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BUNDESBANK DISCUSSION PAPER NO 31/2025

Do capital requirements and their international differences affect banks' profitability?*

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Abstract

A key element of the Basel III reforms are stricter capital requirements, which have been implemented with varying degrees of stringency across jurisdictions. We examine the impact of these requirements on bank profitability in the US and Europe between 2019 and 2024. We find no evidence that higher capital ratios or requirements negatively affect profitability. However, our results indicate that international differences in capital requirements can influence the profitability of banks that operate globally: Since capital requirements in a jurisdiction apply only to domestic banks and foreign subsidiaries, foreign banks operating through cross-border or branch-based activities may gain a competitive advantage. Nevertheless, the effect appears to be limited to the subsample of German significant institutions (SIs). Moreover, our analysis of policy scenarios based on the estimated spillover effects suggests that lowering capital requirements is not an effective strategy for improving bank profitability and could even be detrimental if reciprocated by foreign jurisdictions.

JEL classification: G15, G21, G28, G32
Keywords: Bank capital, capital requirements, bank profitability

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1 Introduction

In response to the global financial crisis (GFC) of 2007–09, the Basel Committee on Banking Supervision (BCBS) developed a set of international regulatory standards, commonly referred to as the Basel III reforms (BCBS 2010). These reforms aimed to improve the regulation, supervision, and risk management of banks. By enhancing the banking sector's resilience and its capacity to absorb shocks from financial and economic stress, the reforms sought to mitigate the risk of spillovers from the financial sector to the real economy.

A large portion of the internationally agreed-upon Basel III reform package has been integrated into national regulations, including stricter requirements for both the quality and quantity of bank capital.[1] The remaining Basel III reform elements are expected to further increase capital requirements for large, internationally active banks.[2] Implementation of these outstanding reforms in the US and Europe has faced multiple delays and weakening. Initially postponed by the BCBS due to the pandemic, the implementation started in 2023. In the EU, the requirements are to be applied from 2025 or 2026, with some transitional arrangements extending until the end of 2032. In the US, implementation was initially planned for mid-2025, but a revised draft will be submitted for renewed consultation, likely leading to further postponements.[3] Until August 2025, US regulators publicly consulted a proposal to reduce the supplementary leverage ratio (SLR) for large banks.[4]

The Basel III regulations set minimum standards for internationally active banks, but national legislators and supervisory authorities have flexibility in implementation. They can adapt the standards to their financial system's specific conditions and may impose stricter requirements. Consequently, capital requirements vary across jurisdictions. For instance, in the US, smaller, nationally active banks face less stringent requirements than larger ones. In contrast, the EU applies Basel minimum standards to all banks, including those that are not internationally active. When comparing capital requirements for larger banks, the US imposes more stringent leverage-based requirements, while the EU generally has higher risk-weighted requirements – though with greater flexibility to apply lower risk weights than in the US if banks use internal credit risk models.

In the ongoing debate on the interplay between (de-)regulation and competitiveness, international differences in capital requirements are often used to argue for a weakening of domestic capital regulations to ensure a level playing field globally. The main argument is that higher

[1] For an overview see Basel III: international regulatory framework for banks. One key element was the introduction of capital buffers on top of minimum requirements, which help to counteract the risk of procyclicality in the event of a shock (Behn, Haselmann and Wachtel 2016, BCBS 2022): Buffers allow banks to absorb higher losses without coming under pressure to (excessively) sell risky assets or restrict the supply of credit in times of stress (Lang and Menno 2023, Repullo and Saurina 2011, Dursun-de Neef, Schandlbauer and Wittig 2023, Couaillier et al. 2022).

[2] The remaining elements of Basel III are commonly referred to as "Basel III finalization" by regulators, while the financial sector and public often calls them "Basel IV". Industry campaigns also use terms like "Basel III endgame."

[3] Speech by Vice Chair for Supervision Barr on Basel III endgame - Federal Reserve Board.

[4] See e.g. Federal Register of the US government (2025): Regulatory Capital Rule: Modifications to the Enhanced Supplementary Leverage Ratio Standards for U.S. Global Systemically Important Bank Holding Companies and Their Subsidiary Depository Institutions; Total Loss-Absorbing Capacity and Long-Term Debt Requirements for U.S. Global Systemically Important Bank Holding Companies.

capital requirements would weaken banks' profitability and thus their competitiveness.[5] If they must maintain a higher capital ratio, their refinancing costs would rise, because, from a bank's perspective, capital is more expensive than debt. In consequence, the lower profit margins would lead to higher loan interest rates and less lending, thereby eroding both the international competitiveness of the domestic banking sector and the economy in general.[6] With some success of this argument, legislators both in the US and the EU have partially rolled back initially planned increases in capital requirements, citing concerns about international competitiveness. In contrast, the empirical literature on the relationship between banks' capital levels and profitability is less conclusive, often finding no or even a positive relationship, for instance because well-capitalized banks are more capable of seizing market opportunities, are better equipped to survive periods of financial stress, or have incentives for more efficient business behavior.

While capital requirements influence the amount of capital a bank uses to refinance its investments, there is no one-to-one relationship. Larger and internationally active banks typically operate with a thinner excess capital buffer compared to smaller local banks, complicating international comparisons based on capital ratios rather than requirements.[7] In addition, when economic conditions deteriorate, the relationship between banks' capital levels and profitability might be confounded as loan losses lead to both a decline in profitability and a reduction in capital. There might also be endogeneity issues when causation runs from low profitability to a suppressed ability to retain earnings, leading to weaker capitalization. Therefore, to directly examine the link between the stringency of capital regulation, banks' profitability, and their international competitiveness, we use bank specific information on both capital ratios and requirements in the US and Europe (European Economic Area, EEA). This allows to disentangle the effect of banks' capitalization and their capital requirements on their profitability, while controlling for a range of macroeconomic factors and bank characteristics.

In addition to using detailed US and EEA bank-level data to examine differences in capital requirement regulations between these two regions and their impact on international banking sector competitiveness, we extend our analysis to the German banking sector. For this, we utilize confidential supervisory data for a much larger sample of banks.

We find no evidence that capital requirements negatively affect bank profitability, measured by return on assets (risk-adjusted or not), for both US and European banks. However, international differences in capital requirements appear to impact the profitability of globally active

[5] Competitiveness in the banking sector refers to the ability of banks to compete for market share and generate profits. It is shaped by various factors, including regulatory frameworks, market structure, and the quality of risk management practices, all of which interact dynamically. A bank's profitability serves as an indicator of its success in managing resources and capitalizing on market opportunities within a given regulatory and economic environment. While profitability reflects a bank's degree of competitiveness, it does not capture all its dimensions. However, more profitable banks can leverage their stronger financial soundness to gain a competitive edge both domestically and internationally. The empirical literature on banking competitiveness employs a mix of qualitative and quantitative measures to capture its multifaceted nature. For a comprehensive survey, see Syverson (2011). For international evidence on factors influencing bank profitability, see e.g. Demirgüç-Kunt and Huizinga (1999).

[6] For instance, the Financial Services Forum, a US lobbying group representing the chief executives of the eight largest US banks, argues that the Basel III Endgame will harm US competitiveness by requiring domestic banks to have higher capital ratios than their European peers (see e.g. U.S. vs. European Capital Adequacy - The Increasingly Unlevel Playing Field Unfolding in Basel III Finalization - FSF). Conversely, EU lobby organizations like EUREFI contend that European banks suffer in their international competitiveness due to higher capital requirements (see e.g. iv.2-basel-iii-implementation-preserving-eu-banks-capacity-to-finance-the-economy.pdf).

[7] In general, especially large and internationally active banks were affected by financial sector reforms after the global financial crisis, which aimed to reduce implicit guarantees and thereby funding cost advantages (Financial Stability Board 2019, 2020).

German banks. Differences between US and German capital requirements increase the profitability of German banks with significant cross-border exposure in the US, while no such effect is observed for US banks with exposures in the EEA or vice-versa. The rationale behind the effect can be explained by the fact that, in one jurisdiction, capital requirements apply to domestic banks and subsidiaries of foreign banks, but not to cross-border exposures or foreign bank branches. This potentially gives foreign banks a competitive advantage.

The remainder of the paper is structured as follows: Section 2 reviews the related literature. Section 3 outlines our data and empirical approach for estimating the impact of banks' capital requirements and their international differences on profitability. Section 4 presents the results. Section 5 analyses the policy implications based on the results of our estimation, examining the overall effect of a decline in domestic capital requirements on the profitability of international banks, in scenarios where either only the home jurisdiction lowers requirements, or both the home and host jurisdictions lower requirements (”reciprocal reduction”). Robustness analyses are presented in section 6, and section 7 concludes.

2 Literature Review

Our paper is related to four strands of literature that examine (i) the connection between changes in capital ratios and banks’ stock returns, (ii) the impact of capital requirements on bank behavior, including changes in credit supply and loan interest rates, (iii) the relationship between capital ratios and accounting-based measures of profitability such as return on assets or equity, and (iv) capital requirements and regulatory spillovers. We add to this literature by more directly investigating the impact of capital requirements rather than banks’ capitalization on bank profitability. We conduct this analysis in a multi-country setting using bank-specific capital requirements data for European and US banks. This enables us to draw conclusions about the impact of bank-specific capital requirements and the effect that differences in the stringency of international capital regulations might have on banks' profitability, and therefore their international competitiveness.

2.1 Capital ratios and banks’ value and stock returns

Higher capital ratios affect banks' refinancing costs and profitability in two ways: they shift the refinancing mix from debt to more expensive capital by increasing total refinancing costs and reducing profitability, but they also reduce default risk and lower costs per unit of capital and debt, boosting profitability. The Modigliani-Miller theorem (MM) postulates that both effects exactly offset each other, so that the capital ratio has no impact on total refinancing costs and thus profitability (Modigliani and Miller 1958). Miller (1995) describes how this also applies to banks, i.e. bank capital has no effect on bank value. However, MM assumes a perfect capital market, which does not hold for the banking system given information asymmetries between banks and their customers, different taxation of equity and debt and potentially underpriced deposit insurance. Mehran and Thakor (2011) find positive correlations between bank capital and total bank value in a sample of detailed financial transactions. Miles, Yang and Marcheggiano (2013) show for a sample of UK banks that the MM offset of a higher capital ratio on the total refinancing costs is somewhere between 45% and 90% as large as it would be

under a full MM offset. For a sample of large US banks, Kashyap, Stein and Hanson (2010) find that the MM largely holds, with only modest effects of substantially higher capital ratios on refinancing costs due to favorable tax treatment of bank debt. Cline (2015) finds a partial MM offset of around 45% for large US banks, while Baker and Wurgler (2015) confirm that equity risk increases with leverage. Clark, Jones and Malmquist (2023) find a higher MM offset for large banks compared to smaller banks in the US. For European banks, Toader (2015) estimates an MM offset of around 40%, which is roughly in line with results for the US. Since the required return on bank debt is typically assumed to be fixed, the estimated MM offset tends to be downward biased in all these studies. Overall, these results suggest that higher capital requirements might increase banks' refinancing costs to some extent and, consequently, on impact lower their profitability.

To assess this MM offset the studies need to rely on stock returns to measure profitability, which limits the analysis to stock market-listed banks. Moreover, stock prices reflect market-based expectations and valuations of future profitability, which do not necessarily align with banks' actual profitability as measured by their return on assets or equity. According to Gentry and Shen (2010) and the literature cited therein, the relationship between accounting and market-based measures of profitability is weak, and they conclude that the two concepts reflect distinct dimensions of a firm's financial performance. Additionally, the studies on the MM offset use the capital ratio instead of capital requirements, even though regulators only set the latter. The capital ratio is also more endogenous to bank profitability than capital requirements. For instance, if a bank uses its returns for retained earnings, the capital ratio increases. In this case, the causation runs from profitability to the capital ratio rather than the other way around.

2.2 Capital requirements, credit supply, and loan interest rates

Another strand of literature related to our paper examines the impact of changes in capital requirements on banks' credit growth and loan interest rates. Generally, the finding is that an increase in capital requirements tends to moderately and temporarily reduce credit supply and raise loan interest rates, especially if banks' excess capitalization is low. See BCBS (2016) for a literature review, and Imbierowicz, Löffler and Vogel (2020), Galardo and Vacca (2022) as well as Fang et al. (2022) for more recent country-level studies on Germany, Italy, and Peru, respectively.[8] If banks feel compelled to alter their lending conditions in response to higher capital requirements, their profitability might be negatively affected. However, the degree to which banks' lending and interest rate adjustments can mitigate the initial negative impact on profitability remains uncertain, particularly since the contractionary effects of higher capital requirements are often found to be only temporary. Furthermore, there might be a 'forced safety effect' if higher capital requirements reduces banks' probability of default (Bahaj and Malherbe 2020). Indeed, well-capitalized banks are more resilient and capable of sustaining credit supply even in adverse economic conditions (BCBS 2021). Accordingly, bank capital levels tend to be positively linked to banks' credit supply over the longer term (Altunbas, Di Tommaso and

[8] For more empirical evidence, see Peek and Rosengren (1995) for the US, Bridges et al. (2014) for the UK, Fraisse, Lé and Thesmar (2020) for France, Jiménez et al. (2017) for Spain, Jonghe, Dewachter and Ongena (2020) for Belgium, Malovaná and Ehrenbergerová (2022) for the Czech Republic, and Gropp et al. (2019) and Deli and Hasan (2017) for multi-country settings.

Thornton 2016, Buch and Prieto 2014, Klein and Turk Ariss 2022). Overall, the long-term impact of higher capital requirements on banks' credit supply and loan interest rates is inconclusive, making it difficult to draw a firm conclusion on the effect of bank capital regulations on bank profitability and international competitiveness.

2.3 Capital ratios and profitability

Capital levels are generally found to have a positive relationship with accounting measures of profitability such as return on assets (RoA) or equity (RoE). For instance, Berger (1995) finds a positive relationship between the capital ratio and RoE for US banks in the 1980s – and a negative relationship with risk-taking. Furthermore, higher capital often leads to increased earnings by reducing the cost of debt and thus, the weighted average cost of capital, particularly for banks with low initial capital and high portfolio risks. In addition, well-capitalized banks are in a better position to seize market opportunities during stress periods (Berger and Bouwman 2013). The positive relationship between the capital ratio and profitability is also found for Asian countries (Lee and Hsieh 2013), for banks from OECD countries (Bitar, Pukthuanthong and Walker 2018) and emerging economies (Al-Zoubi and Sha'ban 2023). The strength, sign and significance of the relationship between capital and profitability depends, for instance, on banks' capital level (Tran, Lin and Nguyen 2016), the measure of profitability (Le, Nasir and Huynh 2023) and the state of the economy (Coccorese and Girardone 2021).

All these studies focus on the effect of the capital ratio rather than capital requirements. Only few papers assess the impact of capital regulation. Chortareas, Girardone and Ventouri (2012) and Pasiouras, Tanna and Zopounidis (2009) utilize survey-based indices of capital stringency and find that stricter capital restrictions can enhance the operational efficiency of banks. Toader (2015) finds that stricter capital requirements reduce the cost of capital, thereby counteracting the main argument why capital requirements would reduce profitability. Deli and Hasan (2017) use a country-level index for capital stringency, finding a positive relationship between this index and bank profits. For the sample of significant institutions in the euro area, Behn and Reghezza (2025) find that capital requirements do not have a statistically significant effect on profit efficiency. De Bandt et al. (2018) utilize the implementation of the different Basel frameworks in France to approximate changes in capital requirements. Through a two-step procedure, they differentiate between the effects of capital requirements and voluntary management buffers on banks' profitability. Their findings indicate that only the voluntary management buffers positively affect RoA, while the effect of capital requirements appears to be insignificant.

2.4 Capital requirements and regulatory spillovers

The studies cited in the previous subsection focus primarily on the microeconomics of bank capital structure and profitability. Some papers also consider aggregate dynamics and interactions with the real economy. However, only a few studies investigate the international regulatory spillovers of capital requirements and the differences between regions' capital requirements.

For example, Avdjiev et al. (2017), Aiyar, Calomiris and Wieladek (2014) as well as Buch and Goldberg (2017) provide evidence on international spillovers of macroprudential policies to bank lending. Houston, Chen and Ma (2012) find bank flows to shift from more to less strictly regulated countries. Their evidence suggests a significant risk of a "race to the bottom" between jurisdictions, especially for less developed countries with weaker institutions. Ongena, Popov and Udell (2013) find that more stringent capital requirements in domestic markets are associated with riskier lending practices of multinational banks abroad. Similarly, Reinhardt and Sowerbutts (2015) show that foreign banks increase their lending in host countries with more stringent regulations, but this expansion does not occur when the regulations also apply to the foreign banks themselves.

In relation to these strands of literature, we investigate the impact of domestic and international differences in capital requirements on banks' profitability both in a multi-country and single-country setting, controlling for various macroeconomic variables and bank characteristics.

3 Data and Empirical Approach

3.1 Data and data sources

Our analysis is based on a comprehensive, bank-level dataset covering the largest banks in the United States (US) and the European Economic Area (EEA), as well as all German banks. The relatively short observation period enables a consistent analysis based on the available data for the regions under consideration (USA, Europe, and Germany). This period was marked by heightened uncertainty, driven by events such as the COVID-19 pandemic and the reversal of interest rates, as well as episodes of financial market stress. While this may limit the generalizability of the findings to calmer periods, it enhances their relevance for understanding dynamics during challenging macro-financial environments. Moreover, the chosen period offers the advantage that the implementation of Basel III capital buffers, particularly their phase-in, has largely been completed.

A key variable in the analysis is the bank-specific CET1 capital requirements under Basel III, including any region-specific gold plating. These capital requirements are determined by the higher of risk-weighted or leverage ratio-based capital requirements, both expressed relative to total assets. Risk-weighted requirements, depending on the region, consist of the following components: Pillar 1 and Pillar 2 (minimum) requirements; combined buffer requirements: capital conservation buffer; buffer for globally (G-SII) or other (O-SII) significant institutions, systemic risk buffer (applicable in the EEA only), countercyclical capital buffer and the stress capital buffer (applies exclusively to large US banks). The leverage ratio-based requirements include the Basel III minimum requirement plus any region-specific additional requirements, such as the Pillar 2 leverage ratio requirement in Europe or the supplementary leverage ratio for large banking groups in the US.[9]

[9] Our measure of required capital (in CET1) also accounts for any gaps in Additional Tier 1 or Tier 2 capital. Specifically, it includes the amount of CET1 capital a bank must hold to meet Tier 1 or Tier 2 capital requirements if it lacks sufficient Additional Tier 1 or Tier 2 capital to fulfil those obligations.

Regarding the capital and other bank-specific variables in the US sample, we rely on bank holding company data (FR Y-9 Reports) from the Federal Reserve System's repository, supplemented with capital requirements information from the Federal Reserve Board. The EEA bank-level data is sourced from the European Banking Authority's (EBA) EU-wide transparency exercise, the European Systemic Risk Board's (ESRB) data on capital buffer requirements, and the European Central Bank's (ECB) data on Pillar 2 capital requirements. This data is cross-checked and supplemented with information collected manually from Pillar 3 reports and confidential supervisory data of 24 significant German institutions (DE-SIs), which are directly supervised by the ECB. We also report results separately for these German banks.

We focus on large banks that likely face international competition. We limit our analysis to banks with at least 10 billion in average assets and include only banks with at least eight quarters of data. Furthermore, we exclude public sector-owned development banks, as they may not be comparable in terms of profitability targets. This results in a panel of 147 US banks and 102 EEA banks representing more than 85% of the total assets of all banks operating in the US or EEA, respectively. Additionally, we perform estimations with more granular data covering the full universe of 1349 German banks (DE-sample).

Macroeconomic controls come from FRED (Federal Reserve Economic Data), BIS, Haver Analytics, and national central banks. We use country-specific measures of the economic and financial cycle. These measures include short-term interest rates, long-term interest rates, stock market yields, real GDP, inflation, and the credit-to-GDP gap. We also include additional bank-specific controls. These controls are the share of deposits to total assets, a measure of loan diversification (sum of the squared portfolio shares of loans to financial institutions, corporates, private households, and the public sector, each expressed as a percentage of total loans), a measure of income diversification (sum of the squared shares of interest income and non-interest income, each expressed as a percentage of total income), the risk density of assets (risk-weighted assets to total assets), and the log of total assets as a measure of bank size. We winsorize all bank-specific ratios at the 1% level, and the RoA variables for the US & EEA sample at the 5% level to account for its wider distribution and outliers in our cross-country sample.

The baseline US-EEA panel spans from Q2 2019 to Q2 2024. Table 1 presents summary statistics for the bank-level variables used in the analyses. Panel A shows the EEA sample, panel B the US sample, panel C (D) the DE SIs (all banks) sample.

3.2 Empirical approach

We employ a stepwise approach. First, we estimate the relationship between profitability and capital in the combined US-EEA sample and respective US, EEA and DE-SIs sample splits. Next, we refine our analysis by decomposing the capital measure into capital requirements and excess capital as well as incorporating interaction terms to investigate whether differences in capital requirements between regions influence profitability.

Our analysis begins with the estimation of the following regression:

(1) $$roa_{i,c,t} = \beta_0 cap_{i,c,t} + \gamma_0 X_{i,c,t} + \alpha_i + \theta_{c,t} + \varepsilon_{i,c,t},$$

where return on assets (roa) for bank i, located in country c from time t, is explained by the bank specific capital measure (cap), which is our primary variable of interest. For the roa, we use moving averages based on the contemporaneous and the following three quarters (t to $t+3$). This serves to smooth the dependent variable and capture medium-term effects of the explanatory variables of interest. Initially, we employ the capital ratio (cap), defined as Common Equity Tier 1 (CET1) over total assets, as our measure of capital. Additionally, the model includes a set of bank and country level characteristics (X) to control for time-varying bank-specific information reflecting different bank business models, as well as country-specific information, such as the state of the economy and financial conditions. In some specifications, we further saturate the regression with bank (α) and/or country-time (θ) fixed effects to account for any potential omitted variables that may operate at these levels; ε denotes the error term.

In the second part of our analysis, we decompose the capital ratio into its constituent components: the bank-specific capital requirement ($capreq$) and any additional voluntary capital held beyond these requirements ($volcap$). Capital requirements reflect the maximum of risk-weighted and leverage-based capital requirements expressed as a percentage of total assets. Using total assets as a common denominator facilitates comparison between US and EEA banks as leverage-based requirements are generally higher in the US, whereas risk-weighted requirements are typically higher in EEA countries. The regression equation reads:

(2) $$roa_{i,c,t} = \beta_0 volcap_{i,c,t} + \beta_1 capreq_{i,c,t} + \gamma_0 X_{i,c,t} + \alpha_i + \theta_{c,t} + \varepsilon_{i,c,t}.$$

For voluntary capital, we use two alternative measures. The first measure is defined as the capital held by banks in excess of their requirements, calculated as $volcap_{i,c,t} = cap_{i,c,t} - capreq_{i,c,t}$. As a robustness exercise, the second measure is derived from the residuals of the regression $\widehat{cap}_{i,c,t} = \hat{\alpha}_0 + \hat{\beta}_0 req_{i,c,t}$ with $volcap_{i,c,t} = cap_{i,c,t} - \widehat{cap}_{i,c,t}$ and $capreq_{i,c,t} = \widehat{cap}_{i,c,t}$ following the approach of De Bandt et al. (2018). In general, both measures for $volcap$ capture the portion of capital that exceeds regulatory requirements. It may include market-implied requirements in addition to regulatory ones, as well as a management buffer that banks maintain to prevent unintentional breaches of regulatory requirements in the event of unexpected losses, or any other components not explained by regulatory capital requirements.

In a third step, we explore international spillovers of differences in capital requirements across countries or regions on banks' profitability. To achieve this, we employ a bank-specific index (INT) which captures the extent to which a bank is exposed to differences in capital regulation. The index is constructed by interacting i) the quarterly difference between the average foreign capital requirements and the own capital requirements with ii) the bank-specific (and constant) share of foreign exposure to total exposure. The regression equation is as follows:

(3) $$roa_{i,c,t} = \beta_0 volcap_{i,c,t} + \beta_1 capreq_{i,c,t} + \beta_2 INT_{i,c,t} + \gamma_0 X_{i,c,t} + \alpha_i + \theta_{ct} + \varepsilon_{i,c,t},$$

with $INT_{i,c,t} = \overline{(capreq}_{f,t} - capreq_{i,c,t}) \times f_exp_{i,c}$. The second term, ($f_exp$), is based on a bank's average foreign exposure share: For US banks, this pertains to their exposure to the

EEA; for EEA banks, to their exposure to the US; and for German banks to their exposure to the US or other EEA countries, respectively. For EEA banks, we can rely on detailed information on the share of US exposure to total credit exposure. For US banks, we lack granular information on their EEA exposure shares. However, we can exploit information from the 009a Data Reports, which provide bank-level data on US banks' self-reported exposures to foreign countries if these exposures exceed the lesser of 0.75 percent of the bank's total assets and 15 percent of its total capital. Whenever a bank reports data to one or more EEA countries, we treat this bank as having substantial EEA exposure and define a dummy variable equal to one. For banks reporting no EEA exposure or banks not listed in the 009a Data Reports, we set this dummy equal to zero.

4 Results for US and EEA banks

The following three subsections present our findings regarding large US and EEA banks, including the DE-SIs subset. In subsection 4.4, we examine the more detailed full sample of German banks and compare results for intra-EEA spillover effects of differences in international capital requirements with the DE-SI sample.

4.1 Banks’ profitability and their capital ratio

First, we estimate the regression using the full EEA-US sample along with the EEA and US sample splits as well as the DE-SI subset (see Equation 1). Table 2 presents the results for the relationship between banks’ profitability, measured as return on assets (RoA), and their capital ratio defined as CET1 to total assets. Regarding the full EEA-US sample, column 1 shows the results for the pooled OLS regression, which includes time-varying bank and country controls. The next three columns show results for fixed-effects regressions, controlling for unobserved constant bank heterogeneity (column 2), common country-specific effects over time (column 3) or both (column 4). The latter specification with both bank and country-time fixed effects is also shown for the subsamples of EEA banks (column 5), US banks (column 6) and the subset of German SIs (column 7). Saturation with fixed effects helps to control for a wide range of potentially confounding factors mitigating potential estimation bias.

In all specifications, the CET1 ratio is positively associated with banks' return on assets, except in the EEA sample. This effect is significant for columns 1 and 3 of the combined EEA-US sample as well as the DE-SI subset. Effects are not statistically significant for the other specifications. This finding aligns with most studies as outlined in the literature review (section 2). Based on the estimate for the German SI sample, a 1 percentage point higher CET1 ratio would translate into a 0.07 percentage point higher RoA, which amounts to a tenth of the mean RoA in the EEA sample. Although not directly comparable due to differences in the definition of the capital ratio, the time period, the sample of banks used and the empirical approach, the magnitude of the coefficient is roughly mid-range compared to estimates in other papers.

4.2 Banks' profitability and domestic capital requirements

Table 3 presents our results for the regression, where we decompose the capital ratio into the capital requirement and any excess capital held voluntarily above these requirements (see Equation 2).

Columns 1 to 7 are defined as before. We find that excess capital – conditional on the level of required capital – is positively and statistically significantly related to banks' profitability in the same specifications as in the previous section (column 1, 3 and 7). Capital requirements also show a positive association with profitability. This relationship is mostly statistically insignificant, except for the DE-SI sample.

As demonstrated in the robustness section 5, the results remain broadly consistent with alternative specifications. These include instrumenting the capital variables using difference GMM (Table 7) or lagged independent variables (Table 8), using risk-adjusted RoA as a measure of profitability (Table 9), and using an alternative approach in the spirit of De Bandt et al. (2018) to decompose the capital ratio into capital requirements and excess capital (Table 10). While some estimates lose significance in some of the subsamples, overall, we cannot find any evidence that higher capital ratios or requirements would *reduce* banks' profitability.

4.3 Banks' profitability and international differences in capital requirements

Next, we examine potential spillovers of differences in capital requirements between regions. Generally, an increase in capital requirements within a country affects domestic banks and subsidiaries of foreign banks located in that country. However, it does not directly affect branches or cross-border exposures of foreign banks. For them, the capital regulation of their home country applies. Consequently, if a country unilaterally increases its capital requirements, foreign banks operating within that country through branches or cross-border exposures could gain a competitive advantage due to differing regulatory standards.[10] To test for these potential level playing field effects, we regress banks' RoA on their capital requirements and voluntary capital buffer, as in the previous exercises, but additionally include an interaction term that accounts for these potential international regulatory spillovers (see Equation 3).[11] The term INT represents a measure of regulatory distance concerning capital requirements (see Section 3.2).

Table 4 shows results for the combined EEA and US sample as well as for both regions and the DE-SIs subset separately. For EEA banks we use information on their US exposure relative to their total credit exposure.

Column 1 depicts results for our baseline specification, which includes bank controls as well as country-time and bank fixed effects, for the combined EEA and US sample. In column 2 and 3, the baseline is estimated for the EEA sample with an US exposure dummy and share,

[10] An exception is the countercyclical capital buffer, which must be reciprocated within the EU. This means banks must apply this capital buffer to exposures in that country, regardless of whether they are domestic or foreign banks.

[11] While we cannot rule out the possibility that, for some large banks, subsidiaries are included in the foreign exposure measure, for most banks the main part primarily consists of cross-border and branch exposures.

respectively. The results for the US, with a dummy indicator on EEA exposure are in column 4, while column 5 shows the results for the DE-SIs sample, with the share of US and EEA exposure.

We find a positive but not significant effect of higher foreign versus domestic capital requirements on the profitability of US and EEA banks in the full sample (column 1). In addition, we find a positive albeit not statistically significant spillover terms for EEA banks in the specifications using the US exposure share (column 2) and the material US exposure dummy (column 3). However, in the DE-SI subsample, banks with a significant proportion of their credit exposure in the US experience a positive effect on their profitability from a higher differential between US and domestic capital requirements, which is also statistically significant (column 5): For a 1 percentage point higher difference in requirements, the RoA of a bank with a US exposure share of 7% (close to the mean based on the estimation sample) increases by 0.16 percentage points, compared to a bank with no US exposure. This amounts to more than a third of the mean RoA of the DE-SIs in the sample. By contrast, the estimated effect of exposure to EEA countries and respective differences in capital requirements are not statistically significant. Overall, this points to limited potential level playing field effects for internationally active banks when there is a significant difference in capital requirements between foreign (host) and home regions.

4.4 Results for German banks

In this section, we analyze data from all German banks, including not only the SIs but also the less significant institutions (LSIs), many of them having a regional focus. The full sample of German banks comprises 1,349 banks, providing a much broader cross section than the previously analyzed panels. Table 5 shows the results of our analysis of the impact of the capital ratio (column 1), the decomposed capital ratio (column 2) and interaction terms that capture potential regulatory spillovers from the US and other EEA countries onto bank profitability (column 3).[12] Due to the diverse range of banks in the full German sample, which includes systemically important institutions, savings banks, cooperative banks and others, we have included banking group-time fixed effects to control for the heterogeneity due to differences in business models.[13]

The results are broadly comparable to the DE-SI results. There is a positive albeit insignificant relationship between both the capital ratio (column 1) and the excess capital ratio and an insignificant relationship of capital requirements (column 2) and bank profitability. Regarding the spillover terms, we observe – as before – a significant positive effect for German banks operating in the US, which is weaker but consistent with the results for German SIs in Table 4 (see column 5). This is not surprising given that only few LSIs have a significant US exposure.

[12] The RoA is corrected for losses due to valuation effects around the interest rate increase, which primarily affected LSIs.
[13] For example, Memmel and Raupach (2010) show that German banks' adjustments of capital ratios are significantly heterogenous between banking groups.

5 Policy Implications of Lowering Capital Requirements

Our results suggest that *lowering* capital requirements would have no or even a negative impact on banks' profitability. For banks that operate globally, however, this could have implications for their international competitiveness. Based on the coefficients in the spillover regressions (Table 4), lower capital requirements for German SIs, for example, would improve the competitive advantage of German SIs with significant lending activity in the US. For those banks, lowering capital requirements at home could have opposing effects on their profitability: On the negative side, lower capital requirements and capital ratios could reduce performance due to the positive association between capital measures and RoA. Conversely, the increased distance to foreign requirements enhances competitiveness in foreign markets. To determine the combined effect of lower capital requirements on internationally active banks, we run two counterfactual policy scenarios that are summarized in Table 6.[14]

First, we assume that only the home region lowers its requirements. We then calculate the overall effect on the profitability of domestic banks, based on their average credit exposure in the foreign market. Second, we examine the impact on profitability if the foreign region also lowers its capital requirements by the same amount, following advice often heard in policy debates ('reciprocal reduction'). Since we do not find a statistically significant spillover effects for EEA banks in general and there do not seem to be opposing effects for US banks, we focus on the profitability impacts for German SIs.

The left panel of Figure 1 illustrates the impact of reducing capital requirements for German SIs by one percentage point based on the regression results depicted in Table 4. The left panel illustrates the impact of a one-sided reduction in domestic capital requirements by one percentage point, while the right panel shows the results for the reciprocal scenario, where both domestic and foreign capital requirements are reduced.

For German SIs with substantial US exposure, the reduction in domestic capital requirements has a negative, but not statistically significant effect on the profitability of banks with no or a comparatively low share of US (credit) exposures. The effect turns positive and significant for internationally active banks whose US exposure share exceeds 16%. However, if the US reciprocates the reduction, the negative profitability effect prevails for all German SIs. This implies that in a reciprocal scenario, not even the uncertain and limited gains in international competitiveness can be reaped by lowering requirements. Ultimately, the reciprocal scenario leads to a “race to the bottom”, which weakens the profitability of banks and impairs their resilience.

6 Robustness

In this section, we conduct robustness checks on the findings presented in Section 4. The next four tables present the results of the most saturated fixed effects regressions shown in Tables

[14] This scenario analysis is a static exercise based on partial effects and implicitly assumes that banks keep their voluntary capital constant when requirements decrease.

2 and 3 (the effect of the capital ratio and the effect of capital requirements and excess capital, respectively) for an alternative empirical specification (Tables 7 and 8), a different measure of profitability (Tables 9), and an alternative breakdown of the capital ratio of banks (Table 10).

We start our robustness analyses by altering the empirical specification. Table 7 shows regression results, where we instrument the capital variables with lagged levels using difference generalized method of moments (GMM) to address potential endogeneity issues. Our main findings remain consistent: capital requirements are not negatively linked to capital ratios or requirements.[15]

Table 8 shows the results of a specification that incorporates the first lag instead of the contemporaneous value of all explanatory bank-level variables, including the capital ratio and its decomposition. Consistent with the findings in Tables 2 and 3, the results indicate that there is no negative link of the capital ratio or required capital to profitability and for the German-SI sample, we find a positive and significant effect of the capital ratio and excess capital.

Next, we assess the robustness of our results regarding the measure of profitability. Although we consider the risk density of bank balance sheets in all specifications, this metric is not an ideal control for portfolio riskiness. For instance, EEA banks that use internal models to calculate risk-weighted assets (RWA) tend to assign lower risk weights to identical portfolios than banks that use the standardized approach. To better capture the effects of banks' risk-taking on performance, we replace our dependent variable with risk-adjusted RoA in Table 9. This is calculated by dividing RoA by its standard deviation. This adjustment mitigates the impact of extreme RoA values that may be attributable to varying risk tolerance. The results are largely consistent with those in Tables 2 and 3, except for the DE-SI sample, where statistical significance is lost. We find no statistically significant negative impact of increased capital requirements on risk-adjusted RoA.

In Table 10, we present results when using a different method to calculate the excess capital ratio. Instead of breaking down the capital ratio into capital requirements and excess capital, we follow the two-step approach by De Bandt et al. (2018). In this approach, excess capital is derived from the residuals of the first stage regression, where the capital ratio is regressed on capital requirements. The residuals represent the part of the excess capital ratio that is not explained by changes in capital requirements. Results align with those in Table 3. The alternative measure of excess capital has a positive and significant coefficient for the DE-SI sample and is insignificant in the other samples.

7 Conclusion

In light of the renewed discussion on (de-)regulation, the debate surrounding the stringency of bank capital requirements and their impact on profitability has resurfaced. In this paper, we

[15] The rather unsatisfactory Hansen statistic for the German SIs specification likely stems from the small cross-section of this group of banks, which complicates the appropriate application of GMM. Accordingly, we consider the other robustness checks presented in this section more suitable to confirm robustness of the results found for German SIs.

present our empirical findings on the relationship between capital requirements and bank profitability in the US and Europe. Our results indicate that higher capital requirements do not negatively affect bank profitability. In fact, higher capital requirements either have no significant explanatory power, or they may even have a positive impact. Consequently, we do not consider capital requirements to be a crucial factor in determining banks' competitiveness.

However, differences in the level of capital requirements across international borders can influence the profitability of banks that operate internationally. More stringent capital requirements abroad can give foreign banks a competitive advantage if they are not subject to these higher requirements. Indeed, we find that differences in capital requirements between the US and German banks contribute to their profitability, provided they have significant cross-border exposure in the US. Conversely, we find no such effect for other EEA banks operating in the US or US banks operating in the EEA. Nevertheless, even for banks that could benefit partially from an increase in the regulatory difference, these advantages are reversed in a reciprocal scenario where both regions simultaneously reduce requirements.

From our analyses, we draw two key conclusions. First, harmonizing capital requirements across countries could help mitigate potential regulatory spillover effects on banks' profitability. An example of internationally harmonized capital requirements is the countercyclical capital buffer (CCyB) within the EU, which applies to all credit exposures in a country that has implemented it, regardless of where a bank is domiciled. Second, the example of German SIs suggests that reducing capital requirements does not appear to be an effective strategy for enhancing banking sector profitability. In fact, it could even have negative implications for profitability, potentially triggering an international race to the bottom. Moreover, this would compromise banks' resilience and increase the probability and severity of financial crises, a factor not considered in this paper.

8 Tables and Figures

8.1 Tables

Table 1. Summary statistics

This table shows summary statistics for the variables used in the analyses. Data is sourced from the EBA Transparency Exercise, Federal Reserve System & Board, ESRB, ECB, and German Supervisory Data. Number of observations (quarter x bank): EEA = 1615 (425 for German SIs); US = 2493 and DE (all banks) = 23685. Percentiles for German SIs not disclosed due to confidentiality of the disaggregated data.

Variable	mean	sd	p10	median	p90
Panel A: EEA					
Capital ratio (CET1, %assets)	5.97	2.20	3.79	5.35	9.10
Capital requirements (CET1, %assets)	4.03	1.41	2.65	3.63	6.00
Excess capital (CET1, %assets)	1.94	1.46	0.53	1.55	3.95
RoA (annualized, %)	0.64	0.92	-0.04	0.59	1.61
RoA (annualized, %, 4 quarter average)	0.72	0.58	0.14	0.61	1.55
RoA (risk-adjusted, %)	1.47	1.47	-0.05	1.30	3.41
RoA (risk-adjusted, %, 4 quarter average)	1.57	1.29	0.16	1.41	3.36
Share of deposits (%liabilities)	47.40	25.19	8.93	52.16	78.62
Income diversification (low=more diversified)	0.62	0.15	0.50	0.57	0.88
Loan diversification (low=more diversified)	0.32	0.09	0.24	0.30	0.45
Size (log assets)	25.54	1.22	24.16	25.24	27.39
Risk density (%, RWA to total assets)	36.85	12.57	23.05	34.51	56.48
Share US exposure (%)	3.70	5.71	0.00	1.37	9.91
US exposure (Dummy)	0.69	0.46	0.00	1.00	1.00
Regulatory distance (US - own)	0.97	1.48	-1.02	1.37	2.43
Real GDP growth (%, yoy)	1.46	6.14	-5.20	1.50	7.70
Inflation (%, yoy)	4.10	4.00	-0.10	2.77	9.40
Government Bond Yield (%, 10y)	1.19	1.66	-0.44	0.64	3.34
Money Market Rate (%)	0.61	1.96	-0.54	-0.40	3.36
Stock market index yield (%)	5.90	18.00	14.62	2.87	31.26
Credit-to-GDP Gap (%)	11.26	22.91	39.78	-6.77	9.24
Panel B: US					
Capital ratio (CET1, %assets)	8.77	2.24	6.65	8.45	11.02
Capital requirements (CET1, %assets)	5.80	1.12	4.36	5.89	7.14
Excess capital (CET1, %assets)	2.95	2.00	1.16	2.50	5.26
RoA (annualized, %)	0.80	0.42	0.30	0.80	1.26
RoA (annualized, %, 4 quarter average)	0.81	0.36	0.39	0.79	1.24
RoA (risk-adjusted, %)	2.06	1.38	0.21	2.04	4.00
RoA (risk-adjusted, %, 4 quarter average)	2.07	1.29	0.28	2.05	3.87
Share of deposits (%liabilities)	60.86	18.74	36.05	61.84	85.52
Income diversification (low=more diversified)	0.67	0.12	0.52	0.66	0.84
Loan diversification (low=more diversified)	0.68	0.13	0.51	0.66	0.85
Size (log assets)	24.47	1.36	23.19	24.01	26.36
Risk density (%, RWA to total assets)	69.82	12.96	50.95	72.61	84.23
EEA exposure (Dummy)	0.15	0.36	0.00	0.00	1.00
Regulatory distance (EEA - own)	-2.33	1.12	-3.66	-2.42	-0.88

Real GDP growth (%, yoy)	2.33	3.75	-1.41	2.30	5.72
Inflation (%, yoy)	4.00	3.22	0.80	2.27	9.07
Government bond yield (%, 10y)	2.09	1.08	0.69	1.79	3.83
Money market rate (%)	1.77	1.82	0.10	1.37	5.13
Stock market index yield (%)	7.78	12.66	-5.97	3.63	26.13
Credit-to-GDP Gap (%)	-1.81	4.25	-7.20	-2.40	4.80

Panel C: DE SIs

Capital ratio (CET1, %assets)	5.41	2.51	4.64	
Capital requirements (CET1, %assets)	3.72	1.40	3.36	
Excess capital (CET1, %assets)	1.64	1.63	1.08	
RoA (annualized, %)	0.40	0.57	0.35	
RoA (annualized, %, 4 quarter average)	0.44	0.40	0.36	
RoA (risk-adjusted, %)	1.07	1.13	1.04	
RoA (risk-adjusted, %, 4 quarter average)	1.14	0.86	1.12	
Share of deposits (% liabilities)	20.63	17.97	15.80	
Income diversification (low=more diversified)	0.72	0.18	0.69	
Loan diversification (low=more diversified)	0.37	0.08	0.35	
Size (log assets)	25.44	1.12	25.17	
Risk density (%, RWA to total assets)	30.20	10.37	28.47	
Share US exposure (%)	7.32	8.29	5.43	
US exposure (Dummy)	0.96	0.20	1.00	
Regulatory distance (US - own)	1.28	1.44	1.59	
Real GDP growth (%, yoy)	0.36	4.03	0.20	
Inflation (%, yoy)	4.16	3.52	3.53	
Government bond yield (%, 10y)	0.41	1.16	-0.28	
Money market rate (%)	0.35	1.44	-0.40	
Stock market index yield (%)	3.88	13.79	1.08	
Credit-to-GDP Gap (%)	6.50	3.79	8.15	

Panel D: DE (all banks)

Capital ratio (CET1, %assets)	9.31	2.55	6.90	9.10	11.67
Capital requirements (CET1, %assets)	6.57	1.49	4.87	6.57	8.33
Excess capital (CET1, %assets)	2.74	1.99	0.84	2.45	4.71
RoA (annualized, %)	0.48	1.22	-0.99	0.66	1.49
RoA (annualized, %, 4 quarter average)	0.51	0.57	0.04	0.45	1.11
RoA (risk-adjusted, %)	0.56	1.09	-0.95	0.70	1.68
RoA (risk-adjusted, %, 4 quarter average)	0.59	0.57	0.04	0.48	1.31
Share of deposits (%liabilities)	47.72	14.39	31.44	49.41	62.33
Income diversification (low=more diversified)	0.65	0.17	0.51	0.57	1.00
Loan diversification (low=more diversified)	0.30	0.09	0.23	0.28	0.39
Size (log assets)	20.83	1.47	18.97	20.90	22.52
Risk density (%, RWA to total assets)	57.35	12.25	43.06	58.17	71.13
Share US exposure (%)	0.58	1.47	0.00	0.00	1.58
Share EEA exposure (%)	4.81	7.02	0.00	2.45	11.33
Regulatory distance (US - own)	-1.58	1.47	-3.32	-1.57	0.11
Regulatory distance (EEA - own)	-3.06	1.49	-4.83	-3.07	-1.36

Table 2. Return on assets and capital ratio

This table shows the results of the regression analysis using Equation (1) for the period from Q2 2019 to Q2 2024. The bank controls comprise deposit share, loan and income diversification, risk density, and size. Country controls comprise the short-term and long-term interest rates, stock market yield, real GDP, inflation, and the credit-to-GDP gap. Fixed effects were considered as indicated; if specified, country-time fixed effects were included for the combined EEA & US sample, and time-fixed effects were included for the US & DE sample. Cluster-robust p-values at the bank level are given in parentheses: ***, **, and * denote statistical significance at the 1, 5, and 10% levels, respectively.

Dep. var: RoA	EEA & US				EEA	US	DE (SIs)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CET1 (% assets)	0.053***	0.002	0.051***	0.032	-0.001	0.038	0.068***
	(0.000)	(0.934)	(0.002)	(0.125)	(0.980)	(0.103)	(0.002)
Controls and Fixed Effects							
Bank controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country controls	Yes	Yes	No	No	No	No	No
Bank FE	No	Yes	No	Yes	Yes	Yes	Yes
(Country x) time FE	No	No	Yes	Yes	Yes	Yes	Yes
Observations	4,108	4,108	4,108	4,108	1,615	2,493	451
Adjusted R-squared	0.242	0.697	0.477	0.833	0.903	0.720	0.792
Number of banks	249	249	249	249	102	147	24

Table 3. Return on assets and decomposed capital ratio

This table shows the results of the regression analysis using Equation (2) for the period from Q2 2019 to Q2 2024. The bank controls comprise deposit share, loan and income diversification, risk density, and size. Country controls comprise the short-term and long-term interest rates, stock market yield, real GDP, inflation, and the credit-to-GDP gap. Fixed effects were considered as indicated; if specified, country-time fixed effects were included for the combined EEA & US sample, and time-fixed effects were included for the US & DE sample. Cluster-robust p-values at the bank level are given in parentheses: ***, **, and * denote statistical significance at the 1, 5, and 10% levels, respectively.

Dep. var: RoA	EEA & US				EEA	US	DE (SIs)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Excess CET1 (% assets)	0.055***	-0.013	0.054***	0.019	-0.022	0.028	0.074**
	(0.000)	(0.519)	(0.002)	(0.313)	(0.441)	(0.155)	(0.011)
Required CET1 (% assets)	0.035	-0.033	0.025	0.016	0.015	0.014	0.098*
	(0.201)	(0.179)	(0.341)	(0.463)	(0.729)	(0.558)	(0.093)
Controls and Fixed Effects							
Bank controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country controls	Yes	Yes	No	No	No	No	No
Bank FE	No	Yes	No	Yes	Yes	Yes	Yes
(Country x) time FE	No	No	Yes	Yes	Yes	Yes	Yes
Observations	4,108	4108	4,108	4108	1,615	2,493	451
Adjusted R-squared	0.239	0.698	0.474	0.831	0.904	0.717	0.792
Number of banks	249	249	249	249	102	147	24

Table 4. Return on assets and regulatory spillover

This table shows the results of the regression analysis using Equation (3) for the period from Q2 2019 to Q2 2024. The bank controls comprise deposit share, loan and income diversification, risk density, and size. As indicated, all specifications include bank-fixed effects, as well as country-time fixed effects for the EEA & US sample and time-fixed effects for the US & DE sample. Cluster-robust p-values at the bank level are given in parentheses: ***, **, and * denote statistical significance at the 1, 5, and 10% levels, respectively. For the combined EEA and US sample (column 1), the interaction for US banks is based on the EEA exposure dummy and the difference between the EEA and the bank-specific CET1 requirements.

Dependent var: RoA	EEA & US	EEA		US	DE (SIs)
	Dummy	Share	Dummy	Dummy	Share
	(1)	(2)	(3)	(4)	(5)
Excess CET1 (% assets)	0.019	-0.023	-0.025	0.028	0.074***
	(0.324)	(0.420)	(0.392)	(0.171)	(0.002)
Required CET1 (% assets)	0.020	0.039	0.035	0.019	0.139
	(0.417)	(0.390)	(0.488)	(0.516)	(0.100)
US exp x CET1 req. [US - own]	0.010	0.007	0.041		0.023***
	(0.702)	(0.164)	(0.222)		(0.008)
EEA exp x CET1 req [EEA - own]				0.011	-0.004
				(0.791)	(0.212)
Controls and Fixed Effects					
Bank controls	Yes	Yes	Yes	Yes	Yes
Country controls	No	No	No	No	No
Bank FE	Yes	Yes	Yes	Yes	Yes
(Country x) time FE	Yes	Yes	Yes	Yes	Yes
Observations	4,108	1,615	1,615	2,493	451
Adjusted R-squared	0.831	0.904	0.904	0.717	0.813
Number of banks	249	102	102	147	24

Table 5. Return on assets and regulatory spillover - DE

This table shows the results of the regressions based on Equations (1), (2) and (3), using the full sample of German banks from Q2 2019 to Q2 2024. The bank controls comprise deposit share, loan and income diversification, risk density, and size. The RoA is corrected for losses due to valuation effects around the interest rate increase, which primarily affected LSIs. As indicated, all specifications include bank-fixed effects alongside banking group-time fixed effects. Banking groups comprise systemically important institutions (O-SII and G-SII), savings banks, cooperative banks, and others. Cluster-robust p-values at the bank level are given in parentheses: ***, **, and * denote statistical significance at the 1, 5, and 10% levels, respectively.

Dependent var: RoA	(1)	(2)	(3)
(Excess) CET1 (% total assets)	0.009	0.012	0.010
	(0.463)	(0.323)	(0.379)
Required CET1 (% total assets)		-0.016	-0.016
		(0.399)	(0.420)
US exposure share x CET1 requirements [US - own]			0.013**
			(0.010)
EEA exposure share x CET1 requirements [EEA - own]			-0.001
			(0.270)
Controls and Fixed Effects			
Bank controls	Yes	Yes	Yes
Country controls	No	No	No
Bank FE	Yes	Yes	Yes
Banking group x time FE	Yes	Yes	Yes
Observations	23,685	23,685	23,685
Adjusted R-squared	0.585	0.586	0.586
Number of banks	1349	1349	1349

Table 6. Policy scenarios: effects of lowering requirements

Scenario	Assumption	Effect on RoA
One-sided: Only home region (EEA) reduces domestic requirements (by 1 pp)	$\Delta\overline{capreq_{US,t}} = 0$ US requirements constant	$-\beta_1 + \beta_2 \times f_exp_{i,c,t}$ (depends on share of US exposure)
Reciprocal: Both regions (EEA and US) reduce domestic requirements by same amount (1 pp)	$\Delta\left(\overline{capreq_{US,t}} - capreq_{req_{i,c,t}}\right) = 0$ Difference in requirements (US minus EEA/DE) stays constant	$-\beta_1$ (does not depend on share of US exposure)

Table 7. Robustness – GMM

This table shows the results of robustness regressions based on Tables 2 and 3, using difference GMM for the period from Q2 2019 to Q2 2024. GMM uses the relevant principal components (i.e. eigenvalues >1 and at least the same number of instruments as regressors) of the first four lags of all bank-level variables as instruments. As indicated, the specifications include time fixed effects and time-varying country controls for the full EEA and US, as well as the EEA subsample, in order to avoid proliferation of instruments. Cluster-robust p-values at the bank level are given in parentheses: ***, **, and * denote statistical significance at the 1, 5, and 10% levels, respectively. Cluster-robust p-values at the bank level are given in parentheses: ***, **, and * denote statistical significance at the 1, 5, and 10% levels, respectively.

Dep. var: RoA	EEA & US		EEA		US		DE (SIs)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(Excess) CET1 (% assets)	-0.051	-0.071	0.008	-0.089	0.083	-0.031	0.015	0.023
	(0.603)	(0.320)	(0.959)	(0.442)	(0.364)	(0.683)	(0.895)	(0.850)
Required CET1 (% assets)		-0.037		-0.259		-0.052		0.280*
		(0.907)		(0.108)		(0.722)		(0.062)
Controls and Fixed Effects								
Bank controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country controls	Yes	Yes	Yes	Yes	No	No	No	No
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,855	3,855	1,509	1,509	2,346	2,346	427	427
Number of banks	249	249	102	102	147	147	24	24
p-value AR(2)	0.046	0.067	0.443	0.014	0.945	0.145	0.542	0.380
p-value Hansen test	0.000	0.001	0.732	0.635	0.275	0.203	1.000	1.000

Table 8. Robustness – lagged bank variables

This table shows the results of robustness regressions based on Tables 2 and 3, using the first lag of all bank variables for the period from Q2 2019 to Q2 2024. As indicated, the specifications include time fixed effects and time-varying country controls for the full EEA and US as well as the EEA subsample to avoid proliferation of instruments. Cluster-robust p-values at the bank level are given in parentheses: ***, **, and * denote statistical significance at the 1, 5, and 10% levels, respectively. Cluster-robust p-values at the bank level are given in parentheses: ***, **, and * denote statistical significance at the 1, 5, and 10% levels, respectively.

Dependent var: risk-adjusted RoA	EEA & US		EEA		US		DE (SIs)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(Excess) CET1 (% assets; t-1)	0.013	0.003	-0.032	-0.033	0.021	0.009	0.083***	0.071**
	(0.499)	(0.857)	(0.250)	(0.328)	(0.348)	(0.594)	(0.007)	(0.013)
Required CET1 (% assets; t-1)		-0.018		0.019		-0.033		0.176
		(0.474)		(0.781)		(0.220)		(0.106)
Controls and Fixed Effects								
Bank controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country controls	No	No	No	No	No	No	No	No
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
(Country x) time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,865	3,865	1,516	1,516	2,349	2,349	427	427
Adjusted R-squared	0.832	0.832	0.907	0.907	0.715	0.715	0.778	0.773
Number of banks	249	249	102	102	147	147	24	24

Table 9. Robustness - risk-adjusted return on assets as dependent variable

This table shows the results of robustness regressions based on Tables 2 and 3, with risk-adjusted return on assets used as the dependent variable instead of return on assets for the period from Q2 2019 to Q2 2024. The bank controls comprise deposit share, loan and income diversification, risk density, and size. As indicated, all specifications include bank-fixed effects alongside country-time effects (for the EEA & US sample) or time-fixed effects (for the US & DE sample). Cluster-robust p-values at the bank level are given in parentheses: ***, **, and * denote statistical significance at the 1, 5, and 10% levels, respectively.

Dep. var: risk-adjusted RoA	EEA & US		EEA		US		DE (SIs)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(Excess) CET1 (% assets)	0.045*	0.044*	0.012	0.003	0.050*	0.049*	0.024	0.034
	(0.050)	(0.056)	(0.748)	(0.945)	(0.057)	(0.065)	(0.493)	(0.304)
Required CET1 (% assets)		0.031		0.055		0.006		-0.006
		(0.491)		(0.533)		(0.905)		(0.944)
Controls and Fixed Effects								
Bank controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country controls	No	No	No	No	No	No	No	No
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
(Country x) time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,108	4,108	1,615	1,615	2,493	2,493	496	496
Adjusted R-squared	0.913	0.913	0.917	0.917	0.907	0.907	0.778	0.779
Number of banks	249	249	102	102	147	147	24	24

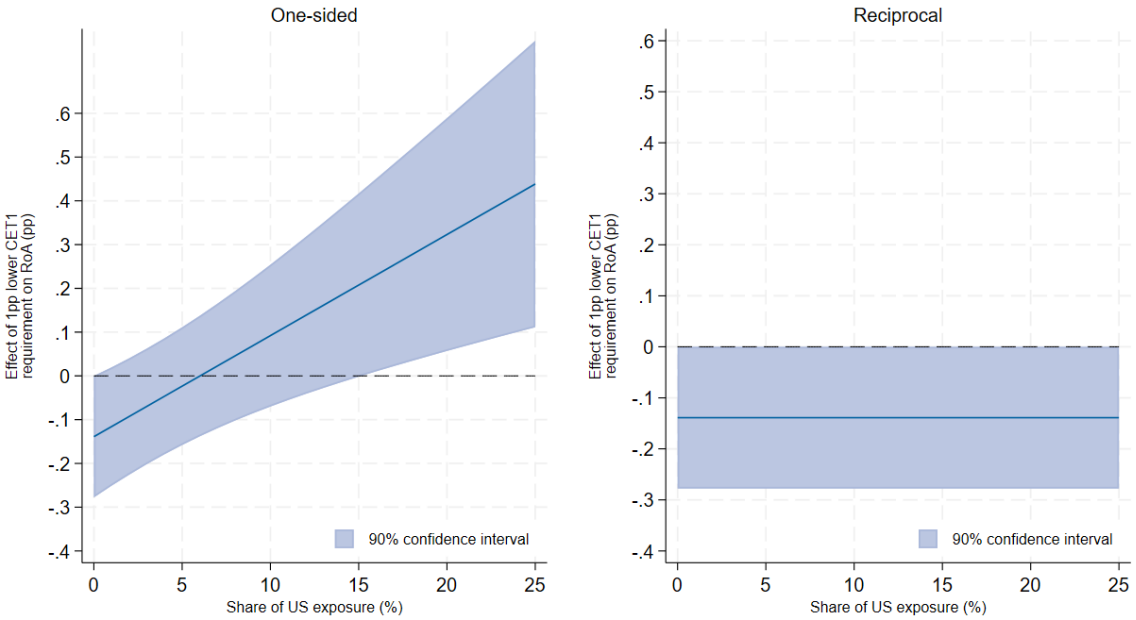
Table 10. Robustness - alternative method to decompose capital ratio

This table shows the robustness regression results based on Table 3 for the period from Q2 2019 to Q2 2024, using an alternative method similar to that of De Bandt et al. (2018) to decompose the capital ratio into required and excess capital. The bank controls comprise deposit share, loan and income diversification, risk density, and size. Country controls comprise the short-term and long-term interest rates, stock market yield, real GDP, inflation, and the credit-to-GDP gap. Fixed effects were considered as indicated; if specified, country-time fixed effects were included for the combined EEA & US sample, and time-fixed effects were included for the US & DE sample. Cluster-robust p-values at the bank level are given in parentheses: ***, **, and * denote statistical significance at the 1, 5, and 10% levels, respectively.

Dependent var: RoA	EEA & US	EEA	US	DE (SIs)
	(1)	(2)	(3)	(4)
Excess CET1 (% assets)	0.032	-0.000	0.038	0.067***
	(0.126)	(0.991)	(0.104)	(0.003)
Required CET1 (% assets)	0.025	0.053	0.002	0.081*
	(0.529)	(0.390)	(0.970)	(0.080)
Controls and Fixed Effects				
Bank controls	Yes	Yes	Yes	Yes
Country controls	No	No	No	No
Bank FE	Yes	Yes	Yes	Yes
(Country x) time FE	Yes	Yes	Yes	Yes
Observations	4108	1,615	2,493	451
Adjusted R-squared	0.833	0.903	0.720	0.792
Number of banks	249	102	147	24

8.2 Figures

Figure 1: Effect of reducing EEA capital requirements on RoA of German banks (SIs)



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