BIS Working Papers
No 1287

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by Mikael Juselius, Aurea Ponte Marques and Nikola Tarashev

Monetary and Economic Department

September 2025

JEL classification: G21, G28, E51, G31

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This publication is available on the BIS website (www.bis.org).

ISSN 1020-0959 (print)
ISSN 1682-7678 (online)

Banks' regulatory risk tolerance*

Mikael Juselius[†] Aurea Ponte Marques[‡] Nikola Tarashev[§]

August 26, 2025

Abstract

In managing their capital, banks balance the risk of breaching regulatory requirements against the cost of maintaining and speedily restoring "management" buffers. Using 68 quarters of data on 17 US and 17 euro-area banks, we find systematic reductions in steady-state management buffer targets and attendant rises in regulatory risk tolerance (RRT) following the Great Financial Crisis (GFC). This phenomenon is particularly pronounced at banks with higher capital requirements post GFC. In parallel, banks facing more volatile management buffer shocks set higher management buffer targets, suggesting that RRT is a conscious choice. High-RRT banks tend to respond to a depletion of their management buffers by cutting lending, whereas low-RRT banks reduce the riskiness of their assets in other ways — thus highlighting real-economy effects of capital management strategies.

Keywords: Capital management, Management buffer target, Speed of reversion, Regulatory regimes
JEL Codes: G21, G28, E51, G31

*For useful comments, we thank Patrizia Baudino, Claudio Borio, Rodrigo Coelho, Mathias Drehmann, Marc Farag, Gaston Gelos, Bryan Hardy, Wenqian Huang, Aakriti Mathur (discussant), Daniel Rees as well as participants at a BIS research seminar and the 2024 Czech National Bank Workshop on Financial Stability and Macroprudential Policy. Jhuvesh Sobrun provided valuable assistance with the data. The views expressed in this paper are those of the authors and do not necessarily reflect those of the Bank for International Settlements, the Bank of Finland, the European Central Bank or the Eurosystem.

[†]Bank for International Settlements and Bank of Finland: mikael.juselius@bis.org
[‡]European Central Bank: aurea.marques@ecb.europa.eu
[§]Bank for International Settlements: nikola.tarashev@bis.org

1 Introduction

Through several regulatory regimes, banks have consistently operated with management buffers (MBs) – defined as the headroom in regulatory capital ratios above the corresponding requirements. Importantly, the implications of a regulatory breach have differed across the regimes. Under Basel I and II — in place before the Great Financial Crisis (GFC) — a marginal breach entailed violating regulatory minima and could therefore trigger severe, or "terminal" penalties. Such penalties could involve a withdrawal of the banking license or a declaration of failure, allowing supervisors to seize the bank's loss-absorbing resources to ensure orderly recovery or resolution. By contrast, a marginal breach of the current Basel III requirements would involve regulatory buffers, which can be dipped into with much milder consequences: distribution restrictions, heightened supervisory oversight, and/or obligations to rebuild regulatory capital. Nevertheless, several studies have found that these penalties and related market expectations are key reasons behind limited usability of regulatory buffers (e.g., BCBS (2022); Hernadez de Cos (2021); Abad and Pascual (2022); Andreeva et al. (2020)).

Hence the interest in the macroeconomic importance of MBs. For instance, Aiyar et al. (2016) find that increases in capital requirements, which reduce the MB all else equal, depress credit supply. Similar findings are reported by Thakor (1996), Peek and Rosengren (1997), and Gambacorta and Mistrulli (2004). Consistent with these studies, Gambacorta and Shin (2018) find that banks with higher MB support credit growth as they face lower funding costs. Likewise, Carlson et al. (2013), Berrospide et al. (2021), ECB (2021), BCBS (2021), and Ferrari et al. (2017) find that large MBs help improve credit conditions in the aftermath of adverse shocks.[1]

Contribution. We deepen the analysis of bank capital management in four key ways. First, we seek evidence of clearly defined capital-management strategies by drawing on long time series of bank capital requirements and balance-sheet ratios. These data cover several regulatory regimes and both US and euro-area banks – including the latter's non-public requirements. Second, as a new summary metric of capital management, we introduce "regulatory risk tolerance" (RRT), which combines estimates of a *steady-state* management buffer target (MBT),[2] the speed of reversion to that target[3] and the volatility of MB shocks. And we study the extent to which RRT differs across individual banks and between groups of banks based on nationality, size, business model, riskiness and performance. Third, we study whether the overhaul of international regulatory standards after the GFC — which tightened capital requirements and introduced regulatory buffers — influenced the evolution of RRT and its dispersion across banks. Fourth, we investigate whether the RRT metric carries information about dimensions of systematic adjustments towards the MBT — notably, capital vs lending — thus providing insights on real-economy effects of capital management.

The RRT components relate directly to banks' trade-off between (i) the cost of maintaining a persistently robust capital position; and (ii) the cost of breaching regulatory requirements. Banks could perceive the former as stemming from the cost of capital relative to other types of funding and from engaging in MB-

[1]BCBS (2021) notes similar effects of increases in management buffers that resulted from policy decisions to (i) reduce regulatory requirements and/or (ii) limit or ban distributions. Findings in the same vein are reported by Jiménez et al. (2017), Sivec et al. (2019), and Behn et al. (2020), with the latter stressing the importance of policy communication. By contrast, Andreeva et al. (2020) highlight that financial market pressure may constrain banks' willingness to use released buffers.

[2]In line with the notion of a time-invariant target, Gropp and Heider (2010) find notable statistical and economic significance of bank fixed effects as explanatory variables of leverage.

[3]The MBT and speed of MB reversion are in the spirit of the "partial adjustment" model in Flannery and Rangan (2006) and Berger et al. (2008), who find that firms actively manage the costs and benefits of their capitalisation. On the basis of euro area data from 2014 to 2020, Couaillier (2021) finds that the speed of reversion towards a *time-varying* target level is higher after a negative than after a positive shock. Since our background tests in the context of a *steady-state* MBT do not uncover such asymmetry, we omit them for the sake of brevity.

preserving actions that potentially destroy shareholder value — such as cutting shareholders payouts, raising capital externally, or lowering risk-weighted assets. These costs increase with the MBT and the speed of reversion but decline if banks do not seek to endogenously counteract exogenous drivers of MB shocks. In turn, a higher MB shock volatility is more likely to trigger a regulatory breach and the attendant regulatory costs when the MBT or the reversion speed are low.

To capture how banks handle this trade-off, our RRT metric is equal to the MB shortfall (or excess) that a typical one-time shock generates relative to the MBT over a given horizon. The metric increases with the volatility of MB shocks and decreases with the MBT and the speed of MB reversion. At time horizon zero, the RRT reveals the share of the MBT that e.g. a one standard-deviation negative MB shock wipes out on impact. At a longer horizon, the RRT is equal to the residual share of MBT that remains depleted as a result of this shock. At any horizon, the higher the RRT the greater the extent to which banks seek to reduce MB-adjustment costs despite the risk of a regulatory breach down the road.[4]

Empirical approach and findings. Long time series are of great importance in studying the MB's evolution. Conditional on having identified a period with a single steady state, longer time series are more likely to reveal mean reversion of the MB, if present. In turn, detectable mean reversion of the MB is a prerequisite for meaningful and accurate estimates of the three *steady-state* parameters of interest — MBT, speed of reversion and volatility of MB shocks. Importantly, the slower the reversion to the MBT the longer the time series needed for detecting mean reversion.

Focusing separately on two periods that correspond to distinct regulatory regimes, we express the MB in terms of the highest quality regulatory capital relative to risk-weighted assets (RWA) and robustly estimate a partial adjustment model of the MB. The first period covers 34 pre-GFC quarters – corresponding to the Basel I and II regulatory standards, which did not differ in terms of the level of capital requirements and the attendant definition of capital. The second period covers 34 post-GFC quarters that are associated with Basel III, which overhauled the previous capital requirements (see below).[5] We estimate regime-specific MBT, speed of reversion to the MBT and volatility of MB shocks – at the level of all banks, groups of banks and individual banks – thus allowing for the possibility that each period features a distinct steady state. We use local projection to obtain estimates that are robust to non-linearities in the evolution of MB, controlling also for bank-specific and macroeconomic factors that may drive temporary deviations of the MB from the MBT.[6] The "MB shocks" are the one-quarter local projection residuals, conflating exogenous effects of the macro-financial environment and any counteracting measures that the bank takes within a quarter.[7]

Meaningful RRT and components. Across alternative econometric specifications, we derive intuitive estimates of RRT components. The speeds of reversion towards the MBT are significant, implying stationary MBs. In addition, MB shocks display little to no serial correlation, which allows us to work with a straightforward, and thus transparent, RRT definition. Ultimately, when we combine the three components in the

[4]RRT conveys ambiguous information about the cyclicality of bank actions. Greater shock absorption of the MB (i.e., a higher RRT) dampens pro-cyclicality. But it also increases the probability of breaching regulatory requirements, in which case banks would need to respond pro-cyclically.

[5]Since we abstract from the GFC and its aftermath, our aim is not to assess banks' resilience under stress, but rather to study capital management during normal times. Banks' resilience in stress depends on their overall loss-absorbing capacity and the extent to which their regulatory risk weights match the actual riskiness of their positions — both aspects are out of scope. That said, the management of capital positions in business as usual carries information about the likelihood that a bank finds itself in stress, as well as about the impact of shocks on capital markets and bank lending.

[6]In contrast to the related literature – in particular, Flannery and Rangan (2006), Couaillier (2021) on euro area banks and Cummings and Durrani (2025) on Australian banks – we do not explicitly seek to identify drivers of time variation in the MB target itself. Rather, we note that strategic changes to the target are econometrically indistinguishable from changes to the management buffer that the bank does not have the capacity to reverse even if it wished to do so.

[7]Da Rocha Lopes et al. (2025) study such short-term counteracting measures, even if over a six-month horizon, which is twice as long as the period underpinning MB shocks in our paper.

RRT metric, we confirm that it contains information about the risk of breaching regulatory requirements.

Strategic evolution of RRT. With the RRT metric under our belts, we investigate how it *evolved* when regulation switched from the pre-GFC to the post-GFC regime. Post GFC, Basel III introduced a stricter definition of the highest quality capital, replacing the Basel II "core equity" with common equity Tier 1 (CET1) capital requirements. In parallel, the change in standards involved a more conservative calculation of RWA. Basel III also raised the minimum requirement in terms of the highest quality capital relative to RWA and introduced regulatory buffers for the first time. Overall, this implies an evolution of the trade-off that RRT reflects: (i) it became more expensive for banks to comply with capital requirements; and (ii) the penalties for a marginal breach of these requirements weakened.

Our estimates do reveal a material increase in the RRT from the pre- to the post-GFC period. The RRT doubles on average — reflecting primarily a decline in the MBT – implying that e.g., a four-, rather than an eight-, standard-deviation shock would wipe out the MBT on impact. The average 2-percentage-point decline in the MBT is the flipside of banks' capital ratios rising 25% less than they would have if MBT levels had remained constant. These findings are robust to changing the level of analysis – all banks, groups of banks or individual banks – and to the inclusion of controls.

At the bank level, there are two distinct signs that strategic choices underpin the post-GFC RRT. First, the RRT rise – and the underlying MBT decline – tends to be more pronounced among banks facing steeper increases in their capital requirements under Basel III. This suggests that RRT counteracts the regulatory overhaul's impact on capital ratios. Second, in the post-GFC (but not the pre-GFC) period, MBT tends to be larger and the speed of reversion to MBT tends to be higher for banks experiencing a higher volatility of MB shocks. This configuration of the three components – which we also observe at the level of bank groups – dampens the RRT cross-sectional dispersion, consistent with a strategy to avoid standing out in terms of capital management post GFC.

RRT differences between bank groups. Focusing on the post-GFC period, we investigate whether the *level* of RRT differs between groups of banks. One might expect such differences between US and euro-area banks to stem from distinct supervisory regimes and jurisdiction-specific add-ons on top of Basel III requirements.[8] In a similar vein, we test whether RRT differences surface under other groupings of banks — based on size, business model, performance or asset riskiness.[9] In each case, we effectively seek to uncover whether the banks in one group face a different RRT-related trade-off relative to those in the other group.

Despite banks' tendency to cluster around a common RRT level, we identify systematic, albeit economically modest, differences between bank groups in the post-GFC period. For instance, US banks have significantly lower RRT than euro-area banks, mainly because of lower volatility of MB shocks. Conversely, even though small banks face more volatile MB shocks – consistent with a less diversified business model – they also have a larger MBT, which ultimately translates into a lower RRT relative to large banks. Interestingly, low-RoA banks exhibit higher RRT mainly because their MB shocks are more volatile than those of high-RoA banks. This is consistent with the notion that lower profitability weakens a bank's capacity to mitigate shocks by retaining earnings. These differences between groups amount to about one-third to one-half of the average between-regimes change in the RRT at a one-quarter horizon.

Dimensions of MB adjustment. The economic significance of capital management depends on the dimension along which banks adjust towards the MBT. Still focusing on the post-GFC period, we consider several potential dimensions: CET1 capital, RWA, total assets, the average risk weight (or the "risk density")

[8]This is similar to the motivation of the analyses in Andreeva et al. (2020) and Couaillier (2021).

[9]On the relevance of such features for capital management, see De Jonge and Öztekin (2015) and Bakkar et al. (2023).

and net lending. And we investigate whether the above groupings – as well as a grouping based on the RRT level – help identify different dimensions of adjustment over multiple quarters.[10]

While the average bank in our sample reverts to the MBT by systematically adjusting both CET1 and RWA, we find that certain bank characteristics help identify groups that use only a particular dimension of adjustment. Concretely, US banks, small banks, high price-to-book (P2B) banks, and those with high deposit ratios adjust mainly through RWA – suggesting that capital raising is a costlier option for them. Digging deeper, we see that US banks and banks with high deposit ratios attain this by adjusting their lending. By contrast, euro-area banks, low-performing banks — i.e., banks with low P2B ratios or RoA — as well as banks with low NPL and low deposit ratios tend to revert to their MBT mainly by altering their CET1 capital. The finding related to bank performance is surprising: better performing banks should find it less challenging to accumulate capital when they need to counteract a drop in the MB.

Grouping banks according to their RRT is also informative as regards the dimension of adjustment towards the MBT. In the face of an MB drop from the MBT, low-RRT banks reduce their RWAs without contracting total assets, or loans in particular. By contrast, when high-RRT banks face a similar drop, they tend to cut lending in order to reduce their RWAs and ultimately raise their capital ratios. Concretely, a one-standard deviation negative shock to the MB leads high-RRT banks to reduce their net lending by 0.75% over a two-quarter horizon. Given high-RRT banks' greater conservatism, this finding suggests that cutting lending is the most expeditious way to revert to one's MBT.

Roadmap. Section 2 describes our dataset and relevant features of the attendant regulatory regimes. Section 3 details our empirical approach to estimating the RRT metric. Section 4 discusses our estimates of the RRT components. Section 5 analyses the evolution of the RRT from the pre- to the post-GFC regulatory regime and underlying drivers. Section 6 zooms in on the post-GFC period to study whether certain bank characteristics systematically relate to the RRT level. Section 7 examnes the dimensions along which the MB revers to the MBT. Some of the findings related to Sections 4-7 are in an appendix. Section 8 concludes.

2 Data on regulatory ratios and requirements

We employ an unbalanced panel dataset, covering 17 euro-area and 17 US banks.[11] The sample extends from 2000:Q1 to 2008:Q2 (that is, 34 "pre-GFC" quarters, which – in terms of international standards – cover the end of the Basel I period and the first two quarters of the Basel II period, which we jointly denote by $r1$) and from 2016:Q1 to 2024:Q2 (that is, 34 "post-GFC" quarters corresponding to Basel III, or $r2$).

We work with ratios of the highest quality regulatory capital to risk-weighted assets (RWA). Both the numerator and the denominator of this ratio have evolved. Up to the GFC (when **Basel I** and **Basel II** were in place), the numerator was generally referred to as ***core equity capital***, whereas the more loss-absorbent

[10] The literature has discussed extensively reasons why banks would prefer not to raise equity, citing intermediation expenses (Allen et al. (2015)), tax advantages of debt (Miles et al. (2013)), and asymmetric information about banks' net worth (Bolton and Freixas (2006); Myers and Majluf (1984)). Empirical evidence supports the view that banks often raise their capital ratios by reducing credit supply rather than by issuing new equity (Bridges et al. (2014); Aiyar et al. (2014, 2016); Noss and Toffano (2016); Gropp et al. (2019); Degryse and Tang (2023); Cappelletti et al. (2024); Ponte Marques et al. (2024).

[11] **Euro-area banks**: KBC Group NV, Intesa Sanpaolo S.p.A., Erwerbsgesellschaft der S-Finanzgruppe mbH & Co. KG, Banco Santander S.A., ING Groep N.V., UniCredit S.p.A., Deutsche Bank AG, Commerzbank Aktiengesellschaft, Coöperatieve Rabobank U.A., Banca Popolare di Sondrio, Società per Azioni (S.p.A.), Banco Bilbao Vizcaya Argentaria S.A., BPER Banca S.p.A., Erste Group Bank AG, BNP Paribas S.A., Banco de Sabadell S.A., Hamburg Commercial Bank AG, and Bankinter S.A. **US banks**: JPMorgan Chase & Co., Citigroup Inc., Zions Bancorporation, KeyCorp, Wells Fargo & Company, State Street Corporation, Huntington Bancshares Incorporated, The Bank of New York Mellon Corporation, Bank of America Corporation, Fifth Third Bancorp, U.S. Bancorp, Comerica Incorporated, Northern Trust Corporation, Regions Financial Corporation, M&T Bank Corporation, The PNC Financial Services Group, Inc., and Citizens Financial Group, Inc.

common equity Tier 1 (CET1) capital became the highest quality capital under **Basel III**. As regards the denominator, **Basel I** standards referred exclusively to a standardised approach (SA) — categorising exposures into crude risk categories and focusing explicitly only on credit risk. **Basel II**, included RWA for market and operational risk and created incentives for large banks to use their own models through the internal ratings-based (IRB) approach. Smaller banks, with limited modelling capabilities, captured these risks via the SA.[12] Relative to Basel II, **Basel III** introduced greater conservatism in risk-measurement: reducing banks' incentives to use the IRB approach by imposing SA-based floors and increasing the "risk sensitivity" of the SA by enhancing the granularity of the attendant risk categories.[13]

We turn next to the capital requirements that we subtract from the regulatory ratio to obtain the MB. The time series of these requirements incorporate information from several US publications (see below) and non-public supervisory data for the euro area. Figure 1 provides a birds-eye view and Table 1 offers institutional detail.

A key component of regulation in terms of the highest quality capital-to-RWA ratio is the ***Pillar 1 minimum requirement***. Under Basel I and II, this requirement was set at 2% of RWA.[14] At that time, there was a prompt corrective action (PCA) add-on of 1% in the United States but not in the euro area.[15] Basel III raised the Pillar 1 minimum requirement to 4.5%. The post-GFC PCA in the United States (GAO (2011)) and the corresponding early intervention measures in the euro area are subsumed in additional regulatory requirements, to which we turn next.

Basel III introduced several regulatory buffers on top of the minimum requirments. First, the ***capital conservation buffer (CCoB)*** was implemented in 2016 at 0.625%, increased annually in equal increments to 2.5% by 2019 and remained at that level thereafter. Second, the ***buffer for global systemically important banks (G-SIBs)***, introduced in 2016, also rose in equal annual increments up to 2019. This buffer differs across banks depending on their G-SIB score.[16] The level of a third Basel III buffer, the ***counter-cyclical capital buffer (CCyB)*** is at the discretion of national authorities. Over our sample period, the CCyB was at positive levels in several euro-area countries but zero in the United States.

Basel III has also led to jurisdiction-specific regulatory requirements. For instance, the US banks in our sample have been subject to two distinct versions of a stress test-based buffer.[17] From the beginning of our post-GFC period to 2020:Q3 (version 1), the effective regulatory buffer was determined by the higher of (i) the capital shortfall implied by the stress test and (ii) the sum of the CCoB and the G-SIB buffers. In 2020:Q4 (version 2), this requirement was replaced by the sum of the G-SIB buffer and the higher of a so-called ***stress capital buffer (SCB)*** and the CCoB (see Federal Reserve (2018), Chart 1).

In the euro area, additional buffers were implemented to address structural and systemic risks.[18] These include a buffer for **global systemically important institutions (G-SIIs)** – which sets a floor to the Basel III G-SIB biffer – a buffer for ***other systemically important institutions (O-SIIs)***, as well as a

[12]Basel II was implemented in the European Union through the Capital Requirements Directive (CRD), which came into effect on January 1, 2007, with advanced approaches for credit and operational risk calculation allowed from January 1, 2008.

[13]While only part of these RWA-related changes were implemented during our sample period in the United States and the euro area, all the other Basel III aspects relevant for our analysis were in place.

[14]This requirement was not explicit but was implied by: (i) a Tier 1 capital requirement of 4%; (ii) a requirement that at least half of the latter be satisfied with core equity; (iii) banks' incentives to minimise the relatively costly core equity. See BCBS (1988), paragraph 50, and BCBS (1998).

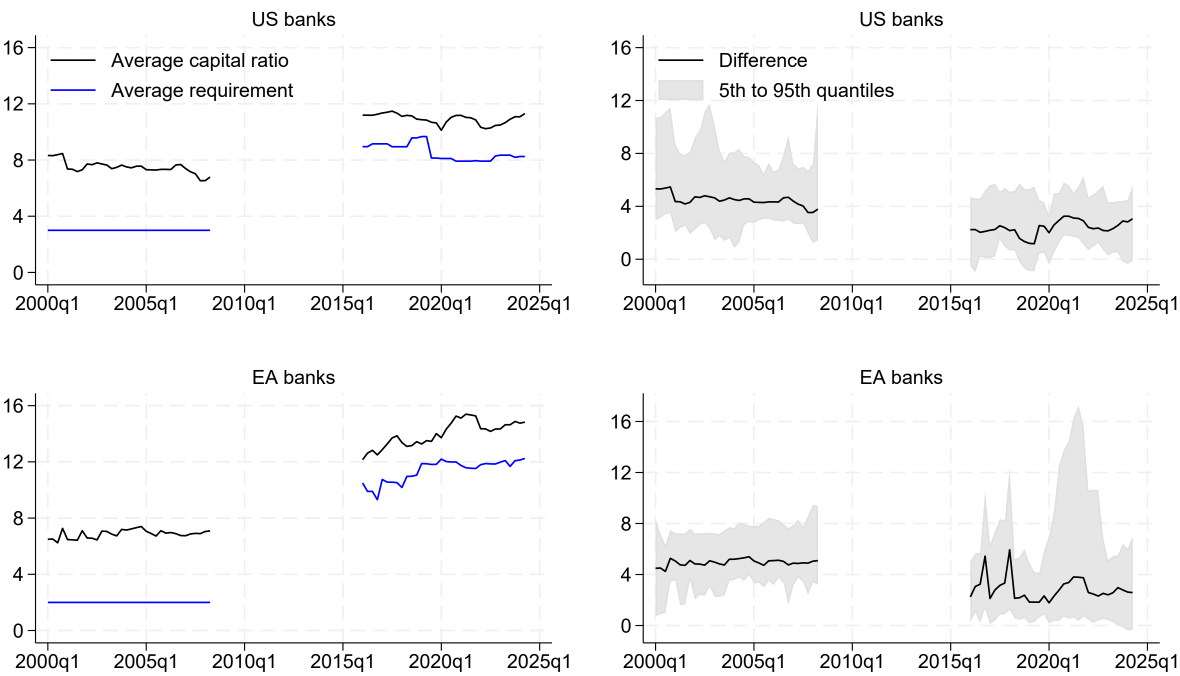
[15]Formally, the PCA add on was 2% Tier 1 capital to RWA (Svoronos (2018)). In line with our assumption about the relationship between minimum Tier 1 and core capital requirements, we assume that half of the Tier 1 PCA add-on was in the form of core equity.

[16]More detailed information is available here: https://www.bis.org/bcbs/gsib/index.htm.

[17]See announcement by the Federal Reserve in US Treasury et al (2009) and a discussion in Berrospide and Edge (2019).

[18]These were introduced by the Capital requirements directive (CRD (2013)) IV/Capital requirements regulation (CRR (2013)) (ESRB (2015) and ESRB (2018)), in particular Article 458 CRR (2013). See also Dierick et al. (2005).

Figure 1: Average capital ratios and regulatory requirements



Notes: The right hand panels refer to bank-level differences between capital ratios and the corresponding regulatory requirement.

Table 1: Regulatory requirements

	2000-2008q2	*2016*	*2017*	*2018*	*2019*	*2020-2024q2*
United Stated and Euro area						
Minimum (core equity or CET1)	2%	4.5%	4.5%	4.5%	4.5%	4.5%
CCyB (CET1, national level, max)	-	0.625%	1.25%	1.875%	2.5%	2.5%
CCoB (CET1)	-	0.625%	1.25%	1.875%	2.5%	2.5%
United States						
GSIB buffer (CET1)	-	By GSIB score, four equal yearly increases				
Prompt corrective action add-on (core eq)	1%	-				
Stress test buffer (CET1)	-	version 1				version 2
Euro area						
Max GSII and OSII buffer (CET1)	-	Per national specification (up to 2%)				
Systemic risk buffer (CET1)	-	Per national specification (min. 0.5%)				
Pillar 2 guidance (CET1)	-	Bank specific, outcome of the SREP process				
Pillar 2 requirement (CET1)	-	Bank specific, outcome of the SREP process				
Regulatory regimes						
Regimes Euro area, US	pre-GFC: r1	post-GFC: r2				
International standards	*Basel I and II*	*Basel III*				

systemic risk buffer (SyRB). EU banks are also subject to ***Pillar 2 requirements*** — which is bank-specific and supplements the Pillar 1 minimum — and ***Pillar 2 guidance*** — which is also bank-specific and reflects legally non-binding supervisory expectations.[19]

3 RRT estimation setup

To derive RRT estimates, we proceed in three steps. First, we estimate parameters of the MB's evolution. Second, we use these parameter estimates to derive the MB target, speed of reversion to that target and the volatility of MB shocks. Third, we combine these three objects in the RRT metric.

3.1 Generic core equation

We estimate variants of the following equation of MB's evolution via local projection:

$$\Delta_h MB_{i,t+h} = \alpha_{g,r,h} + \phi_{i,r,h} + \beta_{g,r,h} MB_{i,t} + \delta^Z_{g,r,h} Z_{i,t} + \delta^Y_{g,r,h} Y_t + \varepsilon_{i,h,t+h} \tag{1}$$

The management buffer $MB_{i,t}$ is defined as the ratio of the highest quality capital to risk-weighted assets (RWA) of bank i in quarter t minus the corresponding regulatory requirement.[20] In turn, $\Delta_h MB_{i,t+h} \equiv MB_{i,t+h} - MB_{i,t}$ and $\varepsilon_{i,h,t+h}$ denotes the error term that materialises in quarter $t+h$ when the local projection is applied at horizon $h \in \{0, 1, ..., 4\}$. At $h = 1$, $\varepsilon_{i,1,t} \sim \left(0, \sigma^2_{i,r}\right)$ is white-noise – we refer to this residual as the "MB shock".[21] The subscript $r \in \{r1, r2\}$ refers to the regulatory regime. In turn, the subscript g captures the level at which we estimate the corresponding coefficients: all banks, individual banks ($g = i$) or groups of banks based on: nationality (US or euro area) and thresholds in terms of size (total assets), the NPL ratio, price-to-book ratio, return-on-assets, loans-to-total assets, deposits-to-total liabilities, or the ratio of RWA to total assets (the "risk density").

Equation (1) also allows for control variables. Those at the bank level, $Z_{i,t}$, are: size in terms of total assets (TA, expressed as a share of the sum across the banks in each jurisdiction), return on assets (RoA), return on equity; the following ratios: operating profits to total assets, price-to-book (P2B, quarterly average), non-performing loans to total assets, loans to total assets and deposits to total liabilities, RWA to total assets (the so-called risk density), retained earnings to total assets; and the distance of the leverage ratio from the corresponding requirement.[22] The controls at the macro (jurisdiction) level, Y_t, are: GDP growth, term spread, unemployment rate, inflation, the change in the USD (US banks) and euro (euro-area banks) exchange rate against a broad currency basket, and real property price growth. Focusing on estimating a steady-state MBT, we do *not* introduce time fixed effects. That said, we include a jurisdiction-specific time dummy for the period when authorities imposed payout restrictions on banks in response to the outbreak of the Covid-19 pandemic: from 2020:Q2 to 2021:Q2 (United States) or to 2021:Q3 (euro area). This dummy captures a restrictions-induced rise to the MBT. All controls are demeaned at the bank level, to avoid confounding the estimates of $\alpha_{g,r,h}$ and $\phi_{i,r,h}$.

[19] The Pillar 2 requirement and guidance are both set through the Supervisory Review and Evaluation Process (SREP). Non-compliance with this requirement can result in supervisory measures, including sanctions. Under EU regulations, large banks must annually disclose Pillar 2 requirements but not the guidance.

[20] We winsorise the data by removing bank-quarter observations that belong to the 2.5% tails of the bank-specific distribution of MB from 2000:Q1 to 2024:Q2.

[21] See Appendix A for a discussion of how equation (1) arises in the special case of vector auto-regression (VAR).

[22] The smaller this distance, the more likely it is to drive adjustments to the bank's CET1 capital ratio, rather than a risk-based management buffer target.

3.2 Three regression specifications

We estimate equation (1) under three different specifications that reflect complementary objectives.

Our baseline is a ***panel setting without controls***. Here, we estimate $\alpha_{g,r,h}$ and $\beta_{g,r,h}$ at the level of all banks or groups of banks. Under this specification, we also estimate bank fixed effects $\phi_{i,r,h}$ but set $\delta^Z_{g,r,h} = \delta^Y_{g,r,h} = 0$. We use the so-obtained estimates of management buffer targets, speeds of adjustment and MB-shock volatilities to look for changes between regimes or differences between groups of banks.

The second specification is a ***panel with controls***. It is the same as the previous one, except that we now also estimate $\delta^Z_{g,r,h}$ and $\delta^Y_{g,r,h}$. The objective is to check the robustness of the baseline findings. The underlying motivation stems from arguments in the related literature that adjustments towards MBT — equivalently, time-varying deviations from this steady-state level — may depend, for instance, on banks' time-varying profitability or macro-financial conditions (see Da Rocha Lopes et al. (2025) for a review).

Third, we work with ***bank-level regressions***. Here, we set $g = i$ and $\phi_{i,r,h} = \delta^Z_{g,r,h} = \delta^Y_{g,r,h} = 0$. Our objective with this specification is to study potential drivers and implications of the *cross-sectional dispersion* in the MB target, speed, shock volatility and RRT within and across regimes. The time series are not long enough to allow us to include control variables in this case.

3.3 Key parameters

The three parameters of key interest are:

$$\begin{aligned} \text{MB target (MBT):} \qquad & \mu_{g,r} \equiv -\frac{\alpha_{g,r,1}}{\beta_{g,r,1}} \\ \text{speed (of reversion to MBT):} \qquad & \gamma_{g,r,h} \equiv -\beta_{g,r,h} \\ \text{volatility of MB shocks:} \qquad & \sigma_{g,r} \equiv st.dev.\left(\varepsilon_{i,1,t+1}\right), \text{ for } i \in g. \end{aligned} \tag{2}$$

The MBT[23] is the level to which MB would eventually converge from any starting point if: (i) there are no more shocks, i.e., $\varepsilon_{i,h,t+h} = 0$ from some date onward; and (ii) $\gamma_{g,r,h} > 0$. The latter condition implies a stationary process for MB — that is, mean reversion.[24] For the third expression, we pool the regression residuals within the relevant group of banks.

3.4 Regulatory risk tolerance

We think of the risk of breaching regulatory requirements, i.e., of depleting the MB, in the following terms. A negative MB shock reflects: (i) exogenous adverse effects of the macro-financial environment on a bank's CET1 capital ratio; and (ii) the extent to which the bank counteracts these effects within a quarter. The latter could be done by retaining earnings, raising CET1 capital or reducing risk-weighted assets — with the relative appeal of these alternatives depending on the bank's business model, its performance as well as the macro environment. In turn, taking the probability distribution of MB shocks and the cost of CET1 funding into consideration, the bank sets its MBT so that a shock would deplete it with a desired (low) probability.[25]

[23] In a VAR environment, the value of the MBT is horizon-invariant — that is, $\alpha_{g,r,h}/\beta_{g,r,h} = \alpha_{g,r,k}/\beta_{g,r,k}$ for any $h \neq k$ (Appendix A). The MBT *estimate* changes with the horizon because so do the underlying data.

[24] When the estimated $\hat{\gamma}_{i,r,1} \approx 0$, i.e. when the MB may be non-stationary, there may be large deviations between (i) $\hat{\mu}_{g,r}$ estimated via (1) and (ii) the sample mean of $MB_{i,t}$ within regime r. To address this issue — which occurs only in the bank-level setting — we replace (i) with (ii) for the banks in the top 10% of the deviations between (i) and (ii).

[25] Employing similar reasoning, Peura and Jokivuolle (2004) calibrate the probability of breaching regulatory requirements to match data on banks' captial ratios.

After a shock, the speed of reversion to a bank's MBT reflects the cost of swift MB adjustments and ultimately influences the probability with which *subsequent* shocks deplete the remaining MB.

We design the regulatory risk tolerance (RRT) metric such that it accounts for the risk of breaching regulatory requirements, which decreases in the MBT and speed of reversion but increases in the probability of large MB fluctuations. Concretely, we combine the parameters in expression (2) as follows:

$$RRT^h_{g,r} = \frac{\sigma_{g,r}}{\mu_{g,r}} \left(1 - \gamma_{g,r,h}\right), \text{ for } h \geq 0 \tag{3}$$

where $\gamma_{g,r,0} = 0$ and $0 < \gamma_{g,r,h} < 1$ for $h \geq 1$.[26] This measure targets simplicity and relies on the standard deviation of shocks as a proxy to the — difficult to gauge — probability of large adverse MB changes. For $h = 0$, the metric is equal to the share of the MBT that a shock of standard size would wipe out on impact. And maintaining the assumption that $\varepsilon_{i,1,t}$ is serially uncorrelated, RRT^h equals the the share of the MBT that remains depleted $h \geq 1$ quarters after the shock's materialisation.[27]

4 RRT components and RRT's information content

Before discussing our key findings, we confirm that the estimates of the RRT components are meaningful and the RRT conveys information that it is supposed to capture.

Well-defined MBTs require statistically significant positive estimates of the speed of reversion. All our panel regression results meet this criterion (Tables 2 and 5). The conclusion is similar in the context of bank-level regressions, where the criterion is met by 31 of the 34 banks in regime 1 and 29 of the same banks in regime 2 (appendix Table B.1). When needed, we use regime-specific sample means to proxy for the MBTs of the remaining banks but drop these banks from the sample when we work with bank-level RRT.

The definition of RRT assumes incomplete reversal to MBT after h quarters and serially uncorrelated MB shocks. As a confirmation of the former assumption, the speed estimates under any of our specifications are deeply below 1: see Tables 2, 5 and B.1. In the light of the second assumption, we work with robust standard errors in the panel variant of equation (1). At the bank level, we confirm a lack of serial correlation in the error terms of regression equation (1) for 28 of the 34 banks in regime 1 and 30 of the same banks in regime 2 (appendix Table B.1).

We also need to confirm that the RRT metric provides information about the risk of breaching a regulatory requirement. This need not be the case if the econometric model in equation (1) is mis-specified or the standard deviation of the error terms does not capture well the likelihood of extreme MB realisations. That is, the second moment of the residuals in equation (1) may be a poor proxy for the MB tail.

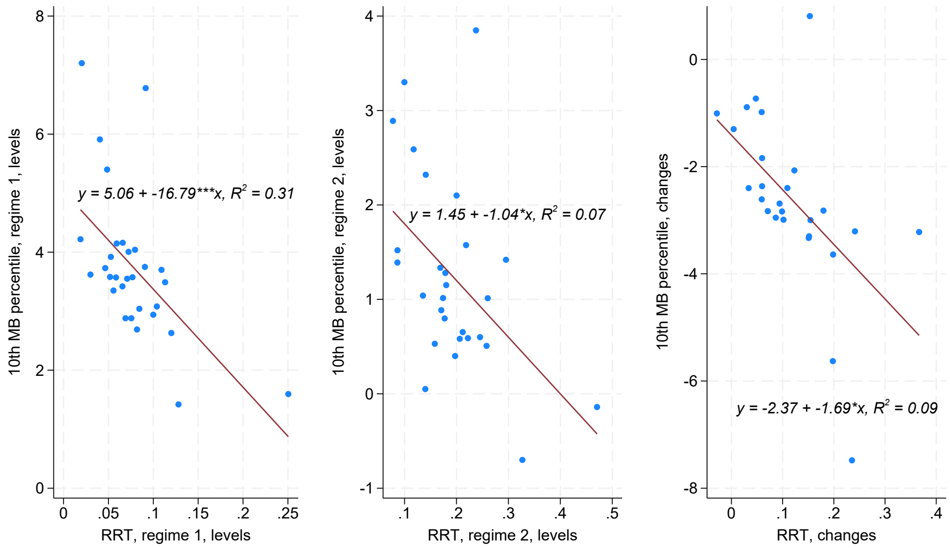
To test whether the RRT serves its intended purpose, we proceed as follows. First, given that de facto breaches are rare in our sample (Figure 1, grey area below zero), we proxy for the risk of a breach with a low percentile of the MB distribution at the bank level.[28] Second, we refer to the following regressions:

[26] Below, we report RRT^h only if we estimate $\gamma_{g,r,h} > 0$ for $h \geq 1$. This is not the case only for seven bank-level estimates.

[27] A similar reasoning would apply to a *positive* MB shock, which – unless counteracted – would generate opportunity costs of an inefficiently high capital ratio.

[28] The few instances of regulatory breaches is a natural outcome of conservative capital management by banks. It also suggests that our sample period did not feature major broad-based stress at large banks in the United States or the euro area.

Figure 2: RRT vs the left MB tail: changes between regimes and levels within-regimes



Notes: Each dot corresponds to a bank with well-defined RRT estimates (at the one-quarter horizon) in a relevant regime. Significance: * (10%), ** (5%), *** (1%).

$$\Delta_r p_{i,r} = \eta_0 + \eta_1 \Delta_r w_{i,r} + \upsilon_{i,r} \tag{4}$$

$$p_{i,r} = \eta_{r,0} + \eta_{r,1} w_{i,r} + \upsilon_{i,r} \tag{5}$$

where $p_{i,r}$ and $w_{i,r}$ are parameter estimates for bank i in regime $r \in \{r1, r2\}$, and Δ_r stands for a value in regime 2 minus that in regime 1. For the exercise at hand, $p_{i,r}$ is the 10^{th} or the 5^{th} percentile of the management buffer and $w_{i,r}$ is the corresponding RRT at the one-quarter horizon.

Reassuringly, we find a negative relationship between the RRT and the low percentiles of the management buffer. Figure 2 illustrates this for the 10^{th} percentile.[29] When we consider *levels* within a regime (left and centre panels), the relationship is both statistically and economically significant. In regime 2, for instance, the 10^{th} percentile of the MB is 30% below the sample average (0.01) for a bank whose RRT is one standard deviation (0.32) above the corresponding sample average. While the statistical significance of this relationship weakens in the context of *changes* between regimes (right panel), the economic significance does not. A bank that experiences an average RRT change (a rise of 0.18) sees the 10^{th} percentile of its MB be 70% below the average 10^{th} percentile (0.04) in regime 1. In sum, the RRT has meaningful information content.

5 RRT evolution and drivers

To study how banks' capital management evolved with the regulatory overhaul, we refer to equations (1) and (3) and test the following hypothesis at the level of all banks, groups of bank and individual banks.

Hypothesis 1: *RRT and its components – MBT, speed and MB shock volatility – do not change between*

[29] The results for the 5^{th} percentile are in appendix Figure B.1.

regulatory regimes, i.e., $RRT^h_{g,1} = RRT^h_{g,2}$, $\mu_{g,1} = \mu_{g,2}, \gamma_{g,1,1} = \gamma_{g,2,1}$, and $\sigma_{g,1} = \sigma_{g,2}$ *for* $h \in \{0, ..., 4\}$.

Banks' RRT is materially higher post GFC. We illustrate this in Table 2, which is based on the baseline specification and reports estimates of the representative RRT across all banks.[30] At horizon 0, this RRT is 0.13 in regime 1 and a statistically higher 0.26 in regime 2. The implication is that an eight-standard-deviation shock is needed to wipe out the MBT on impact in the former regime, whereas a four-standard-deviation shock would have a similar impact in the latter regime. At longer horizons, the RRT level declines — as a result of MB's reversion to MBT — but remains 1.5 to 2 times higher in regime 2 than in regime 1.

Applying alternative econometric specifications confirms the robustness of these findings. For one, zooming in on specific groups of banks and/or including controls barely changes the point estimates and leaves intact the statistical significance of the RRT change between regimes (appendix Table B.2). In addition, bank-level estimates reveal that effectively each single bank in the sample saw a rise in its RRT between regimes (Figure 3 and appendix Table B.1).

Table 2: RRT and components: changes between regimes, all banks

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^{*}
MBT			**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%).

5.1 RRT components

While the above results reject the RRT part of Hypothesis 1, the rest of this hypothesis leads us to investigate whether the MBT, speed of reversion and/or MB-shock volatility drive the evolution of the RRT.

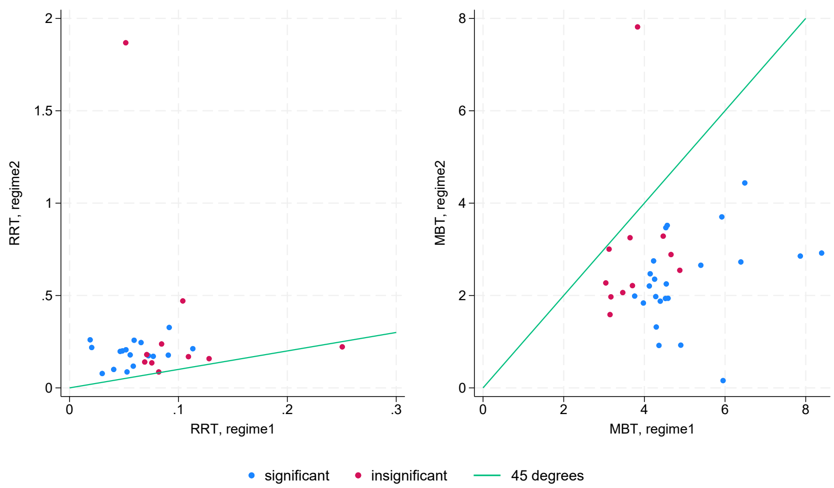
While changes in all three components are consistent with the rise in the RRT from regime 1 to regime 2, a decline in the MBT is the main driver.[31] Indeed, Table 2 reports that the MBT declined by more than 2 percentage points at the representative bank, about half of the average increase in capital requirements (per Figure 1).[32] Effectively, each individual bank chose to reduce its MBT (Figure 3 and Table B.1), thus underpinning a strong negative correlation (-66%) between bank-level changes in the MBT and the RRT at horizon 1 (Table 3, upper panel). In comparison, the volatility of MB shocks rose modestly on average and the corresponding bank-level changes were less strongly correlated with RRT changes.

[30] The estimated coefficient of the Covid-19 dummy is positive and statistically significant. In other words, the distribution restrictions in the first year of the pandemic translated into an increase in the effective MBT.

[31] The robustness of the results discussed in this section is illustrated by appendix Table B.3.

[32] The various components of the regulatory CET1 capital requirements contributed unevenly to the general rise of these requirements post GFC. Fully phased in, the Pillar 1 minimum contributed 1.5 percentage points for US banks and 2.5 percentage points for euro-area banks, with the CCoB adding 2.5 percentage points for all banks. In the case of US banks, the GSIB buffer and the stress-test surcharge contributed on average to additional 0.9 and 0.4 percentage points, respectively. For euro area banks, Pillar 2 requirements added 2 percentage points and the so-called combined buffer requirement — including G-SIIs / O-SIIs buffers, CCyB, and SyRB — another 2 percentage points.

Figure 3: Bank-level MBT and RRT at h=1, across regimes



Notes: Blue dots indicate statistical significance of the difference between the two estimates, at the 5% level; red dots indicate lack of significance at this level.

Table 3: Correlation between RRT and its components, bank level

	RRT h=1	**MBT**	**Speed**	**Shock Vol.**
	Changes between regimes			
RRT h=1	1.00			
MBT	-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			
MBT	-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			
MBT	-0.74^{***}	1.00		
Speed	0.08	-0.10	1.00	
Shock Vol.	0.25	0.36^{**}	0.30^{*}	1.00

Notes: All variables are in logs. Significance: * (10%), ** (5%), *** (1%).

Table 4: Effect of capital requirements on MBT and RRT, bank level

	MBT	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

Notes: Based on linear regressions of bank-specific changes/levels of MBT or RRT on changes/levels of capital requirements (K req.), with jurisdiction-specific intercepts. Significance: * (10%), ** (5%), *** (1%).

As regards the dispersion of RRT across banks within a regime, both the MBT and the volatility of MB shocks play a role but in separate periods. In regime 1, this dispersion stems predominantly from the MB shocks' volatility (Table 3, middle panel). By contrast, MBT is the main driver of the RRT dispersion in regime 2 (bottom panel).

The speed of reversion changes to an economically important extent even if it does not play a systematic role for the evolution and dispersion of the RRT. The average decline of this speed, from 0.19 in regime 1 to 0.12 in regime 2 at the one-quarter horizon (Table 2), indicates a substantial rise in the half life of an MB shock: from 3.3 to 5.4 quarters. That said, in statistical terms, we cannot reject Hypothesis 1 only as regards the speed of reversion.

In the post-GFC regime, there are signs that banks' RRT reflect a strategic choice. Namely, banks that experience more volatile MB shocks in regime 2 tend to choose a larger MBT and/or a higher speed of reversion to the MBT: in Table 3, the bottom panel contrasts in this respect with the middle panel. Such configurations tend to dampen the RRT dispersion in the cross section, thus suggesting that banks sought post GFC to avoid standing apart from their peers in terms of capital management.

5.2 Capital requirements

We turn next to links between capital requirements and the level and evolution of RRT. These regulatory requirements are likely to be exogenous to the capital management strategy of individual banks. Thus, when we find evidence of links – involving either RRT or one of its components – we interpret them as *causal*.

For formal tests, we refer to equations (4) and (5). Now, $p_{i,r}$ stands either for the RRT (horizon 1) or one of its components and $w_{i,r}$ stands for capital requirements. We also allow for a jurisdiction-specific intercept.

We find that capital requirements have driven to a large extent the changes of bank-level RRTs between regimes and the dispersion of RRT across banks within regime 2. The higher the increase in a bank's capital requirement from regime 1 to regime 2 the higher the rise in the respective RRT (Table 4, top panel). Likewise, a bank with a higher capital requirement in regime 2 tends to have a higher RRT in that regime (bottom panel).[33] Thus, since Basel III demanded from banks higher and costlier capital while weakening the penalty for a marginal breach of regulatory requirements — by introducing regulatory buffers — it became optimal for banks to tolerate higher regulatory risk.

The MBT is the RRT component behind these findings.[34] Indeed, acting as an absorber of regulatory tightening, the MBT systematically declined by more at banks that saw a greater increase in their capital requirement (Table 4, first column). The effect is economically significant: an increase in the capital requirements that was larger than the average by one standard deviation (2.23 percentage points) tended to boost the decline in the MBT by 0.9 percentage points, or by about one-half of the average decline from regime 1 to regime 2. We obtain similar findings about the cross-sectional relationship between capital requirements and MBT in regime 2.

Putting together Sections 5.1 and 5.2, we have identified two reasons for the adjustment of MBTs between regimes. For one, MBTs adjustment indicate a recalibration of banks' capital management strategy in the face of an evolving volatility of MB-shocks. This helped reduce the dispersion of RRT in the cross section. In addition, MBT reductions served to partly absorb the post-GFC increase in capital requirements.

6 Capital management post GFC, by groups of banks

Next, we zoom in on the post-GFC sample period to study whether banks' capital management differs systematically with some of their characteristics. In particular, we test the following hypothesis at the level of group pairs, g vs $\tilde{g}$, by estimating equation (1) in a panel setting, focusing on regime 2.

Hypothesis 2: *Post GFC (regime 2), there is no difference between groups in terms of MBT, the speed of reversion, MB shock volatility or RRT, i.e.,* $\mu_{g,2} = \mu_{\tilde{g},2}, \beta_{g,2,1} = \beta_{\tilde{g},2,1}$ $\sigma_{g,2} = \sigma_{\tilde{g},2}$ and $RRT^h_{g,2} = RRT^h_{\tilde{g},2}$ *for* $h \in \{0, ..., 4\}$.

Observations about the RRT components set the stage (Table 5). First, the between-group differences are statistically significant in the case of the MBT and shock volatility — thus, rejecting the corresponding parts of Hypothesis 2 — but not in terms of the speed of reversion. Second, a group with a higher (lower) volatility of MB shocks, which would raise (reduce) the RRT all else equal, *invariably* features a higher (lower) MBT, which reduces (raises) the RRT all else equal. This is yet another indication that banks have sought to avoid standing out in terms of their RRT. Third, these results are quite robust to the inclusion of controls (appendix Table B.4).

Consistent with banks gravitating around a common RRT, we find small RRT differences between groups of banks. The statistically significant differences (mostly, at horizons of 0 and 1 quarters) are at least twice smaller in magnitude than the ones we estimate between regimes (compare Tables 2 and 5). As the horizon lengthens and thus the magnitude of group-specific RRTs decline, the corresponding differences are often insignificant.

[33] The post-GFC dispersion in banks' CET1 capital requirements stems from specific underlying components. The Pillar 1 minimum and the CCoB are *not* among those components, as they do not vary across banks. For US banks, the dispersion arises from the G-SIB buffer (with a standard deviation of bank-level averages of 0.8 pps) and the stress capital surcharge (s). For euro area banks, the main sources of CET1 dispersion are the combined buffer requirements and Pillar 2 measures, each with a standard deviation of bank-level averages amounting to approximately 1 percentage point.

There is a close but imperfect relationship between the bank-level increase in capital requirements between regimes and the dispersion of bank capital requirements in regime 2. These requirements were the same across banks within a jurisdiction in regime 1 but one percentage points higher for US banks which also faced a requirement imposed by prompt corrective action.

[34] The corresponding (unreported) results on the other two components are insignificant.

Table 5: RRT and Components: Differences Between Groups (Regime 2)

	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**
	MBT			**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***

Notes: $g1$ ($g2$) is the first (second) group in the row heading. 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%). "Low" and "high" indicate banks below and above the median (below and above 1 for P2B), respectively.

The comparisons between banks on the basis of nationality and size are cases in point. The lower RRT of US banks at horizons of 0 and 1 quarter — despite a lower MBT — indicates that they tend to manage their capital more conservatively than euro-area banks. This difference is two to three times smaller than the change of RRT between regimes within each group (compare Table 5 and appendix Table B.4) and disappears by the 4^{th} quarter. In turn, having a less diversified business model and a less stable access to capital markets, small banks experience 13% higher volatility of MB shocks and revert more slowly to the MBT but operate with a 50% higher MBT than big banks. With the latter effect dominating, the average RRT is lower for small banks but only slightly so, especially at longer horizons.

For some group pairs, the comparisons do reveal statistically significant RRT differences that are robust to lengthening the horizon, thus leading to a consistent rejection of the RRT part of Hypothesis 2. Notably, banks with a high RoA have a lower RRT up to the four-quarter horizon. This finding reflects a lower volatility of MB shocks, suggesting that high-RoA banks are in a better position to immediately dampen — e.g., via retained earnings — the impact of external hits to their capital ratios.[35] Similarly, lower volatility of MB shocks is behind the consistently lower RRT of banks with high deposit ratios.

7 Dimensions of MB adjustments in the post-GFC regime

Are there bank groups that *systematically* adjust towards their MBT along a particular dimension of the MB? In addressing this question, we estimate the following equation (6) in a panel setting for all banks and for bank groups, at one- to four-quarter horizons. In addition to the groupings studied earlier, we introduce

[35] The findings for high-P2B banks differ materially from those for high-RoA banks, indicating little overlap between the two groups. By contrast, focusing on a measure of profitability that is boosted by leverage, Caparusso et al. (2023) find a tight link between a bank's RoE and its P2B ratio.

a new one, based on the level of the RRT – this allows us to study whether the capital management strategy has real-economy implications.[36]

$$\ln(X_{i,t+h}) = a_{g,h} + f_{i,h} + b_{g,h}\ln(X_{i,t}) + c_{g,h}MB_t + \upsilon_{i,h,t+h}, \tag{6}$$

for $h \in \{0, ..., 4\}$. The meaning of the subscripts is as in equation (1) and X stands for the dimension of adjustment: CET1 capital, RWA, TA, risk density or net loans. The coefficient of interest is $c_{g,h}$, which is equal to the percentage change along a particular dimension for a one percentage point change in the MB.

Two aspects of equation (6) warrant a discussion. First, the MB enters as a level rather than a time difference. The reason is that, while each of the studied dimensions of adjustment, X, is highly non-stationary and thus calls for a lagged observation as a regressor, there is strong mean reversion in MB. Second, the equation lacks time-varying controls. This is because, rather than seeking to estimate the causal effect of the MB on e.g., CET1 capital over and above the effect of bank characteristics or macroeconomic conditions, we are after a *decomposition* of the evolution of the MB. Staying with the example of CET1 capital, estimating $c_{g,h} < 0$ would imply that the MB systematically reverts to the MBT through the denominator. The reasoning is similar for the other versions of X when $c_{g,h} > 0$.

We find that, for all the banks in our sample, the typical adjustment towards the MBT systematically occurs both along the numerator and the denominator of the MB (Table 6). This finding is both statistically significant at all four horizons and of economic materiality. A one standard deviation negative shock to the MB, amounting on average to roughly 1.3 percentage points, leads to a 0.2% increase in CET1 capital one quarter later and to a 0.8% increase four quarters later. The corresponding numbers in the case of RWA are declines of 0.3% and 1.06%. At one- and two-quarter horizons, the RWA adjustments reflect mostly TA changes and, in particular lending. At three- and four-quarter horizons, by constrast, banks tend to shift to exposures with lower risk weights.

Bank characteristics help identify groups that differ from each other in terms of the specific dimension of adjustment that they systematically employ. On the one side, US banks, small banks as well as banks with strong performance, high asset riskiness and more traditional business models (greater reliance on deposits and loans) tend to follow up on declines of the MB by reducing their RWAs. While this mostly involves total asset adjustments at shorter horizons and risk-density adjustments at longer horizons, adjustments to lending tends to underpin each case. On the other side, euro area banks, large banks and banks with low NPL, deposit or price-to-book ratio adjust systematically only along the CET1-capital dimension. The latter finding suggests that, while low-performance banks should find it particularly challenging to retain earnings and costly to raise fresh capital on the market (Adrian et al. (2018)), they face even greater difficulties in contracting RWAs.

A key finding is that the RRT-based grouping also differentiates banks with respect to the dimension of MB adjustment towards the MBT. Low-RRT banks systematically adjust their RWA only over three- and four-quarter horizons and achieve this via the average risk weight (i.e., the risk density) without shedding net loans. By contrast, high-RRT banks use systematically the RWA dimension over the first three quarters, on the back of a statistically significant adjustment to their lending volume up to the two-quarter horizon. In economic terms, a one-standard deviation negative drop in the MB (1.7 percentage points) leads to a 0.75% reduction in net loans two quarters down the road. This compares to a roughly zero average two-quarter growth rate of net loans across these banks and a corresponding post-GFC standard deviation of 8%.

[36] The high-/low-RRT group comprises banks above/below the median RRT. The results are robust to using the 75^{th} percentile as the threshold.

Table 6: Dimension of adjustment towards the MBT, Regime 2, by bank groups

	All banks	Region and size				Performance				Riskiness				Business model				RRT	
		EA	US	Small	Big	*lo* P2B	*hi* P2B	*lo* ROA	*hi* ROA	*lo* density	*hi* density	*lo* NPL	*hi* NPL	*lo* Loans	*hi* Loans	*lo* Dep	*hi* Dep	*lo*	*hi*
CET1																			
h=1	−0.15**	−0.24***	−0.02	−0.07	−0.22**	−0.32***	−0.06	−0.27***	0.09	−0.13	−0.16	−0.18**	−0.08	−0.34**	−0.11	−0.17**	−0.15	−0.12	−0.16
h=2	−0.29**	−0.42***	−0.03	−0.18	−0.39**	−0.45**	−0.19	−0.49***	0.15	−0.31	−0.26	−0.39***	−0.10	−0.59	−0.23	−0.35***	−0.27	−0.27	−0.28
h=3	−0.45**	−0.67***	0.09	−0.34	−0.54*	−0.56*	−0.36	−0.72***	0.21	−0.56	−0.34	−0.63***	−0.08	−0.72	−0.38	−0.67***	−0.31	−0.42	−0.45
h=4	−0.57**	−0.90***	0.16	−0.50	−0.65**	−0.64*	−0.53	−0.97***	0.36	−0.64	−0.49	−0.88***	−0.03	−0.83	−0.50	−1.02***	−0.31	−0.64	−0.53
RWA																			
h=1	0.24**	0.05	0.57***	0.34*	0.10	0.08	0.32**	0.11	0.47***	0.16**	0.27*	0.06	0.51***	0.23**	0.24**	−0.07	0.35***	0.18	0.28*
h=2	0.52***	0.20	1.16***	0.77***	0.24	0.17	0.73***	0.29**	0.93***	0.32*	0.65**	0.21**	1.00***	0.42**	0.55***	−0.01	0.71***	0.48*	0.55***
h=3	0.66***	0.24	1.45***	1.06***	0.22	0.15	0.97***	0.36**	1.15***	0.29	0.89***	0.21*	1.31***	0.39	0.73***	−0.06	0.90***	0.68**	0.62**
h=4	0.81***	0.38*	1.57***	1.40***	0.18	0.19	1.21***	0.40**	1.40**	0.21	1.21***	0.21*	1.62***	0.20	0.97***	0.05	1.02***	1.00***	0.65*
Assets																			
h=1	0.23*	0.07	0.65***	0.26	0.19**	0.20**	0.25	0.14	0.35**	0.27***	0.21	0.07	0.42***	0.50***	0.19	−0.07	0.34***	0.08	−0.34***
h=2	0.37*	0.05	1.24***	0.54	0.18	0.23	0.46	0.22	0.60*	0.29	0.45	0.04	0.83***	0.63**	0.34	−0.17	0.57***	0.30	0.42**
h=3	0.25	−0.14	1.23**	0.58	−0.13	−0.01	0.42	0.01	0.66	−0.15	0.52	−0.24	0.95***	0.18	0.28	−0.42	0.47*	0.32	0.17
h=4	0.16	−0.16	0.93	0.62	−0.35	−0.07	0.17	−0.07	0.51	−0.48	0.60*	−0.40**	0.92**	−0.19	0.27	−0.40	0.31	0.43	−0.10
RW																			
h=1	0.00	0.08	−0.19	0.07	−0.06	−0.05	0.05	−0.04	0.08	−0.15	0.09	0.02	−0.05	−0.29*	0.06	0.10	−0.05	0.19*	−0.16
h=2	0.16	0.32*	−0.31	0.2	0.10	0.03	0.25	0.10	0.29	−0.00	0.26	0.25	−0.04	−0.27	0.25	0.44	0.04	0.35	0.01
h=3	0.44**	0.61***	−0.09	0.48*	0.40*	0.27	0.55*	0.43*	0.46	0.43*	0.45*	0.61***	0.07	0.14	0.50**	0.64**	0.31*	0.58**	0.33*
h=4	0.70***	0.82***	0.22	0.80***	0.58**	0.41**	0.91***	0.64**	0.86**	0.69*	0.71***	0.86***	0.41	0.31	0.78***	0.89***	0.58***	0.77***	0.66***
Net loans																			
h=1	0.18	0.07	0.58***	0.19	0.16	0.19*	0.17	0.05	0.37***	0.23*	0.15	0.07	0.33**	0.41*	0.16	−0.14*	0.31***	−0.03	0.34***
h=2	0.31*	0.07	1.14***	0.40	0.23	0.23	0.38	0.10	0.71**	0.28	0.35	0.08	0.70**	0.48*	0.30	−0.25***	0.56***	0.15	0.44***
h=3	0.27	−0.06	1.31***	0.49	0.03	0.04	0.42	−0.03	0.45**	−0.00	0.45	−0.10	0.90**	0.13	0.31	−0.58**	0.61***	0.17	0.33
h=4	0.34	−0.00	1.40***	0.65	0.00	0.04	0.54	−0.01	1.00**	−0.05	0.60*	−0.09	1.10**	−0.04	0.42	−0.58*	0.70***	0.27	0.35

Notes: RW = risk-weight; "density" = risk density (RWA/TA); "lo" = low; "hi" = high; "Loans" = loans ratio; "Dep" = deposit ratio. High vs low groups are split with respect to the median (with respect to 1 for P2B). Significance: * (10%), ** (5%), *** (1%).

8 Conclusion

We presented and analysed a synthetic capital-management metric that captures banks' tolerance towards the risk of breaching regulatory requirements — the RRT. Banks raised their RRT in response to the post-GFC tightening of capital requirements. More concretely, they partially absorbed this tightening with a reduction in their management buffer targets. In a further sign that RRT reflects conscious capital management decisions, the configuration of management buffer targets, speed of reversion to these targets and the volatility of management buffer shocks tends to dampen the RRT dispersion post GFC. That said, there is a meaningful RRT differentiation between banks of different nationality (US vs euro area), size and return-on-assets. Such differentiation has economic implications as banks adopting a less conservative (i.e., higher) RRT respond to a depletion of their management buffer by reducing lending.

Whereas our focus was on the highest-quality regulatory capital in the United States and the euro area, a multitude of jurisdiction-specific supervisory frameworks and regulatory requirements promise a rich research agenda anchored in the RRT. Applying our empirical strategy to additional jurisdictions could help shed light on supervisory specificities that influence banks' conservatism as regards capital management. In turn, systematic differences of the RRT metric across regulatory requirements — notably, leverage and liquidity requirements, in addition to the risk-based one studied in this paper — would help determine their *relative* tightness from banks' perspective.

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A Appendix: background to the econometric setup

To see the relationship between the parameters defined in (2) and those estimated in (1), note that the bank-level $h = 1$ version of the latter equation can be rewritten as:

$$\Delta MB_{i,t+1} = \gamma_{i,r} \left(\mu_{i,r} - MB_{i,t} \right) + \varepsilon_{i,1,t+1} \tag{7}$$

Here, $\mu_{i,r}$ is the steady state level of MB — or the MBT — and $\gamma_{i,r} \in (0, 1)$ captures the speed with which the bank closes any deviations from the steady state. In particular, $\gamma_{i,r} = 1$ implies that the management buffer will be at its tartget, $MB_{i,t+1} = \mu_{i,r}$, immediately after a shock, $\varepsilon_{i,1,t} \neq 0$, provided that there is no contemporaneous shock, $\varepsilon_{i,1,t+1} = 0$.

Next, assume that the MB follows an auto-regressive process (AR) of order one, which allows us to roll over (7) in order to obtain:

$$\Delta_h MB_{i,t+h} = \alpha_{i,r,h} + \beta_{i,r,h} MB_{i,t} + \varepsilon_{i,h,t+h}, \tag{8}$$

where $\alpha_{i,r,h} = \mu_{i,r} \left(1 - \left(1 - \gamma_{i,r}\right)^h \right)$, $\beta_{i,r,h} = \left(1 - \gamma_{i,r}\right)^h - 1$ and $\varepsilon_{i,h,t+h} = \sum_{j=0}^{h-1} \left(1 - \gamma_{i,r}\right)^j \varepsilon_{i,1,t+h-j}$. Thus, the MBT is given by $\mu_{i,r} = -\alpha_{i,r,h} / \beta_{i,r,h}$ and is independent of the horizon, h.

The horizon-independence of the MBT remains when we introduce controls in a VAR environment. Without loss of generality, consider a system that expands equation (7), with a single macro control:

$$\begin{pmatrix} \Delta MB_{i,t+1} \\ \Delta x_{t+1} \end{pmatrix} = \begin{pmatrix} \alpha_{i,r,1} \\ \omega \frac{\alpha_{i,r,1}}{\beta_{i,r,1}} \end{pmatrix} + \begin{pmatrix} \beta_{i,r,1} & \delta \\ \omega & \varphi \end{pmatrix} \begin{pmatrix} MB_{i,t} \\ x_t \end{pmatrix} + \begin{pmatrix} \varepsilon_{i,1,t+1} \\ \nu_{i,t+1} \end{pmatrix},$$

where the constant term in the second equation implies that the steady-state mean of x_t is zero. Rolling this system forward, one obtains:

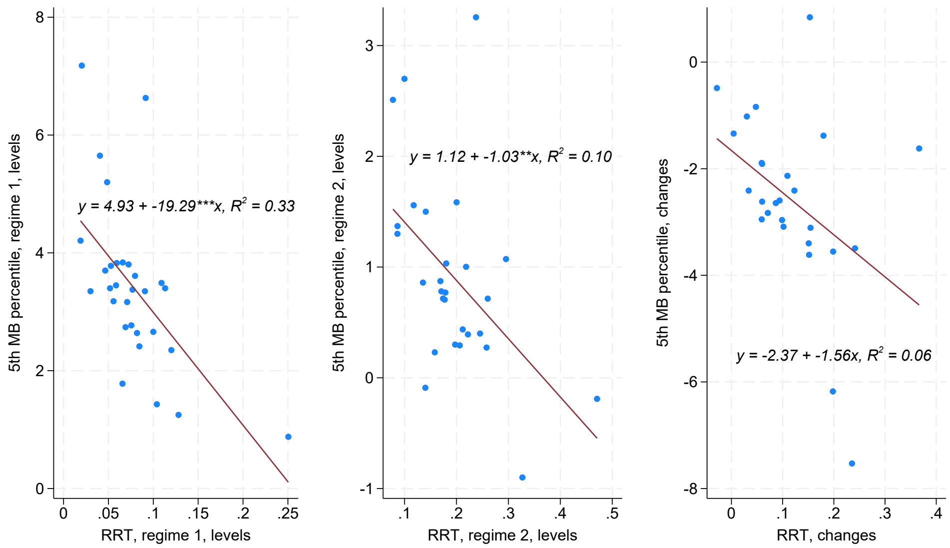
$$\begin{pmatrix} \Delta_h MB_{i,t+h} \\ \Delta_h x_{t+h} \end{pmatrix} = \begin{pmatrix} A_{1,i,r,h} \\ A_{2,i,r,h} \end{pmatrix} + \begin{pmatrix} B_{11,i,r,h} & B_{12,i,r,h} \\ B_{21,i,r,h} & B_{22,i,r,h} \end{pmatrix} \begin{pmatrix} MB_{i,t} \\ x_t \end{pmatrix} + \begin{pmatrix} \varepsilon_{i,h,t+h} \\ \nu_{i,h,t+h} \end{pmatrix},$$

Ultimately, straightforward algebra reveals that the steady-state mean of MB_{t+1} (i.e., the MBT) is given by $\mu_{i,r} = -\frac{A_{1,i,r,h}}{B_{11,i,r,h}}$, and is independent of h.

There are two advantages of relaxing the (V)AR(1) assumption and using local projection — as done in the main text. First, the mapping between the parameters and residuals in (7) and those in (8) rests on a linear underlying relationship. If the linearity is violated, the estimates based on a (V)AR(1) specification would be biased, in contrast to those based on local projection. The "price" for this robustness is reduced estimation efficiency under local projection. Second, in the presence of controls, the local projection approach allows us to obtain the estimates of interest only on the basis of the MB equation from the VAR system. By contrast, a VAR(1) specification would necessitate rolling over the full system.

B Appendix figures and tables

Figure B.1: RRT vs the left MB tail: changes between regimes and levels within-regimes



Notes: Each dot corresponds to a bank with well-defined RRT estimates (at the one-quarter horizon) in a relevant regime. Significance: * (10%), ** (5%), *** (1%).

Table B.1: Bank-level estimates and tests

	Regime 1 (r1)					Regime 2 (r2)					Change (r2-r1)	
Bank	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: For the tests on serial correlation (corr) of the residual in equation (1) and on between-regime changes, significance: * (10%), ** (5%), *** (1%).

Table B.2: RRT changes between regimes, by bank group

Group	Controls	h=0			h=1			h=4		
		r1	r2	change	r1	r2	change	r1	r2	change
Regulatory risk tolerance										
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***
Performance										
low P2B	N	0.09	0.31	0.22***	0.07	0.25	0.18***	0.04	0.07	0.03*
	Y	0.07	0.33	0.27***	-0.02	0.27	0.29***	0.08	0.08	0.01
high P2B	N	0.13	0.23	0.10***	0.11	0.21	0.11***	0.06	0.09	0.04*
	Y	0.13	0.27	0.14***	0.10	0.23	0.13***	0.05	0.10	0.05**
low ROA	N	0.10	0.27	0.17***	0.09	0.24	0.15***	0.02	0.10	0.08***
	Y	0.10	0.32	0.21***	0.08	0.27	0.19***	0.02	0.12	0.10***
high ROA	N	0.16	0.24	0.08***	0.12	0.20	0.08***	0.09	0.05	-0.03*
	Y	0.15	0.26	0.10***	0.11	0.22	0.10**	0.08	0.07	-0.02
Riskiness										
low risk density	N	0.09	0.29	0.19***	0.08	0.24	0.16***	0.02	0.09	0.07***
	Y	0.09	0.29	0.20***	0.08	0.24	0.16***	0.02	0.10	0.08***
high risk density	N	0.16	0.24	0.08***	0.13	0.21	0.09***	0.08	0.09	0.00
	Y	0.16	0.28	0.12***	0.12	0.23	0.11**	0.08	0.09	0.01
low NPL	N	0.14	0.27	0.13***	0.11	0.24	0.13***	0.07	0.11	0.04
	Y	0.14	0.30	0.16***	0.11	0.26	0.15***	0.07	0.13	0.06**
high NPL	N	0.11	0.25	0.13***	0.10	0.21	0.12***	0.02	0.06	0.04**
	Y	0.11	0.28	0.17***	0.08	0.23	0.15***	0.01	0.06	0.05***
Business model										
low loan ratio	N	0.09	0.29	0.20***	0.07	0.25	0.18***	0.01	0.11	0.10**
	Y	0.08	0.28	0.19***	0.07	0.23	0.16***	0.00	0.11	0.11**
high loan ratio	N	0.15	0.25	0.10***	0.12	0.23	0.11***	0.08	0.08	0.01
	Y	0.15	0.29	0.14***	0.11	0.25	0.13***	0.08	0.10	0.02
low deposit ratio	N	0.10	0.26	0.16***	0.08	0.25	0.17***	0.04	0.13	0.09***
	Y	0.10	0.33	0.23***	0.06	0.29	0.23**	0.02	0.17	0.15*
high deposit ratio	N	0.15	0.25	0.10***	0.13	0.21	0.08***	0.07	0.07	0.01
	Y	0.15	0.27	0.12***	0.12	0.22	0.11**	0.07	0.08	0.01

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.

Table B.3: RRT components: changes between regimes, by bank group

Group	Controls	MBT			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*
Performance										
low P2B	N	4.90	2.03	-2.88***	0.24	0.20	-0.05	0.43	0.62	0.20***
	Y	4.98	1.87	-3.12***	1.29	0.20	-1.09***	0.34	0.62	0.29
high P2B	N	4.58	3.05	-1.53***	0.19	0.09	-0.10	0.60	0.71	0.10***
	Y	4.58	2.61	-1.97***	0.23	0.13	-0.10	0.59	0.69	0.10**
low ROA	N	4.74	2.77	-1.97***	0.15	0.11	-0.04	0.49	0.75	0.26***
	Y	4.70	2.38	-2.32***	0.19	-0.14	-0.05	0.49	0.75	0.27**
high ROA	N	4.47	2.38	-2.08***	0.22	0.14	-0.08	0.70	0.56	-0.13***
	Y	4.50	2.16	-2.34***	0.27	0.16	-0.11	0.68	0.55	-0.13***
Riskiness										
low risk density	N	4.92	2.27	-2.65***	0.17	0.16	-0.01	0.46	0.65	0.19***
	Y	4.90	2.16	-2.74***	0.17	0.17	0.00	0.46	0.63	0.17**
high risk density	N	4.33	2.93	-1.40***	0.20	0.10	-0.11	0.69	0.70	0.01***
	Y	4.29	2.52	-1.77***	0.26	0.16	-0.10	0.68	0.69	0.01
low NPL	N	5.19	2.87	-2.32***	0.21	0.10	-0.10	0.72	0.76	0.04***
	Y	5.23	2.54	-2.69***	0.22	0.12	-0.10	0.72	0.75	0.03***
high NPL	N	4.04	2.34	-1.70***	0.16	0.15	-0.02	0.46	0.58	0.12***
	Y	4.03	2.07	-1.96***	0.29	0.18	-0.11*	0.43	0.57	0.14**
Business model										
low loan ratio	N	5.18	2.18	-3.01***	0.16	0.13	-0.02	0.44	0.63	0.19***
	Y	5.22	2.20	-3.03***	0.20	0.16	-0.04	0.44	0.61	0.17
high loan ratio	N	4.35	2.73	-1.62***	0.20	0.12	-0.09	0.65	0.69	0.04***
	Y	4.33	2.38	-1.95***	0.24	0.15	-0.09	0.64	0.69	0.04*
low deposit ratio	N	4.79	3.98	-0.81**	0.26	0.07	-0.19***	0.49	1.05	0.56***
	Y	4.85	3.21	-1.64**	0.37	0.11	-0.27***	0.48	1.06	0.57
high deposit ratio	N	4.44	2.40	-2.05***	0.17	0.15	-0.02	0.67	0.59	-0.08***
	Y	4.44	2.15	-2.29***	0.20	0.17	-0.03	0.65	0.58	-0.07***

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.

Table B.4: RRT and its components: differences between groups (regime 2)

	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

	Controls	MBT			Speed			Shock Volatility		
		g1	**g2**	**Diff**	**g1**	**g2**	**Diff**	**g1**	**g2**	**Diff**
EA vs US banks	N	**2.80**	**2.39**	−0.41***	**0.13**	**0.10**	−0.03	0.82	0.51	−0.31***
	Y	**2.44**	**2.22**	-0.22	**0.15**	**0.12**	-0.03	0.81	0.50	−0.31***
Small vs big banks	N	**3.26**	**2.18**	−1.08***	**0.08**	**0.18**	0.10**	0.72	0.64	−0.08***
	Y	**2.71**	**1.98**	−0.73***	**0.11**	**0.19**	-0.08	0.72	0.62	−0.10***
Low vs high P2B	N	**2.03**	**3.05**	1.02***	**0.20**	**0.09**	−0.11*	0.63	0.71	0.08***
	Y	**1.87**	**2.61**	0.74***	**0.20**	**0.13**	-0.07	0.62	0.69	0.07*
Low vs high ROA	N	**2.77**	**2.38**	−0.38***	**0.11**	**0.14**	0.03	0.75	0.56	−0.19***
	Y	**2.38**	**2.16**	-0.22	**0.14**	**0.16**	0.02	0.75	0.55	−0.20***
Low vs high risk density	N	**2.27**	**2.93**	0.65***	**0.16**	**0.10**	−0.06	0.65	0.70	0.04***
	Y	**2.16**	**2.52**	0.36	**0.17**	**0.16**	-0.01	0.63	0.69	0.06
Low vs high NPL	N	**2.87**	**2.34**	−0.54***	**0.10**	**0.15**	0.04	0.76	0.58	−0.19***
	Y	**2.54**	**2.07**	−0.47*	**0.12**	**0.18**	0.06	0.75	0.57	-0.18
Low vs high loan ratio	N	**2.18**	**2.73**	0.55***	**0.13**	**0.12**	−0.02	0.63	0.69	0.06***
	Y	**2.20**	**2.38**	0.18	**0.16**	**0.15**	-0.01	0.61	0.69	0.07
Low vs high deposit ratio	N	**3.98**	**2.40**	−1.58***	**0.07**	**0.15**	0.08	1.05	0.59	−0.46***
	Y	**3.21**	**2.15**	−1.06*	**0.11**	**0.17**	0.06	1.06	0.58	−0.48***

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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