

# The Impact of Stress Tests on Bank Lending

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## **Abstract**

We investigate one channel through which the annual bank stress tests, as part of the Federal Reserve's Comprehensive Capital Analysis and Review (CCAR) review, could unduly curtail the provision of bank credit, or change the allocation of loan growth in unexpected ways. To quantify the impact of the stress tests, we construct a measure of the extra capital implied by the supervisory stress tests relative to the level of capital implied by the banks' own models, which we call the capital gap. We then study the impact of the capital gap on the loan growth of BHCs with more than \$10 billion in assets. We find no evidence that the higher capital implied by supervisory stress tests beyond capital levels suggested by the banks' own models is unduly restricting loan growth. Consistent with previous results in the bank capital literature, we find some evidence that among the CCAR banks, more capital is actually associated with higher loan growth.

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## 1. Introduction

The appropriate role and stringency of bank regulation worldwide continue to be highly debated among academics, regulators, and banking industry representatives. Supervisory stress testing has become a cornerstone approach to bank regulation and an important component of the post-crisis regulatory reform in the U.S. (Tarullo, 2014). However, the banking industry and other stakeholders have claimed that the stress testing exercises are having the unintended effect of limiting credit availability.<sup>1</sup> In particular, and despite its positive effects on the resilience and stability of the financial sector, a new concern has arisen about whether stress tests might be impairing economic growth by curtailing the supply of bank credit to households and businesses.

We study whether the capital requirements implicit in the annual stress tests, as part of the Federal Reserve's Comprehensive Capital Analysis and Review (CCAR), are restraining the provision of bank credit to a greater degree than expected or changing the allocation of loan growth in ways that are unwarranted. To quantify the effect of the additional capital required by the Federal Reserve's stress tests, we develop a counterfactual aimed at answering the following question: What would the regulatory capital ratios look like in the absence of the supervisory stress tests, assuming that banks still used the results of their own stress tests in their capital planning? To construct this counterfactual measure we compare the minimum post-stress capital ratios implied by the Fed's stress tests and the BHC's own stress tests, both using the CCAR scenarios. We call this difference the capital gap, which we interpret as the additional capital that banks hold to comply with the supervisory stress tests relative to the capital levels implied by their own models. We then study the impact of the capital gap on the loan growth of BHCs across different loan categories.

We conduct our analysis following two approaches. First, we compare the impact of the capital gap on the loan growth of the banks subject to the supervisory stress tests (CCAR banks) and the relatively large regional banks that must run their own stress tests but are not subject to the supervisory stress tests (non-CCAR banks).<sup>2</sup> Supervisory stress tests tend to be more stringent than bank stress tests

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<sup>1</sup> Some of these quotes point to too much capital being held by banks and thus to the idea that banks could be using that capital to finance the economy. These type of arguments may be misleading as they could suggest that excess capital, which otherwise could be used to extend more credit, is kept as idle cash in banks' vaults. Capital requirements do not force banks to immobilize capital in their balance sheets. Instead, capital requirements ensure that banks finance new loans with sufficient capital, rather than with less stable sources of funding that could dry up and exacerbate a nascent crisis (e.g. with 7 cents for each dollar of new loans).

<sup>2</sup> The non-CCAR BHCs in our sample are the relatively large regional banks with assets between \$10 billion and \$50 billion. These BHCs are not subject to the Federal Reserve's stress tests, but the Dodd-Frank Act mandates that they conduct their own annual company-run stress tests, submit their results to their banking regulators (FDIC and

and thus, on average, the capital gap is positive among CCAR banks. By construction, the capital gap is zero for non-CCAR banks. We exploit this variation in our capital gap measure to study the lending implications of the supervisory stress tests using panel data estimation. Furthermore, we refine this analysis looking at a sample of banks that eliminates the largest and most complex banks as well as the smaller regional banks, in order to focus on more comparable banks. That is, the BHCs that mostly engage in traditional lending and deposit taking operations, and are close to the \$50 billion size threshold for participation in the stress test exercise. In our second approach, we study the impact of the severity of the stress tests on loan growth among the CCAR banks only. We extend the analysis by examining the impact of the capital gap on bank lending standards across multiple loan categories using the responses in the Senior Loan Officer Opinion Survey (SLOOS) for both groups CCAR and non-CCAR banks.

We find no systematic evidence that the extra capital implied by the results of the supervisory stress tests may be constraining bank loan growth or causing banks to tighten their lending standards. In our first approach, which compares the loan growth between CCAR and non-CCAR banks, we conclude that although loan growth by CCAR banks has been slower than loan growth by non-CCAR banks, the difference in growth for loan categories such as residential and commercial real estate loans as well as small business loans seems to be driven by factors beyond the stress tests such loan demand, and bank specific characteristics such as risk aversion, credit quality, and funding sources. After we account for those factors, we do not find evidence that the capital calculations associated with the supervisory stress tests explain the loan growth differences. Faster loan growth by smaller non-CCAR banks in general is not new. These banks had faster loan growth rates between 2001 and 2006 (Vojtech, 2017). In contrast, and relative to non-CCAR banks, large CCAR banks faced significantly larger loan and securities losses than non-CCAR banks during the financial crisis as they operated with more fragile funding structures and vulnerable balance sheets. The crisis experience is another factor that may have contributed to reshape CCAR banks' business models and thus to moderate their loan growth during the post-crisis period, even in the absence of stricter regulation and supervision.

Our results are consistent with previous findings in the academic literature supporting the view that that more capital is associated with higher loan growth (Bernanke and Loan, 2000; Francis and Osborne, 2009; Berrospide and Edge, 2010; Carlson, Shan, Warusawitharana, 2013; Chu, Zhang, and Zhao, 2017). Our interpretation is that the higher capital buffers that result from the new regulatory framework, which make banks safer and more resilient, altogether put banks in a better position to lend more, at least across some loan categories. A similar interpretation is consistent with a recent theoretical

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OCC) and make their results public (e.g. through their websites). Throughout the paper we use the terms bank and BHC interchangeably.

framework developed by Bahaj and Malherbe (2017). These authors show that the relationship between lending and capital requirements follow a U-shaped pattern, that is, after sufficiently high capital, higher capital requirements lead banks to increase their lending. This seems to be particularly the case during the post-crisis period, that is, when banks had enough time to remove their legacy of bad loan portfolios and thus potential debt overhang issues are less severe. In those cases, banks can enjoy profitable lending opportunities as the benefit of additional capital (e.g. reduction in the probability of bank default) exceeds the cost of raising new capital. As we discuss below, before the financial crisis, CCAR banks were operating with historically lower capital ratios than smaller non-CCAR banks. The implementation of the stress tests have led the CCAR banks to raise significantly large amounts of capital to meet the stricter capital requirements which, according to our results, has not restricted but favored their lending capacity and thus their contribution to the real economy.

The remainder of the paper is organized as follows. Section 2 provides the background on stress testing in the U.S, section 3 reviews the related literature. Section 4 describes our empirical methodology and section 5 presents our econometric results. Section 6 concludes.

## **2. Background**

Stress tests have become a key macroprudential tool for bank supervisors and regulators worldwide. In the U.S., The Dodd-Frank Act (DFA) requires the Federal Reserve to conduct annual stress tests of BHCs with total consolidated assets of at least \$50 billion and all nonbank financial institutions designated by the Financial Stability Oversight Council (FSOC) for Federal Reserve supervision.<sup>3</sup> The Federal Reserve started conducting Dodd-Frank Act supervisory stress tests (DFAST) in 2013 on the 18 largest BHCs that were subject to the 2009 Supervisory Capital Assessment Program (SCAP). In 2016, 33 BHCs were subject to DFAST, and that number is projected to increase in the coming years as intermediate holding companies (IHCs) and other systemically important nonbank financial institutions are incorporated. The analytical framework developed to conduct DFAST is the basis for the quantitative assessment component of the Federal Reserve's Comprehensive Capital Analysis and Review (CCAR) which started in 2011. CCAR is the annual evaluation of individual BHC's capital planning processes (risk management, internal control practices, and planned capital distributions) and includes the quantitative

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<sup>3</sup> The Dodd Frank Act also mandates that BHCs conduct company-run stress tests using the same supervisory scenarios that the Federal Reserve designs. In addition to these scenarios, each BHC has to conduct a stress test based on its own scenarios, including at least one stress scenario and a baseline scenario. Individual BHCs then submit the results of their baseline scenario using their own planned capital actions and the results of their stress scenario(s) using any alternative capital actions (if applicable).

exercise (similar to DFAST, but with different capital distribution assumptions) and a qualitative assessment.

The supervisory stress testing models developed by the Federal Reserve project losses, revenues, expenses, and post stress capital ratios for each BHC over a nine-quarter planning horizon and under three hypothetical scenarios (baseline, adverse, and severely adverse). The severely adverse scenario features a deep recession in the U.S., characterized by a substantial increase in the unemployment rate, large declines in asset prices, and increases in risk premia. In calculating post-stress capital ratios, capital distribution assumptions are different in the DFAST and CCAR exercises. In DFAST, capital distributions are assumed to be at a level similar to the quarterly average in the previous year (capital repurchases and stock issuance are assumed to be zero, except for common stock issued as employee compensation), whereas in CCAR, capital distributions are based on the BHC proposed capital plans. Furthermore, upon disclosure of results, no specific supervisory actions are attached to DFAST results beyond the requirement that BHCs take the results into account in their capital planning. However, in CCAR the Federal Reserve may object to the BHC's capital plan on either quantitative or qualitative grounds, and thus may restrict the firm's capital distributions included in its capital plan.<sup>4</sup>

Beyond its crucial role in bank supervision and regulation, stress tests are also a key risk management tool for banks. Banks frequently complain that stress tests are expensive to implement, and the exercise is usually seen by banks as another (more binding) capital requirement. However, stress tests provide banks the correct incentives to monitor the risks inherent to their business in a forward-looking basis and may also encourage them to undertake better risk measurement and management practices, and to keep well-organized data and expertise to project revenues and losses under alternatives scenarios (Liang, 2017).

The implementation of supervisory stress tests has significantly improved the resilience of the financial sector. By requiring the largest and complex BHCs to operate with sufficient capital to withstand periods of severe financial and economic stress, and thus to continue functioning as viable financial intermediaries, the supervisory stress tests have reduced systemic risks in the financial system (Tarullo, 2014). As shown in Figure 1, the largest banks historically have funded their balance sheets with less capital than smaller banks. But, this difference in capital has narrowed recently, as the banks subject to the supervisory stress tests (CCAR banks) have more than doubled their high-quality capital (e.g.

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<sup>4</sup> More specifically, the Federal Reserve could require the company to stop dividend payments and share repurchases entirely or could permit these actions within certain bounds. In general, in CCAR all participating BHCs receive extensive supervisory feedback on their capital planning processes, including identification of areas that require improvement (Hirtle and Lehnert, 2015).

Common Equity Tier 1 capital) ratios over the past seven years, converging to the capital levels maintained by smaller banks (non-CCAR banks).

Stress tests may also influence banks' decisions about the quantity or type of credit that they extend, and that could have unintended consequences. One possible unintended consequence is that the inclusion of certain salient risks in the scenarios could lead to less favorable credit allocation decisions, because in adjusting their balance sheet to reduce projected losses, banks may end up reducing the credit supply, for example to sectors with rapid debt growth.<sup>5</sup> This is a concern recently highlighted by banking industry representatives and other policymakers, and is part of the motivation for our study. Figure 2 shows the differences in loan growth between CCAR and non-CCAR banks over the past 6 years. Recent loan growth at (large) CCAR banks has been slower than loan growth at their (small) non-CCAR counterparts across different loan categories. Differences in loan growth are more evident for commercial real estate (CRE), residential real estate (RRE) and small business loans, whereas the lending path for consumer and industrial (C&I) and consumer loans look similar between the two groups of banks.

Differences in loan growth may be explained by factors beyond regulation and stress tests such as changes in business models, credit quality, risk aversion, and different crisis experience. Moreover, faster loan growth by smaller banks in general is not new. On the one hand, these banks also had faster growth rates between 2001 and 2006 (Vojtech, 2017). On the other hand, given their complexity and interconnectedness, CCAR banks had more fragile funding structures and vulnerable balance sheets, and faced significantly larger loan and securities losses than non-CCAR banks during the financial crisis. This crisis experience may have reshaped CCAR banks' business models and thus may have moderated their loan growth in the post-crisis period even in the absence of new regulations or heightened supervision. Furthermore, slower loan growth at some large banks and across certain loan types may be consistent with the macroprudential objective of having banks internalize whether the loans that they are extending remain sustainable through an economic downturn. As we show below, after accounting for these additional factors we do not find systematic evidence that supervisory capital stress tests unduly restrict bank credit supply.

### 3. Related literature

Our paper is related to the two strands of the literature studying the relationship between bank capital and lending. The first strand considers the impact of minimum capital requirements on bank credit supply.

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<sup>5</sup> As Liang (2017) points out, a current practice within the Fed's stress tests that may prevent this unintended risk from materializing is that supervisory scenarios with salient risks vary over time.

Empirical work in this literature finds that changes in minimum capital requirements reduce bank lending (Brinkmann and Horvitz 1995, Peek and Rosengreen 1997, Gambacorta and Mistrulli 2004, Aiyar, Calomiris, and Wieladek 2014, Mésonnier and Monks 2015, and Berrospide and Edge, 2017). Estimates of the impact of a one percentage point increase in capital requirements on loan growth over a one-year horizon range widely and show reductions in lending between 1 to 10 basis points and/or changes in interest rates faced by borrowers of between +3 and -15 basis points. The second strand considers the impact of bank capital more generally on lending. Empirical papers in this strand of the literature find a positive relationship of bank capital (and capital ratios) on lending, though the estimates of the size of the effect are also less clear. For example, Bernanke and Lown (1999) find sizable effects for the lending of U.S. banks in the early 1990s, whereas Francis and Osborne (2009) for U.K. banks and Berrospide and Edge (2010), and Carlson, Shan, and Warusawitharana (2013) for U.S. banks find modest effects using more recent data.

The implication of the positive impact of capital on loan growth is consistent with the former result of a negative effect of higher capital requirements as raising capital requirements relative to existing capital ratios would lower lending, all else equal. Thus, combining these strands of research, the important financial stability implication is that banks with large buffers of capital relative to their regulatory minimums are most likely to maintain credit supply through a downturn. Ensuring that banks maintain a buffer over the regulatory minimum even during a protracted and severe downturn is precisely the goal of the stress tests.

More recent empirical papers in this literature take advantage of the availability of micro, loan-level data of the largest U.S. BHC collected for supervisory purposes. Calem, Correa, and Lee (2017) study the impact of prudential policies on the credit supply of U.S. banks. In particular, they examine the impact of CCAR stress tests on the jumbo mortgage market, the impact of the interagency guidance on leverage lending (IGLL), and the follow-up publication by supervisors of Frequently Asked Questions (FAQ) on the guidance related to syndicated loan markets. They find that the 2011 CCAR stress test exercise reduced jumbo mortgage originations and approval rates, possibly due to the generally-weak capital positions at CCAR banks. Their findings indicate that while the IGLL, which sets minimum standards for safe and sound practices of supervised institutions, had no impact on speculative-grade loan originations, the publication of the FAQs in 2014 led to a significant decline in banks' originations of speculative loans.

On a similar vein, Berrospide and Edge (2017) examine the impact of the U.S. post-crisis regulatory reform on the lending of both BHCs subject to the Basel III capital standards and the largest BHCs subject to the CCAR stress tests. Using matched firm-level data across the largest banks to separate the impact of credit supply shocks implied by the supervisory stress tests from loan demand changes at

the firm level, they find that the unanticipated reduction in regulatory capital implied by the stress tests, made public for the first time in the 2012 CCAR exercise, led to a significant reduction in C&I lending. Similarly, and using a separate analysis on smaller banks subject to Basel III capital rules, they find that the reduction in capital implicit in the announcement of Basel III rules in June 2012 and July 2013 led to a reduction in lending across multiple loan categories.

Our paper is also related to recent work analyzing specifically the impact of stress tests on bank lending. Acharya, Berger and Roman (2017) study the lending implications of the U.S. supervisory stress tests. Using micro-level data for syndicated loans, the authors find that stress-tested banks reduce credit supply to manage their credit risk. The effect seems stronger for riskier borrowers, safer banks, banks that pass the stress tests, and the earlier stress tests. Similarly, using micro-level data from syndicated loan markets Chu, Zhang, and Zhao (2017) find a positive relationship between bank capital and lending. Our paper also examines the lending implications of the Fed's stress tests but rather than looking at banks that pass or fail the stress tests, we examine the implications of the higher capital implied by the stress test relative to the level of capital in the banks' own stress tests. Another important difference with their paper is that we follow a broader approach by studying the lending implications of stress tests on different loan categories.

Another closely related work to ours is the recent research note by The Clearing House (TCH), which also considers the impact of the Fed's stress tests on bank lending and argues that the stress tests impose granular capital requirements that force banks to curtail and distort the provision of credit. The note points specifically to adverse effects of the stress tests on residential mortgages and small business loans. The TCH note derives implicit risk weights for different asset classes by comparing the post-stress capital ratios produced by the supervisory stress tests and the banks' own stress tests. However, this interpretation of the post-stress capital ratios as implicit risk weights for individual loan categories fails to account for the differential revenue generated by different loan categories. We also compare post-stress capital ratios between the Fed's and the banks' stress tests to construct a measure of the extra capital (capital gap) that banks have to hold to meet the capital requirements implied by the stress test exercise. Our findings, however, suggest that the larger capital implied by the stress tests, rather than restraining, may actually be boosting bank lending for certain types of loans. Unlike the TCH note, we examine the determinants of bank loan growth across different loan categories and account for differences in risk characteristics. This omission on the TCH note could be particularly problematic for their conclusion on residential mortgage lending since part of the reduction in residential mortgage lending may be explained by conservative lending practices in light of remaining credit quality issues, given that a number of banks still face large delinquency rates on legacy portfolios of mortgages during our sample period.



## 4. Methodology

### 4.1 Regulatory capital ratios in the absence of stress tests

As noted above, we assess the impact of stress tests on BHC lending by developing a counterfactual aimed at answering the following question: What would regulatory capital ratios look like in the absence of the supervisory stress tests? Because stress testing has become a best practice in risk management, we assume that banks would still be required by regulators to run their own stress tests and to use the results in their risk management framework. According to claims in recent commentary from politicians and banking industry representatives, the banks would indeed heed the capital ratios determined by the banks' own models.<sup>6</sup> To maintain comparability, we use the results of the bank-run stress tests using the Fed's CCAR scenarios.

Thus, using publicly available data, we construct the counterfactual by comparing the minimum capital ratios in the supervisory and the BHC's own stress test exercises.<sup>7</sup> We call this difference the "capital gap". This capital gap can be thought of as the regulatory capital buffer (e.g. extra capital) that each BHC holds over the capital estimated using their models, as a result of the supervisory stress tests being more stringent.<sup>8</sup> Thus, the capital gap represents the capital ratio that banks would hold if no supervisory stress testing were required. The counterfactual, that is, the capital ratios in the absence of the Fed's stress tests, is then calculated as the difference between the actual capital ratio (Common Equity Tier 1 or CET1 capital ratio) at the start of the stress test exercise and the capital gap.

Figure 3 illustrates the calculation of the capital gap for the CCAR banks. The top left chart shows the average drop in the CET1 capital ratio implied by both the supervisory and the BHC's own exercises. As shown in the figure, the supervisory exercise seems more severe as, on average, the implied capital drop is larger than in the banks' stress tests, or equivalently, banks estimate higher post-stress CET1 ratios in their exercise. The capital gap (CET1 gap), shown as the red bar, is the difference between the minimum ratios in the supervisory and the BHC's exercises. The chart on the top left depicts the distribution of the CET1 gap for the CCAR banks between 2015 and 2016. The capital gap is relatively

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<sup>6</sup> For example, during Chair Yellen's Congressional Testimony on February 14, 2017, Senator Toomey argued that CCAR may be somewhat duplicative considering that banks do their own stress testing.

<sup>7</sup> Notice that the minimum capital ratios in both exercises are comparable as they are both intended to meet the DFA requirements. For example, in the Fed's exercise and the BHC's exercise capital ratios are calculated using the same individual capital distribution assumptions (e.g. DFAST) under the same supervisory scenarios published by the Federal Reserve.

<sup>8</sup> Flannery, Hirtle, and Kovner (2016) use a relatively similar idea of a gap between the Federal Reserve's and each BHC's projected loan losses and pre-tax net income. Using data between 2013 through 2015, they report insignificant coefficients in a regression of the growth rate of different loan categories on these gap measures.

small, about 0.8 percentage points (0.9 of RWAs). Notice also that the capital gap is negative for some banks, which means that for these banks the minimum capital in the Fed’s exercise is larger, or equivalently, that banks project higher capital losses than the losses in the supervisory stress tests.

The bottom left panel of Figure 3 shows the capital drop implied by the non-CCAR bank’s own stress tests. The reduction in capital is smaller for non-CCAR banks (about 2 percentage points relative to 2.9 percentage points for CCAR banks). By construction, the capital gap for these banks is zero as they are not subject to the supervisory stress tests.

Figure 4 shows the counterfactual capital ratios for the average CCAR bank over time. In these charts, the blue line is the actual capital ratio and the orange line is the counterfactual capital, that is, the difference between the two is the capital gap. Thus, if banks were subject only to their own stress test results, this counterfactual indicates that their capital ratios could have been lower during earlier years though capital ratios have converged over time.<sup>9</sup>

Next, we turn to the question of whether the capital gap is restricting bank lending.

## 4.2. Empirical analysis

We follow two approaches to study the impact of supervisory stress tests on bank loan growth. First, we compare the historic path of loan growth of banks subject to the supervisory stress test exercise (CCAR banks) and banks not subject to the exercise (non-CCAR banks, our control group) using both a balanced panel of about 90 banks and also a restricted subsample of banks that is more homogeneous (BHCs with size between \$20 and \$200 billion). We conduct this analysis for multiple loan categories: total, commercial and industrial (C&I), commercial real estate (CRE), residential real estate (RRE), small business, and consumer loans. Second, we study the loan growth within the CCAR banks and study whether banks with a larger capital gap restrict their lending more than banks with smaller capital gaps. As in the first part, we conduct this analysis for multiple loan categories.

In both cases we employ the following panel regression specification, which is common in the empirical literature on the impact of bank capital on lending:

$$\Delta \text{Log}(\text{Loan})_{it} = \alpha_0 + \alpha_1 T + \alpha_2 \text{BHC}_i + \alpha_3 \text{Capital Ratio}_{it-1} + \alpha_4 \text{Capital Gap}_{it-1} + \alpha_5 X_{it-1} + \varepsilon_{it} \quad (1)$$

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<sup>9</sup> Studying the reasons for such convergence is beyond the scope of this paper. For that purpose, see Hirtle and Kovner (2014).

The dependent variable is the annual growth rate of loans of BHC  $i$  in year  $t$ , expressed as a function of bank capital (e.g. regulatory capital ratios) and other bank controls. To address the concern of whether stress tests may restrict loan growth we employ our counterfactual and decompose the actual regulatory capital ratio into the *Capital Ratio* (CET1 ratio) of each BHC at the beginning of the stress test (according to their own models) and the *Capital Gap*, also measured at the beginning of the stress test exercise. These two are the main variables of interest in our analysis. We include lagged bank-specific controls in vector  $X_{i,t-1}$ , which include size (log of total assets), the ratio of nonperforming loans to total loans (and, alternatively, net charge-offs to total assets ratio), return on assets (ROA), and the share of deposits in total assets. In our first approach, we also include both bank fixed effects to account for time-invariant and unobserved heterogeneity across banks and time dummies (T) to account for time effects in lending, such as seasonal effects or any other macroeconomic changes that affect all banks equally and simultaneously (e.g. loan demand changes), respectively.

Notice that we use roughly the same regression specification to study loan growth determinants across different loan categories. This may be a limitation as other factors specific to each loan type may not be captured in our regression analysis and this may lead to potential omitted variable problems. Bank fixed effects should help ameliorate this concern, in cases where banks specialized in different loan types. Some bank controls in the regression such as the nonperforming loan ratio (and net charge-offs ratio) are calculated for different loan categories, which also helps to alleviate the concern.

Notice also that in our first approach the capital gap is zero for non-CCAR banks and thus captures the impact of supervisory stress tests on loan growth. In our second approach, we exploit the heterogeneity in the capital gap measure to capture the impact of the severity of the supervisory stress tests on individual CCAR-banks. Our regression analysis under this approach is somewhat constrained by the number of observations as we have data for about 30 BHCs during 4 years (about 102 observations). For that reason, our specification will still include year fixed effects but not firm fixed effects.

We expect a positive coefficient on the capital ratio and a negative coefficient on the capital gap if the claims that stress tests may be restricting bank lending are correct.

### **4.3 Data and Summary Statistics**

We use publicly available data for our empirical analysis. We collect annual balance sheet information from regulatory filings (FR-Y9C) for BHCs with total assets of at least \$10 billion, as these are the firms subject to stress tests requirements mandated by the Dodd Frank Act. We combine this information with data on both supervisory stress tests results from the Federal Reserve's DFAST disclosure documents for

2013 through 2016, and bank's own stress tests results for both CCAR and non-CCAR banks.<sup>10</sup> We control for mergers and acquisitions and also winsorize our data at the 1st and 99th percentiles to deal with potential outliers. After some data cleaning we end up with 288 observations for 91 BHCs.<sup>11</sup>

Table 1 provides summary statistics for the variables in our regression analysis and for 31 CCAR and 60 non-CCAR banks. As seen in this table, CCAR banks are the largest and most complex U.S. BHCs (about \$500 billion in total assets for the median bank). Compared to their non-CCAR counterparts, CCAR banks hold slightly smaller capital ratios (CET1 capital ratio) and on average exhibit smaller annual loan growth rates (measured as the log change in outstanding amounts) in total loans (5 percent versus 10 percent) and across different loan categories. The average CCAR bank also exhibits larger net charge-offs (0.43 percent) than non-CCAR banks (0.27 percent) and lower share of deposits funding total assets (61 percent) relative to their non-CCAR counterparts (75 percent). There are not significant differences between the two groups in terms of liquid assets and return on assets (ROA).

#### 4.4 Univariate Analysis

We start investigating the impact of stress tests on the lending of banks by comparing the annual loan growth between 2013 and 2016 for different loan categories: commercial and Industrial (C&I), commercial real estate (CRE), residential real estate (RRE), small business, and consumer loans for both CCAR and non-CCAR banks and also by splitting them into groups based on complexity measures and existing regulatory capital ratios.

Table 2 shows these results. The top left panel shows the comparison between the CCAR banks and non-CCAR banks. Non-CCAR banks have slightly higher capital ratios than CCAR banks and the growth rate of total loans for these banks doubles that of their CCAR counterparts, a statistically significant difference. The non-CCAR banks also exhibit faster growth in each of the disaggregated loan categories, consistent with Figure 2, but these differences in loan growth are not statistically significant. Thus, the more highly capitalized regional banks exhibited faster loan growth.

The other 3 panels in Table 2 examine loan growth differences across different bank groups within the 31 CCAR banks. The top right panel compares the average loan growth rates between the

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<sup>10</sup> Supervisory stress tests results (DFAST) are available at the Federal Reserve's website: <https://www.federalreserve.gov/supervisionreg/dfa-stress-tests.htm>. Despite the fact that we refer to banks subject to the supervisory stress tests as CCAR BHCs, we use DFAST and not CCAR post-stress capital ratios as banks only disclose publicly their DFAST capital ratios. Furthermore, we restrict our analysis to this four-year period as DFAST results have been publicly available only since 2013.

<sup>11</sup> Of the 33 CCAR BHCs in 2016, we exclude 2 custodian banks with minimal lending exposures.

global systemically important banks (GSIB) and the non-GSIB banks that are subject to CCAR. This comparison is motivated by the higher capital requirements applied to GSIBs outside of the CCAR process, in order to illuminate any differences that might arise from those policies independently of the stress test regime. Indeed, GSIB banks have built up larger regulatory capital ratios than the non-GSIB banks. The GSIB BHCs lend more across all of different categories of loans to nonfinancial businesses and households (core loans), though the differences in growth rates range between 1.5 and 7.1 percentage points and are not statistically significant.<sup>12</sup>

The bottom left panel compares the average loan growth of CCAR banks grouped by their complexity into advanced and non-advanced approach banks. The former group, which includes the GSIBs as well as a handful of other banks with total assets greater than \$250 billion or foreign assets greater than \$10 billion, are subject to stricter capital and liquidity regulation compared to non-advanced approach banks, and they exhibit higher capital ratios on average. Advanced approach banks also seem to lend more across different loan categories. In particular, these banks exhibit significantly larger growth rates on C&I loans (12 percent versus 8 percent) and CRE loans (13 percent versus 7 percent) relative to their peers. Finally, the bottom right panel compares the average loan growth of CCAR banks grouped by the amount of their regulatory capital into high versus low CET1 capital ratios. Banks with higher CET1 ratios tend to lend more across all the loan categories, though the difference in loan growth is only significant for CRE loans.

In short, our univariate analysis suggests that more highly capitalized banks experience faster loan growth. BHCs subject to the stress tests (CCAR banks) have lower capital ratios on average than their non-CCAR counterparts and exhibit smaller annual loan growth, though the difference in growth rates for the average bank across all loan categories is not significant. However, among CCAR banks, both the largest banks, which are required to meet the GSIB capital surcharges, and those banks with the highest capital ratios have higher average annual loan growth than other CCAR banks. The difference in annual growth rates is significant for some loan categories such as CRE and marginally significant for C&I or RRE.

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<sup>12</sup> Other loans such as loans to depository and nondepository financial institutions, loans to foreign governments, and lease financial receivables are excluded. This helps explain the divergence between total loan growth and loan growth across all the loan categories we consider.

## 5. Econometric Results

### 5.1 Comparing loan growth between CCAR and Non-CCAR banks

Table 3 presents our regression results following our first approach, that is, for all BHCs in our sample using 4 different extensions of specification (1) for total loans and across different loan categories. As noted above, all specifications include year and bank fixed effects. All explanatory variables enter the regression specification with a lag, that is, they are measured as of December of the previous year of the stress test exercise. For each loan category, column (1) includes the impact of the capital ratio (CET1 ratio) only. Column (2) uses the counterfactual and decompose the impact of the capital ratio into the adjusted CET1 ratio (estimate of the level of capital in the absence of stress tests) and the capital gap. As discussed in section 4, the capital gap varies across CCAR banks and is zero for non-CCAR banks, and thus captures the impact of the stress tests. Columns (3) and (4) add bank-specific controls to the variables in Column (2): size, the non-performing loan ratio (90-day past due and non-accrual loans over loan), the deposits-to-assets ratio, and return on assets (ROA).

In all specifications, the CET1 capital ratio enters the regression with the expected positive sign and is significant for total loans, CRE, and consumer loans. More importantly, in columns (2) through (4) the impact of the capital gap is either negative and insignificant or positive for all types of loans. The impact of the capital gap is negative and insignificant for total loans, and, within specific loan categories, also negative and insignificant for RRE and small business loans. In contrast, the coefficient on capital gap is positive and marginally significant for CRE, and is positive and strongly significant (at the 1 percent level) for consumer loans. Thus, the higher capital buffers implied by the supervisory stress tests seem to be spurring lending in those categories without hindering lending in other categories.

Furthermore, bank controls such as size, non-performing loans and deposits are also significant for different loan categories in all specifications. Thus, the larger loan growth rates for non-CCAR banks relative to the CCAR banks seem to be explained by factors beyond just the stress tests. These factors, captured by time fixed effects and bank controls in our regression analysis, include loan demand, risk aversion, credit quality, and funding sources, which also capture differences in bank business models.

We interpret these results as empirical evidence against the claims by some that stress testing unduly restricts loan growth. Our evidence also confirms previous findings in the literature that BHCs with higher capital ratios, all else equal, experience higher loan growth across different loan categories. Furthermore, consistent with previous results in the literature, we find economically modest effects of higher capital ratios. Using our estimates in column (4) of Table 3 for total loans, our findings suggest that a 1 percentage point increase in CET1 capital ratios (e.g. from 12 to 13 percent for the average banks)

leads to a 0.4 percentage point increase in total annual loan growth (e.g. from 8 to 8.4 percent for the average bank). The effect seems significantly larger for consumer loans (about 6 percentage points).

One potential drawback in this analysis is that the CCAR and non-CCAR bank comparison may be less relevant for the largest CCAR banks. In other words, the CCAR bank group includes the largest and most complex banks (e.g. GSIB), whose size and business models are very different than those of the smaller and less complex non-CCAR banks. In order to alleviate this concern, we extend our analysis by looking only at the subset of banks that are most similar in size and business models, that is, the sample of BHCs with total consolidated assets between \$20 and \$200 billion.<sup>13</sup>

Table 4 shows the regression results for this restricted sample of BHCs using specification (1) across different loan categories. Unlike Table 3, and given the low number of observations in the restricted sample, we only include year fixed effects. The results are quantitatively and qualitatively similar to those in Table 3. As before, the coefficient on CET1 capital ratios is positive across all specifications and statistically significant for total, CRE and consumer loans. The coefficient on the capital gap is negative but insignificant for C&I loans, positive for all other loan categories, and significant for CRE and consumer loans. Thus, the capital buffer implied by more stringent supervisory stress tests relative to the BHC's own stress tests seems to be boosting bank lending for certain loan categories such as CRE and consumer loans. Interestingly, for these more comparable bank groups, the loan growth across different loan categories seems to be significantly explained by bank controls such as size, nonperforming loans, and deposits. This finding confirms that other factors beyond just the stress tests such as differences in risk aversion, credit quality, and funding sources, seem to better account for the slower loan growth at CCAR banks than supervisory or regulatory capital ratios. In particular, measures of credit quality such as the non-performing loan ratio are negative and strongly significant and appear to be the most important determinant of the annual growth of RRE and small business loans.<sup>14</sup> This finding is consistent with the idea that RRE growth is affected by each bank's crisis experience. As shown in the left chart of Figure 5, delinquency rates on mortgage loans remain elevated at CCAR banks, and that seems to discourage higher RRE loan growth.<sup>15</sup> Furthermore, higher loan growth rates for CRE loans at smaller non-CCAR banks than larger banks are not new. For example, as shown in the right chart

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<sup>13</sup> We repeat the analysis using other size thresholds such as \$20 to \$150 billion, \$30 to \$150, and \$30 to \$200 billion and obtain qualitatively similar results.

<sup>14</sup> We obtain similar results if instead of the non-performing loan ratio we use the ratio of net charge-offs to total assets as an alternative measure of credit quality in our regression specification.

<sup>15</sup> Beyond higher delinquency rates on mortgage loans, mortgage repurchases due to breaches of warranties and representations associated with mortgage securitization around the times of the financial crisis seem to add downward pressure on RRE loan growth. See Vojtech (2017).

of Figure 5, cumulative growth for CRE loans banks (red line) had been larger at non-CCAR between 2001 and 2006.

### **Loan growth among CCAR banks**

In our second approach, we focus on CCAR banks only and exploit the heterogeneity in the CET1 capital gap to study whether supervisory stress tests restrain loan growth. The main idea behind this analysis is that even among banks subject to the supervisory stress tests, the difference in minimum capital ratios between BHCs' stress tests and the Fed's stress tests convey information about the severity of the stress tests on individual banks and thus also captures the differential impact of the stress tests on individual banks' lending decisions.

Table 5 shows the regression results for the sample of 31 CCAR banks, again using specification (1) across different loan categories. As in Table 4, given the restricted number of observations for this sample, we only include year fixed effects to control for loan demand changes. The positive and significant coefficient on the CET1 ratio for total loans and for some loan categories such as C&I and CRE, suggests as before that among the largest and most complex institutions, banks with higher capital ratios lend more. Our results suggest that a 1 percentage point increase in CET1 ratio for CCAR banks leads to about 0.5 percentage point higher annual growth rate of total loans. The effect is larger for C&I, CRE, and consumer loans (between 1 and 1.5 percentage points). Interestingly, we find a more uniformly positive coefficient on the capital gap (CET1 gap) for the sample of CCAR banks than for the broader sample across the different loan categories. The coefficient on the capital gap is positive and significant for C&I, CRE and consumer loans, which indicates that even when supervisory stress tests results are more stringent than BHC-own stress tests results, loan growth tends to be higher all else equal.

Using the estimates in column (4), our results suggest that 1 percentage point increase in the extra capital implied by the stress tests increases C&I loan growth by about 2 percentage points, CRE loans by about 4 percentage points, and consumer loans by about 6 percentage points. Among CCAR banks, bank-specific characteristics such as size, non-performing loans, deposits, and ROA, which capture differences in bank risk aversion, credit quality, and funding sources seem also important explanatory variables for the annual growth rate of different loan categories.

Using our estimated coefficients on the capital gap in column (4), we calculate the impact on the dollar amount of lending if the CCAR banks were allowed to hold regulatory capital ratios according to their own models, that is, in the absence of the supervisory stress tests. In that situation, given that banks held lower capital, loan growth would decline by about \$15 billion in C&I lending and by about \$14 billion in CRE lending. Put together, our analysis provides evidence against the arguments that funding



loans with additional capital in order to satisfy the requirements of supervisory stress tests is restricting lending.

### 5.3 Effect of Capital on Lending Standards

One channel through which higher capital requirements or the stringency of the stress tests could affect loan growth is through changes in lending standards. That is, the policies that banks apply to their decisions to approve credit for households and business, such as credit score cutoffs, documentation requirements, and guarantor requirements. Since 2010, the July edition of the Federal Reserve's SLOOS has included a set of questions in which banks are asked to provide, for a range of loan categories, the current level of their lending standards relative to the tightest or easiest they have been since 2005.

These responses take one of 7 values: 1) easiest, 2) significantly easier than the midpoint, 3) somewhat easier than the midpoint, 4) about at the midpoint, 5) somewhat tighter than the midpoint, 6) significantly tighter than the midpoint, 7) tightest. Due to the relatively few responses in the tightest and easiest baskets for most loan categories, categories 1 and 2 are combined, as are categories 6 and 7, for a total of 5 categories. We use these ordinal response as the dependent variable in a set of ordered logit regressions and test for whether the capital gap affects the level of lending standards. The categories change slightly from year to year, but consistent series exist for 12 different loan categories, including, non-investment-grade syndicated loans, small business loans, three types of commercial real estate loans (construction and land development, backed by nonfarm, nonresidential properties, backed by multifamily properties), prime jumbo residential mortgages, home equity loans and lines of credit, credit cards (prime and subprime), auto loans (prime and subprime), and other consumer loans. In addition to the CET 1 ratio and the capital gap, the regressions include bank and year fixed effects, the ratio of nonperforming loans to total loans for the associated category, and the reported average change in demand over the preceding year for that bank and that loan category from SLOOS.

The left panel of Table 6 reports the marginal effect on the probability of being in each of the five categories of lending standard stringency defined above of a 1 percentage point increase in the capital gap. For most loan categories listed above, the effect of the capital gap on lending standards is not statistically significant. However, for two categories of C&I loans—leveraged syndicated loans and small business loans—a larger capital gap is associated with a significantly higher probability of having standards that are easier than the midpoint since 2005, and a significant lower probability of having standards that are tighter than the midpoint. For instance, a 1 percentage point increase in the capital gap is associated with a nearly 10 percentage point increase in the probability that the bank has eased its lending standards. The only other category where a statistically significant relationship exists between the capital gap and lending standards, subprime auto lending, shows a similar pattern.

These regressions can also reinforce the restraining effect of a legacy portfolio of nonperforming loans on certain types of lending, especially residential mortgages. As shown in the right panel of the table, a larger ratio of nonperforming mortgage loans to total mortgage loans held by a bank is associated with a higher probability of maintaining standards for mortgage loans that are tighter than the midpoint and a lower probability of having standards for such loans that are easier than the midpoint.

The exercise can also be conducted at the aggregate level using an index of the quarterly changes in standards across all loan categories, as in Bassett et al. (2014). Both the levels and the changes in standards can convey important independent information about the state of credit availability (Bassett and Rezende, 2015). We run a regression of the average change in the index of standards over the year following the stress tests on the capital gap and other controls (bank and time fixed effects, the CET1 ratio, an analogous index of demand, and ratio of total nonperforming loans to total loans). As shown in Table 7 a higher capital gap is associated with a statistically insignificant tightening in lending standards over the subsequent year. Once again, the statistically significant effect of nonperforming loans in driving the tightening of lending standards is evident.

In short, we find no evidence that the extra capital implied by the results of the supervisory stress tests (capital gap) is causing banks to tighten their lending standards. If something, the results seem to suggest that relative to their non-CCAR counterparts, CCAR banks tend to ease their lending standards on some loan categories.

## 5.4 Discussion

Our results are consistent with previous findings in the academic literature supporting the view that higher capital is positively associated with stronger loan growth. Our interpretation is that the higher capital buffers that result from the new regulatory framework, which make banks safer and more resilient, altogether put banks in a better position to lend more, at least for some loan categories.

We argue that the loan growth differences for loan categories such as RRE, CRE and small business loans between CCAR and non-CCAR banks observed in the data seem to be explained by factors beyond the stress tests. After we account for those factors (e.g., loan demand and bank specific characteristics such as risk aversion, credit quality, and funding sources) we do not find systematic evidence that the capital calculations associated with the supervisory stress tests explain the loan growth differences. Moreover, part of the slower loan growth at some CCAR banks and across certain loan categories may reflect the goal of the post-crisis regulatory reform to limit the buildup of systemic risks in the financial sector by better incentivizing banks to develop lending operations that are sustainable through an economic downturn. Our findings of the impact on lending standards are also consistent with

little change in credit availability as a result of stress testing as banks with higher a capital gap tend to maintain the same, or in some cases easier lending standards across loan categories.

A typical concern in the approach we follow to identify the impact of capital regulation is the potential endogeneity issues in our identification strategy. We partially alleviate endogeneity issues by lagging our explanatory variables (e.g. using predetermined bank controls). One could argue that our capital gap measure is endogenous to the extent that banks adjust their behavior and try to mimic the stress testing exercise over time. Figure 4 shows the potential learning and convergence of the regulatory capital ratio. We think that it is reasonable to interpret the capital gap as exogenous. The capital gap depends on differences between the Federal Reserve’s models—which are not fully disclosed—and the bank’s own models. Moreover, each year, the scenario includes an emphasis on different “salient risks” which are determined by the Federal Reserve and not revealed to banks until after the date for which stress test data are collected. Therefore, banks cannot adjust their portfolios in order to improve their performance on the stress tests by minimizing exposure to salient risks or by optimizing their portfolio to exploit specific modeling assumptions. Further, we believe the capital gap captures unanticipated effects because any learning takes time and convergence towards the Fed’s stress tests numbers may only be achieved over time.

Another endogeneity concern arises from the possibility that the positive correlation between bank capital (and the capital gap) and loan growth we observed in the data may be caused by shifts in loan demand, which we may fail to identify using bank-level data. For example, strong demand may lead banks to increase their lending and to look better capitalized at the same time if indeed the strong lending driven by higher loan demand comes with higher retained earnings that also increase banks’ capital positions. We believe that our analysis across different loan categories and the use of year fixed effects somewhat alleviates the endogeneity concern to the extent that shifts in loan demand are not correlated and thus are less likely to occur simultaneously across multiple loan categories. Using micro-level data on corporate C&I loans that match the CCAR banks with their borrowers, and following an approach similar to previous studies that use credit registry data to account for changes in loan demand, Berrospide and Edge (2017) also find strong positive effects of bank capital on lending. Similarly, using loan-level data from syndicated loan markets Chu, Zhang, and Zhao (2017) find a positive relationship between bank capital and lending. This empirical evidence conforms to our results and provides additional validation for the identified effects in our study.

## 6. Concluding remarks

We study the impact of the Federal Reserve's stress tests on the lending of U.S. BHCs. Motivated by recent claims by various stakeholders, we address the question of whether the annual supervisory stress tests may be causing an unwarranted reduction in bank credit, or changing the allocation of loans in unintended ways. To quantify the impact of the supervisory stress tests, we construct a measure of the extra capital implied by the supervisory stress tests relative to the banks' own models (capital gap). We find no systematic evidence that the capital gap may be constraining bank loan growth or causing bank to tighten their lending standards.

Although loan growth at CCAR banks has been slower than loan growth at their non-CCAR counterparts, growth differences observed in the data seem to be driven by factors beyond the stress tests such as loan demand, credit quality, and tolerance for risk. After controlling for these factors we find that the capital gap is positively related to the growth of certain loan categories such as CRE and consumer loans. Furthermore, consistent with previous results in the bank capital literature, we find that more capital is associated with higher loan growth. We interpret our results as evidence that the increased level of capital and the higher capital buffers brought by the post-crisis regulatory reform, which make banks safer and more resilient, altogether put banks in a better position to lend more.

## References

- Acharya, V., Berger, A. and R. Roman (2017). "Lending Implications of U.S. Bank Stress Tests: Costs or Benefits?" Working Paper.
- Aiyar, S., Calomiris, C.W., and T. Wieladek (2014). "Does Macro-Prudential Regulation Leak? Evidence from a UK policy experiment," *Journal of Money, Credit, and Banking* 46(1), 181-214
- Bassett, W.F. and M. Rezende (2015). "Relation between Levels and Changes in Lending Standards Reported by Banks in the Senior Loan Officer Opinion Survey on Bank Lending Practices," FEDS Notes 2015-01-16. Board of Governors of the Federal Reserve System.
- Bassett, W. F., M. B. Chosak, J. C. Driscoll, and E. Zakrajsek (2014). "Changes in Bank Lending Standards and the Macroeconomy," *Journal of Monetary Economics*, vol. 62, 23-40.
- Bahaj, S. and F. Malherbe (2016). "A Positive Analysis of Bank Behaviour Under capital Requirements," CEPR Discussion Paper No. DP11607. Available at SSRN: <https://ssrn.com/abstract=2865877>
- Bernanke, B., and C. Lown (1991). "The Credit Crunch." *Brookings Papers on Economic Activity* 2, 205-247.
- Berrospide, J. M., and R. M. Edge (2010). "The Effects of Bank Capital on Lending: What Do We Know, and What Does it Mean?" *International Journal of Central Banking* 6 (4), 5-54.
- Berrospide, J. M., and R. M. Edge (2017). "The Effects of Bank Capital Requirements on Lending". Working Paper. <https://www.aeaweb.org/conference/2017/preliminary/1773?page=3&per-page=50>
- Brinkmann, E. and Horvitz, P. (1995). "Risk-based capital standards and the credit crunch," *Journal of Money, Credit, and Banking* 27, 848-863.
- Calem, P., Correa, R., and S.J. Lee (2016). "Prudential policies and their impact on credit in the U.S.," *International Finance Discussion Papers* 1186. Board of Governors of the Federal Reserve System. <https://www.federalreserve.gov/econresdata/ifdp/2016/files/ifdp1186.pdf>
- Carlson, M., H. Shan, H. and M. Warusawitharana (2013). "Capital ratios and Bank Lending: A Matched Bank Approach," *Journal of Financial Intermediation* 22, 663-687.
- Chu, Y., Zhang, D. and Zhao, Y. (2017). "Bank Capital and Lending: Evidence from Syndicated Loans" Working Paper. <https://ssrn.com/abstract=2462377>

Flannery, M., Hirtle B., and A. Kovner (2016) “Evaluating the information in the Federal Reserve Stress Tests,” Federal Reserve Bank of New York Staff Report No. 744.

Francis, W., and M. Osborne (2009). “Bank Regulation, Capital and Credit Supply: Measuring the Impact of Prudential Standards,” Occasional Paper No. 36, UK Financial Services Authority, London, UK.

Gambacorta, L. and P.E. Mistrulli (2004). “Does bank capital affect lending behavior?” *Journal of Financial Intermediation* 13, 436-457.

Hirtle, B. and A. Lehnert (2015). “Supervisory Stress Tests” *The Annual Review of Financial Economics* 7, 339-55.

Hirtle B, and A. Kovner (2014). “Comparing bank and supervisory stress test projections.” Liberty Street Economics Blog, <http://libertystreeteconomics.newyorkfed.org/2014/01/comparing-bank-and-supervisory-stress-testing-projections.html>

Liang, Nellie (2017) “Higher Capital is not a substitute for stress tests” The Brookings Institution.

Mésonnier, J.S. and A. Monks, (2015). “Did the EBA Capital Exercise cause a credit crunch in the Euro Area?” *International Journal of Central Banking* 11(3), 75-117.

Peek, J. and E. Rosengren (1995). “Bank Regulation and the Credit Crunch,” *Journal of Banking and Finance* 19, 679-692.

Peek, J. and E. Rosengren (1997). “The International Transmission of Financial Shocks: The Case of Japan,” *American Economic Review* 87, 495-505

Tarullo, Daniel (2014) “Stress Testing after Five Years” Remarks at the Federal Reserve Third Annual Stress Test Modeling Symposium.

The Clearing House (2017) “The capital allocation inherent in the Federal Reserve’s capital stress test” [https://www.theclearinghouse.org/media/tch/documents/tch%20weekly/-2017/20170130\\_tch\\_research\\_note\\_implicit\\_risk\\_weights\\_in\\_ccar-final.pdf?la=en](https://www.theclearinghouse.org/media/tch/documents/tch%20weekly/-2017/20170130_tch_research_note_implicit_risk_weights_in_ccar-final.pdf?la=en)

Vojtech, Cindy (2017). “Post-Crisis Lending by Large Bank Holding Companies” FEDS Notes, 2017-07-06. Board of Governors of the Federal Reserve System. <https://www.federalreserve.gov/econres/notes/feds-notes/post-crisis-lending-by-large-bank-holding-companies-20170706.htm>

**Table 1: Summary Statistics**

| BHC      | Variable                           | Obs. | Mean  | Median | Std. Dev. | Min.  | Max.   |
|----------|------------------------------------|------|-------|--------|-----------|-------|--------|
| CCAR     | Total loan growth                  | 102  | 0.05  | 0.04   | 0.09      | -0.24 | 0.42   |
|          | C&I loan growth                    | 102  | 0.10  | 0.09   | 0.14      | -0.16 | 1.08   |
|          | Commercial RE loan growth          | 98   | 0.10  | 0.07   | 0.16      | -0.25 | 0.78   |
|          | Residential RE loan growth         | 98   | 0.02  | -0.01  | 0.19      | -0.38 | 0.83   |
|          | Small Business loan growth         | 99   | 0.01  | -0.02  | 0.19      | -0.58 | 0.78   |
|          | Consumer loan growth               | 102  | 0.10  | 0.06   | 0.21      | -0.51 | 1.15   |
|          | Common Equity Tier 1 Capital ratio | 102  | 0.12  | 0.11   | 0.03      | 0.07  | 0.37   |
|          | Common Equity Tier 1 Capital GAP   | 102  | 0.01  | 0.01   | 0.01      | -0.03 | 0.04   |
|          | Total Assets (US\$ Billion)        | 102  | 503.4 | 158.8  | 691.8     | 55.5  | 2572.8 |
|          | Size                               | 102  | 19.30 | 18.88  | 1.14      | 17.83 | 21.67  |
|          | Non-performing loan ratio          | 102  | 0.02  | 0.02   | 0.01      | 0.00  | 0.07   |
|          | Chargeoff / Assets (percent)       | 102  | 0.43  | 0.28   | 0.45      | 0.00  | 2.00   |
|          | Deposit / Assets                   | 102  | 0.61  | 0.70   | 0.20      | 0.07  | 0.84   |
|          | Liq. Assets / Assets               | 102  | 0.28  | 0.24   | 0.12      | 0.14  | 0.67   |
|          | ROA                                | 102  | 0.01  | 0.01   | 0.01      | -0.03 | 0.04   |
| NON-CCAR | Total loan growth                  | 186  | 0.10  | 0.08   | 0.10      | -0.27 | 0.63   |
|          | C&I loan growth                    | 186  | 0.14  | 0.11   | 0.23      | -0.73 | 1.85   |
|          | Commercial RE loan growth          | 185  | 0.13  | 0.11   | 0.16      | -0.70 | 0.78   |
|          | Residential RE loan growth         | 186  | 0.06  | 0.04   | 0.19      | -0.38 | 0.94   |
|          | Small Business loan growth         | 185  | 0.03  | 0.01   | 0.19      | -0.58 | 0.78   |
|          | Consumer loan growth               | 184  | 0.11  | 0.08   | 0.32      | -1.03 | 1.15   |
|          | Common Equity Tier 1 Capital ratio | 186  | 0.13  | 0.12   | 0.05      | 0.06  | 0.53   |
|          | Common Equity Tier 1 Capital GAP   | 186  | 0.00  | 0.00   | 0.00      | 0.00  | 0.00   |
|          | Total Assets (US\$ Billion)        | 186  | 23.1  | 18.6   | 23.3      | 10.5  | 234.6  |
|          | Size                               | 186  | 16.80 | 16.74  | 0.46      | 16.17 | 19.27  |
|          | Non-performing loan ratio          | 186  | 0.02  | 0.01   | 0.02      | 0.00  | 0.12   |
|          | Chargeoff / Assets (percent)       | 186  | 0.27  | 0.11   | 0.46      | -0.12 | 3.14   |
|          | Deposit / Assets                   | 186  | 0.75  | 0.78   | 0.12      | 0.06  | 0.91   |
|          | Liq. Assets / Assets               | 186  | 0.27  | 0.23   | 0.13      | 0.02  | 0.60   |
|          | ROA                                | 186  | 0.01  | 0.01   | 0.01      | -0.02 | 0.16   |
| ALL      | Total loan growth                  | 288  | 0.08  | 0.07   | 0.10      | -0.27 | 0.63   |
|          | C&I loan growth                    | 288  | 0.12  | 0.10   | 0.20      | -0.73 | 1.85   |
|          | Commercial RE loan growth          | 283  | 0.12  | 0.09   | 0.16      | -0.70 | 0.78   |
|          | Residential RE loan growth         | 284  | 0.05  | 0.02   | 0.19      | -0.38 | 0.94   |
|          | Small Business loan growth         | 284  | 0.02  | 0.00   | 0.19      | -0.58 | 0.78   |
|          | Consumer loan growth               | 286  | 0.11  | 0.06   | 0.29      | -1.03 | 1.15   |
|          | Common Equity Tier 1 Capital ratio | 288  | 0.12  | 0.11   | 0.04      | 0.06  | 0.53   |
|          | Common Equity Tier 1 Capital GAP   | 288  | 0.00  | 0.00   | 0.01      | -0.03 | 0.04   |
|          | Total Assets (US\$ Billion)        | 288  | 193.2 | 25.7   | 470.9     | 10.5  | 2572.8 |
|          | Size                               | 288  | 17.69 | 17.06  | 1.43      | 16.17 | 21.67  |
|          | Non-performing loan ratio          | 288  | 0.02  | 0.01   | 0.02      | 0.00  | 0.12   |
|          | Chargeoff / Assets (percent)       | 288  | 0.33  | 0.16   | 0.46      | -0.12 | 3.14   |
|          | Deposit / Assets                   | 288  | 0.70  | 0.75   | 0.17      | 0.06  | 0.91   |
|          | Liq. Assets / Assets               | 288  | 0.28  | 0.24   | 0.13      | 0.02  | 0.67   |
|          | ROA                                | 288  | 0.01  | 0.01   | 0.01      | -0.03 | 0.16   |

**Table 2: Univariate Analysis**

**Average annual loan growth: 2013 - 2016**  
**All BHCs by CCAR status**

|                           | Non-CCAR     |              |              |
|---------------------------|--------------|--------------|--------------|
|                           | CCAR BHCs    | BHCs         | Difference   |
| Total loans               | 5.1%         | 10.2%        | -5.0% ***    |
| C&I                       | 9.8%         | 13.9%        | -4.1%        |
| CRE                       | 9.7%         | 12.5%        | -2.8%        |
| Residential RE            | 2.2%         | 5.8%         | -3.6%        |
| Small Business            | 1.1%         | 3.1%         | -2.0%        |
| Consumer                  | 9.9%         | 11.2%        | -1.3%        |
| <b>CET1 capital ratio</b> | <b>12.1%</b> | <b>12.7%</b> | <b>-0.7%</b> |

**Average annual loan growth: 2013 - 2016**  
**CCAR BHCS by GSIB status**

|                           | Non-GSIB     |              |             |
|---------------------------|--------------|--------------|-------------|
|                           | GSIB BHCs    | BHCs         | Difference  |
| Total loans               | 2.9%         | 5.7%         | -2.7%       |
| C&I                       | 11.9%        | 9.3%         | 2.6%        |
| CRE                       | 11.7%        | 9.2%         | 2.5%        |
| Residential RE            | 7.9%         | 0.8%         | 7.1%        |
| Small Business            | 3.3%         | 0.6%         | 2.7%        |
| Consumer                  | 11.1%        | 9.6%         | 1.5%        |
| <b>CET1 capital ratio</b> | <b>12.4%</b> | <b>12.0%</b> | <b>0.4%</b> |

**Average annual loan growth: 2013 - 2016**  
**CCAR BHCS by complexity**

|                           | Advanced Approach | Non-Adv. Approach | Difference  |
|---------------------------|-------------------|-------------------|-------------|
| Total loans               | 3.8%              | 6.2%              | -2.4%       |
| C&I                       | 12.4%             | 7.7%              | 4.7% *      |
| CRE                       | 13.4%             | 7.0%              | 6.4% **     |
| Residential RE            | 3.0%              | 1.6%              | 1.4%        |
| Small Business            | 1.1%              | 1.2%              | 0.0%        |
| Consumer                  | 8.9%              | 10.7%             | -1.8%       |
| <b>CET1 capital ratio</b> | <b>12.3%</b>      | <b>11.9%</b>      | <b>0.5%</b> |

**Average annual loan growth: 2013 - 2016**  
**CCAR BHCS by amount of regulatory capital**

|                           | High CET1 ratio | Low CET1 ratio | Diff.           |
|---------------------------|-----------------|----------------|-----------------|
| Total loans               | 8.8%            | 7.9%           | 0.9%            |
| C&I                       | 13.6%           | 11.3%          | 2.3%            |
| CRE                       | 14.1%           | 9.2%           | 4.9% ***        |
| Residential RE            | 6.1%            | 3.1%           | 3.0%            |
| Small Business            | 2.9%            | 2.0%           | 0.9%            |
| Consumer                  | 11.5%           | 9.9%           | 1.6%            |
| <b>CET1 capital ratio</b> | <b>15.1%</b>    | <b>9.9%</b>    | <b>5.2% ***</b> |

Note: Tables use the t-test of the differences in means. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%



**Table 3: Pooled OLS regressions with year fixed effects**  
**ALL BHCs with total assets > \$10 billion**

| Vars                  | Total Loans        |                    |                      |                      | C&I Loans        |                  |                   |                   | CRE Loans         |                   |                     |                      |
|-----------------------|--------------------|--------------------|----------------------|----------------------|------------------|------------------|-------------------|-------------------|-------------------|-------------------|---------------------|----------------------|
|                       | (1)                | (2)                | (3)                  | (4)                  | (1)              | (2)              | (3)               | (4)               | (1)               | (2)               | (3)                 | (4)                  |
| CET1 ratio            | 0.721**<br>[0.322] |                    |                      |                      | 0.297<br>[0.839] |                  |                   |                   | 1.082*<br>[0.593] |                   |                     |                      |
| CET1 ratio adj. (BHC) |                    | 0.718**<br>[0.320] | 0.426*<br>[0.244]    | 0.423*<br>[0.244]    |                  | 0.298<br>[0.841] | 0.309<br>[0.846]  | 0.375<br>[0.827]  |                   | 1.087*<br>[0.597] | 0.847<br>[0.542]    | 0.683<br>[0.519]     |
| CET1 Gap              |                    | -0.757<br>[1.023]  | -0.16<br>[0.916]     | -0.186<br>[0.908]    |                  | 0.626<br>[1.289] | 0.667<br>[1.340]  | 0.801<br>[1.313]  |                   | 3.373<br>[2.308]  | 4.221*<br>[2.375]   | 3.930*<br>[2.269]    |
| Size                  |                    |                    | -0.304***<br>[0.092] | -0.300***<br>[0.092] |                  |                  | -0.038<br>[0.172] | -0.026<br>[0.177] |                   |                   | -0.285**<br>[0.141] | -0.320**<br>[0.133]  |
| NPL ratio             |                    |                    | -0.726<br>[0.968]    | -0.724<br>[0.970]    |                  |                  | -1.534<br>[1.538] | -1.373<br>[1.557] |                   |                   | -2.053<br>[1.330]   | -1.746<br>[1.236]    |
| Deposit / TA          |                    |                    |                      | 0.056<br>[0.253]     |                  |                  |                   | 0.52<br>[0.715]   |                   |                   |                     | -1.205***<br>[0.437] |
| ROA                   |                    |                    |                      | 0.657<br>[1.162]     |                  |                  |                   | -1.045<br>[1.916] |                   |                   |                     | 1.534<br>[1.737]     |
| Constant              | -0.035<br>[0.040]  | -0.029<br>[0.039]  | 5.378***<br>[1.640]  | 5.266***<br>[1.641]  | 0.092<br>[0.103] | 0.091<br>[0.103] | 0.782<br>[3.036]  | 0.214<br>[3.319]  | -0.037<br>[0.070] | -0.046<br>[0.071] | 5.068**<br>[2.478]  | 6.511***<br>[2.372]  |
| Observations          | 288                | 288                | 288                  | 288                  | 288              | 288              | 288               | 288               | 283               | 283               | 283                 | 283                  |
| R-squared             | 0.62               | 0.63               | 0.68                 | 0.68                 | 0.39             | 0.39             | 0.39              | 0.39              | 0.51              | 0.52              | 0.54                | 0.57                 |

Note: All regressions include both bank and year fixed effects. They also control for mergers and acquisitions during the sample period: 2012 - 2016

Standard errors in brackets

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

**Table 3: Pooled OLS regressions with year fixed effects (Continued)**  
**ALL BHCs with total assets > \$10 billion**

| Vars                  | RRE Loans         |                   |                   |                   | Small Business Loans |                   |                     |                     | Consumer Loans       |                      |                     |                     |
|-----------------------|-------------------|-------------------|-------------------|-------------------|----------------------|-------------------|---------------------|---------------------|----------------------|----------------------|---------------------|---------------------|
|                       | (1)               | (2)               | (3)               | (4)               | (1)                  | (2)               | (3)                 | (4)                 | (1)                  | (2)                  | (3)                 | (4)                 |
| CET1 ratio            | 0.244<br>[0.543]  |                   |                   |                   | 0.413<br>[1.133]     |                   |                     |                     | 5.191***<br>[1.379]  |                      |                     |                     |
| CET1 ratio adj. (BHC) |                   | 0.24<br>[0.539]   | 0.183<br>[0.578]  | 0.09<br>[0.566]   |                      | 0.411<br>[1.136]  | 0.26<br>[1.125]     | 0.121<br>[1.139]    |                      | 5.191***<br>[1.382]  | 6.017***<br>[1.439] | 6.089***<br>[1.431] |
| CET1 Gap              |                   | -1.773<br>[2.608] | -1.22<br>[2.506]  | -1.43<br>[2.557]  |                      | -0.385<br>[2.963] | 0.085<br>[3.011]    | -0.154<br>[2.932]   |                      | 5.266**<br>[2.524]   | 6.056**<br>[2.581]  | 6.269**<br>[2.605]  |
| Size                  |                   |                   | -0.117<br>[0.219] | -0.128<br>[0.222] |                      |                   | -0.306<br>[0.186]   | -0.327*<br>[0.185]  |                      |                      | -0.128<br>[0.270]   | -0.108<br>[0.272]   |
| NPL ratio             |                   |                   | -2.439<br>[1.801] | -2.246<br>[1.698] |                      |                   | -5.024**<br>[2.281] | -4.756**<br>[2.258] |                      |                      | -3.887*<br>[2.286]  | -3.705<br>[2.348]   |
| Deposit / TA          |                   |                   |                   | -0.518<br>[0.714] |                      |                   |                     | -0.851*<br>[0.460]  |                      |                      |                     | 0.644<br>[0.728]    |
| ROA                   |                   |                   |                   | 2.166<br>[3.261]  |                      |                   |                     | 2.392<br>[2.060]    |                      |                      |                     | -3.395<br>[2.832]   |
| Constant              | -0.024<br>[0.063] | -0.016<br>[0.062] | 2.13<br>[3.893]   | 2.665<br>[4.067]  | -0.037<br>[0.144]    | -0.034<br>[0.146] | 5.484*<br>[3.300]   | 6.441*<br>[3.337]   | -0.496***<br>[0.168] | -0.496***<br>[0.169] | 1.707<br>[4.801]    | 0.923<br>[4.966]    |
| Observations          | 284               | 284               | 284               | 284               | 284                  | 284               | 284                 | 284                 | 286                  | 286                  | 286                 | 286                 |
| R-squared             | 0.51              | 0.51              | 0.52              | 0.53              | 0.44                 | 0.44              | 0.48                | 0.49                | 0.51                 | 0.51                 | 0.53                | 0.54                |

Note: All regressions include both bank and year fixed effects. They also control for mergers and acquisitions during the sample period: 2012 - 2016

Standard errors in brackets

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

**Table 4: Pooled OLS regressions**  
**CCAR BHCs with total assets between \$20 and \$200 billion**

| Vars                  | Total Loans        |                   |                     |                     | C&I Loans        |                   |                      |                      | CRE Loans           |                     |                      |                      |
|-----------------------|--------------------|-------------------|---------------------|---------------------|------------------|-------------------|----------------------|----------------------|---------------------|---------------------|----------------------|----------------------|
|                       | (1)                | (2)               | (3)                 | (4)                 | (1)              | (2)               | (3)                  | (4)                  | (1)                 | (2)                 | (3)                  | (4)                  |
| CET1 ratio            | 0.502**<br>[0.221] |                   |                     |                     | 0.19<br>[0.484]  |                   |                      |                      | 0.977***<br>[0.304] |                     |                      |                      |
| CET1 ratio adj. (BHC) |                    | 0.418*<br>[0.219] | 0.418**<br>[0.158]  | 0.456**<br>[0.188]  |                  | 0.063<br>[0.511]  | 0.127<br>[0.546]     | -0.116<br>[0.735]    |                     | 1.093***<br>[0.322] | 1.140***<br>[0.310]  | 0.990***<br>[0.309]  |
| CET1 Gap              |                    | -0.549<br>[0.867] | 0.061<br>[0.817]    | 0.075<br>[0.808]    |                  | -1.387<br>[1.404] | -1.017<br>[1.153]    | -1.1<br>[1.268]      |                     | 2.406*<br>[1.217]   | 2.668**<br>[1.156]   | 2.548**<br>[1.093]   |
| Size                  |                    |                   | -0.021**<br>[0.008] | -0.019**<br>[0.008] |                  |                   | -0.014<br>[0.032]    | -0.029<br>[0.033]    |                     |                     | -0.012<br>[0.017]    | -0.018<br>[0.019]    |
| NPL ratio             |                    |                   | -1.065**<br>[0.402] | -1.084**<br>[0.407] |                  |                   | -1.668***<br>[0.488] | -2.035***<br>[0.625] |                     |                     | -0.165***<br>[0.029] | -0.196***<br>[0.036] |
| Deposit / TA          |                    |                   |                     | 0.034<br>[0.060]    |                  |                   |                      | -0.16<br>[0.156]     |                     |                     |                      | -0.127<br>[0.129]    |
| ROA                   |                    |                   |                     | 0.106<br>[0.544]    |                  |                   |                      | 1.835<br>[1.695]     |                     |                     |                      | 0.87<br>[0.825]      |
| Constant              | -0.036<br>[0.035]  | -0.023<br>[0.033] | 0.369**<br>[0.153]  | 0.300*<br>[0.168]   | 0.075<br>[0.055] | 0.095<br>[0.062]  | 0.364<br>[0.600]     | 0.733<br>[0.703]     | -0.041<br>[0.039]   | -0.059<br>[0.046]   | 0.158<br>[0.312]     | 0.355<br>[0.399]     |
| Observations          | 140                | 140               | 140                 | 140                 | 140              | 140               | 140                  | 140                  | 136                 | 136                 | 136                  | 136                  |
| R-squared             | 0.22               | 0.23              | 0.28                | 0.28                | 0.03             | 0.03              | 0.06                 | 0.08                 | 0.11                | 0.12                | 0.15                 | 0.17                 |

Robust standard errors in brackets

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

**Table 4: Pooled OLS regressions (Continued)**  
**CCAR BHCs with total assets between \$20 and \$200 billion**

| Vars                  | RRE Loans         |                   |                     |                     | Small Business Loans |                    |                   |                      | Consumer Loans    |                   |                      |                      |
|-----------------------|-------------------|-------------------|---------------------|---------------------|----------------------|--------------------|-------------------|----------------------|-------------------|-------------------|----------------------|----------------------|
|                       | (1)               | (2)               | (3)                 | (4)                 | (1)                  | (2)                | (3)               | (4)                  | (1)               | (2)               | (3)                  | (4)                  |
| CET1 ratio            | 0.343<br>[0.381]  |                   |                     |                     | 0.695<br>[0.728]     |                    |                   |                      | 1.169<br>[1.005]  |                   |                      |                      |
| CET1 ratio adj. (BHC) |                   | 0.325<br>[0.387]  | 0.378<br>[0.394]    | 0.421<br>[0.402]    |                      | 0.893<br>[0.688]   | 0.954<br>[0.743]  | 0.174<br>[0.470]     |                   | 1.568<br>[1.010]  | 1.428*<br>[0.826]    | 1.572*<br>[0.924]    |
| CET1 Gap              |                   | 0.116<br>[1.405]  | 0.724<br>[1.421]    | 0.788<br>[1.460]    |                      | 3.189<br>[2.047]   | 2.396<br>[2.019]  | 2.071<br>[1.616]     |                   | 6.131<br>[4.060]  | 8.158**<br>[3.991]   | 8.215**<br>[3.964]   |
| Size                  |                   |                   | -0.014<br>[0.012]   | -0.009<br>[0.015]   |                      |                    | 0.023<br>[0.026]  | -0.023<br>[0.022]    |                   |                   | -0.081**<br>[0.035]  | -0.070*<br>[0.039]   |
| NPL ratio             |                   |                   | -1.217**<br>[0.573] | -1.129**<br>[0.485] |                      |                    | -1.143<br>[1.168] | -0.671<br>[1.115]    |                   |                   | -2.712***<br>[0.482] | -2.702***<br>[0.510] |
| Deposit / TA          |                   |                   |                     | 0.108<br>[0.077]    |                      |                    |                   | -0.629***<br>[0.222] |                   |                   |                      | 0.165<br>[0.181]     |
| ROA                   |                   |                   |                     | 2.729<br>[2.584]    |                      |                    |                   | 0.532<br>[1.443]     |                   |                   |                      | 0.874<br>[1.509]     |
| Constant              | -0.079<br>[0.053] | -0.076<br>[0.052] | 0.195<br>[0.232]    | -0.007<br>[0.304]   | -0.09<br>[0.074]     | -0.122*<br>[0.066] | -0.507<br>[0.463] | 0.799<br>[0.519]     | -0.047<br>[0.129] | -0.111<br>[0.140] | 1.383**<br>[0.647]   | 1.055<br>[0.760]     |
| Observations          | 136               | 136               | 136                 | 136                 | 137                  | 137                | 137               | 137                  | 138               | 138               | 138                  | 138                  |
| R-squared             | 0.06              | 0.06              | 0.09                | 0.12                | 0.06                 | 0.07               | 0.08              | 0.27                 | 0.03              | 0.05              | 0.13                 | 0.13                 |

Robust standard errors in brackets

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

Table 5: Pooled OLS regressions  
CCAR BHCs

| Vars                  | Total Loans |         |         |         | C&I Loans |          |           |           | CRE Loans |          |           |           |
|-----------------------|-------------|---------|---------|---------|-----------|----------|-----------|-----------|-----------|----------|-----------|-----------|
|                       | (1)         | (2)     | (3)     | (4)     | (1)       | (2)      | (3)       | (4)       | (1)       | (2)      | (3)       | (4)       |
| CET1 ratio            | 0.478*      |         |         |         | 0.940***  |          |           |           | 1.368**   |          |           |           |
|                       | [0.276]     |         |         |         | [0.289]   |          |           |           | [0.576]   |          |           |           |
| CET1 ratio adj. (BHC) |             | 0.511** | 0.507** | 0.469*  |           | 1.058*** | 1.229***  | 1.237***  |           | 1.627*** | 1.622***  | 1.220***  |
|                       |             | [0.250] | [0.245] | [0.257] |           | [0.314]  | [0.316]   | [0.317]   |           | [0.512]  | [0.431]   | [0.241]   |
| CET1 Gap              |             | 0.862   | 0.846   | 0.768   |           | 2.301*   | 2.331*    | 2.311**   |           | 4.366*** | 4.114***  | 3.204***  |
|                       |             | [0.612] | [0.565] | [0.525] |           | [1.223]  | [1.213]   | [1.015]   |           | [1.281]  | [1.078]   | [1.031]   |
| Size                  |             |         | -0.002  | -0.003  |           |          | 0.012     | 0.001     |           |          | 0.028*    | 0.003     |
|                       |             |         | [0.014] | [0.013] |           |          | [0.010]   | [0.012]   |           |          | [0.014]   | [0.012]   |
| NPL ratio             |             |         | -0.262  | -0.235  |           |          | -1.476*** | -2.540*** |           |          | -0.106*** | -0.174*** |
|                       |             |         | [1.220] | [1.120] |           |          | [0.459]   | [0.558]   |           |          | [0.025]   | [0.045]   |
| Deposit / TA          |             |         |         | -0.014  |           |          |           | -0.163*   |           |          |           | -0.268    |
|                       |             |         |         | [0.082] |           |          |           | [0.082]   |           |          |           | [0.180]   |
| ROA                   |             |         |         | -0.319  |           |          |           | 4.695**   |           |          |           | 1.031     |
|                       |             |         |         | [1.110] |           |          |           | [1.759]   |           |          |           | [1.537]   |
| Constant              | -0.035      | -0.042  | 0       | 0.046   | -0.01     | -0.036   | -0.268    | -0.005    | -0.039    | -0.096*  | -0.636**  | 0.05      |
|                       | [0.036]     | [0.028] | [0.240] | [0.272] | [0.031]   | [0.037]  | [0.200]   | [0.287]   | [0.051]   | [0.049]  | [0.276]   | [0.374]   |
| Observations          | 102         | 102     | 102     | 102     | 102       | 102      | 102       | 102       | 98        | 98       | 98        | 98        |
| R-squared             | 0.26        | 0.26    | 0.27    | 0.27    | 0.08      | 0.09     | 0.14      | 0.25      | 0.11      | 0.15     | 0.2       | 0.27      |

Robust standard errors in brackets

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

**Table 5: Pooled OLS regressions (Continued)**

**CCAR BHCs**

|                       | <b>RRE Loans</b>  |                   |                      |                     | <b>Small Business Loans</b> |                   |                     |                      | <b>Consumer Loans</b> |                    |                    |                   |
|-----------------------|-------------------|-------------------|----------------------|---------------------|-----------------------------|-------------------|---------------------|----------------------|-----------------------|--------------------|--------------------|-------------------|
| <b>Vars</b>           | <b>(1)</b>        | <b>(2)</b>        | <b>(3)</b>           | <b>(4)</b>          | <b>(1)</b>                  | <b>(2)</b>        | <b>(3)</b>          | <b>(4)</b>           | <b>(1)</b>            | <b>(2)</b>         | <b>(3)</b>         | <b>(4)</b>        |
| CET1 ratio            | 0.762<br>[0.994]  |                   |                      |                     | 0.17<br>[0.508]             |                   |                     |                      | 1.019<br>[1.019]      |                    |                    |                   |
| CET1 ratio adj. (BHC) |                   | 1.042<br>[1.061]  | 0.475<br>[0.627]     | 0.089<br>[0.624]    |                             | 0.312<br>[0.477]  | 0.054<br>[0.386]    | -0.361<br>[0.505]    |                       | 1.517*<br>[0.842]  | 1.512*<br>[0.839]  | 1.011<br>[0.792]  |
| CET1 Gap              |                   | 4.007<br>[3.714]  | 2.657<br>[2.685]     | 2.017<br>[1.929]    |                             | 1.899<br>[1.215]  | 1.227<br>[1.334]    | 0.432<br>[1.493]     |                       | 6.755**<br>[2.903] | 6.730**<br>[2.959] | 5.833*<br>[3.060] |
| Size                  |                   |                   | 0.076*<br>[0.040]    | 0.029<br>[0.040]    |                             |                   | 0.050**<br>[0.024]  | 0.014<br>[0.027]     |                       |                    | 0<br>[0.018]       | -0.017<br>[0.017] |
| NPL ratio             |                   |                   | -3.372***<br>[1.182] | -2.364**<br>[1.034] |                             |                   | -5.656**<br>[2.622] | -4.165<br>[2.856]    |                       |                    | 0.36<br>[1.880]    | -0.641<br>[1.525] |
| Deposit / TA          |                   |                   |                      | -0.351<br>[0.215]   |                             |                   |                     | -0.318***<br>[0.085] |                       |                    |                    | -0.24<br>[0.173]  |
| ROA                   |                   |                   |                      | 1.935<br>[2.352]    |                             |                   |                     | 2.163<br>[1.850]     |                       |                    |                    | -1.395<br>[1.889] |
| Constant              | -0.076<br>[0.083] | -0.138<br>[0.094] | -1.402*<br>[0.768]   | -0.287<br>[0.887]   | 0.026<br>[0.063]            | -0.006<br>[0.062] | -0.819*<br>[0.420]  | 0.065<br>[0.514]     | -0.007<br>[0.103]     | -0.116<br>[0.097]  | -0.125<br>[0.356]  | 0.442<br>[0.462]  |
| Observations          | 98                | 98                | 98                   | 98                  | 99                          | 99                | 99                  | 99                   | 102                   | 102                | 102                | 102               |
| R-squared             | 0.03              | 0.06              | 0.22                 | 0.29                | 0.06                        | 0.07              | 0.15                | 0.24                 | 0.12                  | 0.21               | 0.21               | 0.25              |

Robust standard errors in brackets

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

**Table 6: Impact of capital ratios on Levels of Lending Standards at different loan categories  
BHCs with total assets > \$10 billion**

| Level of Standards Relative to Midpoint since 2005 | Marginal Effect of Capital Gap on Level of Lending Standards |                        |                       | Marginal Effect of Nonperforming Loans on Level of Lending Standards |                      |                     |
|--|--|------------------------|-----------------------|--|----------------------|---------------------|
|  | Subprime Auto  | Leveraged Loans        | Small Business        | Jumbo Mortgages  | HELOC                | Small Business      |
| Significantly Easier                               | 0.0388<br>(0.0316)   | 0.0320***<br>(0.00897) | 0.00840<br>(0.00562)  | -0.148<br>(0.123)  | -0.107<br>(0.100)    | -1.168*<br>(0.600)  |
| Somewhat Easier                                    | 0.109*<br>(0.0643)   | 0.0976***<br>(0.0266)  | 0.0548*<br>(0.0316)   | -1.148**<br>(0.510)  | -2.065***<br>(0.571) | -7.622**<br>(3.286) |
| About the midpoint                                 | 0.0324<br>(0.0285)   | -0.00842<br>(0.0121)   | -0.0163<br>(0.0114)   | -1.530**<br>(0.688)  | -2.953***<br>(0.744) | 2.270*<br>(1.197)   |
| Somewhat tighter                                   | -0.0613<br>(0.0385)  | -0.0585***<br>(0.0174) | -0.0323<br>(0.0207)   | 0.835*<br>(0.462)  | 1.947***<br>(0.683)  | 4.491**<br>(2.202)  |
| Significantly Tighter                              | -0.119*<br>(0.0656)  | -0.0626***<br>(0.0203) | -0.0146*<br>(0.00885) | 1.990**<br>(0.807)   | 3.177***<br>(0.596)  | 2.029*<br>(1.170)   |
| Observations                                       | 125  | 204                    | 201                   | 225  | 197                  | 201                 |

Note: Regression includes bank fixed effects, time fixed effects, ratio of nonperforming loans to total loans in loan category, reported demand for loans in loan category. Standard errors in parenthesis. The table shows the marginal effect of a 1 percentage point increase in the capital gap or associated ratio of nonperforming loans to total loans in that category on the probability of a bank reporting that the level of standards was in the associated category. The level of lending standards is defined relative to the midpoint of the range of standards since 2005.

Significance level: \*\*\* 1 percent, \*\* 5 percent, \* 10 percent

**Table 7: Impact of capital ratios on Average Change in Lending Standards  
BHCs with total assets > \$10 billion**

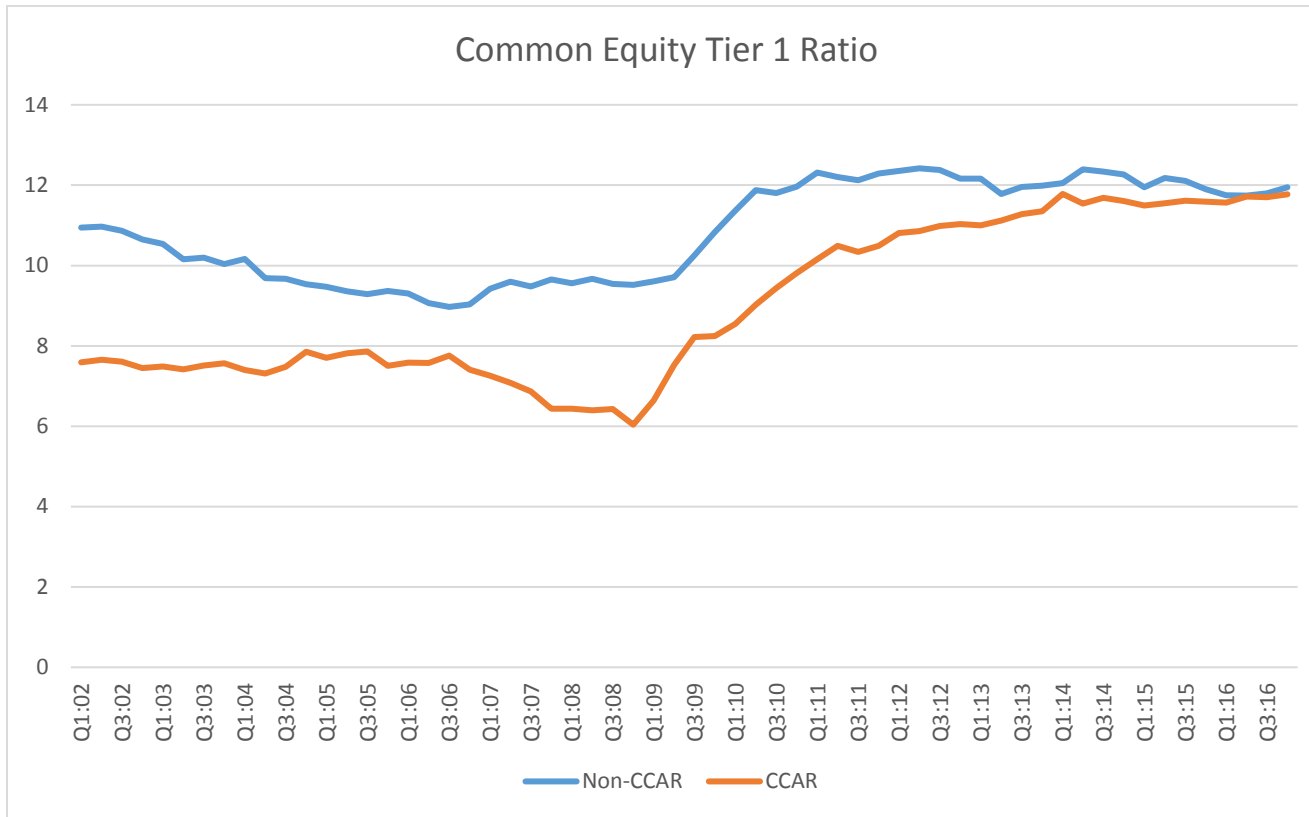
| Variables                 | (1)                | (2)               | (3)                 | (4)                 |
|---------------------------|--------------------|-------------------|---------------------|---------------------|
| CET1 ratio                | -0.0466<br>[1.900] |                   |                     |                     |
| CET1 ratio adj. (BHC)     |                    | 0.0233<br>[1.945] | -1.029<br>[1.960]   | -1.432<br>[1.946]   |
| CET1 Gap                  |                    | -1.720<br>[2.430] | -2.890<br>[2.311]   | -2.976<br>[2.330]   |
| Non-performing loan ratio |                    |                   | -5.347**<br>[2.355] | -4.679**<br>[2.312] |
| Demand                    |                    |                   |                     | 0.141**<br>[0.0626] |
| Observations              | 189                | 189               | 189                 | 189                 |

Note: All regressions include both bank and year fixed effects. Standard errors in brackets.

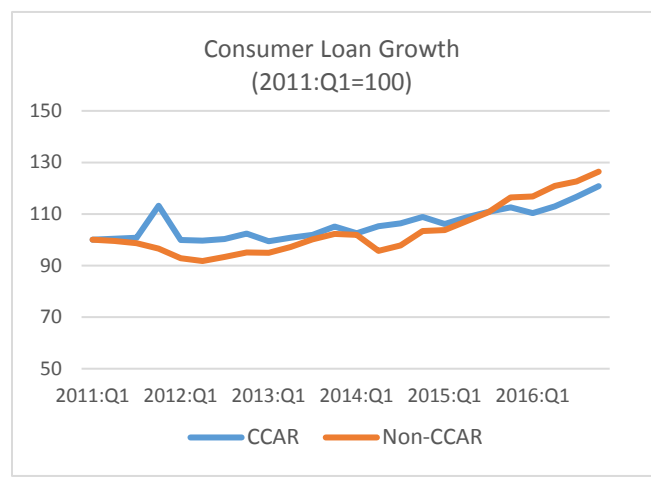
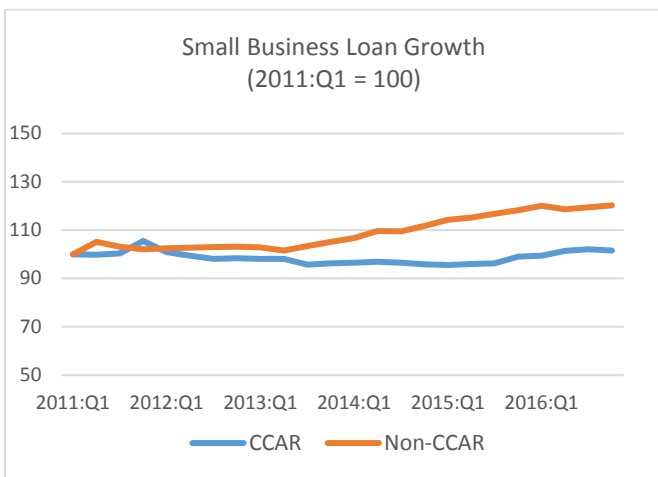
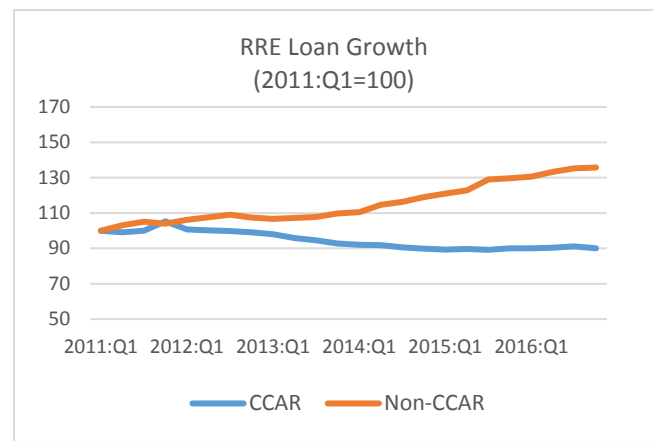
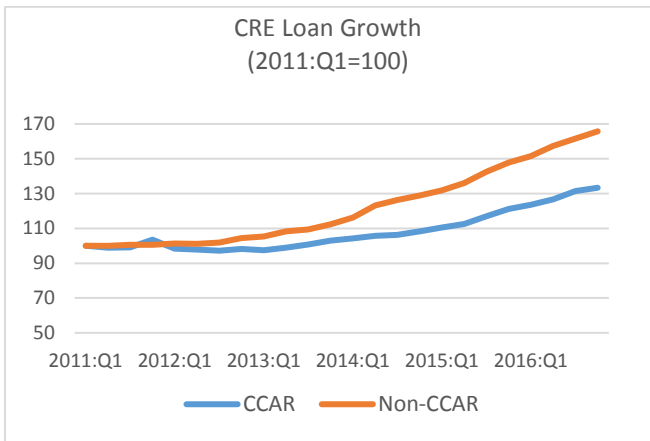
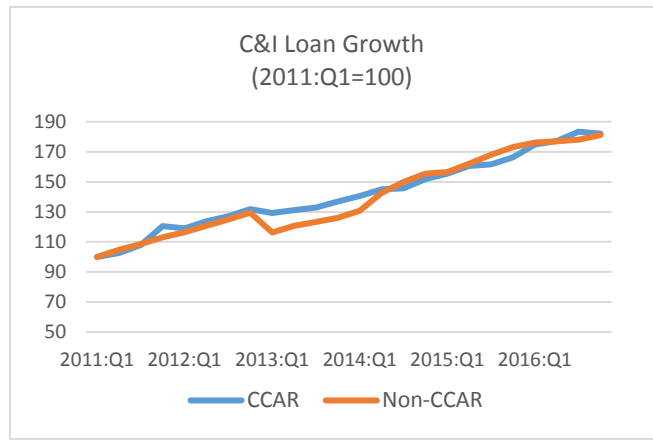
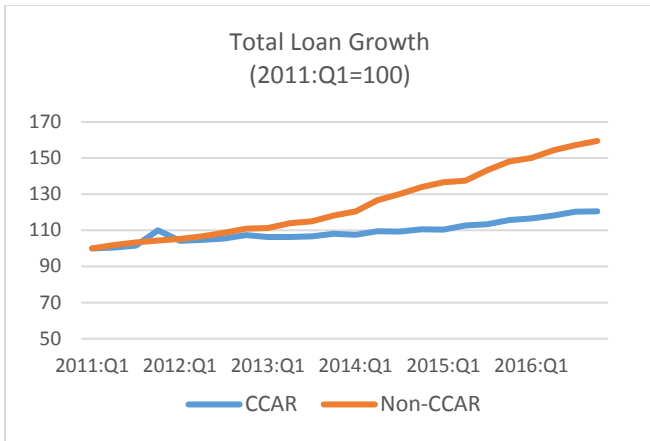
\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%



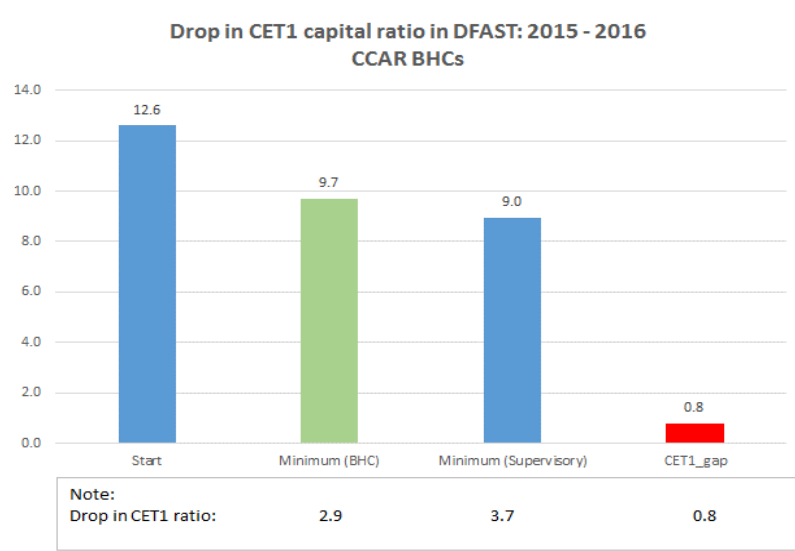
Figure 1: CET1 capital ratio for CCAR and non-CCAR banks



**Figure 2: Loan growth across different loan categories: CCAR and non-CCAR banks**



**Figure 3: Drop in CET1 capital ratio and CET1 gap in CCAR**



**Distribution of CET1 gap - 2015 - 2016  
CCAR BHCs**

| Percentiles |      |         |     |
|-------------|------|---------|-----|
| 1%          | -3.1 |         |     |
| 5%          | -1.2 |         |     |
| 10%         | -0.7 | Obs     | 60  |
| 25%         | 0.1  | Sum of  | 60  |
| 50%         | 0.7  | Mean    | 0.8 |
|             |      | Std. De | 1.3 |
| 75%         | 1.6  |         |     |
| 90%         | 2.3  |         |     |
| 95%         | 3.6  |         |     |
| 99%         | 4.0  |         |     |

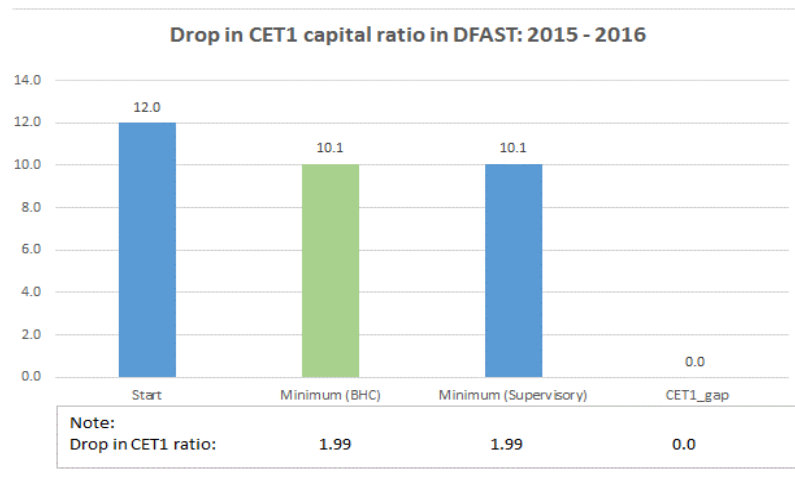
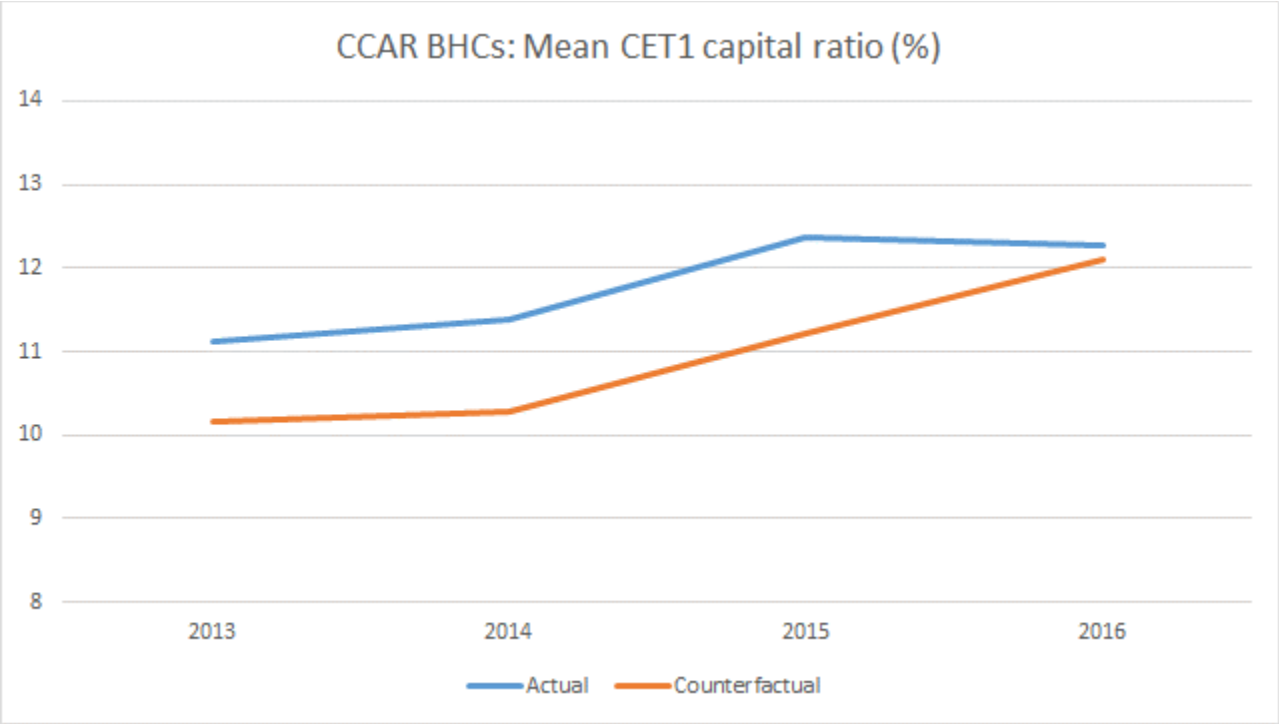


Figure 4: Counterfactual: CCAR banks CET1 capital ratios with and without CCAR stress tests



**Figure 5: Real Estate Loans at CCAR and non-CCAR banks**

