Stress Tests and Small Business Lending

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Abstract

Post-crisis stress tests have altered banks' credit supply to small business. Banks most affected reduce credit supply and raise interest rates on small business loans. These banks price the implied increase in capital requirements from stress tests where they have local knowledge, and exit where they do not: quantities fall most in markets where stress-tested banks do not own branches, and prices rise mainly where they do. These supply reductions are concentrated among risky borrowers. Stress tests do not, however, reduce aggregate credit. Small banks seem to increase their share in geographies formerly reliant on stress-tested lenders.

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I. Introduction

Credit to all classes of borrowers grew sharply during the run-up to the Great Recession, including loans to large and small businesses. During the early years of the 2007 crisis, bank originations of business loans fell by as much as 40% (Figures 1 and 2). Lending to large businesses has bounced back since the Great Recession: In 2016, total real C&I loans on bank balance sheets were more than 50% *higher* than in 2007. The recovery of small business lending, however, continues to be slow: In 2016, small business loans on bank balance sheets remained *lower* than in 2007 (Figure 2). What explains the slow recovery in small business lending? One of the most prominent explanations has been increased regulation, including stress testing.[1] The extant literature suggests that banks facing regulatory capital constraints cut their lending supply, and stress tests create a direct link from bank lending risk to capital.[2]

This paper provides new evidence that stress tests conducted by the Federal Reserve lead to a decrease in affected banks' small business credit supply. Banks more affected by stress tests price the implied increase in capital requirements into loan rates in markets where they have local knowledge, and exit markets where they do not. These effects are concentrated among risky borrowers. Despite this supply reduction by stress-tested banks, we find no evidence of aggregate declines in small business loan originations due to stress tests. The small(er) non-stress tested banks seem to fill in the gap and claim larger market share in geographies formerly reliant

[1] The Clearinghouse Association, an advocate for banks, points specifically to the stress tests as imposing unduly harsh (implicit) capital requirements on small business loans and on residential mortgages (Clearinghouse, 2017 and Covas, 2017).

[2] A large academic literature on bank "capital crunches" documents that shocks to bank equity capital have large contractionary effects on the supply of lending (Bernanke, 1983; Bernanke and Lown, 1991; Kashyap and Stein, 1995, 2000; Houston, James, and Marcus, 1997; Peek and Rosengren, 1997, 2000; Campello, 2002; Calomiris and Mason, 2003; Calomiris and Wilson, 2004; Cetorelli and Goldberg, 2012).

on stress-tested lenders. Overall, our evidence does not support the notion that stress tests contributed to slower recovery of small business lending.

Stress tests provide a comprehensive measure of how much a bank holding company (BHC) might lose during a hypothetical severe economic downturn, which then gets translated into a forecast of regulatory capital ratios conditional on various stress scenarios. Large projected capital declines are likely to incentivize banks owned by such BHCs to reduce their current loan portfolio risks or to improve their capital ratios (e.g., by reducing planned dividend distributions and/or share repurchases). Non-stress-tested banks do not face such pressures, but they also differ from stress-tested banks in many other ways. In our analysis, we therefore focus on banks owned by the 32 stress-tested BHCs, utilizing the publicly available data on the stress-testing results in 2012 through 2016.

We build '*Stress-test Distance*' measures, which capture how far stressed capital ratios remain above regulatory minimums. BHCs closer to binding capital requirements—those with lower *Stress-test Distance*—have incentives to rebalance loan supply away from risky loans and to raise interest rates. But these supply responses likely depend on market structure. Banking theory emphasizes the importance of relationship lending which relies on 'soft' information not easily transferred to other lenders. Relationships require frequent contact and close proximity between banks and firms. Hence, firms borrowing from nearby banks would be less able to switch to alternative lenders.[3] Local banks can thus raise interest rates to compensate for the greater capital burden implicit in stress tests. In contrast, small business loans that are more like

[3] See, e.g., Rajan, 1992; Petersen and Rajan, 1994; Degryse and Ongena, 2005; and Berger et al, 2005; Agarwal and Hauswald, 2010; Gilje, 2017.

commodities – loans made by banks at a distance – would tend to lead to reductions in loan quantities, since attempts by banks to raise rates on such loans would lead borrowers to switch.

To test these ideas, we first evaluate whether banks respond to stress tests by rebalancing away from risky loans. We analyze the small business loan originations data collected under the *Community Reinvestment Act* (CRA). These data capture growth in small business lending at the bank-county-year level. The granularity of the data allows us to absorb potential demand-side confounds with county-time fixed effects. To capture the risk of local small business markets, we introduce a new county-level measure of risk based on the sensitivity of local employment growth to overall national employment (similar to CAPM portfolio betas). Using this market risk measure, we document that banks more affected by the stress tests reduce the quantity of lending to small businesses in riskier markets (counties) relative to safer markets. The results are economically significant. A one standard deviation decrease in *Stress-test Distance*, for example, leads riskier markets (those in top quartile of the employment beta distribution) to experience 2.5% greater declines in small business loan originations than safer ones. Moreover, these declines in quantities occur only in markets where banks *do not* have branches, and thus lack the informational advantage to assess and price risks (compensation for the capital burden of the stress tests) without inducing their borrowers to switch banks (e.g., Agarwal and Hauswald, 2010).

We then investigate the effect of stress tests on loan interest rates using the *Survey of Terms of Business Lending* (STBL) data, which covers a sample of randomly selected banks' lending to businesses. These data provide loan-level price and non-price terms on all new loans originated by each bank in the survey during one business week each quarter. In contrast to the CRA data, which reflect a bank's *total* new lending within each county, the STBL offers loan-

level data on a subset of individual loans originated by banks owned by 26 out of 32 stress-tested BHCs in our sample. It provides detailed data on loan conditions such as the interest rate, the commitment amount, maturity, collateral, etc. More importantly, it offers a direct measure of loan risk on a 1-4 scale, which we exploit in our tests.

Using the STBL data, we document that banks more affected by the stress tests charge higher interest rates on their loans to small businesses, consistent with an inward shift in credit supply from the stress tests. The effect is quantitatively important. A one-standard-deviation decrease in *Stress-test Distance* leads to about a 32 basis-point increase in the interest rate charged on small business loans, which is large relative to the overall variation in loan interest rates (127 basis points). Non-price terms also tighten as *Stress-test Distance* declines. A one-standard-deviation decrease in *Stress-test Distance* leads to a decline in loan maturity of about 13%.

Consistent with banking theory, the effect on interest rates is stronger in areas where banks have a local branch presence and hence plausibly have an informational advantage vis-à-vis other potential lenders. A one-standard-deviation decrease in a bank's *Stress-test Distance* leads to about a 36 basis-point increase in interest rates in local markets (those where banks have branches) but just a 10 basis-point increase in non-local markets. These effects are strongest among risky loans. For low risk loans, we find no effect of *Stress-test Distance* on pricing. In the two highest loan risk categories, lower *Stress-test Distance* translates into higher interest rates. The effect is largest for risky loans originated within banks' branch domains. Among these local but risky loans, a one-standard-deviation decrease in a bank's *Stress-test Distance* leads to an increase in loan interest rates of about 50 basis points. Consistent with these pricing patterns, the share of loans originated to safe borrowers also increases with exposure to the stress tests

(i.e., decreases with *Stress-test Distance)*. But this shift toward safe loans happens *only* in non-local markets, most likely because banks cannot raise prices due to the lack of strong relationships with borrowers in these areas.

Do the supply reductions at the individual bank-level contribute to the aggregate decline in small business lending (Figure 2)? Despite reduced supply by some stress-tested lenders, we find *no evidence* that overall credit origination at the market level declines due to stress tests. County-level small business lending growth is not lower in markets (counties) with more stress-test-affected lenders. Instead, we show that small banks grow their small business market share in localities formerly reliant on stress-tested lenders. The results suggest that stress tests lead to reallocation of the small business credit supply away from the large stress-tested banks and toward more local sources of credit.[4]

This paper contributes to a few strands of literature. First, we add to the literature that links the stress tests to a decline in large banks' willingness to supply credit following the 2007 financial crisis and the Great Recession. Acharya, Berger and Roman (2017) document that stress-tested banks reduce large corporate loan supply and increase prices particularly for riskier borrowers, while Bassett and Berrospide (2017) do not find any negative impact of stress tests on bank loan growth in general. Chen et al. (2017) show a sharp decline in small business lending by four largest banks that has hurt local economies. They attribute this decline to multiple forces including stress tests. We add to this literature by documenting the adverse effect of banks' stress-test exposure on their willingness to supply small business credit, and go one step further by showing that this stress-test-induced reduction in small business supply does not lead to an

[4] Berger et al. (1998) document similar substitution effect. The paper finds that a 1990s wave of bank mergers led to a reduction in small business credit supply by merging banks. However, small banks that remained independent compensated for this supply reduction.

aggregate decline in loan originations. Small banks fill in the gap and increase their market share increases in markets formerly reliant on stress-tested lenders.

Second, our results emphasize the importance of bank market structure in mediating the supply responses to banks' stress tests. Loan quantities formerly supplied by large banks lending outside their branch domains decline most, but these reductions are absorbed by local, small banks. Existing research suggests that small businesses have better access to credit if their local market contains more small banks and that this effect has gotten more important in the post-crisis period (e.g., Berger et al., 2017). Yet the banking industry continues to evolve toward one dominated by large banks and by banks relying heavily on non-traditional funding sources like securitization. Not surprisingly, the share of bank assets in the largest banks has grown steadily over time, as has their share of small business loans. Our results suggest that the stress tests have had the effect of pushing back against this overall trend in the banking system, as more small business loans are now provided by small, local banks.

II. The Stress Tests

The 2008 Financial Crisis led to dramatic changes in regulation and supervision of financial institutions, many of which came out of the Dodd-Frank Act (DFA). DFA requires the Federal Reserve to conduct annual stress tests of a select group of large bank holding companies (BHCs) and non-bank financial institutions designated for stress-testing by the Financial Stability Oversight Council (FSOC). Prior to passage of DFA in 2010, the 2009 Supervisory Capital Assessment Program (SCAP) represented the first stress testing effort. The SCAP aimed to ensure that banks had sufficient capital coming out of the crisis to absorb losses under poor economic conditions and continue supplying credit to the economy, thereby short-circuiting a negative feedback loop between real shocks and financial shocks.

Under SCAP, the Federal Reserve assessed the level of regulatory capital for the 19 largest bank holding companies (BHCs) under three potential paths of the economy. Nine BHCs 'passed' SCAP stress tests and continued operating without needing to raise new equity capital. Of the remaining ones, all but one succeeded in raising sufficient capital in private markets to meet their required capital ratio. The remaining institution came into government conservatorship and was later privatized. SCAP induced rapid re-capitalization and was widely seen as a successful turnaround of bank financial conditions coming out of the crisis.

Following the success of SCAP, the Federal Reserve continued to implement supervisory stress tests, renamed as the Comprehensive Capital Analysis and Review (CCAR). CCAR called for annual tests of whether large BHCs have sufficient capital to absorb a substantial economic and financial downturn, yet continue to be able to provide credit. CCAR began in 2011 with the same set of large BHCs as the SCAP, those with total assets in excess of $100 billion. In 2012, however, the Federal Reserve expanded the set to the 32 BHCs with assets above $50 billion. Starting in 2013, the Federal Reserve began implementing dual stress tests: one based on the Supervisory CCAR process, and the other based on compliance with the Dodd-Frank Act (DFAST). The key difference is that under CCAR, each BHC's *proposed* capital distribution plan is incorporated into the stress test; under DFAST, the assumed capital distribution is held at its current level. The tests are disclosed in March of each year.[5] In 2016 the report date for the stress test disclosure was moved to late June.

The stress tests forecast three possible scenarios for each BHC's regulatory capital ratios nine-quarters into the future ('baseline', 'adverse' and 'severely adverse'). The scenarios

[5] In 2014, the stress test process was expanded to banks with total assets between $10 and $50 billion through the Dodd Frank Act Stress tests. However, stress tests of banks with assets between $10 billion and $50 billion are not disclosed before 2016. Only the results from the CCAR BHCs are disclosed each year; hence, banks owned by CCAR-BHCs constitute our sample.

capture possible paths for aggregate economic variables. The 2017 Federal Reserve *Supervisory Scenarios for Annual Stress Tests Requirements under the Dodd-Frank Act Stress Testing Rules and the Capital Plan Rules* require modelling "six measures of economic activity and prices: percent changes (at an annual rate) in real and nominal gross domestic product (GDP); the unemployment rate of the civilian non-institutional population aged 16 years and over; percent changes (at an annual rate) in real and nominal disposable personal income; and the percent change (at an annual rate) in the Consumer Price Index."[6] Thus, the scenarios focus on aggregate rather than idiosyncratic risks of banks. This approach helps minimize the macro-prudential risk of banks becoming capital constrained collectively during broad economic downturns. The Federal Reserve also develops a model to map the effects of the hypothetical economic and financial variables on each BHC's capital ratio over the forecast.

Alongside the scenarios and models provided by the Federal Reserve, the stress testing also requires data on individual BHC positions and exposures to various risk factors. Thus, the results of the stress tests reflect common scenarios and a common model (i.e., the one developed by the Federal Reserve), but they reflect differences in asset composition. The results are closely watched, not only by regulators, but also by bank managers, analysts, and investors, as they might lead to forced reductions in a BHC's planned capital distributions, as well as other operating changes if the simulated decline in capital is sufficiently large. In addition, stress tests have been widely adopted by regulatory authorities outside the U.S., such as the Bank of England and the European Central Bank.

Despite its widespread use, there is considerable debate about the efficacy of stress tests. Frame et al. (2015) question the utility of stress tests by analyzing pre-crisis stress tests

[6] See https://www.federalreserve.gov/newsevents/pressreleases/files/bcreg20170203a5.pdf.

done by the regulator of Fannie Mae and Freddie Mac. Goldstein and Leitner (2017) theoretically analyze the tradeoffs faced by regulators regarding disclosure of stress test results.[7] Schuermann (2016) discusses the efficacy of such policies during good and bad times. Hirtle et al. (2009) argue, however, that stress tests are a key tool in banking supervision.

Measuring the Effect of Stress Tests

We use three approaches to measure the effect of stress tests. From 2012 to 2016, the Federal Reserve disclosed the minimum Tier 1 Capital ratio, Total risk-based Capital ratio, and Tier 1 Leverage ratio over the forward-looking nine-quarter planning horizon for each BHC in each annual test cycle.[8] These disclosed minimum ratios, which we call the 'stressed capital ratios', provide the building blocks for each variable. The first two variables represent the distance between the stressed capital ratios and their respective regulatory thresholds (6% for the Tier 1 ratio; 8% for the Total Risk-based Capital ratio; and, 4% for the Leverage ratio). Our first (preferred) measure captures all three capital ratios, as follows:

Minimum Stress-test Distance = Min (Stressed Tier 1 Capital – 6%, Stressed Total Risk-based Capital – 8%, Stressed Leverage Ratio – 4%)

This approach incorporates all three capital ratios into a single metric by using the one closest to binding for each BHC in each stress test cycle. Capturing all three stressed capital ratios into one measure appeals, because the ratio that is closest to binding varies substantially

[7] For empirical evidence on the markets' reaction to stress-test disclosures, see Flannery et al.,(2016); Peristiani et al. (2010); Petrella and Resti (2013); Candelon and Sy (2015); Bird et al. (2015); and Fernandes, Igan and Pinheiro (2015).

[8] Our data for 2012 are taken from the Fed's CCAR disclosure, but we use the series of results which do not include the bank's capital plan. Data from 2013-2016 are taken from the disclosure under the Dodd-Frank Act. In other words, our sample includes only the CCAR banks, but the measure of exposure is the one used for compliance with Dodd Frank, which does not incorporate the bank's capital distribution plan. Several other regulatory capital ratios are used in some of the stress test cycles, but the three we use are the only ones available consistently across all cycles.

across BHCs and across cycles. In 42% of the BHC-years, for example, the Tier 1 ratio is closest to the regulatory minimum; 26% of the time, the Total Risk-Based capital is closest to binding; and, in 64%, the leverage ratio is most likely to bind. (These add up to more than 100% due to ties.)

The second distance measure (*Tier 1 Capital Distance*) equals the difference between the stressed Tier 1 Capital ratio and the regulatory minimum for that ratio (6%). The third measures the difference between a BHC's initial Tier 1 ratio from the stressed Tier 1 ratio under the test (*Tier 1 Stress Test Exposure*). This last measure captures the extent of losses without regard to the regulatory minimums; by construction, it relates negatively to the first two (since it decreases rather than increases in the stressed Tier 1 ratio). To maintain consistent interpretation, we reverse the sign of its coefficient in all of our regression results. In other words, decreases in each variable always represent an increase in the impact of the test. When we refer to the variables collectively, we use the term '*Stress Test Distance'*.

Our measures reflect only stressed changes in the value of BHC portfolios, *not* the effect of the capital distribution plan, as this variation would not be directly affected by lending decisions. BHCs whose specific portfolios have the greatest downside risk under the test will be closest to the regulatory minimum; hence they will have the smallest value of *Stress-test Distance.* Banks owned by these BHCs likely face pressure from the regulators, either to reduce risk or improve their current capital ratios (e.g., by reducing planned dividend distributions and/or share repurchases). The measure is unlikely to be endogenous to banks' small business lending as it is driven by a BHC's entire loan portfolio of which small business constitute only a very small fraction. For example, among those with assets over $50 billion, small business loans

outstanding average less than 5% of total assets (less than 3.5% since 2011). Hence, there is little possibility of reverse causality.

Panel A of Table 1 reports the summary statistics. *Tier 1 Capital Distance* equals 2.8 percentage points at the median, while the *Minimum Stress-test Distance* equals 2.7 percentage points. These capture how close the typical stressed capital ratio comes to binding. *Tier 1 Stress-Test Exposure* averages 2.9 percentage points. Each varies substantially across BHCs as well, with a standard deviation of 1.3-1.8 percentage points. Most of the distances are positive, although in a few cases the measure becomes negative, which implies that a stressed capital ratio falls below its regulatory minimum. Figure 3 plots the distribution of *Minimum Stress-test Distance* year by year in a box plot. The figure shows that most of the variation reflects the cross section; in contrast, the distribution exhibits little time-series variation. There is slightly less cross sectional variation in the last cycle in our sample (2016), but overall there does not appear to be a strong trend in either the level or variation in outcomes across banking companies.

III. Empirical Tests and Results

In this section, we describe our empirical strategy, followed by the presentation and interpretation of results. To alleviate the identification problem stemming from stress-tested BHCs (and their subsidiary banks) being different from non-stress-tested ones in many ways that extend beyond the stress tests, we abstain from comparing lending of stress-tested and inherently different non-stress-tested lenders. Rather, we focus solely on the group of banks owned by the 32 stress-tested BHCs. We start by evaluating the effects of stress tests on small business loan quantities, followed by the analysis of the effect on loan pricing.

III.A. Stress Tests and Small Business Loan Quantities

To capture the response of small business loan quantities to *Stress-test Distance*, we exploit CRA loan originations data from 2012-2015, collected by the Federal Financial Institutions Examination Council at the subsidiary bank level.[10] CRA focuses on loans with commitment amounts below $1 million originated by financial institutions with more than $1 billion in assets. Under CRA, the banks report small business loans at a granular, community (county) level. Consequently, CRA data provide us with a complete record of new lending quantities by subsidiary banks of the stress-tested BHCs at the county-year level.

We use CRA to build the annual growth rate of new loan originations under $1 million, which we interpret as loans to small businesses. The purpose of the CRA is to "encourage ensured depository institutions to help meet the credit needs of the communities where they are chartered." The resulting sample covers banks owned by 28 out of 32 stress-tested entities, since some of the stress-tested institutions did not conduct any lending that fell under CRA guidelines.

To mitigate the effect of outliers (e.g., due to a small denominator) we normalize the year-to-year change in lending volume by the mid-point of originations between the two years, as follows:

$$\text{Loan Growth}_{i,c,t} = \frac{\text{Loan Originations}_{i,c,t} - \text{Loan Originations}_{i,c,t-1}}{(\text{Loan Originations}_{i,c,t} + \text{Loan Originations}_{i,c,t-1})/2} \quad \textbf{(1)}$$

where i represents the bank, c represents county, and t represents year. With this definition, the variable is bounded above (+2) and below (-2). Furthermore, to eliminate noise stemming from counties with insignificant amounts of loans originated by a given bank, we restrict our sample to markets where a given bank made at least 5 loans in period $t-1$. Without this restriction, the

[10] See, e.g., Bord, Ivashina, and Taliaferro (2017) for a more comprehensive description of CRA data.

sample contains 130,671 bank-county-year observations. Our final regression sample covers 102,539 observations, which represents 78.8% of the original number of observations but represents 98.2% of the loan volume covered by the original sample.

We merge the annual CRA data to *Stress-test Distance* data based on the identity of a subsidiary bank parent BHC. Since the stress tests are published in March, we operate under the assumption that the majority of the effect from the stress tests on small business lending manifests within the next nine months of the year of the disclosure. In line with this assumption, we match, for example, CRA loan growth from December 2013 to December 2014 to the stress test results reported in March 2014. In 2016, the Federal Reserve started publishing the stress test results in June rather than March. Since CRA data is annual, post-June stress-test lending adjustments are unlikely to be properly captured by 2016 annual small business lending growth. Consequently, we limit the CRA data in our analysis to 2012-2015 sample period.

Panel B of Table 1 provides summary statistics of financial characteristics of the stress-tested BHCs. The sample covers a set of relatively large institutions, with average total assets of $260 billion. The traditional financial characteristics are in line with other studies exploring large banking organizations. Notably, while in aggregate the small business lending grew post 2008 (slowly but grew) as evident from Figure 1, the banks in our sample on average experience 8.3% annual decline in small-business-loan originations.

To evaluate the effect of stress tests on small business loans, we implement the following regression analysis:

$$\text{Loan Growth}_{i,c,t} = \beta_1 \textit{Stress-test Distance}_{h,t} + \text{BHC Controls}_{h,t-1} + \gamma_{c,t} + \varepsilon_{i,c,t}, \quad \textbf{(2)}$$

where we evaluate the annual growth in loan originations by subsidiary bank i of BHC h in county c in year t. The set of BHC controls includes log of total assets, C&I loans to assets, the

share of non-performing loans, the share of consumer loans, the share of mortgages, the share of trading assets, the return on assets, the share of deposits in total liabilities, and a bank's liquidity captured by the ratio of cash and marketable securities to assets. For our first two *Stress-test Distance* measures, we control for the BHC-level initial Tier 1 capital ratio; for our third measure (*Tier 1 Stress-Test Exposure*) we leave this control out, because including it yields results mechanically equivalent to those based on *Tier 1 Capital Distance* measure. All control variables are as of the beginning of the year to avoid reverse causality concerns. As discussed earlier, we use the *Stress-test Distance* variable in the same year *t* since the stress tests are conducted early in the year and, hence, affect bank-lending behavior through the rest of the CRA period. We cluster the standard errors by BHC-year, as this is the level of variation for our core variable of interest.

We expect that BHCs with stressed capital closer to regulatory minimums will reduce small business lending ($\beta_1 > 0$). We reduce the potential for credit demand to drive our results by incorporating high granularity county-year fixed effects ($\gamma_{c,t}$), which help capture local economic conditions ultimately affecting small business credit demand. Effectively, we compare banks operating in similar markets (and serving similar borrowers), but facing different *Stress-test Distance*.

One can argue, however, that the CRA loan growth response to stress tests might be subject to unobserved heterogeneity bias. For example, banks more inclined to take risks would both grow their loan portfolio faster and experience larger stress-induced declines in capital (i.e., lower *Stress-test Distance)*, thus biasing down the direct effect of *Stress-test Distance* on loan growth. To mitigate this concern, we focus on interactions between *Stress-test Distance* and risk, and between *Stress-test Distance* and access to soft information (proxied by branch proximity to

borrowers). If a bank attempts to reduce its loan-risk exposure due to stress tests, then we should observe steeper reductions in riskier markets. This reduction in quantity lent should be most pronounced in markets *without* branches, because banks would have little ability to raise loan interest rates and thus 'price in' the higher capital burden from stress test exposure in such markets.

Measuring Local Market Risk

Since CRA data do not provide information about individual borrower characteristics (e.g., borrower risk), we build an alternative risk measure. Specifically, we develop a new proxy that captures variation in risk at the county level, rather than at the borrower level. Using county employment data, we construct the '*Employment Beta.*' Similar to a stock Beta, our proxy captures the sensitivity of a county's employment growth to changes in national employment growth. We first estimate time-invariant industry-level employment betas using aggregate industry-level and economy-level quarterly data on employment growth from 1992 through 2015. We then compute county-year-level *Employment Beta* as a weighted average of industry-level Betas, based on share of different industries in each local economy:

$$\text{Employment Beta}_{c,t} = \sum \omega_{c,j,t} \times \text{Employment Beta}_{j} \quad \textbf{(3)}$$

where $Employment\ Beta_j$ is the time-invariant estimate of industry j's *Employment Beta* and $\omega_{c,j,t}$ is the share of jobs provided by industry j in county c at time t. Intuitively, the county employment beta is an industry portfolio beta of a given county at a given point of time. This measure meshes well with the intent of the stress test scenarios, which typically contemplate bad outcomes for economic and financial aggregates such as U.S. GDP growth and changes in the overall unemployment rate. Hence, counties whose economies move in lock-step with the overall economy will have greater effects on the results of stress tests.

Appendix Table A1 reports the industry-level betas used as the building blocks in Equation (3). The patterns appear economically sensible. Most of the sectors have positive betas, meaning that employment in the industry varies pro-cyclically. The major exceptions are Education and Government, which exhibit much faster employment growth during economic downturns. Among the pro-cyclical industries, those such as Construction and Entertainment have betas well above one, as employment in these sectors grows sharply in booms (and vice versa in busts). To mitigate the effect of outliers, we winsorize the industry-level Betas before constructing the county weighted averages. Overall these county-level employment Betas mesh well with the intent of the stress test scenarios, which typically contemplate bad outcomes for economic and financial aggregates such as U.S. GDP growth and changes in the overall unemployment rate. Hence, counties whose economies move in lock-step with the overall economy will have greater effects on the results of stress tests.

Loan Quantities and Market Risk

Armed with a granular measure of local economic risk, we evaluate the response of small business lending volumes to *Stress-test Distance* using the following model:

$$\text{Loan Growth}_{i,c,t} =$$

$$= \beta_1 Stress\text{-}test\ Distance_{h,t} + \beta_2 Stress\text{-}test\ Distance_{h,t} \times Emp.Beta_{c,t-1} +$$

$$+ \text{BHC Controls}_{h,t-1} + County \times Year\ FEs + \varepsilon_{i,c,t} \quad \textbf{(4)}$$

Table 2 reports the results. Columns (1), (4) & (7) report the results from simple models without the interaction term, and the other columns report the results with the interaction with *Employment Beta*. The coefficient β_1 enters negatively (with weak statistical significance in some cases), potentially reflecting the downward bias discussed earlier. The coefficient β_2 is consistently positive and statistically significant, irrespective of our measure of *Stress-test*

Distance. The results suggest the banks whose BHCs have stressed capital close to regulatory minimums reduce small business lending more in risky local markets than in safer ones.

In columns (3), (6) & (9) of Table 2, we absorb all sources of bank-level heterogeneity by introducing bank-year fixed effects. In this setting, the direct effect of the *Stress-test Distance* is fully absorbed, as are the effects of the BHC control variables. This approach is appealing in this setting because, although we lose identification of β_1, we can still identify the interaction term (β_2) while absorbing all possible confounding effects at the bank-year level. The results continue to suggest that banks more exposed to stress-tests are more likely to exit risky markets. Despite large increases in R^2 stemming from adding the bank-year fixed effect, the interaction term coefficients retain their economic magnitude and statistical significance. The estimate reported in column (1), based on the minimum distance to the constraint, suggests that in response to a one standard deviation decrease in *Stress-test Distance* in Tier 1 capital (-1.4%), markets in top quartile of the employment beta distribution (beta = 1.36) would see 2.5% greater decline in small business loan originations than those in the bottom beta quartile (beta = 0.96).[11]

Loan Quantities in Local Markets

In Table 3, we augment this analysis to evaluate whether we would observe a differential effect of stress-testing on lending quantities in markets where banks have an informational advantage through a branch presence. Panel A reports the results where the data are confined to counties where subsidiary banks have at least one branch. Panel B evaluates the small business lending sensitivity to *Stress-test Distance* in counties where subsidiary banks do not have branches. We find that the effect of *Stress-test Distance* on loan quantities is

[11] The calculation equals the interaction term's coefficient multiplied by (1.4*(1.36-0.96)).

pronounced in non-local markets, yet virtually non-existent (statistically and economically) in markets where banks have branches.

The evidence provided in Tables 2 and 3 offers a direct link between declines in small business loan originations and *Stress-test Distance*. The effect on quantities of loans supplied is more pronounced in riskier markets and in markets where banks lack local knowledge (due to the absence of a branch presence).[12]

III.B. The Effect of Stress Tests on Small Business Loan Interest Rates

While the previous section evaluates the effect of *Stress-test Distance* on small business loan quantities, this section offers complementary analysis of loan prices (interest rates) based on the confidential Q2-2012 to Q2-2017 *Survey of Terms of Business Lending* (STBL) data.

The STBL Data

The Federal Reserve has instituted the STBL to obtain timely information on the business-lending environment in the U.S. The STBL collects data on loans originated by a random sample of banks during a full business week every three months (February, May, August and November). The selection of banks is conducted in a way that creates a representative sample of C&I loans. Consequently, the large banks are more likely to be surveyed. The STBL data covers banks owned by 26 out of 32 stress-tested BHCs.

The STBL data provides detailed loan characteristics including loan size, the nominal interest rate, maturity, whether or not the loan comes with a pre-payment penalty, collateral

[12] One might argue that the relationship between stress-test exposure and CRA lending could be spuriously driven by banks' M&A incentives. Banks with lower *Stress-test Distance* might be less likely to pursue M&A and as such might have weaker incentives to originate CRA loans. This alternative hypothesis, however, cannot explain why the reduction in lending is observable only in *non-local* markets rather than in *local* markets, since these are the market where banks undergo their CRA assessments.

status, the state of the borrower, etc. In addition to these characteristics, the STBL reports the lender's internal risk rating for each loan. The rating ranges from 1 to 4, with 1 representing loans with the lowest risk level and 4 representing those with the highest risk. While the risk ratings are reported by the banks independently, the Federal Reserve provides instructions on how to make the ratings consistent across institutions. Capturing loan risk helps alleviate alternative explanations stemming from bank risk preferences (discussed earlier). Given our focus on small business credit supply, we consider only originations with commitment amounts under $1 million. We exclude from consideration distressed loans (risk rating = 5) that do not reflect new originations. Furthermore, since controlling for risk is an important factor in our identification strategy we exclude from consideration the unrated loans (risk rating = 0).

We map these quarterly STBL data to the annual BHC-level *Stress-test Distance* on a rolling basis, based on the identity of a bank's parent BHC. Since we want *Stress-test Distance* to be pre-determined with respect to our outcomes, we map each stress-test result into the next four STBL quarterly surveys. So, for example, we map the March 2013 values of *Stress-test Distances* into STBL data from May 2013, August 2013, November 2013, and February 2014. Since 2016 stress-test results are reported in June, we map 2016 *Stress Test Distance* measures to STBL data from August 2016, November 2016, February 2017, and May 2017. We then merge STBL data with BHC financial characteristics by using Call Reports as of the last date available prior to STBL loan cohort date. For example, we merge the STBL survey taken in August of 2013 to the (last available prior to August) June 2013 Call Report data.

Panel C of Table 1 provides summary statistics for loan characteristics reported in the STBL data. An average (log of) loan size in our sample is about 11.1, with maturity of about 15 months and an interest rate of 3.4% (winsorized at the 1st and 99th percentiles). About one-third

of these loans are originated in the riskiest loan category (risk rating = 4). Consistent with relatively low interest rates, 89% of these loans are secured. Most of the loans are made by local banks, with 61% originated within a bank's branch domain (i.e., the bank has a branch in the state of the borrower).[14]

Evidence on Loan Pricing

We use the STBL data to evaluate the effect of *Stress-test Distance* on small business loan pricing. Our loan pricing regressions take the following form:

$$\text{Loan Interest Rate}_{l,i,s,t} = \beta_1 Stress\text{-}test\ Distance_{h,t-1} + \text{Loan Controls}_{l,i,s,t} + \quad \textbf{(5)}$$
$$+ \text{BHC Controls}_{h,t-1} + State \times Quarter\ FEs + \varepsilon_{l,i,s,t}$$

where the dependent variable equals the nominal interest rate on loan l originated by subsidiary bank i within BHC h to a borrower in state s at time t. The STBL does not contain a borrower identifier, which renders capturing borrower heterogeneity with fixed effects impossible. The state-quarter fixed effects help remove unobserved heterogeneity such as variation in loan demand due to (state-specific) business conditions.

On the loan side, we control for the (log of) loan size, and the bank's assessment of borrower risk, which varies from 1 to 4 (with 4 being the highest risk category). The ability to control for loan risk is crucial in this analysis as it helps eliminate alternative explanations stemming from bank risk preferences (discussed earlier). On the BHC side, we control for the time-varying size (*Log of Assets*), the *Initial Tier 1 Capital Ratio* (measured at the same time as the BHC's stressed Tier 1 Capital ratio), as well as an indicator variable set to one if the lending

[14]About 12% of the loans are syndicated, which means that the originating bank shares the loan risk with other lenders. Hence, in an additional robustness test (not reported), we have re-estimated all of our tests without these loans and find that they do not change materially.

bank has a branch in the borrower's state (*Local Lender*). In the model using *Tier 1 Stress-test Exposure,* which equals the Initial Tier 1 ratio minus its stressed value, we omit the *Initial Tier 1 Capital Ratio.* Our variable of interest changes only by BHC-year, consequently we cluster the standard errors at that level.

In some specifications, we augment the model with other (possibly endogenous) loan-level variables. These include the log of maturity, an indicator for loans secured by collateral, an indicator for loans that are syndicated, an indicator for floating rate loans, an indicator for loans guaranteed by the Small Business Administration (SBA), and an indicator for loans with pre-payment penalties.

Table 4 reports our first set of pricing results. In the baseline specifications (columns 1, 4 & 7), we only control for BHC size, the initial Tier 1 ratio, borrower risk rating, the local lender indicator, log of loan size, and year-quarter fixed effects. We intentionally do not control for other (possibly endogenous) non-price loan terms. In the second set of specifications, we saturate the model with state-quarter fixed effects (columns 2, 5, & 8). In the last set of specifications (columns 3, 6 & 9), we control for the non-price loan terms. By adding loan terms to the regressions, we lose about 1/3 of the sample.

The coefficient on *Stress-test Distance* is negative and significant across all specifications, with magnitudes ranging from –0.19 to –0.31. Magnitudes are not very sensitive to adding more granular fixed effects, but they increase in the models that control for other loan terms. Column (1) implies that a one standard deviation decrease in *Minimum Stress-test Distance* (= -1.4) would lead to an increase in the loan rate of 32 basis points (= -1.4 x -0.228 x 100). This effect increases to about 38 basis points in the models with full set of loan controls. The magnitude is similar using the other stress test measures.

The coefficients on the non-price terms are consistent with existing empirical studies of loan interest rates. Larger loans have lower interest rates and loans rated riskier by the lender carry higher interest rates, longer maturity loans have higher interest rates and loans secured by collateral have lower interest rates (see Berger and Udell,1990; and Strahan,1999). The safest loans (risk category 1) tend to have interest rates about 100 basis points lower than the interest rate on the riskiest loans (risk category 4). The coefficients on the *Local Lender* indicator variable suggest that interest rates on loans within subsidiary-bank branch domains are 33 to 52 basis points lower than interest rates on loans outside of the branch domain. The economic and statistical significance on the *Local Lender* indicator disappears, however, once we control for non-price loan-terms.

As noted, adding the non-price terms to our regressions increases the magnitudes of the coefficients on *Stress Test Distance*. This suggests that banks respond to the stress tests not only by raising loan interest rates, but also by simultaneously tightening other terms such as shorter maturity, more and/or better collateral, and more restrictive covenants. Data limitations prevent us from analyzing the full set of non-price terms, but Table 5 provides strong evidence of this conjecture using one that is easily measured, loan maturity. We find that banks with lower *Stress Test Distance* shorten (log) maturity.[16] The economic effect is substantial, as a one standard deviation decrease in *Stress Test Distance* reduces loan maturity by about 13% (column 1).

In analysis presented in Tables 4 and 5 we do not include bank (or BHC) fixed effects in the model because doing so would remove the vast majority of the relevant variation in the *Stress-test Distance*. We are explicitly getting identification from cross-sectional variation. In

[16] Our data contain a flag for whether or not the loan is secured by collateral but not details on the quality or quantity of the collateral. Since almost all of the loans have some kind of collateral, we are not able to explore this dimension in our regressions.

our view, this approach is the only reasonable one to take, but we recognize that leaving out bank fixed effects requires us to establish robustness to unobserved heterogeneity. To do so, Table 6 demonstrates that our coefficients of interest are not sensitive to including a large set of BHC characteristics (beyond size). Here we augment the set of control variables utilized in Table 4 to include the same set of BHC, time-varying financial characteristics included in Tables 2 and 3. That is, we include the following from *Call Reports* during the quarter before the outcome: log of total assets, C&I loans over assets, the share of non-performing loans, the share of consumer loans, the share of mortgages, the share of trading assets, the return on assets, the share of deposits in total liabilities, and a bank's liquidity captured by the ratio of cash and marketable securities to assets. We report the augmented model alongside the one reported earlier from Table 4, to ease comparison across models.

Controlling for the BHC financial characteristics has little effect on the statistical significance of our coefficients of interest. Magnitudes are somewhat smaller in two of the three cases, but this is not too surprising because controlling for so many portfolio characteristics tends to capture much of the variation built into the stress tests. In the extreme – with sufficient granularity and functional flexibility – adding controls would capture all of the variation in the stress tests outcomes, since these outcomes are just complicated nonlinear functions of BHC portfolios at the outset of the tests. Overall, the results suggest that in response to declines in *Stress-test Distance*, banks increase interest rates on small business loans.

Loan Pricing in Local Markets

Table 7 advances the analysis by evaluating whether local presence and the associated local informational advantage affects the pricing response to *Stress-test Distance*. Here we add the interaction between *Local Lender* and *Stress-test Distance* to our core models*:*

$$Loan\ Interest\ Rate_{l,i,s,t} = \quad \textbf{(6)}$$

$$= \beta_1 Stress\text{-}test\ Distance_{h,t-1} + \beta_2 Stress\text{-}test\ Distance_{h,t-1} \times Local\ Bank_{i,s,t}$$

$$+ Loan\ Controls_{l,i,s,t} + BHC\ Controls_{h,t-1} + State \times Quarter\ FEs + \varepsilon_{l,i,s,t}$$

where $Local\ Bank_{i,s,t}$ is an indicator variable equal to one when bank i of BHC h has a branch in state s.

The results suggest that stress tests affect loan pricing more where banks have a local branch presence. We report the baseline models with just fixed effects, *Log of Assets* and *Initial Tier 1 capital*; we then add the additional loan controls; and, last, we add the additional BHC characteristics. In markets with branches, a decrease in *Stress-test Distance* of one standard deviation leads to an increase in loan interest rates of about 36 basis points (= –1.4 x (–0.069 – 0.191) x 100), using the coefficients from column (1). In contrast, interest rates increase by only about 10 basis points where banks do not have branches (= –1.4 x – 0.069). Similar patterns emerge using *Stress-test Distance* from the other capital metric. The results are consistent with the notion that banks with local knowledge are more able to increase prices without borrowers switching (due to their informational advantage).

Loan Interest Rates and Borrower Risk

To capture heterogeneity in pricing responses based on the riskiness of a borrower, Table 8 reports estimates of Equation (6) for three sub-samples broken out by borrower risk. We have omitted the intermediate set of control variables to save space in the table. Panel A reports the regression results for safe loans, those rated 1 or 2. We combine these two categories because the frequency of loans in the safest category is low (around 3% of the sample). Panel B reports results for medium-risk loans, those rated 3. Panel C reports results for highest risk loans, those rated 4.

Prices of low-risk loans (Panel A) do not change reliably with a bank's *Stress-test Distance.* Interest rates of medium-risk (rated 3) and high-risk loans (rated 4), however, *do* increase robustly with decreases in a bank's *Stress-test Distance.* The effect on rates in these two categories is also larger in areas where banks have a local branch presence. Moreover, the marginal effect of *Stress-test Distance* on loan rates is greatest for the high-risk loans in local markets. For example, a decrease in *Stress-test Distance* of one standard deviation would lead to an increase in the loan rate of about 50 basis points (= –1.4 x (–0.176 – 0.180) x 100) for high-risk local loans (Panel C, column 1); a similar decrease in *Stress-test Distance* would lead to an increase in the loan rate of about 40 basis points for medium-risk local loans (Panel B, column 1). *Stress-test Distance* affects rates most among high-risk borrowers in markets where banks have an informational advantage.

Overall, banks more affected by stress tests increase rates on risky, local loans. In contrast, rates on low-risk loans do not change. These findings are consistent with CRA-based evidence that quantities stress-test induced shift *away* from riskier non-local markets towards local markets where banks have informational advantage.

Loan Portfolio Risk

In this section we evaluate the risk profile of bank loans originations by market type (local vs. non-local). We model the relative quantities of STBL loans in different risk categories as a function of the *Stress-Test Distance* by constructing *Risky Share*, defined as the share of loans in the STBL originated in the riskiest category (risk rating = 4) at the bank-state level. If the observed interest rate increases really come from a supply shift, as we have argued, then we ought to observe *Risky Share* increase with *Stress-test Distance* because lenders further away from their regulatory minimums ought to supply more risky loans. If banks are unable to price

risks in non-local markets where they do not have information, as we have also argued, then this shift ought to be larger in non-local markets than in local ones.

To empirically investigate this idea, we estimate the following regression:

$$Risky\ Share_{i,s,t} = \beta_1 Stress\text{-}\ test\ Distance_{h,t-1} + \beta_2 Stress\text{-}test\ Distance_{h,t-1} \times Local_{i,s,t}$$
$$+\text{Avg Loan Size}_{i,s,t} + \text{BHC Controls}_{c,t-1} + State \times Quater\ FEs + \varepsilon_{i,s,t} \quad \textbf{(7)}$$

where $Risky\ Share_{i,s,t}$ is the volume share of loans in the highest loan risk category originated by bank i in state s in quarter t. Since these regressions are implemented at the bank-state level, we control for averages loan size across loans made in each bank-state group for each survey date. As before, standard errors are clustered at BHC-year level.

Table 9 reports the results with just fixed effects, *Log of Assets* and *Initial Tier 1 Capital*; then, we add average loan size; last, we add the other BHC characteristics.[17] The evidence strongly supports the supply interpretation of the interest rate results. For states where banks do not have branches, the coefficient on *Stress-test Distance* is positive and significant, both statistically and economically. A one standard-deviation decrease in *Stress-test Distance* is associated with a 6 to 12 percentage point decline in *Risky Share*. This represents an economically large decline relative to the average *Risky Share* of about 35 percent of the portfolio (recall Table 1). The effect, however, is close to zero in markets where banks have branches: the F-tests indicate that the sum of the two coefficients (*Stress-test Distance* and its interaction with the local lender indicator) is not statistically significant in any of the models (although it usually signs positively). Hence, the ability to raise prices on risky loans allows banks to continue to provide credit, even when facing large losses under the stress test.

[17] We do not include the other loan terms, such as the interest rate, maturity, collateral, and so on, since these may respond endogenously to *Stress test Distance*.

One might argue that the correlation between *Stress-test Distance* and *Risky Share* reflects bank 'gaming' of risk ratings. For example, perhaps banks owned by the most affected BHCs strategically reassign loans to lower risk bins, leaving fewer in the highest-risk category. This argument, however, is not consistent with the results, as we find no shift toward risky loans in markets where banks own branches (where 61% of the loans are made).

Ruling Out Alternative Explanations

These results are unlikely to reflect reverse causality – a connection running *from* bank loan supply or their past outcomes on small business loans *to* outcomes on stress tests – for a number of reasons. First, the stress test results depend on the whole BHC portfolio, and small business lending is a small component of that portfolio. Second, we use lagged values of stress test outcomes to allay concern about timing; for example, we merge stress test results disclosed in March 2013 to the four subsequent quarters of STBL data (starting in May of 2013). Third, reverse causality would predict *exactly the opposite* of what we find. That is, reverse causality would predict that banks supplying more risky loans would be more affected by the stress test, which is the opposite of what we find. Our results are also unlikely to be related to credit demand. We remove potential market-specific shocks at annual/quarterly frequency that might reflect demand conditions, yet whether or not we include these effects matters little to the size of our main coefficient. Last, to alleviate concern over omitted variables, we have shown that our results are robust to varying the set of fixed effects, to varying the set of loan controls, and also to varying the set of time-varying BHC characteristics.

III.C Robustness Test: Alternative Measures of Small Business Lending Risk

Our results on loan quantities (Eq. 4) focus on the overall systematic risk in local markets (counties), based on employment growth. This approach is comprehensive and easily measured, but one might argue that the *Employment Beta* captures only a portion of the risks accounted for by the Federal Reserve's stress-test models. In describing its modeling of small business and other retail lending losses for stress tests, for example, the Federal Reserve says the following: "In general, each rate is modeled in an autoregressive specification that also includes the rate in the previous delinquency state, characteristics of the underlying loans, macroeconomic variables and, in some cases, seasonal factors. In some cases, the characteristics of the underlying loans, such as dummy variables for each segment of credit score at origination, are also interacted with the macroeconomic variables to capture differences in sensitivities across risk segments to changes in the macroeconomic environment."[18] The *Employment Beta* captures some macro-economic factors mentioned, but does not address issues more directly linked to credit scores or delinquency rates. It is also based on employment rather than output which might better capture the credit risk of the local economy.

Given the limitations of *Employment Beta,* in this section we report robustness of our conclusions using four alternative measures of county-level risk: First, we construct an output beta in a manner similar to the *Employment Beta*. Second, we construct the share of residents in a given county with credit score below 620.[19] Third, we build a measure of systematic risk in

[18] See "Dodd-Frank Act Stress Test 2015: Supervisory Stress Test Methodology and Results," pages 55 and 56, available at: https://www.federalreserve.gov/newsevents/pressreleases/files/bcreg20150305a1.pdf.

[19] The data for this measure is available for this research from Equifax, Consumer Credit Panel, from the Federal Reserve Bank of New York

employment growth at small firms, using data on employment in establishments with fewer than 50 workers. Fourth, we use *Risky Share* from the STBL data, as in Table 9.[20]

Each of these new measures has both advantages and disadvantages relative to the employment-based beta from Tables 2 and 3. The output betas capture growth in a more complete manner than the employment betas, but because we do not observe output at the county-industry level, we must use employment shares (rather than output shares) to construct the county-level aggregation. Credit-scores provide an ex ante measure of default risk, but it is more tightly linked to consumer credit than to small business credit. Small establishment employment beta better captures small business risk, but it has measurement problems. During economic expansions, many firms will grow larger and thus move out of the <50 employees group, and vice versa during recessions. Since we cannot observe this transition, our small establishments' employment beta is confounded in a way that dampens its relationship to the business cycle: movements in and out of the <50 worker group will thereby reduce the sensitivity of small-firm employment growth to aggregate growth (the overall *Employment Beta* is immune to this problem). Finally, *Risky Share* – the share of risky loans from the STBL – is close conceptually to the credit risk of small business lending, but it is only available for the surveyed banks, is based on loans originated over four separate weeks, and is available by state rather than by county, so we must assume that all counties in a given state have the same level of risk. Despite these shortcomings, these new risk measures do capture alternative risk dimensions the regulators care about in designing the stress-test models and as such should yield additional insights.

[20] See Appendix Table 2 for detailed definitions of these alternative risk measures.

Table 10 reports these results, with one panel for each of the four alternative risk measures. For brevity, we only report the results based on *Minimum Stress-test Distance*. In general, we find that *Stress Test Distance* interacts positively with each risk measure, consistent with the results in Table 2. And, this effect is driven by the non-local markets (markets where banks do not own branches), consistent with Table 3. The effect is statistically significant for the output-based beta measure as well as the beta measure from employment growth in small establishments, although not for the other two measures. Overall these results support the conclusions drawn from the employment-based betas, which is that stress-test affected banks exit risky markets in which they do not have access to private information (and thus have limited ability to increase prices on their small business loans).

IV. Aggregate Effects on Credit Supply

Our results indicate that individual banks' credit supply was affected by their exposure to stress tests. But, this leaves the question: do stress-tests constrain *overall* credit production? Perhaps lenders not affected by stress tests lend to displaced risky borrowers formerly served by stress-tested banks. And, as we have seen, local stress-tested banks raise prices on risky loans and thus may continue to provide credit. To empirically address this question, we re-visit the CRA quantity data, but now evaluate aggregate annual origination volumes in different markets (counties) and implement the following regression analysis:

$$Loan\ Growth_{c,t} = \quad \textbf{(8)}$$

$$= \beta_1 Local\ Stress\text{-}Test\ Distance_{c,t} + \beta_2\ Non\text{-}local\ Stress\text{-}Test\ Distance_{c,t} +$$

$$+\ County\ Controls_{c,t-1} + County\ FEs + Year\ FEs + \varepsilon_{i,c,t},$$

where $Loan\ Growth_{c,t}$ are growth rates in small business loan originations at the county c and year t level (rather than the bank-county-year level). Given that local and non-local banks

respond differently to stress test exposure, we construct two county-level measures of exposure. The first, *Local Stress-test Distance*$_{c,t}$, equals the average *Stress-test Distance* for all banks with branches in county *c* in year *t*, weighted by their local loan share in 2010 (before the first year of our sample). For the *Tier 1 Capital Exposure* measure, we set the other banks' exposure to zero. For the other two (*Minimum Stress-test Distance* and *Tier 1 Capital Distance)*, zero corresponds to being close to the regulatory minimum (and thus under a lot of stress-test pressure). So, we instead set these at three standard-deviations above the mean value (a little less than 7% above the regulatory minimum). This choice reflects the idea that banks outside the stress testing framework are far above their regulatory minimums. The second county-level exposure measure, *Non-local Stress-test Distance*$_{c,t}$, equals the average *Stress-test Distance* for banks without branches in county *c* in year *t*, also weighted by their local loan share in 2010. If stress-tests lead to tightening of aggregate small business credit, then β_1 and β_2 would be positive, as a decrease in *Stress-Test Distance* would be associated with credit contraction. Furthermore, since we find that non-local banks cut credit more than local ones, we might expect $\beta_2 > \beta_1$. To capture overall economic conditions at the county level, we include county and year fixed effects, as well as local time-varying drivers of loan demand (housing price growth, employment growth, and income growth).

Panel A of Table 11 reports the results from the county-level regressions of the growth in loan originations. We find no difference in aggregate credit origination across markets, regardless of local market reliance on small business lending from local and/or non-local stress-tested banks. Neither *Local banks' Stress-test Distance* nor *Non-local banks' Stress-test Distance* enters with a significant coefficient.

One possible explanation for this result is that non-tested (small) banks fill in the gap and lend to businesses stress-tested banks no longer serve. To test this conjecture, we examine the relationship between *Stress-test Distance* and the share of loans originated by local banks unaffected by stress tests: banks with assets below $10 billion.[21] We evaluate whether small, local banks increase when stress tested banks are closer to binding capital requirements via following regression analysis:

$$Small\ Bank\ Share_{c,t} = \quad \textbf{(9)}$$

$$= \beta_1 Local\ Stress\text{-}Test\ Distance_{c,t} + \beta_2\ Non\text{-}local\ Stress\text{-}Test\ Distance_{c,t} +$$

$$+\ County\ Controls_{c,t-1} + County\ FEs + Year\ FEs + \varepsilon_{i,c,t}.$$

If small banks fill-in the gap created by (non-local) stress-tested banks, we expect $\beta_2 < 0$ and $\beta_1 = 0$. Panel B of Table 11 documents that *Small Bank Share* increases in counties where non-local lenders' stressed capital ratios fall closer to regulatory minimums (i.e., $\beta_2 < 0$ in Eq. 9). The coefficient is statistically significant at the 10% level or higher in two of the three specifications. Taken together, the results of Table 11, along with the earlier results, suggest that small banks unaffected by stress testing, and perhaps non-bank lenders as well, substitute in for large, non-local banks.

V. Conclusion and Policy Implications

Our results suggest that banks more affected by stress tests reduce their willingness to supply loans to small business, and this reduction has been concentrated among relatively riskier small-business borrowers. Quantities fall to a bigger extent in markets where stress tested banks do not own branches near borrowers, and prices rise predominantly where they do. These

[21] Banks with assets between $10 and $50 billion are intermediate because these banks began to be subject to stress testing under the Dodd Frank Act starting in 2014.

differential responses emphasize the importance of market structure and branch location in mediating the impact of capital requirements on credit supply. Aggregate credit, however, has not been adversely affected by stress tests. Instead, credit seems to be supplied more by small, local lenders when large stress-tested banks exit those markets.

Our results suggest that stress tests work as intended. We observe that tested lenders either reduce their exposure to risk or, where they don't, increase the compensation for bearing that risk. These changes would be efficiency enhancing if large banks were taking too much risk and extending too much credit prior to the Financial Crisis. Moral hazard incentives from deposit insurance and 'too big to fail' expectations can induce banks to supply too much risky credit (Feldman and Stern, 2004; Strahan, 2013; Acharya, Mehran, and Thakor, 2016). Regulations that accurately tie loan risk to required capital can help alleviate this distortion. Stress tests may be achieving this objective. Moreover, the movement of credit supply from large, non-local lenders toward smaller banks with more local knowledge may help enhance both financial stability and the efficiency of credit allocation.

On the other hand, advocates for large banks have argued that stress tests raise the implicit capital requirement on small business lending excessively – beyond the level justified by the risk. This would also be consistent with many of our findings, but with very different normative implications. Without better information on the details of the models used to assess lending risk across market segments, we hesitate to take a stronger stand on these policy debates.

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Figure 1: Total Small Business Lending Originations

The figure shows the total volume of small business loans originated by the Community Reinvestment Act (CRA) reporting banks in the USA between 1997 and 2015. The data are aggregated to the national level from the CRA institution-level Disclosure Reports covering the lending activity of all CRA-reporting institutions.

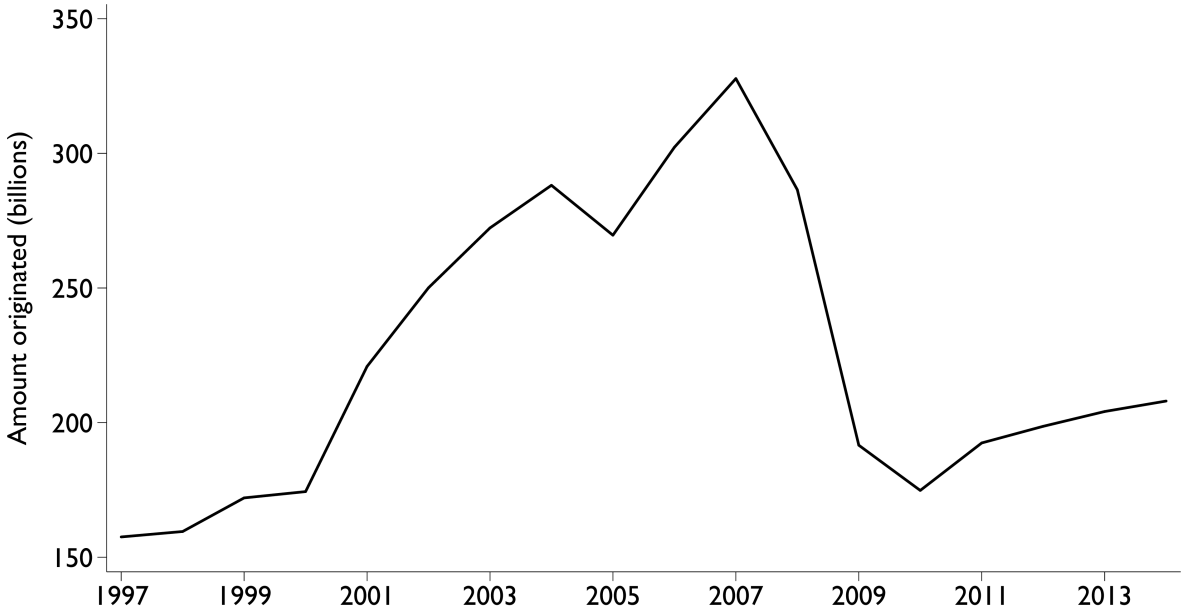

Figure 2: Total Outstanding C&I Loans

The figure shows the total amount of outstanding commercial and industrial (C&I) loans split by loan size between 1997 and 2016, indexed to 1997, in 2007 US dollars. The data are from the Consolidated Reports of Condition and Income (Call Reports), reported in June of each year. Non-commercial banks, foreign-controlled banks (with foreign ownership larger than 25%) and banks with missing data for assets, loans, equity, and deposits are excluded.

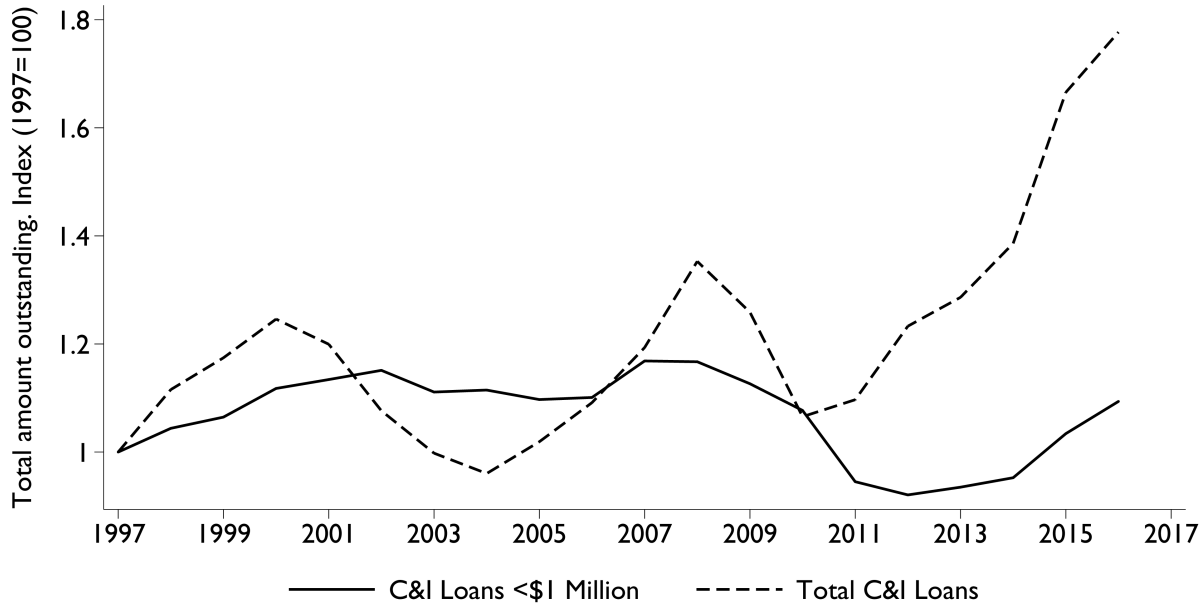

Figure 3: Distribution of Minimum Stress-Test Distance

This figure shows the cross-sectional distribution of *Minimum Stress-Test Distance* for each year between 2012 and 2016. For each BHC-year, *Minimum Stress-Test Distance* = min(*Stressed Tier 1 Capital*–6%, *Stressed Total Risk-based Capital*–8%, *Stressed Leverage Ratio*–4%). An "*" marks an outlier.

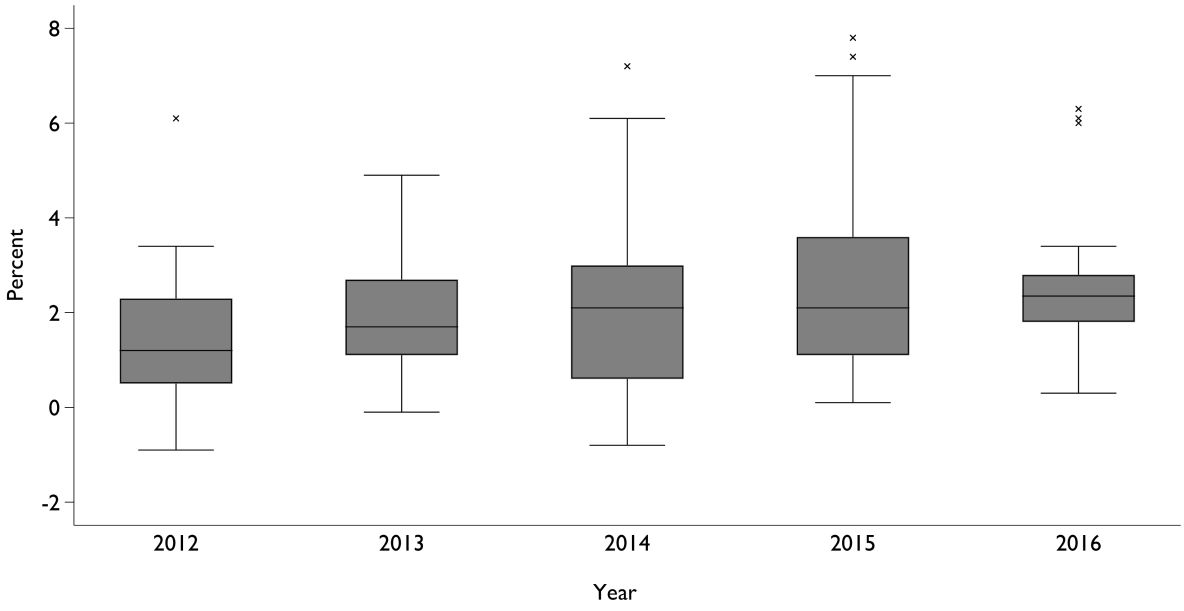

Table 1: Summary Statistics

This table reports summary statistics for the stress test exposures, bank characteristics, growth in small business loan originations, and small business lending loan terms. Data sources are public release of the stress test results by the Federal Reserve, Consolidated Report of Condition and Income (call reports), Community Reinvestment Act (CRA) data, and Survey of Terms of Business Lending (STBL), respectively.

	Mean	Median	Standard Deviation
Panel A: Stress Test Distance (2012-2016)			
Minimum Stress Test Distance	2.57	2.70	1.41
Tier 1 Capital Distance	2.86	2.80	1.31
Tier 1 Capital Stress Test Exposure	3.48	2.90	1.81
Panel B: BHC Characteristics (2012-2016)			
Log of Bank Assets	19.41	19.00	1.15
Deposits / Total Liabilities	75.2%	77.2%	8.1%
NPL / Loans	1.4%	1.2%	1.2%
ROA	0.2%	0.2%	0.1%
C&I Loans / Assets	15.1%	15.2%	9.2%
Cash + Securities / Assets	33.9%	25.4%	17.4%
Consumer Loans/Assets	6.2%	1.3%	10.1%
Mortgage Loans/Assets	8.4%	7.5%	7.9%
Trading Assets/Assets	22.4%	24.1%	12.9%
Growth in CRA Loans	-8.3%	-2.6%	52.7%
Panel C: STBL Loan Terms (Q2 2012- Q2 2017)			
Loan Rate (percentage points)	3.38	3.40	1.27
Log of Loan Size	11.14	10.97	1.11
Maturity (months)	15.27	12.00	15.94
Rating (1=safest; 4=riskiest)	3.17	3.00	0.76
Share of Risky Loans (Rating = 4)	0.35	0.00	0.48
Local Lender? (Branch in Borrower's State)	61%	-	-
Loan is Secured?	88.7%	-	-
SBA Loan?	1.7%	-	-
Syndicated Loan?	11.9%	-	-
Prepayment Penalty?	11.3%	-	-
Floating Rate Loan?	56.4%	-	-
Panel D: Local-Market Risk Measures			
Employment Beta	1.29	1.12	0.69

Table 2: The Effect of Stress Tests on Loan Growth by Market (CRA Data)

This table reports the results from the OLS regressions following equations (4). The dependent variable is the growth in small business loan originations by bank *i* in county *c* at time *t*, as reported by the CRA data. An increase in *Stress Test Distance* implies that a BHC is less affected by its stress-test results. County-year-level *Employment Beta* is calculated as the weighted average of industry betas based on the shares of different industries in a county-year. BHC-level controls are log of total assets, share of C&I loans in a bank total loan portfolio, share of non-performing loans in total loans, return on assets, share of deposits in total liabilities, share of consumer loans, share of mortgage loans, share of trading assets, and a bank's liquidity captured by the ratio of cash and marketable securities to assets. The sample covers the period between 2012 and 2015. Standard errors are clustered by BHC-year. T-statistics are reported in parentheses. '*' denotes significance at the 10% level, '**' the 5% level, and '***' the 1% level.

	Dependent Variable = Growth in CRA Loan Originations								
	Panel A: Minimum Stress Test Distance			*Panel B: Tier 1 Capital Distance*			*Panel C: Tier 1 Capital Stress Test Exposure*		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Stress Test Distance	-0.106	-0.169**		-0.126*	-0.201***		-0.110**	-0.149***	
	(1.36)	(2.03)		(1.92)	(3.00)		(2.02)	(2.65)	
Stress Test Distance x		0.056***	0.044**		0.067***	0.057***		0.035**	0.026**
County Employment Beta		(2.82)	(2.53)		(3.19)	(2.85)		(2.11)	(2.42)
Initial Tier 1 Capital	0.083	0.084		0.086	0.087		-	-	
	(1.26)	(1.27)		(1.34)	(1.36)				
County x Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other BHC Controls	Yes	Yes	-	Yes	Yes	-	Yes	Yes	-
Bank x Year Fixed Effects	-	-	Yes	-	-	Yes	-	-	Yes
Observations	102,563	102,543	102,539	102,563	102,543	102,539	102,563	102,543	102,539
R^2	0.21	0.21	0.57	0.22	0.22	0.57	0.22	0.22	0.57

Table 3: The Effect of Stress Tests on Loan Growth in Local and Non-local Markets

This table reports the results from the OLS regressions following equations (4). Panel A reports the results for local lenders, those that own a branch in the county. Panel B reports the result for non-local lenders. An increase in *Stress Test Distance* implies that a BHC is less affected by its stress-test results. County-year-level *Employment Beta* is calculated as the weighted average of industry betas based on the shares of different industries in a county. BHC-level controls are log of total assets, share of C&I loans in a bank total loan portfolio, share of non-performing loans in total loans, return on assets, share of deposits in total liabilities, share of consumer loans, share of mortgage loans, share of trading assets, and a bank's liquidity captured by the ratio of cash and marketable securities to assets. The sample covers the period between 2012 and 2015. Standard errors are clustered by BHC-year. T-statistics are reported in parentheses. '*' denotes significance at the 10% level, '**' the 5% level, and '***' the 1% level.

	Dependent Variable = Growth in CRA Loan Originations					
	Minimum Stress Test Distance		*Tier 1 Capital Distance*		*Tier 1 Capital Stress Test Exposure*	
Panel A: Local Banks						
Stress Test Distance	0.089**		0.037		0.046*	
	(2.22)		(1.17)		(1.89)	
Stress Test Distance x County Employment Beta	-0.019	-0.019	0.011	-0.011	-0.011	-0.010
	(0.81)	(1.16)	(0.47)	(0.73)	(0.73)	(0.91)
Initial Tier 1 Capital	-0.016		-0.019		-	
	(0.67)		(0.76)			
County x Year Effects	Yes	Yes	Yes	Yes	Yes	Yes
Other BHC Controls	Yes	-	Yes	-	Yes	-
Bank x Year Effects	-	Yes	-	Yes	-	Yes
Observations	16,610	16,587	16,610	16,587	16,610	16,587
R^2	0.34	0.44	0.34	0.44	0.34	0.44
Panel B: Non-Local Banks						
Stress Test Distance	-0.222**		-0.251***		-0.183**	
	(2.25)		(3.20)		(2.57)	
Stress Test Distance x County Employment Beta	0.056**	0.043**	0.072***	0.055***	0.041**	0.030***
	(2.53)	(2.33)	(3.31)	(2.64)	(2.24)	(2.88)
Initial Tier 1 Capital	0.08		0.086		-	
	(0.97)		(1.05)			
County x Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Other BHC Controls	Yes	-	Yes	-	Yes	-
Bank x Year Fixed Effects	-	Yes	-	Yes	-	Yes
Observations	82,891	82,890	82,891	82,890	82,891	82,890
R^2	0.28	0.66	0.29	0.66	0.29	0.66

Table 4: The Effect of Stress Tests on Loan Interest Rates

This table reports the results from the loan-level OLS regressions following equation (5). The dependent variable is loan-level interest rate. Sample covers small business loan originated by the stress-tested banks between 2012Q2 and 2017Q2 and reported in the STBL. An increase in*Stress Test Distance* implies that a BHC is less affected by its stress-test results. Standard errors are clustered by BHC-year. T-statistics reported in parentheses. '*' denotes significance at the 10% level, '**' the 5% level, and '***' the 1% level.

	Dependent Variable = Loan Interest Rate (in Percentage Points)								
	Panel A: Minimum Stress Test Distance			*Panel B: Tier 1 Capital Distance*			*Panel C: Tier 1 Capital Stress Test Exposure*		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Stress Test Distance	-0.228***	-0.193***	-0.270***	-0.240***	-0.202***	-0.294***	-0.222***	-0.194***	-0.309***
	(5.32)	(5.52)	(6.59)	(5.77)	(5.53)	(7.29)	(5.23)	(5.07)	(6.41)
Log Assets	-0.04	-0.04	0.04	-0.03	-0.03	0.04	-0.03	-0.03	0.04
	(0.79)	(1.01)	(0.66)	(0.63)	(0.78)	(0.67)	(0.57)	(0.76)	(0.70)
Initial Tier 1 Capital	0.160***	0.148***	0.276***	0.206***	0.185***	0.341***	-	-	-
	(3.26)	(3.58)	(4.11)	(3.86)	(4.01)	(4.62)			
Log Loan Size	-0.127***	-0.161***	-0.080**	-0.133***	-0.164***	-0.084**	-0.133***	-0.164***	-0.082**
	(2.72)	(4.65)	(2.33)	(2.87)	(4.76)	(2.48)	(2.88)	(4.76)	(2.40)
Rating (1=safest; 4=riskiest)	0.290***	0.289***	0.359***	0.285***	0.285***	0.357***	0.280***	0.283***	0.364***
	(4.46)	(4.43)	(6.95)	(4.40)	(4.39)	(6.99)	(4.21)	(4.26)	(6.84)
Local Lender?	-0.488***	-0.332***	0.124	-0.518***	-0.361***	0.103	-0.492***	-0.347***	0.081
	(5.46)	(4.13)	(1.55)	(5.58)	(4.38)	(1.28)	-5.27	-4.37	(1.11)
Log Maturity			0.125***			0.127***			0.128***
			(3.03)			(3.13)			(3.14)
Loan is Secured?			-0.147			-0.158*			-0.156*
			(1.63)			(1.82)			(1.80)
SBA Loan?			1.725***			1.700***			1.696***
			(9.03)			(9.05)			(9.10)
Syndicated Loan?			-0.184			-0.169			-0.167
			(1.62)			(1.53)			(1.53)
Pre Payment Penalty?			-0.871***			-0.923***			-0.920***
			(5.44)			(6.06)			(5.99)
Floating Rate Loan?			0.309**			0.175			0.171
			(2.19)			(1.30)			(1.25)
Quarter Fixed Effects	Yes	-	-	Yes	-	-	Yes	-	-
State x Quarter Fixed Effects	-	Yes	Yes	-	Yes	Yes	-	Yes	Yes
Number of observations	541,471	498,816	305,324	541,471	498,816	305,324	541,471	498,816	305,324
R^2	0.19	0.25	0.34	0.19	0.25	0.35	0.19	0.25	0.35

Table 5: The Effect of Stress Tests on Loan Maturity

This table reports the results from the loan-level OLS analysis of (log of) loan maturity of small business loans. The sample covers small business loan originated by the stress-tested banks between 2012Q2 and 2017Q2 and reported in the STBL. An increase in *Stress Test Distance* implies that a BHC is less affected by its stress-test results. Standard errors are clustered by BHC-year. T-statistics reported in parentheses. '*' denotes significance at the 10% level, '**' the 5% level, and '***' the 1% level.

	Dependent Variable = Log(maturity)								
	Panel A: Minimum Stress Test Distance			*Panel B: Tier 1 Capital Distance*			*Panel C: Tier 1 Capital Stress Test Exposure*		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Stress Test Distance	0.096***	0.070***	0.075***	0.092***	0.066***	0.070***	0.088***	0.057***	0.063***
	(5.55)	(4.38)	(4.25)	(5.50)	(4.39)	(4.21)	(4.94)	(3.76)	(3.68)
Log Assets	-0.097***	-0.129***	-0.129***	-0.104***	-0.134***	-0.132***	-0.104***	-0.133***	-0.131***
	(6.51)	(9.16)	(6.27)	(6.79)	(9.36)	(6.45)	(6.66)	(8.80)	(6.42)
Initial Tier 1 Capital	-0.066**	(0.03)	-0.035*	-0.082***	-0.038*	-0.049**	-	-	-
	(2.59)	(1.31)	(1.81)	(3.07)	(1.86)	(2.23)			
Log Loan Size	0.099***	0.096***	0.080***	0.100***	0.097***	0.080***	0.101***	0.098***	0.081***
	(6.41)	(6.77)	(7.68)	(6.55)	(6.91)	(7.77)	(6.64)	(7.06)	(7.93)
Rating (1=safest; 4=riskiest)	0.067	0.071	0.108***	0.071	0.074*	0.109***	0.073	0.078*	0.112***
	(1.38)	(1.65)	(2.95)	(1.48)	(1.74)	(2.98)	(1.51)	(1.82)	(3.06)
Local Lender?	-0.469***	-0.428***	-0.344***	-0.465***	-0.423***	-0.342***	-0.468***	-0.436***	-0.352***
	(6.11)	(8.67)	(7.98)	(6.10)	(8.38)	-7.76	(6.06)	(8.33)	(7.50)
Loan is Secured?			0.106			0.111			0.112
			(1.49)			(1.57)			(1.57)
SBA Loan?			0.838***			0.840***			0.839***
			(4.61)			(4.64)			(4.64)
Syndicated Loan?			0.639***			0.635***			0.637***
			(9.51)			(9.41)			(9.44)
Pre Payment Penalty?			0.221*			0.234*			0.235**
			(1.86)			(1.98)			(2.00)
Floating Rate Loan?			-0.031			0.01			0.009
			(0.42)			(0.15)			(0.13)
Quarter Fixed Effects	Yes	-	-	Yes	-	-	Yes	-	-
State x Quarter Fixed Effects	-	Yes	Yes	-	Yes	Yes	-	Yes	Yes
Number of observations	328,811	305,739	305,739	328,811	305,739	305,739	328,811	305,739	305,739
R^2	0.08	0.11	0.16	0.08	0.11	0.16	0.08	0.11	0.16

Table 6: The Effect of Stress Tests on Loan Interest Rates: Robustness

This table reports the results from the loan-level OLS regressions following equation (5) with additional time-varying BHC control variables. The dependent variable is loan-level interest rate. Sample covers small business loan originated by the stress-tested banks between 2012Q2 and 2017Q2 and reported in the STBL. An increase in *Stress Test Distance* implies that a BHC is less affected by its stress-test results. Standard errors are clustered by BHC-year. T-statistics are reported in parentheses. '*' denotes significance at the 10% level, '**' the 5% level, and '***' the 1% level.

	Dependent Variable = Loan Interest Rate (in Percentage Points)					
	Panel A: Minimum Stress Test Distance		*Panel B: Tier 1 Capital Distance*		*Panel C: Tier 1 Capital Stress Test Exposure*	
Stress Test Distance	-0.193***	-0.162***	-0.202***	-0.158***	-0.194***	-0.194***
	(5.52)	(4.80)	(5.53)	(4.87)	(5.07)	(5.23)
Log Loan Size	-0.161***	-0.171***	-0.164***	-0.172***	-0.164***	-0.169***
	(4.65)	(5.35)	(4.76)	(5.36)	(4.76)	(5.25)
Rating (1=safest; 4=riskiest)	0.289***	0.339***	0.285***	0.338***	0.283***	0.339***
	(4.43)	(4.82)	(4.39)	(4.81)	(4.26)	(4.81)
Log Bank Assets	-0.044	-0.012	-0.032	-0.042	-0.031	-0.04
	(1.01)	(0.13)	(0.78)	(0.48)	(0.76)	(0.45)
Initial Tier 1 Capital Ratio	0.148***	0.235***	0.185***	0.252***	-	-
	(3.58)	(4.23)	(4.01)	(4.30)		
Local Lender?	-0.332***	-0.053	-0.361***	-0.059	-0.347***	-0.069
	(4.13)	(0.68)	(4.38)	(0.76)	(4.37)	(0.90)
Deposits / Total Liabilities		1.769*		1.748*		1.069
		(1.87)		(1.87)		(1.38)
NPL / Loans		16.438**		15.694**		14.266*
		(2.18)		(2.10)		(1.92)
ROA		-10.784		-10.442		-12.362*
		(1.62)		(1.56)		(1.79)
C&I Loans / Assets		8.002***		8.078***		7.500***
		(4.48)		(4.77)		(4.57)
(Cash + Securities) / Assets		1.345		2.2		2.16
		(0.93)		(1.61)		(1.55)
Trading Assets/Assets		8.234***		8.640***		7.098***
		(3.89)		(3.98)		(3.85)
Consumer Loans/Assets		3.923***		4.346***		3.585**
		(2.70)		(2.98)		(2.59)
Mortgage Loans/Assets		1.06		1.149		1.163
		(0.76)		(0.86)		(0.87)
State x Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	498,816	498,816	498,816	498,816	498,816	498,816
R^2	0.25	0.29	0.25	0.29	0.25	0.28

Table 7: The Effect of Stress Tests on Local Branch Loan Interest Rates

This table reports the results from the OLS regressions following equation (6). The dependent variable is loan-level interest rate. Sample covers small business loan originated by the stress-tested banks between 2012Q2 and 2017Q2 and reported in the STBL. An increase in *Stress Test Distance* implies that a BHC is less affected by its stress-test results. Standard errors are clustered by BHC-year. T-statistics reported in parentheses. '*' denotes significance at the 10% level, '**' the 5% level, and '***' the 1% level.

	Dependent Variable = Loan Interest Rate (in Percentage Points)								
	Panel A: Minimum Stress Test Distance			*Panel B: Tier 1 Capital Distance*			*Panel C: Tier 1 Capital Stress Test Exposure*		
Stress Test Distance	-0.069**	-0.102***	-0.083**	-0.095***	-0.125***	-0.090**	-0.088***	-0.103***	-0.100***
	(2.40)	(3.09)	(2.56)	(3.00)	(3.48)	(2.54)	(3.46)	(3.56)	(3.71)
Local Lender?	0.261*	0.142	0.412**	0.164	0.052	0.323*	-0.964***	-1.019***	-0.665***
	(1.71)	(0.84)	(2.54)	(0.97)	(0.28)	(1.86)	(6.41)	(6.14)	(5.67)
Local Lender x Stress Test Distance	-0.191***	-0.169***	-0.162***	-0.151***	-0.134**	-0.121***	-0.198***	-0.197***	-0.193***
	(4.17)	(3.38)	(3.83)	(2.93)	(2.43)	(2.67)	(4.71)	(4.51)	(5.05)
State x Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control for Size	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control for Initial Tier 1 Capital	Yes	Yes	Yes	Yes	Yes	Yes	-	-	-
Loan Controls	-	Yes	Yes	-	Yes	Yes	-	Yes	Yes
Other BHC Controls	-	-	Yes	-	-	Yes	-	-	Yes
Number of observations	511,828	498,816	498,816	511,828	498,816	498,816	511,828	498,816	498,816
R^2	0.20	0.26	0.29	0.20	0.25	0.29	0.21	0.26	0.29

Table 8: The Effect of Stress Tests on Loan Interest Rates by Risk Rating

This table reports the results from the OLS analysis following equation (6). The dependent variable is loan-level interest rate. Sample covers small business loan originated by the stress-tested banks between 2012Q2 and 2017Q2 and reported in the STBL. Each Panel reports results for different loan risk rating sub-samples. These risk ratings are assigned by originating bank and are mapped to a scale provided by the Federal Reserve for better comparison across banks. An increase in *Stress Test Distance* implies that a BHC is less affected by its stress-test results. Standard errors are clustered by BHC-year. T-statistics reported in parentheses. '*' denotes significance at the 10% level, '**' the 5% level, and '***' the 1% level.

	Dependent Variable = Loan Interest Rate (in Percentage Points)					
	Minimum Stress Test Distance		*Tier 1 Capital Distance*		*Stress Test Exposure Based on Tier 1 Capital*	
Panel A: Low Risk Loans (Rating = 1 or 2)						
Stress Test Distance	0.001	-0.023	-0.007	-0.013	-0.016	-0.018
	(0.05)	(1.12)	(0.25)	(0.65)	(0.78)	(0.91)
Local Lender?	-0.552***	0.014	-0.579***	-0.007	-0.361**	0.506***
	(5.72)	(0.16)	(5.57)	(0.08)	(2.27)	(3.37)
Local Lender x Stress Test Distance	-0.025	0.051	-0.015	0.055*	0.072*	0.109***
	(0.63)	(1.57)	(0.37)	(1.80)	(1.90)	(3.54)
State x Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Control for Size	Yes	Yes	Yes	Yes	Yes	Yes
Control for Initial Tier 1 Capital	Yes	Yes	Yes	Yes	-	-
Other Loan and BHC Controls	-	Yes	-	Yes	-	Yes
Number of observations	84,576	84,576	84,576	84,576	84,576	84,576
R^2	0.40	0.46	0.40	0.46	0.40	0.46
Panel B: Medium Risk Loans (Rating = 3)						
Stress Test Distance	-0.055*	-0.034	-0.063*	-0.029	-0.078***	-0.069***
	(1.80)	(1.33)	(1.84)	(1.02)	(3.33)	(2.92)
Local Lender?	0.245	0.233	0.244	0.239	-0.994***	-0.723***
	(1.60)	(1.59)	(1.31)	(1.49)	(6.55)	(5.89)
Local Lender x Stress Test Distance	-0.228***	-0.178***	-0.214***	-0.162***	-0.177***	-0.152***
	(5.02)	(4.74)	(4.06)	(3.91)	(4.11)	(4.64)
State x Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Control for Size	Yes	Yes	Yes	Yes	Yes	Yes
Control for Initial Tier 1 Capital	Yes	Yes	Yes	Yes	-	-
Other Loan and BHC Controls	-	Yes	-	Yes	-	Yes
Number of observations	231,115	231,115	231,115	231,115	231,115	231,115
R^2	0.34	0.41	0.34	0.41	0.34	0.41
Panel C: High Risk Loans (Rating = 4)						
Stress Test Distance	-0.176***	-0.055	-0.198***	-0.073	-0.198***	-0.114***
	(4.67)	(1.32)	(5.11)	(1.65)	(6.48)	(3.30)
Local Lender?	0.489**	0.439**	0.322	0.339*	-0.746***	-0.501***
	(2.52)	(2.26)	(1.57)	(1.75)	(3.91)	(3.77)
Local Lender x Stress Test Distance	-0.180***	-0.128***	-0.124**	-0.094**	-0.189***	-0.172***
	(3.06)	(2.65)	(2.09)	(2.09)	(3.78)	(3.28)
State x Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Control for Size	Yes	Yes	Yes	Yes	Yes	Yes
Control for Initial Tier 1 Capital	Yes	Yes	Yes	Yes	-	-
Other Loan and BHC Controls	-	Yes	-	Yes	-	Yes
Number of observations	183,125	183,125	183,125	183,125	183,125	183,125
R^2	0.21	0.27	0.21	0.28	0.21	0.27

Table 9: Share of High-Risk Loans

This table reports the results from the OLS regressions following equation (7). The dependent variable is *Risky Share*, which is defined as the share of high-risk (rating = 4) loans originated by bank i in state s during year t as reported in the STBL. Sample covers small business loan originated by the stress-tested banks between 2012Q2 and 2017Q2 and reported in the STBL. An increase in *Stress Test Distance* implies that a BHC is less affected by its stress-test results. Standard errors are clustered by BHC-year. T-statistics reported in parentheses. '*' denotes significance at the 10% level, '**' the 5% level, and '***' the 1% level.

	Dependent Variable = Share of Loans in Risk Category 4								
	Panel A: Minimum Stress Test Distance			*Panel B: Tier 1 Capital Distance*			*Panel C: Tier 1 Capital Stress Test Exposure*		
Stress Test Distance	0.083***	0.078***	0.044**	0.072***	0.069***	0.051***	0.053***	0.051***	0.054***
	(3.34)	(3.27)	(2.55)	(4.28)	(4.27)	(3.61)	(4.72)	(4.70)	(4.12)
Local Lender?	0.164***	0.136***	0.101**	0.128***	0.094**	0.077*	-0.122***	-0.144***	-0.193***
	(3.64)	(3.24)	(2.26)	(2.91)	(2.27)	(1.90)	(2.94)	(3.31)	(4.39)
Local Lender x Stress Test Distance	-0.063***	-0.059***	-0.059***	-0.043***	-0.039***	-0.041***	-0.034***	-0.034***	-0.045***
	(3.88)	(3.86)	(3.87)	(3.62)	(3.45)	(3.64)	(3.16)	(3.28)	(3.76)
Log Assets	0.050**	0.051***	0.026	0.051**	0.053**	0.031	0.051**	0.052**	0.027
	(2.58)	(2.64)	(0.79)	(2.43)	(2.54)	(0.97)	(2.38)	(2.49)	(0.85)
Initial Tier 1 Capital	-0.011	-0.01	-0.025*	-0.038***	-0.036***	-0.044***	-	-	-
	(1.26)	(1.15)	(1.85)	(3.60)	(3.47)	(3.14)			
State x Quarter Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Average Loan Size	-	Yes	Yes	-	Yes	Yes	-	Yes	Yes
Other BHC Controls	-	-	Yes	-	-	Yes	-	-	Yes
Observations	10,216	10,216	10,216	10,216	10,216	10,216	10,216	10,216	10,216
R^2	0.15	0.16	0.28	0.16	0.17	0.28	0.15	0.16	0.29

Table 10: Robustness Tests using Alternative Local Market Risk Measures

This table reports the results from the OLS regressions similar to those reported in Table 2 (full sample) and Table 3 (local vs. non-local banks), with alternative measures of local market risk. (See Table A2 for definitions.) The dependent variable is the growth in small business loan originations by bank *i* in county *c* at time *t*, as reported by the CRA data. We classify a county as a bank's local market if the bank has a branch in that county. The sample covers the period between 2012 and 2015 An increase in *Minimum Stress Test Distance* implies that a BHC is less affected by its stress-test results. Standard errors are clustered by BHC-year. T-statistics are reported in parentheses. '*' denotes significance at the 10% level, '**' the 5% level, and '***' the 1% level.

	Dependent Variable = Growth in CRA Loan Originations					
	All Banks		Local Banks		Non-local Banks	
Panel A: Risk Measure Based on GDP Beta						
Minimum Stress Test Distance	-0.151*		0.087*		-0.209**	
	(1.97)		(1.91)		(2.28)	
Minimum Stress Test Distance x	0.048**	0.034*	-0.015	-0.003	0.049**	0.035*
County Risk Measure	(2.29)	(1.81)	(0.71)	(0.23)	(2.15)	(1.84)
Initial Tier 1 Capital	0.075		-0.013		0.076	
	(1.11)		(0.54)		(0.88)	
Observations	102,543	102,539	16,610	16,587	82,891	82,890
R^2	0.21	0.57	0.34	0.44	0.28	0.66
Panel B: Risk Measure Based on Lag of STBL Share of High-risk Loans (Risk Raiting = 4 at BHC-year-state level)						
Minimum Stress Test Distance	0.078		0.039		0.08	
	(0.79)		(1.23)		(0.92)	
Minimum Stress Test Distance x	0.162***	0.0400*	0.019	-0.002	0.151***	0.026
County Risk Measure	(3.97)	(1.72)	(1.01)	(0.09)	(3.35)	(1.62)
Initial Tier 1 Capital	0.102**		-0.014		0.159***	
	(2.18)		(0.82)		(2.86)	
Observations	36,519	36,517	9,890	9,883	23,530	23,527
R^2	0.37	0.49	0.37	0.41	0.51	0.62
Panel C: Risk Measure Based on Share of Consumers with Credit Score <620						
Minimum Stress Test Distance	-0.142		0.096**		-0.204*	
	(1.63)		(2.25)		(1.94)	
Minimum Stress Test Distance x	0.169	0.156**	-0.098	0.059	0.198	0.112
County Risk Measure	(1.13)	(2.12)	(1.35)	(1.18)	(1.11)	(1.62)
Initial Tier 1 Capital	0.077		-0.013		0.079	
	(1.14)		(0.53)		(0.91)	
Observations	102,283	102,279	16,610	16,587	82,635	82,634
R^2	0.21	0.57	0.34	0.44	0.28	0.66
Panel D: Risk Measure Based on Beta of Employment in Small Establishments (< 50 Employees)						
Minimum Stress Test Distance	-0.175**		0.103		-0.226**	
	(2.31)		(1.46)		(2.42)	
Minimum Stress Test Distance x	0.179***	0.123**	-0.075	0.048	0.167**	0.107**
County Risk Measure	(2.93)	(2.36)	(0.64)	(0.63)	(2.52)	(2.09)
Initial Tier 1 Capital	0.075		-0.013		0.075	
	(1.11)		(0.54)		(0.88)	
Observations	102,543	102,539	16,610	16,587	82,891	82,890
R^2	0.21	0.57	0.34	0.44	0.28	0.66
County x Year Effects	Yes	Yes	Yes	Yes	Yes	Yes
Other Bank Controls	Yes	-	Yes	-	Yes	-
Bank x Year Effects	-	Yes	-	Yes	-	Yes

Table 11: The Effect of Stress Tests on Overall Loan Growth (CRA Data)

This table reports county-year level regressions of county-level growth in small business loans (Panel A) and market share of banks with under $10 billion in assets (Panel B). Local Banks' *Stress Test Distance* equals the average *Stress Test Distance* across all lending banks with local branch presence weighted by their 2010 SMB loan market share. The non-stress-tested local banks are assigned the value of *Distance* equal to mean plus 3 standard deviations. Non-local Banks *Stress Test Distance* at the county level is similarly defined. An increase in *Stress Test Distance* implies that a BHC is less affected by its stress-test results. Standard errors are clustered by county. T-statistics are reported in parentheses. '*' denotes significance at the 10% level, '**' the 5% level, and '***' the 1% level.

	Minimum Stress Test Distance	*Tier 1 Capital Distance*	*Tier 1 Capital Stress Test Exposure*
Panel A: Dependent Variable = County Level SBL Growth			
Local Banks' Stress Test Distance	-0.005	-0.003	-0.008
(county average)	(0.62)	(0.54)	(1.05)
Non-local Banks' Stress Test Distance	-0.039	-0.0187	-0.033
(county average)	(1.50)	(1.15)	(1.47)
Home Price Growth	0.054	0.056	0.052
	(0.50)	(0.51)	(0.47)
Employment Growth	0.170	0.178	0.169
	(0.71)	(0.74)	(0.71)
Personal Income Growth	0.212*	0.215*	0.220*
	(1.69)	(1.71)	(1.75)
County Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Observations	10,608	10,608	10,608
R^2	0.13	0.13	0.13
Panel B: Dependent Variable = Market Share of Small, Local Banks not owned by Stress Tested BHCs			
Local banks' stress test Distance	0.002	-0.001	0.001
(county average)	(0.80)	(0.49)	(0.74)
Non-local banks' stress test Distance	-0.003	-0.008*	-0.019***
(county average)	(0.45)	(1.87)	(3.36)
Home Price Growth	0.059**	0.057**	0.056**
	(2.18)	(2.08)	(2.06)
Employment Growth	0.288***	0.281***	0.279***
	(3.80)	(3.71)	(3.70)
Personal Income Growth	-0.035	-0.036	-0.035
	(1.07)	(1.07)	(1.06)
County Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Observations	10,608	10,608	10,608
R^2	0.77	0.77	0.77

Table A1: Employment Betas for 2-Digit NAICS Industries

This table reports time-invariant, industry-level employment betas, where beta equals the coefficient from a time series regression of industry-level employment growth on overall economy-level employment growth, based on quarterly data from 1992 through 2015.

NAICS2	Industry Title	Winsorized Employment Beta
11	Agriculture, Forestry, Fishing and Hunting	4.93
21	Mining	1.05
22	Utilities	0.49
23	Construction	2.91
31	Manufacturing: Food, Beverage, Textiles	0.88
32	Manufacturing: Wood, Paper, Chemicals	0.69
33	Manufacturing: Metals, Machinery, Equipment	0.49
42	Wholesale Trade	0.61
44	Retail Trade	1.17
45	Retail Trade: Specialty Stores (e.g., florists)	1.64
48	Transportation and Warehousing	0.76
49	Transportation and Warehousing: Specialty Services (e.g., postal transporta	0.69
51	Information	0.46
52	Finance and Insurance	0.34
53	Real Estate Rental and Leasing	1.13
54	Professional, Scientific, and Technical Services	-0.03
55	Management of Companies and Enterprises	-0.10
56	Administrative and Support and Waste Management and Remediation Serv	1.76
61	Educational Services	-0.98
62	Health Care and Social Assistance	0.23
71	Arts, Entertainment, and Recreation	4.93
72	Accommodation and Food Services	1.36
81	Other Services (except Public Administration)	0.76
99	Public Administration	-0.98

Table A2: Alternative Measures of Local Risk

This table provides detailed description of the calculations and data used in building alternative risk measures in Table 10 of the paper.

Panel A: GDP Beta

GDP Beta is built as a weighted average of industry GDP beta similar to Employment Beta describe in detail in Section III.A of the paper. Specifically, we implement two step procedure. First we use quarterly GDP data reported by Bureau of Economic Analysis at NAICS industry level to estimate industry betas based on panel covering 24 industries from Q1 2005 to Q4 2016. Second, we use local industry employment shares to construct the weighted average beta for each county-year. We use employment-based weights because the output data are not available at county-industry level. We lag the risk measure by one year to avoid potential reverse causality.

Panel B: Risk Measure Based on the Share of High-risk Loans (Risk Rating = 4)

Risky Share is a BHC-state-year-level measure equal to the share of high risk loans (risk rating = 4) in all rated loans originated by a given BHC in the state during the prior year, as reported by STBL data. We merge *Risky Share* to the BHC-state-year-level loan-growth CRA data. Since the location of the borrower was only reported to STBL starting in 2012, the regressions based on this measure cover CRA originations between 2013 and 2015.

Panel C: Risk Measure Based on the Share of Consumers with Credit Score < 620

Share of Consumers with Credit Score < 620 is a county-year-level share of consumers with credit scores less than 620, a cut-off commonly used to identify subprime consumers. The data for this measure is available for this research from Equifax, Consumer Credit Panel, from the Federal Reserve Bank of New York. These data cover a 5% random sample of all consumers with a Social Security Number and a credit history maintained in Equifax. The credit score in the data, Risk Score, ranges from 280 to 850. We merge the lagged values of this county-year-level measure for years 2011 to 2014 to the BHC-county-year CRA loan-growth data for years 2012-2015. For robustness, we implemented our analysis using alternative cut-off points (600, 640, and 660) and found the results to be similar to those reported in Table 10.

Panel: Beta Based on Employment of Small Businesses with < 50 Employees

Small Business Employment Beta is similar to Employment Beta describe in detail In Section III.A of the paper. Specifically, we implement two step procedure. First, we obtain information from the Survey of County Business Patterns about the number of establishments in 4 different categories: firms with 1-4; 5-9; 10-19; 20-49 employees. Using the median number of employees in each group (e.g., 7 for 5 to 9 employee group) we estimate the total number of employees working in firms with less than 50 employees for each county-industry-year. With this data in hand we estimate the small business employment beta following the formula (Eq. 3 in the paper). Second, we use local industry employment shares to construct the weighted average beta for each county-year. Finally we lag the risk measure by one year to avoid potential reverse causality.