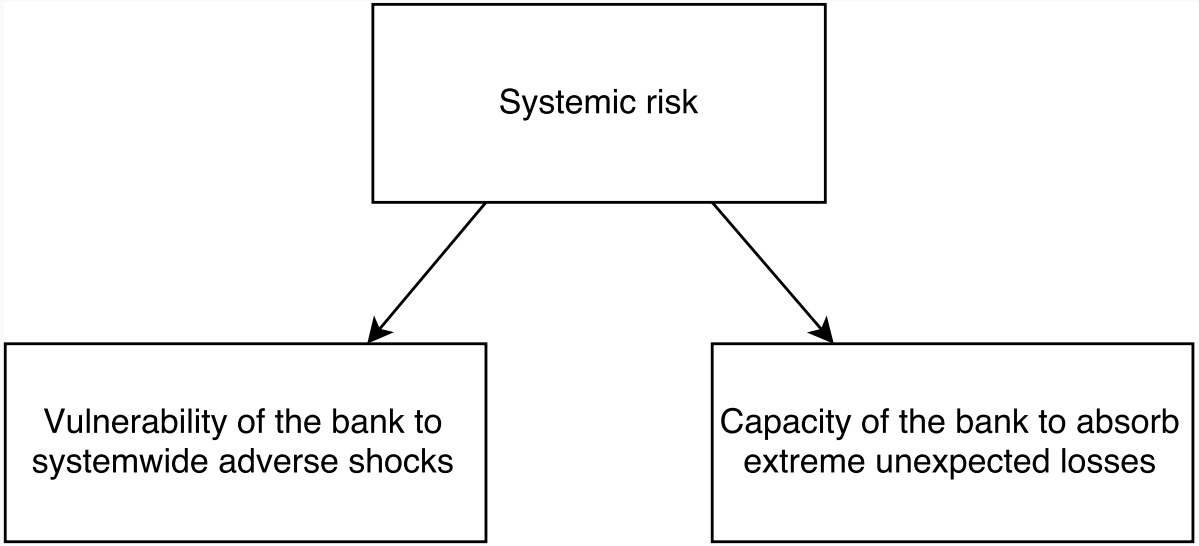
Systemic Risk: Measurement



- Long-run marginal expected shortfall (Acharya et al., 2012 AER)

$$LRMES_{i,t} = -E_t(r_{i,t+6M} | r_{m,t+6M} < -40\%)$$

Systemic Risk: Measurement



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- Market's appraisal of capitalization: *Market Value*

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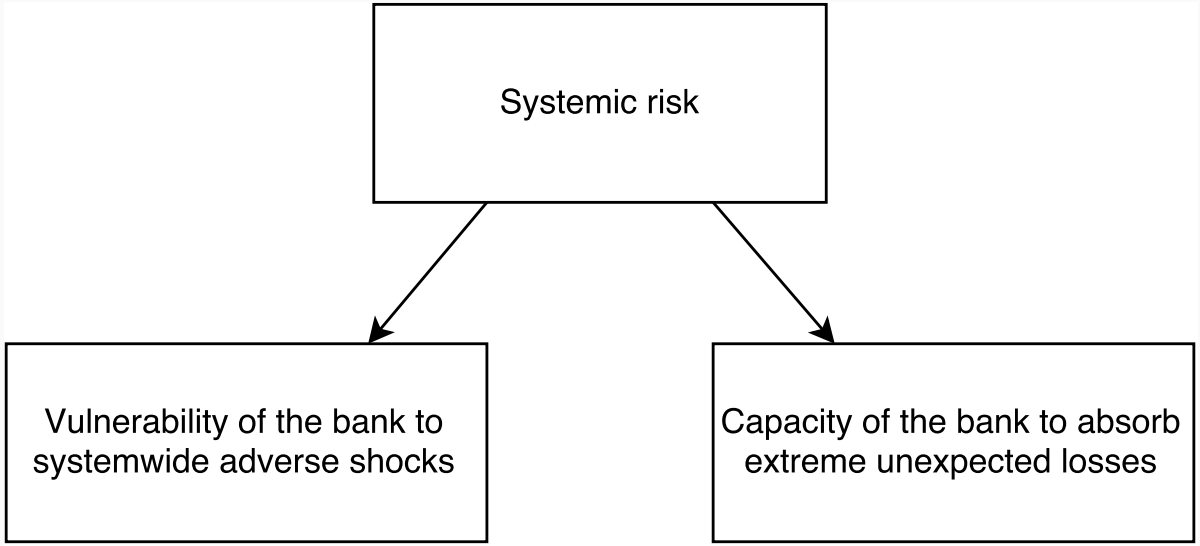

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- Market's appraisal of capitalization: *Market Value*
- Combined in *Stressed Market Value*

$$SMV_{i,t} = (1 - LRMES_{i,t}) \times MV_{i,t}$$

Model

$$\Delta Y_{i,t} = \alpha_i + \left(\beta_0 + \sum_{k=1}^{K} \beta_k \mathbf{BM_{k,i,t}} \right) \times Shock_t + \sum_{k=1}^{K} \gamma_k \mathbf{BM_{k,i,t}} + \varepsilon_{i,t}$$

- $MP\ Shock_t$: identification-through-heteroskedasticity
- $Y_{i,t}$: stock market-based measures of bank systemic risk
- $\mathbf{BM_{k,i,t}}$: **bank-specific characteristics**

Bank-specific Characteristics

- Asset structure:
  - Loan ratio, RWA density (asset risk), NPL ratio
- Funding structure
  - Deposit ratio
- Capital structure
  - Unweighted capital ratio
- Income structure
  - Share of non-interest income
- Size as control variable

Results

Results: Total Impact

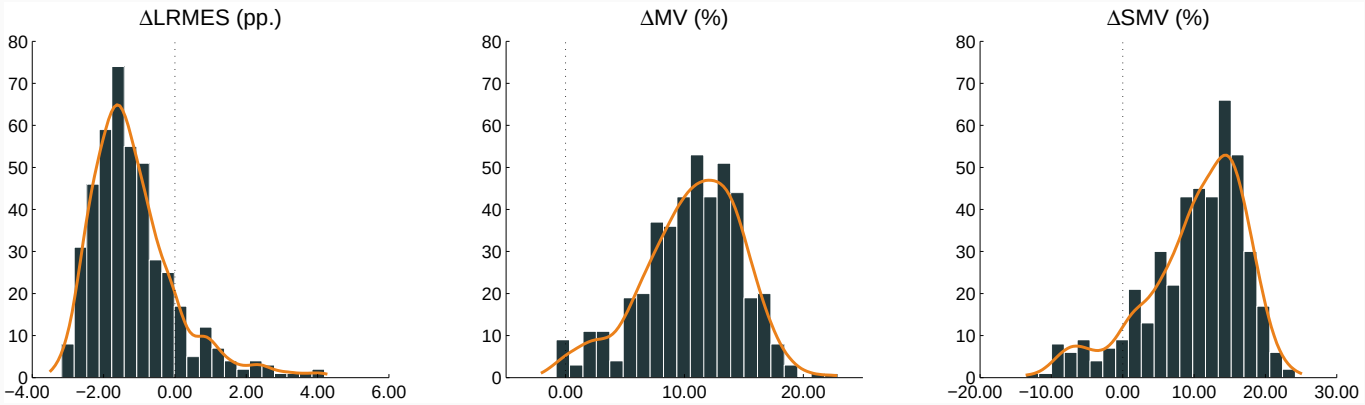
$$\Delta Y_{i,t} = \alpha_i + \left(\beta_0 + \sum_{k=1}^{K} \beta_k \mathbf{BM_{k,i,t}} \right) \times Shock_t + \sum_{k=1}^{K} \gamma_k \mathbf{BM_{k,i,t}} + \varepsilon_{i,t}$$

- Total impact of MP shock on bank systemic risk is given by:

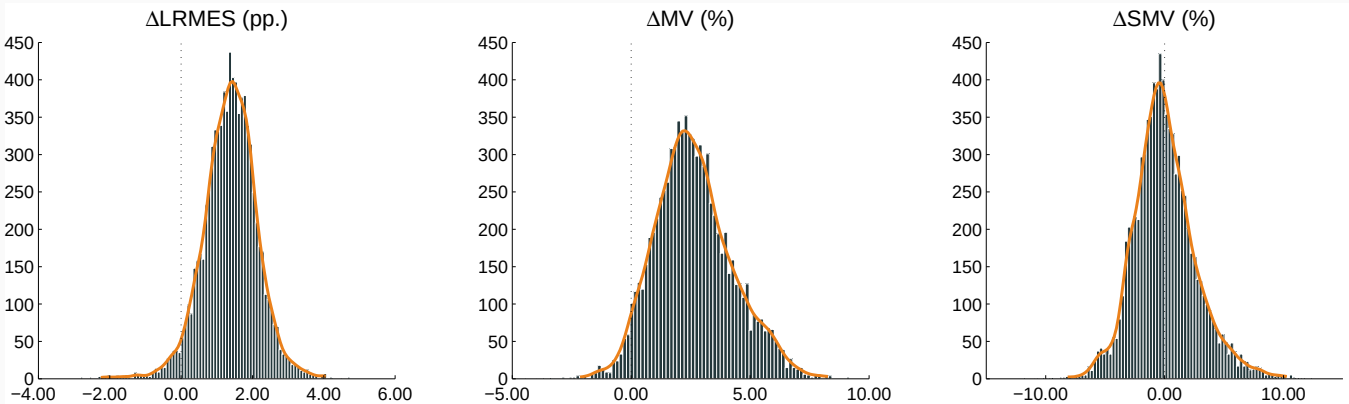
$$\frac{\partial(\Delta Y_{i,t})}{\partial Shock_t} = \beta_0 + \sum_{k=1}^{K} \beta_k BM_{k,i,t}$$

Results: Total Impact

Euro Area

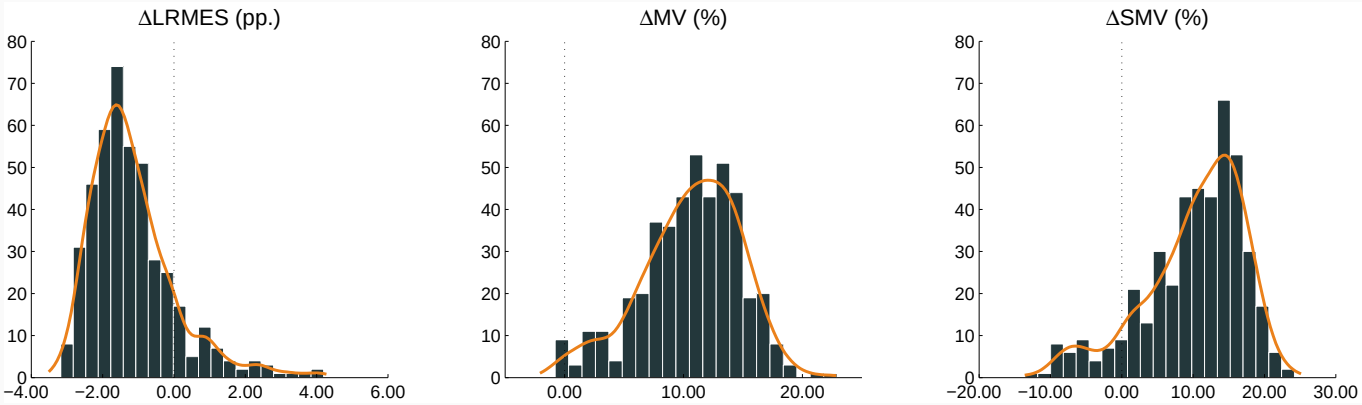


United States

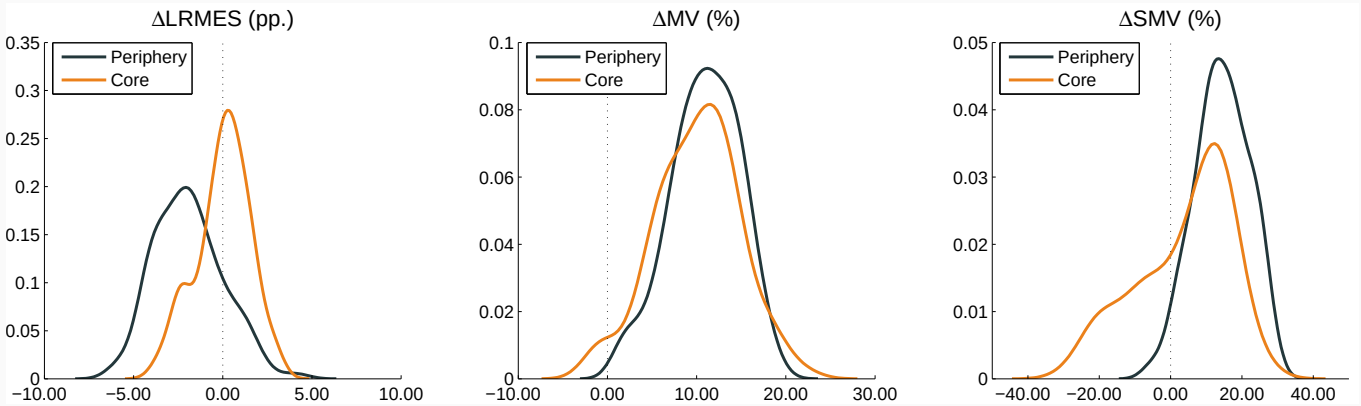


Results: Total Impact

Euro Area



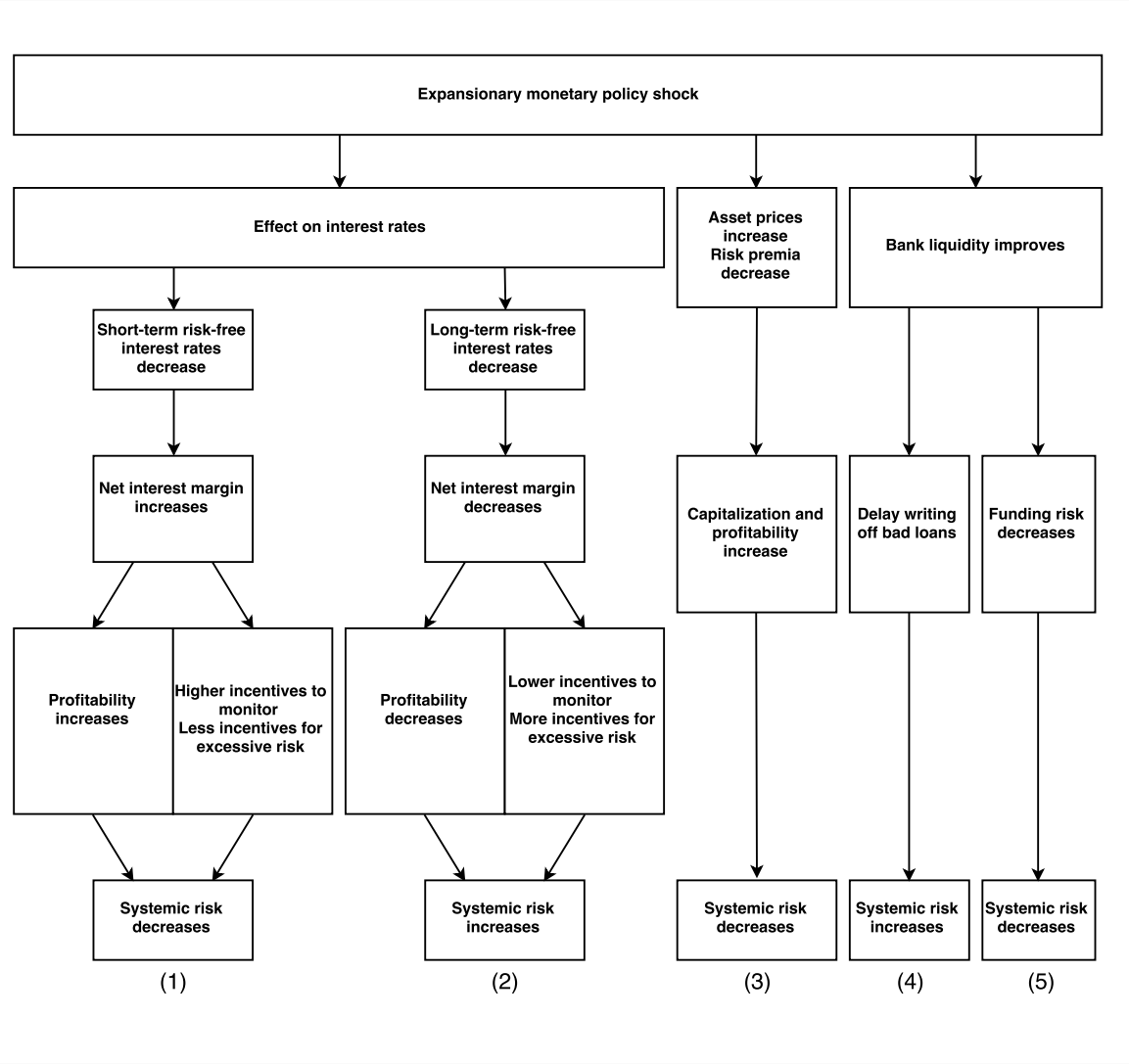
Euro Area Core vs. Periphery



Monetary Policy Transmission

- Monetary policy impacts systemic risk through:
  - Interest rates
  - Asset prices
  - Liquidity provisioning

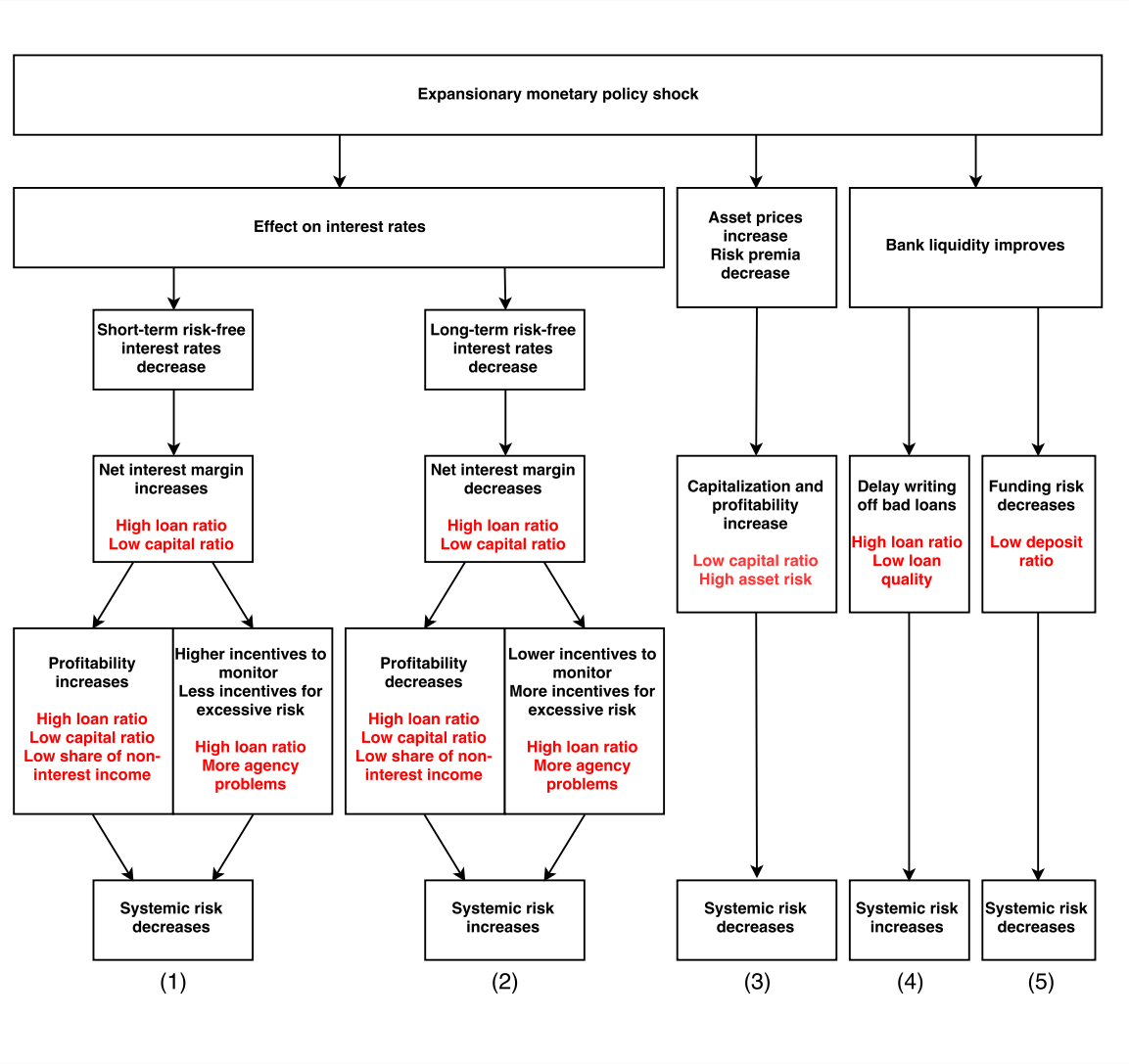
Monetary Policy Transmission



Monetary Policy Transmission

- Monetary policy impacts systemic risk through:
  - Interest rates
  - Asset prices
  - Liquidity provisioning
- Strength of the transmission depends on bank specific characteristics

Monetary Policy Transmission



Results: Euro Area and United States

	Euro Area			United States		
	$\Delta LRMES$	ΔMV	ΔSMV	$\Delta LRMES$	ΔMV	ΔSMV
	(1)	(2)	(3)	(4)	(5)	(6)
Loans to earning assets	-0.018	-0.065**	-0.127	0.002	0.008	-0.046
	(0.032)	(0.032)	(0.163)	(0.018)	(0.019)	(0.036)
Non-performing loans to loans	-0.010	-0.152	0.005	0.014	0.125	0.269
	(0.085)	(0.151)	(0.254)	(0.098)	(0.205)	(0.251)
RWA to earning assets	-0.043	0.147***	0.264**	-0.044***	0.071**	0.138***
	(0.035)	(0.052)	(0.118)	(0.017)	(0.033)	(0.052)
Size	-0.006**	0.014***	0.041***	0.001	0.006**	0.001
	(0.003)	(0.004)	(0.015)	(0.002)	(0.003)	(0.008)
Deposits to liabilities	-0.009	-0.052	0.199	0.040**	-0.048**	-0.101**
	(0.033)	(0.036)	(0.227)	(0.018)	(0.025)	(0.042)
Equity to assets	0.067	-0.683	0.481	0.125*	-0.168	-0.432**
	(0.338)	(0.431)	(1.259)	(0.074)	(0.148)	(0.176)
Share of non-interest income	-0.040	-0.126***	0.064	0.006	-0.050***	-0.084**
	(0.031)	(0.044)	(0.144)	(0.008)	(0.018)	(0.037)
Constant	0.154**	-0.058	-0.869*	-0.011	-0.036	0.056
	(0.068)	(0.079)	(0.466)	(0.030)	(0.036)	(0.100)
Observations	4502	4502	4502	24467	24467	24467
Banks	63	63	63	438	438	438
R^2 (within)	0.007	0.203	0.045	0.004	0.065	0.008

Results: Asset Structure

- Asset risk: RWA density
  - Expansionary monetary policy
    - Increases asset prices and collateral values
    - Lowers risk premiums
  - More beneficial for banks with risky asset structure

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Results: Asset Structure

- Asset composition: Loan ratio
- Risk-taking hypothesis
  - Loan-oriented banks more sensitive to changes of net interest margins
  - But impact of expansionary monetary policy shock on *NIM* is ambiguous
    - $r_{ST} \downarrow$: Net interest margin increases, less risk-taking incentives
    - $r_{LT} \downarrow$: Net interest margin decreases, search-for-yield
- Forbearance hypothesis
  - Stronger incentives to use central bank liquidity to delay write-offs

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Banks	63	63	63	438	438	438
R^2 (within)	0.007	0.203	0.045	0.004	0.065	0.008

Results: Asset Structure (Core/Periphery)

	Euro Area Periphery			Euro Area Core		
	$\Delta LRMES$	ΔMV	ΔSMV	$\Delta LRMES$	ΔMV	ΔSMV
	(1)	(2)	(3)	(4)	(5)	(6)
Loans to earning assets	0.074	**-0.113****	**-0.256*****	**-0.060****	-0.010	-0.413
	(0.045)	**(0.046)**	**(0.092)**	**(0.025)**	(0.052)	(0.529)
Non-performing loans to loans	-0.007	-0.122	-0.165	0.039	-0.517*	0.591
	(0.093)	(0.179)	(0.256)	(0.212)	(0.274)	(1.085)
Observations	2891	2891	2891	1611	1611	1611
Banks	37	37	37	26	26	26
R^2 (within)	0.016	0.189	0.108	0.012	0.311	0.041

Results: Asset Structure (U.S. detailed)

	$\Delta LRMES$		ΔMV		ΔSMV	
	(1)	(2)	(3)	(4)	(5)	(6)
Loans to earning assets	0.002		0.008		-0.046	
	(0.018)		(0.019)		(0.036)	
Cons. loans to earning assets		**0.044****		**0.007**		**-0.076**
		(0.023)		**(0.018)**		**(0.056)**
RE loans to earning assets		0.004		0.004		-0.039
		(0.014)		(0.012)		(0.029)
Bus. loans to earning assets		**0.018**		**-0.042***		**-0.138*****
		(0.028)		**(0.022)**		**(0.048)**
Non-performing loans to loans	0.014	0.065	0.125	0.044	0.269	0.111
	(0.098)	(0.104)	(0.205)	(0.203)	(0.251)	(0.242)
Observations	24467	24467	24467	24467	24467	24467
Banks	438	438	438	438	438	438
R^2 (within)	0.004	0.005	0.065	0.070	0.008	0.011

Results: Asset Structure Summary

- Expansionary monetary policy shock
  - Is more beneficial for banks with riskier asset structures
  - May increase forbearance incentives

Results: Funding Structure

- Funding risk hypothesis
    - Central bank liquidity lowers banks' reliance on wholesale funding
- Risk-taking hypothesis
    - High deposit funding weakens private monitoring
    - If expansionary *MP* shocks increase risk-taking incentives
        - Effect will be stronger for banks with high deposit ratios

Results: Funding Structure

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	(0.338)	(0.431)	(1.259)	(0.074)	(0.148)	(0.176)
Share of non-interest income	-0.040	-0.126***	0.064	0.006	-0.050***	-0.084**
	(0.031)	(0.044)	(0.144)	(0.008)	(0.018)	(0.037)
Constant	0.154**	-0.058	-0.869*	-0.011	-0.036	0.056
	(0.068)	(0.079)	(0.466)	(0.030)	(0.036)	(0.100)
Observations	4502	4502	4502	24467	24467	24467
Banks	63	63	63	438	438	438
R^2 (within)	0.007	0.203	0.045	0.004	0.065	0.008

Results: Funding Structure (Core/Periphery)

	Euro Area Periphery			Euro Area Core		
	$\Delta LRMES$	ΔMV	ΔSMV	$\Delta LRMES$	ΔMV	ΔSMV
	(1)	(2)	(3)	(4)	(5)	(6)
Deposits to liabilities	0.009	-0.049	-0.094	0.009	**-0.098***	0.594
	(0.035)	(0.040)	(0.083)	(0.020)	(0.053)	(0.631)
Observations	2891	2891	2891	1611	1611	1611
Banks	37	37	37	26	26	26
R^2 (within)	0.016	0.189	0.108	0.012	0.311	0.041

Results: Funding Structure (U.S. detailed)

	$\Delta LRMES$		ΔMV		ΔSMV	
	(1)	(2)	(3)	(4)	(5)	(6)
Deposits to liabilities	**0.040****		**-0.048****		**-0.101****	
	(0.018)		**(0.025)**		**(0.042)**	
Share of core funding		**0.043****		**-0.046****		**-0.099****
		(0.017)		**(0.023)**		**(0.040)**
NSFR		0.008		-0.027		-0.044
		(0.012)		(0.022)		(0.038)
Observations	24467	24467	24467	24467	24467	24467
Banks	438	438	438	438	438	438
R^2 (within)	0.004	0.005	0.065	0.070	0.008	0.011

Results: Funding Structure Summary

- Expansionary monetary policy shock
  - Is more beneficial for banks with higher share of wholesale funding
  - Evidence for risk-taking channel

Results: Capital Structure

- Stealth recapitalization
    - Banks with low capital ratios benefit more
- Risk-taking hypothesis
    - Low capital ratio increases risk-shifting incentives
    - If expansionary *MP* shocks increase risk-taking incentives
        - Effect will be stronger for banks with low capital ratio

Results: Capital Structure

	Euro Area			United States		
	$\Delta LRMES$	ΔMV	ΔSMV	$\Delta LRMES$	ΔMV	ΔSMV
	(1)	(2)	(3)	(4)	(5)	(6)
Loans to earning assets	-0.018	-0.065**	-0.127	0.002	0.008	-0.046
	(0.032)	(0.032)	(0.163)	(0.018)	(0.019)	(0.036)
Non-performing loans to loans	-0.010	-0.152	0.005	0.014	0.125	0.269
	(0.085)	(0.151)	(0.254)	(0.098)	(0.205)	(0.251)
RWA to earning assets	-0.043	0.147***	0.264**	-0.044***	0.071**	0.138***
	(0.035)	(0.052)	(0.118)	(0.017)	(0.033)	(0.052)
Size	-0.006**	0.014***	0.041***	0.001	0.006**	0.001
	(0.003)	(0.004)	(0.015)	(0.002)	(0.003)	(0.008)
Deposits to liabilities	-0.009	-0.052	0.199	0.040**	-0.048**	-0.101**
	(0.033)	(0.036)	(0.227)	(0.018)	(0.025)	(0.042)
Equity to assets	0.067	-0.683	0.481	**0.125***	-0.168	**-0.432****
	(0.338)	(0.431)	(1.259)	**(0.074)**	(0.148)	**(0.176)**
Share of non-interest income	-0.040	-0.126***	0.064	0.006	-0.050***	-0.084**
	(0.031)	(0.044)	(0.144)	(0.008)	(0.018)	(0.037)
Constant	0.154**	-0.058	-0.869*	-0.011	-0.036	0.056
	(0.068)	(0.079)	(0.466)	(0.030)	(0.036)	(0.100)
Observations	4502	4502	4502	24467	24467	24467
Banks	63	63	63	438	438	438
R^2 (within)	0.007	0.203	0.045	0.004	0.065	0.008

Results: Capital Structure (Core/Periphery)

	Euro Area Periphery			Euro Area Core		
	$\Delta LRMES$	ΔMV	ΔSMV	$\Delta LRMES$	ΔMV	ΔSMV
	(1)	(2)	(3)	(4)	(5)	(6)
Equity to assets	0.577	**-1.066****	**-1.925****	-0.595	-0.342	4.166
	(0.405)	**(0.521)**	**(0.831)**	(0.391)	(0.583)	(2.566)
Observations	2891	2891	2891	1611	1611	1611
Banks	37	37	37	26	26	26
R^2 (within)	0.016	0.189	0.108	0.012	0.311	0.041

Results: Capital Structure Summary

- Expansionary monetary policy
  - benefits banks with low capital ratios more
  - evidence for stealth recapitalization
  - risk-shifting incentives are less important

Conclusion

Conclusion: Financial Stability Trade-off

- Weaker banks benefit more from accommodative monetary policy:
  - Banks with higher asset risk
  - Banks with less deposit funding
  - Banks with lower capital ratios
- The effects are more pronounced for the periphery country banks, which experienced a deeper recession than the core Euro Area banks
- There is evidence that expansionary monetary policy stimulates banks to delay cleaning up the balance sheet

Conclusion: Policy Implications

- Need for macroprudential policy measures aimed at containing risk-taking by the most vulnerable banks.
- The clean-up of bank balance sheets after periods of stress requires much more attention.
- Long period of low rates may jeopardize bank profits and amplify risk-taking incentives. Hence need for structural improvement of bank business models (similar to the call by the IMF in its latest GFSR).
- We welcome the inclusion of a genuine business model analysis in the SREP framework. This should allow supervisors to tailor risk-mitigating actions to those banks identified as weak.

Monetary Policy Shock: Estimation

- Iterative estimation procedure set out by Lanne & Lutkepohl (2008)
  1. Estimation of the reduced form VAR with OLS
     - Covariance matrices of residuals on non-announcement and announcement days: $\tilde{V}_t$
  2. Minimization of the following likelihood type loss function using the estimates for V_t to get an estimate for parameters R and Ω_t

$$\left(\hat{R}, \hat{\Omega}_t\right) = \arg\min_{\hat{R},\hat{\Omega}_t} \left\{ \sum_{t=1}^{T} - \log |R\Omega_t R'| - \operatorname{tr}\left[\tilde{V}_t \left(R\Omega_t R'\right)^{-1}\right] \right\}$$

  3. Using $\hat{R}$ and $\hat{\Omega}_t$, we re-estimate the VAR using FGLS to construct new estimates of V_t

  - Steps 2 and 3 are iterated until convergence
  - This procedure results in Gaussian QML estimators

	Euro Area Periphery			Euro Area Core		
	$\Delta LRMES$	ΔMV	ΔSMV	$\Delta LRMES$	ΔMV	ΔSMV
	(1)	(2)	(3)	(4)	(5)	(6)
Loans to earning assets	0.074	-0.113**	-0.256***	-0.060**	-0.010	-0.413
	(0.045)	(0.046)	(0.092)	(0.025)	(0.052)	(0.529)
Non-performing loans to loans	-0.007	-0.122	-0.165	0.039	-0.517*	0.591
	(0.093)	(0.179)	(0.256)	(0.212)	(0.274)	(1.085)
RWA to earning assets	-0.084*	0.154**	0.241**	-0.016	0.194***	-0.230
	(0.051)	(0.069)	(0.094)	(0.050)	(0.067)	(0.328)
Size	-0.011***	0.016***	0.040***	-0.007***	0.018***	0.038*
	(0.003)	(0.004)	(0.005)	(0.003)	(0.006)	(0.021)
Deposits to liabilities	0.009	-0.049	-0.094	0.009	-0.098*	0.594
	(0.035)	(0.040)	(0.083)	(0.020)	(0.053)	(0.631)
Equity to assets	0.577	-1.066**	-1.925**	-0.595	-0.342	4.166
	(0.405)	(0.521)	(0.831)	(0.391)	(0.583)	(2.566)
Share of non-interest income	-0.071	-0.096	-0.035	-0.002	-0.169***	0.012
	(0.053)	(0.062)	(0.156)	(0.028)	(0.052)	(0.213)
Constant	0.167**	-0.060	-0.342**	0.194***	-0.169	-0.856
	(0.068)	(0.096)	(0.164)	(0.056)	(0.136)	(0.527)
Observations	2891	2891	2891	1611	1611	1611
Banks	37	37	37	26	26	26
R^2 (within)	0.016	0.189	0.108	0.012	0.311	0.041

	ΔLRMES		ΔMV		ΔSMV	
	(1)	(2)	(3)	(4)	(5)	(6)
Loans to earning assets	0.002		0.008		-0.046	
	(0.018)		(0.019)		(0.036)	
Cons. loans to earning assets		0.044**		0.007		-0.076
		(0.023)		(0.018)		(0.056)
RE loans to earning assets		0.004		0.004		-0.039
		(0.014)		(0.012)		(0.029)
Bus. loans to earning assets		0.018		-0.042*		-0.138***
		(0.028)		(0.022)		(0.048)
Non-performing loans to loans	0.014	0.065	0.125	0.044	0.269	0.111
	(0.098)	(0.104)	(0.205)	(0.203)	(0.251)	(0.242)
RWA to earning assets	-0.044***	-0.043**	0.071**	0.070**	0.138***	0.135***
	(0.017)	(0.019)	(0.033)	(0.030)	(0.052)	(0.046)
Size	0.001	0.001	0.006**	0.004	0.001	-0.001
	(0.002)	(0.002)	(0.003)	(0.003)	(0.008)	(0.008)
Deposits to liabilities	0.040**		-0.048**		-0.101**	
	(0.018)		(0.025)		(0.042)	
Share of core funding		0.043**		-0.046**		-0.099**
		(0.017)		(0.023)		(0.040)
NSFR		0.008		-0.027		-0.044
		(0.012)		(0.022)		(0.038)
Equity to assets	0.125*	0.063	-0.168	-0.077	-0.432**	-0.277*
	(0.074)	(0.069)	(0.148)	(0.111)	(0.176)	(0.157)
Share of non-interest income	0.006		-0.050***		-0.084**	
	(0.008)		(0.018)		(0.037)	
Share of fee income		-0.013		-0.001		-0.026
		(0.019)		(0.024)		(0.046)
Share of fiduciary income		-0.061		0.208**		0.200
		(0.059)		(0.105)		(0.158)
Share of trading income		0.004		0.021		0.046
		(0.032)		(0.072)		(0.208)
Share of insurance income		0.026		-0.093*		-0.177***
		(0.039)		(0.054)		(0.060)
Constant	-0.011	-0.009	-0.036	-0.020	0.056	0.074
	(0.030)	(0.035)	(0.036)	(0.046)	(0.100)	(0.127)
Observations	24467	24467	24467	24467	24467	24467
Banks	438	438	438	438	438	438
R^2 (within)	0.004	0.005	0.065	0.070	0.008	0.011