Regulatory Changes and Bank Equity Risk: The CAPM Cost of Capital and Lending Supply*

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Abstract

Regulation has changed the cost of capital for banks. Since the passage of the Dodd-Frank Act, banks' value-weighted CAPM cost of capital has averaged 10.5% and declined by more than 4% relative to non-banks on a within-firm basis. This decrease has been driven by the very largest stress-tested banks and was much greater for larger banks than for smaller banks. We find that these changes in the systematic risk of bank equity have real economic consequences – increases in banks' cost of capital are associated with tightening in credit supply and loan rates.

Keywords: Cost of Capital, Beta, Bank Regulation, Dodd-Frank Act, Banks
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1 Introduction

The cost of capital for banks drives lending amounts, borrowing rates, and thus real economic activity.[1] Bank managers seek to earn or outperform their cost of capital. In this paper, we calculate the CAPM cost of capital for banks over the last twenty years and link this cost to bank lending supply. We find that, in net, regulations enacted after the the financial crisis have significantly lowered the CAPM cost of capital for banks relative to the all-time highs experienced during the crisis. Since these results are driven by time series changes in equity betas, an additional interpretation is that the systematic risk of the banking industry has fallen in the post-Dodd-Frank period. These changes to the systematic risk of bank equity matter. When the CAPM cost of capital falls, we find that banks expand credit supply and ease lending terms to borrowers.

The first contribution of this paper is to estimate the CAPM cost of capital and examine how it has changed with bank regulation. In order to separate the effects of regulation from market wide changes in interest rates and the business cycle, we employ a difference-in-differences approach that compares changes in the cost of capital for banks and non-banks across periods that are separated by key dates in bank regulation including the: Gramm-Leach-Bliley Act (November 1999), Financial Crisis (January 2007), Supervisory Capital Assessment Program (May 2009), and Dodd-Frank Act (July 2010).

We find that banks' value-weighted CAPM cost of capital soared to over 15% during the financial crisis, but then declined by 4.5% relative to non-banks after the passage of the Dodd-Frank Act (DFA) to 10.5%. At the same time, when we compare the post-DFA period to the pre-Gramm-Leach-Bliley (GLB) period of the late 1990s, we estimate that banks' cost of capital has increased by 1-2% relative to non-banks after controlling for changes in

[1] See, for example, Cummins et al. (1994), Bernanke et al. (1996), Philippon (2009), Gilchrist et al. (2013), and Brunnermeier and Sannikov (2014).

the risk-free rate. To confirm that we are capturing regulation, we also compare banks to non-bank financial intermediaries, a control group of firms with business models that are closely related to banks but that are not directly affected by changes to bank regulation. As before, we find that banks' relative cost of capital has declined since DFA but increased since the pre-GLB period. One interpretation of these results is that post-crisis decreases in systematic risk may have been partially offset by lower expectations of government insurance, resulting in a higher cost of capital for banks relative to the late 1990s (Gandhi and Lustig 2015; Atkeson et al. 2018).

As a further test that we are capturing the impact of regulation on the cost of capital, we compare changes for the very largest banks relative to smaller banks to changes for non-banks of different sizes. This analysis is particularly relevant when estimating the impact of the DFA, which includes several provisions that specifically affect the largest banks. We find that large banks drive the differential changes in the cost of capital over time. Since the passage of the DFA, the CAPM cost of capital for large banks has differentially declined by 3-4% relative to post-crisis highs and by 0-2% relative to the pre-GLB period. In particular, large banks' cost of capital is either unchanged or lower relative to the late 1990s, not higher as for the banking industry in aggregate. Within this set of very largest banks, we also study the impact of stress testing on the cost of capital by following the identification approach in Flannery et al. (2017) that exploits the staggered implementation of stress testing for banks with more than $50 billion in assets. Consistent with the hypothesis that stress testing lowers systematic risk, we find that the cost of capital has declined the most for the largest stress-tested banks that were originally subject to SCAP.

Our analysis and the difference-in-differences results highlight the importance of the comparison period and the comparison set of companies when measuring changes in the cost of capital. For example, Sarin and Summers (2016) compare a pre-crisis period from

2002-2007 to a post-crisis period from 2010-2015 and find that the CAPM cost of capital has increased for large banks. Their conclusions are driven, in part, by the unusually low cost of capital estimates for banks in the years leading up to the financial crisis.

This paper also builds on the substantial literature that studies how market measures such as Tobin's q are related to regulation and bank characteristics such as asset size, the value of intangibles, and the composition of bank assets (Calomiris and Nissim 2014; Minton et al. 2017; Huizinga and Laeven 2012). To explore the importance of bank characteristics in our setting, we add controls for asset mix, leverage, and liquidity to our difference-in-differences regressions. We find that characteristics have little explanatory power for banks' CAPM cost of capital on average, but that conditional controls do provide some evidence of time-varying relationships. The strongest association occurs for risk-weighted assets (RWA) in the aftermath of the crisis when a one standard deviation increase in RWA is associated with a 1% increase in the cost of capital. This result appears to be driven by changes in the pricing of loans and loan commitments, particularly real estate loans. After the Dodd-Frank Act, the association with RWA falls, which explains most of the post-financial crisis fall in the cost of capital for banks. This result does not explain the fall in cost of capital for the largest banks, however. Even after including time-varying controls, we still find a significant decline in the post-DFA cost of capital for the largest banks, consistent with the interpretation that regulation has lowered the systematic risk for the largest banks.

The second contribution of the paper is to document how changes in banks' CAPM cost of capital matter for the real economy. This analysis contributes to the literature that studies the real effects of bank regulation (Kroszner and Strahan 2014). Rather than propose a new factor to predict stock returns or a new method to estimate the cost of capital, we focus on the CAPM because it is a benchmark single-factor equilibrium model that is easy to interpret. The CAPM also serves as an important reference point because it is used in practice by managers, investors, and lawyers (Graham and Harvey 2001; Berk and van Binsbergen 2016; Gilson et al. 2000). For non-financials, firm-level investment is sensitive to the cost of debt and the weighted average cost of capital (Philippon 2009; Gilchrist and Zakrajšek 2012; Frank and Shen 2016). Anecdotally, the cost of capital matters for banks because managers use cost of capital estimates to allocate capital across divisions and because bank CEOs cite the need to meet investors' return on equity targets, as illustrated, for example, in annual reports. To our knowledge, our study is the first to investigate this hypothesis empirically by relating bank-level CAPM cost of capital estimates to bank lending supply.

We establish this link by making use of confidential bank level survey response data from the Senior Loan Officer Opinion Survey (SLOOS), a survey commonly used to measure banks' willingness to lend that allows us to separate credit supply and demand effects (Lown and Morgan 2006; Hirtle 2009; Bassett et al. 2014; DeYoung et al. 2015). We find that changes in the cost of capital are associated with changes in both the supply and the pricing of credit. This result holds in aggregate for the panel of surveyed banks as well as in the cross section. The relationship between the cost of capital and lending conditions is not just driven by the business cycle, bank profitability, or the level of interest rates – our results hold after adjusting for changes in the risk free rate, controlling for business cycle variation, and for bank-level stock market returns to control for firm-specific shocks. When banks' cost of capital increases, bank managers tighten loan standards and increase loan spreads. Through this channel, lower CAPM costs of capital after DFA are passed through to the real economy.

When interpreting these results, one qualification is that factor-based cost of capital estimates only describe expected returns in an economy where investors price the systematic risk of the proposed factors (Merton 1973; Ross 1976). Numerous prior studies have criticized the CAPM for the low-risk anomaly. Stocks with high (low) equity betas have historically earned lower (higher) returns than predicted by the CAPM (Black et al. 1972; Frazzini and Pedersen 2014; Baker and Wurgler 2015). This is a concern in our setting as mismeasurement of expected returns that is correlated with the business cycle may bias our results. To account for this, we provide a range of robustness checks and repeat our main regression specifications using multi-factor cost of capital estimates, CAPM cost of capital estimates with a time-varying equity risk premium, log changes in CAPM betas that difference out the equity risk premium, and asset betas[2] (Merton 1974; Fama and French 1993; Schuermann and Stiroh 2006; Adrian et al. 2015). Across measures, we consistently find a decrease in the cost of capital for the largest banks since the passage of the DFA. By some measures, we also estimate that the largest banks' cost of capital has differentially fallen post-DFA relative to the levels that prevailed in the late 1990s.

2 Estimating the cost of capital

2.1 CAPM cost of capital

The cost of capital reflects the expected return of equity investors as well as the time value of money as captured by the risk-free rate. Empirically, expected stock returns are not observed. Instead, we must rely on economic or statistical models to estimate expected returns. As a result, any test regarding the cost of capital is a joint test of the null hypothesis and the model that is used to estimate expected returns (Fama 1970).

Our analysis focuses on the CAPM cost of capital which we define as,

$$CAPM_{i,t} = Rf_t + \beta_{i,t} \cdot \mu. \tag{1}$$

[2]In comparison to the CAPM, multi-factor models have been criticized for poor out-of-sample performance and for data snooping (Linnainmaa and Roberts 2016; Harvey et al. 2016). Larger models also have the disadvantage that they may be harder for managers to interpret.

The first term is the risk-free rate Rf_t. The second term is a time-varying CAPM beta $\beta_{i,t}$. The last term is the equity risk premium μ, which we assume is constant.[3] We set the risk-free rate to the three-month Treasury bill rate and the equity risk premium to 8%, the average CRSP value-weighted excess return from 1926 to 2017. The betas are estimated from one-year rolling regressions of firm-level daily excess returns onto market excess returns. The market return is the CRSP value-weighted return obtained from Ken French's website. The estimates are ex-ante betas in the sense that each month the beta is computed using lagged daily data over the previous 252 trading days. We use an ex-ante approach in order to approximate manager estimates of their cost of capital.

A number of alternative choices can be made when estimating betas. For example, to name a few methods from a large literature, betas can be estimated from five-year rolling regressions with monthly data, one-year rolling regressions with daily data, or directly from volatility and correlation estimates.[4] Betas may also use lagged, centered, or forward data depending on the application. Given our interest in how the cost of capital has varied over time, we prefer using daily data (252 observations per year) to deliver more precise and less biased estimates in comparison to slow moving estimates from monthly data (60 observations per five years).

An implication of this approach is that we rely on the time-series and cross-sectional differences in betas to identify changes in the cost of capital. If the CAPM holds and the market risk premium is roughly constant over our periods of interest, time variation in betas

[3]Betas can be estimated precisely with high frequency data. In contrast, the equity risk premium is notoriously difficult to estimate. Even with a constant risk premium and log-normal returns, it would take over forty years to estimate the equity risk premium with a standard error of 3% (Merton 1980). This imprecision dominates the uncertainty in estimating expected returns in factor model settings (Fama and French 1997). Empirically, Welch and Goyal (2007) find that many models underperform the historical mean and are unstable out of sample. Based on this observation and for simplicity, we assume the equity risk premium is a constant equal to the historical mean in our baseline analysis. We relax this assumption in Section 6.

[4]For example, see Scholes and Williams (1977), Fama and French (1997), Ang and Kristensen (2012), Frazzini and Pedersen (2014), and Baker and Wurgler (2015).

will reflect how the cost of capital is changing for banks relative to other firms, even if there is large uncertainty surrounding the level of the cost of capital itself. Alternatively, our estimates will capture how regulation impacts the systematic risk of bank equity over time.

2.2 Sample selection and definition of banks

We use CRSP, Compustat, and regulatory data from call reports and Y-9C filings from March 1996 to December 2017 when estimating the cost of capital and for panel regressions with bank characteristics. We estimate the cost of capital for all CRSP firms with share codes 10 or 11 that are traded on the NYSE, NASDAQ, or AMEX. Later in the paper we also estimate asset betas by merging quarterly Compustat data onto monthly CRSP data using the most recent observation that was announced prior to the start of the month (based on RDQ date). We filter observations from this dataset with missing cost of capital estimates or missing Compustat asset data as well as observations with share prices that are less than one dollar. The resulting sample includes a panel of 1,111,127 firm-month observations.[5]

Defining banks within this sample is not straightforward. Limiting banks to depository institutions in SIC code 60 would exclude firms that became bank holding companies after the financial crisis in 2009. These firms are subject to financial regulation that is a key object of interest in this analysis. We therefore expand our definition to include both firms that are depository institutions (SIC code 6020-6036) as well as firms that have an RSSDID (the unique identifier assigned to financial institutions by the Federal Reserve) between the first and the last dates when regulatory assets from Y-9C filings are within 10% of total assets from Compustat. Firms that fulfill either of these criteria in month-t are identified as banks

[5] In the event that firms issue multiple securities, we obtain unique firm-month observations by retaining the PERMCO-date pairs for the security (PERMNO) that has the largest market capitalization each month. Our use of the most recent quarterly accounting data from Compustat is similar to Hou et al. (2014) and Adrian et al. (2015) who form portfolios based on recent quarterly earnings data. This differs from Fama and French (1993) who form portfolios annually.

by the binary variable $Bank_{i,t}$. We identify RSSDIDs using the FRBNY RSSDID-Permco crosswalk, which matches banks between Compustat and regulatory reports using name, city and state, and financial variables.[6] Of the 11,959 firms in the sample, 1,414 firms are identified as banks throughout the sample while 33 firms are identified as banks for only part of the sample, including Metlife, Goldman Sachs, and Morgan Stanley. Because we include savings and loans in our definition as banks, and these firms only file call reports after 2012:Q1, there are fewer banks with regulatory data than there are total banks. The result is a sample containing 99,049 bank-month observations for banks with regulatory data when all regulatory variables are available as compared to 142,189 bank-month observations for the cost of capital.

3 Changes over time in the cost of capital

Changes in expected returns for the banking industry over time are shown in Figure 1, which plots the monthly value-weighted average cost of capital for banks, with horizontal lines at the means of the different regulatory time periods. By calculating these averages in a time series panel regression format instead of looking at simple averages, we can control for differences in the composition of the panel and for firm characteristics while adjusting the standard errors to account for the fact that the observations are not independent (neither over time nor within firm). This allows us to construct confidence intervals around our time period measures while also investigating differences-in-differences specifications that compare

[6]SIC codes are obtained with descending priority from Compustat historical, Compustat header, CRSP historical, or CRSP header data depending on availability following the procedure described in Adrian et al. (2015). RSSDID-Permco matches are based on the FRBNY crosswalk as of 2016q4. This definition of banks differs from an entirely SIC code or NAICS driven approach. For example, 24 companies with SIC code 6099 (functions related to depository banking) are not coded as banks at some point in our sample. This subset includes some of the credit card companies that do not have an RSSDID or regulatory assets that match Compustat data (i.e. Mastercard, Visa). At the same time, 13 companies with an SIC code beginning with 62 are coded as banks in our analysis (i.e. Goldman Sachs, Morgan Stanley). We exclude AIG and CIT from the sample.

changes in estimated expected returns for all the non-bank firms in the CRSP database to changes in expected returns of banks.

3.1 Regulatory time periods

We compare changes in the cost of capital across time periods in which bank regulations changed from 1996 to 2017. The periods are:

1. Basel I: Pre-period (March 1996 to October 1999)
2. GLB: The Gramm-Leach-Bliley Act (November 1999 to December 2006)
3. Crisis: The Financial Crisis (January 2007 to April 2009)
4. SCAP: The Supervisory Capital Assessment Program (May 2009 to June 2010)
5. Dodd-Frank: The Dodd-Frank Act (July 2010 to December 2017)

We define break points as the month of the passage of the relevant banking law. Results are similar if we vary the time periods within a few months to capture anticipation of the passage of the law. To see how the cost of capital has changed over time, we estimate the following specification:

$$CAPM_{i,t} = \alpha + \beta_1 GLB_t + \beta_2 Crisis_t + \beta_3 SCAP_t + \beta_4 Dodd\text{-}Frank_t + e_{i,t} \quad (2)$$

where $CAPM_{i,t}$ is the estimated CAPM cost of capital and GLB_t, $Crisis_t$, $SCAP_t$, and $Dodd\text{-}Frank_t$ are binary variables equal to one during the periods defined above. The omitted pre-period begins twenty years ago in 1996 and thus is characterized by the Basel I regulatory regime.

The estimated coefficient for each time period is the difference between the average cost of capital in that time period relative to the pre-period, whose value is captured by the constant term. The null hypothesis is that all β are equal to 0 – meaning that there have not been any changes to expected returns over time and, as a result, that regulatory changes have not changed the cost of capital. We estimate the specifications both on a value-weighted and equal-weighted basis to understand how the cost of capital is changing in aggregate and for the average company in the panel. Standard errors are clustered by firm and by month. Results are similar if the analysis incorporates earlier data (back through 1986), however, we focus on the more recent time period to have consistency in the regulatory data, which becomes available for all fields used in the analysis starting in 1996:Q1.

3.2 Difference-in-differences across industries

We estimate our first difference-in-differences regressions by adding a bank indicator variable that is interacted with each of the time period dummies,

$$\begin{aligned} CAPM_{i,t} - Rf_t = \alpha + \beta_1 GLB_t + \beta_2 Crisis_t + \beta_3 SCAP_t + \beta_4 Dodd\text{-}Frank_t \\ +\rho Bank_{i,t} + \delta_1 Bank_{i,t} \cdot GLB_t + \delta_2 Bank_{i,t} \cdot Crisis_t + \delta_3 Bank_{i,t} \cdot SCAP_t \\ +\delta_4 Bank_{i,t} \cdot Dodd\text{-}Frank_t + e_{i,t} \end{aligned} \tag{3}$$

This specification nets out the risk-free rate Rf_t and allows the cost of capital to change differently for banks and non-banks around the time periods when bank regulation changed. When we estimate δ that are different from 0, it means that changes to the cost of capital for banks relative to the pre-period are different from that for non-banks. One concern with this specification is the changing composition of the panel over time. For example, when a number of very large broker dealers and credit card firms become bank holding companies in 2009, to the extent that these firms have different costs of capital than the other banks in the sample, the time period dummies and interaction terms will pick up these changes. There are also changes in the sample of banks and non-bank firms for reasons other than changing industry definitions. For example, private firms may enter the sample by going public and public firms may exit as a result of mergers and acquisitions. We mitigate these issues by estimating the same regression absorbing firm fixed effects α_i that replace the constant α. This allows us to control for changes in the composition of the sample over time and to narrow our focus only to the effects of regulatory changes within firms. In some specifications, we include controls for $Leverage_{i,t}$, which is defined as total debt divided by the market value of assets (total debt plus the market value of equity). We add total deposits to the Compustat measure of total debt to calculate leverage for banks, because the Compustat definition of total debt does not include deposits. In unreported regressions, we include 3-digit SIC code fixed effects as controls and expand the the definition of banks to include all firms that have RSSDIDs, and results are similar.

3.3 Top firms

While the difference-in-differences regressions highlight the change in the cost of capital for banks relative to other firms, they potentially conflate the impact of changing regulation with other sources of time variation in the cost of capital. The cost of capital for the very largest firms in any industry may be different from that of smaller firms, for example, as a result of differences in systematic risk, market beliefs about implicit government support, or an association between firm size and market power.[7] In the bond market, Hale and Santos (2014) find that all large firms pay lower rates for bonds, and the very largest banks pay differentially lower rates than non-banks. For equity capital, size is a priced risk factor in the FF3 model with smaller firms earning a risk premium or having a higher cost of capital relative to larger firms. Further, the relationship between size and expected returns can

[7] While large banks may be better diversified, diversification may not result in reduced risk to the extent that it facilitates greater leverage or riskier lending (Demsetz and Strahan 1997). As a result, large and diversified banks may still be exposed to the economy in general, resulting in high systematic risk which is the only risk priced in the CAPM.

change over time. To better understand the impact of regulation targeted at the largest banks, we thus need to ensure that we difference out changes over time in the cost of capital for the very largest non-banks when we look at changes to the cost of capital for the very largest banks.

To build a time series of large banks, we look more closely at the subset of banks most affected by post financial crisis regulatory changes, banks with more than $50 billion in assets. Banks with more than $50 billion in assets are approximately the twenty largest banks in the US, so we create a dummy variable ("Top") to capture the largest twenty firms by total assets within each industry at each point in time. We define industries by SIC code using the twelve industry portfolios on Ken French's website and split financials into banks and non-bank financials using the definition described before. This gives us a measure that we can use over a longer time series and across industries. We repeat the analysis from equation 3 adding interactions between our coefficients of interest and the Top dummy variable. A significant interaction between Top, time period, and bank indicates that the difference between Top banks and smaller banks is different than the difference between Top non-banks and non-Top non-banks in the current period relative to the pre-period.

3.4 The role of bank characteristics

In order to understand how changes to bank business models are affecting their cost of capital, we zoom in on regulated banks for which we have detailed income statement and balance sheet data (call reports and Y-9C filings). This allows us to study how the cost of capital has changed over time while controlling for observable bank characteristics that are targeted by regulation such as capital and liquidity, as well as for changes in the asset and liability mix. To do this, we estimate the following regression:

$$\begin{aligned} CAPM_{i,t} - Rf_t = \alpha + \beta_1 GLB_t + \beta_2 Crisis_t + \beta_3 SCAP_t + \beta_4 Dodd\text{-}Frank_t \\ + \rho Bank_{i,t} + \delta_1 Bank_{i,t} \cdot GLB_t + \delta_2 Bank_{i,t} \cdot Crisis_t + \delta_3 Bank_{i,t} \cdot SCAP_t \\ + \delta_4 Bank_{i,t} \cdot Dodd\text{-}Frank_t + \theta \cdot X_{i,t} + \phi_1 \cdot X_{i,t} \cdot GLB_t + \phi_2 \cdot X_{i,t} \cdot Crisis_t \\ + \phi_3 \cdot X_{i,t} \cdot SCAP_t + \phi_4 \cdot X_{i,t} \cdot Dodd\text{-}Frank_t + e_{i,t}. \end{aligned} \tag{4}$$

We continue to include the full panel of companies and add dummy variables for missing regulatory data (omitted in the equation above). To proxy for capital and liquidity, we include in X the proportion of total liabilities funded with core deposits, the Tier 1 capital ratio, and a proxy for the liquidity coverage ratio (weighted assets divided by weighted liabilities including off balance sheet commitments x 100)[8]. For asset composition and risk we include the proportion of noninterest income to total income and the ratio of risk-weighted assets to total assets . We also include specifications that decompose risk-weighted assets into its components including the proportion of cash-equivalent assets, loans, trading assets, commitments, and derivatives to total assets. All balance sheet items are measured as of the most recent quarter. Table 1 presents summary statistics for these variables in Panel A over the full sample period. Panel B tabulates the value-weighted averages for each regulatory regime, illustrating how the asset composition, funding mix and asset risk of the banking industry have changed over time.

As a starting point, we study the impact of controlling for bank characteristics unconditionally ($\phi = 0$). Like the cost of capital itself, however, the expected return that investors demand for different bank characteristics may vary over time. To explore this possibility we interact the bank characteristics with the time period dummy variables to allow the co-

[8]LCR proxy uses regulatory data to approximate the LCR ratio as follows: Assets are weighted and include: Cash, FF Repo, US treasury, Agency Securities, Municipal securities, MBS, Other securities, Loans. Liabilities include respective weights times the following: FF Repo, Trading Liabilities, Commercial Paper, OBM, Subdebt, Deposits. Off balance sheet securities include respective weights times the following: Unused commitments, Financial Standby Letters, Securities underwritten, Securities lent.

efficients to change over time ($\phi \neq 0$). This allows us to understand whether changes to expected returns arise from changes to the market price of risk for different characteristics both within and across firms. For example, if liquidity has a large and significant coefficient only in the SCAP time period, this will be reflected in the ϕ_3 coefficient, absorbing variation that would have been reflected in the SCAP time period dummy in regression specification 4. The Appendix extends this analysis to the difference-in-differences regressions for the Top banks.

3.5 Effect of stress testing

We also look in detail at the effect of stress testing on the cost of capital by adopting the identification approach of Flannery et al. (2017) to estimate:

$$\begin{gathered} CAPM_{i,t} - Rf_t = \alpha + \beta_1 GLB_t + \beta_2 Crisis_t + \beta_3 SCAP_t + \beta_4 Pre\text{-}CCAR_t + \\ \beta_5 Post\text{-}CCAR_t + \beta_6 SCAP\ Firm_i + \beta_7 CCAR\ Firm_i + \beta_8 SCAP\ Firm_i \cdot SCAP_t \\ + \beta_9 SCAP\ Firm_i \cdot Pre\text{-}CCAR_t + \beta_{10} SCAP\ Firm_i \cdot Post\text{-}CCAR_t \\ + \beta_{11} CCAR\ Firm_i \cdot Post\text{-}CCAR_t + \theta \cdot X_{i,t} + e_{i,t} \end{gathered} \tag{5}$$

In contrast to Flannery et al. (2017) who analyze the abnormal stock market returns of firms subjected to US stress testing, we study how stress tests impact the cost of capital. Each specification includes a set of non-overlapping time fixed effects and controls for bank characteristics X. We split the banks into two groups based on the timing of their exposure to Federal Reserve stress testing. The first banks exposed to stress testing are captured by the binary variable $SCAP\ Firm_i$ which is equal to 1 for the largest BHCs that were initially included in stress tests beginning with SCAP in 2009.[9] The next banks exposed to stress testing are captured by the binary variable $CCAR\ Firm_i$ which is equal to 1 for

[9] Two US stress tested firms were not public for the entire sample. The first observation for Ally (SCAP) is April 2015 and the first observation for Citizens (CCAR) is September 2015.

the banks subjected to Comprehensive Capital Analysis and Review (CCAR) stress tests starting in 2014 ("CCAR 2014 Addition"). The regulatory time periods are also changed to accommodate the phased implementation of stress testing by splitting the Dodd-Frank Act period into two sub-periods before and after the expansion of firms subject to stress testing:

1. $Pre\text{-}CCAR_t$: Passage of the Dodd-Frank Act when the 18 firms ($SCAP\ Firm_i$) are subject to stress testing and associated disclosure (July 2010 to August 2013)

2. $Post\text{-}CCAR_t$: Addition of 7 firms ($CCAR\ Firm_i$) to stress testing and associated disclosure (September 2013 to December 2017)

As in Flannery et al. (2017), we limit the panel to the top 90 banks by assets each month to ensure that our comparison group of non-stress-tested banks is closer to the group of stress-tested banks.

3.6 Effects on credit supply

We are interested in understanding if changes in the cost of capital for banks have effects on the real economy through the provision and pricing of credit. For this, we make use of the Senior Loan Officer Opinion Survey (SLOOS), which provides qualitative and limited quantitative information on the standards and terms of bank lending as well as the state of business and household demand for loans as measured by the survey responses of senior loan officers. The Federal Reserve conducts the SLOOS at a quarterly frequency covering questions about changes in the supply and demand for loans over the previous three months as well as special topics on evolving developments and lending practices in U.S. loan markets. As of 2017, the panel of reporting banks in the SLOOS included up to eighty large domestically chartered commercial banks that span all Federal Reserve Districts and up to 24 large U.S. branches and agencies of foreign banks that are primarily located in the New York District.

Our analysis focuses on questions that cover changes in lending standards and loan terms relative to the previous quarter. Using survey responses instead of measuring balance sheet loan growth or changes in interest income allows us to focus on the supply effect at the individual bank level. We make use of survey questions on credit standards such as this example from the July 2018 SLOOS:

> *Over the past three months, how have your bank's credit standards for approving applications for C&I loans or credit lines—other than those to be used to finance mergers and acquisitions—to large and middle-market firms and to small firms changed?*

Possible survey responses included: *eased considerably, eased somewhat*, *remained basically unchanged*, *tightened somewhat,* and *tightened considerably.* The questions are collected for loan standards to both large and middle-market firms (annual sales of $50 million or more) as well as small firms. Consistent with previous work using this data, we code these categorical responses as variables equal to -2, -1, 0, 1, and 2 in our regression analysis, with higher numbers indicating a tightening of credit standards or a tightening of the terms for loans that banks are willing to approve including the cost of credit lines, the spread of loan rates over bank's cost of funds, the premium charged on riskier loans, loan covenants, collateralization requirements, and the maximum size of credit lines.

The regression specification for this analysis is:

$$SLOOS_{i,t} = \alpha + \eta \cdot \Delta(CAPM_{i,t} - Rf_t) + e_{i,t}. \tag{6}$$

We regress bank-level SLOOS survey responses, a quarterly change, onto one-year changes in bank-level CAPM cost of capital estimates net of the risk-free rate. Similar results hold using six-month and two-year changes in the cost of capital and when we lag the change in the cost of capital by a quarter relative to the survey response. In addition, we also report specifications that control for one-year changes in the risk-free rate and one-year lagged realized bank-level stock market returns. This helps to confirm that we are identifying a relationship between the CAPM cost of capital and lending supply and that the results are not explained by omitted variables like bank distress. Finally, we add time fixed effects to absorb business cycle variation in the survey responses. A positive coefficient on η in these regressions indicates that bank managers are tightening credit standards or loan terms when their cost of capital is increasing.

4 The impact of regulation on the cost of capital

Over the last twenty years, value-weighted expected returns for banks averaged 11.5% based on an unbalanced panel of 1,447 banks. This compares to expected returns for non-banks of 10.0% (value weighted, based on an unbalanced panel of 10,545 non-banks). The risk-free rate averaged 2.2% over our sample period, and as mentioned in Section 2, we set the level of the equity risk premium to 8% for our baseline cost of capital estimates. In comparison to these averages, Table 2 presents the results from estimating equation 2 on different panels of firms. Firms are subset into panels of banks and non-banks. Dependent variables include the CAPM cost of capital and risk premium (CAPM and CAPM-Rf), the Fama and French (1993) three-factor risk premium (FF3-Rf), and the monthly realized excess return multiplied by twelve (Realized-Rf). Regressions are estimated on an equal-weighted (EW) basis as well as a value-weighted (VW) basis. The value weights are proportional to lagged market capitalization and are normalized each month by the total market capitalization of all firms in the panel. Each column is the estimated coefficient on the time series dummy for the different regulatory regimes, while the estimated coefficient on the constant term represents the average (EW) or weighted average (VW) for the pre-GLB time period (the omitted time period). The average level of the estimated cost of capital in any time period can be calculated by summing the coefficient for the time period with the constant. Standard errors are clustered by month and by firm, and thus when the coefficients on the regulatory time series dummies are statistically significant, it means that the average in that time period is statistically significantly different from the pre-GLB time period.

4.1 Difference-in-differences across industries

In order to see if changes in the cost of capital for banks are different from those of non-banks over time, Table 3 combines all firms into a single panel and estimates the specification in equation (3) for the CAPM cost of capital and risk premium. The first column (1) primarily reflects the dramatic decline of more than 4 percentage points in the risk-free rate since the late 1990s. The subsequent columns present the main difference-in-differences analysis.

In the second column (2), the bank dummy variable indicates that banks' value-weighted cost of capital is about 70 basis points higher than that of other firms on average, consistent with the higher systematic risk of banks as evidenced by their average value-weighted beta of 1.17. But this premium has changed over time. In the GLB period, the cost of capital for banks is unusually low relative to non-banks (Bank x GLB coefficient of -1.25). In the Dodd-Frank period, the cost of capital for banks is 3% lower overall but 1.90% higher relative to non-banks (Dodd-Frank coefficient of -4.91 + Bank x Dodd-Frank coefficient of 1.90). Changes in banks' cost of capital diverge the most from non-banks in the period immediately following the financial crisis and prior to the passage of the Dodd-Frank Act – comparing the current period to the SCAP period, banks' cost of capital fell by approximately 4.5% (Bank x SCAP coefficient of 6.55 minus Bank x Dodd-Frank coefficient of 1.90), while the change in the cost of capital in those time periods for non-banks was roughly zero (SCAP coefficient of -5.02 minus Dodd-Frank coefficient of -4.91). This is consistent with post-financial crisis regulation enacted in 2010 reducing the systematic risk of banks back towards the pre-deregulation period of the late 1990s.

The third column (3) explores the robustness of these findings. To control for changes in the composition of the panel, we look at changes in the estimated cost of capital within firms over time by adding firm fixed effects. The addition of non-depository institutions such as investment banks and credit card companies to our definition of banks in 2009 does not drive the results. Similar to the cross-sectional analysis in column 2, the within firm cost of capital for banks differentially increases after the financial crisis and then falls by around 4.5%. At the same time, the within firm cost of capital for banks has returned to a level around 2.5% higher than that of non-banks relative to the pre-period.This could be consistent with an increase in the perceived riskiness of the industry due to a reduced probability of government assistance or with a re-evaluation of the systematic risk of the banking industry in general.

In the fourth column (4), we limit the sample to banks and non-bank financial intermediaries. The estimated coefficient on Bank x SCAP falls by almost half in this specification, suggesting that some of the increase in banks' cost of capital reflects market wide changes to the cost of capital for all financial intermediaries. That said, the cost of capital for banks still fell by more than the cost of capital for non-bank financial intermediaries after the passage of the DFA. The difference between the Bank x SCAP coefficient of 3.69 and the Bank x Dodd-Frank coefficient of 1.42 is economically and statistically significant, indicating that banks' cost of capital declined by about 2.25% relative to non-bank financials.

To the extent that different banks serve different borrowers, it is important to understand these changes not just on an industry level, but also on an equal-weighted basis to inform us about the change in the cost of capital for the average bank. In contrast to the value-weighted results, the change in banks' cost of capital after the financial crisis is much smaller when the results are equal-weighted. In fact, in the cross section, the cost of capital is lower in the Dodd-Frank period relative to the pre-period for the average bank (specification 5). However, looking within firm, the sign flips and we see a differential increase of around 1.75% relative to the pre-period (specification 6). Overall these results are consistent with the decline in banks' cost of capital post-crisis arising from changes to the cost of capital for the largest banks. We explore this question in more detail in the next section.

The last two columns repeat the analysis with a dependent variable equal to the CAPM cost of capital minus the risk-free rate (CAPM - Rf). If the panel were balanced and if the time period dummies were replaced with time fixed effects, the bank interaction coefficients in columns (7) and (8) would be identical to those in columns (3) and (6). However, since there are not the same number of firms in each time period and because the time period dummies are more coarse than monthly time fixed effects, the coefficients are slightly different, with the time period dummies only picking up some of the change in the risk-free rate. In order to ensure that our subsequent analysis is not capturing changes in the risk-free rate, the remainder of the paper studies estimates of the cost of capital less the risk-free rate as the dependent variable.

4.2 Top firms

Table 4 examines differences in the cost of capital for the largest banks and non-banks over time. In the first specification, we document the general patterns – while Top non-banks have about 1.5% lower expected returns than non-Top non-banks, Top banks have about 2% higher expected returns than non-Top banks (Top coefficient of -1.46 + Bank x Top coefficient of 3.41). The remaining specifications include interactions between our size indicator and the time periods to understand how these differences play out as regulations change. Consistent with our initial concerns about measurement, we estimate the difference between the largest firms and other firms in column 2 and find that this difference has changed over time for non-banks as well. Since the GLB period, the extent to which the largest firms have a lower cost of capital than do smaller firms has increased for all companies by around 2% as indicated by the negative and statistically significant coefficients on the Top x time period interaction terms. The very largest banks have shared in the overall decline in the cost of capital for the very largest firms with the notable exception of the post-crisis SCAP period. During the SCAP period, the wedge in the cost of capital between Top banks and non-Top banks differentially increased to almost 4%, a significant difference that reverted in the post-DFA period.

Figure 2 summarizes the results graphically by plotting the value-weighted difference in the cost of capital for banks versus non-banks and for Top banks versus non-Top banks relative to Top non-banks versus non-Top non-banks. The average changes in these differences relative to the pre-period are similar to the value-weighted regressions without fixed effects in Tables 3 and 4 (specification 2). Controlling for time-invariant differences across firms, the Bank x Top x Dodd-Frank coefficient indicates that the cost of capital has fallen for the Top banks relative to non-Top banks when comparing the Dodd-Frank period to the pre-period across specifications with fixed effects, some of which feature a statistically significant decline by as much as 1% to 2%. While these within-firm specifications have the advantage of controlling for the panel composition, they have important limitations as well. For example, the coefficients for the Bank, Top, and Bank x Top indicators are estimated off the firms that switch between being banks and Top firms. The cross-sectional regressions without fixed effects capture many more firms when estimating these coefficients, while the latter approach is more cleanly identified. Relative to pre-period, the fall in the cost of capital for the very largest banks is even larger if we compare changes to only non-bank financials, although looking at the change between SCAP and Dodd-Frank, the drop in cost of capital for the very largest banks is no longer statistically significant. In specification

5, we add leverage as a control and find broadly similar results. We explore the impact of leverage further and other bank characteristics in Section 4.3. The final two columns repeat the analysis on an equal-weighted basis.

In summary, looking across the various specifications in Table 4, we find a negative relationship or no statistically significant difference for the Top banks in the Dodd-Frank period as measured by the Bank x Top x Dodd-Frank coefficient. The difference between the Bank x Top x Dodd-Frank and Bank x Top x SCAP coefficients is consistently negative and statistically significant in most specifications, meaning that the current cost of capital for the very largest banks has fallen since DFA. Perhaps the best identified test of the effect of changes in regulation since DFA comes in specification 4 in which we limit the panel to only banks and non-bank financials, and estimate within firm effects. In this specification, we estimate that the cost of capital for the very largest banks relative to all non-banks is differentially lower by 245 basis points since pre-GLB. The difference has fallen by 118 basis points since the financial crisis, although this difference is not statistically significant.

4.3 How bank characteristics affect the cost of capital

While any study of the cost of capital for banks must take into account changes in the cost of capital for non-banks, we can learn more about the impact of regulation by looking within the universe of regulated banks for which we have detailed data from regulatory reports. Changes in regulation can impact banks' cost of capital by changing bank risk, capital, liquidity, and business models. At the same time, bank managers may change their firm's characteristics in response to time-varying investment opportunities or in response to changes in the market's evaluation of bank risks, thereby impacting their cost of capital.

In order to better understand the importance of these effects on the cost of capital, we add bank characteristics and bank characteristics interacted with the regulatory time periods to value-weighted regressions with firm fixed effects as in equation (4). The sample includes 1,023 publicly traded banks with regulatory data. As before, we continue to employ the difference-in-differences strategy by including the full panel of companies and adding dummy variables if companies are missing regulatory data. Table 5 reports the results. For brevity we omit the time period dummy variables and bank indicator coefficients in the reported results, although these variables are included in all the specifications.

To begin, the first column (1) in Table 5 replicates the seventh column (7) in Table 3 to provide a reference point. We then add controls for the share of revenue that is noninterest income, the ratio of liabilities that are core deposits, a measure of liquidity coverage, the Tier 1 capital ratio, and the ratio of risk-weighted assets to total assets. Summary statistics for these bank characteristics are presented in Panel A of Table 1. The extent to which the bank industry has changed over time is shown in Panel B of Table 1, where each column tabulates the value-weighted average within a time period. For example, capital ratios are higher and risk weighted assets are a smaller ratio of total assets in the post Dodd-Frank era. Liquid assets are a higher share of assets while loans comprise a smaller share. Other ratios peaked in the crisis and pre-DFA time periods such as derivatives and noninterest income share. Some of these changes in the summary statistics are impacted by the changes in the panel composition, such as the addition of investment banks to the panel in 2009. The regressions, however, control for the changing panel by including bank fixed effects. In particular, the second column (2) of Table 5 adds all of these bank characteristics to our value-weighted specification with bank fixed effects, allowing us to control for changes over time in these observable measures within banks.

On average, bank characteristics do little to explain the way in which banks' cost of capital has changed with the passage of the Dodd-Frank Act. When we add controls for observable characteristics, the estimated coefficients on the bank x time interaction terms barely change comparing column (2) to column (1). For example, the decline in the cost of capital between the SCAP and Dodd-Frank periods continues to be around 4.5% and is highly statistically significant. This suggests that the changes in the cost of capital that we observe are not correlated with changes in observable characteristics.

But what if the importance of bank characteristics is varying over time? We explore this possibility in columns (3) to (7), allowing the relationship with the cost of capital to vary in the different regulatory time periods for non-interest income, core deposits, liquidity coverage, and capital (as measured by the Tier 1 capital ratio). Each of these columns examines one characteristic in isolation by adding interaction terms with the regulatory time periods so the coefficients can vary over time. The final specification (8) includes all of the characteristics and their time period interactions together to highlight how the estimated coefficients on the bank x time interactions change in comparison to column (1), although in column (8) we do not report the characteristic x time interaction coefficients as in column (2) for readability.

The results indicate that there has been some variation in the association between banks' cost of capital and bank characteristics across the regulatory time periods. This is consistent with Calomiris and Nissim (2014) who find changes in the valuation of bank business models over time. For example, in the pre-GLB period, banks with more non-interest income have a higher CAPM cost of capital (positive coefficient on characteristic in column (3) of Table 5), while the magnitude of this positive association has fallen in each of the periods since GLB. In contrast, column (4) shows that the association with core deposits is the opposite - the negative relationship in the pre-GLB time period has become more positive over time and is close to zero in the Dodd-Frank period. In columns (5) and (6) there is further evidence that the coefficients on liquidity coverage and equity are changing over time, although the significance of these changes is somewhat lower.

While columns (3) to (6) indicate that the significance of the different bank characteristics are changing over time, accounting for this time variation does not reverse the general patterns in banks' cost of capital after the financial crisis, such as the decline after DFA. The results do change, however, after including risk-weighted assets (RWA) in column (7). While there is no statistically significant relationship between RWA and expected returns for most of the regulatory time periods, RWA emerges as a key driver of banks' cost of capital during the post-crisis SCAP period with a coefficient that is positive and highly significant. Moreover, when this interaction is included, the difference between the coefficients on the Bank x SCAP and Bank x Dodd-Frank indicators falls to almost nothing and is no longer significant. This result suggests that after the financial crisis, market expected returns for banks with higher RWA increased dramatically, and then fell again after the passage of the Dodd-Frank Act.

The final specification (8) includes the interaction terms for all of the bank characteristics together. The interaction coefficients are generally similar to columns (3) to (7), and thus for ease of presentation we only report the coefficients on the bank x time interaction terms over time. Comparing these coefficients to the other specifications, we find a similar pattern to specification (7) in which there is a statistically significant increase in banks' cost of capital from the GLB to the Crisis period, but no significant decline between the SCAP and Dodd-Frank periods. As before, RWA appears to be the key variable driving the change in the results.

The result for RWA appears to be driven by changes in the association between the cost of capital and loans. We run similar regressions using key components of RWA such as liquid assets (cash, fed funds, and securities), loans, trading assets, commitments, and derivatives (results are in Appendix Table A.4). While none of the RWA components by itself reverses the general patterns in banks' cost of capital over time, the biggest changes in the characteristic coefficients during the SCAP period occur for loans and loan commitments, which both become significant and positive. Within loans, the coefficients on real estate loans increase the most in SCAP period (not shown). This is consistent with a market increase in expected returns for banks with more real estate loans and loan commitments in the SCAP period that was subsequently reversed.

In the Appendix, we also explore the implications of time-varying bank characteristics on specifications which compare the very largest banks to smaller banks (Appendix Table A.5). We find that a time-varying association with RWA does not explain the decline in the cost of capital for the largest banks. Across specifications that include controls for time-varying bank characteristics, the cost of capital for the largest banks continues to decline by 3% to 4% after the SCAP period. Since the largest banks are differentially subject to increased regulation, these results are consistent with an increase in regulation leading to lower risk and lower expected returns in the Dodd-Frank period. To lend further weight to this interpretation, we extend the analysis by looking specifically at a single regulatory change in the next section.

4.4 Stress tests

In this section we focus on a particular regulatory change, stress testing. While it is hard to attribute changes in the cost of capital to particular regulations because so many regulations were changed at the same time for the same set of firms, we attempt to take advantage of the staggered implementation of stress testing on banks with more than $50 billion in assets to understand how stress testing may have affected the cost of capital for stress-tested banks.

Table 6 presents the results of this analysis. Rather than using an indicator for banks, the panel includes only the 90 largest banks by assets each month that have regulatory data and then use separate indicators for the sets of banks that became subject to stress testing at different times. Even though we limit the panel to the largest banks, stress tested firms are different from a cost of capital perspective relative to other large banks. Over the whole time period, firms subject to the initial stress testing in the SCAP with public market data have a 1% higher cost of capital (SCAP firm indicator). In contrast, the firms added later with assets ranging from $50 to $250 billion do not have a higher cost of capital relative to the other 90 largest banks (CCAR firm indicator).[10]

On average, the cost of capital increases for the large banks in this panel relative to the pre-period. The coefficients on the time periods are all positive and statistically significantly different from zero. Relative to the pre-period, the cost of capital is 7% higher after SCAP, 4% higher after the Dodd-Frank Act is passed and prior to the initial disclosure of stress testing results in 2012, and 3.5% higher in the post stress testing CCAR period (specification 1).

Figure 3 illustrates these results by plotting the equal-weighted cost of capital for the SCAP, CCAR, and other banks in the top 90 by asset size. The higher cost of capital for the SCAP firms on average is evident from the plot. Moreover, the plot indicates that the largest increase in the cost of capital during the financial crisis and subsequent decline post-DFA occurs for the SCAP firms relative to the other large banks. Table 6 formalizes these results. The last rows include SCAP firm x time period interactions that allow the coefficients for SCAP firms to differ from other large banks after 2009 and a CCAR firm x Post-CCAR coefficient that allows CCAR firms to differ in the post stress testing CCAR period (specifications 2-4, 6-8). We find that, while SCAP firm's cost of capital increased by 2 percentage points during the SCAP period, their cost of capital fell after DFA and then

[10]Note that not all firms that are stress tested are publicly traded – we exclude from the analysis the banks with foreign parents, and Ally and Citizens join the panel only after IPO. Because of its bankruptcy and subsequent reorganization, we exclude CIT from the panel entirely. If included, it would be the only bank in its category, since it was added to stress testing in 2016, and it would be in the comparison, non-stress tested group before that time. Similarly, we exclude Metlife from the panel entirely due to its subsequent debanking.

continued to decline by 150 basis points in the post stress testing CCAR period relative to other large banks (specification 3). This within-firm decline of more than 3% since the SCAP period is significant at the 1% level and robust to including bank characteristics as unconditional control variables as in Table 5. Similar to prior results, we include all controls in the regression and only report the coefficient on the Tier 1 Capital ratio for readability (specification 4).

The results indicate that the largest reduction in the cost of capital occurs for the very largest stress-tested banks. This means that stress testing has differentially reduced risk captured in expected returns for the very largest firms. While we think that the staggered introduction of firms to stress testing contributes identifying power, we cannot distinguish this hypothesis from the alternative explanation that it reflects other regulations to which only these very largest firms are subject have also been implemented with timing similar to that of CCAR. Generally, since the cost of capital estimates in our approach require time to estimate betas, we think it is difficult to identify changes in time windows shorter than those captured in this analysis.

5 The impact of the cost of capital on lending supply and pricing

In this section we test whether there are real effects of the changes in the cost of capital. While the CAPM costs of capital estimates are interesting on their own as measures of the systematic risk of banks as captured in equity market prices, this analysis provides further motivation for our empirical approach as it explores if changes in the CAPM cost of capital affect the supply and pricing of credit. We make use of the SLOOS data because it offers a way in which to separate changes to lending standards from changes in demand. This approach is superior to a simple estimation of the relationship between loan balances and interest margins using bank holding company data, because those measures conflate the supply of bank lending with demand.[11]

Since we are interested in documenting the co-movement of the cost of capital at individual banks with bank lending supply, rather than more general co-movements driven by the business cycle, we focus on a cost of capital measure that nets out the risk free rate. Lending standards and the cost of capital appear to move together – Figure 4 plots the the average change in credit standards for large and middle-market firms against the average one-year change in the CAPM risk premium less the risk-free rate for the banks in the SLOOS survey. In aggregate, these variables are positively correlated and the average response to the business cycle is procyclical, with banks tightening standards during recessions and easing standards during expansions. We make use of the confidential bank-level data to examine this result in the cross-section while controlling for changes over time through quarterly time fixed effects. This approach increases power, controls for the business cycle, and identifies a relationship between bank-level credit standards and changes in the cost of capital net of the risk-free rate.

5.1 Changes in lending standards and the cost of capital

We begin by looking at the most general survey question on terms of lending, changes to "lending standards." Table 7 reports the results of this analysis in Panel A which presents a set of regressions of quarterly changes in lending standards (Std) as measured by survey responses in the SLOOS onto one-year changes in the cost of capital net of the risk-free rate, similar to the approach described in equation 6. The first three columns examine the relationship for the largest borrowers, while the second three columns look at responses to

[11] We do not estimate a statistically significant relationship between quarterly changes in loan balances or interest margins and banks' cost of capital.

questions about smaller borrowers. We estimate a positive and significant coefficient on the change in the cost of capital indicating that bank managers are tightening credit standards when their cost of capital net of the risk-free rate is increasing. To interpret the magnitude of the point estimate, an increase in a bank's CAPM beta from 1 to 2 would increase the cost of capital risk premium by 8% which translates into a 8 x .024 = 0.19 higher survey response, about one-fifth the magnitude of an increase from one category of the response to another or about one-half the standard deviation of the dependent variable which equals .47. When a bank's cost of capital increases, lending standards are tightened. The effect is larger for large borrowers, although the difference is not statistically significant in all specifications.

We want to be sure that we are not just capturing variation in the business cycle or the impact of idiosyncratic bank shocks. To account for this, we add one-year changes in the risk-free rate and one-year bank-level stock market returns as control variables (specification 2). Including bank-level stock market returns is a challenging test for omitted variable bias that allows us to capture the extent to which a negative shock from bad loans or poor profits may contribute to tighter lending standards. As expected, we estimate a negative and significant relationship between loan standards and both control variables. When interest rates decline or bank stock returns are low, lending standards are tighter. Adding these controls reduces the coefficient on the change in the CAPM cost of capital by half, but it does not reverse the result. An increase in the CAPM cost of capital remains significantly and positively associated with tighter loan standards. Interpreting the magnitude of the coefficients, a one-standard deviation change in the cost of capital, risk-free rate, and realized return results in a .03, .15, and .06 change in lending standards (specification 2). Bank managers appear to tighten credit standards when the cost of capital risk premium (Δ CAPM - Rf) increases, even after controlling for changes in the risk-free rate and for firm-level stock market returns.

Finally, we illustrate that the results are robust to including quarterly fixed effects (specification 3), a more comprehensive control for any time-varying shock that would affect bank lending supply. These time fixed effects increase the explanatory power from 14% to 26%, indicating the importance of robust controls for changes in the business cycle variation including the aggregate tightening of spreads during the financial crisis. Despite this, the change in the cost of capital remains significant with a similar magnitude to the second specification. The results are largely similar although of slightly smaller magnitudes for smaller borrowers (specifications 4-6).

5.2 Changes in lending terms and the cost of capital

In panels B and C of Table 7, we go beyond broad lending standards and look separately at the effect of changes in the cost of capital on different lending terms covered in the SLOOS questions such as:: the cost of credit lines, the spread of loan rates over bank's cost of funds, the premiums charged on riskier loans, loan covenants, collateralization requirements, and the maximum size of credit lines. Each of these terms is a dependent variable in the different columns of Panel B (larger borrowers) and C (small borrowers). Since we found that quarterly fixed effects contribute substantial explanatory power, we include quarter fixed effects in all the specifications, similar to the third specification from Panel A. We find that increases in banks' cost of capital are associated with tightening in the supply and pricing of credit through all of the lending terms measured, with greater statistical and economic significance for larger borrowers. The estimated relationship is generally positive but not significant for smaller borrowers.

The spread of loan rates over a bank's cost of funds and the premiums charged on riskier loans are perhaps the survey responses that most directly relate to the cost of capital. Indeed, we estimate the largest relationship between changes in the cost of capital and the response to these questions. When a bank's CAPM beta increases from 1 to 2, senior loan officers report a .12 to .14 higher survey response on average for loan spreads and premiums on riskier loans, about one-fifth of one standard deviation of the survey response. In addition to these impacts on loan prices, we also find that banks decrease the maximum size of credit lines and tighten loan covenants when their cost of capital increases, thereby reducing credit supply. The results for collateral requirements are similar but not significant. These varied findings highlight the rich nature of the SLOOS data. Rather than being restricted to only study the quantity and pricing of loans through quarterly changes in loan balances or interest margins in call report data, the SLOOS allows us to investigate the provision of credit along multiple dimensions from the perspective of senior loan officers who are responsible for allocating credit in the economy. Building on the prior literature that has documented a negative relationship between the cost of capital and investment for non-financials, our results provide new evidence that banks act in a similar fashion, tightening the supply and pricing of credit in the economy when their CAPM cost of capital increases.

6 Alternative cost of capital estimates

In general, misspecification of expected returns that is associated with our regulatory time periods could bias our results. The advantage of multifactor models is to potentially better measure expected returns, thereby reducing any bias. To understand the robustness of the results for the CAPM cost of capital, Table 8 repeats the key difference-in-differences specifications for banks and top banks for different cost of capital estimates including three-factor estimates following Fama and French (1993), five-factor estimates that incorporate additional interest rate and term spread factors, one-factor estimates with a time-varying equity risk premium, log CAPM betas that difference out the equity risk premium, and asset betas from the Merton (1974) model. Across the various estimates we consistently find a significant decrease in the cost of capital for the largest banks since the passage of the DFA. Figure 5 summarizes these results by plotting the value-weighted alternative cost of capital estimates alongside our estimates of asset betas and market leverage for the banking sector. As before, while the plot may be affected by the changing composition of the panel, we control for this in the regressions with firm fixed effects and document significant within firm changes over time.

6.1 Multifactor cost of capital estimates

The Fama and French (1993) three-factor model (FF3) delivers cost of capital estimates that account for the variation in expected returns for small versus big firms and for value versus growth firms. As before, we define the FF3 cost of capital as the sum of time-varying betas multiplied by constant factor risk premiums. We set the factor risk premiums equal to the average excess returns for the tradeable factors from 1926 to 2017 which are equal to 8%, 4.6%, and 2.5% in annualized units for the market, size, and value factors respectively. The average beta or loading on these factors for banks over the last twenty years has been 1.17 (0.54), 0.85 (0.43), -0.11 (0.41) respectively versus 1.17 (0.55) for the CAPM on a value-weighted (equal-weighted) basis.

Columns (1) and (2) of Table 8 repeat the value-weighted difference-in-differences regressions with firm fixed effects from Tables 3 and 4 for banks and top banks. Compared to the previous results, the FF3 model indicates that banks' cost of capital diverged the most from non-banks in the period immediately preceding the financial crisis, when value factor betas were declining and banks were trading more like growth firms, rather than exhibiting a decline in the period immediately following the crisis. Another difference is the Bank x Dodd-Frank coefficient, which indicates that banks have exhibited a 1% decline in their within-firm FF3 cost of capital (column 1) versus generally positive and significant estimates for the CAPM model. This fall in the cost of capital is driven by the largest banks, as shown in the results in column (2). For the top banks, the FF3 cost of capital has differentially fallen since the passage of the Dodd-Frank Act by about 3%, similar to the CAPM regressions. Moreover, the Bank x Top x Dodd-Frank coefficient is large in economic magnitude and highly significant, indicating that the FF3 cost of capital has differentially declined for the largest banks relative to the pre-GLB period as well. These results are stronger than the Top regressions for the CAPM which also feature negative coefficients on Bank x Top x Current but with magnitudes that are smaller and less significant. By capturing the changing loadings on the value and size factors during the financial crisis, the FF3 analysis indicates that the cost of capital for the largest banks has differentially fallen by as much as 3% relative to both the pre-GLB period and since the passage of the Dodd-Frank Act.

In addition to size and value, other factors that affect expected stock returns for banks differently from other companies and that are correlated with the business cycle have the potential to bias our results. One such factor may be changes in interest rates, as maturity transformation and interest rate risk management are key aspects of bank business models, but may be less important for non-bank firms. To that end, we form a five-factor model (IR) that adds a short-term interest rate factor and a yield curve slope factor to the three-factor model. Columns (3) and (4) of Table 8 report the results. To maintain consistency with our prior results, we use tradeable interest rate factors that are constructed from zero-coupon bond prices using the yield curve from Gurkaynak et al. (2006).[12] Having controlled for interest rates in this manner, we confirm our CAPM cost of capital finding that banks

[12]The interest rate factors are $R_{short,t} = R_{2y,t} - R_{f,t}$ and $R_{slope,t} = \frac{1}{5}(R_{10y,t} - R_{f,t}) - (R_{2y,t} - R_{f,t})$ where $R_{2y,t}$ and $R_{10y,t}$ are the daily return for two-year and ten-year zero coupon bonds and $R_{f,t}$ is the daily risk-free rate. The slope factor has zero duration by construction and is -99% (-74%) correlated with the change in the 10y-2y zero-coupon (constant maturity) slope at a daily frequency. The short term factor is -99% (-94%) correlated with the change in the 2y zero-coupon (constant maturity) yield at a daily frequency. The average factor risk premiums from 1975 to 2017 are $\mu_{short} = 1.14\%$ and $\mu_{slope} = -.41\%$ (the average annualized excess return for the 10-year zero coupon bond is 3.67%).

exhibit a large and significant decrease in their cost of capital after the passage of the Dodd-Frank Act relative to both the SCAP and pre-GLB periods. The decrease of approximately 4.5% relative to the pre-GLB period is large relative to both the CAPM and FF3 models (column 3). The Top regression confirms that the largest banks are driving this result, with a differential decline of 3% relative to the SCAP period and 5% relative to the pre-GLB period (column 4).

6.2 CAPM with a time-varying equity risk premium

There is ample empirical evidence that risk premia vary over time (Cochrane 2011). So far, our analysis has assumed a constant equity risk premium so that time variation in beta captures the change in the cost of capital for banks relative to other firms (equation 1). A time-varying risk premium that is correlated with bank betas may bias our results. For example, if bank betas and the equity risk premium both increased in the Crisis and SCAP periods and then declined in the Dodd-Frank period, our estimate of the decline in the cost of capital for banks assuming a constant risk premium will be underestimated, all else equal.

To address this concern we consider two approaches. First, we use a model to estimate the equity risk premium and then repeat our analysis for the CAPM with this time-varying risk premium. To do this, we form a one-factor partial least squares estimate of the equity risk premium by combining 14 models of the equity risk premium from Duarte and Rosa (2015) with available data from 1965 to 2016.[13] We then project one-year ahead CRSP value-weighted returns onto the partial least squares estimate and use the fitted value as a measure of the equity risk premium. This approach has the advantage that it directly addresses the concern that the equity risk premium is time varying but the disadvantage that the results are model and sample dependent.

[13]Similar results hold by projecting one-year ahead returns onto the estimate of the equity risk premium from a dividend discount model, which is one of the 14 models included in the partial least squares estimate.

For an alternative perspective, we take advantage of the fact that the equity risk premium drops out of a difference-in-differences analysis after taking the logarithm since the CAPM is a one-factor model.[14] We thus estimate our difference-in-differences regressions using the logarithm of the CAPM betas as the dependent variable. We implement this idea empirically by winsorizing the estimated betas at .05 to remove negative values from the sample.

Table 8 reports the baseline regressions for the CAPM using the partial least squares estimate of the equity risk premium (PLS-Rf) and for the logarithm of the CAPM betas (Log(Beta)).[15] For the PLS-Rf regressions almost all of the time period coefficients are larger than those in the specifications with a constant risk premium. This reflects the fact that our estimate of the time-varying equity risk premium has increased over the sample period, consistent with the findings in Duarte and Rosa (2015). For banks, the results are generally consistent with those from other CAPM specifications, in that the estimated cost of capital is higher in the Dodd-Frank period relative to the pre-GLB period but significantly lower than the SCAP period. Column (5) indicates that the cost of capital for banks has declined by around 9% from the SCAP period to the Dodd-Frank period. Column (6) shows that these results are again driven by the very largest banks. In comparison to the previous results, the larger magnitudes suggest that the assumption of a constant equity risk premium may be biasing our results down. Equivalently, the results suggest that bank betas are positively correlated with the equity risk premium.

Similar results also hold when taking the logarithm of the CAPM betas as the dependent variable in columns (7) and (8). For example, columns (7) and (8) indicate that bank CAPM betas have declined by about 35% from SCAP to Dodd-Frank with much of the decline being

[14] In particular, $\log(\beta_{i,t}\mu_t) - \log(\beta_{i,t-1}\mu_{t-1}) - (\log(\beta_{j,t}\mu_t) - \log(\beta_{j,t-1}\mu_{t-1})) = \log(\beta_{i,t}) - \log(\beta_{i,t-1}) - (\log(\beta_{j,t}) - \log(\beta_{j,t-1}))$. This argument does not apply to multifactor models.

[15] The PLS-Rf results are from March 1996 to 2016 when the equity risk premium estimates are available from Duarte and Rosa (2015). This results in a slightly smaller sample and contrasts the other regressions which end in 2017.

driven by the largest banks. One difference from the PLS-Rf results in column (6) is the negative and significant coefficient on Bank x Top x Dodd-Frank in column (8). The negative coefficient for log betas is consistent with the CAPM, three-factor, and five-factor cost of capital estimates using constant factor risk premiums which all indicate that the cost of capital for the largest banks has declined relative to both the pre-GLB and SCAP periods on a within firm, value-weighted basis.

6.3 Asset betas

The key component driving changes in our cost of capital estimates is the estimate of equity betas. In this way, the analysis captures changes to the systematic risk of the banking industry. However, since these estimates also are affected by leverage we may also be interested in looking directly at asset betas, which may better capture the systematic risk of banking assets, regardless of capital structure changes. This risk may have increased since the financial crisis, due to the reduction in the expectation of government support (as suggested by Gandhi and Lustig (2015) and Atkeson et al. (2018)) or decreased with the reduction in risk from changes to capital and liquidity regulation that have decreased leverage and increased the share of liquid assets held in the banking sector. To perform this test empirically, we compute asset betas in the Merton (1974) model using equity market capitalization and equity volatility for each firm-month observation in the sample following the approach in Bharath and Shumway (2008).[16] The advantage of this analysis is that it directly incorporates leverage into the estimated beta rather than including leverage as a linear control variable in reduced form regressions as in Table 4 (specification 5) or in Table

[16]We compute asset betas by solving for firm value and volatility from two nonlinear equations for the value of equity and equity volatility, similar to how the default probability π^{simul}_{Merton} is computed in Bharath and Shumway (2008). To do this we assume that debt matures in one year and define the face value of debt as short-term debt plus one-half long-term debt plus deposits if available. In a previous draft we found similar results by assuming that debt was riskless as in Baker and Wurgler (2015) in which case asset betas are equal to $\beta^{asset}_{i,t} = \beta_{i,t}(1 - L_{i,t})$ where $L_{i,t} = D_{i,t}/(D_{i,t} + ME_{i,t})$.

5 (specification 6) (where leverage is included as a time-varying characteristic as measured by the Tier 1 capital ratio). The disadvantage of this approach is that the computation of asset betas is model specific and requires a number of assumptions, such as how to compute the maturity and face value of debt. These assumptions may be particularly important for banks.

Columns (9) and (10) in Table 8 report the results with asset beta as the dependent variable. Looking at the bank interaction coefficients on the regulatory time periods, we still estimate a significant decrease in banks' asset betas between the SCAP and Dodd-Frank periods that is primarily driven by the very largest banks. This result is noteworthy as the significant decline persists despite the decrease in bank leverage in recent years, which would imply increased asset betas of banks if equity betas were unchanged. From a longer historical perspective, bank asset betas have increased relative to the pre-GLB period by around .10 as measured by the significant and positive Bank x Top x Dodd-Frank coefficient in column (10). This result differs from the cost of capital estimates which generally feature a negative difference for the largest banks.

7 Conclusion

Banks' cost of capital is an input into decisions about lending quantities and pricing as well as decisions regarding resource allocation to different business lines. This paper rigorously estimates the cost of capital for the banking industry and explores how it has changed over time. After spiking in the financial crisis, the cost of capital for the banking industry has fallen dramatically since the passage of the Dodd-Frank Act. Expected returns for the very largest banks most affected by regulation have fallen differentially by 1% to 3% relative to post-financial crisis highs depending on the metric. Since these measures are driven by changes in equity and asset betas, this means that the systematic risk of these firms has fallen since the passage of the Dodd-Frank Act. For the largest banks in particular, there has been a differential decline relative to both the financial crisis and relative to the late 1990s across different measures and regression specifications. This is striking in the face of research such as Atkeson et al. (2018) that suggests that the value of government guarantees are falling over the same period of time.

While these results suggest that the systematic risk of banks has declined in the post Dodd-Frank era, it is worth noting the limitations of any analysis that seeks to understand the cost of capital. The true cost of capital measure relevant to bank managers is the unobserved expected returns of bank investors. Bank managers and econometricians do not have a time series of expected returns, only the models by which we estimate expected returns. Any test is thus a joint test of changes to expected returns and of the model for estimating expected returns. Some issues are alleviated by the differences-in-differences approach. For example, the risk-free rate is added to the expected returns and thus drops out when differencing. Changes in banks' cost of capital can be compared to other industries using different models, even if it is difficult to precisely estimate the level of banks' cost of capital itself. Finally, the exact years in which cost of capital estimates for banks were unusually low were exactly the years in which ex-post realizations suggest that tail risk was growing in the banking industry.

Ultimately, these questions are not just of academic interest. Our estimates of the cost of capital are capturing changes in market prices that matter to bank managers as reflected by changes in bank lending supply – increases in CAPM cost of capital we measure are associated with tighter lending conditions, pricing, and quantity.

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Table 1: Summary Statistics for Cost of Capital Measures and Bank Variables

Panel A reports summary statistics for banks and non-banks in the CRSP-Compustat universe from March 1996 to December 2017. CAPM is the expected return from a single factor market model. CAPM-Rf is the expected return in excess of the one-month Treasury bill rate. FF3-Rf is the excess expected return from the Fama and French (1993) three-factor model. WACC-Rf is the excess weighted average cost of capital. Realized-Rf is the monthly excess realized return multiplied by 12. Bank regulatory variables are obtained from call reports and Y-9C filings. Panel B reports weighted averages over different time periods. The cost of capital is in annualized percentage units. Leverage is the ratio of total debt to total debt plus market equity, where we add deposits to total debt for banks.

Panel A Variable	p25	p50	p75	mean	sd	count
Nonbanks:						
CAPM	6.5	9.2	12.4	9.7	4.9	968938
CAPM - Rf	3.6	6.8	10.2	7.2	4.9	968938
FF3 - Rf	5.2	9.5	14.3	10.1	8.2	968938
WACC-Rf	2.8	5.3	7.9	5.6	3.8	521126
Realized - Rf	-85.4	2.2	92.4	16.7	228.8	968938
Banks:						
CAPM	3.3	6.3	9.5	6.8	4.5	142189
CAPM - Rf	0.8	2.9	7.6	4.4	4.5	142189
FF3 - Rf	1.9	6.5	12.1	7.3	6.8	142189
WACC-Rf	-1.1	0.5	1.3	0.2	1.8	128562
Realized - Rf	-40.4	6.2	58.0	11.5	121.0	142189
Leverage	0.83	0.87	0.91	0.86	0.09	135921
Noninterest Income/ Total Income	14.2	21.1	29.8	60.7	3382.8	101457
Core Deposits / Total Liab.	52.0	60.3	68.2	58.9	14.1	101457
Liquidity Coverage Ratio	58.1	65.7	71.7	63.6	15.8	101457
Tier 1 Capital Ratio	10.5	12.1	14.4	13.2	6.5	99049
RWA / Total Assets	65.0	72.8	80.1	72.2	12.3	99049
Cash + FF Repo + Sec. / Total Assets	18.7	25.6	33.7	27.4	12.3	101457
Loan / Total Assets	60.3	68.2	75.0	66.2	13.7	101457
Trading Assets / Total Assets	0.0	0.0	0.0	0.5	2.9	101457
Commitments / Total Assets	10.5	15.4	22.2	19.9	37.2	101457
Derivatives / Total Assets	0.0	0.0	0.0	0.4	3.2	101457

Panel B Time Period	Basel 1	GLB	Crisis	SCAP	Dodd-Frank
Noninterest Income/ Total Income	41.4	48.3	97.2	52.7	49.6
Core Deposits / Total Liab.	41.1	36.4	34.7	33.8	40.8
Liquidity Coverage Ratio	34.8	32.0	33.7	47.9	57.4
Tier 1 Capital Ratio	9.5	10.6	10.9	13.4	13.8
RWA / Total Assets	79.2	74.4	72.3	67.4	66.7
Cash + FF Repo + Sec. / Total Assets	26.7	28.7	26.9	33.1	34.4
Loan / Total Assets	60.6	52.7	51.2	42.8	46.7
Trading Assets / Total Assets	5.7	7.7	9.4	11.5	8.8
Commitments / Total Assets	70.8	71.7	55.3	45.4	46.0
Derivatives / Total Assets	4.2	7.5	11.6	16.8	12.5
Leverage - Banks and Nonbanks	0.25	0.26	0.26	0.28	0.25
Leverage - Banks	0.80	0.77	0.81	0.85	0.81
Leverage - Nonbanks	0.19	0.19	0.20	0.21	0.19

Table 2: The Cost of Capital for Banks and Non-Banks Over Time

This table reports regressions of cost of capital measures onto a constant and time period dummies for banks and non-banks from March 1996 through December 2017. The dependent variables include the CAPM expected return, CAPM-Rf and FF3-Rf excess expected returns, WACC-Rf excess return, and realized excess return in annualized percent. Standard errors are clustered by firm and month with *, **, *** indicating significance at the 10%, 5%, and 1% levels respectively.

Cost of Capital Measure	Constant	GLB	Crisis	SCAP	Dodd-Frank	N
Banks, Equal Weighted						
CAPM	7.91***	-1.58***	-0.09	-1.42***	-1.69***	142189
	(0.12)	(0.27)	(0.39)	(0.31)	(0.24)	
CAPM-Rf	3.04***	0.24	2.33***	3.33***	2.99***	142189
	(0.15)	(0.21)	(0.25)	(0.33)	(0.24)	
FF3-Rf	8.89***	-3.75***	-0.24	-1.01**	-0.19	142189
	(0.33)	(0.34)	(0.53)	(0.48)	(0.42)	
Realized-Rf	16.91**	-1.33	-47.16***	-4.66	1.80	142189
	(7.69)	(8.46)	(15.96)	(19.66)	(9.14)	
Banks, Value Weighted						
CAPM	13.59***	-3.15***	-0.60*	1.54*	-3.01***	142189
	(0.33)	(0.40)	(0.36)	(0.82)	(0.40)	
CAPM-Rf	8.71***	-1.14***	1.61***	6.28***	1.64***	142189
	(0.34)	(0.38)	(0.52)	(0.83)	(0.39)	
FF3-Rf	15.91***	-6.64***	-0.55	-0.25	-1.29*	142189
	(0.44)	(0.53)	(0.81)	(0.84)	(0.69)	
Realized-Rf	19.17	-12.96	-60.64**	-3.01	-4.95	142189
	(11.96)	(13.13)	(24.30)	(23.95)	(13.76)	
Non-banks, Equal Weighted						
CAPM	10.24***	-0.35	0.02	-1.44***	-1.25***	968938
	(0.12)	(0.25)	(0.44)	(0.18)	(0.16)	
CAPM-Rf	5.37***	1.37***	2.38***	3.29***	3.41***	968938
	(0.13)	(0.21)	(0.18)	(0.19)	(0.15)	
FF3-Rf	11.28***	-1.38***	-2.38***	-1.08***	-1.57***	968938
	(0.19)	(0.23)	(0.23)	(0.22)	(0.20)	
Realized-Rf	12.20	10.50	-24.18	31.67	6.08	968938
	(10.46)	(13.86)	(20.42)	(22.66)	(11.93)	
Non-banks, Value Weighted						
CAPM	12.93***	-1.90***	-2.74***	-5.02***	-4.91***	968938
	(0.18)	(0.29)	(0.44)	(0.25)	(0.22)	
CAPM-Rf	8.06***	-0.12	-0.26	-0.28	-0.26	968938
	(0.17)	(0.20)	(0.23)	(0.25)	(0.22)	
FF3-Rf	6.97***	0.84**	0.25	0.76	0.42	968938
	(0.50)	(0.35)	(0.43)	(0.47)	(0.48)	
Realized-Rf	16.82**	-15.86	-31.50**	1.82	-1.17	968938
	(8.20)	(10.08)	(15.56)	(16.42)	(9.20)	

Table 3: The Cost of Capital for Banks Compared to Other Industries

This table reports the differential cost of capital for banks over time relative to other industries by regressing the CAPM expected return in annualized percentage units onto a constant and time period dummies along with indicator and interaction terms for banks. Regressions are value-weighted by market capitalization or equal-weighted with some specifications including firm fixed effects. Specification (4) is restricted to banks and non-bank financials where financials are defined as firms with two-digit SIC codes between 60 and 69. The sample includes monthly observations for 11,959 companies in CRSP-Compustat from March 1996 to December 2017. Standard errors are clustered by firm and month with *, **, *** indicating significance at the 10%, 5%, and 1% levels respectively.

	(1) CAPM	(2) CAPM	(3) CAPM	(4) CAPM	(5) CAPM	(6) CAPM	(7) CAPM - Rf	(8) CAPM - Rf
GLB	-2.03***	-1.90***	-2.54***	-3.55***	-0.35	-0.75***	-0.83***	0.74***
	(0.27)	(0.29)	(0.27)	(0.52)	(0.25)	(0.23)	(0.20)	(0.20)
Crisis	-2.55***	-2.74***	-3.23***	-1.57***	0.02	-0.66	-0.85***	1.44***
	(0.41)	(0.44)	(0.44)	(0.44)	(0.44)	(0.45)	(0.25)	(0.19)
SCAP	-4.38***	-5.02***	-5.44***	-2.28***	-1.44***	-2.21***	-0.82***	2.23***
	(0.30)	(0.25)	(0.30)	(0.74)	(0.18)	(0.20)	(0.29)	(0.20)
Dodd-Frank	-4.75***	-4.91***	-5.54***	-4.51***	-1.25***	-2.20***	-0.98***	2.20***
	(0.21)	(0.22)	(0.26)	(0.47)	(0.16)	(0.17)	(0.25)	(0.16)
Bank		0.66*	-3.26***	-3.31***	-2.33***	-2.54***	-3.15***	-2.34***
		(0.37)	(0.47)	(0.53)	(0.18)	(0.53)	(0.46)	(0.54)
Bank x GLB		-1.25***	-0.78*	0.23	-1.24***	0.22	-0.58	0.33
		(0.45)	(0.41)	(0.60)	(0.21)	(0.23)	(0.40)	(0.24)
Bank x Crisis		2.14***	2.50***	0.84	-0.11	1.97***	2.24***	2.05***
		(0.60)	(0.65)	(0.59)	(0.30)	(0.33)	(0.65)	(0.33)
Bank x SCAP		6.55***	6.87***	3.69***	0.02	2.32***	6.88***	2.36***
		(0.88)	(0.96)	(1.05)	(0.33)	(0.34)	(0.95)	(0.34)
Bank x Dodd-Frank		1.90***	2.46***	1.42**	-0.44*	1.73***	2.45***	1.76***
		(0.46)	(0.55)	(0.65)	(0.25)	(0.27)	(0.53)	(0.27)
Observations	1111127	1111127	1111062	223432	1111127	1111062	1111062	1111062
Adjusted R^2	0.170	0.199	0.598	0.566	0.053	0.484	0.542	0.537
Fixed Effects	No	No	Yes	Yes	No	Yes	Yes	Yes
Weighting	VW	VW	VW	VW	EW	EW	VW	EW
Sample	All Firms	All Firms	All Firms	Banks+NBF	All Firms	All Firms	All Firms	All Firms

Table 4: The Cost of Capital for the Largest Banks

This table reports the differential cost of capital for the largest banks over time relative to large firms in other industries by interacting the binary variable *Top* with the time period dummies, the *Bank* indicator, and the *Bank* and time period interaction terms. *Top* is a binary variable equal to one when a firm is among the 20 largest firms as measured by assets within its Fama-French 12 industry. Regressions are either value-weighted by market capitalization or equal-weighted with some specifications including firm fixed effects. Standard errors are clustered by firm and month with *, **, *** indicating significance at the 10%, 5%, and 1% levels. The sample period is March 1996 to December 2017.

	(1) CAPM - Rf	(2) CAPM - Rf	(3) CAPM - Rf	(4) CAPM - Rf	(5) CAPM - Rf	(6) CAPM - Rf	(7) CAPM - Rf
GLB	-0.24	1.49***	0.60***	-0.27	0.73***	1.43***	0.81***
	(0.19)	(0.23)	(0.19)	(0.27)	(0.17)	(0.21)	(0.21)
Crisis	-0.10	0.94***	0.24	1.15***	0.76***	2.43***	1.49***
	(0.21)	(0.26)	(0.26)	(0.43)	(0.22)	(0.19)	(0.21)
SCAP	0.34	1.25***	0.50*	2.03***	1.36***	3.34***	2.25***
	(0.29)	(0.26)	(0.27)	(0.53)	(0.23)	(0.20)	(0.21)
Dodd-Frank	-0.10	1.22***	0.39*	0.69**	0.97***	3.53***	2.31***
	(0.21)	(0.22)	(0.23)	(0.35)	(0.21)	(0.16)	(0.17)
Bank	-0.91***	-1.20***	-3.00***	-3.28***	-2.46***	-2.50***	-1.88***
	(0.28)	(0.40)	(0.54)	(0.55)	(0.62)	(0.17)	(0.56)
Top	-1.46***	0.46	1.25***	1.05	1.70***	1.71***	1.10***
	(0.22)	(0.31)	(0.43)	(0.65)	(0.42)	(0.19)	(0.26)
Bank x Top	3.41***	3.17***	0.13	0.25	-0.46	5.19***	0.37
	(0.40)	(0.53)	(0.60)	(0.73)	(0.59)	(0.30)	(0.54)
Bank x GLB		-0.95*	-0.03	0.87**	-0.22	-1.08***	0.41*
		(0.50)	(0.36)	(0.38)	(0.33)	(0.22)	(0.24)
Bank x Crisis		1.85***	3.02***	2.15***	2.61***	-0.08	2.10***
		(0.65)	(0.53)	(0.56)	(0.50)	(0.30)	(0.34)
Bank x SCAP		3.02***	4.42***	2.94***	3.91***	-0.16	2.30***
		(0.65)	(0.64)	(0.75)	(0.57)	(0.32)	(0.34)
Bank x Dodd-Frank		1.69***	3.25***	3.02***	2.71***	-0.52**	1.82***
		(0.46)	(0.39)	(0.44)	(0.39)	(0.25)	(0.27)
Top x GLB		-2.50***	-2.12***	-2.71***	-2.30***	-1.46***	-1.17***
		(0.41)	(0.34)	(0.70)	(0.33)	(0.26)	(0.25)
Top x Crisis		-1.86***	-1.57***	-0.73	-1.91***	-1.35***	-0.84***
		(0.42)	(0.41)	(0.70)	(0.40)	(0.29)	(0.31)
Top x SCAP		-2.34***	-1.90***	2.07	-2.59***	-1.23***	-0.49
		(0.42)	(0.44)	(1.36)	(0.43)	(0.36)	(0.35)
Top x Dodd-Frank		-2.28***	-1.94***	-0.84	-2.35***	-2.26***	-1.48***
		(0.36)	(0.37)	(0.76)	(0.37)	(0.26)	(0.28)
Bank x Top x GLB		-0.48	-0.99*	-0.40	-0.66	-1.27***	-2.32***
		(0.71)	(0.55)	(0.84)	(0.54)	(0.38)	(0.39)
Bank x Top x Crisis		-0.50	-1.27*	-2.13**	-0.75	0.65	-0.88
		(0.78)	(0.70)	(0.85)	(0.61)	(0.59)	(0.62)
Bank x Top x SCAP		3.81***	2.78***	-1.27	3.26***	4.21***	2.04**
		(1.01)	(1.07)	(1.64)	(1.02)	(0.85)	(0.87)
Bank x Top x Dodd-Frank		-0.23	-1.24*	-2.45**	-0.78	0.25	-1.86***
		(0.66)	(0.63)	(0.95)	(0.66)	(0.50)	(0.52)
Leverage					0.03		
					(0.58)		
Observations	1111127	1111127	1111062	223432	890583	1111127	1111062
Adjusted R^2	0.055	0.092	0.551	0.599	0.561	0.111	0.538
Fixed Effects	No	No	Yes	Yes	Yes	No	Yes
Weighting	VW	VW	VW	VW	VW	EW	EW
Sample	All Firms	All Firms	All Firms	Banks+NBF	All Firms	All Firms	All Firms

Table 5: The Cost of Capital for Banks Controlling for Bank Characteristics

This table reports the differential cost of capital for banks over time relative to other industries controlling for bank characteristics. Regulatory variables are obtained from call reports and Y-9C filings. The results are reported for expected excess returns in the CAPM in value-weighted regressions with firm fixed effects. The time period dummies and bank indicator are included in the regressions but omitted in the results for brevity. Column (1) replicates column (8) from Table 3. Column (2) includes all of the characteristics unconditionally. Columns (3) to (7) allow the coefficients on each characteristic to vary over time through interaction terms. Column (8) includes all of the characteristics together with time-varying coefficients. Standard errors are clustered by firm and month with *, **, *** indicating significance at the 10%, 5%, and 1% levels. The sample period is March 1996 to December 2017.

	(1) None	(2) All	(3) Non Int. Inc.	(4) Core Deposits	(5) Liq. Coverage	(6) Tier 1	(7) RWA	(8) All
Bank x GLB	-0.58	-0.60	0.45	-1.82***	-1.05**	-1.07**	0.12	-0.20
	(0.40)	(0.37)	(0.57)	(0.53)	(0.47)	(0.46)	(0.59)	(0.51)
Bank x Crisis	2.24***	2.24***	4.04***	0.36	0.95	1.74**	2.29***	2.34***
	(0.65)	(0.62)	(0.79)	(0.77)	(0.80)	(0.71)	(0.83)	(0.78)
Bank x SCAP	6.88***	6.76***	7.80***	3.49***	4.93***	6.87***	1.65	1.74
	(0.95)	(0.95)	(1.22)	(1.07)	(1.50)	(1.11)	(1.49)	(1.27)
Bank x Dodd-Frank	2.45***	2.31***	4.39***	0.27	0.81	2.03***	1.89	1.36
	(0.53)	(0.49)	(0.66)	(0.74)	(0.95)	(0.65)	(1.28)	(1.23)
Characteristic			0.05***	-0.07***	-0.01	-0.01	0.01	
			(0.01)	(0.02)	(0.02)	(0.03)	(0.01)	
Characteristic x GLB			-0.03**	0.03***	0.02*	0.05*	-0.01	
			(0.01)	(0.01)	(0.01)	(0.03)	(0.01)	
Characteristic x Crisis			-0.05***	0.05***	0.04***	0.05*	-0.00	
			(0.01)	(0.01)	(0.01)	(0.03)	(0.01)	
Characteristic x SCAP			-0.03	0.10***	0.05*	0.00	0.08***	
			(0.02)	(0.02)	(0.03)	(0.03)	(0.02)	
Characteristic x Dodd-Frank			-0.05***	0.06***	0.03*	0.03	0.01	
			(0.01)	(0.01)	(0.02)	(0.03)	(0.02)	
Observations	1111062	1111062	1111062	1111062	1111062	1111062	1111062	1111062
Adjusted R^2	0.542	0.543	0.542	0.543	0.543	0.542	0.543	0.546
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Weighting	VW	VW	VW	VW	VW	VW	VW	VW
Sample	All Firms	All Firms	All Firms	All Firms	All Firms	All Firms	All Firms	All Firms
Characteristic	None	All	Non Int. Inc.	Core Deposits	Liq. Coverage	Tier 1	RWA	All
Time Varying	NA	No	Yes	Yes	Yes	Yes	Yes	Yes

Table 6: The Impact of Stress Testing

This table reports the cost of capital for the largest 90 banks each month by assets with regulatory data from March 1996 to December 2017. The sample includes 227 banks in total and separates the Dodd-Frank period into Dodd-Frank: Pre-CCAR from July 2010 through August 2013 and Dodd-Frank: Post-CCAR from September 2013 through December 2017. SCAP Firm is a binary variable equal to 1 for banks included in the initial round of stress testing. CCAR Firm is a binary variable equal to 1 for banks that were later added to stress testing. Results are reported for expected excess returns in the CAPM and FF3 models. Regressions are equal-weighted with some specifications including firm fixed effects and control variables for bank characteristics. Standard errors are clustered by firm and month with *, **, *** indicating significance at the 10%, 5%, and 1% levels. The sample period is March 1996 to December 2017.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	CAPM - Rf	CAPM - Rf	CAPM - Rf	CAPM - Rf	FF3 - Rf	FF3 - Rf	FF3 - Rf	FF3 - Rf
GLB	0.46	0.46	0.19	0.19	-4.86***	-4.85***	-4.80***	-4.81***
	(0.30)	(0.30)	(0.28)	(0.29)	(0.40)	(0.40)	(0.43)	(0.45)
Crisis	4.20***	4.19***	3.84***	3.84***	3.26***	3.26***	3.45***	3.46***
	(0.44)	(0.43)	(0.48)	(0.48)	(0.98)	(0.98)	(1.01)	(1.01)
SCAP	6.96***	6.57***	6.40***	6.38***	1.68**	1.46*	1.86**	1.94**
	(0.61)	(0.61)	(0.62)	(0.61)	(0.73)	(0.76)	(0.81)	(0.78)
Dodd-Frank: Pre-CCAR	3.89***	3.92***	3.99***	4.01***	0.40	0.06	1.00	1.12*
	(0.33)	(0.35)	(0.40)	(0.40)	(0.54)	(0.56)	(0.66)	(0.65)
Dodd-Frank: Post-CCAR	3.46***	3.67***	3.88***	3.48***	1.04**	1.27**	2.76***	2.56***
	(0.40)	(0.43)	(0.47)	(0.43)	(0.50)	(0.54)	(0.63)	(0.61)
SCAP Firm	1.07***	1.24***			-0.04	-0.15		
	(0.30)	(0.36)			(0.42)	(0.45)		
CCAR Firm	0.23	0.23			-0.44	-0.43		
	(0.42)	(0.45)			(0.59)	(0.53)		
SCAP Firm x SCAP		2.00***	1.95***	1.78**		1.20	1.11	1.00
		(0.72)	(0.75)	(0.74)		(0.90)	(0.96)	(0.98)
SCAP Firm x DF: Pre-CCAR		-0.20	-0.49	-0.62		1.76*	1.14	1.08
		(0.54)	(0.55)	(0.57)		(0.90)	(0.88)	(0.90)
SCAP Firm x DF: Post-CCAR		-1.10**	-1.50***	-1.55***		-1.10	-2.25***	-2.19***
		(0.44)	(0.48)	(0.49)		(0.73)	(0.74)	(0.78)
CCAR Firm x DF: Post-CCAR		-0.06	-0.51	-0.59		-0.06	-0.94	-1.04
		(0.40)	(0.40)	(0.43)		(0.75)	(0.70)	(0.73)
Tier 1 Capital Ratio				-0.01				-0.02
				(0.02)				(0.03)
Observations	23347	23347	23347	23347	23347	23347	23347	23347
Adjusted R^2	0.364	0.369	0.581	0.592	0.319	0.323	0.506	0.509
Fixed Effects	No	No	Yes	Yes	No	No	Yes	Yes
Controls	No	No	No	Yes	No	No	No	Yes
Weighting	EW	EW	EW	EW	EW	EW	EW	EW

Table 7: The CAPM Cost of Capital and Lending Supply

This table reports regressions of quarterly changes in lending standards as measured by survey responses onto one-year changes in the CAPM risk premium (Δ CAPM - Rf) from March 1996 to December 2017. Panel A regresses the change in lending standards (Std) onto different specifications that include one-year changes in the risk-free rate (Δ Rf) and one-year realized bank-level stock market returns (Realized Return) and quarter fixed effects. Panels B and C regress changes in the terms for loans that banks are willing to approve to large and middle-market firms (LM) and small firms (S) onto one-year changes in the CAPM risk premium with quarter fixed effects. The loan terms include the cost of credit lines (CCL), the spread of loan rates over bank's cost of funds (Spd), the premiums charged on riskier loans (RP), loan covenants (Cov), collateralization requirements (Col), and the maximum size of credit lines (Max). The positive and significant coefficients across specifications and loan terms in Panels A and B are consistent with the interpretation that bank managers tighten credit standards and charge wider spreads for large and middle-market firms when their cost of capital increases.

Panel A: Δ Lending Standards

	Std-LM	Std-LM	Std-LM	Std-S	Std-S	Std-S
Δ CAPM - Rf	0.024***	0.012***	0.011**	0.021***	0.010**	0.007*
	(0.007)	(0.004)	(0.005)	(0.007)	(0.004)	(0.004)
Δ Rf		-0.131***			-0.114***	
		(0.020)			(0.018)	
Realized Return		-0.002***			-0.002***	
		(0.001)			(0.001)	
Observations	3776	3776	3776	3672	3672	3672
Adjusted R-squared	0.019	0.159	0.262	0.018	0.153	0.241
Quarter Fixed Effects	No	No	Yes	No	No	Yes
Weighting	EW	EW	EW	EW	EW	EW

Panel B: Δ Loan terms for large and middle-market firms, equal weighted, quarter fixed effects

	CCL	Spd	RP	Cov	Col	Max
Δ CAPM - Rf	0.015**	0.018***	0.016**	0.012**	0.006	0.008*
	(0.007)	(0.007)	(0.006)	(0.005)	(0.004)	(0.005)
Observations	3760	3760	3462	3761	3757	3759
Adjusted R-squared	0.304	0.366	0.313	0.209	0.185	0.180

Panel C: Δ Loan terms for small firms, equal weighted, quarter fixed effects

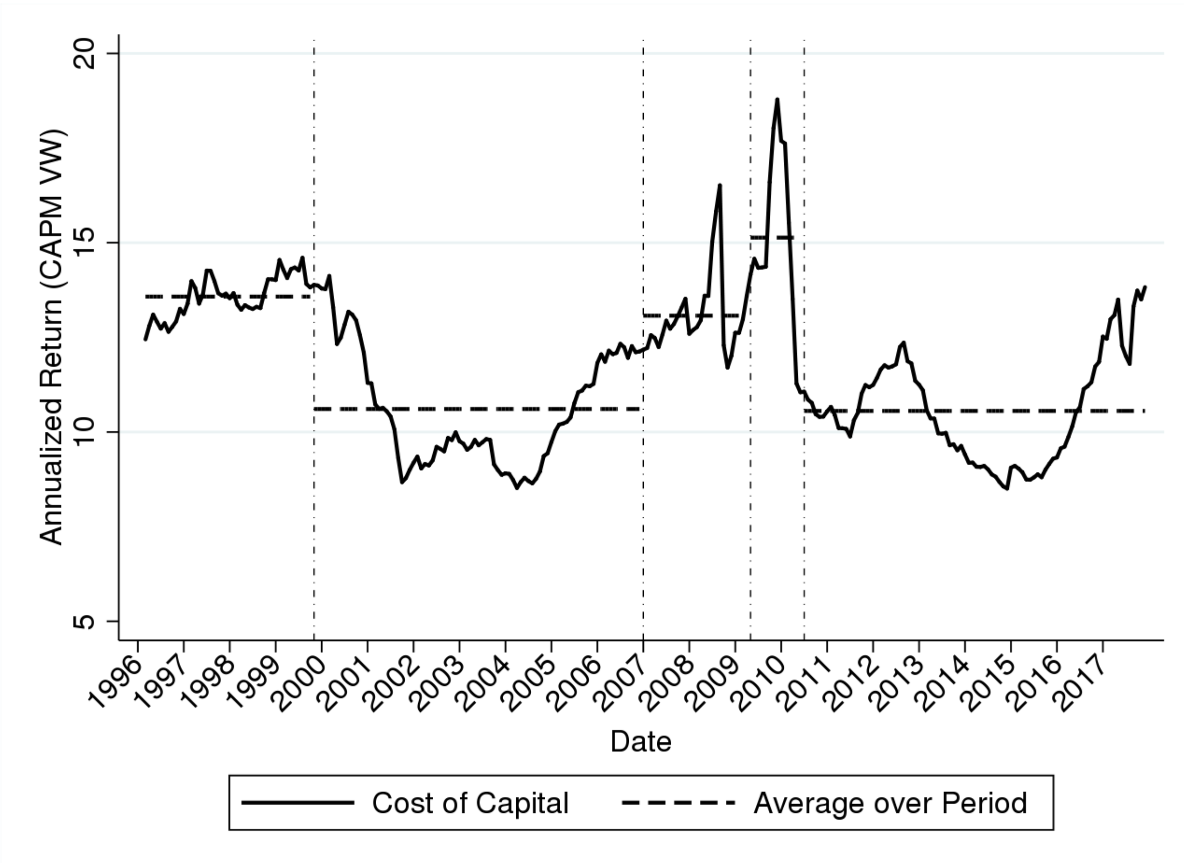
	CCL	Spd	RP	Cov	Col	Max
Δ CAPM - Rf	0.006	0.005	0.008	0.006	0.004	0.004
	(0.006)	(0.006)	(0.006)	(0.004)	(0.004)	(0.005)
Observations	3639	3639	3351	3639	3634	3636
Adjusted R-squared	0.256	0.318	0.267	0.171	0.157	0.138

Table 8: Alternate Cost of Capital Estimates for Banks

This table reports the differential cost of capital net of the risk-free rate for banks and for the largest banks as measured by the Fama and French (1993) three-factor model (FF3-Rf) in columns (1) to (3), a five-factor model that combines the Fama and French (1993) factors with tradeable interest rate factors for the short rate and slope of the yield curve (IR-Rf) in columns (4) to (6), and the weighted average cost of capital (WACC-Rf) in columns (7) to (9). Regressions are value-weighted by market capitalization with some specifications including firm fixed effects. Standard errors are clustered by firm and month with *, **, *** indicating significance at the 10%, 5%, and 1% levels. The sample period is March 1996 to December 2017.

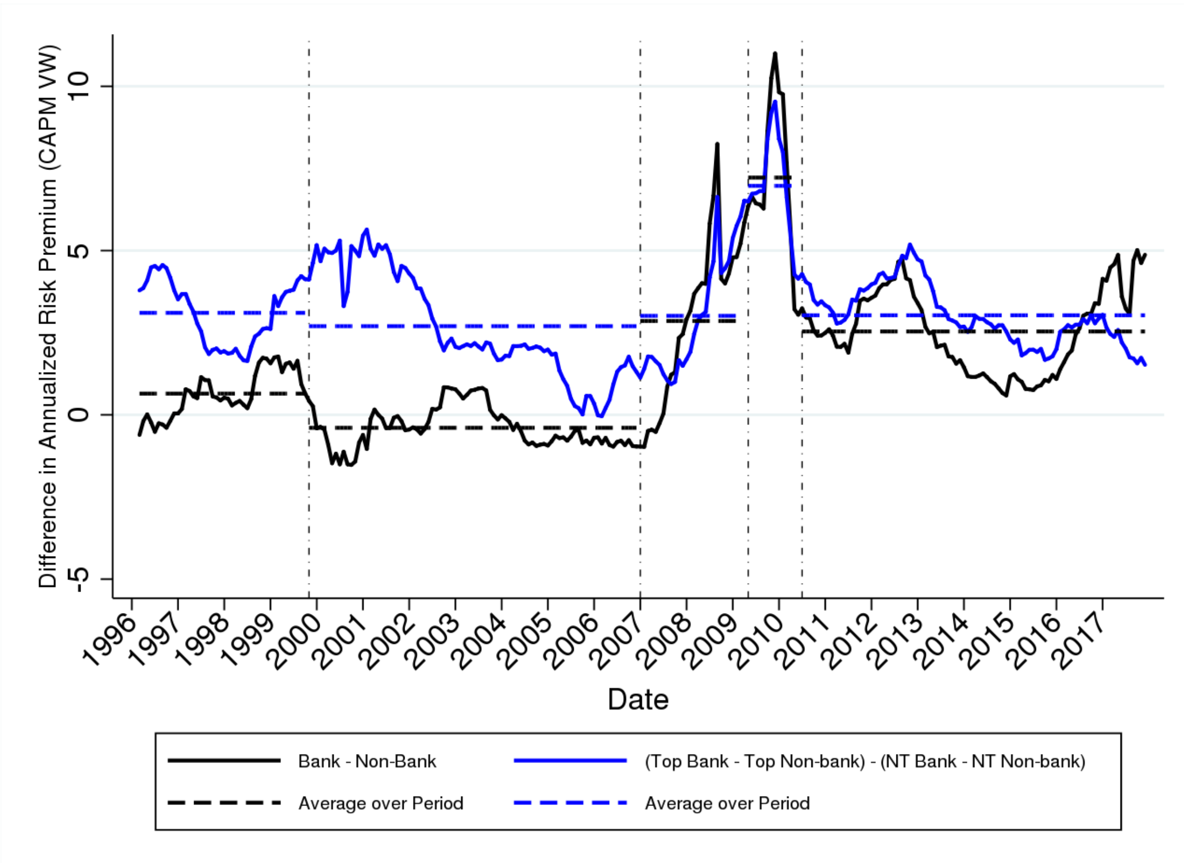
	(1) FF3 - Rf	(2) FF3 - Rf	(3) IR-Rf	(4) IR-Rf	(5) PLS-Rf	(6) PLS-Rf	(7) Log(Beta)	(8) Log(Beta)	(9) Asset Beta	(10) Asset Beta
GLB	1.33***	0.78**	1.14***	0.58	5.13***	5.04***	-0.21***	0.05	-0.11***	0.06***
	(0.43)	(0.37)	(0.41)	(0.39)	(0.63)	(0.70)	(0.04)	(0.03)	(0.03)	(0.02)
Crisis	0.58	-0.62	0.54	-0.62	9.08***	9.10***	-0.08**	0.11***	-0.11***	0.04
	(0.49)	(0.41)	(0.49)	(0.43)	(0.71)	(0.69)	(0.04)	(0.03)	(0.03)	(0.03)
SCAP	1.39**	0.55	1.36**	0.48	14.77***	16.19***	-0.10**	0.13***	-0.13***	0.07***
	(0.55)	(0.40)	(0.55)	(0.43)	(0.64)	(0.57)	(0.04)	(0.03)	(0.03)	(0.03)
Dodd-Frank	1.02*	-0.34	1.23**	0.01	13.12***	14.36***	-0.10***	0.14***	-0.13***	0.05**
	(0.54)	(0.40)	(0.54)	(0.43)	(0.46)	(0.44)	(0.04)	(0.03)	(0.03)	(0.03)
Bank	0.91	-0.58	2.16	0.45	-1.06	1.32	-0.41***	-0.36***	-0.08*	0.03
	(1.32)	(1.20)	(1.36)	(1.31)	(1.34)	(1.46)	(0.07)	(0.07)	(0.04)	(0.05)
Bank x GLB	-7.70***	-5.00***	-6.59***	-3.55***	1.38***	0.62	0.07	0.10*	0.04	-0.08***
	(0.65)	(0.53)	(0.66)	(0.59)	(0.32)	(0.39)	(0.06)	(0.06)	(0.03)	(0.02)
Bank x Crisis	-0.52	2.03**	-0.51	2.84***	4.02***	2.03***	0.27***	0.44***	0.06	-0.00
	(0.98)	(0.93)	(0.94)	(0.90)	(0.73)	(0.60)	(0.08)	(0.07)	(0.04)	(0.04)
Bank x SCAP	-0.60	-0.37	-0.81	0.28	14.02***	4.59***	0.66***	0.60***	0.18***	-0.02
	(1.09)	(0.80)	(1.15)	(0.98)	(1.82)	(0.88)	(0.09)	(0.08)	(0.05)	(0.04)
Bank x Dodd-Frank	-1.17	1.41**	-4.48***	-1.07	5.34***	1.29**	0.32***	0.50***	0.04	-0.04
	(0.99)	(0.67)	(1.06)	(0.71)	(0.89)	(0.51)	(0.07)	(0.06)	(0.04)	(0.03)
Top		-1.47*		-1.57**		1.51***		0.27***		0.16***
		(0.78)		(0.76)		(0.50)		(0.06)		(0.05)
Bank x Top		2.53**		2.97***		-3.78***		-0.01		-0.14***
		(1.07)		(1.14)		(1.09)		(0.08)		(0.05)
Top x GLB		0.83		0.86		0.10		-0.38***		-0.25***
		(0.68)		(0.67)		(0.30)		(0.06)		(0.04)
Top x Crisis		1.80**		1.76**		-0.05		-0.28***		-0.21***
		(0.71)		(0.71)		(0.36)		(0.06)		(0.05)
Top x SCAP		1.25		1.32		-2.21***		-0.34***		-0.28***
		(0.80)		(0.81)		(0.57)		(0.07)		(0.05)
Top x Dodd-Frank		2.01**		1.84**		-1.91***		-0.35***		-0.25***
		(0.79)		(0.79)		(0.46)		(0.06)		(0.04)
Bank x Top x GLB		-4.13***		-4.69***		1.43**		-0.07		0.16***
		(0.92)		(0.92)		(0.57)		(0.09)		(0.04)
Bank x Top x Crisis		-3.93***		-5.06***		2.99***		-0.26***		0.09
		(1.05)		(1.06)		(0.76)		(0.09)		(0.06)
Bank x Top x SCAP		-0.95		-2.16		12.60***		0.04		0.26***
		(1.34)		(1.44)		(1.78)		(0.11)		(0.06)
Bank x Top x Dodd-Frank		-3.98***		-5.10***		5.92***		-0.25***		0.12**
		(1.33)		(1.33)		(1.14)		(0.08)		(0.05)
Observations	1111062	1111062	1111062	1111062	1072888	1072888	1111062	1111062	890356	890356
Adjusted R^2	0.491	0.494	0.413	0.416	0.671	0.675	0.460	0.471	0.656	0.663
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Weighting	VW	VW	VW	VW	VW	VW	VW	VW	VW	VW
Sample	All Firms	All Firms	All Firms	All Firms	All Firms	All Firms	All Firms	All Firms	All Firms	All Firms

Figure 1: The Cost of Capital for Banks



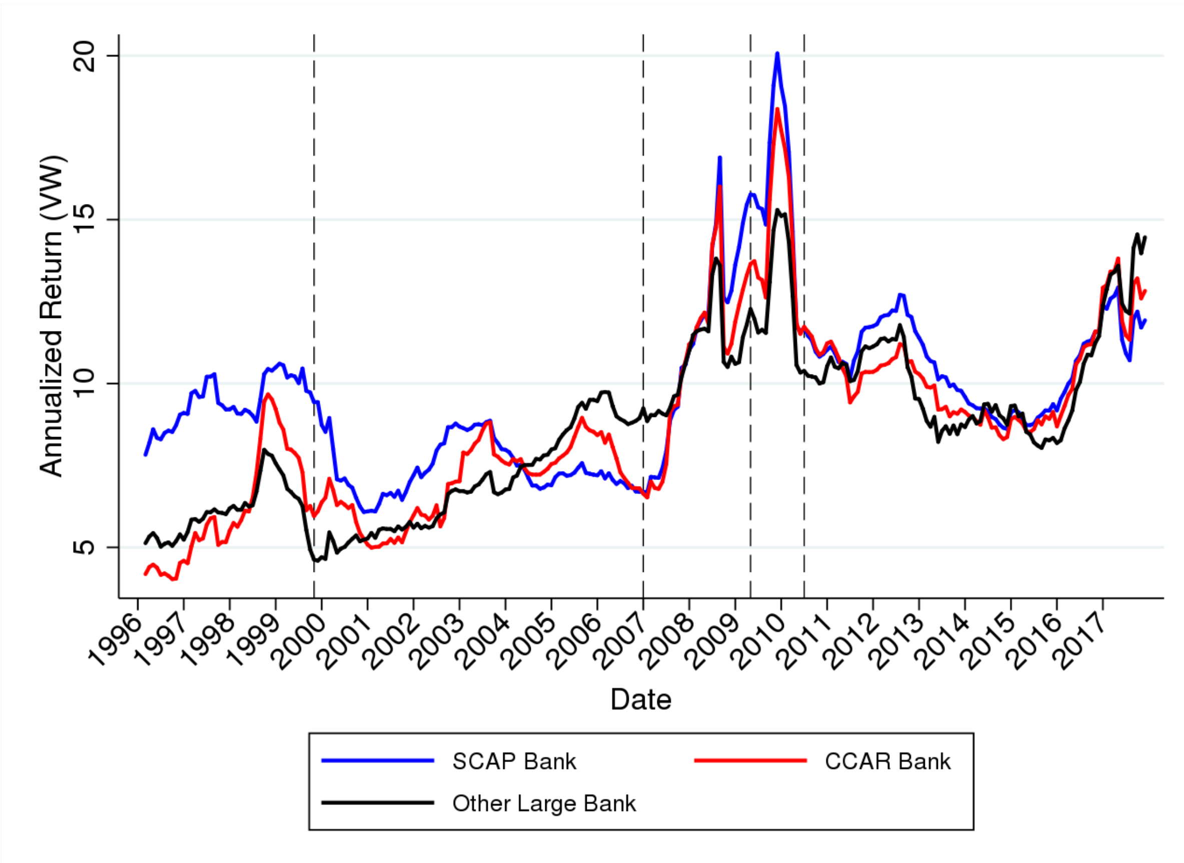
This figure plots the CAPM cost of capital for banks in the CRSP-Compustat universe value-weighted by market capitalization from March 1996 to December 2017. The cost of capital is estimated for each bank as $E_t[R_{i,t+1}] = R_{f,t} + \beta_{i,t} \cdot \mu$ where $R_{f,t}$ is the three-month Treasury bill rate, $\beta_{i,t}$ is a time-varying beta from rolling one-year regressions of daily firm level excess returns onto CRSP value-weighted excess returns, and $\mu = 8.2\%$ is the average annualized return for the CRSP value-weighted portfolio from 1975 to 2016.

Figure 2: The Cost of Capital for Banks Compared to Other Industries



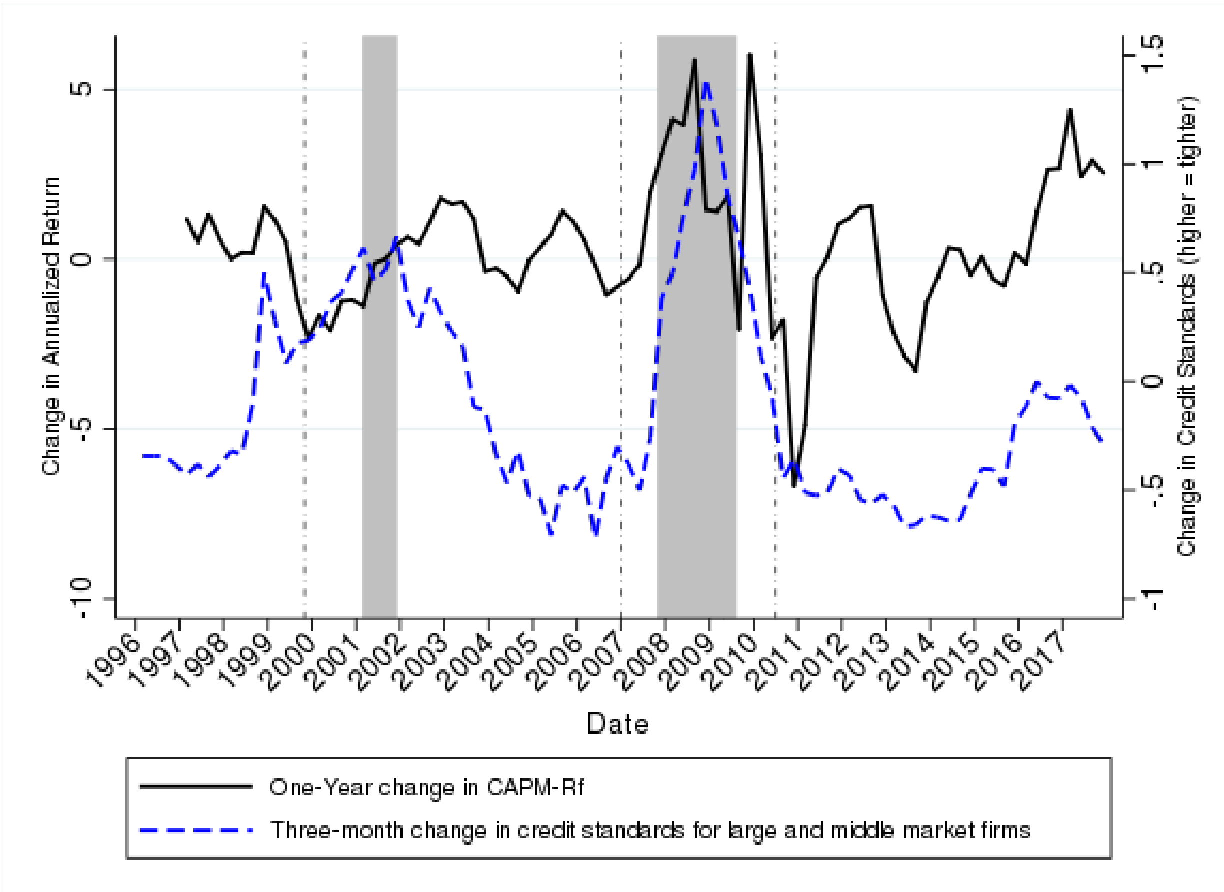
This figure plots the difference in the CAPM cost of capital estimate net of the risk-free rate for banks and top banks relative to other firms in the CRSP-Compustat universe value-weighted by market capitalization from March 1996 to December 2017. The dashed lines plot the average differences across subperiods.

Figure 3: The Cost of Capital for the Largest Banks



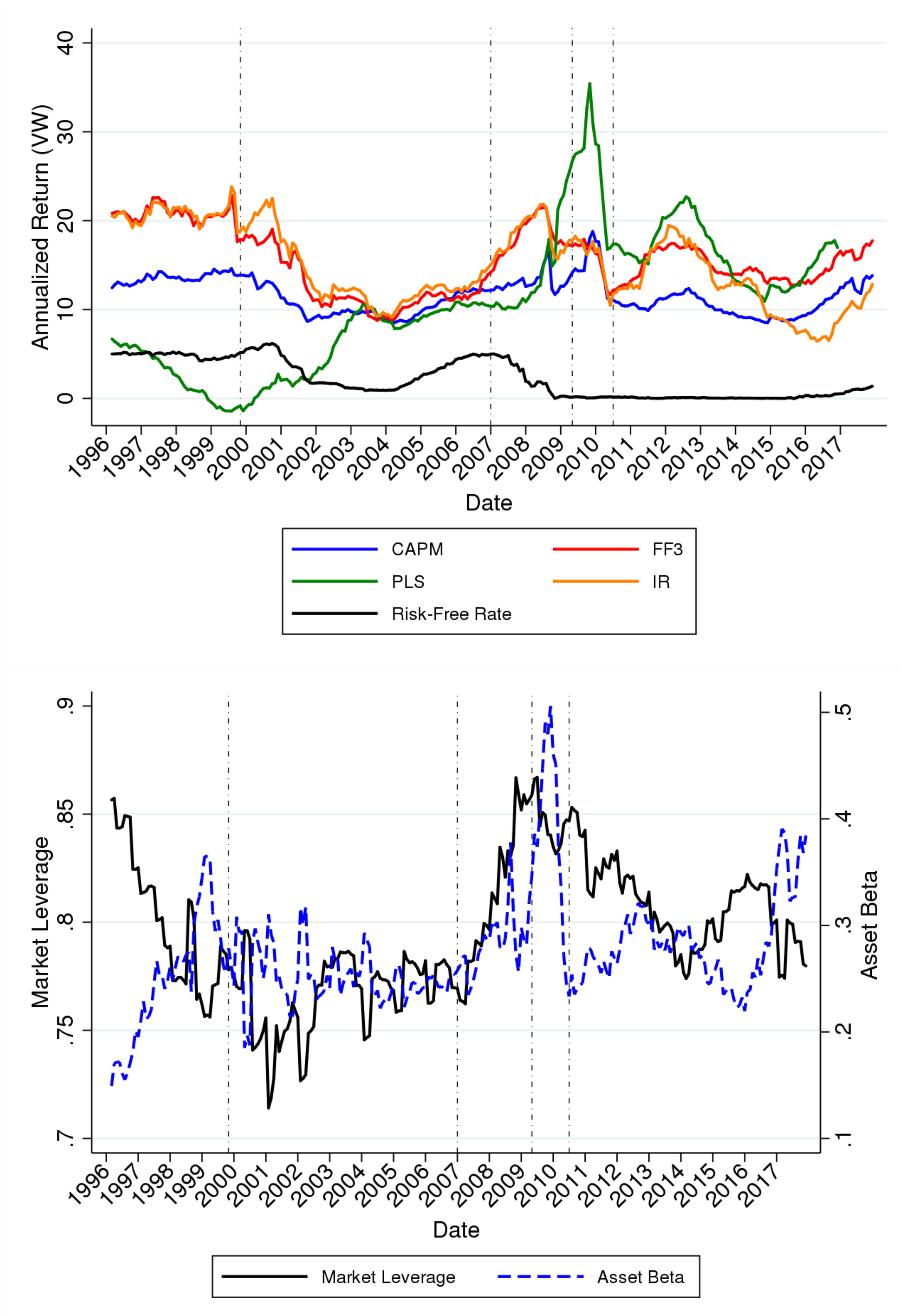
This figure plots the CAPM cost of capital for the $SCAP$, $CCAR$, and other Top 90 largest banks by assets in the CRSP-Compustat universe as an equal-weighted average from March 1996 to December 2017. Table 6 analyzes the cost of capital for these banks to study the impact of stress testing.

Figure 4: Senior Loan Officer Opinion Survey and Cost of Capital



This figure plots the average three-month change in credit standards for large and middle-market firms as measured by survey responses against the average one-year change in the CAPM risk premium from March 1996 to December 2017. In aggregate, changes in credit standards are 29% [1.83] correlated with the change in the CAPM risk premium, measuring significance with a Newey-West t-statistic in brackets that is computed with 4 quarterly lags. Gray bars indicate NBER recession shading.

Figure 5: Alternative Cost of Capital Estimates for Banks



The top figure plots the alternative cost of capital estimates in the CAPM, FF3, IR, and PLS models. The bottom figure plots asset beta against market leverage. The results are value-weighted by market capitalization for banks in the CRSP-Compustat universe from March 1996 to December 2017, except for the PLS model which is available until 2016.

A Appendix

A.1 Alternative definitions of regulatory breaks

In addition to varying our regulatory time periods by a few months, we experiment with different time series breaks. Because the SCAP was a one time stress test, rather than a regulatory change, we combine together the Crisis with the SCAP period. Comparing Table AA.1, specification (3) to Table 3 specification (7), our finding that the difference-in-difference for the current period between banks and non-banks is still economically and statistically significant at 199 basis points for the combined period, as compared to 209 basis points when comparing the current to the SCAP period.

A.2 Alternative bank sample

To the extent that we are interested in understanding changes to the market expected returns from banking assets, we considered other definitions of banks. We narrowing the sample to define as banks only those firms with SIC codes beginning with 60 (Depository Institutions). We drop from our sample entirely firms that were previously identified as banks but had SIC codes that did not begin with 60, since these firms are also subject to changes in regulation and thus do not belong in the comparison group. Results are generally similar to those presented in the paper, suggesting that changes to the cost of capital are not being driven solely by changes to the sample of regulated banks.

A.3 Alternative beta estimation methods

In addition to exploring alternative factor models to the CAPM, we also check the robustness of our findings by varying the estimation method for computing time-varying betas. Table A.3 summarizes these results by reporting value-weighted difference-in-difference regressions for the CAPM, three-factor, and five-factor models using different estimation methods to compute the betas for each of these models. In unreported analysis we confirm that similar results hold for specifications that include firm fixed effects.

Overall we find that the cost of capital estimates are similar across the different beta estimation methods. In the first column (1) we report the baseline approach in which lagged betas are estimated from rolling regressions using daily returns over a one-year window. The second column (2) repeats this analysis using rolling regressions with overlapping weekly returns instead of daily returns. The third column (3) follows Ang and Kristensen (2012) to estimate centered betas from rolling Gaussian kernel-weighted regressions with an optimal bandwidth parameter that is selected for daily returns. The fourth column (4) estimates lagged betas following the betting-against-beta approach from Frazzini and Pedersen (2014) for the CAPM.

Comparing the betas estimated from daily versus weekly returns, the betas from daily returns should be preferred in the absence of microstructure noise as the accuracy of covariance estimation is increasing in the sampling frequency (Merton 1980). However, in the presence of noise such as nonsynchronous observations of firm-level and factor returns, zooming out to a lower frequency may be preferred. Empirically, we find the results are similar using betas estimated from daily and weekly returns. For example, the CAPM risk premium declines by 4.67% using daily betas and 4.07% using weekly betas from the SCAP to the Dodd-Frank period while increasing 1.89% and 1.32% relative to the pre-GLB period. The standard errors on these coefficients are about .50% to 1%, so these differences are not statistically significant. There is a difference, however, for the weekly beta estimates in the SCAP period where banks cost of capital appears somewhat lower in column (2) relative to column (1). In this case, one might argue in favor of the daily betas on economic grounds, as weekly returns during the financial crisis may be smoothing over some of the volatile moves in bank stocks that were correlated with the risk factors at daily and higher frequencies.

In column (3) the Ang and Kristensen (2012) estimates (AK) differ from the other measures as they reflect centered betas that are smoothed in Gaussian kernel-weighted regressions.[17] Despite these differences, the results are relatively similar across the different models. For example, in the case of the CAPM, the AK risk premium declined by 2.65% from SCAP to Dodd-Frank. While this magnitude is somewhat lower than in columns (1) and (2), the AK estimates also feature a higher cost of capital for banks in the Crisis period relative to the daily and weekly betas. The CAPM risk premium for banks increases by 3.5% in column (3) versus only 1.87% and .90% increases in columns (1) and (2). Taken together, these differences reflect how the centered AK betas have shifted and smoothed some of the differential increase in the cost of capital for banks.

Finally, in column (4), the betting-against-beta approach separates the estimation of the firm-level volatility and correlation parameters for the CAPM. Following Frazzini and Pedersen (2014), volatility is estimated using daily log-returns over the past year while

[17]The optimal bandwidth balances the bias-variance trade-off in estimating the time-varying betas. It is estimated from a first-stage regression using a uniform one-sided kernel with 252 days of lagged data (the baseline estimates). The distribution of optimal bandwidths for the second-stage regressions has a 1.96 z-score for the Gaussian kernel at .47, .88, 1.01, 1.12, and 1.48 years for the 1st, 25th, 50th, 75th, and 99th quantiles respectively. As a result, most of the weight for the kernel regressions falls within one-year of the current date. In rare cases where the 1.96 z-score is less than 3-months, we truncate the optimal bandwidth to ensure that at least 6-monthns of data fall within 95% of the mass for the Gaussian kernel. The truncation impacts less than .01% of observations.

correlation with the market is estimated using three-day log returns over the past five years. The results are similar to the estimates in columns (1) and (2), with the different treatment of the volatility and correlation parameters reflecting the tradeoffs in using daily versus weekly data as discussed above.

A.4 Additional Time-Varying Bank Characteristic Analysis

RWA is a complicated metric which makes it difficult to interpret the change in the bank x time interaction coefficients between column (2) and column (7) in Table 5. Table A.4 extends the analysis by decomposing RWA into its component parts to better understand which type of risks are driving changes in the cost of capital over time. We examine the relationship between the cost of capital and securities (including cash, available-for-sale and held-to-maturity securities, and securities purchased under agreements to resell), loans, trading assets, loan commitments, and total derivatives. As before, we first include all of the variables unconditionally, then one by one conditionally, and then all conditionally with time-varying coefficients. While none of the RWA components by itself reverses the general patterns, we do find, as in Table 5 specification (7), that including all RWA components results in no significant change for banks' cost of capital from the SCAP to the Dodd-Frank periods. In addition, from inspecting the coefficients for the different components, we find evidence that loans and loan commitments drive part of the increase in RWA's explanatory power during the SCAP period, although not enough to explain all of the change in banks' cost of capital following the financial crisis. This contrasts securities, trading, and derivatives whose coefficients are roughly stable since the GLB period. Finally, we extend the analysis from Table 5 for the largest banks by adding the bank x Top interaction terms. In these regressions we find a decline in the largest banks' cost of capital by about 3% to 4% from the SCAP to the Dodd-Frank period across specifications, even with the increased coefficient on RWA during the SCAP period in specification (7). This indicates that RWA is not driving the results for the very largest banks, a result that contrasts Tables 5 and A.4.

A.5 Weighted average cost of capital estimates

Bank managers often focus on the cost of equity capital which is compared to ROE. The advantage of this measure is that if banks are actively managing a net interest margin spread, their cost of debt may not be a relevant metric. However, since banks are so heavily financed with debt, an equity based measure may not capture their average financing cost (nor their marginal cost). We therefore explore another commonly used measure of the cost of capital, the weighted average cost of capital (WACC). This measure explicitly takes into account the after-tax cost of debt, the cost of equity, and the capital structure. It may not, however, reflect changes in bank risk or the pricing of bank risk as quickly as an equity based cost of capital metric when estimates of the cost of debt adjust slowly.

We estimate the weighted average cost of capital from merged CRSP-Compustat data as,

$$WACC_{i,t} = Re_{i,t} \cdot \frac{ME_{i,t}}{D_{i,t} + ME_{i,t}} + Rd_{i,t} \cdot (1 - \tau_{i,t}) \cdot \frac{D_{i,t}}{D_{i,t} + ME_{i,t}}, \tag{7}$$

where $Re_{i,t}$ is the cost of equity capital as estimated in equation 1, $Rd_{i,t}$ is the cost of debt, $\tau_{i,t}$ is the effective tax rate, $D_{i,t}$ is total debt, $ME_{i,t}$ is market equity, and $L_{i,t} = D_{i,t}/(D_{i,t} + ME_{i,t})$ is market leverage.[18] We winsorize the cost of debt, the effective tax rate, and market leverage at the 1% and 99% percentiles to mitigate the impact of outliers and measurement error. This data cleaning step is performed separately for financials and non-financials each month to allow for differences in firm characteristics and time trends, such as the high leverage of financial firms and the lower cost of debt and tax rates in recent years. When defining total debt for banks, we add the total amount of deposits to capture this important component of bank leverage. This results in average leverage in the current period for banks of 0.81 and for non-banks of 0.19 (see Table 1).

Table A.6 repeats the difference-in-differences analysis using WACC-Rf as the dependent variable. Column (1) reports the weighted average of WACC-Rf over time which has increased by around 1% over the past twenty years. Columns (2) and (3) report the differential WACC-Rf for banks. One immediate change is that bank WACC is almost 6% lower than non-bank WACC on average (Bank dummy in column 2). This result reflects banks' use of leverage and the lower cost of debt relative to equity financing. In similarity to the previous results for the CAPM, columns (2) and (3) indicate that banks' WACC-Rf decreased from the SCAP to the Dodd-Frank period but increased from the pre-GLB period to the Dodd-Frank period. Finally, we do not find a significant decline in WACC-Rf for the top banks between the SCAP and Dodd-Frank periods either in the cross-section or within firm (columns 4 and 5). This contrasts the estimates of the cost of equity capital for the top banks which have featured a large and significant decline across specifications when comparing the SCAP and Dodd-Frank periods. This may reflect the fact that deposit expenses may be constrained from falling by the zero lower bound.

[18] The cost of debt is a one-year moving average of quarterly interest expense over total debt which includes deposits. Total debt is long-term debt (Item DLTTQ) plus short-term debt (Item DLCQ) plus deposits if available (Item DPTCQ). Depending on availability, we use Item XINTQ or Item TIEQ in that order for quarterly interest expense. The effective tax rate is a one-year moving median of quarterly income taxes (Item TXTQ) over pre-tax income (Item PIQ).

Appendix Table 1: Cost of Capital Estimates for Banks with Alternative Regulatory Breaks

This table reports the differential cost of capital for banks over time relative to other industries by regressing the CAPM expected return in annualized percentage units onto a constant and time period dummies along with indicator and interaction terms for banks. This table combines the Crisis and SCAP time periods to create one dummy for both periods. Regressions are value-weighted by market capitalization or equal-weighted with some specifications including firm fixed effects. Standard errors are clustered by firm and month with *, **, *** indicating significance at the 10%, 5%, and 1% levels.

	(1) CAPM - Rf	(2) CAPM - Rf	(3) CAPM - Rf	(4) CAPM - Rf	(5) CAPM - Rf	(6) CAPM - Rf	(7) CAPM - Rf	(8) CAPM - Rf	(9) CAPM - Rf	(10) CAPM - Rf	(11) CAPM - Rf
GLB	-0.22	-0.12	-0.84***	-1.80***	1.37***	0.74***	1.49***	0.60***	-0.34	1.43***	0.81***
	(0.18)	(0.20)	(0.20)	(0.44)	(0.21)	(0.20)	(0.23)	(0.19)	(0.27)	(0.21)	(0.21)
Crisis	0.06	-0.26	-0.84***	0.99**	2.67***	1.69***	1.04***	0.32	1.31***	2.72***	1.73***
	(0.23)	(0.23)	(0.26)	(0.46)	(0.18)	(0.18)	(0.25)	(0.25)	(0.44)	(0.18)	(0.19)
Dodd-Frank	-0.09	-0.26	-0.98***	-0.08	3.41***	2.18***	1.22***	0.38*	0.60*	3.53***	2.29***
	(0.20)	(0.22)	(0.25)	(0.43)	(0.15)	(0.16)	(0.22)	(0.23)	(0.35)	(0.16)	(0.17)
Bank		0.65*	-2.81***	-2.84***	-2.34***	-2.29***	-1.20***	-2.68***	-2.81***	-2.50***	-1.76***
		(0.37)	(0.42)	(0.46)	(0.18)	(0.54)	(0.40)	(0.50)	(0.50)	(0.17)	(0.56)
Bank x GLB		-1.02**	-0.58	0.38	-1.13***	0.33	-0.95*	-0.06	0.89**	-1.08***	0.40*
		(0.44)	(0.40)	(0.54)	(0.21)	(0.24)	(0.50)	(0.36)	(0.38)	(0.22)	(0.24)
Bank x Crisis		3.52***	3.81***	1.98***	-0.03	2.14***	2.19***	3.35***	2.38***	-0.11	2.15***
		(0.64)	(0.70)	(0.62)	(0.29)	(0.31)	(0.61)	(0.53)	(0.57)	(0.29)	(0.32)
Bank x Dodd-Frank		1.89***	2.32***	1.40**	-0.42*	1.75***	1.69***	3.16***	2.98***	-0.52**	1.81***
		(0.45)	(0.51)	(0.59)	(0.25)	(0.27)	(0.46)	(0.39)	(0.44)	(0.25)	(0.27)
Top							0.46	1.24***	1.26**	1.71***	1.10***
							(0.31)	(0.43)	(0.63)	(0.19)	(0.26)
Bank x Top							3.17***	0.20	0.16	5.19***	0.43
							(0.53)	(0.58)	(0.69)	(0.30)	(0.52)
Top x GLB							-2.50***	-2.13***	-2.72***	-1.46***	-1.17***
							(0.41)	(0.34)	(0.69)	(0.26)	(0.25)
Top x Crisis							-2.02***	-1.68***	-0.17	-1.29***	-0.70**
							(0.40)	(0.40)	(0.70)	(0.28)	(0.29)
Top x Dodd-Frank							-2.28***	-1.94***	-1.01	-2.26***	-1.48***
							(0.36)	(0.37)	(0.72)	(0.26)	(0.27)
Bank x Top x GLB							-0.48	-0.97*	-0.37	-1.27***	-2.33***
							(0.71)	(0.54)	(0.81)	(0.38)	(0.39)
Bank x Top x Crisis							1.18	0.33	-1.19	1.83***	0.05
							(0.82)	(0.78)	(0.86)	(0.62)	(0.60)
Bank x Top x Dodd-Frank							-0.23	-1.31**	-2.29***	0.25	-1.94***
							(0.66)	(0.61)	(0.88)	(0.50)	(0.51)
Observations	1111127	1111127	1111062	223432	1111127	1111062	1111127	1111062	223432	1111127	1111062
Adjusted R^2	0.001	0.033	0.536	0.535	0.103	0.536	0.086	0.545	0.557	0.110	0.537
Fixed Effects	No	No	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes
Weighting	VW	VW	VW	VW	EW	EW	VW	VW	VW	EW	EW
Sample	All Firms	All Firms	All Firms	Banks+NBF	All Firms	All Firms	All Firms	All Firms	Banks+NBF	All Firms	All Firms

Appendix Table 2: Cost of Capital Estimates for Banks with Alternative Bank Sample

This table reports the differential cost of capital for banks over time relative to other industries by regressing the CAPM expected return in annualized percentage units onto a constant and time period dummies along with indicator and interaction terms for banks. This table uses an alternative definition of banks defined as SIC code 60 firms and removing from the panel banks in the original sample that don't have SIC code 60. Regressions are value-weighted by market capitalization or equal-weighted with some specifications including firm fixed effects. Standard errors are clustered by firm and month with *, **, *** indicating significance at the 10%, 5%, and 1% levels.

	(1) CAPM - Rf	(2) CAPM - Rf	(3) CAPM - Rf	(4) CAPM - Rf	(5) CAPM - Rf	(6) CAPM - Rf	(7) CAPM - Rf	(8) CAPM - Rf	(9) CAPM - Rf	(10) CAPM - Rf	(11) CAPM - Rf
GLB	-0.24	-0.12	-0.83***	-1.76***	1.37***	0.74***	1.50***	0.61***	-0.22	1.43***	0.81***
	(0.18)	(0.20)	(0.20)	(0.47)	(0.21)	(0.20)	(0.23)	(0.20)	(0.27)	(0.21)	(0.21)
Crisis	-0.14	-0.26	-0.85***	0.62	2.38***	1.44***	0.94***	0.24	1.22***	2.43***	1.49***
	(0.21)	(0.23)	(0.26)	(0.46)	(0.18)	(0.19)	(0.26)	(0.26)	(0.45)	(0.19)	(0.21)
SCAP	0.18	-0.28	-0.81***	2.80***	3.29***	2.23***	1.28***	0.53**	2.53***	3.34***	2.26***
	(0.30)	(0.25)	(0.29)	(0.76)	(0.19)	(0.20)	(0.26)	(0.27)	(0.53)	(0.20)	(0.21)
Dodd-Frank	-0.16	-0.27	-0.98***	0.11	3.41***	2.20***	1.23***	0.40*	0.69**	3.53***	2.31***
	(0.21)	(0.22)	(0.25)	(0.46)	(0.15)	(0.16)	(0.22)	(0.23)	(0.35)	(0.16)	(0.17)
Bank		0.52	-3.14	-11.01***	-2.33***	-2.25***	-1.20***	-3.35*	-11.25***	-2.49***	-2.23***
		(0.37)	(2.07)	(1.69)	(0.17)	(0.81)	(0.40)	(1.90)	(1.50)	(0.17)	(0.82)
Bank x GLB		-1.36***	-0.49	0.43	-1.17***	0.32	-1.38***	-0.24	0.57*	-1.10***	0.38
		(0.40)	(0.40)	(0.58)	(0.21)	(0.23)	(0.33)	(0.33)	(0.35)	(0.22)	(0.24)
Bank x Crisis		1.73***	2.56***	1.09**	-0.08	2.03***	1.24**	3.11***	2.12***	-0.08	2.06***
		(0.58)	(0.62)	(0.55)	(0.30)	(0.33)	(0.51)	(0.50)	(0.55)	(0.30)	(0.34)
Bank x SCAP		6.02***	6.85***	3.24***	-0.10	2.27***	1.66**	3.90***	1.89**	-0.16	2.24***
		(1.04)	(1.05)	(1.14)	(0.32)	(0.33)	(0.69)	(0.69)	(0.79)	(0.32)	(0.34)
Bank x Dodd-Frank		1.50***	2.67***	1.58**	-0.56**	1.73***	1.19***	3.25***	2.95***	-0.59**	1.75***
		(0.44)	(0.61)	(0.71)	(0.25)	(0.27)	(0.45)	(0.39)	(0.46)	(0.25)	(0.27)
Top							0.46	1.26***	1.05	1.71***	1.09***
							(0.31)	(0.44)	(0.72)	(0.19)	(0.26)
Bank x Top							3.02***	0.33	0.57	5.14***	0.75
							(0.53)	(0.64)	(0.86)	(0.30)	(0.60)
Top x GLB							-2.50***	-2.13***	-2.89***	-1.46***	-1.17***
							(0.41)	(0.34)	(0.73)	(0.26)	(0.25)
Top x Crisis							-1.86***	-1.58***	-0.95	-1.35***	-0.83***
							(0.42)	(0.41)	(0.74)	(0.29)	(0.31)
Top x SCAP							-2.37***	-1.93***	1.67	-1.23***	-0.49
							(0.42)	(0.45)	(1.41)	(0.36)	(0.35)
Top x Dodd-Frank							-2.29***	-1.95***	-0.58	-2.26***	-1.47***
							(0.36)	(0.37)	(0.85)	(0.26)	(0.28)
Bank x Top x GLB							-0.33	-0.64	0.13	-1.34***	-2.28***
							(0.62)	(0.55)	(0.84)	(0.39)	(0.40)
Bank x Top x Crisis							0.19	-1.01*	-1.63**	0.54	-0.80
							(0.69)	(0.59)	(0.80)	(0.61)	(0.64)
Bank x Top x SCAP							5.59***	3.86***	0.26	4.19***	2.38**
							(1.16)	(1.25)	(1.78)	(0.97)	(1.00)
Bank x Top x Dodd-Frank							0.08	-1.12	-2.48**	0.07	-1.59***
							(0.69)	(0.69)	(1.03)	(0.51)	(0.58)
Observations	1108439	1108439	1108374	220744	1108439	1108374	1108439	1108374	220744	1108439	1108374
Adjusted R^2	0.001	0.025	0.538	0.577	0.105	0.537	0.081	0.548	0.607	0.111	0.538
Fixed Effects	No	No	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes
Weighting	VW	VW	VW	VW	EW	EW	VW	VW	VW	EW	EW
Sample	All Firms	All Firms	All Firms	Banks+NBF	All Firms	All Firms	All Firms	All Firms	Banks+NBF	All Firms	All Firms

Appendix Table 3: Cost of Capital Estimates for Banks with Alternative Betas

This table reports the differential cost of capital for banks relative to other industries for the CAPM, three-factor, and five-factor models using different estimation methods to compute time-varying betas. Daily and weekly returns over the past year are used to compute lagged betas from rolling regressions (Daily and Weekly columns). Daily returns are also used to compute centered betas following the Ang and Kristensen (2012) approach (AK) and lagged betas following the betting-against-beta approach (BAB) from Frazzini and Pedersen (2014). Standard errors are clustered by firm and month with *, **, *** indicating significance at the 10%, 5%, and 1% levels.

	CAPM-Rf				FF3-Rf			IR-Rf		
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(1)	(2)	(3)
	Daily	Weekly	AK	BAB	Daily	Weekly	AK	Daily	Weekly	AK
GLB	-0.12	-0.02	0.30	-0.51**	0.84**	0.97**	0.58*	0.69**	0.77**	0.42
	(0.20)	(0.21)	(0.21)	(0.22)	(0.35)	(0.40)	(0.33)	(0.34)	(0.38)	(0.34)
Crisis	-0.26	-0.20	0.04	-1.06***	0.25	0.30	0.44	0.34	0.30	0.74*
	(0.23)	(0.22)	(0.23)	(0.23)	(0.43)	(0.44)	(0.42)	(0.42)	(0.44)	(0.42)
SCAP	-0.28	-0.01	-0.13	-0.80***	0.76	1.04**	0.48	0.88*	1.37***	0.62
	(0.25)	(0.25)	(0.25)	(0.26)	(0.47)	(0.51)	(0.43)	(0.47)	(0.53)	(0.45)
Dodd-Frank	-0.26	-0.17	-0.03	-0.70***	0.42	0.49	0.32	0.70	0.83	0.72
	(0.22)	(0.19)	(0.22)	(0.21)	(0.48)	(0.51)	(0.44)	(0.48)	(0.52)	(0.46)
Bank	0.65*	1.22***	0.92**	0.95***	8.95***	9.00***	8.53***	9.01***	8.90***	8.88***
	(0.37)	(0.36)	(0.36)	(0.36)	(0.67)	(0.71)	(0.65)	(0.67)	(0.74)	(0.62)
Bank x GLB	-1.02**	-1.91***	-1.39***	-1.60***	-7.48***	-7.96***	-7.01***	-6.27***	-6.52***	-6.10***
	(0.44)	(0.45)	(0.47)	(0.46)	(0.66)	(0.68)	(0.63)	(0.63)	(0.73)	(0.56)
Bank x Crisis	1.87***	0.90	3.53***	1.41**	-0.81	-1.36	1.90**	-0.80	-0.55	0.97
	(0.60)	(0.61)	(0.55)	(0.62)	(0.95)	(0.97)	(0.88)	(0.88)	(0.99)	(0.72)
Bank x SCAP	6.56***	5.39***	4.37***	5.86***	-1.01	-3.12***	-2.07**	-1.07	-4.93***	-2.00**
	(0.87)	(1.22)	(0.75)	(0.92)	(0.98)	(1.08)	(0.86)	(1.01)	(1.24)	(0.98)
Bank x Dodd-Frank	1.89***	1.32***	1.72***	1.53***	-1.71**	-2.11**	-1.01	-4.78***	-6.03***	-4.63***
	(0.45)	(0.48)	(0.47)	(0.46)	(0.86)	(0.87)	(0.90)	(0.88)	(1.02)	(0.90)
Observations	1110835	1110835	1110835	1110835	1110835	1110835	1110835	1110835	1110835	1110835
Adjusted R^2	0.039	0.029	0.041	0.036	0.099	0.070	0.121	0.067	0.033	0.086
Fixed Effects	No	No	No	No	No	No	No	No	No	No
Weighting	VW	VW	VW	VW	VW	VW	VW	VW	VW	VW
Sample	All Firms	All Firms	All Firms	All Firms	All Firms	All Firms	All Firms	All Firms	All Firms	All Firms

Appendix Table 4: The Cost of Capital Controlling for Components of Risk-Weighted Assets

This table reports the differential cost of capital for banks over time relative to other industries controlling for components of risk-weighted assets. Regulatory variables are obtained from call reports and Y-9C filings. The results are reported for expected excess returns in the CAPM in value-weighted regressions with firm fixed effects. The time period dummies and bank indicator are included in the regressions but omitted in the results for brevity. Column (1) replicates column (8) from Table 3. Column (2) includes all of the characteristics unconditionally. Columns (3) to (7) allow the coefficients on each characteristic to vary over time through interaction terms. Column (8) includes all of the characteristics together with time-varying coefficients. Standard errors are clustered by firm and month with *, **, *** indicating significance at the 10%, 5%, and 1% levels. The sample period is March 1996 to December 2017.

	(1) None	(2) All	(3) Cash+FF+Sec.	(4) Loans	(5) Trading Assets	(6) Commitments	(7) Derivatives	(8) All
Bank x GLB	-0.58	-0.50	-1.48***	-0.87*	-0.17	-0.44	-0.21	-0.79*
	(0.40)	(0.39)	(0.43)	(0.52)	(0.41)	(0.41)	(0.38)	(0.44)
Bank x Crisis	2.24***	2.29***	1.70**	1.25	2.97***	3.15***	2.72***	1.80**
	(0.65)	(0.64)	(0.75)	(0.82)	(0.60)	(0.55)	(0.62)	(0.75)
Bank x SCAP	6.88***	6.92***	7.11***	3.56***	7.60***	5.54***	7.30***	2.15
	(0.95)	(0.94)	(1.64)	(1.33)	(1.08)	(1.11)	(1.03)	(1.54)
Bank x Dodd-Frank	2.45***	2.52***	2.72***	0.60	2.98***	2.13***	2.87***	0.98
	(0.53)	(0.51)	(0.66)	(1.15)	(0.55)	(0.68)	(0.51)	(1.40)
Characteristic			-0.05***	-0.02	0.11**	-0.01	0.13***	
			(0.02)	(0.01)	(0.05)	(0.01)	(0.03)	
Characteristic x GLB			0.03**	0.00	-0.09**	-0.00	-0.11**	
			(0.01)	(0.01)	(0.04)	(0.00)	(0.04)	
Characteristic x Crisis			0.02	0.02	-0.13***	-0.02**	-0.12***	
			(0.02)	(0.01)	(0.03)	(0.01)	(0.02)	
Characteristic x SCAP			-0.00	0.07***	-0.12**	0.03**	-0.11***	
			(0.04)	(0.02)	(0.05)	(0.01)	(0.03)	
Characteristic x Dodd-Frank			0.00	0.03**	-0.11**	0.01	-0.11***	
			(0.02)	(0.02)	(0.05)	(0.01)	(0.02)	
Observations	1111062	1111062	1111062	1111062	1111062	1111062	1111062	1111062
Adjusted R^2	0.542	0.542	0.543	0.543	0.542	0.543	0.542	0.545
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Weighting	VW	VW	VW	VW	VW	VW	VW	VW
Sample	All Firms	All Firms	All Firms	All Firms	All Firms	All Firms	All Firms	All Firms
Characteristic	None	All	Cash+FF+Sec.	Loans	Trading Assets	Commitments	Derivatives	All
Time Varying	NA	No	Yes	Yes	Yes	Yes	Yes	Yes

Appendix Table 5: The Cost of Capital for Top Banks Controlling for Bank Characteristics

This table reports the differential cost of capital for banks and for the largest banks over time relative to other industries and to the largest firms in other industries by adding the Bank x Top interaction terms to the regressions in Table 5 that control for time-varying bank characteristics. As before, we omit the time period dummies and Bank and Top indicators and interactions for brevity.

	(1) None	(2) All	(3) Non Int. Inc.	(4) Core Deposits	(5) Liq. Coverage	(6) Tier 1	(7) RWA	(8) All
Bank x GLB	-0.03	-0.17	0.29	-0.97**	-0.48	-0.37	-0.06	-0.60
	(0.36)	(0.33)	(0.44)	(0.48)	(0.34)	(0.38)	(0.39)	(0.40)
Bank x Crisis	3.02***	2.87***	3.97***	1.31**	1.35*	2.63***	2.36***	1.72**
	(0.53)	(0.52)	(0.62)	(0.64)	(0.69)	(0.57)	(0.79)	(0.71)
Bank x SCAP	4.42***	4.33***	5.29***	0.27	2.40**	4.35***	-0.04	0.11
	(0.64)	(0.65)	(0.87)	(0.77)	(1.11)	(0.82)	(1.14)	(1.05)
Bank x Dodd-Frank	3.25***	3.03***	4.20***	1.15*	1.68**	3.18***	2.17**	1.36
	(0.39)	(0.44)	(0.52)	(0.64)	(0.79)	(0.49)	(0.85)	(1.06)
Bank x Top	0.13	0.11	-0.07	-0.06	0.14	0.14	0.06	-0.25
	(0.60)	(0.58)	(0.57)	(0.56)	(0.59)	(0.62)	(0.56)	(0.57)
Bank x Top x GLB	-0.99*	-0.80	-0.81	-0.78	-0.97*	-0.87	-0.92*	-0.21
	(0.55)	(0.51)	(0.54)	(0.54)	(0.54)	(0.54)	(0.55)	(0.54)
Bank x Top x Crisis	-1.27*	-1.06	-0.84	-0.97	-0.77	-1.15*	-1.25*	0.49
	(0.70)	(0.66)	(0.69)	(0.64)	(0.64)	(0.67)	(0.66)	(0.61)
Bank x Top x SCAP	2.78***	2.78***	3.15***	3.67***	2.80***	2.73**	1.90**	3.23***
	(1.07)	(1.03)	(1.04)	(0.88)	(0.98)	(1.08)	(0.90)	(1.04)
Bank x Top x Dodd-Frank	-1.24*	-1.12*	-0.74	-0.69	-1.08*	-1.25*	-1.17*	-0.22
	(0.63)	(0.63)	(0.64)	(0.58)	(0.59)	(0.64)	(0.64)	(0.63)
Characteristic			0.03***	-0.06***	-0.01	0.00	0.00	
			(0.01)	(0.02)	(0.02)	(0.02)	(0.01)	
Characteristic x GLB			-0.01	0.02**	0.01***	0.02	-0.00	
			(0.01)	(0.01)	(0.00)	(0.02)	(0.00)	
Characteristic x Crisis			-0.03***	0.04***	0.04***	0.03	0.01	
			(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	
Characteristic x SCAP			-0.03*	0.10***	0.05**	0.01	0.08***	
			(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	
Characteristic x Dodd-Frank			-0.03***	0.05***	0.03**	0.00	0.01	
			(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	
Observations	1111062	1111062	1111062	1111062	1111062	1111062	1111062	1111062
Adjusted R^2	0.551	0.552	0.551	0.553	0.552	0.551	0.552	0.554
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Weighting	VW	VW	VW	VW	VW	VW	VW	VW
Sample	All Firms	All Firms	All Firms	All Firms	All Firms	All Firms	All Firms	All Firms
Characteristic	None	All	Non Int. Inc.	Core Deposits	Liq. Coverage	Tier 1	RWA	All
Time Varying	NA	No	Yes	Yes	Yes	Yes	Yes	Yes

Appendix Table 6: Weighted Average Cost of Capital Estimates for Banks

This table reports the differential weighted average cost of capital net of the risk-free rate (WACC-Rf) for banks over time relative to other industries and for the largest banks over time relative to large firms in other industries. Regressions are value-weighted by market capitalization or equal-weighted with some specifications including firm fixed effects. Standard errors are clustered by firm and month with *, **, *** indicating significance at the 10%, 5%, and 1% levels. The sample period is March 1996 to December 2017.

	(1) WACC-Rf	(2) WACC-Rf	(3) WACC-Rf	(4) WACC-Rf	(5) WACC-Rf	(6) WACC-Rf	(7) WACC-Rf
GLB	-0.02	-0.11	-0.63**	1.48***	0.77***	1.33***	0.91***
	(0.22)	(0.24)	(0.25)	(0.18)	(0.17)	(0.21)	(0.20)
Crisis	0.62**	0.38	-0.30	1.93***	1.08***	3.00***	2.18***
	(0.27)	(0.26)	(0.27)	(0.22)	(0.19)	(0.13)	(0.14)
SCAP	0.86***	0.55*	-0.21	2.39***	1.60***	3.83***	3.00***
	(0.29)	(0.29)	(0.29)	(0.22)	(0.21)	(0.16)	(0.18)
Dodd-Frank	0.93***	0.68***	-0.35	2.30***	1.33***	3.85***	2.99***
	(0.27)	(0.26)	(0.27)	(0.19)	(0.20)	(0.12)	(0.14)
Bank		-5.94***	-2.16***	-5.54***	-0.86*	-4.87***	-0.54
		(0.25)	(0.42)	(0.30)	(0.45)	(0.11)	(0.46)
Bank x GLB		1.11***	1.00***	0.26	0.07	-0.28	0.07
		(0.39)	(0.30)	(0.62)	(0.23)	(0.22)	(0.18)
Bank x Crisis		1.30**	1.34***	0.54	0.56	-1.14***	-0.29
		(0.53)	(0.41)	(1.08)	(0.43)	(0.33)	(0.33)
Bank x SCAP		2.54***	2.51***	1.57	1.33***	-0.65***	0.18
		(0.51)	(0.39)	(1.20)	(0.30)	(0.19)	(0.20)
Bank x Dodd-Frank		1.56***	1.66***	0.43	0.66***	-1.35***	-0.53***
		(0.42)	(0.32)	(0.59)	(0.25)	(0.13)	(0.14)
Top				0.77**	1.48***	1.05***	1.07***
				(0.34)	(0.38)	(0.18)	(0.22)
Bank x Top				-0.54	-1.67***	0.13	-1.14***
				(0.42)	(0.43)	(0.20)	(0.31)
Top x GLB				-2.27***	-1.91***	-1.31***	-1.27***
				(0.35)	(0.35)	(0.19)	(0.19)
Top x Crisis				-2.23***	-1.86***	-1.83***	-1.64***
				(0.43)	(0.39)	(0.24)	(0.24)
Top x SCAP				-2.60***	-2.45***	-1.88***	-1.70***
				(0.45)	(0.41)	(0.26)	(0.27)
Top x Dodd-Frank				-2.31***	-2.25***	-1.93***	-1.96***
				(0.40)	(0.38)	(0.22)	(0.23)
Bank x Top x GLB				1.12	1.22***	0.87***	0.43**
				(0.71)	(0.38)	(0.30)	(0.22)
Bank x Top x Crisis				1.13	1.06**	1.67***	0.91***
				(1.14)	(0.49)	(0.42)	(0.27)
Bank x Top x SCAP				1.49	1.64***	2.04***	0.89**
				(1.30)	(0.51)	(0.56)	(0.37)
Bank x Top x Dodd-Frank				1.63**	1.37***	1.87***	0.68**
				(0.75)	(0.43)	(0.45)	(0.28)
Observations	649688	649688	649606	649688	649606	649688	649606
Adjusted R^2	0.018	0.230	0.666	0.267	0.673	0.392	0.695
Fixed Effects	No	No	Yes	No	Yes	No	Yes
Weighting	VW	VW	VW	VW	VW	EW	EW
Sample	All Firms	All Firms	All Firms	All Firms	All Firms	All Firms	All Firms