

The Effect of Higher Capital Requirements on Bank Lending: The Capital Surplus Matters

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The authors note that the presentation represents their own views and not necessarily those of the Czech National Bank.

- Introduction & motivation
- Transmission mechanism & literature review
- Data
- Macro-level approach – methodology and results
- Micro-level approach – methodology and results
- Conclusion

- Relationship between capital requirements, capital and lending crucial for assessing linkages between banking sector and real economic activity
 - Basel III capital requirements – costs and benefits
- CNB one of the most active macroprudential authorities - three capital buffers + Pillar 2 requirements
- **What are the effects of the higher additional capital requirements regarding the loan growth?**
- The literature not conclusive so far
- We provide the first analysis using Czech supervisory data
- We utilize different methodologies to provide comprehensive picture

Banks' response to higher capital requirements:

- utilize capital surplus
- slow down balance sheet growth
- change the risk composition of assets
- increase interest rate margins, decrease dividend payout ratio, postpone investment activities in order to increase retained earnings
- increase stated capital

- Differences between pre- and post-crisis studies
- Some studies analyse the impact of *capitalisation* instead of *capital requirements*

Three groups:

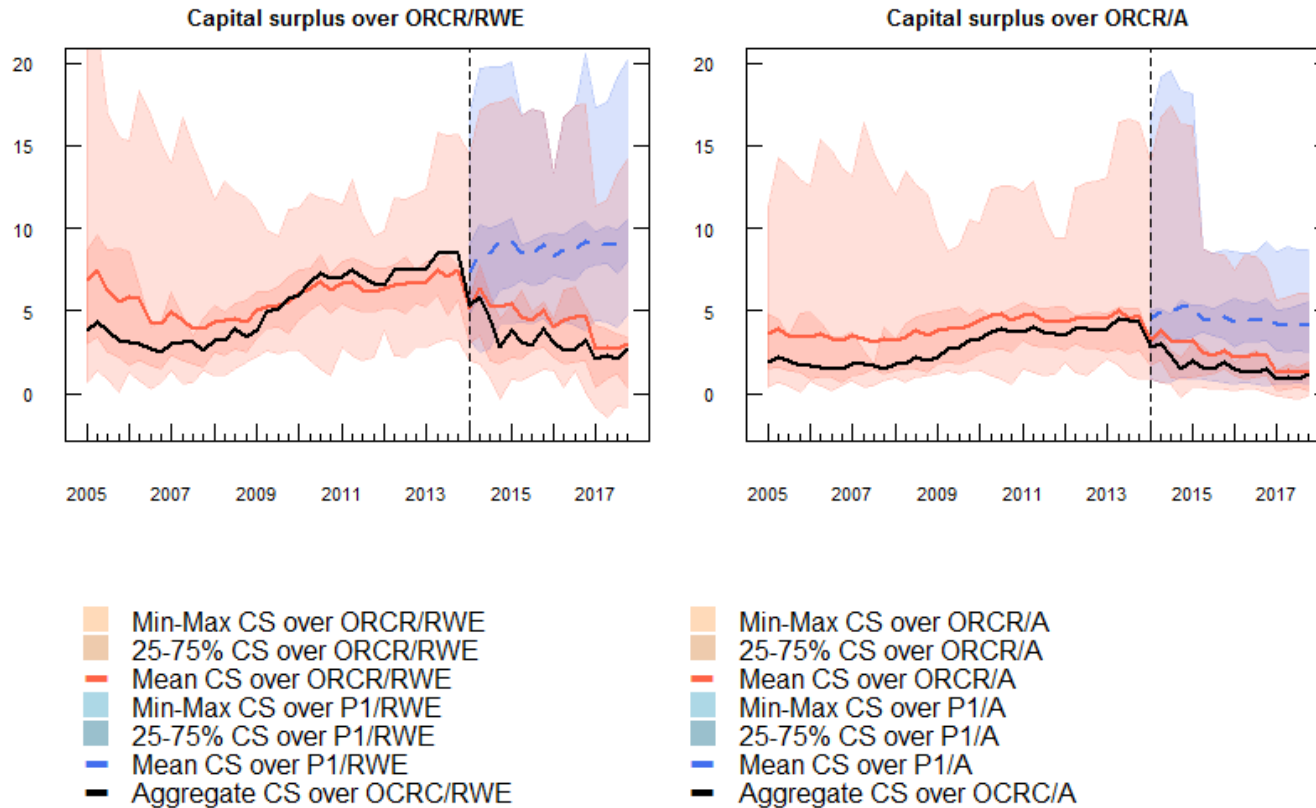
1. Identifying negative effect of capital requirements on lending
 - Aiyar et al., 2014; Bridges et al., 2015; de Ramon et al., 2016
2. Identifying negative effect of capital ratio on lending
 - De Nicolo, 2015; Noss and Toffano, 2014; MAG, 2010
3. Identifying a positive effect of higher capital ratios on lending
 - Berrospide and Edge, 2010

Inconsistencies in the literature due to:

- different explained variables, time spans
- different motivation for changes in capital ratios
 - increase in capital requirements and decrease in capital surplus - **negative** effect on lending, avoiding higher costs of financing
 - profit accumulation, increased capital surplus - **positive** effect, space for balance sheet expansion
 - differences wrt to intentional and unintentional capital surplus

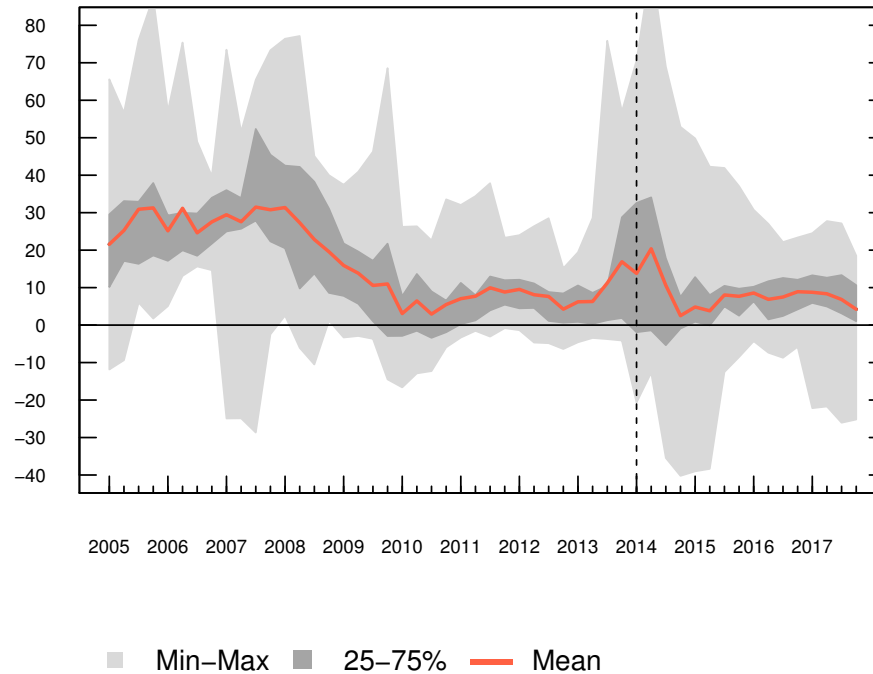
- Supervisory bank-level data (FINREP, COREP)
- Consolidated basis
- Foreign bank branches excluded, wholly state-owned banks excluded
- 14 banks
 - 2004 Q4 to 2017 Q4 (56 quarters) → 630 observations
 - 2014 Q4 to 2017 Q4 (restricted sample) → 276 observations
- 90% of the total assets of the whole banking sector covered

Figure 1: Capital Surplus



- CZK 180 billion surplus at its peak in 2013
- CZK 67 billion surplus at the end of 2017
- Heterogeneity & visible effect of higher additional capital requirements since 2014

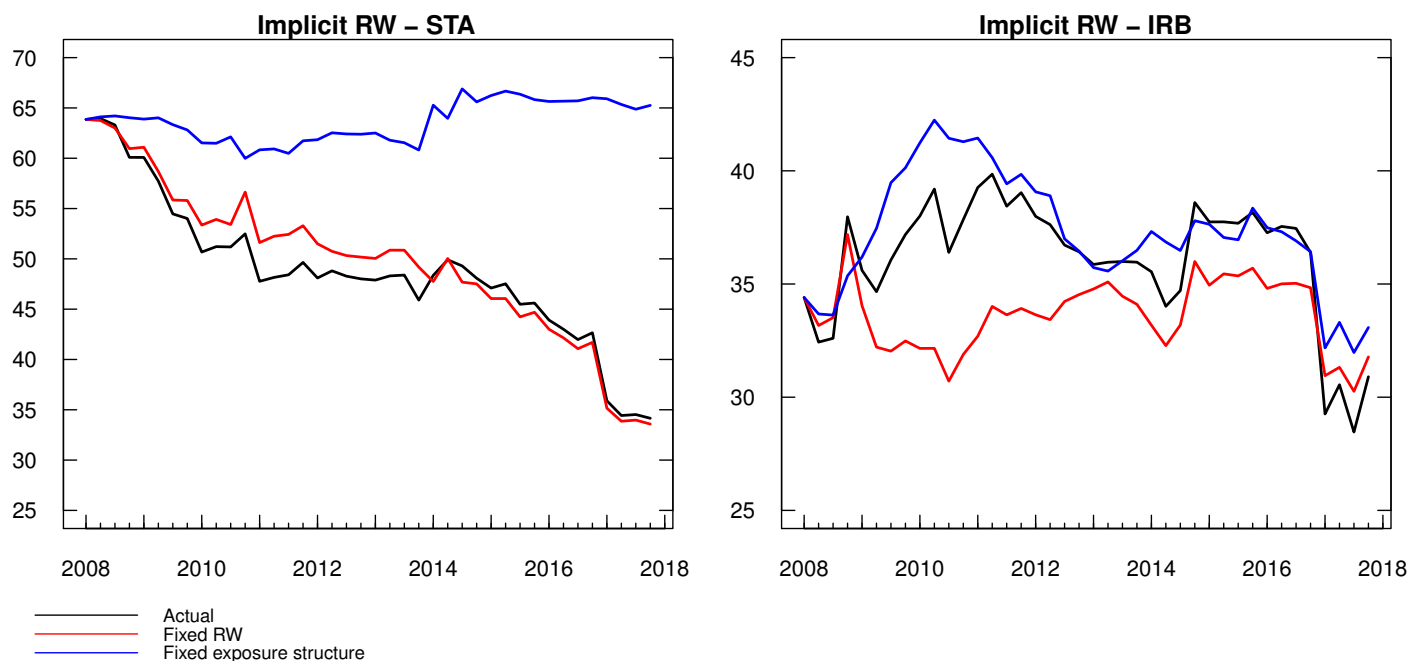
Figure 2: Year-on-Year Growth of Loans to Private Sector Excluding Interbank Loans



- Significant heterogeneity across banks
- Decrease in the mean, the median and the dispersion of the y-o-y growth in 2014

- Assessing the importance of individual factors in determining banks' capital surplus
- Simple counterfactual simulations
- Fixing banks' exposure structure or average implicit risk weights at their level in 2008; fixing retain earnings at their level in 2008 or 2014

Figure 3: Implicit Risk Weights – IRB vs STA; Fixed to 2008 Q1



- Exposure structure crucial under the STA approach; under the IRB approach, risk parameter estimates also plays the role.

Figure 4: Capital Surplus – IRB vs STA; Fixed to 2008 Q1

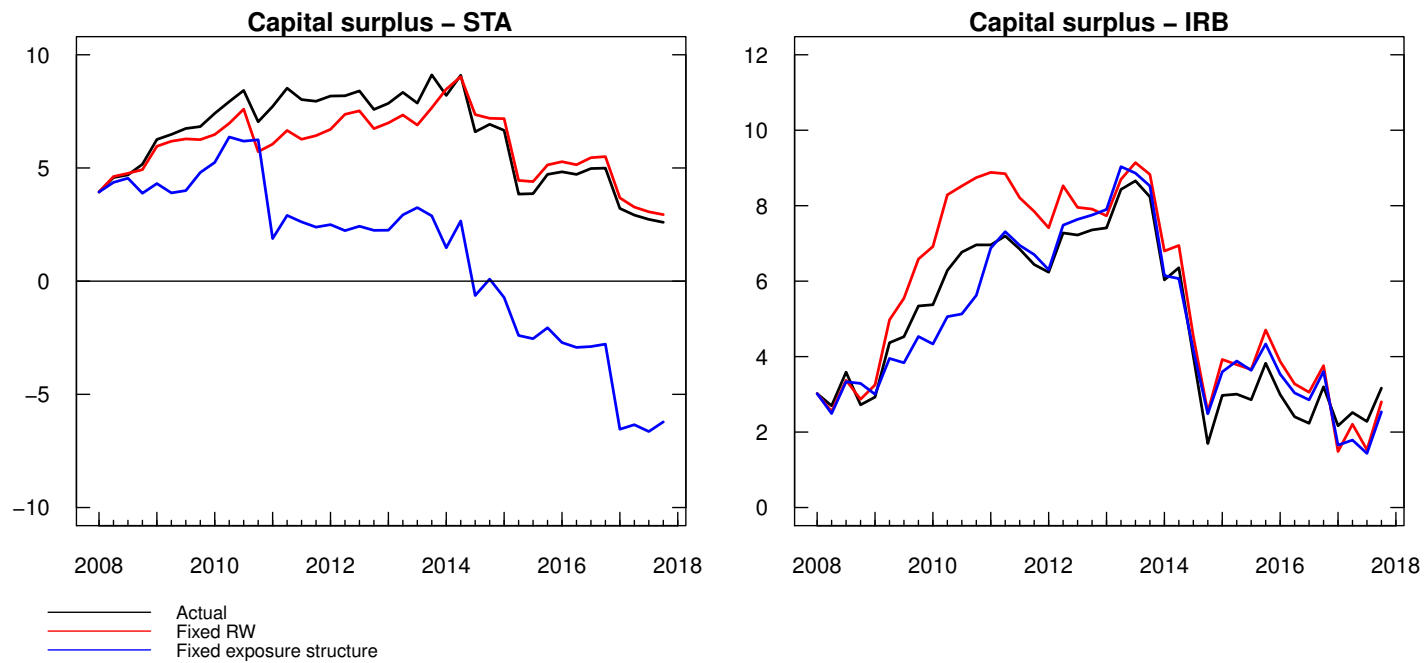
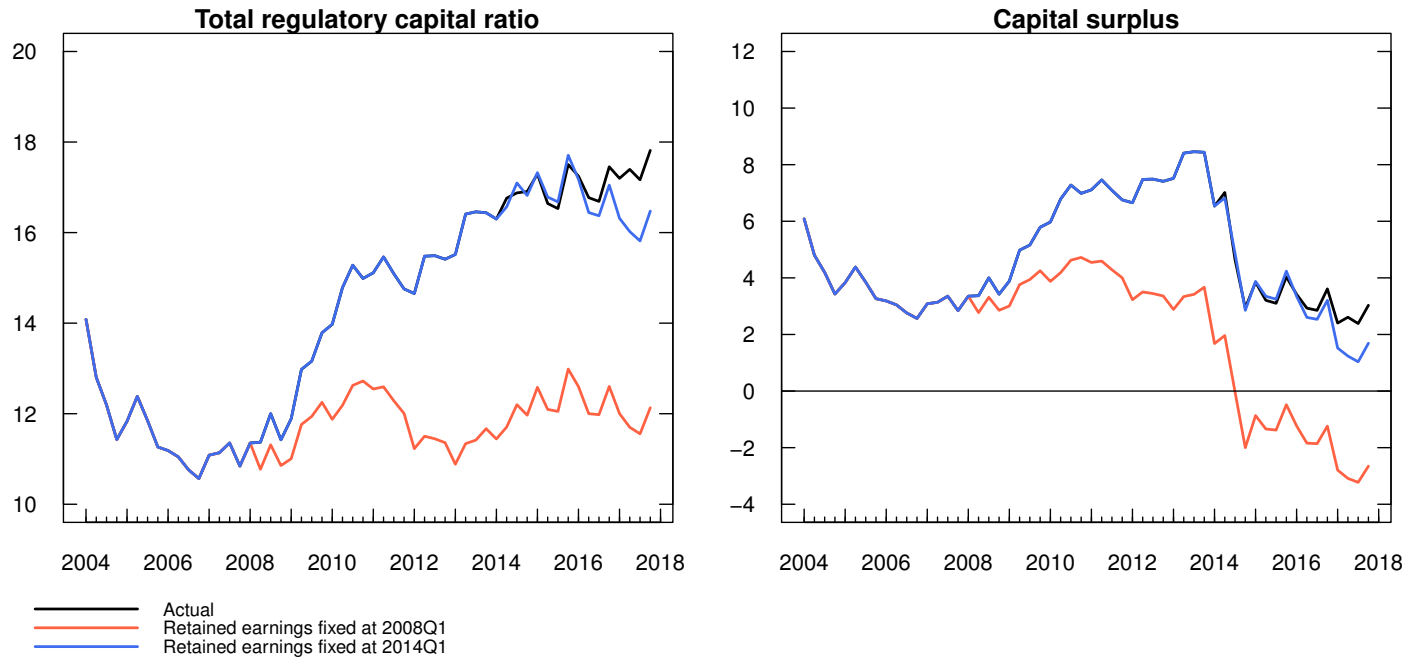


Figure 5: Aggregate Capital Adequacy Ratio and Capital Surplus; Fixed Retained Earnings



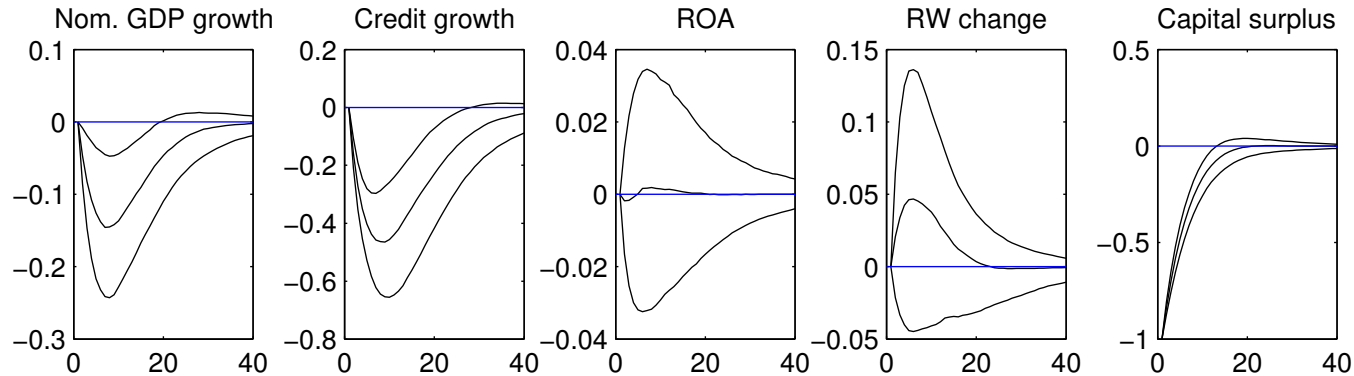
- Retained earnings essential in determining aggregate capital adequacy ratio
- BS expansion possible because of relatively high profitability

- Bayesian VAR model, independent Normal inverse-Wishart prior distribution
- Information on the macro-financial linkages, dynamics of the whole system
- Immune to endogeneity issues, but coefficients not easily interpretable → IRFs, simple Cholesky decomposition
- Baseline ordering:

$Y = [nGDP \text{ growth, credit growth, proxy for profit. or leverage ratio, } iRW \text{ change, capital surplus}]$

- Robustness check to proposed ordering

Figure 6: Baseline IRFs – negative shock to capital surplus



Note: 32th, 50th and 68th percentiles of the distribution reported.

- Positive relationship between capital surplus and bank loan growth; transmission to nominal GDP growth
- Lower capital surplus \rightarrow less space for BS expansion \rightarrow slower credit growth
- Sensitivity analysis wrt different proxy variables for banks' profitability and leverage ratio, RMCI and lending rate

- Dynamic panel data model
- First, different ways of reaction to higher capital requirements examined
- Second, we focus in more detail on the effect on loan growth
 - Direct vs. indirect approach
- Single-equation: LSDV and bootstrap-based bias corrected estimator (BBBC; De Vos et al., 2015)
- Multiple-equation system: three-stage least squares (3SLS) procedure

$$EA_{i,t} = \alpha_1 EA_{i,t-1} + \beta_1 ORCR_{i,t} + \gamma_1 X_{i,t-1} + \nu_{1,i} + \epsilon_{1,i,t} \quad (1)$$

$$REA_{i,t} = \alpha_2 REA_{i,t-1} + \beta_2 ORCR_{i,t} + \gamma_2 X_{i,t-1} + \nu_{2,i} + \epsilon_{2,i,t} \quad (2)$$

$$CA_{i,t} = \alpha_3 CA_{i,t-1} + \beta_3 ORCR_{i,t} + \gamma_3 X_{i,t-1} + \nu_{3,i} + \epsilon_{3,i,t} \quad (3)$$

$$CS_{i,t} = \alpha_4 CS_{i,t-1} + \beta_4 ORCR_{i,t} + \gamma_4 X_{i,t-1} + \nu_{4,i} + \epsilon_{4,i,t} \quad (4)$$

$$RW_{i,t} = \alpha_5 RW_{i,t-1} + \beta_5 ORCR_{i,t} + \gamma_5 X_{i,t-1} + \nu_{5,i} + \epsilon_{5,i,t} \quad (5)$$

$$\% \Delta loans_{i,t} = \alpha_6 \% \Delta loans_{i,t-1} + \beta_6 ORCR_{i,t} + \gamma_6 X_{i,t-1} + \nu_{6,i} + \epsilon_{6,i,t} \quad (6)$$

where $CS_{i,t}$ is total capital surplus; $\% \Delta loans_{i,t}$ is the year-on-year change in loans to private sector; $RW_{i,t}$ are implicit risk weights, $EA_{i,t}$ is equity to total assets; $REA_{i,t}$ are retained earnings to total assets. $CA_{i,t}$ is Tier 1 capital plus Tier 2 capital to total assets; $ORCR_{i,t}$ are overall regulatory capital requirements, $X_{i,t-1}$ is a vector of control variables specific for each equation; ν_i stands for bank fixed effects; and $\epsilon_{1,i,t}$ is the error.

Table 1: The Effect of Higher Additional Capital Requirements

Dependent var.:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	EA	REA	CA	CS	CS	RW	RW	% Δ loans
Dependent variable (t-1)	0.956*** (0.058)	0.994*** (0.059)	0.895*** (0.054)	0.641*** (0.046)	0.600*** (0.046)	0.809*** (0.059)	0.793*** (0.053)	0.852*** (0.057)
ORCR	0.0208 (0.046)	0.564* (0.032)	-0.052 (0.032)	-0.609*** (0.073)	-0.636*** (0.076)	-0.056 (0.171)	0.046 (0.176)	-0.737** (0.354)
ROA (t-1)	0.004 (0.156)	0.083 (0.073)	-0.013 (0.138)	-0.147 (0.259)	-0.066 (0.259)			
LLPA (t-1)	0.241 (0.210)	0.154 (0.170)	0.166 (0.123)	-0.386*** (0.120)	-0.445*** (0.121)	1.007*** (0.366)	1.121*** (0.379)	0.437 (0.575)
CA (t-1)								1.593*** (0.493)
Lending rate (t-1)								-1.269* (0.669)
⋮				⋮				⋮
Observations	276	276	276	276	276	276	276	276

Note: Specifications are estimated using bootstrap-based bias corrected estimator. Bootstrapped standard errors reported in parentheses; ***, **, and * denote the 1%, 5%, and 10% significance levels.

1pp increase in capital requirements:

- decreases CS by 0.64pp
- decreases loan growth by 0.74pp

- Second, detailed analysis of the effect on loan growth
- Wrt capitalisation: the effect remains significant only for banks with lower capital surplus (-1.2pp)

Table 2: The Effect of Higher Additional Capital Requirements wrt Banks Capital Surplus

	(1)	(2)
Estimation method:	BBBC	LSDV
Dependent var.:	$\% \Delta loans$	$\% \Delta loans$
$\% \Delta loans$ (t-1)	0.853*** (0.0582)	0.749*** (0.0465)
ORCR*dLowCS	-1.147* (0.659)	-1.751*** (0.576)
ORCR*(1-dLowCS)	-0.472 (0.305)	-0.606 (0.365)
LLPA (t-1)	0.445 (0.496)	0.166 (0.263)
CA (t-1)	1.404** (0.542)	1.794** (0.695)
Lending rate (t-1)	-1.161* (0.673)	-1.501*** (0.442)
Real GDP growth	-0.0859 (0.377)	-0.0838 (0.295)
Observations	276	276

- Wrt to different lags and leads (announcements, phase-ins)
 - the reaction is strongest when the requirements become effective
→ more lags or leads not necessary

- Multiple equation system (3SLS)
- The effect of higher ORCR via its effect on the capital surplus

$$CS_{i,t} = \alpha_8 CS_{i,t-1} + \beta_9 ORCR_{i,t} + \gamma_8 X_{i,t-1} + \nu_{8,i} + \epsilon_{8,i,t} \quad (7)$$

$$\% \Delta loans_{i,t} = \alpha_9 \% \Delta loans_{i,t-1} + \beta_{10} CS_{i,t-1} + \gamma_9 X_{i,t-1} + \nu_{9,i} + \epsilon_{9,i,t} \quad (8)$$

Table 3: Estimation Results of Higher Additional Capital Requirements – System of Two Equations

	(1)	(2)	(3)	(4)
Dependent var.:	CS	<i>%Δloans</i>	CS	<i>%Δloans</i>
Dependent var. (t-1)	0.516*** (0.040)	0.769*** (0.0334)	0.519*** (0.040)	0.765*** (0.0319)
ORCR (t-1)	-0.702*** (0.063)			
CS (t-1)		0.197 (0.248)		
ORCR*dLowCS			-0.668*** (0.084)	
ORCR*(1-dLowCS)			-0.711*** (0.066)	
CS (t-1)*dLowCS				2.188*** (0.445)
CS (t-1)*(1-dLowCS)				-0.236 (0.251)
Observations	276		276	

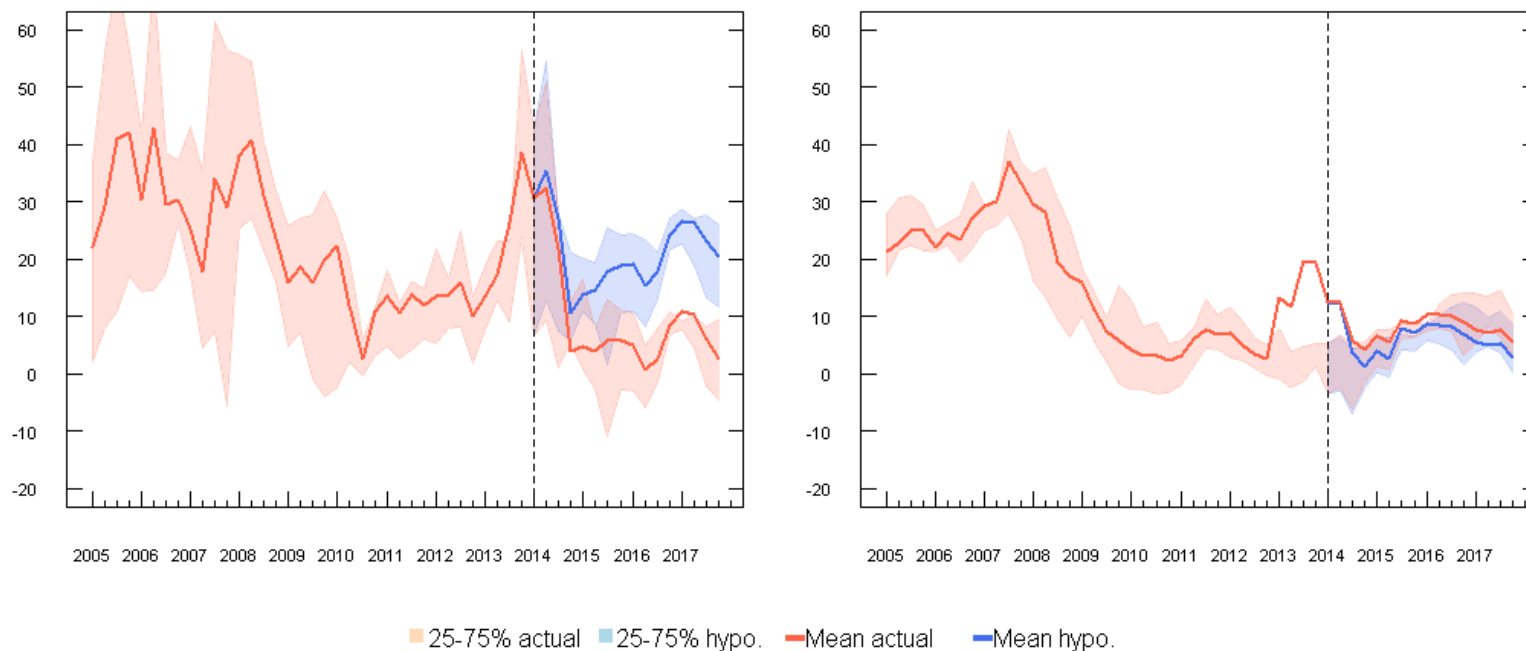
- Significant only for low-capitalised banks: 1pp increase in ORCR decreases loan growth by $0.7 * 2.2 = 1.5$ pp

Table 4: Summary of Selected Estimation Results of the Effect of Higher Additional Capital Requirements on Bank Loan Growth

Table	Specification	Data sample	Estimation technique	ST effect	LT effect
2	direct effect	short	BBBC	-0.74**	-4.98
3	direct effect, low-cap	short	BBBC	-1.19*	-7.85
3	direct effect, better-cap	short	BBBC	not statistically significant	
C2	direct effect	short	LSDV	-1.03**	-4.21
C2	direct effect, low-cap	short	LSDV	-1.75***	-6.98
C2	direct effect, better-cap	short	LSDV	not statistically significant	
4	indirect effect	short	3SLS	not statistically significant	
4	indirect effect, low-cap	short	3SLS	-1.47***	-6.22
4	indirect effect, better-cap	short	3SLS	not statistically significant	
C4	indirect effect	short	LSDV	not statistically significant	
C4	indirect effect, low-cap	short	LSDV	-1.48***	-6.18
C4	indirect effect, better-cap	short	LSDV	not statistically significant	
C4	indirect effect	short	BBBC	not statistically significant	
C4	indirect effect, low-cap	short	BBBC	-1.09**	-6.51
C4	indirect effect, better-cap	short	BBBC	not statistically significant	

- Hypothetical loan growth if no increase in ORCR had occurred

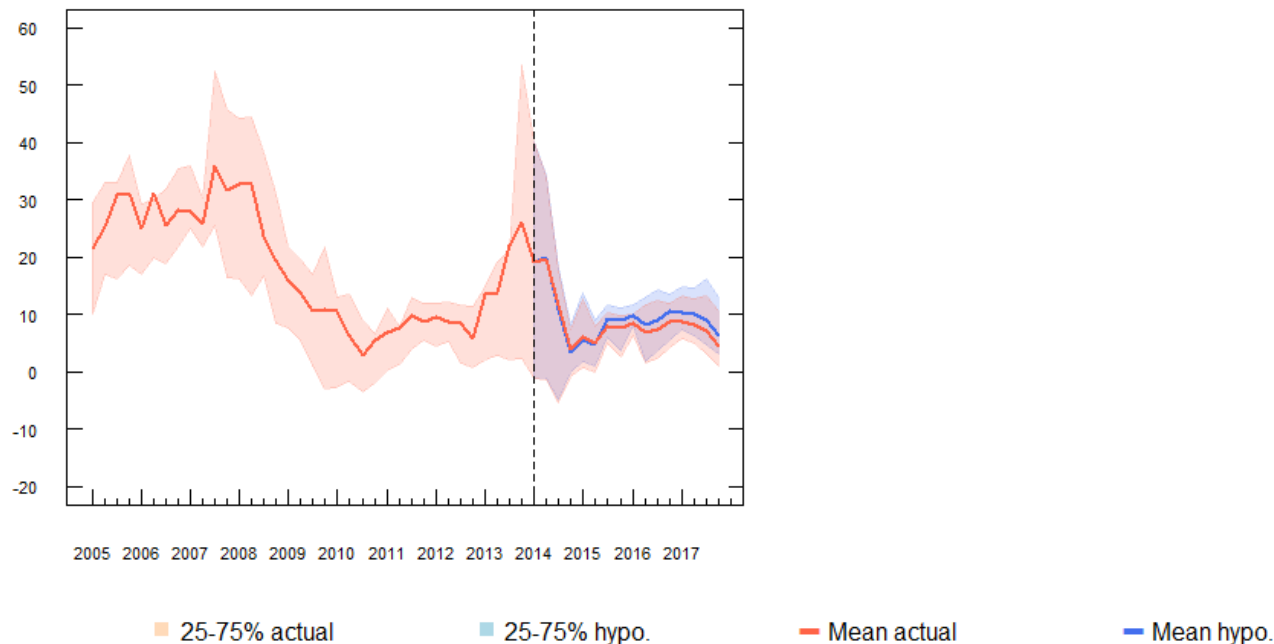
Figure 7: Actual vs. Simulated Bank Loan Growth, Indirect Effect – Banks with Relatively Low (Left) and High (Right) Capital Surplus



- Significant differences between banks with low and high CS
- Loan growth of banks with low CS might have been higher without additional ORCR

- This does not hold for the sector as a whole, which remains well-capitalised and absorbs higher capital requirements

Figure 8: Actual vs. Simulated Bank Loan Growth – Indirect Effect



- We study the impact of higher additional capital requirements on the loan growth
- Both macro- and micro-level approach
- Bayesian VAR model and dynamic panel data model

Results:

- The effect of higher additional capital requirements on loan growth is negative
- The negative relationship applies primarily to the low-capitalised banks
- 1pp increase in capital requirements depresses loan growth by about 1.2–1.8pp
- Capital surplus is important in the transmission of higher capital requirements

Thank you!

Figure 9: Bank-Level Capital Requirements

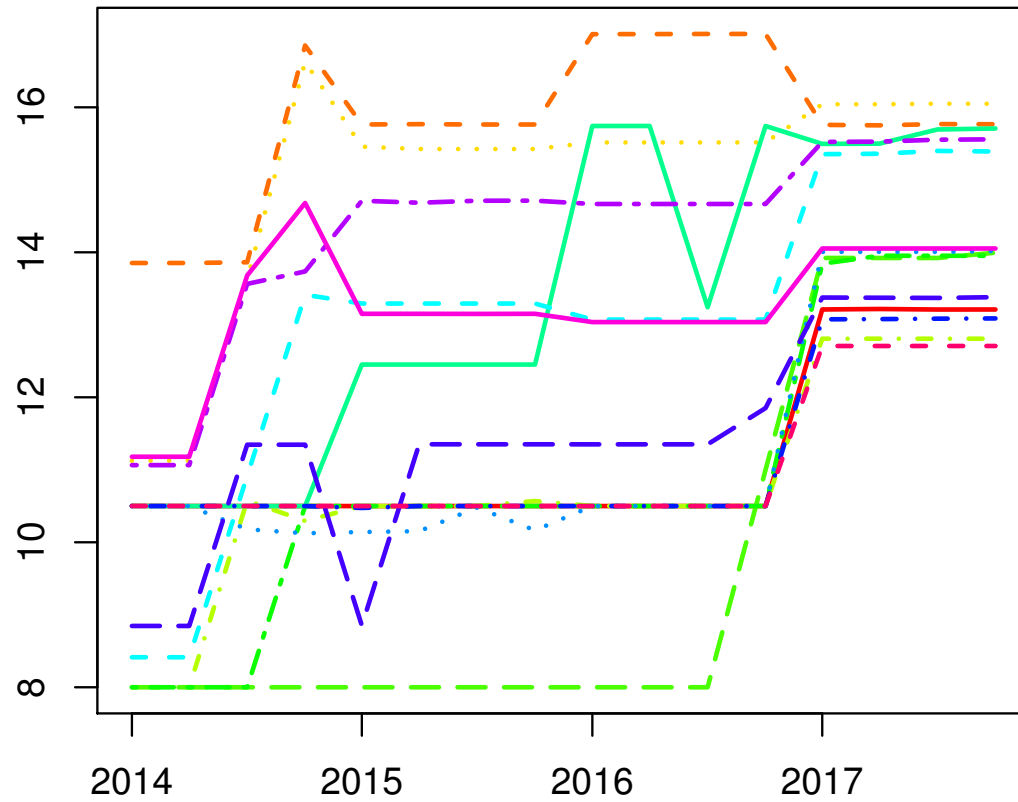


Figure 10: Risk-Weighted Credit Exposures (Left Chart: Amount in CZK Billions; Right Chart: Share in %)

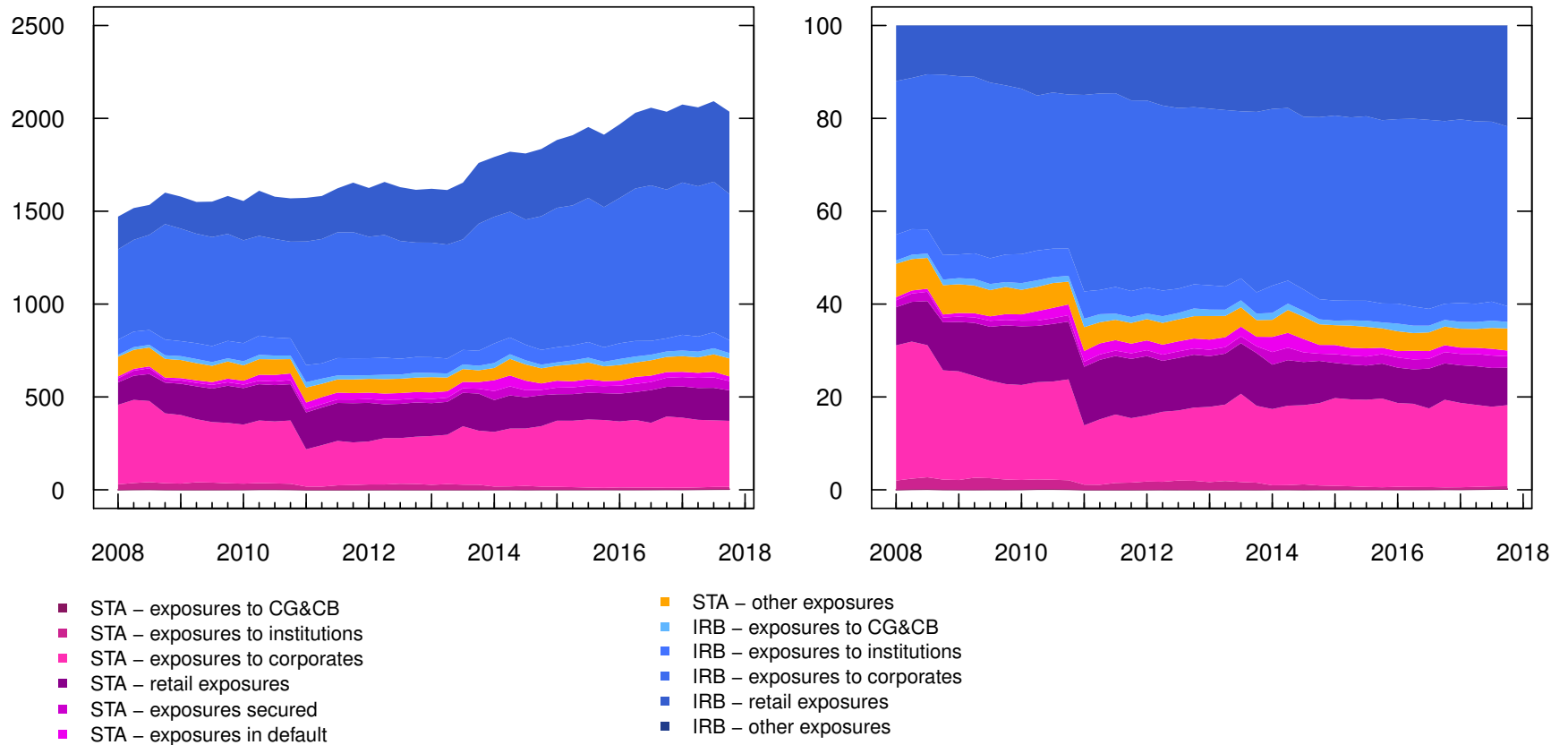
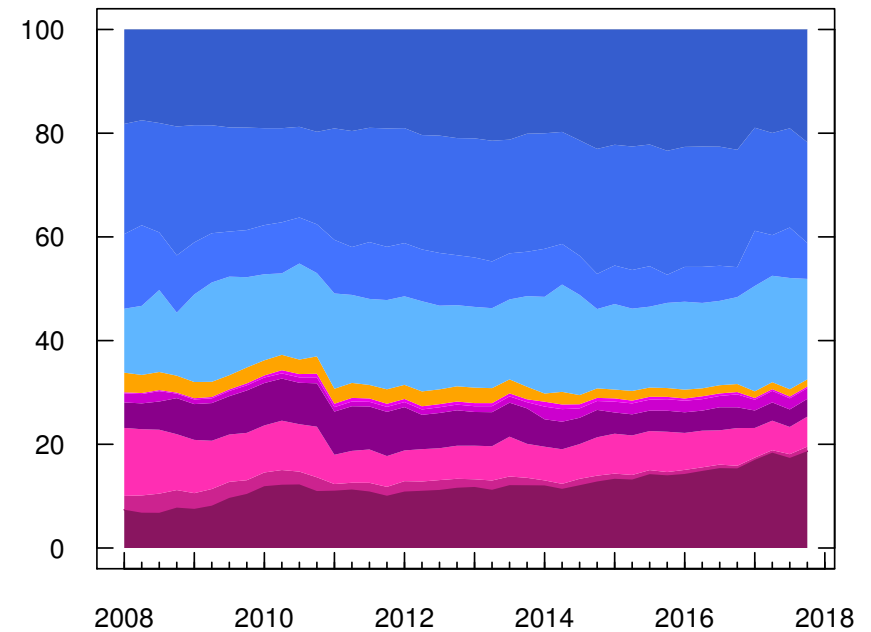
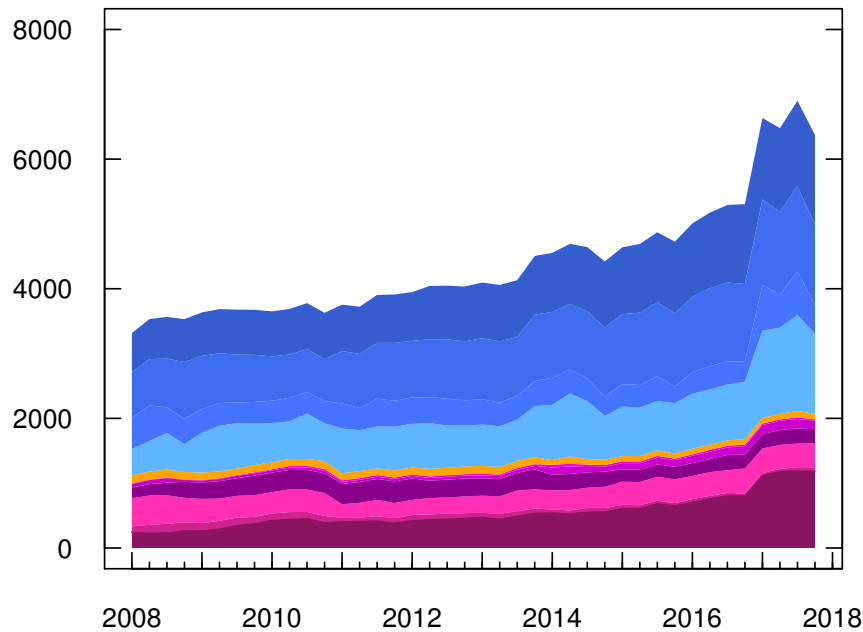


Figure 11: Non-Risk-Weighted Credit Exposures (Left Chart: Amount in CZK Billions; Right Chart: Share in %)



- STA – exposures to CG&CB
- STA – exposures to institutions
- STA – exposures to corporates
- STA – retail exposures
- STA – exposures secured
- STA – exposures in default

- STA – other exposures
- IRB – exposures to CG&CB
- IRB – exposures to institutions
- IRB – exposures to corporates
- IRB – retail exposures
- IRB – other exposures

Figure 12: Implicit Risk Weights under the STA and IRB Approaches (%)

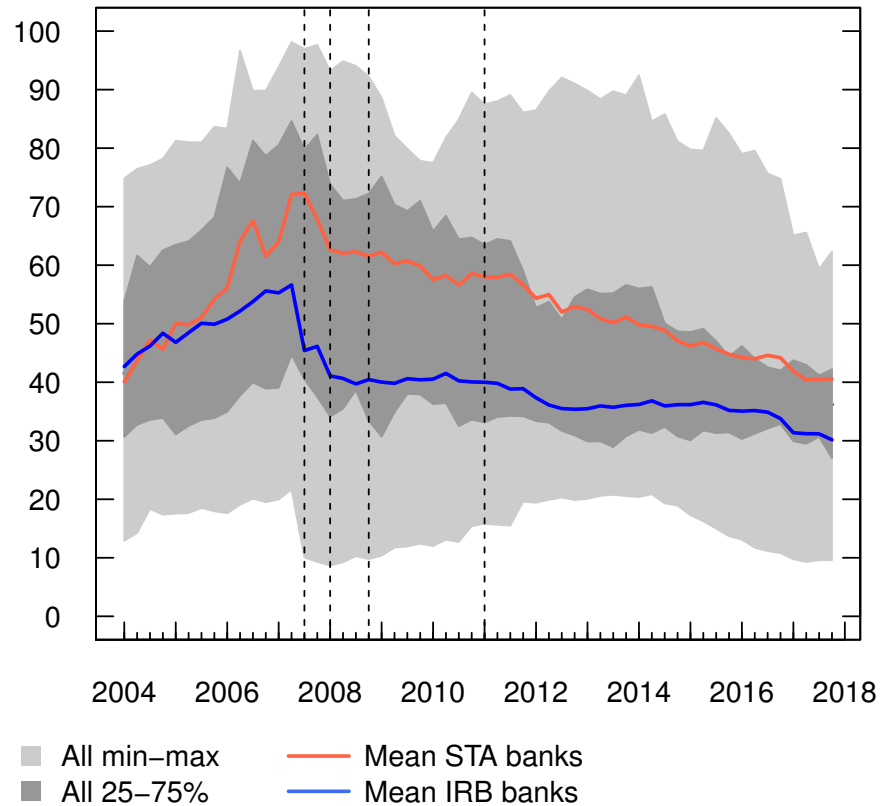


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ORCR	0.0208 (0.046)	0.564* (0.032)	-0.052 (0.032)	-0.609*** (0.073)	-0.636*** (0.076)	-0.056 (0.171)	0.046 (0.176)	-0.737** (0.354)
ROA (t-1)	0.004 (0.156)	0.083 (0.073)	-0.013 (0.138)	-0.147 (0.259)	-0.066 (0.259)			
LLPA (t-1)	0.241 (0.210)	0.154 (0.170)	0.166 (0.123)	-0.386*** (0.120)	-0.445*** (0.121)	1.007*** (0.366)	1.121*** (0.379)	0.437 (0.575)
CA (t-1)								1.593*** (0.493)
Interbank loans/A (t-1)					0.006 (0.038)		0.133 (0.157)	
Loans to CB&CG/A (t-1)					-0.002 (0.010)		0.012 (0.027)	
Loans to PS (t-1)					-0.049** (0.022)		0.007 (0.053)	
Bonds/A (t-1)					0.016 (0.016)		0.080 (0.049)	
Lending rate (t-1)								-1.269* (0.669)
Real GDP growth	-0.0170 (0.041)	-0.068** (0.030)	0.010 (0.031)	0.087 (0.062)	0.092 (0.063)	-0.122 (0.166)	-0.161 (0.169)	-0.121 (0.329)
PX growth	-0.003 (0.008)	0.002 (0.005)	0.003 (0.006)	0.031*** (0.011)	0.028** (0.012)	-0.024 (0.027)	-0.013 (0.027)	
Spread	0.0229 (0.159)	-0.057 (0.114)	-0.203* (0.112)	-1.099*** (0.220)	-1.076*** (0.231)	0.293 (0.545)	0.0218 (0.570)	
Observations	276	276	276	276	276	276	276	276

Note: Specifications are estimated using bootstrap-based bias corrected estimator. Bootstrapped standard errors reported in parentheses; ***, **, and * denote the 1%, 5%, and 10% significance levels.

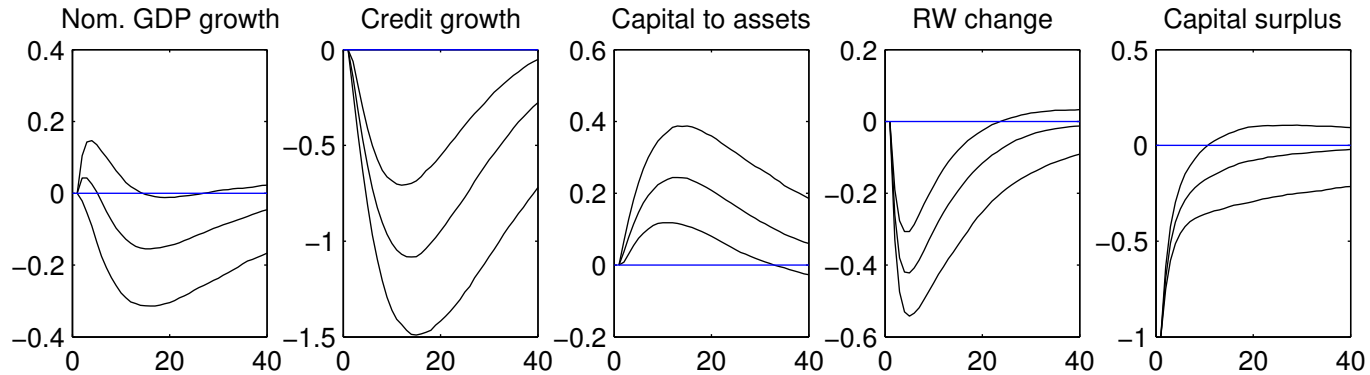
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ORCR*(1-dLowCS)			-0.711*** (0.066)	
CS (t-1)*dLowCS				2.188*** (0.445)
CS (t-1)*(1-dLowCS)				-0.236 (0.251)
ROA (t-1)	-0.035 (0.170)		-0.037 (0.172)	
LLPA (t-1)	-0.531*** (0.106)	0.380 (0.654)	-0.532*** (0.106)	-0.053 (0.629)
Interbank loans/A (t-1)	0.002 (0.036)		0.010 (0.037)	
Loans to CB&CG/A (t-1)	-0.008 (0.011)		-0.008 (0.011)	
Loans to PS excl. IL/A (t-1)	-0.064*** (0.019)		-0.061*** (0.019)	
Bonds/A (t-1)	0.015 (0.017)		0.016 (0.017)	
Lending rate (t-1)		-0.853 (0.526)		-0.973* (0.505)
CA (t-1)		1.901*** (0.500)		1.674*** (0.479)
Real GDP growth	0.100* (0.056)	-0.681*** (0.262)	0.095* (0.056)	-0.390 (0.256)
PX growth	0.028*** (0.0107)		0.029*** (0.0108)	
Spread	-1.058*** (0.212)		-1.077*** (0.212)	
IRB dummy	-0.891 (0.556)		-1.373 (1.008)	
Observations		276		276

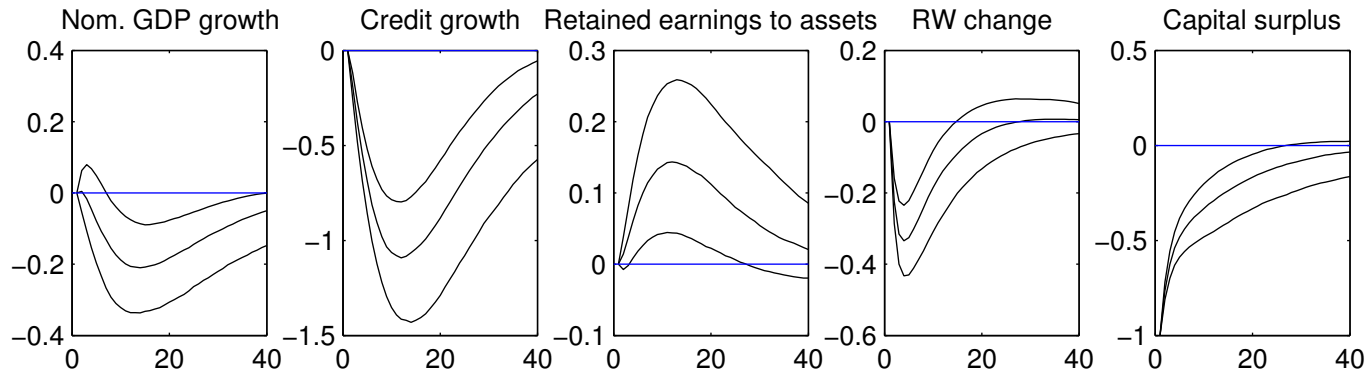
Note: Specifications are estimated using three-stage least squares estimator. Standard errors reported in parentheses; ***, **, and * denote the 1%, 5%, and 10% significance levels.

Figure 13: Additional IRFs – negative shock to capital surplus

(a)



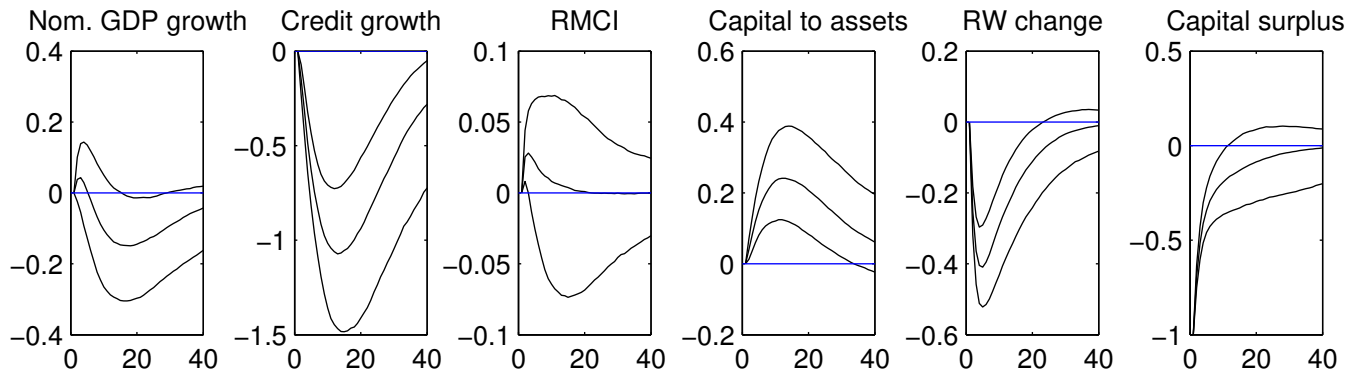
(b)



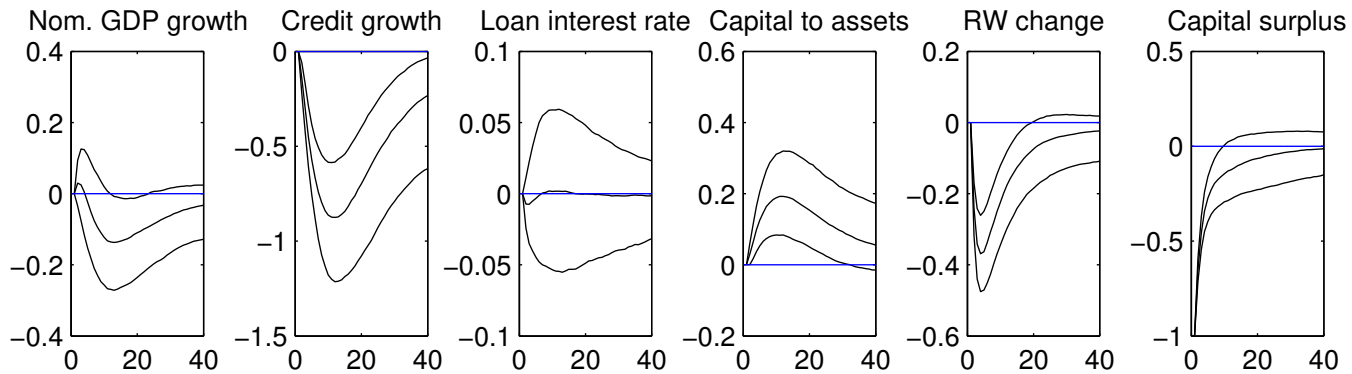
Note: 32th, 50th and 68th percentiles of the distribution reported.

Figure 14: Additional IRFs – negative shock to capital surplus

(c)



(d)



Note: 32th, 50th and 68th percentiles of the distribution reported.