Capital Requirements and Banks' Behavior: Evidence from Bank Stress Tests*

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Abstract

This paper examines the impact of higher regulatory capital on banks' behavior using stress tests as a quasi-natural experiment. I employ an exogenous source of variation in bank capital requirements based on the U.S. Federal Reserve's selection rule. I find that banks meet higher capital ratios through issuing equity that expands their assets and reduces debts. The capital requirements transmit to the real economy through the bank lending channel. Stress-tested banks increase lending while reducing credit supply to small and riskier borrowers. Dependent firms on borrowing from stress-tested banks reduce assets and investments extensively in response to the credit loss.

1 Introduction

The systematic risks of the financial system are the major focus of macroprudential supervision (Hanson, Kashyap, and Stein (2011)). By contrast, a microprudential approach to financial regulation examines the insolvency of financial institutions independently regardless of the spillover effects in the economy (Kashyap and Stein (2004) and Kashyap, Rajan, and Stein (2008)). After the great recession of 2008, regulatory reforms moved in a macroprudential direction to prevent fire-sales and credit-crunches (Diamond and Rajan (2011), Stein (2012)). New bank examinations—so called stress tests—represent one of the most important regulatory responses to the 2008 financial crisis, linking the micro and macroprudential supervisions (Hirtle, Schuermann, and Stiroh (2009)). Stress tests require a set of banks to have higher regulatory capital ratios to absorb losses and to mitigate moral hazard problems. How banks meet higher capital requirements—whether through raising fresh capital or shrinking assets—determines the financial stability of the economy (Admati, Demarzo, Hellwig, and Pfleiderer (2018)). In this paper, I examine how banks respond to the higher regulatory capital requirements of stress tests and adjust their capital and lending actions to pass these tests. I also analyze how these credit shocks disseminate to the real economy.

Banks can meet higher capital ratio requirements in three ways. Banks can recapitalize their balance sheets by issuing equity and repurchasing debt while keeping assets intact. Alternatively, banks may issue new equity to expand their assets (asset expansion), or they may also sell assets to buy back existing debt (asset sales) (Admati et al. (2018)). In both recapitalization and asset expansion mechanisms, banks increase capital ratios by issuing equity. That is, banks have the discretion to decide whether to increase capital ratios by asset sales or equity issuance. Phrased differently, banks may raise the numerator of capital ratio through issuing equity or decrease the denominator by selling assets. Whether banks acquire or sell high versus low-quality assets affects the systematic risks in the economy. A bank's strategy may also affect financial decisions of borrowing firms via the lending channel. Dependent non-financial borrowers that cannot compensate for the bank-specific credit loss may become financially distressed and reduce investments.

There are empirical challenges to test the effects of higher regulatory capital requirements on

banks' behavior. Historically, capital requirements rarely change over time, and typically, all banks must comply with these requirements at the same time. This makes it difficult to find a subset of banks that must comply with higher capital ratios. To address these issues, my analysis uses an empirical strategy that exploits the Federal Reserve's selection rule in choosing banks that undergo stress testing after the 2008 financial crisis in the United States. In stress tests, the cross-sectional variation of higher capital requirements in banks serves to exogenously classify banks into stress-tested and non-tested groups, allowing me to identify the effects of higher capital requirements. The estimates determine how banks credit shock transmits to the real economy and eliminate the impact of the demand channel of borrowers on bank lending. Specifically, I disentangle credit supply from the demand channel, using multiple bank-firm relationships in the syndicated loans market. To control for changes in credit demand, I compare the same firm borrowing from two banks, where the banks differ on eligibility for stress tests. Using within-firm comparison, I can solely attribute changes in loan rates to the banks' credit supply and not any other firm-specific factors.

This paper shows that in response to the regulatory reform, stress-tested banks increase the total capital ratio[1] by 11.7 percent compared to the non-tested banks. To do this, stress-tested banks increase both the level of capital (numerator) and risk-weighted assets (denominator)[2] of capital ratio. In particular, the numerator of the capital ratio exceeds the denominator. Stress-tested banks achieve this target by issuing equity to expand assets and reduce leverage as a form of asset expansion and recapitalization. Furthermore, the loan-level analysis helps to separate the banks' lending channel from firms borrowing. I find that stress-tested banks originate new syndicated loans more than the non-tested matched group by 29 percentage points. At the extensive margin, I find that stress-tested banks keep lending to existing borrowers and start lending to new ones, but they exclude small borrowers.[3]

[1]The total regulatory capital consists of two components of core capital (Tier1) and supplementary capital (Tier2) components, adjusted by risk-weighted assets to create a total capital risk-based ratio. Tier1 capital consists of common stockholder's equity, qualifying perpetual preferred stocks, and minority interests of subsidiaries minus certain intangible assets. Tier2 capital includes an allowance for loan and lease losses, perpetual preferred stocks, hybrid capital instruments, and subordinated debt (12 CFR, part 225, Appendix A - II.A.1 and II.B).

[2]Risk-weighted assets are bank assets and off-balance sheet items adjusted by the risk weight.

[3]Small borrowers are at the bottom of 70% of total borrowings across all lenders in each quarter.

Stress tests connect capital to loan portfolios of banks and induce banks to rebalance their loan portfolio towards safer lending. Stress-tested banks address risk by acting more conservatively than the non-tested matched banks, reporting higher non-performing loans, and adopting greater loan loss reserves. Stress tests induce banks to manage the risk of their portfolios better and increase lending to large and safer borrowers while reducing credit supply to small and riskier firms by 28 percentage points relative to the large ones. The higher regulatory capital requirements influence banks to incorporate the borrower's risk in designing their loan contracts. Although stress-tested banks charge higher interests on originated loans, they require fewer covenants on the loan contract. The results show that small borrowers violate more covenants than large borrowers. Therefore, stress-tested banks effectively adopt stricter standards towards small borrowers. They treat small and riskier borrowers differently by setting lower interests while demanding more covenants and shorter maturity on their loan contracts.

The transmission of bank credit supply shocks to the real economy depends on whether borrowers can mitigate bank-specific credit loss by borrowing from all available lenders in the market. More importantly, if firms cannot smooth out any liquidity shortages due induced by stress testing, this leads to adverse economic effects. The results show that higher capital requirements of stress tests sharply alter lending behavior, harming dependent borrowers that cannot find other sources of external financing. Firms reliant on borrowing from stress-tested banks cannot compensate for bank credit loss by borrowing from alternative lenders. As a result, they significantly reduce assets and investments by 26 and 28 percentage points vis-à-vis less dependent borrowers. Overall, the results show that stress tests affect bank lending and have adverse impacts on dependent borrowers.

My analysis uses the recent U.S. banking examinations as a quasi-natural experiment to exploit the cross-sectional variation in banks' capital requirements. This regulation requires a subset of selected banks to have at least a 6% Tier1 capital ratio and 4% Tier1 common capital ratio by the end of the year 2010 (FRB (2009a), FRB (2009b), and Hirtle et al. (2009)). The cross-sectional variation of banks allows uncovering the causal impact of higher capital requirements on banks' credit supply by comparing before and after the policy change. As an identification strategy, I use a matching difference-in-differences and regression discontinuity to estimate the model. In

addition to the bank-level analysis, I disentangle bank credit supply from the borrower's demand channel following Khwaja and Mian (2008) by considering multiple bank-firm relationships in the syndicated loan market. I restrict the sample of syndicated loans to the same firm borrowing from both a stress-tested bank and an untested bank before the tests.[4] This method attributes the lending results to a bank credit supply and not the demand channel.

The 2008 recession highlighted critical deficiencies in the risk management practices and resiliency of financial institutions. On October 18, 2008, US regulators devised the supervisory capital assessment program (SCAP), known as stress tests, to determine the vulnerability of financial institutions. Regulators have conducted stress tests regularly since then through comprehensive capital analysis and review (CCAR) and Dodd-Frank Act stress test (DFAST) (FRB (2013), FRB (2014), FRB (2015a), and FRB (2015b)). The goal of stress tests is to ensure that banks have enough capital to continue lending even in adverse economic conditions. Unlike regular banking examinations, stress tests are simultaneous, forward-looking assessments of banks' capital adequacy under a variety of stressful scenarios. These tests are unusually transparent in inputs, process, and outputs of models, and banks must disclose their results to the public.[5]

I exploit the Federal Reserve's criterion that selects a subset of banks to include in stress tests based on a determined asset threshold. Only banks with at least $100 billion in assets in the last quarter of 2008 were subject to testing. My difference-in-differences approach exploits the cross-sectional variation of banks based on the regulatory decision before and after the policy change.[6] I use nearest neighborhood matching techniques to find the most comparable banks to the tested group based on observable characteristics one year before the tests. I choose banks with assets below $100 billion, but above $20 billion in the last quarter of 2008 as a control group. A median chi-squared test statistic shows that stress-tested banks are not systematically different from the matched control group before the test announcement. The graphical findings illustrate similar trends of capital ratios, loan issuance, and loan pricing between stress-tested and non-tested

[4]The regressions include firm fixed effects to control for borrowing channel.

[5]The European banking authorities also conducted stress-testing exercises during the financial crisis. In contrast to the U.S. bank stress tests, the 2009 European stress exercises did not require banks to publish bank-specific results. However, the results of the 2010 and 2011 European bank stress tests are disclosed to the public.

[6]Similar results obtained qualitatively using a regression discontinuity design around the asset-size threshold using a McCrary (2008) density test and estimations as shown in an online appendix.

banks prior to the tests, but at the time of test announcement, stress-tested banks start to behave differently.

In the Dodd-Frank Act (2014), the Federal Reserve's focus also shifted to include medium-sized banks. I examine the impact of stress tests on medium-sized banks, those with assets between $50 to $100 billion in the last quarter of 2013, separately from the large banks in an online appendix. I use banks with assets between $10 to $50 billion in the same quarter as the control group. Stress-tested banks are similar to the matched control group on most other observable characteristics before the test began in 2014 using the nearest neighborhood matching method. Estimates reveal that medium-sized stress-tested banks increase capital ratios vis-à-vis the non-tested matched banks, decreasing real estate lending after the tests.

I find that at the extensive margin, medium-sized stress-tested banks are 25 and 41 percentage points more likely than non-tested banks to stop lending to existing and new borrowers. At the intensive margin, there is no difference between loan originations of medium-sized stress-tested and non-tested banks. Regarding the pricing of loan contracts, medium-sized stress-tested banks set lower spreads than the non-tested matched banks. Dependent firms on medium-sized stress-tested banks cannot hedge bank credit loss by borrowing from all available lenders—stress tests harm dependent borrowers, causing firms reliant on borrowing from medium-sized stress-tested banks to reduce assets, sales, fixed assets, and capital expenditures.

It is now evident that banks took excessive risks without disclosure prior to the financial crisis, and regulators only intervened after panic spread across the financial system. Some have argued that capital requirements enhance market discipline by allowing outsiders to better price banks' risks and prevent bank insiders from engaging in excessive risk-taking (Tarullo (2010), Bernanke (2013)). However, in promoting financial stability, capital requirements may exacerbate bank-specific inefficiencies and encourage managers to act strategically, taking actions to inflate short-term performance (Goldstein (2014)). Regulating banks to have more high-quality capital, and not just a higher capital ratio can mitigate this problem (Hanson et al. (2011)). Shahhosseini (2014) shows banks adjust capital and balance sheet variables in response to the U.S. stress tests. My findings contribute to the literature on the effects of bank capital requirements.

My paper is closely related to the nascent strands of literature on bank stress tests. Regarding market reactions to stress test announcements, Flannery, Hirtle, and Kovner (2017) find higher abnormal returns and trading volume after stress test disclosure. In a contemporaneous paper, Acharya, Berger, and Roman (2018) provides findings of higher loan spreads after SCAP and CCAR stress tests. Cortés, Demyanyk, Li, Loutskina, and Strahan (2020) show the negative impact of SCAP and CCAR stress tests on small business lending using the community reinvestment act (CRA) data. Calem, Correa, and Lee (2016) examine the effect of CCAR (2011) on residential loans and find adverse effects on jumbo mortgage originations using the HMDA data. Gropp, Mosk, Ongena, and Wix (2018) show the detrimental impact of the 2011 European bank capital exercise on bank lending and firm financial outcomes.

This paper contributes to the literature by showing the effects of regulatory capital requirements on bank lending and the transmission of credit loss to borrowers. Using the cross-sectional variation of banks based on the Federal Reserve's selection rule, I employ the U.S. bank stress test as a quasi-natural experiment. I use multiple bank-firm relationships and firm fixed effects to separate bank credit supply from the demand channel. I find that stress-tested banks meet the capital requirements by increasing both capital and risk-weighted assets. While they increase lending, they reduce credit supply to riskier and financially-constrained firms. I find that firms dependent on borrowing from stress-tested banks reduce financial outcomes in response to credit loss. Findings for medium-sized banks included in the Dodd-Frank Act (2014) mirror those for large tested banks in terms of financial outcomes for dependent borrowers.

I next present the institutional background. Section 3 describes data sources. Section 4 provides the empirical strategy, including the nearest neighborhood matching method and the timing of the effects. Section 5 presents the results, including bank behavior analysis, mechanisms, the intensive and extensive margins of bank lending channel and loan pricing and non-pricing attributes. Section 6 discusses firm heterogeneity. Section 7 analyzes the firms' borrowing channel. Section 8 provides firm-level impacts. An online appendix presents the results of the regression discontinuity design and medium-sized stress-tested banks.

2 Institutional Background of Stress Tests

Many observers link the 2008 great recession to bank opacity. According to Gorton (2008), *"the ongoing panic is due to a loss of information,"* reflecting that bank counterparties and investors cannot evaluate bank solvency as well as bank insiders. The global financial crisis highlighted concerns about asymmetric information and illiquidity in the U.S. banking system. The government responded with unprecedented actions, including bank stress tests, liquidity provision, debt and deposit guarantees, large-scale asset purchases, and direct assistance. Bank stress tests began annually in 2009 with the Supervisory Capital Assessment Program (SCAP) tests, followed by the Comprehensive Capital Analysis and Review (CCAR) tests in 2011 and 2012 and the Dodd-Frank Act (DFAST) tests in 2013 and 2014 with no stress testing in 2010.

Stress tests were unprecedented in scope and in the range of information made public about the forecasted losses and capital positions of tested banks. The first round of stress tests required the largest U.S. bank holding companies to undergo simultaneous, forward-looking examinations to determine if they had adequate capital to sustain lending to the economy even in severe future recessions. In the first year of implementation, the Federal Reserve's criterion was to include bank holding companies with at least $100 billion assets as of the last quarter of 2008. Nineteen bank holding companies were selected based on this criterion and included in yearly stress tests since 2009. Although the number of banks subject to stress tests is not large, these bank holding companies represent about two-thirds of the U.S. banking assets and over half of all loans. Since 2009, all nineteen banks subject to the first year's stress test participate in the later rounds of stress tests, and the Federal Reserve publicly reported the stress test results.

Stress tests differ from regular bank examinations in three key ways (Hirtle et al. (2009) and Morgan, Peristiani, and Savino (2014)). First, stress-tested banks are subject to simultaneous examinations with the same information about economic conditions and quantitative techniques. In contrast, regular examinations perform less simultaneous comparison across banks. Second, stress tests are forward-looking to forecast bank capital shortages and estimate loan losses versus regular examinations that focus on banks' current conditions. The results of stress tests can provide

better information to the market, while regular examinations do not predict bank performance (Berger, Davies, and Flannery (2000)). Third, stress tests are unusually transparent. The modeling inputs and processes that generate capital losses are disclosed, but regular examinations are opaque, including confidential inputs and outputs information. The goal of stress tests is to return confidence to market investors. The Federal Reserve believes that disclosure of stress test results provides valuable information to market participants.

To assess the strength of financial institutions, stress-tested banks required to adjust their capital, using a minimum of three macroeconomic scenarios designed by the Federal Reserve. The scenarios consist of a current, and two hypothetical adverse and severely adverse cases that include incomes, unemployment, interest rates, prices, and exchange rates as the leading indicators. In the Dodd-Frank Act (2014), the Federal Reserve started testing medium-sized banks with at least $50 billion assets in the last quarter of 2013 in addition to the larger banks. A total of thirty bank holding companies were tested using the designed macroeconomic scenarios. Also, banks with assets between $10 and $50 billion were required to perform an annual company-run stress test without publicly disclosing the results.

3 Data

The data sources consist of consolidated financial statements of publicly traded U.S. bank holding companies (FRB Y-9C), known as Call Reports, which are quarterly filed with the U.S. Federal Reserve System. I also use the syndicated loan-level data provided by loan pricing corporation (LPC) Thompson Reuters Dealscan with information on loan types, contract terms and maturity of loans. I use Compustat quarterly data to obtain a borrower's accounting information. This paper complements the bank holding companies' information using the Bloomberg dataset for four banks, American Express, Goldman Sachs, Morgan Stanley, and Ally Financial, that were not bank holding companies before the 2008 financial crisis. Bank of New York Mellon became a financial holding company in the third quarter of 2007, so I obtain basic historical information from Compustat starting the first quarter of 2000. I consider all rounds of bank stress tests, starting with SCAP (2009) and continuing with CCAR (2011), CCAR (2012), CCAR (2013), and DFAST (2014). The

sample goes from the first quarter of 2005 to the last quarter of 2015. I eliminate banks that did not experience the stress test in a particular year from the analysis of that year. For example, Metlife ceased to be considered a bank holding company in 2013 after it sold its bank units.

The Federal Reserve's selection rule only includes U.S. bank holding companies with assets above $100 billion in the last quarter of 2008 to be part of the first four rounds of stress tests. Following the Federal Reserve's selection criterion, I only include the U.S. bank holding companies headquartered in the U.S., excluding foreign-owned banks from the sample of both treated and control groups in the first four rounds of stress tests. To identify foreign-owned banks, I use information from the National Information Center (NIC), a repository of banks' financial data and other institutions collected by the Federal Reserve System. Also, I further manually search available news resources to identify foreign-owned banks.

In 2014 stress tests, known as Dodd-Frank Act (DFAST), the Federal Reserve broadened the scope of examinations by adding the U.S. medium-sized banks with assets of $50 to $100 billion in the last quarter of 2013 to the existing sample of large stress-tested banks. In DFAST (2014), the Federal Reserve also stress-tests foreign-owned bank holding companies such as HSBC USA Holding, Santander, and Deutsche Banks. The Federal Reserve added these foreign-owned banks because foreign-owned banks with operations in the U.S. may systematically affect the U.S. banking system. To ensure compatibility with the latest Federal Reserve's stress testing framework, I include foreign-owned banks in both the treated and control groups in the 2014 stress tests. Income statement variables from Call Reports data are reported as of year-to-date in each quarter. I transform year-to-date variables into a quarterly timeline by keeping the first quarter observation of each year while differencing year-to-date values of subsequent quarters from the previous quarter in the same year. This ensures that all Call Reports variables have the same quarterly format.

To construct loan-level data, I collect four different datasets from Dealscan, including company, facility, lenders, and current facility pricing. I first merge a lender's information with company data using a unique company identifier to obtain the parent information. The resulting dataset is then combined with the facility and current facility pricing information using a unique facility identifier. To link lenders with borrowers, I hand-match bank holding companies data of Call

Reports with syndicated loan data of Dealscan. I convert the parent companies of lenders, either commercial banks or financial firms, to their first Tier company at the top of the hierarchy in the Dealscan dataset to create a similar bank holding company structure to the Call Reports. There is no universally-accepted identifier to connect the Call Report with syndicated Dealscan data. Therefore, I manually use the name of a lender's parent company and its location to hand-match lender's information with borrowers in the syndicated loan market. The key variable of matching is the first two words extracted from the full name of bank-holding companies. Some banks have the same first two words in their names, so I increase the number of words to the first three or four words in some cases to find unique matches. To ensure consistency of names between Call Report and Dealscan, I edit bank names in both datasets before the merge, such as capitalizing letters or adding spaces. Then, I merge Call Reports and Dealscan data with Compustat using the link provided by Chava and Roberts (2008) and a self-updated link until 2017.

To track mergers and acquisitions of bank holding companies, I use the National Information Center (NIC) and search for the information of a particular bank holding company or commercial banks using a unique bank identifier. The primary information is to find the parent-subsidiary relationship and history of merger and acquisition, which could be found in Organization Hierarchy, Institution History, and Institution Acquired sections of the NIC webpage. Any corporate actions of bank holding companies that change the owner's relationships will be controlled and incorporated in the matching process. Foreign-owned banks are treated differently from U.S. subsidiaries. I trace each merger and acquisition event manually before the event and adjust the parent identity because the parent-subsidiary relationship in Dealscan is not updated. For instance, Bank One was acquired by JP Morgan Chase in 2004. Thus, before this year, I keep the parent identity of Bank One to itself and not as JP Morgan Chase, as indicated in the Dealscan database.

In Dealscan data, bank allocation among syndicated members of each loan represents the share of each bank's lending in a syndicated loan contract. However, full information on bank allocation between syndicated members is not provided for all loans in the Dealscan dataset. Following Chodorow-Reich (2014), I consider the under-reporting of data as random and impute remaining missing values of lending share from the available bank allocation records in Dealscan data. First,

I focus on banks with a leading role in a syndicated loan contract, because these are the ones that contribute most of the lending and have a greater influence on contract terms. To define the leading role, I select "administrative agent," "arranger," "book-runner," "lead arranger," "lead bank," and "lead manager" in the lender role field of Dealscan as lead arranger. The process estimates the average share of lead arrangers in each syndicated loan with similar characteristics, such as the number of lead lenders or the number of participants. This share is subsequently equally allocated to all leading banks, and the remaining share is equally distributed among participants. For instance, for the simple case of a loan with only one leading lender, the lead bank receives 100% of a loan allocation. In most other cases, a syndicated loan includes one leading bank plus a participant; I allocate approximately 60% of the loan amount to the bank with a leading role. The rest of the syndicated loans are aggregated to estimate lead arrangers and participant allocations, and I then follow the same procedure above.

To capture a comprehensive picture of bank credit supply and observe the lending behavior of banks to both domestic and international borrowers, I include all outstanding term-loans and lines-of-credit to both U.S. and non-U.S. firms. To measure the type of lending, I distinguish between term-loan and line-of-credit as loan facility types in the Dealscan dataset. The term loans are the loan types identified as "Term Loan," "Term Loan A," "Term Loan B," "Term Loan C," "Term Loan D," "Term Loan E," "Term Loan F," "Term Loan G," "Term Loan H," "Term Loan I," "Term Loan J," "Term Loan K," "Delay Draw Term Loan." The line-of-credit loans have the loan types as "Revolver/Line<1Yr," "Revolver/Line>=1Yr," "364-Day Facility," "Limited Line/Term Loan" or "Revolver/Term Loan" as specified in the Dealscan. I restrict the sample to loans issued to non-financial companies and remove loans without maturity information. In the loan-level analysis, I adjust the loan amount and accounting information of non-financial firms by the consumer price index to account for inflation. To eliminate outliers, I winsorize loan contract terms, such as loan amount, loan spread and maturity, and accounting ratios of non-financial firms at the 1% level each quarter. In the firm-level analysis, I only consider U.S. companies in Compustat North America.

4 Empirical Strategy

Bank stress tests have two unique features of a quasi-natural experiment that help with the design of an identification strategy. First, the stress test was an unprecedented response to the recent financial crisis and was not driven by any particular bank's performance. Second, the criterion of inclusion into stress tests was not a bank decision, but rather was exogenously determined by the Federal Reserve System; banks did not know in advance whether they would be part of the tests. I use the Federal Reserve's selection criterion to include banks into stress tests as an exogenous source of variation across banks. I classify banks into a group of stress-tested banks and a non-tested group based on the Federal Reserve's selection rule: stress-tested banks consist of banks with at least $100 billion assets in the last quarter of 2008, and the non-tested group of banks is a matched control group with similar characteristics to the stress-tested ones. The latest round of tests also included medium-sized banks with assets between $50 to $100 billion in the last quarter of 2013.

To construct a comparable control group of banks, I restrict the sample of banks to those with assets above $20 and less than $100 billion in the last quarter of 2008 during the first four rounds of stress tests. I define pre-treatment periods of stress tests starting in the first quarter of 2005 to the third quarter of 2008. The post-treatment periods start from the last quarter of 2008 to the last quarter of 2013, which ends just before the starting time of the Dodd-Frank Act (2014) in the last quarter of 2013. In the latest round of stress tests, DFAST (2014), I restrict the control group to banks with assets between $10 to $50 billion in the last quarter of 2013. The pre-treatment periods of this round of stress tests begin in the first quarter of 2012 to the third quarter of 2013, and the post-treatment periods are from the last quarter of 2013 to the last quarter of 2015. I also remove the top three banks in asset size as of the last quarter of 2008 - JP Morgan, Citi Group, and Bank of America - for further analysis in all rounds of stress tests. The reason is that it is hard to find a close match for these banks in the sample.

To analyze the impact of higher capital requirements on banks' behavior, lending actions, and the transmission of bank credit supply shock to the real economy, I adopt a difference-in-differences

approach as the primary identification strategy. In an online appendix, I employ a regression discontinuity design around the asset-size threshold based on the Federal Reserves selection rule. I first adopt a nearest neighborhood matching method to identify a similar control group of banks to the stress-tested ones. I perform a median chi-squared test statistic to assess the quality of the matching procedure. I then estimate a difference-in-differences approach to determine the impact of higher capital requirements on capital adjustments and lending actions at the intensive and extensive margins in addition to pricing and non-pricing attributes of loan contracts. I also explore the quality of lending by considering the heterogeneity of borrowers regarding their size, bond rating, and Altman Z-score measures. Finally, I examine firm borrowing channels and the impact of bank-specific credit shock on firm financial outcomes. I mainly investigate how firms' dependency on borrowing from stress-tested banks impacts their assets, sales, and investment decisions in response to the bank credit shock. In an online appendix, I also analyze the behavior of medium-sized banks that became part of the latest stress tests.

4.1 The Nearest-Neighborhood Matching Method

To find the most comparable control group to the stress-tested banks, I employ a nearest-neighborhood matching method before the test announcement. Based on the Federal Reserve's selection rule, to construct a control group of banks with similar attributes to the stress-tested group, I focus on banks with assets below $100 billion in the last quarter of 2008 and find the best match to the stress-tested banks in the absence of treatment. I use the bias-corrected nearest-neighborhood matching estimator developed by Abadie and Imbens (2011) to find a matched control group of banks to the tested group. I use the robust Abadie-Imbens standard error method, which reduces estimation bias relative to standard propensity score matching. The matching method is one-to-one with replacement using bias-corrected covariates. I refer to the matched sample of banks as a matched control group.

To construct the matching group, I restrict the sample to banks with assets between $20 and $100 billion in the last quarter of 2008. In the nearest neighborhood matching process, I use the Tier1 capital ratio as the primary outcome variable. Then, I find the closest match to the stress-

tested banks based on the banks' median characteristics, such as asset size, loan ratio, deposit ratio, net interest income, and common shares ratio during one year of pre-treatment periods. The pre-treatment periods in the matching process used the quarters between the third quarter of 2006 and the second quarter of 2007 in the first four rounds of stress tests. I exclude the third and fourth quarters of 2007 from the pre-treatment periods because they overlap with the 2008 financial crisis. To ensure that banks in the treated group are comparable to the matched control group, I perform a median chi-squared test statistic before and after the matching process.

Table 4 shows the median characteristics of stress-tested banks and non-tested matched banks in the absence of treatment before and after the matching process. Obviously, stress-tested banks are larger, and they are more profitable than banks in the control group. Treated banks and the matched control group are otherwise similar along with most key observable characteristics. For example, asset size differences can only be attributed to fixed assets and Federal funds sold by banks and *not* to any other components of assets such as cash, securities, or loans. Overall, matching results in similar compositions of stress-tested banks and a matched control group. For instance, the difference in loan ratio between the treated and control group is statistically significant without matching, but matching removes differences in lending between the two groups of banks.

To address concerns that banks with more assets have different investment opportunities so that they behave differently than the control group, I provide results in an online appendix focusing on banks with assets close to $100 billion thresholds using a regression discontinuity design. In particular, banks around the asset threshold have similar characteristics, save for the fact that banks on the right side of the threshold are stress tested, while banks on the left side of the threshold are not. Also, in the latest round of stress tests, the Federal Reserve added medium-sized banks with assets between $50 to $100 billion in the last quarter of 2013 to the tests. Thus, as a robustness check, I provide the results of capital adjustments and lending behavior of medium-sized banks to address concerns over bank size in an online appendix.

4.2 Timing of the Effects

Bank stress tests represent unprecedented regulation, and banks did not know in advance whether they would be part of the tests. To assess the validity of the empirical strategy, I expect to observe changes in capital adjustments and lending behavior of stress-tested banks just after the introduction of the tests and not before the event. In particular, stress-tested banks and the matched control group should have similar pre-existing trends regarding capital ratios and loan issuance before the tests, and the differences between the two groups of banks should only emerge after the introduction of stress tests in the last quarter of 2008. This test ensures that the results are driven by higher capital requirements of stress tests and not by other pre-existing differences between the two groups.

To specify the dynamic behavior of the bank outcome variables, I estimate equation (1), including quarters before and after the announcement of the tests. Drawing valid inferences of estimation require that the change in outcome variables between stress-tested banks and matched control group are the same in the absence of stress tests.

$$Y_{bt} = \alpha_b + \beta_1 Q_t^{-15} * Treated_b + \beta_2 Q_t^{-14} * Treated_b + ... + \beta_{34} Q_t^{+19} * Treated_b + \beta_{35} Q_t^{+20} * Treated_b + \varepsilon_{bt} \quad (1)$$

In equation (1), Y_{bt} is the outcome variable, such as Tier1 capital ratio, Tier1 common equity capital ratio, Tier1 capital, Tier1 common equity capital, and loan origination. I include year-quarters before and after the test announcement to capture the timing of the effects. The year-quarter dummy variable, Q_t^{-n}, has a value of one for banks in the nth quarter before the stress tests announcement, and zero otherwise. Similarly, the quarter dummy variable Q_t^{+n} equals one for banks in the nth quarter after stress tests announcement and it is zero otherwise. In the first four rounds of stress tests, I consider a thirty-five year-quarter window, starting with the first quarter of 2005 to the last quarter of 2013, spanning fifteen quarters before and twenty quarters after the test announcement.

To illustrate the timing of the effects, I plot estimated coefficients of the interaction term between year-quarter and treated variable, β_i, in equation (1) using a 95% confidence interval, in Figure 1, panel (a). This figure reveals that the interaction coefficients of the Tier1 capital ratio

estimation are insignificant before the test announcement and only become significant at the test's announcement time and thereafter. There are no systematic differences between the stress-tested and non-tested groups in the Tier1 capital ratio trend before the tests (panel (c)). Tier1 capital and Tier1 common equity capital show similar trends before the tests as graphically shown in panels (b) and (d). In particular, banks do not differ in capitals in the absence of stress tests, but just at the time of test announcement, stress-tested banks begin to behave differently from the non-tested group. This test provides strong support for the identification strategy that stress-tested banks do not differ from the non-tested group before the tests.

To examine the bank lending channel, I compare the lending behavior of two different sets of banks to the same firm that has been borrowing in both periods, before and after stress tests. I restrict the sample to firms that borrow from at least two banks, only one of which is stress-tested during pre-treatment periods. For loan issuances, I aggregate loans originated by each type of bank in each quarter and plot loan originations of each group of banks over time, in Figure 2, panel (a). This figure illustrates similar lending trends between stress-tested and non-tested groups of banks before the test announcement, so any changes in the pattern after the test announcement cannot be attributed to pre-existing differential trends. The lending gap between the two different types of banks emerges only after stress tests with a higher loan originations by stress-tested banks, while loan originations of the non-tested group stay the same. After the test, the lending gap between stress-tested and non-tested groups of banks widens with time.

The divergence in lending trends after the tests captures the bank lending channel due to higher capital requirements that I later estimate using a difference-in-differences method. I estimate the difference in lending between stress-tested and non-tested groups of banks after the test minus the difference between the two groups before the tests. Then, I compare the lending behavior of two types of banks within the same firm that borrows both before and after stress tests. As in panel (a), I restrict the sample to only firms that borrow from both tested and non-tested banks in each quarter during the pre-treatment periods. I aggregate loans originated by each type of bank in each quarter and then de-mean loan originations by subtracting the firm's average loan in each quarter and plot it over time, as shown in panel (c). The plot is analogous to including firm fixed effects

in loan originations estimations. Graphically, the two lines are a mirror image of each other since the same firm exists in both lines borrowing from two types of banks, but they experience different bank credit shocks from each type of banks after the test.

Then, I examine the impact of stress tests on the pricing of loans to firms that borrow both before and after stress tests. Using only the sample of firms that borrow from both stress-tested and non-tested groups of banks before the test, I aggregate the price of originated loans charged by each type of bank. Panel (b) shows a parallel-trend of loan spread across two types of banks before the test announcement and that the two groups diverge only after the test with stress-tested banks charging higher spread. I then compare the spreads of originated loans of the two types of banks within the same firm to create a counterpart of using firm fixed effects in estimations. Panel (d) illustrates the de-meaned values of loan spread of each type of banks by subtracting the average of loan spread in each quarter. The same firm that borrows from both types of banks experiences higher loan spread from stress-tested banks after the test.

5 Results

The graphs provide preliminary evidence of the impact of stress tests on capital adjustments and banks' lending behavior. To explore the magnitude of the effects and mechanisms, I next present the results of estimation separately at the bank, loan, and firm levels. Stress-tested banks behave differently regarding capital adjustments and loan issuance than non-tested banks. I examine the bank lending channel at both intensive and extensive margins in addition to pricing and non-pricing attributes of loan contracts. I then explore how the bank lending shock transmits to the real economy and whether firms can hedge bank-specific credit losses through other external financing sources. To this end, I show the impact of a bank liquidity shock on firm financial outcomes, including assets, fixed assets, sales, and investments, to examine the real effects of bank stress tests.

5.1 The Bank Behavior Analysis

To understand the impact of stress tests on banks' behavior, I consider asset, liability, and equity sides of the bank's balance-sheets. The question is whether higher regulatory capital adequacy induces banks to meet this requirement by adjusting their balance-sheet. To answer this question, I employ a difference-in-differences approach based on the Federal Reserve's selection rule to estimate the response of stress-tested banks relative to a matched non-tested group. I use equation (2) as the main model specification using quarterly bank-level data from 2005 to 2013. The coefficient of interest is β, showing the interaction between stress-tested banks and time after the test announcement, in the last quarter of 2008.

$$Y_{bt} = \alpha_b + \tau_t + \beta Treated_b * Post_t + \varepsilon_{bt} \tag{2}$$

$Treated_b$ is an indicator variable with a value of one for banks subject to stress tests and a value of zero for the matched control group. To construct the matched control group, I use primary bank variables, such as assets, loan ratio, deposit ratio, net interest income, and common shares ratio, as matching covariates during the pre-treatment periods. I consider the median of these variables during the one-year pre-treatment period between the third quarter of 2006 and the second quarter of 2007. $Post_t$ is an indicator variable with a value of one in each quarter beginning the last quarter of 2008, the announcement time of the first stress test, and it has a value of zero in earlier quarters. The Y_{bt} represents outcome variables such as total capital ratio, Tier1 capital ratio, Tier1 common equity capital ratio, loan ratio, and other balance sheet variables. To address any different time trends in the panel data, I use τ_t as year fixed effects. I include α_b as bank fixed effects to absorb any unobservable characteristics of banks relevant to different investment or lending opportunities. In this estimation, standard errors are clustered at the bank level.

Table 5 reports the results of capital adjustments at the bank level. To meet the higher capital requirements, stress-tested banks increase the total capital ratio by 1.67 percentage points relative to the matched non-tested group (column 1). Given that the average total capital ratio during the sample periods is 14 percent, this estimate is quite large in magnitude, about 11.7 percent. I find a positive impact of stress tests on the total capital ratio components, such as the Tier1 capital ratio, Tier1 common equity capital ratio, and Tier2 capital ratio. In particular, stress-tested banks

increase the Tier1 capital ratio and Tier1 common equity capital ratio by 2.1 and 1.8 percentage points, respectively, as shown in columns 2 and 3, but they decrease the Tier2 capital ratio by .4 percentage points compared to the non-tested group. Banks change lending behavior to meet the regulatory requirements that transmit to the economy through the credit supply channel.

5.2 Mechanisms

It is essential to explore how banks adjust capitals and balance-sheets in response to the higher capital adequacy of stress tests. Banks have three primary ways of adjusting—recapitalization, asset expansion, and asset sales—to meet higher capital requirements (Admati et al. (2018)). With both recapitalization and asset expansion, banks issue equity to increase their capital ratio, but they liquidate assets via the asset sales mechanism. That is, banks can increase the numerator of capital ratio, i.e., the level of capital, or decrease the denominator of this ratio, i.e., the risk-weighted assets, or both. Banks can increase capital levels by increasing retained earnings, issuing common, and preferred shares or paying dividends. They can also increase both the numerator and denominator of this ratio at different rates and still have a higher capital ratio and comply with the tests' requirements. In turn, the mechanisms chosen can have different economic consequences.

A bank that recapitalizes can issue equity and repurchase debt without changing assets. Via asset expansions, banks can issue equity to increase their assets while keeping debt constant. With asset expansions that increase banks' new equity capital, it is crucial to know whether banks invest in safer or riskier assets. Finally, banks may sell assets to buy back existing debt. Asset sales can reduce the risk-weighted assets in the denominator of capital ratios; asset sales can reflect either reducing assets (asset shrinkage) or replacing riskier assets with safer ones (risk reduction). Asset shrinkage can lead to reduced credit supply that can have negative consequences on the economy, for example, credit-crunches or fire-sales if all banks simultaneously follow this channel. However, risk reduction can be a positive response to higher capital requirements. In each case, the asset sales mechanism does not create new equity capital.

It is critical to examine new equity capital and the risk of portfolios to determine the impact of higher capital requirements. The results show evidence of both recapitalization and asset expansion

mechanisms. Table 6 shows that stress-tested banks increase equity by issuing preferred shares to expand assets and reduce leverage. The increase in the numerator of capital ratio exceeds that of the denominator, causing the capital ratio to increase in the stress-tested group. Table 5 shows that stress-tested banks increase the numerator of capital ratios, including total capital, Tier1 capital, and Tier1 common equity capital by .49, .57, and .55 percentage points, respectively relative to the non-tested group. Column 7 shows that stress-tested banks also increase the denominator of capital ratios, risk-weighted assets, and assets by .37 and .34 percentage points, respectively.

Asset expansion occurs by increasing different components of assets, such as cash, securities, and mortgage-backed securities. Relative to the non-tested group, stress-tested banks only increase commercial and industrial lending. On the liability side, stress-tested banks have a higher deposit ratio of more than non-tested banks (Table 6, column 6). This result is only driven by an increase in interest deposit ratio and not a non-interest deposit ratio (Table 8, column 8). Regarding the risk components, stress-tested banks act more conservatively than the non-tested matched banks by having higher non-performing loans and loan loss reserve ratios (Table 8, columns 1 and 2). Overall, they pay lower dividends and become less profitable, as measured by return on equity.

5.3 The Bank Lending Channel: Intensive Margin

The bank-level analysis can explain capital adjustments of banks in response to stress tests, but it cannot be used to identify the bank lending channel. That is, it is difficult to attribute the bank-level findings to credit supply but not borrowing channels. In particular, it is plausible that higher lending occurs due to an increase in credit demand and not necessarily an increase in credit supply. To identify bank credit supply, I perform a loan-level analysis using multiple bank-firm relationships following Khwaja and Mian (2008) in addition to including firm fixed effects in the estimations. This conservative identification strategy requires multiple bank-firm relationships to keep the demand side constant and show the banks' different lending behavior in response to the higher capital requirements. By focusing on the same firm borrowing from both tested and non-tested banks, I can attribute the bank lending behavior in response to higher capital requirements to the bank credit supply channel and not the demand channel.

To capture the impact of higher capital requirements on bank lending behavior, I create an intensive margin sample by restricting data to firms that borrow both before and after the test. The intensive margin sample excludes firms that do not receive new loans or start borrowing after the test. To capture the credit supply channel, I restrict the sample only to firms that borrow from both types of banks in the pre-treatment periods. To create a new loan originations measure, I use the loan amount issued at the origination time, regardless of the loan's maturity. I estimate the following specification of equation (3).

$$Y_{lbft} = \alpha_b + \beta Treated_b * Post_t + \sum_{k}^{5} X_{b,t-1} + \eta_f + \tau_t + \mu_l + \nu_{ft} + \varepsilon_{lbft} \tag{3}$$

In equation (3), the Y_{lbft} is the natural logarithm of new loan originations of loan l issued by bank b to firm f in quarter q. $X_{b,t-1}$ are bank control variables that are lagged by one quarter. The control variables include the natural logarithm of total asset, Tier1 capital ratio, consumer loan ratio, net interest income ratio, deposit ratio, and return on asset. The regression includes firm fixed effects, η_f, to capture the borrowing demand channel. This estimation ensures that the demand side is constant, and the bank credit supply drives the results. In addition, I include α_b as bank fixed effects, μ_t as loan-type fixed effects and τ_t as year-quarter fixed effects in the regressions. Standard errors are clustered at the bank level.

The impact of higher capital requirements on bank credit supply may vary depending on the type of borrowers. For example, a bank may restrict lending to riskier borrowers (e.g., smaller) but not safer ones (e.g., larger). Small firms are known as riskier and more financially constrained than large firms. Therefore, I consider the heterogeneity of borrowers regarding the size of borrowing in the syndicated market. To measure small borrowers, I aggregate the total borrowings of a firm from all stress-tested and non-tested banks in each quarter. Small borrowers are firms at the bottom 70% of total borrowings across all banks in each quarter. Equation (4) is similar to equation (3) using a difference-in-difference-in-differences method to capture heterogeneity of borrowers in the intensive margin sample.

$$\begin{aligned} Y_{lbft} = {} & \alpha_b + \delta Small\ Firms_f + \beta Treated_b * Post_t + \xi Treated_b * Small\ Firms_f + \eta_f + \mu_l + \tau_t \\ & + \gamma Treated_b * Small\ Firms_f * Post_t + \sum_{k}^{5} X_{b,t-1} + \varepsilon_{lbft} \end{aligned} \tag{4}$$

In equation (4), the Y_{lbft} is the natural logarithm of new loan originations of loan l issued by bank b to firm f at quarter q. $X_{b,t-1}$ are bank control variables that are lagged by one quarter. $Small\ Firms_f$ is an indicator variable with a value of one if the total borrowings of a firm across all banks are at the bottom 70% and zero otherwise. I also include bank control variables in addition to bank, firm, loan-type, and year-quarter fixed effects as in equation (3). Here, the coefficient of interest is the interaction term between $Treated_b * SmallFirms_f * Post_t$ to capture the heterogeneity impact of lending on small borrowers.

Table 9 reports the results of a bank lending channel at the intensive margin using the sample of firms that borrow from two different types of banks, one tested and one not. The estimation results show the bank credit supply, keeping the demand side constant by restricting the sample to the same borrowers and including firm fixed effects. Stress-tested banks increase new loan originations by 29 percentage points more than the non-tested group after the tests (column 1). Given that the average loan amount during the sample periods is 16.6 million dollars, the magnitude impact of the stress tests on lending is substantial. The increase in new loan originations only occurs in the form of a line-of-credit, but not a term-loan. It is plausible that stress tests affect firms borrowing behavior in a way that firms demand certain types of loans. To capture the loan-specific demand channel of borrowers, I repeat the same specification as equation (4) by including an interaction term of firm fixed effects with loan types. The result is robust comparing the same firm, borrowing the same type of loan from both tested and non-tested banks.

To examine how lending impacts vary with firm risk, I include small firms in regressions as described in equation (4). Small firms are at the bottom 70% of total borrowings in each quarter. Using the intensive margin sample, Table 9, column 2 shows that stress-tested banks reduce lending to small firms relative to large borrowers by 28 percentage points. Here, I only include firm fixed effects and do not restrict the sample to the firms borrowing from both types of banks due to a limited number of small firms with multiple bank-firm relationships in the syndicated loan market. The estimation results show that stress-tested banks reduce credit supply to small borrowers that are known for being riskier and more financially constrained than large firms. It is essential to learn whether small firms can substitute this bank credit loss by borrowing from alternative resources.

Later, I explore how small firms respond to this negative supply shock and the real impact of credit loss on firm financial outcomes.

5.4 The Bank Lending Channel: Extensive Margin

In addition to affecting intensive margins, higher capital requirements might induce banks to stop lending to existing borrowers (exit) or start lending to new borrowers (entry). In other words, higher capital adequacy of stress tests might affect banks' lending behavior at the extensive margin. I examine whether the exit or entry rate of stress-tested banks in the loan market differs from the non-tested group. The exit variable is one if a bank has been lending to a particular firm before the stress test but stops lending to that firm after the tests, and it is zero otherwise. The entry variable equals one if a bank starts lending to a new borrower only after the tests, and it is zero otherwise. I collapse the data by time to keep each (bank, firm) relationship pair. Then, I estimate equation (5), using entry or exit as an outcome variable, also including firm fixed effects to specify the credit supply channel while keeping the demand side constant.

$$Exit_{lbf} = \alpha_b + \beta Treated_b + \sum_{k}^{5} X_{b,pre-event} + \eta_f + \mu_l + \varepsilon_{lbf} \tag{5}$$

In equation (5), I use $Exit_{lbf}$ as an outcome variable. The coefficient of interest is β, which captures banks' lending behavior in response to higher capital requirements at the extensive margin and examines whether stress-tested banks stop lending to the existing borrowers. I control for bank characteristics in 2007 before the stress test in addition to bank, firm, and loan-type fixed effects. To test whether stress-tested banks start lending to new borrowers, I repeat the same specification in equation (5), using $Entry_{lbf}$ as an outcome variable.

Table 10 reports the results of bank lending behavior at the extensive margin, using the exit rate as an outcome variable. Stress-tested banks are 9 percentage points more likely than non-tested banks to maintain lending to a firm, as shown in column 1. This bank behavior is related to a line-of-credit type of loans and not a term-loan (columns 3 and 4). As for new borrowers, column 5 of Table 10 shows that stress-tested banks start lending to new borrowers by 21 percentage points using the entry rate as an outcome variable. This extension of lending to new borrowers also occurs through line-of-credit and not term-loan (columns 7 and 8). Stress tests do not affect withdraw or

the initiation of lending to existing or new small borrowers (columns 2 and 6). Overall, the results show that stress-tested banks extend lending to existing borrowers and start lending to new ones relative to the non-tested group.

5.5 The Bank Lending Channel: Loan Pricing and Non-Pricing Attributes

In addition to the quantitative impact of bank credit supply after the tests, banks might also change the price and non-price attributes of a loan contract to improve the monitoring of borrowers. Thus, the impact of higher capital requirements can not only emerge in the quantity of lending but also in features of loan contracts, such as interest rate, maturity, and covenants. In particular, capital adequacy of stress tests might induce banks to become much stricter or lenient toward different types of borrowers. To test the monitoring behavior of banks towards riskier borrowers, I estimate equation (3) using features of a loan contract as outcome variables.

Banks may also change the pricing of a loan contract as a result of stress tests. Table 9, column 5, shows that stress-tested banks increase loan spreads by 20 percentage points relative to the non-tested banks. The result is robust using an interaction term of the firm and loan-type fixed effects. The increase in the loan price occurs in the form of a line-of-credit but not a term-loan. For small firms, stress-tested banks reduce loan spreads by 35 percentage points for financially-constrained borrowers relative to large ones (column 6). Overall, stress-tested banks increase loan prices but reduce covenants relative to the non-tested group.

Regarding the non-pricing attributes of a loan contract, Table 11 shows the effects of stress tests on the number of covenants and maturity of a loan. Stress-tested banks set .15 fewer loan covenants than non-tested banks (column 1). The reduction in covenants is only related to a line-of-credit. The number of covenants does not differentiate between small and large borrowers (column 2). As for maturity, there is no effect of stress tests on this feature of the loans. To examine the quality of loans issued by stress-tested banks, I consider net worth covenant violation as a measure of borrowers' performance, as shown in Table 12. Borrowers of stress-tested banks violate fewer covenants, while small borrowers violate more covenants than large borrowers after the tests.

6 The Bank Lending Channel: Firm Heterogeneity

It is essential to examine whether capital requirements lead to safer or riskier lending. If stress-tested banks expand credit supply to riskier borrowers, this adds to the long-term risk of the financial system, but lending to safer borrowers can improve economic conditions, especially after a financial crisis. To address the lending behavior, I focus on the heterogeneity of borrowers regarding the size and other riskiness measures and how loan quality can change in response to higher capital requirements.

To examine the nature of bank lending, I focus on how bank credit supply and loan features vary for different types of borrowers. In particular, I use different measures of borrowers' riskiness, including asset size, bond rating, and the Altman Z-score, to determine borrowers' ability to pay back their debt. The goal is to capture borrowers' heterogeneity while keeping the demand side constant using firm fixed effects. To complement the analysis, I use the Compustat data to create measures of borrowers' riskiness and estimate a similar specification to equation (4) using these variables instead of small firms as measured by borrowing size. Some existing borrowers in the Dealscan data are private or international companies. Therefore, they may not be in the Compustat data. For this reason, the sample size used to examine borrower heterogeneity is reduced.

Table 13, column 1, shows that stress-tested banks increase new loan originations by 23 percentage points relative to non-tested banks while decreasing lending to riskier borrowers relative to safer ones. Borrowers with a bond rating lower than BBB- based on the S&P rating scale, considered as a speculative-grade, receive 21 percentage points less credit supply from stress-tested banks (column 3). There are no effects on small asset sized firms that are the ones with assets below the median in each quarter. The result is not significant using the Altman Z-score as a riskiness measure of borrowers. Stress-tested banks set loan spreads 27 percentage points higher than the non-tested group (Table 13, column 5). Stress-tested banks increase loan spread for large borrowers but decrease it for small and speculative-grade firms by 24 percent and 52 percentage points, respectively (Table 13, columns 6 and 7).

Turning to non-pricing attributes of loan contracts, stress-tested banks set fewer covenants than

non-tested banks while they become stricter towards riskier borrowers (Table 14). Stress-tested banks set more covenants on loan contracts for small riskier borrowers measured by speculative-grade rating while fewer covenants for large safer firms (columns 2 and 3). As for using a bankruptcy measure, healthier firms receive fewer covenants as determined by a higher Altman Z-score (column 4). Regarding maturity, stress-tested banks charge shorter maturity to riskier borrowers by 18 percentage points, as shown in Table 14, column 7. Overall, this explains that lenders monitor borrowers through setting stricter features on a loan contract.

7 The Firm Borrowing Channel

The results of the previous section show that higher capital requirements induce banks to increase lending to large borrowers, but reduce lending to small, riskier, and financially-constrained firms. Therefore, the real impact of stress testing on the economy depends on how firms complement or substitute credit loss by borrowing from other banks. I now explore how firms react to the bank-specific credit shock induced by stress tests via the borrowing channel. First, I focus on the aggregate borrowing of firms across all banks, including tested, non-tested, or any other available lenders in the Dealscan dataset. I investigate whether small firms affected by negative liquidity shock can find alternative sources of external finance. In particular, it is plausible that financially-constrained firms mitigate bank-specific credit loss by borrowing from other lenders.

To explore the degree of substitution, I compute an aggregate borrowing measure of a firm from all lenders and examine whether stress-tested banks affect the total borrowing of firms after the tests. I seek to uncover whether firms that rely more on borrowing from stress-tested banks before the tests compensate for the credit loss by borrowing from other lenders. Therefore, I create a borrowing share variable using equation (6) to measure the dependency of each firm on borrowing from stress-tested banks during the pre-treatment periods. The borrowing share is a loan size weighted average of borrowing from stress-tested banks in the absence of stress tests before the test announcement.

$$Borrowing\ Share_f = \frac{\sum_{b=1}^{B} Stress\text{-}Tested_b \sum_{l=1}^{L} Loan\ Amount_{bfl,prior}}{Loan\ Amount_{f,prior}} \tag{6}$$

In equation (6), to quantify the borrowing share variable, I compute the borrowing of each firm from stress-tested banks divided by total borrowing across all banks before the test announcement. The stress-test indicator is one if a bank is part of a stress test, and zero otherwise; the sample includes treated, matched control banks in addition to any other available lenders.

Using the borrowing share variable, I estimate equation (7) to examine the borrowing behavior of firms after the tests.

$$Y_{ft} = \alpha + \beta Borrowing\ Share_f * Post_t + \eta Borrowing\ Share_f + \sum_{k}^{5} X_{b,q-1} + \mu_b + \tau_t + \varepsilon_{ft} \tag{7}$$

In this model, the outcome variable is the total borrowing of a firm from all available lenders in the market. $X_{b,q-1}$ are bank control variables, such as natural logarithm of assets, Tier1 capital ratio, Tier1 common equity capital ratio, deposit ratio, loan ratio, interest income ratio, and return on asset, lagged by one quarter. I include mu_b as bank fixed effects and tau_t as year-quarter fixed effects in the estimations. Firms that depend on borrowing from stress-tested banks before the tests may compensate for a negative liquidity shock by borrowing from other lenders. To determine the source of borrowing, I split the total borrowing measure into borrowing from existing banks or new banks. Existing banks are those that firms borrowed from both before and after the tests, while new banks are those that only provide loans to the firms after the tests. I use the same specification of equation (7) using these alternative outcome variables. To examine heterogeneity in firms' responses to the bank-specific credit loss, I estimate the following specification in equation (8), including small and financially-constrained firms.

$$\begin{aligned} Y_{ft} = \alpha_b + \delta Small\ Firms_f + \eta Borrowing\ Share_f + \beta Borrowing\ Share_f * Post_t + \nu Small\ Firms_f * Post_t \\ + \xi Small\ Firms_f * Borrowing\ Share_f + \gamma Small\ Firms_f * Borrowing\ Share_f * Post_t + \sum_{k}^{5} X_{b,t-1} + \mu_b + \tau_t + \varepsilon_{ft} \end{aligned} \tag{8}$$

The coefficient of interest is γ, which shows how dependency of small firms on stress-tested banks before the tests affects their total borrowing from all available lenders. If γ is not zero, it means that small firms borrowing is affected by the negative liquidity shock, and they cannot fully compensate for this credit supply loss by borrowing from other lenders. Therefore, the reduction in lending of stress-tested banks harms dependent firms.

Table 15, column 1, shows that banks' liquidity shock affects the firms' total borrowing from all available lenders. Firms that rely on borrowing from stress-tested banks before the tests are unable to compensate for the credit loss. This sample includes stress-tested, non-tested, or any other lenders in the market. As documented in the previous section, stress-tested banks induce adverse liquidity shocks on small and financially-constrained firms. This shock harms dependent firms as they cannot borrow from available lenders in the market, unlike less financially-constrained firms. Therefore, they cannot borrow from new lenders to compensate for bank-specific credit loss (column 6). The results show that dependent firms try to maintain their borrowing relationship with existing lenders and do not access new liquidity sources.

8 Firm-Level Impacts

The previous section documents that dependent firms cannot compensate for the credit loss by borrowing from all available lenders in the loan market. Therefore, the question is whether financially-constrained firms can substitute the reduction in credit supply with internal resources so that there is no need to cut back on their assets or investments. In particular, I analyze the impact of bank-specific credit loss on firm financial outcomes such as assets, sales, fixed assets, and investment. The impact of negative credit supply on dependent firms can be mitigated if they can use their internal capital such as cash holdings or informal sources of borrowings, such as family sources or crowd-funding, to compensate for bank-specific credit loss. If financially constrained firms cannot substitute the reduction in external financing with internal resources, there is a real adverse effect on firm financial outcomes. This section measures the transmission of credit supply shock to the real economy.

To examine firms' responses to bank-specific credit losses, I consider firms with high versus low dependency on bank borrowing before the tests. Explicitly, I create a borrowing share variable similar to that capturing the reliance of a firm on borrowing from stress-tested banks. I classify firms into two separate groups, treated firms with a borrowing share above the median, that are more dependent on borrowing from stress-tested banks, and a control group of firms with a borrowing share below the median. Then, I use the nearest neighborhood matching method to find the best

match to treated firms based on firms' pre-treatment characteristics. In the matching process, I use the median of cash flow ratio, leverage, tangibility, and net worth of firms during one year before the tests and the firm's industry and country of location, named as a firm-cluster. Table 17 shows the summary statistics before and after the matching process during the pre-treatment periods. The matched control group of firms are similar in all characteristics to the treated firms. Figure 3 verifies the parallel-trend assumption between treated firms and a matched control group for assets and fixed assets.

To examine firms' responses to the credit loss, I use a similar specification to equation (7), replacing the total borrowing variable with different firms' financial outcomes using the matched sample of firms. In this estimation, the outcome variable is the natural logarithm of total assets, sales, fixed assets, and capital expenditures. I include firm control variables, such as assets, cash flow ratio, leverage, tangibility, EBITDA ratio, and net worth, which lagged by one quarter. I aggregate firms into different clusters based on their industry and country of incorporation and define a firm-cluster group for each pair of industry and firm's country of location. I include bank, firm-cluster, and year-quarter fixed effects in the estimations. The hypothesis is that firms that are highly dependent on borrowing from stress-tested banks reduce firm financial outcomes after the tests.

To study the impact of negative credit supply on small firms, I repeat a similar specification to equation (8) using firm financial outcome variables. Small firms are the ones with assets below the median in each quarter. I explore whether small firms use alternative resources such as internal liquidity or informal financing to compensate for the credit supply shock. If they do so, then the negative liquidity shock does not affect these firms' real outcomes. I again include firm control variables in addition to bank, firm-cluster, and year-quarter fixed effects. Table 16 shows the impact of stress tests on firm assets. Treated firms that depend more on borrowing from stress-tested banks before the tests, reduce their assets by 26 percentage points more than firms with lower dependence on tested banks (column 1). The small and highly dependent firms reduce their assets by 12 percentage points more than large firms (column 2).

Using other firm outcome variables, including sales, fixed assets, and capital expenditures,

generates similar results. Treated firms with higher borrowing share reduce sales, fixed assets, capital expenditures more than less dependent borrowers by 22, 22, and 28 percentage points more than the matched control group, as shown in Table 16, columns 3, 5, 7. Small firms with a higher dependency on stress-tested banks decrease fixed assets and capital expenditures by 12 and 15 percentage points (Table 16, columns 6 and 8). Overall, the results show that a negative bank credit supply has a real impact on firm financial outcomes. Banks reduce lending to small and financially-constrained firms, and this negative liquidity shock transmits to the real economy through a reduction in firm financial outcomes.

9 Conclusion

The recent stress test in the banking system is a compelling policy change to test the impact of higher capital requirements on banks' behavior. Stress tests are an unprecedented event in scale and scope, as well as the range of information that made public on the projected losses and capital positions of the tested banks. The Federal Reserve's criterion to include a bank as part of the stress tests was initially unknown and not driven by an individual bank's performance. This allows using the Federal Reserve's criterion as an exogenous source of variation in banks using a difference-in-difference approach and a regression discontinuity design as an identification approach. I examine all different stress testing rounds in the U.S. since 2009 to show the impact of the capital rule on the real economy.

I find that stress-tested banks increase capital ratios and lending vis-à-vis the non-tested matched group. To achieve this goal, they increase the numerator of capital ratio, the capital level, more than raising the denominator, risk-weighted assets. Stress-tested banks change the composition of assets by increasing commercial and industrial lending and holding more cash. They also increase the equity ratio by issuing preferred shares and not increasing the retained earnings. To separate the bank credit supply from the demand channel, I investigate the loan-level analysis using multiple bank-firm relationships. I find that stress-tested banks increase lending to large borrowers but decrease lending to small firms. At the extensive margin, stress-tested banks keep lending to existing firms and start lending new borrowers vis-à-vis non-tested banks.

The various effects of lending are salient for the pricing and non-pricing attributes of a loan contract. Stress-tested banks set stricter standards for small and riskier borrowers by requiring more covenants and setting shorter maturity loans. As a measure of performance, small borrowers of stress-tested banks violate a higher number of covenants after the tests. I further explore the transmission of bank liquidity shock to the real economy through the bank lending channel. To this end, I show that firms that rely on borrowing from stress-tested banks cannot mitigate the credit loss by borrowing from other existing lenders or using internal resources. As a result, they reduce assets and investments more than the less dependent borrowers. Using the medium-sized banks as part of the Dodd-Frank Act (2014) stress tests, I find a similar behavior to the large banks in capital adjustments and lending behavior.

Banks have incentives to liquidate assets rather than recapitalize in an adverse economic condition. Therefore, in a macroprudential approach, it is reasonable for regulators to require greater common equity to ensure the quality of banks' capital (Hanson et al. (2011)). The reduction of credit to small borrowers in response to higher capital requirements is also an important result of the U.S. bank stress tests. From a policy perspective, the form of regulatory intervention is critical to prevent fire sales and credit-crunches in the financial system (Diamond and Rajan (2011), Stein (2012)). To protect the economy as a whole, it is essential also to address the impact of reforms on the expansion of the shadow banking system. Going forward, the results of the U.S. bank stress tests can guide regulators and policymakers to assess higher capital requirements under the Basel III process.

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TABLE 1:
Bank Variable Definitions

Variable	Definition
Assets (Billions)	Total assets
Cash ratio	Noninterest-bearing balances+Interest bearing balances in US offices+Interest bearing balances in foreign offices/Total assets
Securities ratio	Total Held-to-maturity securities+Total Available-for-sale securities/Total assets
Held-to-maturity securities ratio	Total Held-to-maturity securities/Total assets
Available-for-sale securities ratio	Total Available-for-sale securities/Total assets
Fed funds sold ratio	Federal funds sold in domestic offices+Securities purchased/Total assets
Loan ratio	Total loans/Total assets
Trading assets ratio	Trading Assets/Total assets
Fixed assets ratio	Premises and fixed assets/Total assets
Other real estate ratio	Other real estate owned/Total assets
Deposit ratio	Deposits noninterest bearing+Deposits interest bearing in domestic offices+Deposits noninterest bearing+Deposits interest bearing in foreign offices/Total assets
Noninterest-bearing deposit ratio	Deposits noninterest bearing+Deposits noninterest bearing/Total assets
Interest-bearing deposit ratio	Deposits interest bearing in domestic offices+Deposits interest bearing in foreign offices/Total assets
Fed funds purchased ratio	Federal funds purchased in domestic office+Securities sold/Total assets
Trading liabilities ratio	Trading liabilities/Total assets
Leverage ratio	Total liabilities/Total assets
Preferred stock ratio	Perpetual preferred stock/Total assets
Common stock ratio	Common stock/Total assets
Retained earnings ratio	Undivided profits and capital reserves+Accumulated other income+Other components of equity capital/Total assets
Equity ratio	Total equity capital/Total assets
Net interest income ratio	Net interest income/Total assets
Net noninterest income ratio	Total noninterest income-Total noninterest expense/Total assets
Return on assets	Net income/Total assets
Return on equity	Net income/Total equity capital
Dividend ratio	Cash dividends declared on common stock/Total assets
Non-performing loan ratio	Total loans, leasing and debt securities, past due 90 days or more and still accruing+Total loans, leasing and debt securities-Debt securities and other assets, past due 90 days or more and still accruing-Debt securities and other assets, nonaccrual/Total loans
Loan loss provision ratio	Provision for Loan and Lease Losses/Total loans
Loan loss reserve ratio	Allowance for Loan and Lease Losses/Total loans
Net charge-offs ratio	Charge-offs on allowance for loan and lease losses-Recoveries on allowance for loan and lease losses/Total loans
Foreclosed real estate ratio	Real estate acquired in satisfaction of debts previously contracted/Total loans
Restructured loan ratio	Loans and leases restructured and in compliance with modified terms/Total loans
Total risk-based capital ratio	Total qualifying capital allowable under the risk-based capital guidelines/Risk-weighted assets
Tier 1 risk-based capital ratio	Tier 1 capital allowable under the risk-based capital guidelines/Risk-weighted assets
Tier 1 common equity ratio	Tier 1 common equity capital/Risk-weighted assets
Tier 1 risk-based leverage ratio	Tier 1 capital allowable under the risk-based capital guidelines/Average total assets for leverage capital purposes
Tier 2 risk-based capital ratio	Tier 2 capital allowable under the risk-based capital guidelines/Risk-weighted assets
Risk-weighted asset ratio	Risk-weighted assets, net of allowances and other deductions/Total assets
Gross Risk-weighted asset ratio	Risk-weighted assets before deductions for excess allowance for loan and lease losses and allocated transfer risk reserve/Total assets
Real estate loan ratio	Loans secured by real estate/Total loans
C&I loan ratio	Commercial and industrial loans/Total loans
Consumer loan ratio	Loans to individuals for household/Total loans

This table includes the definition of bank variables in the Call Reports data.

TABLE 2:
Firm and Loan Variable Definitions

Variable	Definition
Firm-Level:	
Sales	Total Sales
Assets	Total Assets
Fixed Assets	Total of Fixed Assets (PP&E)
Capital Expenditues	Total of Capital Expenditure
EBITDA Ratio	EBITDA/Total Assets
Tangibility	Total PP&E/Total Assest
Leverage	Total Liability/Total Assets
Cash Flow Ratio	Cash Flow/Total Assets
Net Worth	Total Assets - Total Liabilities
Current Ratio	Current Assets/Current Liabilities
Z-Score	1.2 Working Capital+1.4 Retained Earning+3.3 Operating Income+0.99 Revenue/Total Assets
Small Firm	Equals to one if a firm has assets below the median of total assets in each quarter and zero otherwise
Small Loan	Equals to one if a firm has borrowings below 70% percentile of total borrowings in each quarter and zero otherwise
Interest Coverage	Operating Income(EBIT)/Interest paid
Speculative	Equals to one if a company's bond rating is lower than BBB- based on S&P Ratings Scale and zero otherwise
Bond Access	Equals to one if firm's bond received S&P rating during the examined period and zero otherwise
Loan-Level:	
Loan Origination	Total loan amount issued at the time of loan origination
Loan Exposure	Loan amount spreaded across the given time periods
Loan Spread	Loan interest rate in bps over LIBOR for each dollar drawn down.
Loan Seniority	Type of seniority the facility has in the company's overal debt structure.
Secured Loan	Loan is backed by a collateral
Number of Covenants	Number of requirements a borrower has to adhere to for each deal
Term-Loan	Loans with Term Loan type of Term Loan A to Term Loan K or Delay Draw Term Loan
Line-of-Credit	Loan types of Revolver/Line<1Yr.,Revolver/Line>=1Yr.,364-Day Facility,Limited Line/Term Loan or Revolver/Term Loan

This table includes the definition of loan and firm variables in the Dealscan and Compustat data.

TABLE 3:
List of Stress-Tested Banks in the SCAP and CCAR Stress Tests

Rssd 9001	Bank-Holding Companies
1120754	WELLS FARGO COMPANY
2380443	GOLDMAN SACHS GROUP INC
2162966	MORGAN STANLEY
2945824	METLIFE, INC.
1069778	PNC FINANCIAL SERVICES GROUP, INC., THE
1119794	U.S. BANCORP
3587146	BANK OF NEW YORK MELLON CORP
1562859	ALLY FINANCIAL INC
1131787	SUNTRUST BANKS, INC.
1111435	STATE STREET CORPORATION
2277860	CAPITAL ONE FINANCIAL CORPORATION
1074156	BB&T CORPORATION
3242838	REGIONS FINANCIAL CORPORATION
1275216	AMERICAN EXPRESS CO
1070345	FIFTH THIRD BANCORP
1068025	KEYCORP

This table shows the list of stress-tested banks in the SCAP and CCAR stress tests. The banks have at least $100 billion assets in the last quarter of 2008. I remove the top three large banks in assets from the sample.

TABLE 4:
The Pre-Treatment Median Test of Banks in the Earlier Rounds of Stress Tests

	Medians-Unmatched Sample			Medians-Matched Sample	
	Control	Treated	Difference	Control	Difference
Total Capital Ratio	12.15	12.27	-0.12	11.97	-0.30
Tier1 Capital Ratio	8.96	8.73	0.24	8.31	-0.42
Tier2 Capital Ratio	3.49	3.38	0.11	3.58	0.20
Tier1 Common Equity Ratio	8.96	8.62	0.35	7.88	-0.73
Total Assets in Billion	38.61	140.72	-102.11***	56.47	-84.25***
Cash Ratio	2.61	2.59	0.02	2.55	-0.04
Securities Ratio	12.47	10.75	1.72	10.90	0.15
Fed Funds Sold Ratio	0.75	0.24	0.51	1.20	0.96***
Loan Ratio	73.99	63.37	10.62***	74.69	11.32
Fixed Assets Ratio	1.01	1.17	-0.16**	1.02	-0.15**
Deposit Ratio	68.59	60.26	8.33***	70.00	9.74
Fed Funds Purchased Ratio	6.26	3.76	2.51***	4.95	1.19
Leverage Ratio	89.32	90.80	-1.48**	90.22	-0.58
Common Ratio	0.46	0.30	0.16	0.55	0.25
Retained Earnings Ratio	5.70	5.39	0.32	6.37	0.99
Equity Ratio	10.64	9.10	1.54**	9.76	0.66
Interest Income Ratio	0.73	0.74	-0.01	0.75	0.01
Noninterest Income Ratio	-0.23	-0.03	-0.20***	-0.17	-0.14
Return on Equity	3.33	3.94	-0.62***	3.63	-0.31
Return on Assets	0.33	0.35	-0.02	0.36	0.00
LLR Ratio	1.04	1.05	-0.02	1.02	-0.03

This table summarizes the median chi-squared test of bank variables to show the difference between stress-tested banks and non-tested group before and after the nearest neighborhood matching process. To find the best match, I use the median of primary bank characteristics during a one year period before the test announcement between the third quarter of 2006 to the second quarter of 2007.

TABLE 5:
Adjustment of Capital Ratios

	TCr	T1Cr	T1CEr	T1Lr	T2Cr	LnTC	LnRWA	LnT1C	LnT1CE	LnT2C	LnAT
Treated*Post	1.67**	2.09***	1.84**	1.05	-0.44*	0.49***	0.37***	0.57***	0.55***	0.21	0.34***
	(0.70)	(0.67)	(0.66)	(0.63)	(0.26)	(0.11)	(0.12)	(0.11)	(0.10)	(0.15)	(0.12)
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dependent-mean	14.27	11.24	10.22	8.78	3.05	16.52	18.49	16.27	16.17	14.87	18.86
Dependent-sd	2.55	2.73	2.66	2.05	1.16	0.87	0.87	0.90	0.91	0.90	0.99
AdjR-squared	0.36	0.37	0.27	0.18	0.19	0.49	0.30	0.52	0.47	0.19	0.24
Observations	702	702	702	702	702	702	702	702	702	702	777

This table presents coefficient estimates of capital ratio specifications at the bank-level. The outcome variables include total capital ratio, Tier1 capital ratio, Tier1 common equity capital ratio, Tier2 capital ratio, total capital, risk-weighted assets, Tier1 capital, Tier1 common equity capital, Tier2 capital, and assets. The treated banks are stress-tested banks with at least $100 billion assets in the last quarter of 2008. The post is an indicator variable with a value of one for the last quarter of 2008 and after, and zero otherwise. The sample periods are from the first quarter of 2005 to the last quarter of 2013. The regressions include bank and year fixed effects. Standard errors in parentheses are clustered at the bank-level. *, **, and *** indicate significance at the 10%, 5% and 1% levels, respectively.

TABLE 6:
Adjustment of Balance Sheet

	EQr	CSr	PRr	RETr	LEVr	DPr	LNr	CASHr	SECr	MBSr	TSr
Treated*Post	1.54**	-0.15	0.45**	0.11	-1.56**	4.76*	-0.74	3.54*	3.57**	8.11***	-0.43
	(0.55)	(0.11)	(0.19)	(0.78)	(0.57)	(2.35)	(2.64)	(1.96)	(1.60)	(1.51)	(0.75)
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dependent-mean	9.93	0.65	0.77	3.95	89.88	55.55	53.53	6.95	16.17	5.35	2.32
Dependent-sd	2.63	0.84	1.25	2.98	2.63	24.20	25.11	8.89	13.03	6.67	3.51
AdjR-squared	0.26	0.02	0.33	0.06	0.26	0.16	0.02	0.15	0.18	0.54	0.03
Observations	767	702	702	777	767	777	777	777	777	777	777

This table presents coefficient estimates of balance sheet specifications at the bank-level. The outcome variables include equity ratio, common shares ratio, preferred shares ratio, retained earnings ratio, leverage ratio, deposit ratio, loan ratio, cash ratio, securities ratio, mortgage-backes securities ratio, and Treasury securities ratio. The treated banks are stress-tested banks with at least $100 billion assets in the last quarter of 2008. The post is an indicator variable with a value of one for the last quarter of 2008 and after, and zero otherwise. The sample periods are from the first quarter of 2005 to the last quarter of 2013. The regressions include bank and year fixed effects. Standard errors in parentheses are clustered at the bank-level. *, **, and *** indicate significance at the 10%, 5% and 1% levels, respectively.

TABLE 7:
Lending Behavior

	RELr	CRELr	CILr	CLr	FRELr	RSLr	OREr	RENCOr	CINCOr	CNCOr
Treated*Post	-1.93	-1.76	2.39**	-0.41	-0.46	-0.09	0.04	0.01	0.00	0.05*
	(2.07)	(1.17)	(1.07)	(1.64)	(0.59)	(0.12)	(0.08)	(0.04)	(0.01)	(0.02)
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dependent-mean	46.59	17.27	20.20	12.76	0.60	0.07	0.19	0.14	0.03	0.05
Dependent-sd	23.48	14.76	11.38	15.78	1.86	0.24	0.25	0.26	0.05	0.16
AdjR-squared	0.10	0.06	0.08	0.03	0.01	0.21	0.15	0.27	0.33	0.09
Observations	702	777	702	702	702	453	702	777	777	777

This table presents coefficient estimates of loans specifications at the bank-level. The outcome variables include real estate loan ratio, commercial real-estate loan ratio, commercial and industrial loan ratio, consumer loan ratio, foreclosed real estate loan ratio, restructured loan ratio, other real estate loan ratio, real estate net charge-offs ratio, commercial and industrial net charge-offs ratio, and consumer net charge-offs ratio. The treated banks are stress-tested banks with at least $100 billion assets in the last quarter of 2008. The post is an indicator variable with a value of one for the last quarter of 2008 and after, and zero otherwise. The sample periods are from the first quarter of 2005 to the last quarter of 2013. The regressions include bank and year fixed effects. Standard errors in parentheses are clustered at the bank-level. *, **, and *** indicate significance at the 10%, 5% and 1% levels, respectively.

TABLE 8:
Risk Components

	NPLr	LLRr	NCOr	ROA	ROE	IIr	NIIr	IDPr	NIDPr	DIVr
Treated*Post	1.14***	0.41**	0.05	-0.09	-1.47**	-0.03	-0.11	6.67**	-1.91	-0.07***
	(0.29)	(0.18)	(0.05)	(0.06)	(0.66)	(0.03)	(0.07)	(2.78)	(3.00)	(0.02)
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dependent-mean	1.96	1.71	0.26	0.20	2.08	0.67	-0.18	40.92	14.63	0.08
Dependent-sd	1.84	1.17	0.37	0.43	4.32	0.29	0.34	20.54	9.55	0.07
AdjR-squared	0.63	0.57	0.38	0.14	0.15	0.04	0.04	0.17	0.07	0.47
Observations	777	712	777	777	767	711	777	777	777	700

This table presents coefficient estimates of risk components specifications at the bank-level. The outcome variables include non-performing loan ratio, loan loss reserves ratio, net charge-offs ratio, return on asset, return on equity, net interest income ratio, net noninterest income ratio, interest deposit ratio, noninterest deposit ratio, and dividend ratio. The treated banks are stress-tested banks with at least $100 billion assets in the last quarter of 2008. The post is an indicator variable with a value of one for the last quarter of 2008 and after, and zero otherwise. The sample periods are from the first quarter of 2005 to the last quarter of 2013. The regressions include bank and year-quarter fixed effects. Standard errors in parentheses are clustered at the bank-level. *, **, and *** indicate significance at the 10%, 5% and 1% levels, respectively.

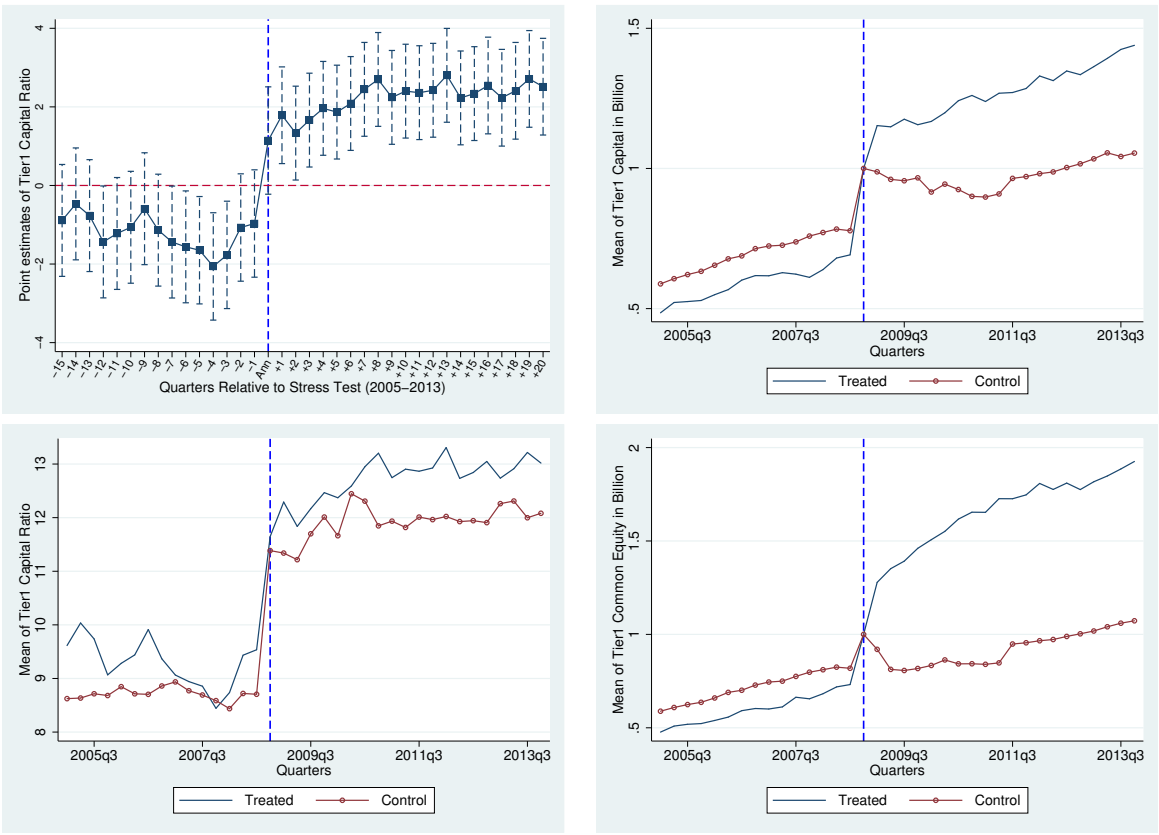

FIGURE 1: The Trend of Tier1 Capital Ratio and Tier1 Capital

This figure shows the differences in the Tier1 capital ratio between stress-tested banks and matched control group in the panel(a). The y-axis represents the point estimate of the Tier1 capital ratio. The x-axis is the interaction term between each quarter and treated banks. The point estimates are within 95% confidence intervals. The announcement time of stress tests is in the last quarter of 2008, as shown by a dashed vertical line. Panel(b) compares the general trend in the Tier1 capital between treated banks and matched control group for the periods from the first quarter of 2005 to the last quarter of 2008, normalized to the last quarter of 2008. The y-axis is normalized to the last quarter of 2008. The announcement time of stress tests is in the last quarter of 2008, as shown by a dashed vertical line. Panel(c) shows the general trend for the Tier1 capital ratio between stress-tested banks and matched control group. Panel(d) shows the general trend similar to panel(b) for Tier1 common equity capital between treated banks and matched control group, normalized to the last quarter of 2008.

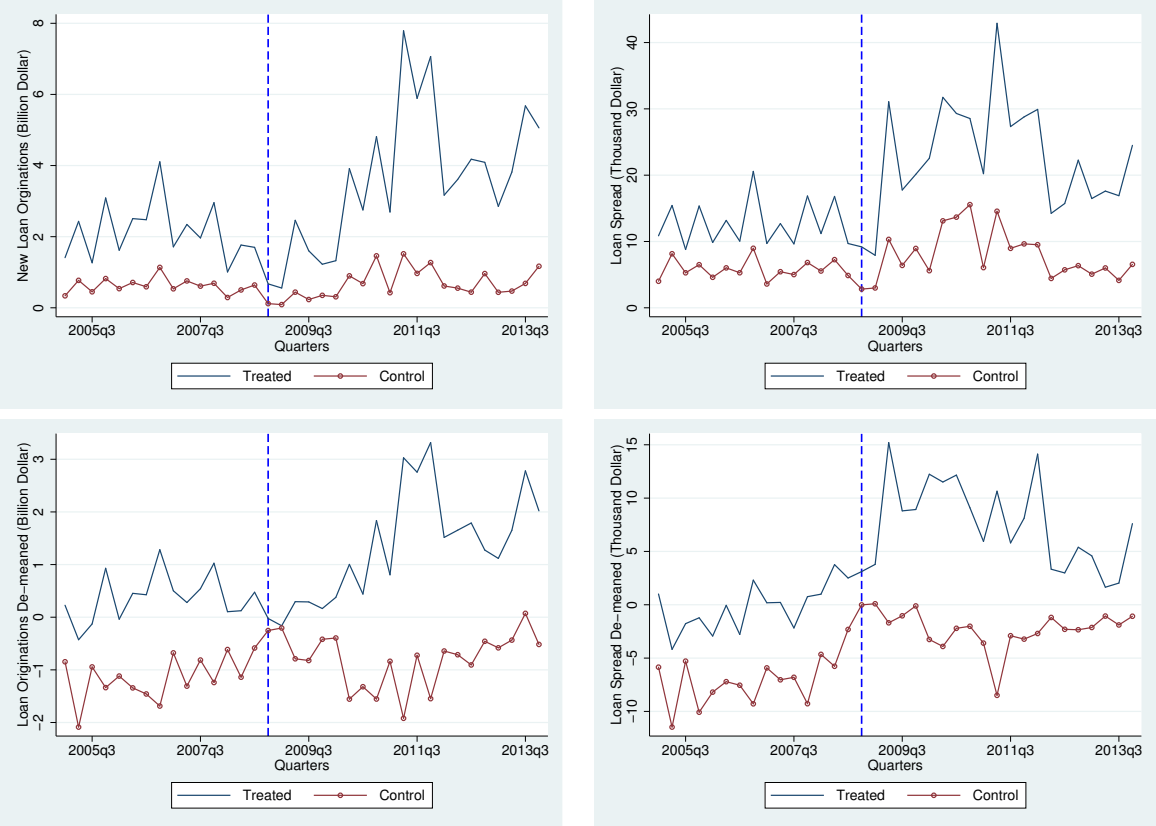

FIGURE 2: **The Trend of New Loan Originations and Loan Spread with and without Firm Fixed Effects**

This figure illustrates the trend of new loan originations and loan spread of stress-tested banks and matched control group using an intensive margin sample. The top panels (panel(a) and (b)) show the trends without firm fixed effects and the lower panels show the trends including firm fixed effects (panels(c) and (d)). Panel(a) and (b) consider firms that borrow from two types of banks, one being tested and the other not tested, during the pre-treatment periods to show the bank lending channel. The announcement time of stress tests is in the last quarter of 2008, as shown by a dashed vertical line. Panel(c) and (d) illustrates the trend of new loan originations and loan spread of stress-tested banks and matched control group relative to the firm's average of borrowing using an intensive margin sample. I consider the same firm that borrows from two types of banks, one being tested and the other non-tested, during the pre-treatment periods to show the bank lending channel. In panel(c) and (d), the y-axis shows the de-meaned value of loan originations to each firm. The announcement time of stress tests is in the last quarter of 2008, as shown by a dashed vertical line.

TABLE 9:
The Bank Lending Channel: Intensive Margin and Loan Prices

	Ln-Originations				Ln-Spread			
	Firms	Firms	Line-of-Credit	Term-Loan	Firms	Firms	Line-of-Credit	Term-Loan
Treated*Post	0.29***	0.35**	0.30***	0.28	0.20*	0.33**	0.19*	-0.02
	(0.09)	(0.13)	(0.08)	(0.17)	(0.11)	(0.14)	(0.11)	(0.08)
Treated*Small Firms*Post		-0.28**				-0.35**		
		(0.11)				(0.13)		
Treated*Small Firms		0.07				0.16*		
		(0.08)				(0.08)		
Small Firms*Post		0.20***				0.06		
		(0.06)				(0.12)		
Small Firms		-0.84***				-0.18**		
		(0.06)				(0.07)		
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan-Type Fixed Effects	Yes	Yes	No	No	Yes	Yes	No	No
Dependent-mean	16.65	16.76	16.67	16.55	4.99	5.16	4.89	5.64
Dependent-sd	0.92	1.00	0.87	1.15	0.84	0.97	0.80	0.79
AdjR-squared	0.51	0.51	0.52	0.64	0.72	0.74	0.72	0.82
Observations	4856	15523	4098	668	4479	13963	3809	622

This table presents coefficient estimates of loan origination and spread specifications using the intensive margin sample at the loan-level. I consider firms that borrow from two types of banks, one being tested and the other not tested, during the pre-treatment periods to show the bank lending channel. The outcome variable is the natural logarithm of the new loan originations and spread. The treated banks are stress-tested banks with at least $100 billion assets in the last quarter of 2008. The post is an indicator variable with a value of one for the last quarter of 2008 and after, and zero otherwise. The small firms are the ones at the bottom of 70% of total borrowings across all banks. The sample periods are from the first quarter of 2005 to the last quarter of 2013. The regressions include bank, year-quarter, firm, firm-year-quarter, and loan-type fixed effects. Standard errors in parentheses are clustered at the bank-level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

TABLE 10:
The Bank Lending Channel: Extensive Margin

	Exit				Entry			
	Firms	Firms	Line-of-Credit	Term-Loan	Firms	Firms	Line-of-Credit	Term-Loan
Treated	-0.09***	-0.08**	-0.13***	0.02	0.21***	0.20***	0.24***	0.11
	(0.03)	(0.03)	(0.04)	(0.06)	(0.03)	(0.03)	(0.05)	(0.08)
Treated*Small Firms		-0.03				0.03		
		(0.02)				(0.02)		
Small Firms		0.05**				-0.15***		
		(0.02)				(0.02)		
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan-Type Fixed Effects	Yes	Yes	No	No	Yes	Yes	No	No
Dependent-mean	0.28	0.28	0.26	0.32	0.51	0.51	0.51	0.52
Dependent-sd	0.45	0.45	0.44	0.47	0.50	0.50	0.50	0.50
AdjR-squared	0.62	0.62	0.61	0.72	0.50	0.50	0.48	0.59
Observations	17218	17218	12321	4357	17218	17218	12321	4357

This table presents coefficient estimates of exit and entry specifications at the loan-level. The exit variable has a value of one if a bank has been lending to a particular firm before stress test announcement but stops lending to that firm after the event and zero otherwise. The entry variable has a value of one if a bank starts lending to a new borrower only after the announcement of test and zero otherwise. The treated banks are stress-tested banks with at least $100 billion assets in the last quarter of 2008. The small firms are the ones at the bottom of 70% of total borrowings across all banks. I collapse the data by time to keep each pair of the bank and firm relationship. The sample periods are from the first quarter of 2005 to the last quarter of 2013. The regressions include bank, firm, and loan-type fixed effects. Standard errors in parentheses are clustered at the bank-level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

TABLE 11:
The Bank Lending Channel: Non-Price Attributes

	Covenants			Ln-Maturity		
	Firms	Firms	Line-of-Credit	Firms	Firms	Line-of-Credit
Treated*Post	-0.15**	-0.21	-0.15*	0.01	-0.03	-0.00
	(0.07)	(0.13)	(0.07)	(0.03)	(0.03)	(0.02)
Treated*Small Firms*Post		0.05			-0.01	
		(0.18)			(0.03)	
Treated*Small Firms		-0.07			-0.01	
		(0.06)			(0.03)	
Small Firms*Post		-0.21			-0.01	
		(0.17)			(0.01)	
Small Firms		-0.01			-0.31***	
		(0.05)			(0.03)	
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Loan-Type Fixed Effects	Yes	Yes	No	Yes	Yes	No
Dependent-mean	2.72	2.77	2.70	4.05	4.09	4.00
Dependent-sd	0.75	0.88	0.75	0.59	0.69	0.53
AdjR-squared	0.90	0.91	0.90	0.53	0.52	0.53
Observations	343	896	322	4837	15397	4086

This table presents coefficient estimates of loan contracts specifications using the intensive margin sample at the loan-level. I consider firms that borrow from two types of banks, one being tested and the other not tested, during the pre-treatment periods to show the bank lending channel. The outcome variable is the number of covenants and the natural logarithm of loan maturity. The treated banks are stress-tested banks with at least $100 billion assets in the last quarter of 2008. The post is an indicator variable with a value of one for the last quarter of 2008 and after, and zero otherwise. The small firms are the ones at the bottom of 70% of total borrowings across all banks. The sample periods are from the first quarter of 2005 to the last quarter of 2013. The regressions include bank, year-quarter, firm, and loan-type fixed effects. Standard errors in parentheses are clustered at the bank-level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

TABLE 12:
Networth Covenants Violation

	Covenants-Violation	
Treated*Post	-0.09*	-0.01
	(0.04)	(0.02)
Treated*Small Firms*Post		1.59***
		(0.12)
Treated*Small Firms		0.02
		(0.02)
Small Firms		-0.02
		(0.02)
Bank Fixed Effects	Yes	Yes
Bank Controls	Yes	Yes
Quarter Fixed Effects	Yes	Yes
Firm Fixed Effects	Yes	Yes
Dependent-mean	0.03	0.03
Dependent-sd	0.17	0.17
AdjR-squared	0.64	0.72
Observations	102	102

This table presents coefficient estimates of net worth covenants violation specifications using the intensive margin sample at the loan-level. The treated banks are stress-tested banks with at least $100 billion assets in the last quarter of 2008. The post is an indicator variable with a value of one for the last quarter of 2008 and after, and zero otherwise. The small firms are the ones at the bottom of 70% of total borrowings across all banks. The sample periods are from the first quarter of 2005 to the last quarter of 2013. The regressions include bank controls, bank, year-quarter, and firm fixed effects. Standard errors in parentheses are clustered at the bank-level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

TABLE 13:
Intensive Margin and Loan Prices

	Ln-Originations				Ln-Spread			
Treated*Post	0.23*	0.24*	0.31**	0.23*	0.27**	0.21	0.53**	0.24**
	(0.13)	(0.14)	(0.12)	(0.13)	(0.12)	(0.12)	(0.20)	(0.11)
Treated*Small Asset Firms*Post		-0.11				-0.24*		
		(0.11)				(0.12)		
Treated*Small Asset Firms		0.08				0.13**		
		(0.07)				(0.06)		
Small Asset Firms*Post		0.31***				0.16		
		(0.09)				(0.12)		
Small Asset Firms		-0.34***				-0.09		
		(0.04)				(0.06)		
Treated*Speculative*Post			-0.21***				-0.52**	
			(0.07)				(0.19)	
Treated*Speculative			0.09**				0.28**	
			(0.04)				(0.10)	
Speculative*Post			0.30***				-0.05	
			(0.07)				(0.19)	
Speculative			-0.71***				1.51***	
			(0.09)				(0.15)	
Treated*Z-Score*Post				-0.09				-0.16*
				(0.07)				(0.08)
Treated*Z-Score				0.02				0.10**
				(0.06)				(0.04)
Z-Score*Post				0.24***				0.36***
				(0.04)				(0.07)
Z-Score				-0.23***				-0.43***
				(0.06)				(0.05)
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan-Type Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dependent-mean	16.76	16.76	16.83	16.82	5.16	5.16	4.98	4.98
Dependent-sd	1.00	1.00	0.96	0.95	0.97	0.97	0.93	0.93
AdjR-squared	0.44	0.44	0.45	0.45	0.73	0.73	0.75	0.75
Observations	15523	15523	10151	9273	13963	13963	9507	8690

This table presents coefficient estimates of loan originations and spread specifications using the intensive margin sample at the loan-level. The outcome variable is the natural logarithm of the loan originations and spread. The treated banks are stress-tested banks with at least $100 billion assets in the last quarter of 2008. The post is an indicator variable with a value of one for the last quarter of 2008 and after, and zero otherwise. The small asset firms are the ones with assets below the median in each quarter. The speculative-grade rating indicates borrowers with a bond rating lower than BBB- based on the S&P rating scale. The Altman Z-score measures riskiness of borrowers that identifies a lower chance of bankruptcy with a higher Z-score. The sample periods are from the first quarter of 2005 to the last quarter of 2013. The regressions include bank, year-quarter, firm, and loan-type fixed effects. Standard errors in parentheses are clustered at the bank-level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

TABLE 14:
Non-Price Attributes

	Covenants				Ln-Maturity			
Treated*Post	-0.26**	-0.34**	-0.35***	0.13**	-0.03	-0.03	0.10*	0.02
	(0.11)	(0.14)	(0.11)	(0.06)	(0.04)	(0.04)	(0.05)	(0.04)
Treated*Small Asset Firms*Post		0.35**				-0.03		
		(0.14)				(0.04)		
Treated*Small Asset Firms		-0.22**				0.02		
		(0.08)				(0.03)		
Small Asset Firms*Post		-0.46***				0.11***		
		(0.11)				(0.02)		
Small Asset Firms		0.10				-0.11***		
		(0.08)				(0.04)		
Treated*Speculative*Post			0.34**				-0.18***	
			(0.12)				(0.04)	
Treated*Speculative			-0.11**				0.09***	
			(0.05)				(0.02)	
Speculative*Post			-0.51***				0.19***	
			(0.09)				(0.04)	
Speculative			1.71***				0.56**	
			(0.06)				(0.22)	
Treated*Z-Score*Post				-0.13**				-0.05*
				(0.04)				(0.03)
Treated*Z-Score				0.02*				0.01
				(0.01)				(0.02)
Z-Score*Post				0.15*				0.12***
				(0.07)				(0.02)
Z-Score				-0.14				-0.08**
				(0.10)				(0.03)
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan-Type Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dependent-mean	2.77	2.77	2.76	2.76	4.09	4.09	4.09	4.09
Dependent-sd	0.88	0.88	0.88	0.91	0.69	0.69	0.62	0.62
AdjR-squared	0.90	0.91	0.92	0.94	0.50	0.50	0.46	0.48
Observations	896	896	787	705	15397	15397	10115	9240

This table presents coefficient estimates of the number of covenants and loan maturity specifications using the intensive margin sample at the loan-level. The outcome variable is the number of covenants and the natural logarithm of loan maturity. The treated banks are stress-tested banks with at least $100 billion assets in the last quarter of 2008. The post is an indicator variable with a value of one for the last quarter of 2008 and after, and zero otherwise. The small asset firms are the ones with assets below the median in each quarter. The speculative-grade rating indicates borrowers with a bond rating lower than BBB- based on the S&P rating scale. The Altman Z-score measures riskiness of borrowers that identifies a lower chance of bankruptcy with a higher Z-score. The sample periods are from the first quarter of 2005 to the last quarter of 2013. The regressions include bank, year-quarter, firm, and loan-type fixed effects. Standard errors in parentheses are clustered at the bank-level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

TABLE 15:
The Borrowing Channel: Loan-Level

	All-Banks		Existing-Banks		New-Banks	
	Ln Total Borrowing	Ln Total Borrowing	Ln Total Borrowing	Ln Total Borrowing	Ln Total Borrowing	Ln Total Borrowing
Borrowing Share*Post	1.13***	0.36***	0.19	0.09	0.81***	0.07*
	(0.39)	(0.13)	(0.13)	(0.09)	(0.06)	(0.03)
Borrowing Share	-0.50	-0.39**	-0.70	-0.47**		
	(0.47)	(0.14)	(0.46)	(0.18)		
Borrowing Share*Small Firms*Post		0.08		-0.03		0.31***
		(0.17)		(0.13)		(0.06)
Borrowing Share*Small Firms		0.27		0.35*		
		(0.19)		(0.19)		
Small Firms*Post		0.14*		0.12**		-2.03***
		(0.08)		(0.05)		(0.03)
Small Firms		-2.20***		-2.11***		
		(0.08)		(0.05)		
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Dependent-mean	18.34	18.34	18.69	18.69	18.17	18.17
Dependent-sd	1.31	1.31	1.23	1.23	1.28	1.28
AdjR-squared	0.03	0.64	0.05	0.63	0.04	0.63
Observations	115048	115048	47629	47629	44452	44452

This table presents coefficient estimates of total borrowing specifications at the loan-level. The outcome variable is the natural logarithm of total borrowing from all available lenders. The borrowing share variable measures the dependency of a firm in borrowing from stress-tested banks before the test. The stress-tested banks are the ones with at least $100 billion assets in the last quarter of 2008. The post is an indicator variable with a value of one for the last quarter of 2008 and after, and zero otherwise. The small asset firms are the ones with assets below the median in each quarter. The sample periods are from the first quarter of 2005 to the last quarter of 2013. The regressions include bank, and year-quarter fixed effects. Standard errors in parentheses are clustered at the bank-level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

TABLE 16:
Firm Financial Outcomes

	Ln-Assets		Ln-Sales		Ln-Fixed-Assets		Ln-Capital-Exp.	
Treated Firms*Borrowing-Share*Post	-0.26***	0.01	-0.22***	-0.03	-0.22***	0.01	-0.28***	0.01
	(0.05)	(0.06)	(0.06)	(0.06)	(0.04)	(0.06)	(0.06)	(0.08)
Borrowing-Share	-0.32**	-0.68**	-0.23**	-0.52*	-0.37***	-0.68**	-0.38***	-0.70**
	(0.12)	(0.27)	(0.10)	(0.26)	(0.12)	(0.27)	(0.11)	(0.28)
Treated Firms*Borrowing-Share*Small Firms*Post		-0.12**		-0.04		-0.12**		-0.15*
		(0.06)		(0.05)		(0.06)		(0.07)
Borrowing-Share*Small Firms		0.69**		0.58**		0.69**		0.65**
		(0.27)		(0.28)		(0.27)		(0.29)
Small Firms		-1.08***		-0.96***		-1.08***		-1.06***
		(0.07)		(0.07)		(0.07)		(0.07)
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Level Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Cluster Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dependent-mean	3.61	3.61	2.89	2.89	2.95	3.61	1.80	1.80
Dependent-sd	0.73	0.73	0.69	0.69	0.93	0.73	0.91	0.91
AdjR-squared	0.32	0.65	0.26	0.55	0.56	0.65	0.45	0.65
Observations	30944	30944	30913	30913	30905	30944	30873	30873

This table presents coefficient estimates of firm financial specifications at the firm-level. The outcome variable is the natural logarithm of total asset, sales, fixed assets and capital expenditures. The borrowing share variable measures the dependency of a firm in borrowing from stress-tested banks before the test. Stress-tested banks are the ones with at least $100 billion assets in the last quarter of 2008. The treated firms have a borrowing share above the median, so highly dependent on borrowing from stress-tested banks before the test. The post is an indicator variable with a value of one for the last quarter of 2008 and after, and zero otherwise. The small asset firms are the ones with assets below the median in each quarter. The sample periods are from the first quarter of 2005 to the last quarter of 2013. The regressions include firm controls, bank, year-quarter, and firm-cluster fixed effects. Standard errors in parentheses are clustered at the bank-level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

TABLE 17:
The Pre-Treatment Median Test of Firms in the Earlier Rounds of Stress Tests

	Medians-Unmatched Sample			Medians-Matched Sample	
	Control	Treated	Difference	Control	Difference
Ln Total Assets	3.37	3.41	-0.05**	3.39	-0.02
Tangibility	23.79	26.03	-2.24***	24.52	-1.50
Net Worth	34.60	36.20	-1.61	35.93	-0.27
EBITDA/Total Assets	3.18	3.44	-0.25***	3.29	-0.14
Leverage Ratio	59.99	56.32	3.68***	57.34	1.03
Cash Flow/Total Assets	3.92	4.69	-0.77***	4.37	-0.33

This table summarizes the median chi-squared test of firm variables to show the difference between a firm with a higher dependency on borrowing from stress-tested banks and firms with less dependence on stress-tested banks before and after the nearest neighborhood matching process. Treated firms are the ones with a borrowing share above the median and control firms are the ones with a borrowing share below the median. To find the best match, I use the median of main firm characteristics during a one year period before the test announcement between the third quarter of 2006 to the second quarter of 2007.

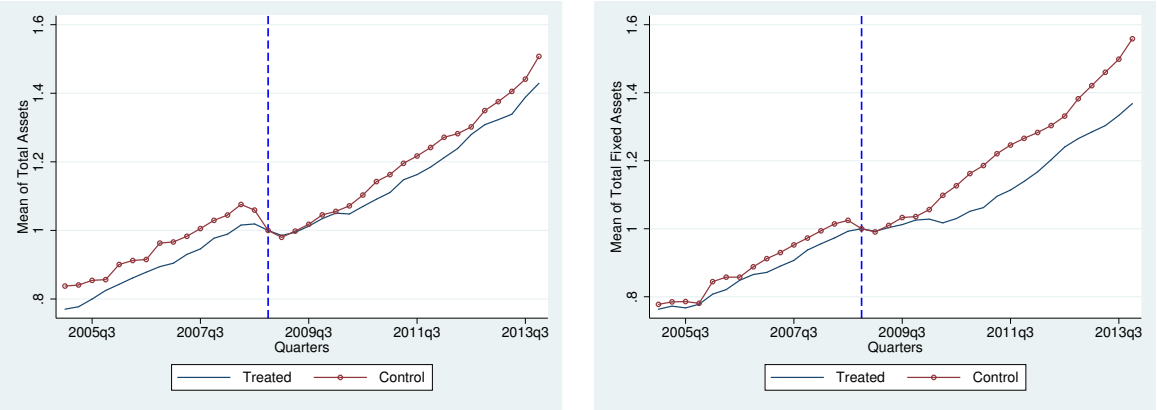

FIGURE 3: **The Trend of Firm Financial Outcomes**
This figure compares the general trend in total assets and fixed assets between treated firms and matched control group for the periods from the first quarter of 2005 to the last quarter of 2013. The treated firms are the ones with higher dependency on borrowing from stress-tested bank before the test. The y-axis is normalized to the last quarter of 2008. The announcement time of stress tests is in the last quarter of 2008, as shown by a dashed vertical line.