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Nicholas T. Fritsch and Jan-Peter Siedlarek

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How Do Banks Respond to Capital Regulation?

— The Impact of the Basel III Reforms in the United States*

Nicholas Fritsch & Jan-Peter Siedlarek†

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Abstract

Understanding banks' responses to capital regulation is essential for regulators to use this key tool of modern banking regulation effectively. We study how and when US banks responded to changes to the way capital ratios are measured, changes that were introduced as part of the adoption of Basel III. We find that small banks — those below USD 10bn — responded neither before nor after the release of the new rules to the change in measured capital they experienced under the new rules. In contrast, we show that regional banks — those with total assets between USD 10bn and USD 50bn — adjusted their capital ratios to partially compensate for the changes resulting from the new rules: On average, if a bank's capital ratio when measured under the new rules was lower than under the old rules, then the bank took steps to increase its capital ratio, compared to a bank whose capital ratio did not change with the new rules. This adjustment took place prior to the publication of the specific language applicable to US banks, suggesting that the changes were largely expected by that time. Both groups of banks responded in the periods following the release of the new US rules in relation to their exposure to mortgage servicing rights, suggesting that the severe treatment of this asset class was not expected. The bank responses we estimate take place well before the Basel III rules started to come into force after 2014, emphasizing the importance of policy announcements in shaping bank behavior.

JEL Classification: G21, G28

Keywords: Bank regulation, bank capital, capital requirements

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†Federal Reserve Bank of Cleveland, jan-peter.siedlarek@clev.frb.org. *Disclaimer:* The views stated herein are those of the authors and are not necessarily those of the Federal Reserve Bank of Cleveland or of the Board of Governors of the Federal Reserve System.

1 Introduction

The establishment of capital adequacy standards has been a fundamental pillar of modern banking regulation in economies around the world. They are meant to protect the financial stability of the banking systems. Capital adequacy generally works by specifying a minimum capital ratio, measured by the amount of capital that a bank must hold relative to its asset position, so that there is sufficient capital to absorb potential losses without threatening the bank's solvency. Indeed, the introduction of standards on capital regulation was a primary function of the first Basel Capital Accord published in 1988.[1] Capital regulation has continued to be a primary focus of reforms to the 1988 Basel proposals. Following the financial crisis of 2007–2009, tightening capital regulation was one of the main instruments that regulators employed to avoid future crises. For example, the Basel III framework proposed in 2010, among other key elements, both increased the required capital ratios and tightened the definition of what counts as capital.

To ensure that they achieve their objectives without creating undue burdens for the banking system, it is crucial for policymakers to understand how such capital regulations impact the banking system. Studying the response of banks to new regulations can be an important part of this effort. In this paper, we ask the question: How and when do banks respond to the introduction of changes in capital adequacy regulations, in the context of the Basel III reforms and their adoption by US banking regulators?

A key challenge in the literature on capital regulations concerns the identification of the effects of the regulations. Much of the existing empirical work that looks at the impacts of regulatory reforms within the banking sector attempts to identify the causal effects of regulatory changes by exploiting time variation in regulatory requirements that were implemented by certain foreign central banks, comparing outcomes prior to the changes with outcomes after the changes (Aiyar et al., 2014; Francis and Osborne, 2012). Another strand of the literature utilizes cross-sectional variation in the effects of regulatory changes across banks (Gropp et al., 2019; Shahhosseini, 2020). Our work employs both approaches to identification and compares both across time and across banks with different exposures to the new rules using a difference-in-differences estimation. We contribute to the literature on the effect of capital regulations by studying the "when" as well as the "how" of bank responses. In addition, while many of the existing papers in the field explore the effect of regulations on lending, we focus on the way banks manage their regulatory capital structure.

The Basel III reforms we study in this paper were endorsed at the international level by the Basel Committee on Banking Supervision (BCBS) in 2010. Among other elements, including increases in minimum capital ratios, the BCBS framework proposed several changes that redefined the measurement of bank regulatory capital ratios by both creating a narrower definition of loss-absorbing capital and adjusting the

[1] https://www.bis.org/publ/bcbs04a.pdf

risk weights of a variety of asset classes to better reflect their underlying risk to banks. In effect, these changes redefined the way banks measured regulatory capital ratios and on average implied that the "new" ratios were lower than those prior to these reforms. Following the release of the BCBS proposal, US banking agencies presented a proposal for the regulatory changes required to implement the Basel III framework for US banks in 2012.[2] Following a comment period, a final set of changes was released in 2013. The new rules were implemented from 2015 onward, with some elements only coming into force several years later.

We analyze the effects of these regulatory changes on banks' capital ratios in a difference-in-differences setting with a continuous treatment variable. As treatment we employ an estimate of the difference in tier 1 capital ratios under the old rules and the new rules, following a procedure outlined in the congressional testimony of Federal Reserve staff during a hearing on the topic of the new capital regulations (Board of Governors of the Federal Reserve System, 2012). We then ask the questions: Did banks that received a negative shock to their regulatory capital ratios because of the regulatory changes attempt to "catch up"? Similarly, did banks with a positive shock to their regulatory capital ratios "return" to a lower target ratio? Also, how did the response to the regulatory changes vary over time and across banks of different sizes?

We find that small banks — those between $500 million and $10 billion — do not appear to have changed their capital positions in response to the new regulations. For the larger regional banks — those between $10 billion and $50 billion — in our sample we find a negative association between the impact on their capital ratios and the path of their capital positions. That is, regional banks with a negative impact strengthen their capital position relative to banks with a positive impact. Notably, these changes are observed for the period prior to the release of the proposed rules for US banks in 2012, and then disappear for subsequent periods. This suggests that the regional banks did expect to be affected by the new regulations and do appear to have estimated their impact, so that no further adjustments were required after the rules had been released.

We then drill down to one set of changes affecting mortgage servicing rights (MSRs). These changes were subject to substantial discussion at the time of the release and have been previously shown to affect bank lending in the literature (Buchak et al., 2018; Irani et al., 2021). We find that both small and regional banks in our sample responded to the proposed rules released in 2012 in a way that depended on their exposure to MSRs. In both cases, banks with greater exposure to MSRs increased their capital ratios relative to those less exposed to this asset class, and these adjustments took place in the periods following the release of the proposed rules by US regulators. The timing of the response suggests that banks in both size bands may not have anticipated the changes regarding MSRs that ended up in the US implementation of Basel III, even though the BCBS framework introduced very similar changes as early as 2010.

Our paper is part of a wide literature that studies the role of capital regulation in banking. More narrowly,

[2] https://www.federalreserve.gov/newsevents/pressreleases/bcreg20120607a.htm

the papers closest to ours estimate the effect of capital regulation. The key challenge in this area is to find suitable settings that generate a plausibly exogenous change in capital requirements to permit convincing identification of the effect of capital. One approach to addressing this challenge has been to study the effects of changes in capital requirements, such as the Basel III reforms, that are the focus of this paper.

Our paper builds on Berrospide and Edge (2016), who first study the implementation of the Basel III reforms through the US regulators and exploit the cross-sectional variation in the effects of these reforms on the affected banks. In their paper, Berrospide and Edge (2016) focus on the effect that higher capital requirements have on lending and find a negative, albeit small, effect. Using the same estimates for the changes in capital requirements, Irani et al. (2021) find that banks whose capital ratios decreased more were more likely to sell shares of syndicated loans on their books than less affected banks, and that adverse exposure to the new regulation facilitated the rise of non-bank financing of syndicated loans. Differently from these earlier papers, in our paper we focus on the bank response in terms of managing capital ratios and study the timing of the bank response and its implications for policy.

In the European context, Gropp et al. (2019) and Mésonnier and Monks (2015) study the 2011 European Banking Authority capital exercise, which presented an unexpected announcement of increased capital requirements for large European banks. They find that banks for which the new requirements were binding reduced risk-weighted assets, reduced lending, and experienced slower loan growth compared to banks that had capital ratios exceeding the new target. In a follow-up paper, Gropp et al. (2020) provide evidence that banks met the higher capital requirements partly by exploiting the discretion to inflate regulatory capital without accompanying increases in book equity.

Fraisse, Lé, and Thesmar (2020) use detailed loan-level data for firms and banks in France. They exploit the variation in capital requirements across firms and banks arising from the risk-based capital regulations in Basel II. Following Khwaja and Mian (2008) they are able to control for loan demand (or supply) by comparing lending across banks to the same firm (or across firms by the same bank). They find relatively strong effects from higher capital requirements. An increase in capital requirements of 1 percentage point leads to a reduction in bank lending of 8 percent and a reduction in firm borrowing of 4 percent, suggesting limited substitution to other banks.

A small number of papers take advantage of the time-varying capital regulations that exist in some jurisdictions. For example, Jiménez et al. (2017) study the impact of dynamic provisioning in Spain, which had been in place from before the 2007–2009 financial crisis and which experienced a number of adjustments and policy experiments over time. Using these experiments, the authors estimate the effect of changes in regulation on credit and the real economy, showing that countercyclical regulation can smooth credit supply cycles and, by releasing credit in bad times, improve firm outcomes. Francis and Osborne (2012) exploit the

variation across time in capital requirements for banks in the UK under Basel I. They find that banks respond to an increase in their capital requirement by increasing their internal capital target. The adjustment toward the new target tends to occur through changes in the composition of bank assets rather than by adjusting the volume of loans and other assets and by adjusting the amounts of lower quality tier 2 capital, which is cheaper to raise than higher quality tier 1 capital. Imbierowicz, Kragh, and Rangvid (2018) study the capital and lending response of banks to changes in capital and disclosure requirements for banks in Denmark. They find an asymmetric impact of changes to capital regulations: an increase in the bank capital requirement results in higher capital ratios through a reduction in asset risk, while a decrease in the requirement leads to more lending and leverage and lower capital. Auer, Matyunina, and Ongena (2022) show how targeted countercyclical capital regulation can have implications beyond the targeted sector. In their study of Swiss banks, an increase in the countercyclical capital buffer applied to residential mortgages leads to increased growth in commercial lending.

Relatedly, the impact of stress tests has provided some insight into the effect of regulation on banks. For example, Berrospide and Edge (2019) study the effect on banks of having to meet new and higher capital buffers for the US CCAR stress tests. Their findings suggest that an increase in the required capital buffer results in lower loan growth for the affected large banks, but that firms borrowing from these banks can compensate by tapping other sources of credit. Other recent studies of the effects of stress tests include Doerr (2021), Kok et al. (2021), Shahhosseini (2020), Acharya, Berger, and Roman (2018) and Cortés et al. (2020).

This paper adds to the existing body of research by shedding light on both the "when" and the "how" of banks' responses to capital regulation. In particular, the timing of banks' responses relative to the announcement of changes in capital regulation has been little studied in the literature. Arnould et al. (2020) consider the introduction of a capital relief policy and study whether and when UK banks' pre-position their mortgage portfolios to take advantage of the policy's features. Their results suggest that banks did not respond to a discussion paper the regulator published in the earlier stages of the policy cycle but did so later after the publication of the policy statement. In our work, we study the timing of responses to changes in capital ratios for the US and find that at least the larger banks in our sample respond well before the official release of rules applicable to them.

The remainder of this paper is structured as follows. Section 2 lays out the implementation of Basel III in the US that we exploit in our study, describing the adjustments to the key capital ratios and the treatment of mortgage servicing rights. Section 3 describes the data and empirical framework and Section 4 the results of our analysis. Section 5 concludes.

2 Implementation of Basel III in the US

The policy change we study in this paper is related to the adoption of the Basel III framework in the United States. In this section we give some background on both the Basel III framework as proposed by the BCBS and its US implementation. As the sequence and timing of events will be important in our analysis, we first present the timeline of changes and then proceed to describe the key changes we use in our analysis.

2.1 Timeline of Implementation

The Basel III reforms were designed to address shortcomings in the pre-crisis framework, with the stated goal "... to improve the banking sector's ability to absorb shocks arising from financial and economic stress, whatever the source, thus reducing the risk of spillover from the financial sector to the 'real economy' " (Basel Committee on Banking Supervision, 2009). The reforms strengthened the resiliency of banks via an increase in the level and the quality of capital that banks are required to maintain, a revision of the risk-weighted capital framework, the introduction of a new leverage ratio to constrain bank leverage, a new liquidity coverage ratio and a net stable funding ratio, as well as new counter-cyclical capital buffers to limit pro-cyclicality. These changes aimed to stabilize the banking system throughout the economic cycle and lower the probability of systemic risk events.

The Basel III framework was first proposed and endorsed at the international level by the BCBS, with subsequent introduction and implementation in the United States. The BCBS first published a set of proposed reforms in December 2009 that were designed to strengthen capital and liquidity regulations, and accepted comments on proposed reforms from banking institutions until April 16, 2010.[3] These reforms were subsequently approved at the international level. On July 26, 2010, the oversight body of the BCBS announced that an agreement had been reached on the overall design of the capital and liquidity reform package.[4] On September 12, 2010, the agreements were fully endorsed by the oversight body of the Basel Committee on Banking Supervision.[5]

Next, a set of rules for US banks based on the internationally endorsed framework was proposed by US banking agencies. On June 12, 2012, the Office of the Comptroller of the Currency, the Federal Reserve System, and the Federal Deposit Insurance Corporation (jointly referred to as the US banking agencies) proposed regulations that would implement the Basel III capital and liquidity reforms, and accepted comments on the proposed regulations from banking institutions until September 7, 2012.[6] On

[3] https://www.bis.org/publ/bcbs164.htm
[4] https://www.bis.org/press/p100726.htm
[5] https://www.bis.org/press/p100912.htm
[6] https://www.federalreserve.gov/newsevents/pressreleases/bcreg20120612a.htm

July 2, 2013, the US banking agencies announced the final rules that would implement the Basel III reforms.[7] Figure 1 shows the timeline of the relevant Basel III announcements.

It is instructive to note that there were additional changes to bank regulation that overlapped with the Basel III reforms. Important for large banks was the Dodd-Frank Act (DFA), which became effective on July 21, 2010. Section 165 of the DFA mandated stronger regulation and supervision of large bank holding companies of greater than $50 billion in total consolidated assets. On December 20, 2011, the Federal Reserve Board first proposed a set of enhanced prudential standards as mandated by the DFA, which included requirements for risk-based capital and leverage, liquidity, stress testing, single-counterparty credit limits, and early remediation of financial weaknesses.[8] On February 18, 2014, the Federal Reserve Board approved the final rules based on DFA mandates.[9] US banks with greater than $50 billion in total consolidated assets that were subject to the final rules needed to comply by January 1, 2015. For the largest banks, the new regulations introduced by the DFA, in particular, the stress test, presented the primary regulatory constraint. For this reason, we explicitly exclude banks greater than $50 billion in total consolidated assets from our sample.

2.2 The Basel III Changes to US Bank Capital Regulation

The Basel III reforms included numerous changes that were implemented by the US agencies. We focus on a subset of these changes related to regulatory capital for banks of different sizes, highlighting changes to the definition of regulatory capital and changes to risk weights which jointly implied a significant change in the way banks calculated their regulatory capital ratios.

One key part of the Basel III reforms and their implementation via the proposed and final rules in the US was a narrower definition of loss-absorbing capital that placed a greater emphasis on a measure of common equity of the highest quality. The Basel III reforms explicitly decomposed tier 1 capital into two components, common equity tier 1 (CET1), based on high-quality common equity subject to various regulatory deductions, and additional tier 1 capital as the remainder of tier 1 capital after accounting for CET1. CET1 was defined as common stock and surplus, retained earnings, accumulated other comprehensive income, and qualifying minority interest. Additional tier 1 capital was defined as noncumulative perpetual preferred stock and related surplus, and qualifying minority interest.

Basel III also set forth several adjustments and deductions to be applied to CET1 balances prior to computation of the CET1 ratio. Three adjustments to CET1 relevant to our analysis are the following

[7] https://www.federalreserve.gov/newsevents/pressreleases/bcreg20130702a.htm

[8] See: https://www.federalreserve.gov/newsevents/pressreleases/bcreg20111220a.htm and https://www.govinfo.gov/content/pkg/FR-2012-01-05/pdf/2011-33364.pdf.

[9] See: https://www.federalreserve.gov/newsevents/pressreleases/bcreg20140218a.htm and https://www.govinfo.gov/content/pkg/FR-2014-03-27/pdf/2014-05699.pdf.

threshold deductions and risk weights:

1. Significant investments in the common shares of unconsolidated financial institutions, MSRs and deferred tax assets that arise from temporary differences were each subject to a 10 percent threshold with respect to CET1 recognition.[10]

2. The sum of balances across the three asset types remaining (after applying deductions from the 10 percent threshold rule) that is greater than 15 percent of a bank's CET1 must be deducted from CET1.

3. After these 10 and 15 percent threshold deductions are applied, any remaining amount of the three asset types that remain on a bank's balance sheet would be assigned a risk weight of 250 percent.

The threshold deductions in effect assigned a proportion of high-quality capital on a bank's balance sheet to holdings of these three asset types beyond the thresholds, and the increased risk weighting in addition penalizes a bank's capital ratios in treating the holdings not deducted as high-risk assets.

In addition to narrowing the definition of regulatory capital, the new proposed rules under Basel III adjusted risk weights for various asset classes to better capture their associated risks. In many cases, these changes led to more granular and risk-sensitive weights. While the changes were generally consistent with the international framework endorsed by the BCBS, the proposed US rules included three additional changes not discussed in the original reforms endorsed by the BCBS:

1. Risk weights for high volatility commercial real estate (HVCRE) exposures increased from 100 percent to 150 percent.

2. Risk weights for non-guaranteed or non-secured loan exposures that were more than 90 days past due or on non-accrual increased. Under Basel II, these risk weights ranged from 50 percent to 150 percent. Under the proposed rules, these risk weights would be set uniformly at 150 percent.[11]

3. A new differentiated risk-weight framework for residential mortgage exposures that would apply varying risk weights on such assets based on key risk factors was introduced.

The proposed US rules released in July 2012 were modified based on comments from financial institutions in several areas before being finalized later in 2013. A portion of the modifications was in response to comments received from banks on the differential impacts of the rules on institutions of different sizes, specifically concerns that community banks would be disproportionately impacted by many of the proposals. The concerned parties argued that community banks differed from larger banks in terms of capital structure,

[10] For example, a bank would be required to compute 10 percent of its CET1 balances, and amounts in excess of the 10 percent threshold for each of the three asset types would be deducted from CET1.
[11] Note that this excluded sovereign and residential mortgage exposures.

ability to access capital markets, financial sophistication, systemic importance, and other factors, so that some aspects of the proposals would place too much regulatory burden on these smaller, less-complex financial institutions. Partly in response to such concerns, the final rules no longer included differentiated risk weights for residential real estate and also preserved the treatment of accumulated other comprehensive income (AOCI) and trust-preferred securities (TruPS) in tier 1 capital for all but the largest banks.[12]

3 Data and Estimation Approach

We analyze bank responses to the Basel III regulations using the quarterly financial statements for US bank holding companies (BHC) and domestic financial holding companies (FHD) reported on Federal Reserve Form FR Y-9C for the period 2010 Q1 to 2014 Q4.[13] The Y-9C form reports, among other items, bank balance sheets and income statements as well as regulatory ratios. We refer to the institutions in this data set simply as "banks." Our sample covers banks ranging from $500 million to $50 billion in 2012 Q1 total assets, where throughout this paper we distinguish between "small" banks, those with total assets less than $10 billion, and "regional" banks, those with total assets above that threshold. We exclude banks with total assets greater than $50 billion, because they were subject to enhanced supervision, including stress testing, under the DFA in our sample period. We also exclude from our sample one bank that experienced rapidly dropping total assets toward the end of our sample period, suggesting imminent failure. Finally, for our main analysis we use a balanced panel and require banks to have no missing data during any of the quarters in our sample period. Although this allows us to sidestep issues associated with bank entry and exit during the sample, our results will admittedly be subject to some degree of bias by not considering de novo banks, acquired banks, or failed banks. In total, we end up with a sample of 20 periods for 675 small and 39 regional banks, for a total of 13,500 and 780 bank-quarter observations, respectively. Table 1 and Table 2 show summary statistics for the banks in our sample.

Our main treatment is the impact of the new rules under Basel III implementation proposed in June 2012 on regulatory tier 1 capital ratios. We estimate this impact for each bank in our sample based on financial information reported at the end of 2012 Q1, the last full quarter before the release of the proposed regulation. We follow Berrospide and Edge (2016) and replicate the approach Federal Reserve staff used in preparing estimates of the new proposed regulations in support of congressional testimony (Board of Governors of the Federal Reserve System, 2012, Attachment A). The overall impact of the proposed rule on

[12] See the discussion of these comments in the official documents on the final rules: https://www.govinfo.gov/content/pkg/FR-2013-10-11/pdf/2013-21653.pdf.

[13] We end the sample in 2014 due to the structural changes in the reporting of regulatory data that followed the implementation of the Basel III rules we study.

measured tier 1 capital ratios is estimated by applying the changes listed in the proposed regulation to both capital definitions and risk weighting, using as inputs the components of capital and risk-weighted assets as reported in the balance sheet and regulatory forms of Form Y-9C.

Figure 2 shows the mean tier 1 capital ratios over time for those banks in the size bands that we consider, and Figure 3 shows a scatter plot of the calculated effect against bank total assets in 2012 Q1. In our sample the average effect of the proposed regulations on tier 1 capital ratios is around negative 2 percentage points, with significant variation around this, including some banks for which the new rules result in an increase in their tier 1 capital ratio (see Table 3 and Table 4). The chart shows the significant dispersion of the effect of the regulation among the banks in each size band, with a variance of around 2 percentage points. We use this variation in the direct impact on tier 1 capital ratios to study the effect of the regulation on bank behavior after the proposed regulation. In addition, we study the effect that regulations specific to the treatment of MSRs had on bank behavior. For that analysis we use as treatment the ratio of MSRs over total assets. This treatment variable has an average value of 0.7 percent for small banks and 2.3 percent for the regional banks in our sample.

For our main results we estimate variation of a difference-in-differences model where the extent to which a bank's tier 1 capital ratio changed with the proposed regulation acts as a continuous treatment variable.[14] The baseline specification with both bank and quarter fixed effects is shown in Equation 1.

$$y_{i,t} = \alpha_t + \alpha_i + \beta X_{i,t} + \gamma \delta_{i,t}^{\text{Basel III Impact} \times \text{After 2012 Q2}} + \epsilon_{i,t} \tag{1}$$

The parameter of interest is γ which captures the relative effect of the Basel III impact for quarters after the proposed regulation had been released. We cluster standard errors at the level of each individual bank. The identifying assumption in this estimation is that outcome variables for banks with different levels of impact would have moved in parallel absent the release of the proposed regulation.

4 Results

4.1 Banks' Response to Changes to Their Tier 1 Ratio

We first examine the effect of the proposed rules regarding tier 1 capital ratio calculations on the path of regulatory capital. How did banks that received a positive adjustment to their measured tier 1 capital ratios adjust relative to those that received a negative adjustment? Regression results are shown in Table 5.

[14] See Acemoglu, Autor, and Lyle (2004) for an earlier application of this approach. Callaway, Goodman-Bacon, and Sant'Anna (2021) discuss the additional issues that arise in difference-in-differences models that involve continuous treatment variables and the stronger assumptions required for causal inference.

For small banks, column (1) suggests that banks in this size group did not respond differentially based on the shock to their tier 1 capital ratio in 2012. While the coefficient is negative, it is not statistically significant with standard errors clustered at the level of individual banks. Columns (2) and (3) break out the effect of the proposed ruling over time by interacting the impact measure with quarter fixed effects, either for quarters after the release of the proposed rules (column (2)) or for all quarters, including those prior to the release (column (3)). The breakouts are consistent with the conclusion that banks below $10 billion in total assets do not appear to have responded to the changes to their tier 1 capital ratio imposed by the 2012 proposals as far as the path of their tier 1 capital ratio was concerned. Figure 4 illustrates the results by plotting the coefficients from column (3).

The lack of a systematic response by smaller banks, in particular after the announcement of the new rules in June 2012, is notable. Based on comments regulators received following the 2012 announcement, it was viewed that "Basel III was designed for large, internationally active banking organizations in response to a financial crisis attributable primarily to those institutions."[15] However, in the proposed rules of 2012 the US regulators included all banks down to $500 million in total assets, capturing many smaller and community banks. For the smaller banks in our sample, the 2012 announcement thus arguably came as a surprise, and we would have expected them to react to the capital rules once it was clear that these rules indeed applied to smaller banks.

In contrast, for regional banks larger than $10 billion in total assets, the results in Table 5 columns (4) through (6) find a strong negative relationship between the adjustment to measured tier 1 capital implied by the proposed rule and tier 1 capital ratios. Column (4) suggests that relative to the period prior to the release of the proposed rule, regional banks had a 0.4 percentage point lower tier 1 capital ratio after 2012 Q2 for every 1 percentage point increase in measured capital. However, analyzing the timing of this effect by quarter in columns (5) and (6) uncovers that the negative relationship is present prior to the release of the proposed rule, while there seems to be zero effect of the adjustment in quarters after the release. Including the interactions between all quarter fixed effects and the tier 1 impact shows that for every 1 percentage point increase in tier 1 capital from the new regulations, banks decreased their tier 1 capital ratio by about 0.5 percentage point from the beginning of our sample to our reference quarter 2012 Q2. Figure 5 illustrates this relationship by plotting the coefficients from column (6). The relationship is statistically and economically meaningful. On average, if a bank experienced an impact that was two percentage points (about one standard deviation) more adverse relative to other banks, then that bank increased its tier 1 capital ratio by about one percentage point between 2010 Q1 and 2012 Q2.

The results imply that we cannot interpret the negative coefficient found for regional banks in column

[15] https://www.federalreserve.gov/aboutthefed/boardmeetings/20130702__Basel__III_Board__Memo.pdf, p.2

(4) as a causal effect of the 2012 Q2 proposed rules. Nonetheless, the regression finds a statistical pattern in the path of tier 1 capital ratios that suggests that prior to the release of the proposed regulation in June 2012 banks that were about to receive a negative adjustment to their measured tier 1 capital increased their capital ratios preemptively. It is notable that the relationship disappears as soon as the proposed rule was released: the estimated coefficients and thus the line in the coefficient plot return to zero. This implies that once the information was released, no further systemic adjustments to tier 1 capital ratios were taken by regional banks, suggesting that any adjustments prior to 2012 Q2 fully achieved the desired capital position.

Banks can adjust their regulatory capital ratios in two ways: by changing the amount of capital and by changing the amount of risk-weighted assets. Furthermore, the amount of risk-weighted assets is the product of the amount of total assets and the average risk weight of those assets. To learn more about bank response we decompose the movements of the regulatory tier 1 ratios into these elements.

Table 6 and Table 7 break out the relationship between the effect of the changes in measured capital ratios and several components of bank balance sheets. These include a decomposition of the tier 1 ratio (column (1)) into the numerator tier 1 capital and the denominator risk-weighted assets (RWA), both normalized by total assets. The tables also show the results for the growth rates of total assets (column (4)), loans (column (5)), and securities (column (6)). For small banks (Table 6), the regressions confirm the finding of the previous section. Overall, there appears to be no systematic relationship between the change in measured capital ratio implied by the proposed rule and the numerator or denominator of the regulatory tier 1 capital ratio. However, we do find that banks with a bigger negative impact experienced faster growth in total assets and securities holdings. For regional banks (Table 7), the results suggest that the negative relationship between the change in capital from the proposed rules and the tier 1 capital ratio falls largely on the numerator; that is, the amount of capital increases for banks with a greater negative impact compared to those with a less negative impact. We find no systematic change in the riskiness of the asset portfolio or the growth rates of total assets, loans, and securities. We note that the qualifications identified above around timing and the resulting interpretation of the results likewise apply here.

4.2 Effect of MSR Provisions

The results above on the overall impact of the implementation of Basel III in the United States on capital ratios suggest that overall, there was no — or only a limited — response by banks following the release of the proposed rule in 2012. Indeed, for regional banks we document adjustments to bank capital in quarters prior to the release of the rule that correlated negatively with the Basel III impact, suggesting some degree of anticipation by banks of the effect of the proposed rules.

Having said that, one component of the implementation of Basel III in the United States that at the time received a strong response from interested parties was the treatment of MSRs. As we discuss above, in the proposed rule, MSR holdings were disadvantaged compared to the status quo in two main ways. First, there was a cap on the share of common equity tier 1 capital that could be made up of MSR assets. Second, risk weights on MSRs were increased to 250 percent for balances remaining after the 10 and 15 percent threshold deductions were applied.

Prior to the Basel III US implementation, MSRs had been limited to 100 percent of tier 1 capital. Banks were allowed to include the minimum value of 90 percent of the MSRs fair value or 100 percent of the MSRs amortized value in their regulatory capital, and the remaining amount not deducted received a 100 percent risk weight. The new treatment of MSRs under Basel III was considered punitive by market participants, who, among other issues, complained of disproportionate consequences for banks of different sizes, specifically the increased regulatory complexity due to the new treatment of MSRs that would be faced by community banks with total assets under $10 billion.[16] While these changes attracted many comments and complaints, suggesting, for example, that it would disadvantage US banks relative to rivals in other countries, the US regulators maintained both provisions in the final rule.[17]

Both changes disadvantage banks holding a larger amount of MSRs relative to capital compared to banks with a smaller exposure to MSRs in the calculation of regulatory capital ratios. To the extent that the stark response to the unfavorable treatment of MSRs in the Basel III rules suggests that this was not expected by banks, as argued, for example, in Irani et al. (2021), it presents a plausibly exogenous shock to banks with significant MSR exposure when the proposed rules were released in June 2012. We calculate the ratio of MSRs over tier 1 capital in June 2012 as a measure of the relative importance of MSRs to bank capital for individual banks and use this variable as a continuous treatment variable to our difference-in-differences regressions.

The results in Table 8 columns (1) to (3) suggest that for small banks the treatment of MSR had a noticeable effect on bank capital ratios. The quarter-by-quarter estimation of the effect suggests a positive relationship starting to phase in from about 2012 Q4 and stabilizing from around 2013 Q4 onward (see Figure 6). Decomposing the effect on tier 1 capital ratios shows that small banks with a greater share of MSRs increased tier 1 capital and the growth rate of total assets but decreased the riskiness of their portfolios (Table 9).

[16] For example, see comments obtained by federal agencies (https://www.bis.org/publ/bcbs164.htm), as well as the critique put forth by the Mortgage Bankers Association (https://www.federalreserve.gov/SECRS/2012/December/20121206/R-1442/R-1442_101712_109231_345804474500_1.pdf)

[17] For example, a 2016 report to Congress produced by the US agencies suggested that, unlike the US, most foreign countries had adopted mortgage finance systems that do not create a considerable volume of MSAs. See: https://www.federalreserve.gov/publications/other-reports/files/effect-capital-rules-mortgage-servicing-assets-201606.pdf

For regional banks, the results in Table 8 suggest a similarly statistically significant positive relationship between MSR exposure and tier 1 capital ratios following the release of the proposed rule. The quarter-by-quarter estimation of the effect finds that the response to MSR exposure on tier 1 capital ratios almost entirely takes place in the first few quarters after the release of the proposed rule (see Figure 7). This timing is different from the effects for the overall impact of the proposed rule in quarters prior to the publication reported in Section 4.1. This pattern is consistent with banks not expecting the extent of the unfavorable treatment of MSRs in the US implementation of Basel III or, alternatively, waiting until the rules were put in writing for the US, before responding. The result is nonetheless surprising given that much of the wording of the provisions concerning MSRs was already included in the BCBS framework published in 2010 (Basel Committee on Banking Supervision, 2009, see p.26, para 87-89) and the new rules did not become binding before the end of 2014.

Table 10 decomposes the effect on regional banks by considering the components of the tier 1 capital ratio as well as growth rates to components of the bank balance sheet. The results suggest that the positive relationship between MSR exposure and tier 1 capital ratios after the publication of the proposed rule was due to both a negative effect on risk-weighted assets (column (3)) and a slowing of growth in bank balance sheets overall (column (4)), and, in particular, for securities (column (6)).

5 Discussion and Conclusion

We have studied the response of US banks to changes introduced by the adoption of Basel III to the capital regulations applicable to them. Our key results concern the timing of banks' responses to the new capital regulation we study. We find that the regional banks in our sample that were more adversely impacted by the proposed rules adjusted their tier 1 capital ratios prior to the announcement of the specific rules proposed by the US bank regulators, which suggests that they were at least to some extent expected. Indeed, what is notable about that result is the extent to which the response stopped swiftly following the announcement of the new rules. We further zoom in on the effect that specific regulations concerning the treatment of MSRs had on banks. We find that both small and regional banks adjust their capital ratios and balance-sheet composition following the announcement of the new MSR rules, but not before. Banks with a greater share of MSRs on their balance sheets increased their tier 1 capital ratios relative to those with fewer MSRs.

Our findings emphasize the importance of the announcement of regulatory changes for the affected banks. The new ways of computing regulatory capital ratios under Basel III were not implemented until early 2015, and in many cases even later than that, and they were phased-in slowly. Thus, banks could have continued with their existing regulatory capital policy for a substantial time following the announcement

of the proposed rules in 2012. Instead, we find that banks do respond in measurable ways well before the full implementation of the new rules. This suggests that, in making decisions concerning their target levels of regulatory capital, banks respond to incentives beyond the direct constraint imposed by regulations in force. Such incentives might include discipline imposed by capital markets, which want to know on a forward-looking basis that a bank is well-positioned under the incoming regulations well before they take effect.

References

Acemoglu, **Daron**, **David H. Autor**, and **David Lyle** (2004). "Women, War, and Wages: The Effect of Female Labor Supply on the Wage Structure at Midcentury." *Journal of Political Economy* 112.3 (June 1, 2004), pp. 497–551. DOI: 10.1086/383100.

Acharya, **Viral V.**, **Allen N. Berger**, and **Raluca A. Roman** (2018). "Lending Implications of U.S. Bank Stress Tests: Costs or Benefits?" *Journal of Financial Intermediation* 34 (Apr. 2018), pp. 58–90. DOI: 10.1016/j.jfi.2018.01.004.

Aiyar, **Shekhar**, **Charles W. Calomiris**, **John Hooley**, **Yevgeniya Korniyenko**, and **Tomasz Wieladek** (2014). "The International Transmission of Bank Capital Requirements: Evidence from the UK." *Journal of Financial Economics* 113.3 (Sept. 1, 2014), pp. 368–382. DOI: 10.1016/j.jfineco.2014.05.003.

Arnould, **Guillaume**, **Benjamin Guin**, **Steven R. G. Ongena**, and **Paolo Siciliani** (2020). "(When) Do Banks React to Anticipated Capital Reliefs?" *SSRN Electronic Journal*. DOI: 10.2139/ssrn.3733513.

Auer, **Raphael**, **Alexandra Matyunina**, and **Steven Ongena** (2022). "The Countercyclical Capital Buffer and the Composition of Bank Lending." *Journal of Financial Intermediation* (Feb. 2022), p. 100965. DOI: 10.1016/j.jfi.2022.100965.

Basel Committee on Banking Supervision (2009). *International Framework for Liquidity Risk Measurement, Standards and Monitoring*. Dec. 2009.

Berrospide, **Jose M.** and **Rochelle M. Edge** (2016). *The Effects of Bank Capital Requirements on Bank Lending: What Can We Learn from the Post-crisis Regulatory Reforms*. Dec. 15, 2016.

Berrospide, **Jose M.** and **Rochelle M. Edge** (2019). "The Effects of Bank Capital Buffers on Bank Lending and Firm Activity: What Can We Learn from Five Years of Stress-Test Results?" *Finance and Economics Discussion Series* 2019-050 (July 2019). DOI: 10.17016/FEDS.2019.050.

Board of Governors of the Federal Reserve System (2012). *Testimony by Michael S. Gibson, Director, Division of Banking Supervision and Regulation, on Basel III*. Nov. 14, 2012.

Buchak, **Greg**, **Gregor Matvos**, **Tomasz Piskorski**, and **Amit Seru** (2018). "Fintech, Regulatory Arbitrage, and the Rise of Shadow Banks." *Journal of Financial Economics* 130.3 (Dec. 1, 2018), pp. 453–483. DOI: 10.1016/j.jfineco.2018.03.011.

Callaway, **Brantly**, **Andrew Goodman-Bacon**, and **Pedro H. C. Sant'Anna** (2021). "Difference-in-Differences with a Continuous Treatment." July 9, 2021. arXiv: 2107.02637 [econ].

Cortés, **Kristle R.**, **Yuliya Demyanyk**, **Lei Li**, **Elena Loutskina**, and **Philip E. Strahan** (2020). "Stress Tests and Small Business Lending." *Journal of Financial Economics* 136.1 (Apr. 2020), pp. 260–279. DOI: 10.1016/j.jfineco.2019.08.008.

Doerr, **Sebastian** (2021). "Stress Tests, Entrepreneurship, and Innovation." *Review of Finance* 25.5 (Oct. 7, 2021), pp. 1609–1637. DOI: 10.1093/rof/rfab007.

Fraisse, **Henri**, **Mathias Lé**, and **David Thesmar** (2020). "The Real Effects of Bank Capital Requirements." *Management Science* 66.1 (Jan. 2020), pp. 5–23. DOI: 10.1287/mnsc.2018.3222.

Francis, **William B.** and **Matthew Osborne** (2012). "Capital Requirements and Bank Behavior in the UK: Are There Lessons for International Capital Standards?" *Journal of Banking & Finance*. Perspectives on International and Corporate Finance 36.3 (Mar. 1, 2012), pp. 803–816. DOI: 10.1016/j.jbankfin.2011.09.011.

Gropp, **Reint**, **Thomas Mosk**, **Steven Ongena**, and **Carlo Wix** (2019). "Banks Response to Higher Capital Requirements: Evidence from a Quasi-Natural Experiment." *The Review of Financial Studies* 32.1 (Jan. 1, 2019), pp. 266–299. DOI: 10.1093/rfs/hhy052.

Gropp, **Reint**, **Thomas C. Mosk**, **Steven R. G. Ongena**, **Carlo Wix**, and **Ines Simac** (2020). "Supranational Rules, National Discretion: Increasing versus Inflating Regulatory Bank Capital?" *SSRN Electronic Journal*. DOI: 10.2139/ssrn.3731333.

Imbierowicz, **Björn**, **Jonas Kragh**, and **Jesper Rangvid** (2018). "Time-Varying Capital Requirements and Disclosure Rules: Effects on Capitalization and Lending Decisions." *Journal of Money, Credit and Banking* 50.4 (June 2018), pp. 573–602. DOI: 10.1111/jmcb.12506.

Irani, **Rustom M**, **Rajkamal Iyer**, **Ralf R Meisenzahl**, and **José-Luis Peydró** (2021). "The Rise of Shadow Banking: Evidence from Capital Regulation." *The Review of Financial Studies* 34.5 (Apr. 16, 2021), pp. 2181–2235. DOI: 10.1093/rfs/hhaa106.

Jiménez, **Gabriel**, **Steven Ongena**, **José-Luis Peydró**, and **Jesús Saurina** (2017). "Macroprudential Policy, Countercyclical Bank Capital Buffers, and Credit Supply: Evidence from the Spanish Dynamic Provisioning Experiments." *Journal of Political Economy* 125.6 (Aug. 7, 2017), pp. 2126–2177. DOI: 10.1086/694289.

Khwaja, **Asim Ijaz** and **Atif Mian** (2008). "Tracing the Impact of Bank Liquidity Shocks: Evidence from an Emerging Market." *American Economic Review* 98.4 (Aug. 2008), pp. 1413–1442. DOI: 10/b2zrxg.

Kok, **Christoffer**, **Carola Müller**, **Steven Ongena**, and **Cosimo Pancaro** (2021). "The Disciplining Effect of Supervisory Scrutiny in the EU-wide Stress Test." *ECB Working Paper* (No 2551 May 2021). DOI: 10.2866/196362.

Mésonnier, **Jean-Stéphane** and **Allen Monks** (2015). "Did the EBA Capital Exercise Cause a Credit Crunch in the Euro Area?" *International Journal of Central Banking* 11.3 (June 2015), pp. 75–117.

Shahhosseini, **Mehrnoush** (2020). *Capital Requirements and Banks' Behavior: Evidence from Bank Stress Tests*. Nov. 19, 2020, p. 47.

Appendix

A Figures

Figure 1: Timeline of Basel III Capital Regulation in the US

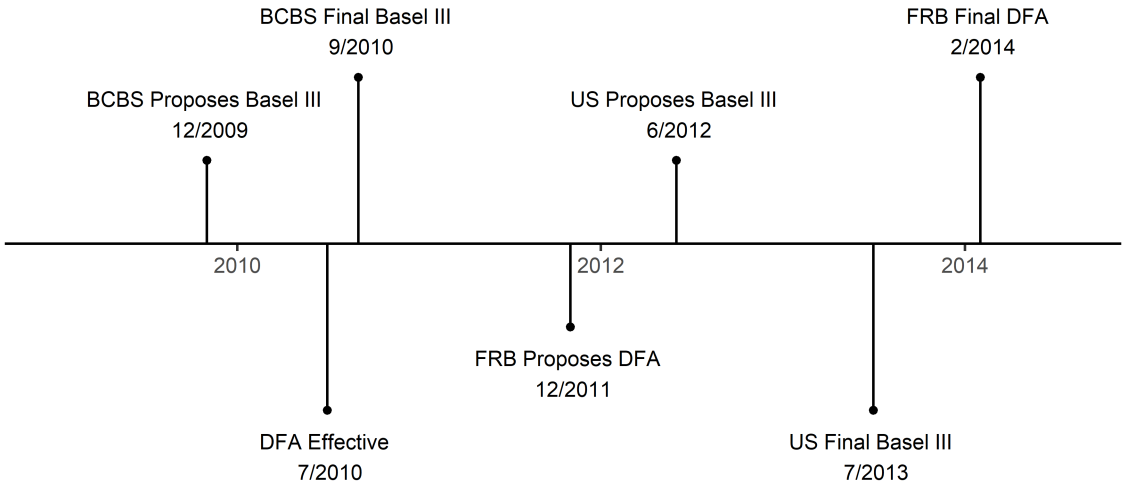


Figure 2: Tier 1 Capital Ratios over Time

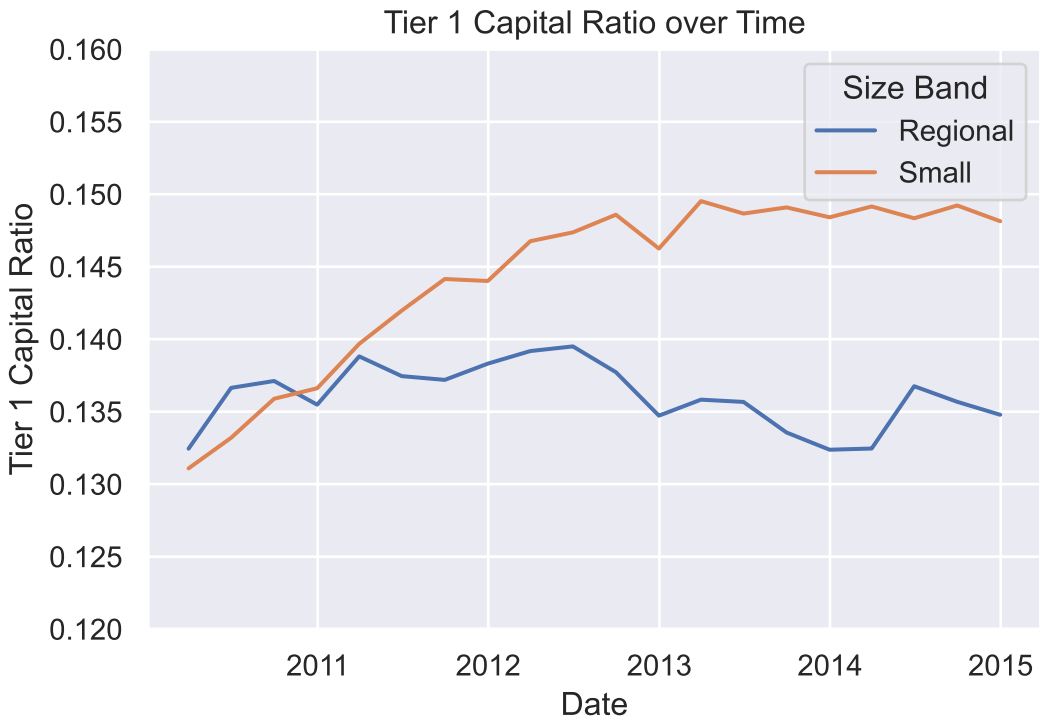


Figure 3: Proposed Regulation Impact on Tier 1 Capital Ratio

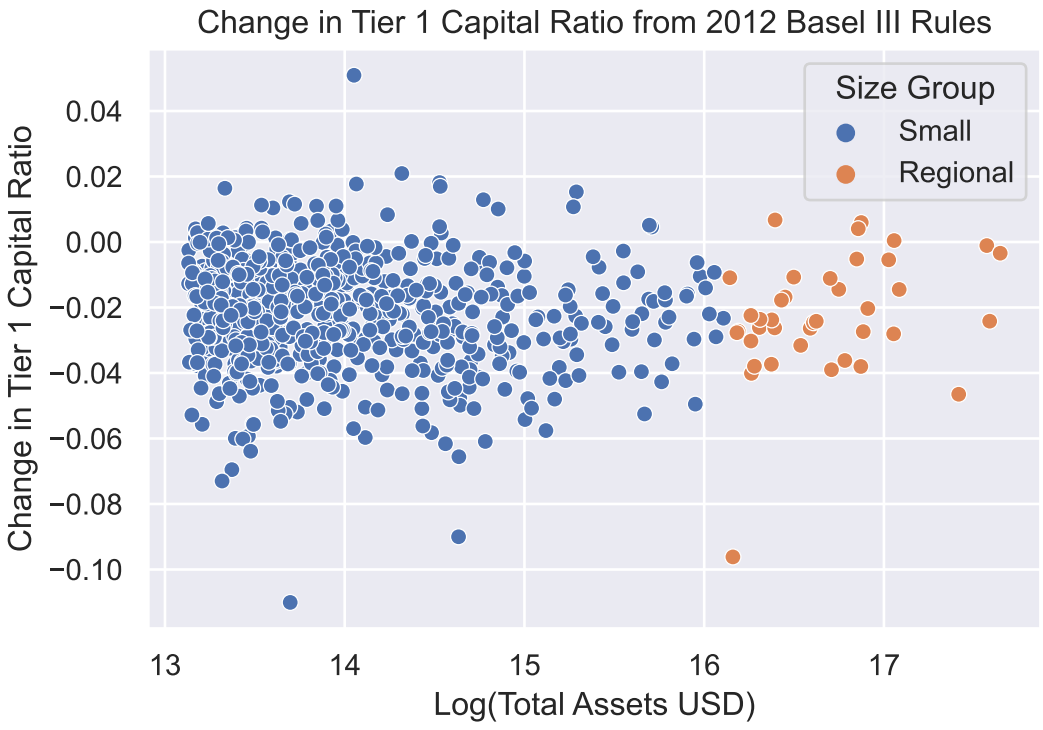


Figure 4: Effect of Tier 1 Ratio Impact by Quarter — Small

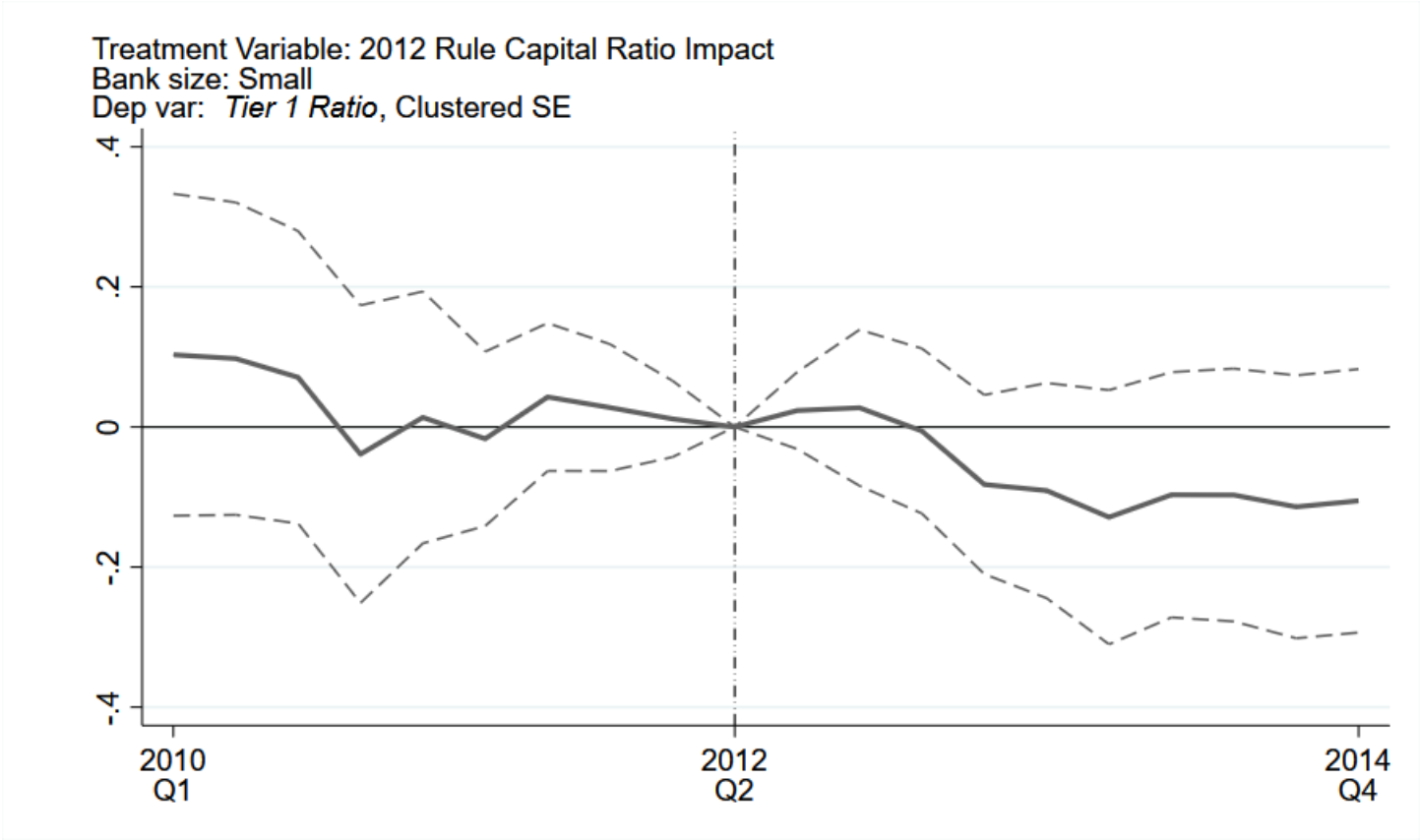


Figure 5: Effect of Tier 1 Ratio Impact by Quarter — Regional

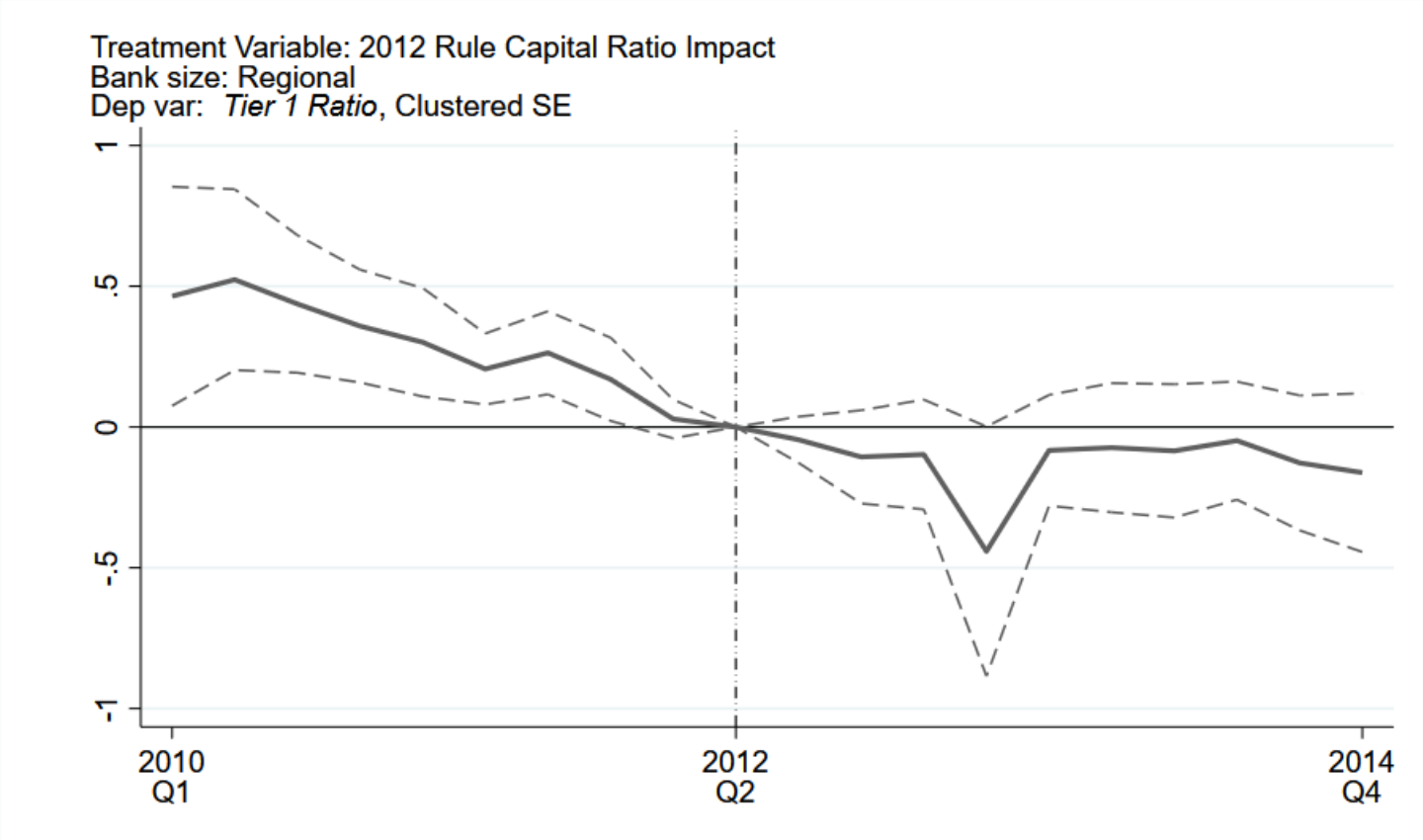


Figure 6: Effect of MSR Share by Quarter — Small

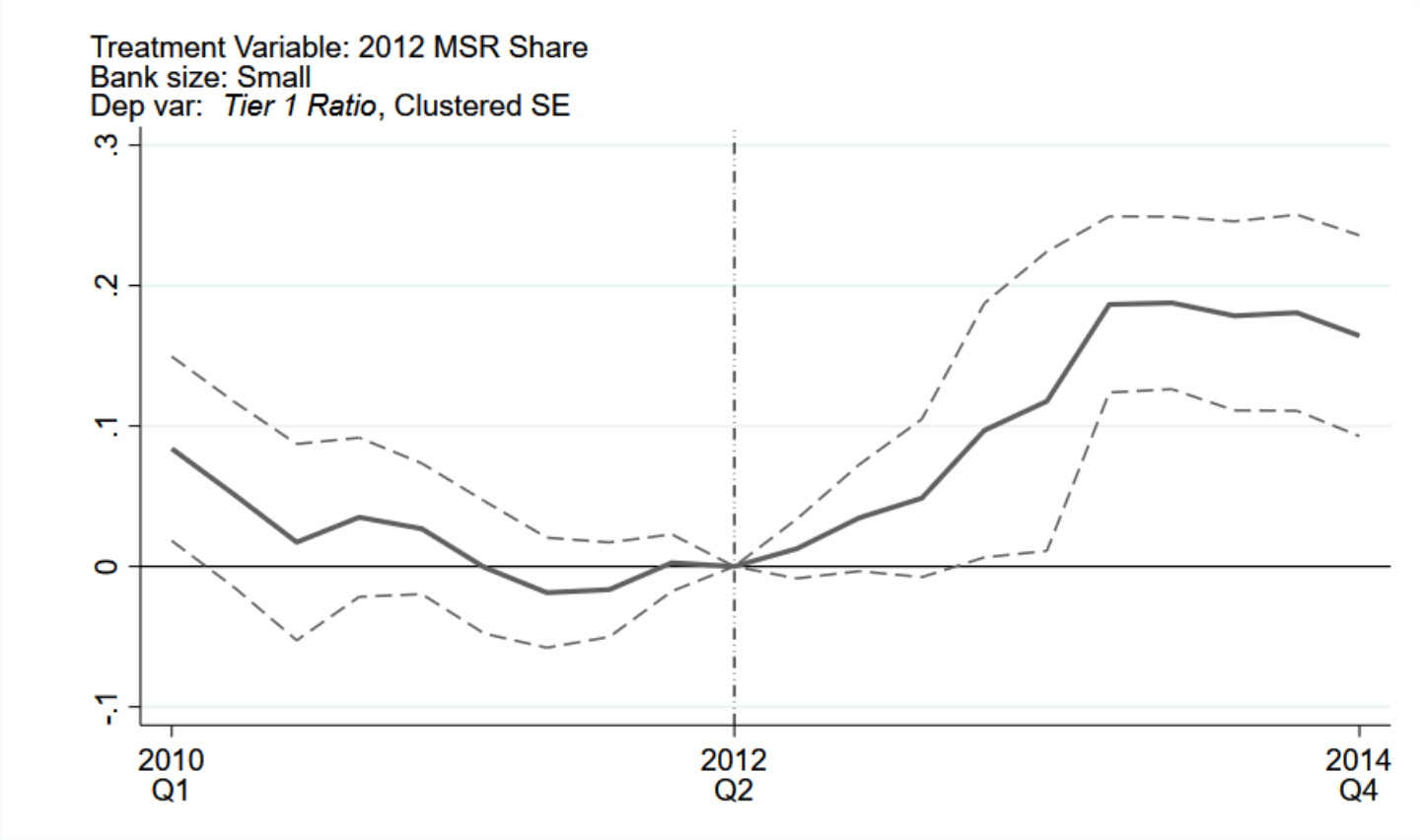
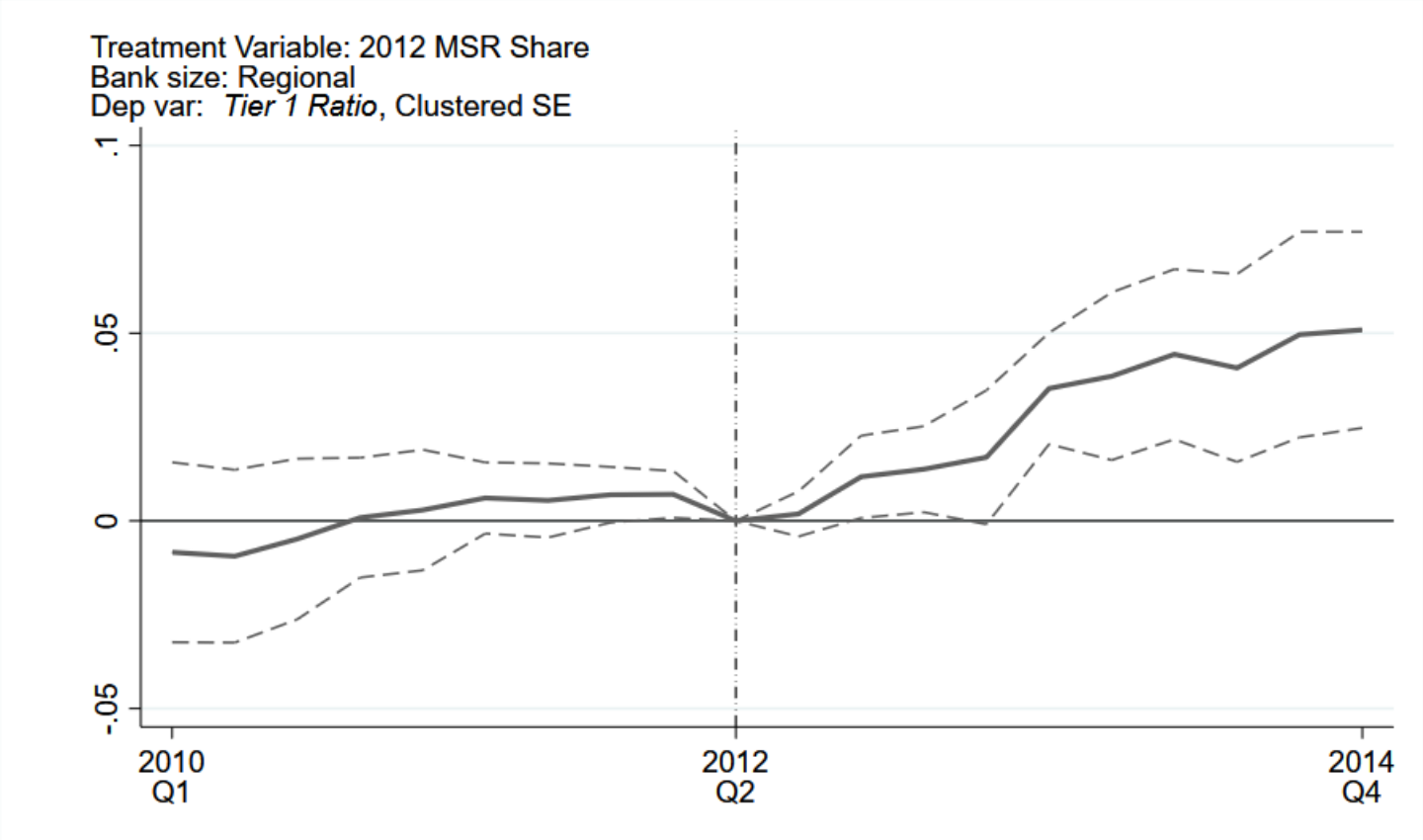


Figure 7: Effect of MSR Share by Quarter — Regional



B Tables

Table 1: Summary Statistics — Small Banks

	Full Sample	Mean By Announcement		
	Mean	Before	After	Difference
After Rule	0.500	0	1	1
	(0.500)	(0)	(0)	(0)
Tier 1 Ratio	0.121	0.117	0.126	0.00862***
	(0.0628)	(0.0604)	(0.0649)	(0.00108)
Tier 1 / Total Assets	0.0969	0.0941	0.0996	0.00548***
	(0.0325)	(0.0322)	(0.0325)	(0.000557)
RWA / Total Assets	0.694	0.694	0.693	-0.00144
	(0.110)	(0.108)	(0.112)	(0.00189)
Log Total Assets	13.99	13.95	14.04	0.0915***
	(0.701)	(0.679)	(0.719)	(0.0120)
Δ Log Total Assets	0.00978	0.00675	0.0128	0.00603***
	(0.0482)	(0.0452)	(0.0507)	(0.000828)
Δ Log Loans	0.00778	-0.00226	0.0178	0.0200***
	(0.0502)	(0.0446)	(0.0534)	(0.000848)
Δ Log Securities	0.0164	0.0263	0.00645	-0.0199***
	(0.144)	(0.152)	(0.134)	(0.00248)
Observations	13500	6750	6750	13500

Summary statistics show standard deviations in parentheses.

Difference column reports t-test results with standard errors in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2: Summary Statistics — Regional Banks

	Full Sample	Mean By Announcement		
	Mean	Before	After	Difference
After Rule	0.500	0	1	1
	(0.500)	(0)	(0)	(0)
Tier 1 Ratio	0.114	0.114	0.115	0.00112
	(0.0294)	(0.0298)	(0.0290)	(0.00211)
Tier 1 / Total Assets	0.0921	0.0903	0.0939	0.00359**
	(0.0253)	(0.0225)	(0.0278)	(0.00181)
RWA / Total Assets	0.686	0.668	0.704	0.0365***
	(0.120)	(0.112)	(0.124)	(0.00848)
Log Total Assets	16.69	16.63	16.75	0.128***
	(0.435)	(0.441)	(0.420)	(0.0309)
Δ Log Total Assets	0.0133	0.00995	0.0166	0.00664
	(0.0582)	(0.0588)	(0.0574)	(0.00416)
Δ Log Loans	0.0151	0.00728	0.0229	0.0156***
	(0.0550)	(0.0567)	(0.0521)	(0.00390)
Δ Log Securities	0.0106	0.0119	0.00931	-0.00261
	(0.115)	(0.136)	(0.0904)	(0.00827)
Observations	780	390	390	780

Summary statistics show standard deviations in parentheses.

Difference column reports t-test results with standard errors in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3: Treatment Variables — Small Banks

	Mean	Standard Deviation
2012 Rule Capital Ratio Impact	-0.021	(0.016)
2012 MSR Share	0.007	(0.021)
Observations	675	

Table 4: Treatment Variables — Regional Banks

	Mean	Standard Deviation
2012 Rule Capital Ratio Impact	-0.023	(0.018)
2012 MSR Share	0.023	(0.079)
Observations	39	

Table 5: Effect of Regulatory Capital Change from Basel III Proposed Rule on Tier 1 Capital Ratios

	(1)	(2)	(3)	(4)	(5)	(6)
After Rule × 2012 Rule Capital Ratio Impact	-0.0982			-0.402***		
	(0.108)			(0.102)		
2010 Q1 × 2012 Rule Capital Ratio Impact			0.103			0.464**
			(0.117)			(0.192)
2010 Q2 × 2012 Rule Capital Ratio Impact			0.0976			0.523***
			(0.114)			(0.159)
2010 Q3 × 2012 Rule Capital Ratio Impact			0.0709			0.437***
			(0.106)			(0.121)
2010 Q4 × 2012 Rule Capital Ratio Impact			-0.0388			0.358***
			(0.108)			(0.0990)
2011 Q1 × 2012 Rule Capital Ratio Impact			0.0137			0.301***
			(0.0916)			(0.0952)
2011 Q2 × 2012 Rule Capital Ratio Impact			-0.0169			0.206***
			(0.0634)			(0.0622)
2011 Q3 × 2012 Rule Capital Ratio Impact			0.0428			0.264***
			(0.0537)			(0.0729)
2011 Q4 × 2012 Rule Capital Ratio Impact			0.0277			0.170**
			(0.0461)			(0.0730)
2012 Q1 × 2012 Rule Capital Ratio Impact			0.0116			0.0285
			(0.0278)			(0.0339)
2012 Q3 × 2012 Rule Capital Ratio Impact		-0.00774	0.0234		-0.320***	-0.0451
		(0.0828)	(0.0280)		(0.0888)	(0.0406)
2012 Q4 × 2012 Rule Capital Ratio Impact		-0.00373	0.0274		-0.382***	-0.106
		(0.101)	(0.0567)		(0.116)	(0.0818)
2013 Q1 × 2012 Rule Capital Ratio Impact		-0.0369	-0.00575		-0.373***	-0.0976
		(0.105)	(0.0600)		(0.129)	(0.0963)
2013 Q2 × 2012 Rule Capital Ratio Impact		-0.113	-0.0822		-0.717***	-0.442*
		(0.0977)	(0.0651)		(0.257)	(0.219)
2013 Q3 × 2012 Rule Capital Ratio Impact		-0.122	-0.0908		-0.358***	-0.0830
		(0.110)	(0.0782)		(0.126)	(0.0972)
2013 Q4 × 2012 Rule Capital Ratio Impact		-0.160	-0.129		-0.349***	-0.0734
		(0.119)	(0.0924)		(0.116)	(0.113)
2014 Q1 × 2012 Rule Capital Ratio Impact		-0.128	-0.0968		-0.360***	-0.0846
		(0.121)	(0.0892)		(0.114)	(0.117)
2014 Q2 × 2012 Rule Capital Ratio Impact		-0.128	-0.0971		-0.324***	-0.0484
		(0.130)	(0.0919)		(0.102)	(0.104)
2014 Q3 × 2012 Rule Capital Ratio Impact		-0.145	-0.114		-0.403***	-0.128
		(0.132)	(0.0956)		(0.116)	(0.118)
2014 Q4 × 2012 Rule Capital Ratio Impact		-0.137	-0.105		-0.437***	-0.162
		(0.133)	(0.0958)		(0.128)	(0.139)
Constant	0.126***	0.126***	0.126***	0.117***	0.117***	0.117***
	(0.000575)	(0.000575)	(0.000575)	(0.00159)	(0.00160)	(0.00138)
Obs	13500	13500	13500	780	780	780
R-squared	0.0940	0.0950	0.0956	0.0970	0.107	0.130
Adj R-squared	0.0927	0.0930	0.0930	0.0732	0.0723	0.0852
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	Yes	Yes	Yes	Yes	Yes	Yes
Sample	Small	Small	Small	Regional	Regional	Regional

Standard errors in parentheses
2012 Q2 is the base period in regressions with quarter-by-quarter effects.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Decomposition of Regulatory Capital Effect — Small Banks

	(1) Tier 1 Ratio	(2) Tier 1 / Total Assets	(3) RWA / Total Assets	(4) Δ Log Total Assets	(5) Δ Log Loans	(6) Δ Log Securities
After Rule × 2012 Rule Capital Ratio Impact	-0.0982	-0.0805*	-0.0542	-0.144***	-0.136*	-0.351**
	(0.108)	(0.0451)	(0.138)	(0.0459)	(0.0753)	(0.155)
Constant	0.126***	0.0968***	0.681***	0.00130	0.0123***	-0.00336
	(0.000575)	(0.000319)	(0.00102)	(0.00149)	(0.00123)	(0.00429)
Obs	13500	13500	13500	13462	13462	13462
R-squared	0.0940	0.0802	0.105	0.0284	0.0781	0.0181
Adj R-squared	0.0927	0.0789	0.103	0.0270	0.0768	0.0166
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	Yes	Yes	Yes	Yes	Yes	Yes
Sample	Small	Small	Small	Small	Small	Small

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Decomposition of Regulatory Capital Effect — Regional Banks

	(1) Tier 1 Ratio	(2) Tier 1 / Total Assets	(3) RWA / Total Assets	(4) Δ Log Total Assets	(5) Δ Log Loans	(6) Δ Log Securities
After Rule × 2012 Rule Capital Ratio Impact	-0.402***	-0.399*	-0.242	0.0612	-0.00778	-0.0880
	(0.102)	(0.223)	(0.656)	(0.157)	(0.148)	(0.429)
Constant	0.117***	0.0932***	0.679***	0.00124	0.0147***	-0.0570***
	(0.00159)	(0.00116)	(0.00334)	(0.00348)	(0.00341)	(0.0183)
Obs	780	780	780	780	780	780
R-squared	0.0970	0.148	0.273	0.0333	0.0637	0.0477
Adj R-squared	0.0732	0.125	0.254	0.00785	0.0390	0.0226
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	Yes	Yes	Yes	Yes	Yes	Yes
Sample	Regional	Regional	Regional	Regional	Regional	Regional

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: Effect of MSR Share on Tier 1 Capital Ratios

	(1)	(2)	(3)	(4)	(5)	(6)
After Rule × 2012 MSR Share	0.103***			0.0297***		
	(0.0368)			(0.00836)		
2010 Q1 × 2012 MSR Share			0.0839**			-0.00838
			(0.0334)			(0.0118)
2010 Q2 × 2012 MSR Share			0.0512			-0.00942
			(0.0337)			(0.0114)
2010 Q3 × 2012 MSR Share			0.0173			-0.00483
			(0.0356)			(0.0106)
2010 Q4 × 2012 MSR Share			0.0350			0.000843
			(0.0288)			(0.00788)
2011 Q1 × 2012 MSR Share			0.0269			0.00288
			(0.0237)			(0.00794)
2011 Q2 × 2012 MSR Share			-0.000613			0.00609
			(0.0240)			(0.00468)
2011 Q3 × 2012 MSR Share			-0.0187			0.00543
			(0.0200)			(0.00488)
2011 Q4 × 2012 MSR Share			-0.0166			0.00695*
			(0.0171)			(0.00366)
2012 Q1 × 2012 MSR Share			0.00260			0.00707**
			(0.0103)			(0.00308)
2012 Q3 × 2012 MSR Share		-0.00549	0.0126		0.00118	0.00185
		(0.0272)	(0.0108)		(0.00578)	(0.00297)
2012 Q4 × 2012 MSR Share		0.0165	0.0346*		0.0111	0.0117**
		(0.0313)	(0.0193)		(0.00698)	(0.00542)
2013 Q1 × 2012 MSR Share		0.0305	0.0486*		0.0131*	0.0138**
		(0.0406)	(0.0287)		(0.00713)	(0.00566)
2013 Q2 × 2012 MSR Share		0.0788	0.0969**		0.0163	0.0169*
		(0.0557)	(0.0461)		(0.0109)	(0.00882)
2013 Q3 × 2012 MSR Share		0.0995	0.118**		0.0346***	0.0353***
		(0.0640)	(0.0543)		(0.00801)	(0.00733)
2013 Q4 × 2012 MSR Share		0.168***	0.187***		0.0379***	0.0385***
		(0.0394)	(0.0319)		(0.0106)	(0.0110)
2014 Q1 × 2012 MSR Share		0.170***	0.188***		0.0437***	0.0444***
		(0.0391)	(0.0313)		(0.0108)	(0.0112)
2014 Q2 × 2012 MSR Share		0.160***	0.178***		0.0401***	0.0407***
		(0.0411)	(0.0343)		(0.0117)	(0.0124)
2014 Q3 × 2012 MSR Share		0.163***	0.181***		0.0490***	0.0496***
		(0.0413)	(0.0356)		(0.0130)	(0.0135)
2014 Q4 × 2012 MSR Share		0.146***	0.164***		0.0502***	0.0509***
		(0.0405)	(0.0364)		(0.0127)	(0.0129)
Constant	0.126***	0.126***	0.126***	0.117***	0.117***	0.117***
	(0.000572)	(0.000572)	(0.000572)	(0.00136)	(0.00137)	(0.00138)
Obs	13500	13500	13500	780	780	780
R-squared	0.0952	0.0973	0.0977	0.0383	0.0426	0.0431
Adj R-squared	0.0938	0.0953	0.0952	0.0130	0.00557	-0.00595
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	Yes	Yes	Yes	Yes	Yes	Yes
Sample	Small	Small	Small	Regional	Regional	Regional

Standard errors in parentheses
2012 Q2 is the base period in regressions with quarter-by-quarter effects.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9: Decomposition of MSR Effect — Small Banks

	(1) Tier 1 Ratio	(2) Tier 1 / Total Assets	(3) RWA / Total Assets	(4) Δ Log Total Assets	(5) Δ Log Loans	(6) Δ Log Securities
After Rule × 2012 MSR Share	0.103***	0.0492**	-0.176**	0.0711**	0.0892	-0.130
	(0.0368)	(0.0242)	(0.0853)	(0.0351)	(0.0581)	(0.207)
Constant	0.126***	0.0968***	0.681***	0.00130	0.0123***	-0.00336
	(0.000572)	(0.000314)	(0.00102)	(0.00149)	(0.00123)	(0.00429)
Obs	13500	13500	13500	13462	13462	13462
R-squared	0.0952	0.0790	0.107	0.0280	0.0780	0.0178
Adj R-squared	0.0938	0.0776	0.105	0.0266	0.0766	0.0163
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	Yes	Yes	Yes	Yes	Yes	Yes
Sample	Small	Small	Small	Small	Small	Small

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 10: Decomposition of MSR Effect — Regional Banks

	(1) Tier 1 Ratio	(2) Tier 1 / Total Assets	(3) RWA / Total Assets	(4) Δ Log Total Assets	(5) Δ Log Loans	(6) Δ Log Securities
After Rule × 2012 MSR Share	0.0297***	0.000303	-0.195***	-0.0350***	-0.0157	-0.108***
	(0.00836)	(0.00713)	(0.0372)	(0.0110)	(0.0121)	(0.0261)
Constant	0.117***	0.0932***	0.679***	0.00124	0.0147***	-0.0570***
	(0.00136)	(0.00101)	(0.00382)	(0.00345)	(0.00337)	(0.0183)
Obs	780	780	780	780	780	780
R-squared	0.0383	0.0499	0.304	0.0338	0.0639	0.0491
Adj R-squared	0.0130	0.0248	0.286	0.00839	0.0392	0.0240
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	Yes	Yes	Yes	Yes	Yes	Yes
Sample	Regional	Regional	Regional	Regional	Regional	Regional

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$