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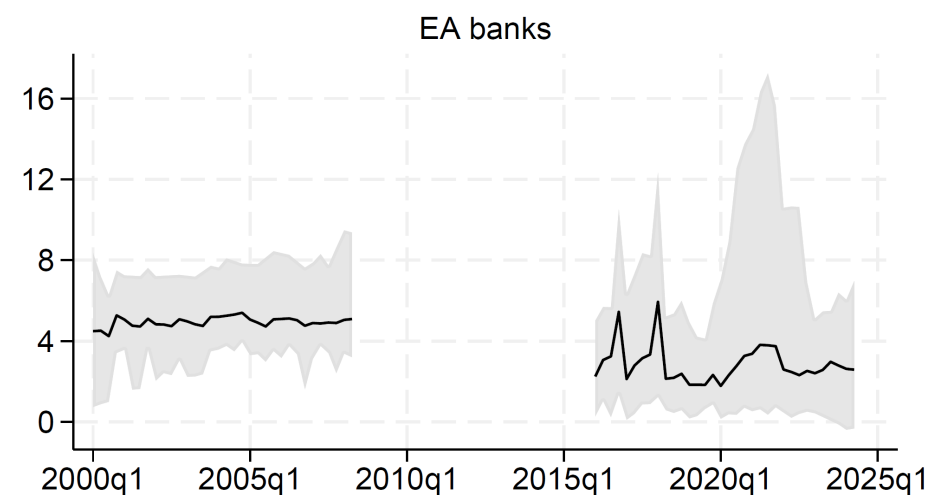
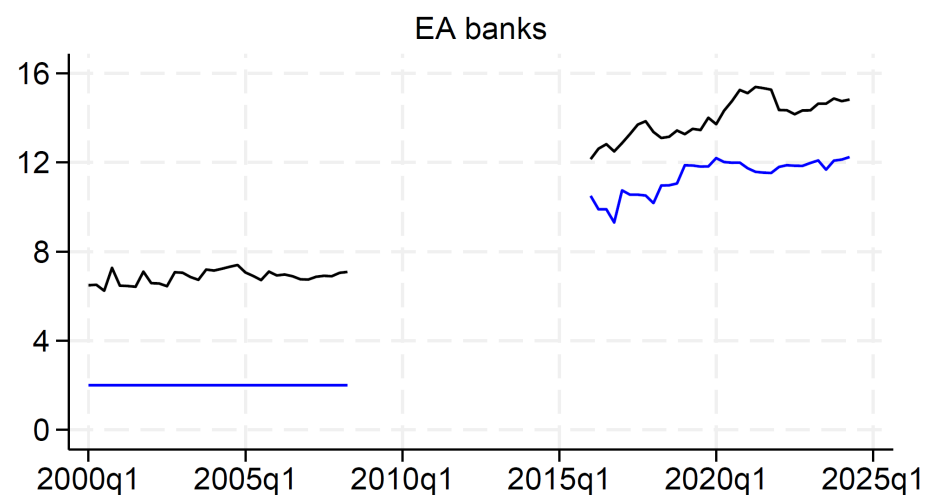
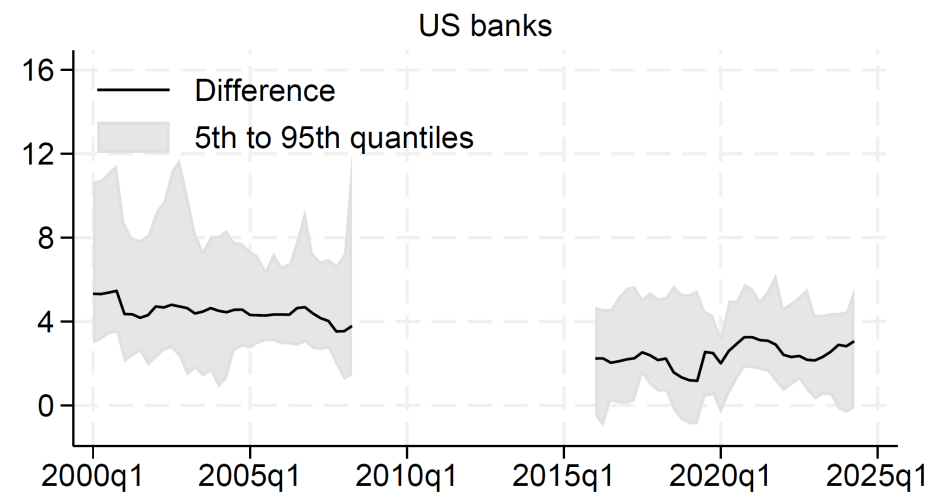
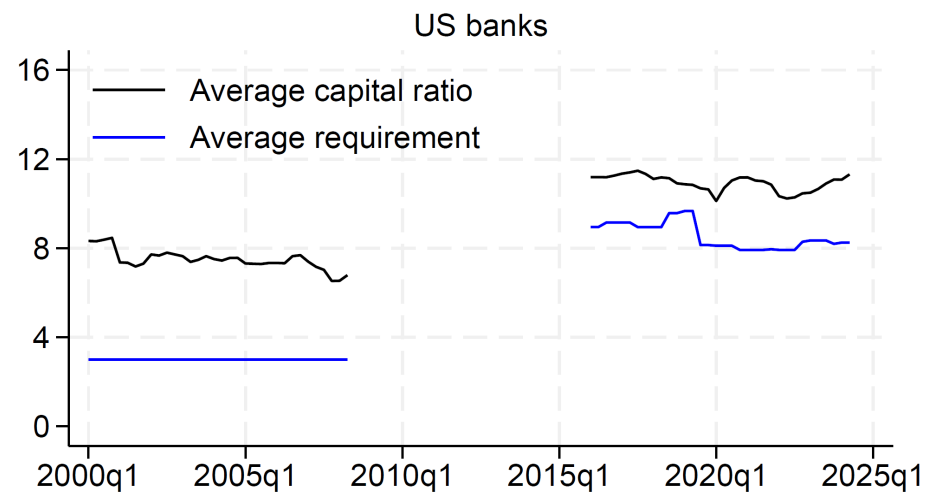
Banks' capital management over the long run: buffer targets and regulatory risk tolerance

Mikael Juselius (BIS), Aurea Ponte Marques (ECB) and Nikola Tarashev (BIS)

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The views expressed here are my own and not necessarily those of the BIS or its member institutions.

Object of analysis – management buffer



Motivation

- The only truly usable buffer: management buffer (MB)
 - *Andreeva et al (2020), Abad and Pascual (2022)*
 - *BCBS (2022), Hernandez de Cos (2021),*
- Economic effects of MB
 - funding costs: *Gambacorta and Shin (2018)*
 - credit supply: *Thakor (1996), Peek and Rosengren (1997), Aiyar et al (2016),*
 - lending conditions: *Berrospide et al (2021), ECB (2021), Ferrari et al. (2017)*
 - boosting MB helps absorb large shocks: eg *Covid-19 experience*
- Evidence of MB target
 - partial adjustment model: *Flannery and Rangan (2006)*
 - time invariant *bank-specific* target: *Gropp and Heider (2010)*
 - drivers of pre-announced time-varying MB target: *Couailler (2021)*
 - dimensions of adjustment toward MB: *De Jonghe and Oeztekin (2015), Couailler (2021)*

Deepen analysis of banks' capital management over the long run

- Study *steady-state* capital management strategies
 - long time series of public and supervisory data from the US and the euro area
 - two regulatory regimes: pre- and post-GFC
- Capital management is a multi-dimensional strategy
 - MB target only partly reflects degree of strategic conservatism
 - Size of shocks and speed of reversion to target also matter
- Regulatory risk tolerance (**RRT**)
 - Definition: MB shortfall relative to target, over some horizon, after a typical adverse “shock”
 - Increases in the **volatility** of MB shocks
 - Decreases in the steady state **MB target** and **speed** of reversion to MB target
- Trade-off of maintaining a high MB: regulatory penalties vs catering to shareholders

Selected findings

- MB target and RRT metrics are, empirically, well-defined steady-state objects
- Signs that RRT is a strategic capital management choice
 - Time: MB target dropped & RRT rose post GFC, in line with trade-off evolution
 - Cross section: MB target dropped by more at banks with greater increases in requirements – banks seek to cluster around a common capital ratio
 - Cross section: shock volatility and speed of reversion adjusted, to dampen impact of MB target on RRT – banks seek to cluster around a common RRT
- RRT carries information about dimension of MB adjustment to MBT: capital vs. lending

Roadmap

- Empirical setup
 - data
 - partial adjustment model
 - RRT metric
- Selected findings
- Conclusions

Empirical setup

Data

- 17 large US banks and 17 large euro area banks
- Pre-GFC: 2000:Q1 – 2008:Q2 (*regime 1*)
 - Tier 1 core equity capital to RWA
 - Basel I and Basel II: minimum requirements + US PCA
- Post-GFC: 2016:Q1 – 2024:Q2 (*regime 2*)
 - Common equity Tier 1 (CET1) capital to RWA
 - Basel III: minimum requirements & regulatory buffers
 - Rich capital stack
 - Pillar 1 minimum + CCoB + CCyB + GSIB buffer + ...
 - US: ... + stress-test buffer (two variants: up to and post 2020:Q3)
 - Euro area: ... + O-SII buffer + SyRB + Pillar 2 requirements + Pillar 2 guidance (supervisory data)

Empirical setup

- Management buffer (MB): regulatory capital ratio minus sum of regulatory requirements
- Partial-adjustment model of the MB, local projection estimates
 - $\Delta_h MB_{i,t+h} = \alpha_{g,r,h} + \phi_{i,r,h} + \beta_{g,r,h} MB_{i,t} + \delta_{g,r,h}^Z Z_{i,t} + \delta_{g,r,h}^Y Y_t + \varepsilon_{i,h,t+h}$
 - separate estimates for the pre- and post-GFC period
 - bank-level and group-level specifications
 - controls:
 - TA, RoA, RoE; operating profits, price-to-book, non-performing loans, loans, deposits, risk density, retained earnings; distance of the leverage ratio from LR requirement.
 - GDP growth, term spread, unemployment rate, inflation, change in domestic exchange rate, real property price growth, Covid-19 dummy.
- Key objects of interest
 - MB target: $\mu_{g,r} \equiv -\alpha_{g,r,1}/\beta_{g,r,1}$
 - speed (of MB reversion): $\gamma_{g,r,h} \equiv -\beta_{g,r,h}$
 - MB "shock" volatility: $\sigma_{g,r} \equiv st. dev. (\varepsilon_{i,1,t+1}), \text{ for } i \in g$

Regulatory risk tolerance (RRT)

- $RRT_{g,r,h} = \frac{\sigma_{g,r}}{\mu_{g,r,1}} (1 - \gamma_{g,r,h})$ for $h \geq 0$
- Components
 - MB target: $\mu_{g,r}$
 - speed (of MB reversion): $\gamma_{g,r,h}$
 - MB "shock" volatility: $\sigma_{g,r}$
- Interpretation
 - Horizon 0: size of MB shock – in standard deviations – that would wipe out MBT on impact
 - Horizons h: share of MBT that remains depleted h quarters after a typical shock

Findings

Evolution of banks' capital management

- RRT increased from the first to the second regime
 - Pre-GFC: an 8-standard-deviation shock wipes out the target MB on impact
 - Post-GFC: a 4-standard-deviation shock enough
- MB target declined by 2 pps.
- MB shocks more volatile
- Trade-off evolution: lower penalty for a marginal breach of requirements

Bank-level responses to higher capital requirements

- Higher increase in requirements:
 - greater decline in MB target
 - cluster capital ratios

Berger et al (1995) – ECB (2015)
- Amplifies RRT dispersion
ceteris paribus

	MB targ	RRT				
		h=0	h=1	h=2	h=3	h=4
Changes between regimes						
K req.	-0.41**	0.04**	0.04***	0.03**	0.02**	0.01
adj R ²	0.21	0.17	0.38	0.14	0.13	-0.04
obs.	33	33	26	27	30	32
Regime 1						
K req.	-1.55	0.03	0.03	0.01	0.00	-0.02
adj R ²	0.01	-0.01	-0.06	-0.06	-0.07	-0.03
obs.	33	33	30	29	31	32
Regime 2						
K req.	-0.22*	0.10*	0.08*	0.04***	0.04**	0.02*
adj R ²	0.11	0.15	0.09	0.33	0.12	0.09
obs.	33	33	28	31	32	33

Under the hood of the RRT

- Bank-level confirmation
- Pre-GFC: dispersion driven by MB shock volatility
- Post-GFC: dispersion driven by MB target
- Not all else stays the same:
→ cluster towards similar RRT

	RRT h=1	MB target	Speed	Shock Vol.
Changes between regimes				
RRT h=1	1.00			
MB target	−0.66***	1.00		
Speed	−0.03	−0.18	1.00	
Shock Vol.	0.46**	0.19	0.20	1.00
regime 1				
RRT h=1	1.00			
MB target	−0.30	1.00		
Speed	−0.02	−0.09	1.00	
Shock Vol.	0.79***	0.15	0.31*	1.00
regime 2				
RRT h=1	1.00			
MB target	−0.74***	1.00		
Speed	0.08	−0.10	1.00	
Shock Vol.	0.25	0.36**	0.30*	1.00

RRT differences between groups of banks

- Rather small
- Banks cluster around a common RRT

	RRT h=0			RRT h=1			RRT h=4		
	g1	g2	Diff	g1	g2	Diff	g1	g2	Diff
EA vs US banks	0.29	0.21	-0.08***	0.25	0.19	-0.06***	0.10	0.06	-0.04
Small vs big banks	0.22	0.29	0.07***	0.20	0.24	0.04***	0.08	0.09	0.01
Low vs high P2B	0.31	0.23	-0.08***	0.25	0.21	-0.04**	0.07	0.09	0.02
Low vs high ROA	0.27	0.24	-0.03***	0.24	0.20	-0.04***	0.10	0.05	-0.05***
Low vs high risk dens.	0.29	0.24	-0.05***	0.24	0.21	-0.03***	0.09	0.09	0.00
Low vs high NPL	0.27	0.25	-0.02***	0.24	0.21	-0.03**	0.11	0.06	-0.05
Low vs high loan ratio	0.29	0.25	-0.04***	0.25	0.23	-0.02**	0.11	0.08	-0.03
Low vs high dep. ratio	0.26	0.25	-0.01***	0.25	0.21	-0.04***	0.13	0.07	-0.06**
	MB target			Speed			Shock Volatility		
	g1	g2	Diff	g1	g2	Diff	g1	g2	Diff
EA vs US banks	2.80	2.39	-0.41***	0.13	0.10	-0.03	0.82	0.51	-0.31***
Small vs big banks	3.26	2.18	-1.08***	0.08	0.18	0.10**	0.72	0.64	-0.08***
Low vs high P2B	2.03	3.05	1.02***	0.20	0.09	-0.11*	0.63	0.71	0.08***
Low vs high ROA	2.77	2.38	-0.38***	0.11	0.14	0.03	0.75	0.56	-0.19***
Low vs high risk dens.	2.27	2.93	0.65***	0.16	0.10	-0.06	0.65	0.70	0.04***
Low vs high NPL	2.87	2.34	-0.54***	0.10	0.15	0.04	0.76	0.58	-0.19***
Low vs high loan ratio	2.18	2.73	0.55***	0.13	0.12	-0.02	0.63	0.69	0.06***
Low vs high dep. ratio	3.98	2.40	-1.58***	0.07	0.15	0.08	1.05	0.59	-0.46***

Dimensions of MB adjustment toward MB target

- $\ln(X_{i,t+h}) = a_{g,h} + b_{g,h}\ln(X_{i,t}) + c_{g,h}MB_{i,t} + v_{i,h,t+h}$
- Average bank adjusts through
 - both capital and RWA;
 - first asset size, then risk weights
- Strong performers adjust through RWA;
weak performers through capital
- Only high-RRT banks adjust through loans

	All banks	Performance				RRT	
		lo P2B	hi P2B	lo ROA	hi ROA	lo	hi
CET1							
h=1	-0.15**	-0.32***	-0.06	-0.27***	0.09	-0.12	-0.16
h=4	-0.57**	-0.64*	-0.53	-0.97***	0.36	-0.64	-0.53
RWA							
h=1	0.24**	0.08	0.32**	0.11	0.47***	0.18	0.28*
h=4	0.81***	0.19	1.21***	0.40**	1.40**	1.00***	0.65*
Assets							
h=1	0.23*	0.20**	0.25	0.14	0.35**	0.08	-0.34***
h=4	0.16	-0.07	0.17	-0.07	0.51	0.43	-0.10
RW							
h=1	0.00	-0.05	0.05	-0.04	0.08	0.19*	-0.16
h=4	0.70***	0.41**	0.91***	0.64**	0.86**	0.77***	0.66***
Net loans							
h=1	0.18	0.19*	0.17	0.05	0.37***	-0.03	0.34***
h=4	0.34	0.04	0.54	-0.01	1.00**	0.27	0.35

Dimension of adjustment towards the MB target, Regime 2, by bank groups. Notes: RW = risk-weight; "lo" = low; "hi" = high. Significance: * (10%), ** (5%), *** (1%).

Key takeaways

- Regulatory risk tolerance (RRT): a meaningful metric of banks' capital management strategy
 - embeds intuitive responses to post-GFC tightening of capital requirements
 - banks seek to not stand out in terms of RRT
- RRT level carries information about real-economy effects of capital management
- Additional (implicit) takeaways
 - For researchers: assumptions about binding regulatory constraints – misleading
 - For regulators: a decline in the perceived penalties for regulatory breach – as intended

Additional graphs and tables

Bank-level parameters

Bank	Regime 1 (r1)					Regime 2 (r2)					Change (r2-r1)	
	Speed	MBT	Shock vol	RRT	corr	Speed	MBT	Shock vol	RRT	corr	MBT	RRT
1	0.33	4.0	0.28	0.05	**	0.14	1.8	0.42	0.12	.	-2.2***	0.07 ***
2	0.05	4.4	0.11	0.48	.	0.21	-0.9	0.55	0.47	.	-5.3**	-0.01
3	0.35	4.2	0.34	0.05	.	0.11	2.8	0.1	0.09	***	-1.4**	0.04 **
4	0.21	3.2	0.28	0.07	.	0.00	2.0	0.28	0.14	.	-1.2	0.07
5	0.21	3.8	0.26	0.06	*	0.27	2.0	0.49	0.18	.	-1.8***	0.12***
6	0.14	8.4	0.9	0.09	.	0.19	3.0	1.17	0.33	.	-5.4***	0.24 **
7	0.06	4.3	0.34	0.08	.	0.28	2.4	0.44	0.14	.	-1.9**	0.06
8	-0.05	3.6	0.33	.	.	0.16	3.3	0.55	0.14	.	-0.3	.
9	0.05	3.1	0.22	0.07	**	0.16	1.6	0.46	0.25	.	-1.5	0.18**
10	-0.01	6.4	0.40	.	.	-0.08	2.7	0.36	.	.	-3.7*	.
11	0.12	3.1	0.29	0.08	.	0.06	3.0	0.27	0.09	**	-0.1	0.01
12	0.08	4.5	0.15	0.03	*	0.22	3.5	0.34	0.08	.	-1.0 ***	0.05***
13	0.25	6.5	0.35	0.04	.	0.12	4.4	0.50	0.10	.	-2.1 ***	0.06**
14	0.15	4.7	0.44	0.08	.	-0.06	2.9	0.39	.	.	-1.8	.
15	0.28	3.0	0.51	0.12	.	-0.31	2.3	0.46	.	.	-0.7	.
16	0.20	3.5	0.43	0.10	.	-0.06	2.1	0.51	.	.	-1.4	.
17	0.07	3.7	0.51	0.13	.	0.05	2.2	0.37	0.16	.	-1.5	0.03
18	0.20	5.9	0.36	0.05	.	0.21	3.7	0.94	0.20	.	-2.2 *	0.15**
19	0.10	4.6	0.30	0.06	.	0.41	3.5	0.70	0.12	.	-1.1*	0.06**
20	-0.07	4.9	0.63	.	.	0.09	2.5	0.82	0.30	***	-2.4	.
21	0.24	4.3	0.51	0.09	.	0.48	1.3	0.45	0.18	.	-3.0***	0.09*
22	0.33	4.5	0.25	0.02	.	0.09	1.9	0.56	0.26	.	-2.6**	0.24*
23	0.33	4.5	0.47	0.07	.	0.04	3.3	0.62	0.18	.	-1.2	0.11
24	0.26	6.0	0.41	0.05	.	0.13	0.2	0.34	1.87	.	-5.8***	1.82
25	0.30	4.3	0.32	0.05	.	0.26	2.0	0.55	0.21	.	-2.3***	0.16 ***
26	0.09	7.9	0.18	0.02	***	0.18	2.9	0.76	0.22	**	-5.0***	0.20***
27	0.38	5.4	2.19	0.25	.	0.44	2.7	1.10	0.22	.	-2.7 ***	-0.03
28	0.29	4.6	0.71	0.11	.	0.24	1.9	0.43	0.17	.	-2.7 ***	0.06
29	0.23	4.5	0.35	0.06	***	0.28	2.2	0.80	0.26	.	-2.3***	0.20***
30	0.45	4.1	0.86	0.11	.	0.26	2.2	0.63	0.21	.	-1.9 ***	0.10**
31	0.24	4.9	0.43	0.07	.	-0.19	0.9	0.61	.	.	-4.0***	.
32	0.13	4.4	0.36	0.07	.	0.37	1.9	0.51	0.17	.	-2.5 ***	0.10 **
33	0.64	3.8	0.90	0.08	.	0.05	7.8	1.96	0.24	.	4.0	0.16
34	0.09	4.1	0.35	0.08	.	0.18	2.5	0.52	0.17	.	-1.6*	0.09**

Notes: MBT = MB target. For the tests on serial correlation (corr) of the residual in equation (1) and on between-regime changes, significance: * (10%), ** (5%), *** (1%).

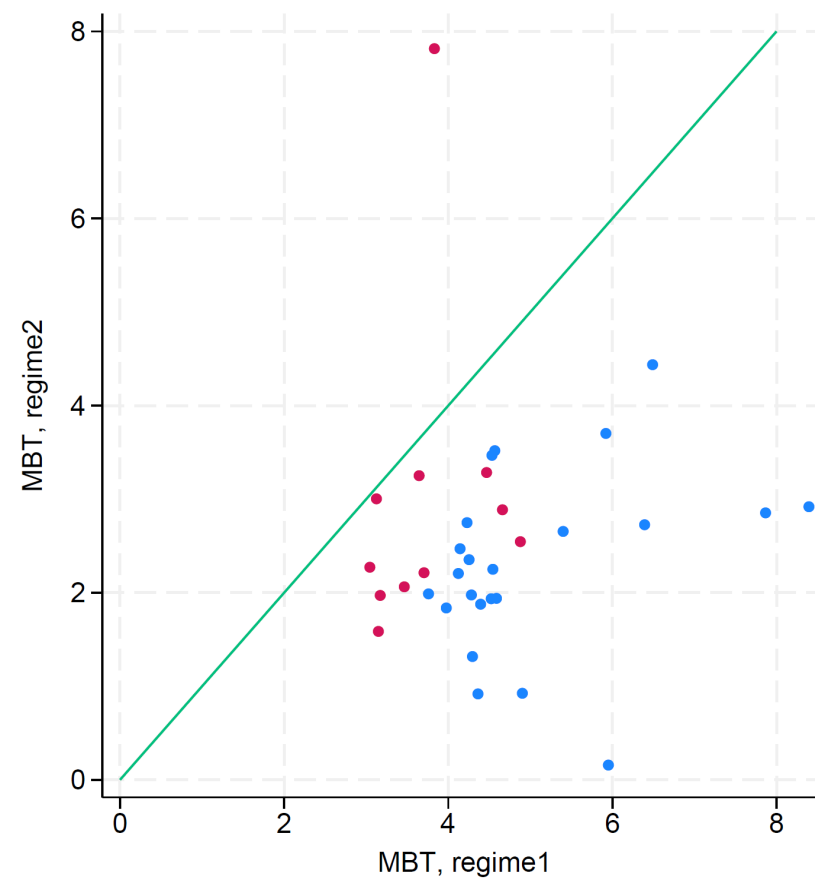
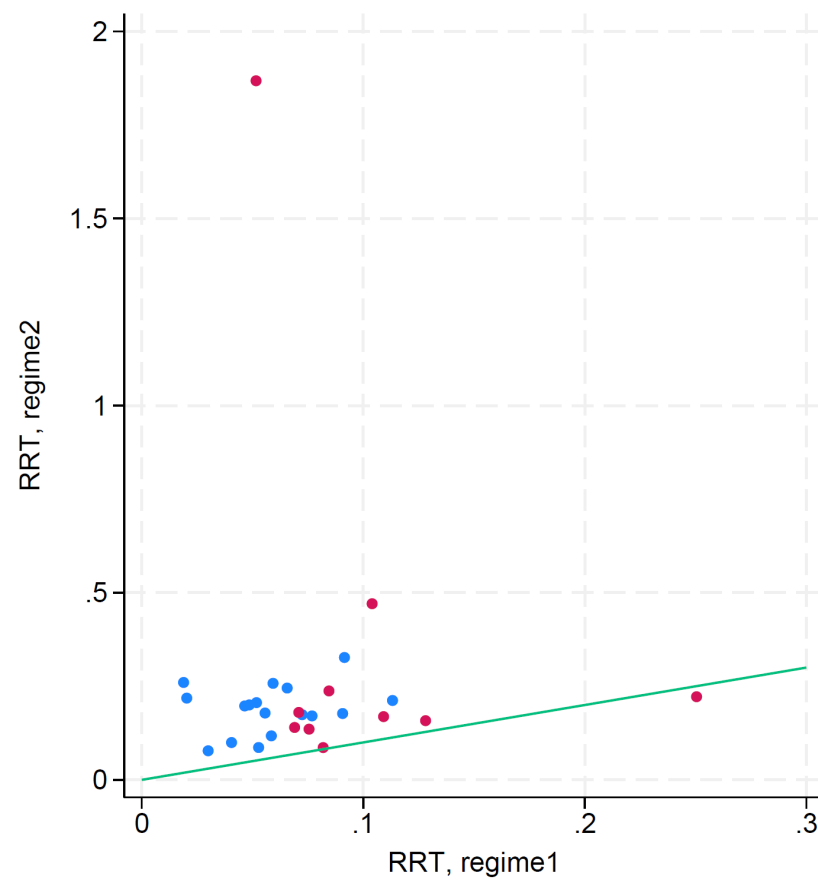
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Sample-wide findings

RRT h=0			RRT h=1			RRT h=4		
r1	r2	change	r1	r2	change	r1	r2	change
0.13	0.26	0.13***	0.11	0.23	0.12***	0.06	0.09	0.03*
MB target			Speed			Shock volatility		
r1	r2	change	r1	r2	change	r1	r2	change
4.59	2.59	-2.00***	0.19	0.12	-0.07	0.60	0.68	0.08***

Notes: r1 (r2) is the pre- (post-) GFC regime. Level estimates that are statistically significant at the 5% level are in boldface (not applicable for shock volatility). For changes, significance: * (10%), ** (5%), *** (1%).

Bank-level findings

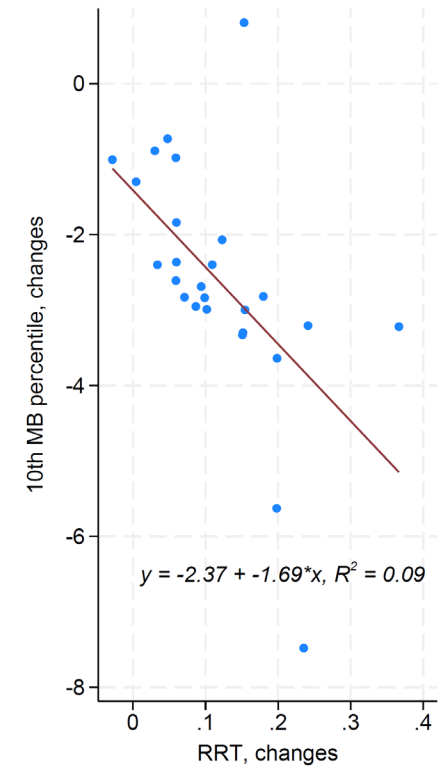
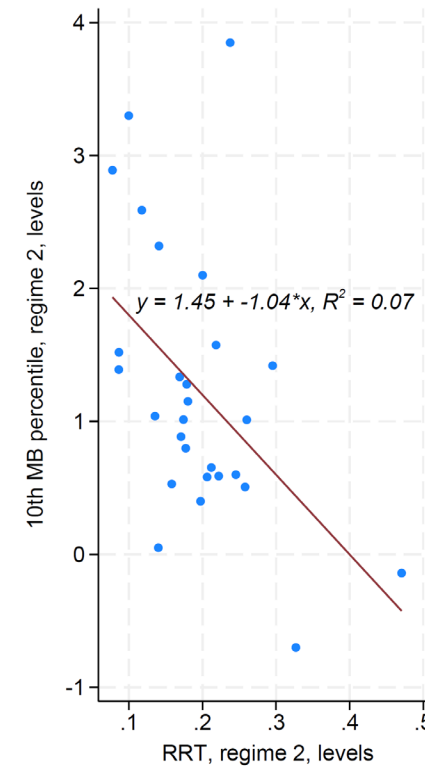
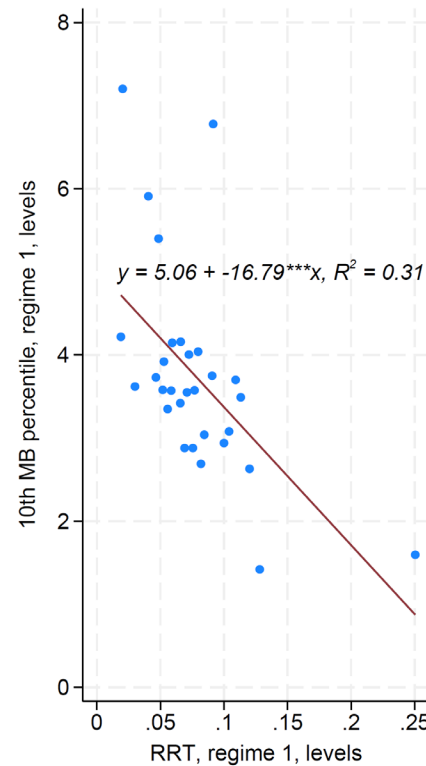


● significant ● insignificant — 45 degrees

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RRT components and information content: sanity check

- Well-defined steady-state MB target:
mean reversion in MB
- Well-defined RRT:
no serial correlation in MB shocks
[\[link\]](#)
- RRT make sense:
negative relationship between RRT
and left MB tail



Robustness results: RRT changes between regimes

Group	Controls	RRT0			RRT1			RRT4		
		r1	r2	change	r1	r2	change	r1	r2	change
Region and size										
EA banks	N	0.15	0.29	0.14***	0.11	0.25	0.15***	0.07	0.10	0.04*
	Y	0.15	0.33	0.19***	0.09	0.28	0.19***	0.05	0.12	0.07**
US banks	N	0.11	0.21	0.11***	0.10	0.19	0.10***	0.04	0.06	0.03
	Y	0.10	0.22	0.12***	0.09	0.20	0.10***	0.04	0.07	0.04
small banks	N	0.17	0.22	0.06***	0.13	0.20	0.07***	-0.01	0.08	-0.01
	Y	0.16	0.27	0.10***	0.13	0.24	0.11**	0.10	0.09	-0.01
big banks	N	0.10	0.29	0.19***	0.08	0.24	0.16***	0.02	0.09	0.07***
	Y	0.10	0.31	0.22***	0.07	0.26	0.18***	0.01	0.11	0.10***

RRT changes between regimes, by bank group. *Notes:* N = no; Y = yes. Significance: * (10%), ** (5%), *** (1%). “Low” and “high” indicate banks below and above the median (below and above 1 for P2B), respectively.

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Robustness results: RRT components' changes between regimes

Group	Controls	MB target			Speed of reversion			Shock volatility		
		r1	r2	change	r1	r2	change	r1	r2	change
Region and size										
EA banks	N	4.96	2.80	-2.16***	0.29	0.13	-0.16*	0.73	0.82	0.08***
	Y	4.98	2.44	-2.54***	0.38	0.15	-0.23***	0.81	0.50	-0.31***
US banks	N	3.95	2.39	-1.56***	0.08	0.10	0.02	0.42	0.51	0.09***
	Y	3.98	2.22	-1.76***	0.09	0.12	0.03	0.41	0.50	0.09***
small banks	N	4.34	3.26	-1.08***	0.19	0.08	-0.11*	0.72	0.72	0.00***
	Y	4.30	2.71	-1.59***	0.22	0.11	-0.11	0.70	0.72	0.02***
big banks	N	4.82	2.18	-2.64***	0.20	0.18	-0.03	0.47	0.64	0.16***
	Y	4.88	1.98	-2.89***	0.26	0.19	-0.07	0.47	0.62	0.16*

RRT components: changes between regimes, by bank group. *Notes:* N = no; Y = yes. Significance: * (10%), ** (5%), *** (1%). “Low” and “high” indicate banks below and above the median (below and above 1 for P2B), respectively.

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Robustness results: differences between groups

	Controls	RRT h=0			RRT h=1			RRT h=4		
		g1	g2	Diff	g1	g2	Diff	g1	g2	Diff
EA vs US banks	N	0.29	0.21	−0.08***	0.25	0.19	−0.06***	0.10	0.06	−0.04
	Y	0.33	0.22	−0.11***	0.28	0.20	−0.08***	0.12	0.07	−0.05
Small vs big banks	N	0.22	0.29	0.07***	0.20	0.24	0.04***	0.08	0.09	0.01
	Y	0.27	0.31	−0.04***	0.24	0.26	0.02	0.09	0.11	0.02
Low vs high P2B	N	0.31	0.23	−0.08***	0.25	0.21	−0.04**	0.07	0.09	0.02
	Y	0.33	0.27	−0.06***	0.27	0.23	−0.04	0.08	0.10	0.02
Low vs high ROA	N	0.27	0.24	−0.03***	0.24	0.20	−0.04***	0.10	0.05	−0.05***
	Y	0.32	0.26	−0.06***	0.27	0.22	−0.05*	0.12	0.07	−0.05*
Low vs high risk density	N	0.29	0.24	−0.05***	0.24	0.21	−0.03***	0.09	0.09	0.00
	Y	0.29	0.28	−0.01***	0.24	0.23	−0.01	0.10	0.09	−0.01
Low vs high NPL	N	0.27	0.25	−0.02***	0.24	0.21	−0.03**	0.11	0.06	−0.05
	Y	0.30	0.28	−0.02***	0.26	0.23	−0.03	0.13	0.06	−0.07***
Low vs high loan ratio	N	0.29	0.25	−0.04***	0.25	0.23	−0.02**	0.11	0.08	−0.03
	Y	0.28	0.29	0.01***	0.23	0.25	0.02	0.11	0.10	−0.01
Low vs high deposit ratio	N	0.26	0.25	−0.01***	0.25	0.21	−0.04***	0.13	0.07	−0.06**
	Y	0.33	0.27	−0.06***	0.29	0.22	−0.07	0.17	0.08	−0.09

RRT and its components: differences between groups (regime 2). *Notes:* g1 (g2) is the first (second) group in the row heading. “Low” and “high” indicate banks below and above the median (below and above 1 for P2B), respectively. N = no; Y = yes. Level estimates that are statistically significant at the 5% level are in boldface (not applicable for shock volatility). For the differences between groups (Diff), significance: * (10%), ** (5%), *** (1%).

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