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## Evaluating the information in the Federal Reserve stress tests

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Federal Reserve Bank of New York  
Staff Reports

# Evaluating the Information in the Federal Reserve Stress Tests

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Staff Report No. 744  
October 2015



This paper presents preliminary findings and is being distributed to economists and other interested readers solely to stimulate discussion and elicit comments. The views expressed in this paper are those of the authors and do not necessarily reflect the position of the Federal Reserve Bank of New York or the Federal Reserve System. Any errors or omissions are the responsibility of the authors.

## **Evaluating the Information in the Federal Reserve Stress Tests**

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### **Abstract**

We find evidence that the Federal Reserve stress tests (CCAR and DFAST) produce information about the stress-tested firms as well as other, non-stress-tested banking companies. Although standard event studies do not always show abnormal returns for the stress-tested sample on average, we argue that such tests are ill-suited for this sort of information event. Using a different empirical approach, we show that around stress test announcement dates, the absolute value of the cumulative abnormal returns ( $|CAR|$ ) of stress-tested bank holding companies averages almost 3 percent. Cumulative abnormal trading volumes are more than 1 percentage point higher than a market model would predict. Absolute value abnormal returns and volumes are higher for more levered and riskier firms. We explore several theoretical hypotheses outlined in Goldstein and Sapra (2014) but find no evidence of negative welfare costs associated with the disclosure of stress test results.

Key words: stress test, bank capital, event study

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## 1. Introduction

When the first supervisory stress tests were administered to large U.S. bank holding companies (BHCs) in the first half of 2009, the Federal Reserve took the unprecedented step of announcing publicly its assessment of the BHCs' capital positions under stress. The Supervisory Capital Assessment Program (SCAP) of 2009 evolved into a series of annual supervisory stress tests beginning in 2011. The process now includes two related reviews of BHC capital: the Comprehensive Capital Analysis and Review (CCAR) and Dodd-Frank Act stress tests (DFAST). As these processes have evolved, the Federal Reserve has provided ever more detailed public disclosures about the tests' results and implications. This paper evaluates how the publication of this official sector analysis affects private investors' assessments of the tested BHCs' values.

Previous authors have studied market reactions to stress test announcements (Morgan et al. 2014, Petrella and Resti 2013, Candelon and Sy 2015, Bird et al. 2015). They have found mixed evidence of whether banking firms experience significant abnormal average stock returns when supervisory stress test results are disclosed. These studies report statistically significant average abnormal returns on some disclosure event dates but not on others. Some studies report both positive and negative average abnormal returns across different event dates. To at least some extent, we believe that these variable findings reflect inappropriate assumptions embedded in standard event study methodology. For example, this approach assumes that all treated firms react in the same direction, so a zero mean abnormal return implies no effect on treated firms. But a mean return for stress-tested banks could be zero for two quite different reasons. Either the abnormal return is very small for all firms, or the returns are large in absolute value, but positive for some BHCs and negative for others. Disparate revaluations are particularly likely when an event's timing is known to investors. Because stress test announcement dates are known well in advance, their information content for each firm must be evaluated in relation to the market's prior beliefs about that firm's condition. By contrast, standard event study methodology assumes that the events are unanticipated, making market expectations zero by definition. Large negative or positive announcement effects are both consistent with the stress test results conveying new information to the market.<sup>1</sup> In sum, a standard event study does not necessarily tell us what we need to know about new information produced in the stress tests.

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<sup>1</sup> A uniform price reaction across treated firms might occur if the announcements reduce the amount of (systematic) uncertainty associated with the firms' valuations.

To address this conceptual shortcoming, we examine two additional measures that should better capture disparate, but significant, changes in share price. First, we examine the absolute change in share prices associated with stress test result announcements. This measure should be large if investors react to the announcement, regardless of the distribution of positive and negative effects. Second, trading volume also spikes upwards if new disclosure affects investors' priors (Bamber et al. 2011, Karpoff 1986). We develop a measure of "abnormal trading volume" that captures deviations in BHC trading volume from what would be expected given market-wide trading volume. We interpret these price and volume changes as empirical measures of information production.

The history of U.S. stress testing provides nine dates on which the Federal Reserve disclosed stress-related assessments of large BHCs. The sample of stress tested BHCs has varied, with additional firms being added over time. For each date, we also look at a comparison group of large BHCs not subject to supervisory stress testing and compare the two samples' abnormal absolute returns and abnormal trading volumes for the nine disclosure dates. The non-stress tested BHC sample permits us to explore whether stress test results contain significant information about the banking industry in general, and not just about the stress tested firms. Stress testing might provide information about non-stress tested BHCs if these firms have businesses, activities or exposures in common with stress tested BHCs.

Our results suggest that disclosure of supervisory stress test results generates information about stress tested BHCs. As in previous studies (Petrella and Resti 2013, Morgan et al. 2014, Candelon and Sy 2015, Bird et al. 2015), we find statistically significant average cumulative abnormal returns (CARs) for stress tested BHCs around many, though not all, of the stress test disclosure dates. Also like previous studies, these average CARs are sometimes positive and sometimes negative, suggesting that simply averaging positive and negative abnormal returns in a standard event study could obscure the impact of stress test disclosures. In fact, average absolute value CARs ( $|CAR|$ ) are significantly larger than pre-disclosure event values around most disclosure dates for stress tested BHCs. The tested sample  $|CAR|$  always shows larger effects than does the non stress tested sample. Further, we find that some event dates are associated with abnormal returns for non-stress tested BHCs, a result consistent with the hypothesis that this supervisory information relates to the broader banking industry, beyond the stress tested firms. Average abnormal trading volumes are also significantly higher, on average, on stress test disclosure dates. Again, the mean abnormal trading volumes are larger and more significant for stress tested BHCs than for other banking companies.

We next investigate whether the market reaction to supervisory stress test results affects some types of BHCs – e.g. riskier institutions – more prominently. For each event date, we regress  $|CAR|$  or abnormal trading volume on BHCs' leverage and risk to see if these characteristics are associated with greater information on stress test disclosure dates. Our results suggest that the stress tests produce more information about riskier or more highly leveraged BHCs.

Finally, Goldstein and Sapra (2014) suggest that the public disclosure of stress testing results may drive out private information producers (such as stock analysts), with negative welfare effects. We look for empirical evidence of these theoretical negative welfare effects. We begin by examining if the release of stress testing information by the Federal Reserve discourages private information gathering, using data on equity analyst coverage. We find no evidence of reduction in equity analyst coverage or deterioration in forecast accuracy. We also explore whether supervisory stress test disclosure negatively impacts private risk sharing. We see no decline in risk sharing, as stress tested BHCs do not seem to reduce interbank borrowing. Next, we assess whether stress test results affect BHCs' subsequent portfolio choices. Perhaps stress test results cause banks to increase their loans to sectors with relatively low Federal Reserve-estimated loss rates. Stress tested firms do not change their loan portfolio composition in response to stress testing results. Finally, we find no relationship between market responsiveness to stress testing disclosure and firms' liquidity coverage ratios, suggesting that disclosures are not disproportionately affecting firms more vulnerable to runs (higher strategic complementarities in their investors). These preliminary results thus provide little evidence of negative social welfare consequences of supervisory stress test disclosure. Of course, we conduct these tests in the context of a relatively benign environment for banking firms. With the exception of 2009, only a relatively small number of firms have failed to pass the stress tests, therefore we cannot rule out the possibility of different results in a different climate for the banking industry.

This paper is organized as follows. Section 2 provides a brief history and description of the U.S. stress testing process and the associated public information releases. Section 3 contains a review of previous literature on the market impact of supervisory stress test disclosures and describes our main hypotheses. Results about market reaction to stress test announcements and the relationship between BHC characteristics and market information are presented in Section 4. Section 5 discusses our analysis of possible welfare-reducing effects of supervisory stress test disclosures. The paper concludes with a summary and discussion of the results.

## 2. Overview of U.S. Supervisory Stress Testing

We present here a review of supervisory stress testing programs in the United States. A more detailed review of the history and goals of US stress testing can be found in Hirtle and Lehnert (2014), which also describes the coordinated supervisory stress tests conducted in Europe in the years since the financial crisis.

### ***Supervisory Capital Assessment Program***

The first coordinated supervisory stress testing exercise in the United States was the 2009 Supervisory Capital Assessment Program (SCAP). Nineteen U.S.-owned bank holding companies (BHCs) with assets of at least \$100 billion, representing two-thirds of the assets of the U.S. banking system, participated in the SCAP (Board of Governors of the Federal Reserve System 2009a). Conducted in the months following the collapse of Lehman Brothers and the resulting financial market turmoil, the goal of the SCAP was to ensure that the largest U.S. BHCs had sufficient capital to withstand a worse-than-anticipated macroeconomic outcome and continue to be viable financial intermediaries.

The SCAP stress tests assessed the impact of two hypothetical macroeconomic scenarios on each BHC's regulatory capital ratios. The core of the SCAP stress test was a projection of net income for each BHC over a two-year forward horizon, with projected net income flowing into equity and regulatory capital. The SCAP net income projections were combinations of projections made by the BHCs, projections from models developed by supervisors, comparisons to historical data and benchmarks, and supervisory judgment (Board of Governors of the Federal Reserve System 2009a).

Bank holding companies whose stressed capital ratios fell below minimum target levels were required to raise new capital in amounts sufficient to eliminate the shortfall between the post-stress ratio and the target level.<sup>2</sup> The ten firms with identified shortfalls, along with several others without capital shortfalls, raised \$100 billion in common equity following the SCAP (Hirtle and Lehnert, 2014). Results of the SCAP for each BHC were publicly disclosed on May 7, 2009. Information about the stress test framework and methodology had been publicly released a few weeks before the publication of the results, on April 24 (Board of Governors of the Federal Reserve System 2009a, 2009b). These disclosures, which were essentially unprecedented in terms of publication of confidential supervisory information, were intended to help restore confidence in the capitalization of the BHCs participating in

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<sup>2</sup> It was announced that the U.S. Treasury would provide capital for qualifying BHCs unable to raise required equity in the market. This capital backstop was accessed by one SCAP firm (Ally Financial).

the SCAP and in the banking system more broadly (Board of Governors of the Federal Reserve System 2009b).

### ***Dodd-Frank Act Stress Tests***

Following the SCAP, stress testing was formally integrated into the Federal Reserve's supervisory assessment of BHC capital adequacy on an on-going basis. This integration occurred through two separate, though related, channels: the Dodd-Frank Act stress tests (DFAST) and the Comprehensive Capital Analysis and Review (CCAR).

Enacted in 2010, the Dodd-Frank Wall Street Reform and Consumer Protection Act ("Dodd-Frank Act") required the Federal Reserve to conduct annual stress tests of all BHCs with assets exceeding \$50 billion, as well as certain other large, complex financial companies subject to Federal Reserve supervision. The Dodd-Frank Act also requires BHCs with assets greater than \$10 billion to do annual stress tests based on scenarios provided by the Federal Reserve and BHCs with assets greater than \$50 billion to do additional stress tests based on their own scenarios. The Federal Reserve and BHCs with assets greater than \$50 billion are required to publish stress test results based on the Federal Reserve's scenarios.

Similar to the SCAP, the DFAST supervisory stress tests involve projections of BHC net income and capital over a nine-quarter forward horizon under three separate scenarios: baseline, adverse and severely adverse. The supervisory stress tests are calculated using confidential regulatory report data on each BHC's loans, securities, trading and counterparty positions, revenues and expenses as inputs into models developed by the Federal Reserve (Board of Governors of the Federal Reserve System 2015b). These data are used to project net income for each BHC under the macroeconomic and financial market conditions assumed in the scenario. The key outputs of the stress tests are pro forma values of each BHC's regulatory capital ratios in each quarter of the stress test horizon, where equity capital and regulatory capital are determined by the net income projections and assumptions about dividends, share repurchases and other capital actions.<sup>3</sup>

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<sup>3</sup> In the 2015 DFAST, these regulatory capital ratios included the tier 1 common ratio (tier 1 common equity divided by risk-weighted assets calculated under the Basel 1 regulatory capital rules), the common equity tier 1 ratio (common equity tier 1 divided by risk-weighted assets calculated under the Basel 2.5/Basel 3 rules), the tier 1 ratio (tier 1 capital divided by Basel 2.5/Basel 3 risk-weighted assets), the total risk-based capital ratio (total regulatory capital divided by Basel 2.5/Basel 3 risk-weighted assets), and the tier 1 leverage ratio (tier 1 capital divided by average assets). With the exception of the tier 1 common ratio, each of these ratios is calculated using the



The first DFAST results were released in March 2013, when the Federal Reserve and the BHCs reported their firm-level simulation results under the severely adverse scenario. Since DFAST 2014, the Federal Reserve has disclosed results under both the adverse and severely adverse scenarios. BHCs must disclose their severely adverse scenario results, and are free to disclose results under the other scenarios. Most have limited their disclosures to the severely adverse scenario.

### ***Comprehensive Capital Analysis and Review***

In 2011, the Federal Reserve implemented a new supervisory program for assessing capital planning and capital adequacy at large, complex bank holding companies, the Comprehensive Capital Analysis and Review (CCAR). The CCAR involves both a qualitative assessment of the internal capital planning processes and a quantitative assessment of the capital positions of each BHC subject to the program. Each year, BHCs submit a capital plan to the Federal Reserve containing descriptions of their internal capital planning processes and governance, a capital policy governing their decisions about dividends and other capital distributions, stress test results based on scenarios provided by the Federal Reserve as well as internal scenarios intended to be uniquely stressful to each BHC based on its business focus and strategies, and information about the dividends and other capital actions the BHC would like to take over the coming two years. The Federal Reserve assesses each capital plan based on the material submitted in the plan, as well as on supervisory stress test results generated by the Federal Reserve. The BHC and supervisory stress test results are used to assess whether the BHC's regulatory capital ratios would fall below minimum required levels under the stress scenarios (Board of Governors of the Federal Reserve System 2015a).

If the Federal Reserve does not object to a BHC's capital plan, the BHC is free to make the capital distributions included in the plan. If the Federal Reserve objects to the plan – either because the stressed capital ratios fall below required minimum levels or because aspects of the BHC's internal capital planning processes fail to meet supervisory expectations – then the firm may make only those capital distributions approved by the Federal Reserve. Because of the implications for dividends, share repurchases, and other capital actions, the CCAR results typically attract considerable attention and are covered extensively by the financial press.

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regulatory capital rules that will be in place during the quarter of the forward-looking stress test horizon, reflecting the phase-in the Basel 3 regulatory capital rules between 2014 and 2019. (Board of Governors of the Federal Reserve System 2015b).

A description of the first CCAR was publicly released by the Federal Reserve in March 2011, but did not include individual BHC stress test results or information about which BHCs' plans the Federal Reserve objected to. Some BHCs subsequently disclosed that the Federal Reserve had objected to their plans. The Federal Reserve did disclose the scenario used in the stress test, however. Beginning with the 2012 CCAR, the Federal Reserve disclosed individual BHC stress test results and, starting with the 2013 CCAR, also disclosed which firms' capital plans were objected to along with a brief description of the reasons for the objection (Board of Governors of the Federal Reserve System 2015a). CCAR results have been disclosed in March of each year.

The CCAR and DFAST stress tests share the same macroeconomic scenarios and are based on a common set of net income projections, but differ in their assumptions about the BHCs' dividends, share repurchases and other capital actions. In the CCAR stress test results, the dividend, share repurchase and other capital actions used to calculate equity and regulatory capital are the actions included in each BHC's capital plan.<sup>4</sup> This is consistent with one of the goals of the CCAR exercise, which is to evaluate each BHC's ability to make take the capital actions in its capital plan while maintaining adequate capital. In contrast, the capital actions used in calculating equity and regulatory capital in the DFAST results are stylized assumptions specified in the regulation implementing the Dodd-Frank Act requirements. These assumptions set dividends at recent historical levels for each BHC (in dollars) and set share repurchases and share issuance at zero, except for issuance associated with employee compensation (Board of Governors of the Federal Reserve System 2015a, 2015b).

### ***Timing and Content of Public Disclosure***

Results of the DFAST stress tests are typically released about a week before the corresponding CCAR results. The DFAST disclosures include details of the net income projections and their primary components – pre-provision net revenue, loan losses and loan loss rates, losses on trading and counterparty positions, losses on securities, as well as balance sheet and risk-weighted asset projections – in the aggregate and for each of the participating BHCs. The DFAST disclosures also include the starting, ending and minimum values of each BHC's regulatory capital ratios. The CCAR stress test results, disclosed approximately a week later, combine the DFAST net income projections with the

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<sup>4</sup> Specifically, the capital actions included in the stressed regulatory capital ratios are those from each BHC's baseline scenarios, even for stress test results calculated under the adverse and severely adverse scenarios. The policy objective of using baseline distributions in stress scenarios is to see whether the BHC could make those distributions and remain above minimum regulatory capital levels even under stressed conditions. (Board of Governors of the Federal Reserve System 2015a).

capital actions in each BHC's capital plan to yield a different set of starting, ending and minimum regulatory capital ratios. Since 2014, BHCs have had the opportunity to make a one-time downward adjustment to their planned capital actions under CCAR (giving them the ability to adjust in case their initially projected regulatory capital ratios fall below minimum required levels). The CCAR disclosures include minimum stressed ratios under both the original and adjusted capital actions (Board of Governors of the Federal Reserve System 2015a). Table 1, Panel A contains a timeline of the disclosure events from the SCAP, CCAR and DFAST programs between 2009 and 2015.

### ***Stress Tested Entities***

The set of BHCs participating in the CCAR and DFAST programs has expanded over time. The original SCAP BHCs participated in the 2011 to 2013 CCAR exercises as well as the initial DFAST in 2013.<sup>5</sup> In 2014, the CCAR and DFAST exercises expanded to include an additional 12 BHCs with assets greater than \$50 billion. As of 2015, 31 BHCs participated in the DFAST and CCAR programs. Additional large, complex financial institutions supervised by the Federal Reserve, including savings and loan holding companies and nonbank firms designated as systemically important by the Financial Stability Oversight Council (FSOC), will participate in the programs over time as they become subject to the Federal Reserve's regulatory capital rules. Table 1, Panel B includes a list of stress tested entities and the date at which public disclosure of their supervisory stress test results began.

### **3. Literature Review and Hypotheses**

A number of studies examine the market response to the public release of supervisory stress test results, with somewhat mixed findings. Morgan et al. (2014) examine the stock price reaction for bank holding companies involved in the 2009 SCAP and find positive cumulative abnormal returns that vary in relation to each BHC's capital "gap" (that is, the amount of capital needed for each BHC's stressed capital ratios to meet minimum target levels). In particular, the results suggest that abnormal returns were lower (more negative) the larger the difference between the capital gap calculated in the stress test and *ex ante* expectations of the gap, consistent with the idea that the stress tests provided new information about the extent of capital shortfalls at these firms. Bird et al. (2015) find both higher

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<sup>5</sup> In 2013, Metlife, Inc. dropped out of the program after it sold its commercial bank and ceased to be a bank holding company. Starting in 2012, approximately one dozen additional BHCs with assets greater than \$50 billion but not in the original SCAP group also submitted capital plans to the Federal Reserve. The capital plans for these firms were reviewed in a separate, parallel exercise to the CCAR. While the capital plans for these firms contained BHC-generated stress test results, the Federal Reserve did not calculate supervisory stress test results for these firms until the 2014 CCAR. (Board of Governors of the Federal Reserve System 2013, 2014a).

abnormal returns and trading volume, on average, across CCAR disclosure dates. Glasserman and Tangirala (2015) find a high correlation between projected supervisory losses for BHCs in the 2013 and 2014 DFAST results. They also find no statistically significant correlation between projected loss rates and abnormal returns at the disclosure of the U.S. stress test results. Based on these findings, they conclude that the stress tests have become more predictable and thus less informative over time.

Researchers have also evaluated the disclosure effects of European stress tests, which have been undertaken in various formats and with a range of accompanying disclosure since 2009. Looking at disclosure of the 2011 European stress tests, Petrella and Resti (2013) find that stress tested banks had significantly larger announcement date cumulative abnormal returns than non-stress tested banks. They also find that cumulative abnormal returns were larger for BHCs that experienced smaller declines in regulatory capital in the stress test, consistent with the idea that the stress test provided information about the capital strength of individual BHCs. Using information on bond and equity bid-ask spreads, equity option implied volatilities and CDS spreads, Ellahie (2013) finds that release of the 2011 European stress test results reduced information asymmetries among investors and allowed sorting of strong and weak banks but increased uncertainty more broadly. Candelon and Sy (2015) examine both U.S. and European stress tests conducted between 2009 and 2013. In Europe, they find statistically significant cumulative abnormal returns at the release of the 2010 and 2011 results, though not for release of the 2009 or 2012 tests. They also find positive cumulative abnormal returns for stress tested U.S. bank holding companies around the publication of the SCAP results in 2009, but the size and/or statistical significance of abnormal returns decline for the subsequent 2012 and 2013 CCAR stress test results.

These papers all address the question of whether public disclosure of supervisory stress test results provides information, but for the most part do not address whether any information provided is beneficial to the financial system. Goldstein and Sapra (2014) theoretically address the welfare implications of supervisory stress test disclosure. They argue that much of the discussion of disclosure of supervisory stress test results has focused on the benefits of disclosure, principally via enhancing market discipline. To balance these considerations, Goldstein and Sapra (2014) synthesize a range of prior theoretical work addressing potential social welfare-reducing channels of such disclosure by the

official sector,<sup>6</sup> identifying potential channels through which disclosure of supervisory stress test results could adversely affect the efficiency of the financial system.

First, by lowering the value of private information production, disclosure of supervisory stress test results could limit the contribution of (costly) private information gathering to market efficiency. Seemingly authoritative information from the official sector could crowd out use, and therefore production, of private information. This crowding out would reduce market discipline to the extent that private information is superior to or more precise than the information contained in the supervisory stress tests. With less private information production, traders would have less incentive to trade, making market prices less informative and thus limiting the usefulness of market information as a complement to supervisory information.

Second, disclosure of supervisory stress tests could harm risk-sharing infrastructure such as the interbank lending market. Because stress test results could help market participants identify weaker institutions, banks could be unwilling to provide liquidity insurance to weak banks via interbank lending, which could prevent the interbank market from functioning. As initially modelled by Hirshleifer (1971), disclosure can be ex ante inefficient, since it limits welfare-enhancing risk-sharing that would otherwise occur. Goldstein and Sapra (2014) argue that this effect is likely to be stronger in normal times, when few banking companies would be in weak condition, and less important during stress periods, when interbank lending would likely be limited in any case, since many banks would be stressed.

Third, disclosure of supervisory stress test results could affect incentives of bank managers in choosing assets and business focus. Bank managers might adjust their lending and other activities in ways that produce better stress test results, even if those choices are not value-maximizing. This incentive could strengthen over time, as banks become more familiar with the stress tests and are better able to predict the results.

Finally, because banks are at risk for coordination failures and runs, disclosure of stress test results could exacerbate tendencies for market participants to overweight public information and underweight private information. In such situations, market participants may be more concerned about what other participants know and how they will react than about actual fundamentals. Disclosure of

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<sup>6</sup> For conciseness, we do not cite individual papers references in Goldstein and Sapra (2014), which contains detailed descriptions of the papers and an extensive reference section.

supervisory stress test information that is flawed or imprecise could induce market reactions that would not otherwise have occurred based on superior and more diffuse private information.

This paper examines three key questions about U.S. supervisory stress test disclosures. First, do these disclosures produce market-relevant information about the stress tested BHCs and/or about the broader banking industry? As noted, some have argued that the information content of the U.S. stress tests has declined over time (Glasserman and Tangirala 2015) and previous event studies of supervisory stress test disclosures in the United States and Europe have found mixed evidence of significant market price reaction. Our first tests, then, are designed to assess whether disclosures provide information that affects the actions or views of market participants.

Next, we ask whether BHC characteristics are correlated with the amount of information produced by stress test disclosures. Previous research (Morgan 2002, Hirtle 2006) has found that more highly levered BHCs and BHCs with more liquid assets are more opaque, suggesting a higher marginal value for additional information about these institutions. We therefore examine how BHC leverage, risk and liquidity are associated with the amount of information produced by stress test disclosures. Our hypothesis is that market participants might find supervisory stress test information more valuable for BHCs that are more highly levered and/or riskier since, all else equal, these firms are more vulnerable to the negative economic and financial market conditions. We find that the market response is larger for riskier firms.

We then assess whether the potential negative welfare consequences of public disclosure of that private supervisory information has negative welfare consequences. Following the channels suggested by Goldstein and Sapra (2014), we examine whether supervisory stress test disclosures are associated with reduced information production by private sector participants, distorted managerial incentives, reduced risk sharing or increased probability of runs. We find no evidence to support the theoretical concerns relating to increased disclosure. The information environment for public equity appears if anything, better, for stress tested firms, and we find no evidence for reduced risk sharing or runs.

#### 4. Market Response to Stress Testing Announcements

##### *Average Market Response*

As a first step in examining the market response to supervisory stress test disclosures, we conduct a conventional event study of stock price reaction around nine specific stress test disclosure dates between 2009 and 2015 (see Panel A of Table 1). We focus on dates on which the SCAP, CCAR or DFAST stress test results were released.

We use a market model to estimate cumulative abnormal stock price returns in a window around the time of each supervisory stress test disclosure. Since the stress tested BHCs are the largest bank holding companies in the United States, we choose a three factor model as in Fama and French (1993) to account for differences in returns of larger firms.<sup>7</sup> (Campbell, Lo and MacKinlay 1997 and Kothari and Warner 2006 provide overviews of event study methodology). This specification differs from those used in earlier studies (Morgan et al. 2014 and Candelon and Sy 2015), which use a banking stock index or simple market model. We estimate the three factor market model using daily returns over a 6 month window ending on the last day of the month prior to the event date (e.g. through April 30, 2009 for the SCAP, whose results were published in May 2009). We cumulate abnormal returns for the 3-day window  $[t-1, t+1]$ . This relatively short event window ensures that we capture the impact of stress testing public disclosures, although at the risk that we may understate the impact of stress testing if information arrives in the market in advance of the announcement date.

We calculate average cumulative abnormal returns (“CAR”) for each disclosure date for two groups of BHCs: those subject to public disclosure of stress testing results and other large publicly traded banking firms (“Other BHCs”). We examine CARs at non-stress tested BHCs to see whether stress test disclosures provide information about these firms, as well as the BHCs directly involved in the stress tests. This could occur if the stress tested and non-stress tested BHCs have common businesses, activities or portfolios, so that the stress test results contain information that is more broadly relevant.

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<sup>7</sup> Abnormal returns are calculated using the daily Fama-French Factors described at this link: [http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data\\_Library/f-f\\_factors.html](http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/f-f_factors.html) and accessed in May 2015.

The total sample consists of the 100 largest publicly traded banking firms<sup>8</sup> as of 2013:Q3. The total panel is constant over time, although a few firms do not have available information in every quarter. By the end of the sample, the supervisory stress tested group includes 23 firms. This is fewer than the BHCs subject to stress testing and associated public disclosure of information because we exclude Metlife, Inc. (which ceased to be a BHC in 2013), Ally Financial (which is not publicly traded), and seven BHCs that are subsidiaries of foreign banks. Note that six BHCs begin the panel as non-stress tested firms, and are added to the stress tested group in 2014, the first year in which stress testing results related to those BHCs are made public.

Panel A of Table 2 presents the conventional event study results. The average abnormal returns differ across announcement dates in sign and significance. The sign and significance of average CARs are the same for the two groups of BHCs for a given disclosure event. Averaging across all dates in the rightmost column, we find a mean CAR of 76 bps for stress tested BHCs and 38 bps for the set of other BHCs, though the difference between these two groups is not statistically significant. Thus, disclosure of stress test results appears to affect the value of all large BHCs. Some of our results are similar to those reported by earlier researchers (Morgan et al. 2014 for SCAP, Candelon and Sy 2015 for SCAP through 2013), despite differences in our return generating functions.

Because the results are averages across BHCs in each group, this simple event study approach fails to distinguish between positive and negative information effects. In our setting, to know whether a particular supervisory stress test result represents positive or negative news, it is necessary to know the market's *ex ante* expectation of the stress test results. For instance, Morgan et al. (2014) found a significant association between abnormal returns and the difference between the expected and actual size of each BHC's capital "gap" in the SCAP results. Because standard event study methodology assumes that all treated firms react in the same direction, this does not necessarily tell us what we need to know about new stress test information.

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<sup>8</sup> Public banking firms are defined as BHCs and commercial banks that have both CRSP PERMCOS and Federal Reserve RSSDIDs (identified using the Federal Reserve PERMCO-RSSDID link). Our panel is constant and includes the 100 largest banking firms by 2013:Q3 equity market capitalization. Not all firms have available data in every specification.



To address this conceptual shortcoming, we examine three additional measures that should better capture disparate, significant changes in share price. First, we examine the average absolute 3-day cumulative abnormal change in share prices (“|CAR|”) associated with stress test result announcements.<sup>9</sup> This measure should be large if investors react to the announced information, regardless of how positive and negative effects are distributed across the sample. All else equal, absolute abnormal returns will be larger the more new information is revealed by the stress test disclosures. Average |CAR| is calculated as:

$$\text{Average } |CAR| = \frac{\sum_{i=1}^J |CAR_i|}{J}. \quad (1)$$

where J is the number of BHCs in the stress tested or non-stress tested group. Panel B of Table 2 reports |CAR| for the groups of stress tested and non-stress tested BHCs.

Because it is the sum of absolute values, |CAR| will have a positive mean and thus we cannot rely on standard event study test statistics, since these evaluate event window outcomes against a null hypothesis that abnormal returns are zero. Instead, we assess the significance of |CAR| during the event window by comparing it to its average value over the pre-event estimation period. The 4<sup>th</sup> and 5<sup>th</sup> rows of Panel B show these average estimation period values for each of the nine disclosure dates. The panel also reports the outcomes of three different test statistics to evaluate whether the |CAR| differs significantly from these pre-event values. The first is a basic t-test of the difference in means between |CAR| and the pre-event values. The second statistic tests for difference in means using the Wilcoxon rank sum test. This test is a non-parametric test and, unlike the t-test, does not required the underlying populations to be normally distributed. The final test is the statistic suggested by Corrado (1989), which is an alternative non-parametric approach based on the rank of event date |CAR| relative to the rank of values in the estimation window. The p-values of these statistics are reported in the middle rows of the table.

Bank holding companies that are subject to stress testing have average |CAR| of at least one percent on each supervisory stress test disclosure date. The average |CAR| is statistically significant at the 5 percent level or better for five of the nine disclosure dates. For disclosure events after 2012, DFAST disclosures appear to generate a larger market reaction than CCAR disclosures, perhaps reflecting the relative timing of these disclosures (DFAST disclosures preceded CCAR disclosures by a week or less).

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<sup>9</sup> Bird et al. (2015) examine the absolute value of daily abnormal returns around CCAR disclosure dates and find that the absolute value of abnormal returns increases on average for CCAR disclosure dates in 2012 to 2014.

Across all stress testing dates, the average absolute abnormal return is almost three percent and is statistically larger than its pre-event value (see column 11 of the table).

In addition to information about the stress tested BHCs, we find that supervisory stress test disclosures may be informative about other large BHCs. The average  $|CAR|$  is two percent, and statistically significant at the 5 percent level or better for several of the nine disclosure dates for the non-stress tested firms. However, the effect is clearly stronger for the stress tested firms. The  $|CAR|$  is higher for the stress tested firms on several of the event dates, although the difference between the stress tested and non-stress tested firms is not always statistically significant. Combining all event dates, the  $|CAR|$  is 75 basis points higher for stress tested firms than for non-stress tested firms, a difference of more than 25 percent (see column 11). The difference is not just size driven. In unreported results, we also did similar calculations for the largest publicly traded non-bank companies and for non-bank financial firms (NAICS codes starting in 52), many of which are comparable in size to the stress tested BHCs in market capitalization. The stress tested BHCs have significantly higher  $|CAR|$  than each of these other portfolios, suggesting that the abnormal returns are not driven exclusively by firm size.

The SCAP is associated with the highest absolute value abnormal returns – almost 10 percent. However, these returns do not appear to be statistically different from those in the pre-event estimation period. This is puzzling because the general view in the academic and popular literature is that the SCAP has provided substantial information about the banking sector's overall condition. Upon closer inspection, the lack of statistical significance arises from the fact that the absolute abnormal returns in the SCAP estimation period are quite high. The estimation period spans November 2008 to April 2009, including much of the market turmoil that followed the collapse of Lehman Brothers, a time period which was usually turbulent and volatile. As an alternative, we also estimated the market model over the six month period following the May 2009 SCAP disclosure and compared  $|CARs|$  around the SCAP disclosure date to average absolute abnormal returns during this post-disclosure window. As shown in column 2, SCAP-related  $|CARs|$  are significantly greater than absolute abnormal returns in the post-disclosure estimation window, consistent with the idea that these disclosures had significant market impact. In any case, the SCAP results do not appear to drive the overall finding that  $|CAR|$  is large around disclosure event dates. As illustrated in the last column of the table, when the SCAP results are omitted, average  $|CAR|$  continues to be statistically different from its

pre-event period value and  $|CAR|$  for the stress tested BHCs significantly exceeds  $|CAR|$  for the non-stress tested sample.

The second direction-neutral way in which we measure the information content of stress tests is by looking at abnormal trading volume. This measure, which is similar to one used in the accounting literature (see Bamber et al. 2011 for a summary) is based on the assumption that trading volume increases if new information affects investors' prior beliefs (Karpoff 1986).<sup>10</sup> We would thus expect to see abnormally high trading volume during periods of high information dispersal. This is consistent with the findings of Bird et al. (2015), who show that actual trading volume on CCAR disclosure dates in 2012, 2013 and 2014 is higher on average than in the days immediately preceding the disclosures.

Analogously to abnormal stock returns, we measure abnormal trading volume as deviations in BHC trading volume relative to what would be expected given market-wide trading volume. To calculate abnormal trading volume, we regress each BHC's daily trading volume on daily market trading volume:

$$Vol_{i,t} = \beta_0 + \beta_1 Vol_{Market,t} + \varepsilon_{i,t}. \quad (2)$$

Daily trading volume for BHC  $i$ ,  $Vol_{i,t}$ , is defined as number of shares traded on day  $t$  divided by number of shares outstanding. Market trading volume,  $Vol_{Market,t}$ , is the total number of shares traded in the CRSP Total Index divided by the number of shares outstanding in the index. The regression is estimated using daily data over the six month period ending on the last day of the month prior to the stress test disclosure date. Abnormal trading volume is the difference between the actual and predicted trading volumes on each day around the disclosure date. Cumulative abnormal trading volume (CAV) equals that sum of abnormal trading volume over the 3-day  $[t-1, t+1]$  window around the disclosure date.

Panel C of Table 2 presents results for CAV. Stress tested BHCs have higher abnormal volumes on stress testing event dates –including all stress testing announcement dates, trading volumes are 132 basis points higher than volumes predicted by a market model. This compares to 14 basis points higher abnormal trading volumes for non-stress tested BHCs (the difference is statistically significant). CAV is positive for stress tested BHCs on all of the nine event dates,

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<sup>10</sup> See Lo and Wang (2000) for a discussion of this method in the context of mutual fund separation.

although the measure is not always statistically significant. The stress tested BHCs' CAV statistically exceeds the other BHCs' CAV on seven of nine event dates.

Since stress testing is oriented towards performance in bad macroeconomic and financial market outcomes, supervisory stress test disclosures may be more informative for instruments, such as CDS, that vary more with downside risk.<sup>11</sup> As a final assessment of the information impact of supervisory stress test disclosures, we examine changes in credit default swap (CDS) spreads. Similar to stock returns and volumes, we estimate an abnormal change in CDS spreads as the fitted residual from a regression of daily changes in CDS spreads on changes in a "market" CDS spread measure, estimated over the six months prior to the start of the supervisory stress test disclosure month:

$$(CDS_{i,t} - CDS_{i,t-1}) = \gamma_0 + \gamma_1 (CDX_t - CDX_{i,t-1}) + \varepsilon_{i,t} \quad (3)$$

where  $CDS_{i,t}$  is the change in CDS spread on the  $i^{\text{th}}$  BHC's 5-year CDS contract on day  $t$ , and  $CDX$  is the change in spread of the CDX North America Investment Grade CDS index.

Since a stress test might reveal unanticipated strength or weakness at sample BHCs, we again take the absolute value cumulative abnormal spread change  $|CACDS|$ . Temporary data limitations in the availability of CDS prices permit us to calculate  $|CACDS|$  only for the first seven event dates. (We exclude the 2015 CCAR and DFAST disclosures.)

The results in Panel D of Table 2 provide somewhat limited evidence that the CDS spreads of stress tested BHCs change abnormally around all the available supervisory stress test disclosure dates. The average  $|CACDS|$  across these seven event dates is 4.6 percent, which is statistically significantly higher than the average  $|CACDS|$  for the non-stress tested BHCs and higher than average value in the pre-event periods, and this difference is statistically significant (see column 11). These averages are influenced by the very high abnormal spreads at the SCAP disclosure, the only individual disclosure event date for which  $|CACDS|$  differs significantly from its pre-event value. Omitting the SCAP results (column 13), the average  $|CACDS|$  falls to 3.3 percent, which is again higher than the value for non-stress tested BHCs but is just about equal to the value in the pre-event window. These results should be interpreted with care, because

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<sup>11</sup> In future versions of the paper we plan to add similar analysis on option implied volatility, volatility skew, as well as other stock market driven measures such as price nonsynchronicity (as in Chen et al. 2007) and probability of informed trading (PIN) (as in Easley et al. 2002).

not all our sample BHCs have traded CDS. The results in Panel D of Table 2 are therefore based on smaller sample sizes, especially for the non-stress tested group. The stress tested BHCs generally have higher  $|CACDS|$  than the non-stress tested group, but the non-stress tested sample is so small that it is difficult to make rigorous comparisons.

Finally, in contrast to Glasserman and Tangirala (2015), our results suggest that the market response to supervisory stress test disclosures continues to be significant even for the more recent disclosure events. Figure 1 presents our  $|CAR|$ ,  $CAV$ , and  $|CACDS|$  results graphically for the stress tested BHCs across the nine SCAP, CCAR and DFAST disclosure dates. Clearly, these values are highest for the original SCAP disclosures in 2009 and have declined since 2012, but are roughly equal for the 2013, 2014 and 2015 disclosures. While the measures have decreased since 2012, the hypothesis that the values are the same (and non-zero) for the 2013 to 2015 disclosures cannot be rejected.

In summary, Table 2 and Figure 1 present evidence that stress testing disclosure dates are associated with statistically significant absolute abnormal stock returns and abnormal trading volumes. We find little evidence that these abnormal securities movements have decreased in significance over time, though they have decreased in size since the 2009 SCAP. In total, the findings suggest that supervisory stress test disclosures have continued to provide relevant information to investors and other market participants. Further, abnormal securities movements are bigger for stress tested BHCs than for the next largest banking firms. While supervisory stress test disclosures may provide information about the banking industry in general, that information appears to be most relevant for the stress tested BHCs.

### ***Market Response in the Cross Section***

Does stress testing produce more information about riskier BHCs? Or about BHCs with different business models? We examine the cross section of market reactions to see if observable BHC characteristics are associated with abnormal securities movements. We focus on  $|CAR|$  and  $CAV$ , since we do not have a large sample for CDS. In particular, we run a cross-sectional regression across the 100 largest BHC for each of the nine event dates:

$$|CAR|_{i,t} \text{ or } CAV_{i,t} = \alpha + \beta(\text{Stress tested BHC})_{i,t} + \gamma(\text{BHC characteristic})_{i,t} + \delta(\text{Stress tested BHC})_{i,t}(\text{BHC characteristic})_{i,t} + \Sigma \gamma + \epsilon_{i,t} \quad (4)$$

where *Stress tested BHC*<sub>*i,t*</sub> is a dummy variable equal to 1 if that BHC participated in the stress testing at time *t*. *BHC characteristic*<sub>*i,t*</sub> is a set of observable characteristics as of the BHC's Y-9C regulatory filing from the most recent quarter prior to the announcement date or a market measure calculated through the end of the prior quarter. These variables, which are defined in detail in Appendix A, are intended to capture variation in leverage, risk and liquidity across BHCs.  $\Sigma_y$  is a set of year fixed effects, included to control for variation in business conditions over time. (Note that these are similar to event date fixed effects, except for in 2014 and 2015 when there are two event dates, but only one year fixed effect.) Standard errors are clustered by BHC.

The estimated coefficients  $\gamma$  and  $\delta$  indicate whether BHC characteristics are associated with the amount of information in supervisory stress test disclosures for some or all of the sample BHCs. A finding that  $\gamma$  is statistically different from zero suggests that the BHC characteristic in question is associated with significant variation in information for all BHCs in the sample. If  $\delta$  is statistically significant, this indicates that there is a differential effect for stress tested BHCs relative to non-stress tested BHCs.

Stress tested BHCs differ from non-stress tested BHCs across a number of characteristics. We present summary statistics for the panel of BHCs in Table 3, with one observation per firm per event date. Not surprisingly, stress tested BHCs are much larger, in both total assets and in their market capitalization. Stress tested BHCs have lower equity capital ratios as measured in book or market terms, although the difference is not statistically significant. Stress tested BHCs have insignificantly less volatile business models, on average, as measured by stock price and earnings volatility, although they experienced higher losses in the financial crisis. They have more liquid assets, but also more runnable liabilities (lower liquidity coverage).

The relationship between firm characteristics and  $|CAR|$  is tabulated in Table 4, and CAV in Table 5. In the first 9 columns of each table, we look at individual measures of leverage, risk and liquidity. In columns 10 and 11, we combine subsets of our measures of leverage, risk and liquidity, since we expect these measures may be correlated. Finally, in column 12, we include all of the measures of all of the BHC characteristics together. There appears to be meaningful variation across BHCs with different firm characteristics in the scale of the market

response on supervisory stress test disclosure dates – adding all the BHC characteristics to the specification adds an incremental 20 to 25 percentage points to the adjusted R-squared.

More highly levered firms are likely to be more vulnerable to a severely adverse macroeconomic scenario, and therefore stress testing information may be more salient for these firms. In fact, the results suggest that banking firms with higher leverage have larger absolute abnormal returns and abnormal trading volumes on disclosure event dates. The estimated coefficient on equity is negative whether we examine book leverage (Tier 1 capital / risk-weighted assets) or a market leverage measure (equity market capitalization / total assets).<sup>12</sup> The relationship between leverage and |CAR| is statistically significant for both stress tested and non-stressed tested BHCs (there is no differential impact between the two groups), while for CAV, the relationship is significant just for stress tested BHCs. A stress tested firm with one standard deviation lower equity market capitalization has absolute value abnormal return and abnormal trading volume that both exceed the predictions of a market model by more than 60 basis points on stress testing announcement dates.

Stress testing appears to be more informative about riskier firms in general. Abnormal event date returns and volumes are associated with several other measures of risk, including earnings volatility, stock price volatility and the ratio of risk-weighted assets to total assets. The relationship between these risk measures and |CAR| is positive and statistically significant for all BHCs, with no differential effect for the stress tested BHC group, while the risk measures are significantly correlated with CAV only for the stress tested BHCs. BHCs that had high losses in the financial crisis have higher abnormal returns and volumes as well – for stress tested BHCs, a one standard deviation higher loss is associated with 2 percentage point higher absolute abnormal returns and 3 percentage point higher abnormal volumes.

Consistent with the stated goal of Federal Reserve stress testing to focus on capital in a tail risk scenario, we find evidence that absolute abnormal returns and abnormal volumes are higher for riskier firms – just the type of firms that might be most vulnerable to a tail risk event. More highly leveraged and riskier stress tested BHCs have larger absolute abnormal returns and abnormal trading volumes. In addition, non-stress tested BHCs with higher leverage and more volatile business models also experience higher |CAR| on stress testing disclosure dates. This

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<sup>12</sup> Results are similar if we look at equity market value divided by market value of assets and at tier 1 capital divided by total assets.

suggests that there may also be information produced in the stress tests about the banking industry more broadly.

## **5. Are there Negative Consequences of Disclosure?**

Theory suggests a number of ways in which supervisory stress test disclosures could be detrimental to social welfare, including crowding out private information production, inhibiting risk-sharing, increasing run vulnerability, and distorting management incentives (Goldstein and Sapra 2014). In this section, we present preliminary analysis to determine if there is empirical evidence consistent with the predictions of these theories.

### ***Crowding out private information production***

The production of information in stress testing need not improve welfare. If the disclosure of information in stress testing reduces incentives for private markets to produce information, the net welfare gains of information disclosure are reduced. There are many ways in which private information production can be reduced. We assess private sector information production by examining changes in the number of analysts following each stress tested and non-stress tested BHC over time, in a difference-in-differences format. We begin with the obvious – equity analyst coverage. If stress testing is displacing equity analyst information production, we would expect to see less analyst coverage and poorer quality earnings estimates of stress tested BHCs. We do not see this. If anything, there are more equity analysts and analyst earnings estimates appear to have improved in forecast accuracy.

The results of our analysis of equity analyst information are reported in Table 6. The dependent variable in each specification is a measure of analyst information production using quarterly data from I/B/E/S from 2007:Q1 to 2014:Q1.<sup>13 14</sup> Each specification includes cumulative time fixed effects for the time period after SCAP, CCAR 2011, CCAR 2012, CCAR 2013 and CCAR 2014 and interactions between the time fixed effects with dummies for stress tested BHCs. We also add controls for firm characteristics that are associated with analyst coverage such as firm size (total assets), whether the firm is about to release a negative earnings report

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<sup>13</sup> I/B/E/S data is widely used in the literature. Michaely and Womack (2005) summarize some of the stylized facts and limitations of analyst recommendations.

<sup>14</sup> We will add additional information through March 2015 when that data becomes available.



and the recent path of abnormal returns for the firm (following Gomes et al. 2006).<sup>15</sup> In addition, we estimate each specification with BHC fixed effects, which allows us to control for constant unobservable characteristics of the firm that may be associated with analyst coverage.

For ease of interpretation, we add up the estimated coefficients to calculated marginal effects, which are shown at the bottom of the table. Each marginal impact measures the cumulative change in the dependent variable between the 2009 SCAP and the end of 2014 for a particular group of BHCs, controlling for other variables in the specification. We calculate marginal effects for three groups of BHCs. *Non-Stress Tested Marginal Effect* is the marginal effect for non-stress tested BHCs, calculated as the sum of the time fixed effects; *SCAP BHC Marginal Effect* is the cumulative change in the dependent variable for the original SCAP BHCs, calculated as the sum of the time fixed effects and the sum of the interaction between the time fixed effects and stress tested BHCs. This is a simple sum, because all SCAP firms have been stress tested since the beginning of the sample. Finally, *New BHC Marginal Effect*, is the cumulative change in the dependent variable for six BHCs with assets greater than \$50 billion that became part of the CCAR and DFAST programs for the first time in 2014. This effect is calculated as the sum of the time fixed effects and the interaction between the time fixed effects and stress tested BHCs only for 2014. This reflects the fact that these six firms were not part of the stress tested group prior to that date.

We begin with the simplest possible interpretation of information production, looking at the amount of analyst coverage. Even after controlling for size, it is worth noting that stress tested firms have more analyst coverage and higher earnings forecast errors than do other large BHCs. The introduction of stress testing does not seem to stop analysts from covering these firms – on average, relative to before stress testing began, SCAP firms have 6 more analysts (marginal effects, SCAP firms, specification (2)). The pattern is more nuanced, however, for the firms that entered stress testing in 2014. These smaller stress tested firms have not increased analyst coverage by as much as other firms. Relative to the pre-2009 period, these “New BHCs” have added one additional analyst. However in the same time, non-stress tested BHCs have almost two additional analysts.

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<sup>15</sup> Size based on Bhushan (1989); Brennan and Hughes (1991); Lang and Lundholm (1993, 1996); and Chung and Jo (1996). The other explanatory variables are dimensions of firm performance, as in Bhushan and O'Brien (1990). Results are similar if none of these controls are included.

What about the quality of the information produced by these analysts? If anything, forecast accuracy (scaled by actual EPS) has improved in the time period after stress testing (Table 6, columns (3) and (4)). In sum, mean forecast errors are significantly lower for SCAP BHCs relative to other BHCs and relative to the pre-stress test period. Much of the difference occurs after the SCAP, when forecast errors increase for non-stress tested BHCs, but decrease for stress tested BHCs. Mean forecast errors are lower for “New BHCs” as well, but the amount is similar to the decrease for non-stress tested BHCs and neither amount is statistically different from zero. Results are similar if the dependent variable is median forecast error instead of mean (not shown).

We also looked at the variability of analysts’ estimates, since this is sometimes used as a measure of firm opacity. We observe a large, statistically significant increase in the standard deviation of analyst forecasts for stress tested BHCs after the SCAP, which is more than offset by a large, statistically significant decrease in the standard deviation of analyst forecasts after the 2012 CCAR. On net, there has been a marginal decrease in the standard deviation of analyst estimates stress tested BHCs, a decrease almost twice that of non-stress tested BHCs, though the cumulative change is not statistically significant for either group. Still, in combination with the increase in forecast accuracy, we interpret this as a decline in opacity. It may also reflect the effect of a common signal.

The identification strategy of this analysis assumes that BHCs are similar in the pre- and post-stress testing period or that they have changed in ways that are similar to how non-stress tested BHCs have changed. While this may be plausible when looking at the number of analysts, it may be harder to believe when evaluating the forecast errors. For example, if the banking business has become easier to forecast (or the stress tested BHCs have disproportionately changed their business models), a comparison of these BHCs in the pre- and post-period may reflect business model changes, rather than the impact of stress testing. In this case the identification strategy relies on the premise that the ways in which forecast errors and the SD of analysts’ estimates have changed are similar for the stress tested and non-stress tested BHCs. This assumption is likely the most plausible for the “New BHCs,” which are generally similar to the next smallest banking companies.

### ***Ex Ante Reduction in Risk Sharing***

A traditional argument in favor of limiting disclosure of supervisory information is reducing the possibility of runs. Hirshleifer (1971) suggests that there may be endogenous costs of disclosure. For example, disclosure can reduce welfare by reducing mutual risk sharing, such as interbank lending. In contrast, Heider et al. (2009) and Acharya et al. (2009) model contagion risk from information asymmetry. In these models the elimination of the risk of firm default can prevent the market from unraveling.

We examine interbank borrowing and find that there is no difference between stress tested BHCs' and non-stress tested BHCs' borrowing in this market. The dependent variable in this specification is each BHC's federal funds and repo borrowing scaled by total assets, as reported in quarterly FRY-9C regulatory reports. The time period is 2007:Q1 to 2014:Q1. Each specification includes cumulative time fixed effects for the time period after SCAP, CCAR2011, CCAR 2012, CCAR 2013 and CCAR 2014. The omitted time period is thus 2007:Q1 through 2009:Q2.<sup>16</sup> As before, we interact the time fixed effects with dummies for stress tested firms.

The results are shown in Panel A of Table 7. We observe a decrease in interbank lending since 2009 for all firms – the coefficients on the time period dummy variables are all negative and mostly statistically significant. However, structural changes in the interbank lending markets that were initiated at the same time as stress testing make it unlikely that this change reflects the impact of stress testing on these markets in the time series.<sup>17</sup> Looking within the cross-section, we do not estimate a statistically significant coefficient on any of the interactions with stress tested BHCs. In other words, we find no differential decrease in interbank borrowing by stress tested BHCs. If anything there may be an increase.

It may be instead that we need to look at the interbank access of stress tested BHCs with poor stress test performance. Specifically, in Panel B of Table 7, we look at the change in fed funds and repo borrowing of the stress tested BHCs between March 31 and December 31 (i.e. the quarter end before and after the stress testing announcement dates). The first two columns examine the change in amounts, and the second two columns examine the change in

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<sup>16</sup> We will add additional information through March 2015 when that data becomes available.

<sup>17</sup> The unsecured overnight market in the US experienced dramatic declines after October 2008, when the Federal Reserve began paying interest on reserves. Similarly, changes to the repo market reflect increased supervisory attention to those markets after the 2008 financial crisis.

average pricing (defined as the interest expense on fed funds and repo normalized by the quarter end fed funds and repo balance). While on average, stress tested BHCs appear to be decreasing interbank borrowing (negative coefficient on stress tested dummy variable), the estimated coefficient for stress tested BHCs is not statistically significant. Notably, we do not see a large decline in interbank borrowing for BHCs whose stressed capital ratios fall below minimum levels (“quantitative failure”) or for those BHCs experiencing a broader range of negative DFAST/CCAR outcomes, including capital plan objections, reducing their original capital distribution requests, and stressed capital ratios below minimum levels (“negative outcomes”).

### ***Run Vulnerability: Disproportionate Effect on Firms with Investors that have Strategic Complementarities?***

The receipt of a common signal may make firms more vulnerable to runs. Goldstein and Sapra (2014) posit that disclosure of information from supervisory stress testing may induce a larger market response when investors have strong strategic complementarities.<sup>18</sup> For example, creditors may be more likely to run on banks with a severe maturity mismatch or more illiquid assets when a common signal is received. Counter to this theory, we find that the revelation of a common signal does not appear to differentially affect banking firms with more strategic complementarities. We do not find strong evidence that abnormal event date returns are higher for banks with a higher maturity mismatch or more illiquid assets (see columns (8) and (9) of Tables 4 and 5). Generally there is no statistically significant relationship between these BHC characteristics, and in some volume specifications, the estimated coefficient on our liquidity coverage ratio measure is actually positive for stress tested BHCs.

### ***Distorting Managerial Decisions***

One consequence of disclosing supervisory stress test results is that stress tested BHCs could have incentives to change their business focus or assets composition so that they perform better on the stress tests. Such incentives could be positive or negative from a social welfare perspective. If the stress tests provide new information about the underlying risks of certain activities or assets, then changes the BHCs make in response to that information could be welfare enhancing. However, there are several ways in which these incentives could have negative effects on social welfare. As described by Goldstein

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<sup>18</sup> Chen et al. (2010) find empirical evidence consistent with the importance of ownership complementarities among equity mutual funds.

and Sapra (2014), BHCs may choose investments or projects that perform well on supervisory stress tests but that are not value-maximizing in the long run. They argue that BHCs' ability to alter portfolios in this way becomes stronger over time as supervisory stress tests are repeated. Further, BHCs could alter their portfolios to perform well on supervisory stress tests, but retain risk in forms not well-captured in the stress tests. This concern is echoed by Schuermann (2013), who argues that BHCs have strong incentives to mimic the Federal Reserve's stress test models to be able to anticipate the Fed's stress test results. Such incentives could result in a destabilizing "model monoculture" in which emerging risks are less likely to be identified.

We explore these concerns by examining whether BHCs appear to alter the growth of assets or loans in response to supervisory stress test results. In particular, we examine how differences between BHC-generated and Federal Reserve DFAST results are related to subsequent asset and loan growth. When the Federal Reserve's stress test results are more severe than a BHC's, do assets or loans grow more slowly? If we find that BHCs respond to the gap between the Fed's and their own stress test projections, then this would be preliminary evidence that disclosure of supervisory stress test results is affecting BHCs' portfolio choice – though simply finding a relationship does not indicate whether the relationship is welfare enhancing or welfare detrimental. In contrast, if we do not find a relationship, then concerns about supervisory stress testing causing sub-optimal portfolio choice seem less warranted.

We estimate cross sectional regressions of loan or asset growth in the three quarters following the release of the DFAST results on the difference between the Federal Reserve's and the BHC's stress test projections:

$$Y_{i,t+3} = \beta_0 + \beta_1 GAP_{i,t} + \gamma_t + \varepsilon_{i,t}, \quad (5)$$

where  $Y_{i,t+3}$  is growth in assets or loans at BHC  $i$  in the three quarters following stress test disclosure quarter in year  $t$ ,  $GAP_{i,t}$  is the difference between the Federal Reserve and BHC stress test projection in disclosure year  $t$ , and  $\gamma_t$  is a fixed effect for year  $t$ . The equations are estimated using data for the 2013 and 2014 DFAST disclosures. A negative value for  $\beta_1$  would suggest that assets or loans grew more slowly at BHCs for which the Federal Reserve's stress test projections were more severe than the BHC's own projections.

Panel A of Table 8 contains results of these estimates for the loan portfolio. These regressions relate growth of different categories of loans to the difference between the Federal Reserve's and the BHC's projected loss rate for that type of loan. Results are reported for all observations and for observations involving just material portfolios (defined as portfolios representing at least 3 percent of total loans), since BHCs might have greater incentives to adjust larger and more consequential loan portfolios.

As the table shows, however, there is little consistent evidence that BHCs loan portfolios grow more slowly when the Federal Reserve projects higher loss rates for those loans. For regressions involving all observations, there is no statistically significant relationship between total loan growth and the difference between the Federal Reserve and BHC projected loan loss rate. There is a statistically significant relationship for four of the seven individual loan categories, but two of these suggest that when the Federal Reserve projects a higher loss rate than the BHC (so that "GAP" is positive), loan growth is actually higher than at other BHCs. When the results focus just on material portfolios, the results are significant for only one loan category (commercial and industrial loans), and again, the sign of the coefficient on the Fed-BHC GAP is the opposite of what we would expect if BHCs were adjusting their portfolios to perform better on the supervisory stress tests.

Panel B of Table 8 presents the results of regressions of total asset and total loan growth on the BHC – Federal Reserve gap in three more comprehensive stress test projections: pre-tax net income (scaled by assets) and the minimum values of the tier 1 common and tier 1 leverage capital ratios. Each of these three measures captures differences in the overall severity of the BHCs' and the Federal Reserve's stress test results. The results suggest that when the Federal Reserve's stress test results are more severe than the BHC's (that is, when the BHC projection of net income or minimum capital ratio is higher than the Fed's projection), that total assets grow more slowly over the subsequent three quarters. The coefficients on all three variables are negative and are statistically significant for net income and the minimum tier 1 common ratio. However, there is no evidence that overall loan growth is related to this gap.

In sum, then, these results suggest that BHCs whose stress test projections are less severe than the Federal Reserve's tend to grow more slowly overall, but there is little evidence that either the overall loan growth or the growth of particular types of loans is related to gaps between the BHC and Federal Reserve stress test results. BHCs appear to respond in a general way to supervisory stress test results that are more severe than their own, but there is little evidence of modification of loan portfolio

growth or composition in response to supervisory stress test results. Thus, these findings thus do not provide strong preliminary support of the idea that BHCs are adjusting their portfolios in response to the Federal Reserve's stress test findings.

## **6. Conclusion**

The disclosure of supervisory stress testing information about large BHCs by the Federal Reserve provides information that is material to investors in these firms. Stress testing disclosures are accompanied by abnormal price and volume movements. Information appears to be most meaningful for riskier and more volatile BHCs. While the initial stress test in 2009 had the largest announcement effects on stress tested BHCs, subsequent stress testing disclosure dates appear to continue to inform the market, with statistically significant abnormal volumes and returns for the 2015 DFAST and CCAR results. Stress disclosures appear to provide information not only about stress tested BHCs, but also about other large banking firms that were not directly involved in the stress tests. Methodologically, our analysis highlights the benefits of a simple approach, using absolute value abnormal returns, to avoid the joint problem of measuring information and guessing about the direction of the information.

Despite the theoretical possibility of negative welfare impacts from stress testing disclosure, our analysis does not find evidence consistent with these theories. Stress tested BHCs (and the banking industry) have more analysts producing more accurate earnings estimates than before stress testing was initiated. Risk sharing does not appear to be reduced, and banks do not seem to be changing their business models in response to stress test results.

Of course, we are evaluating the consequences of stress testing disclosure in a relatively benign environment in which BHC leverage is at recent historical lows. A full analysis of the consequences of stress testing disclosure may require the realization of a bank failure. The fact that we find little evidence of negative repercussions of stress testing disclosure does not mean they could not be possible if stress testing and assorted disclosure were applied to a different set of firms. Investor demand for information about the largest firms in an industry may make the largest BHCs less vulnerable to changes in the information environment.

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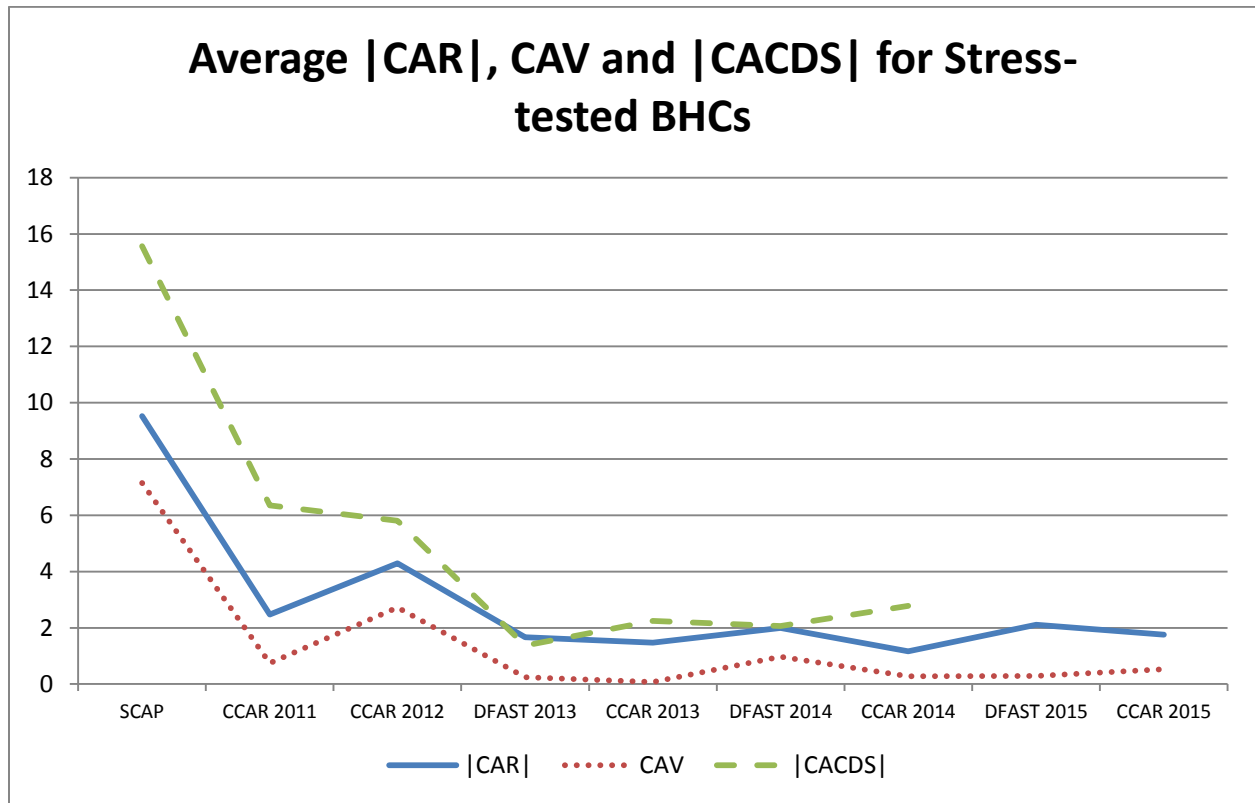
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Figure 1



**Table 1, Panel A: Timeline of Supervisory Stress Test Disclosures (2009 to 2015)**

<b>May 7, 2009</b>	SCAP stress test results released
<b>March 18, 2011</b>	2011 CCAR results released
<b>March 13, 2012</b>	2012 CCAR results released
<b>March 7, 2013</b>	2013 DFAST results released
<b>March 14, 2013</b>	2013 CCAR results released
<b>March 20, 2014</b>	2014 DFAST results released
<b>March 26, 2014</b>	2014 CCAR results released
<b>March 5, 2015</b>	2015 DFAST results released
<b>March 11, 2015</b>	2015 CCAR results released

Note: Stress testing announcements are typically made after the market closes. The event date (t=0) is the first trading day after the announcement. Stress testing event dates indicated in bold.

Source: [federalreserve.gov](http://federalreserve.gov)

**Table 1, Panel B: List of Stress Tested Entities**

<b>Firm</b>	<b>Original SCAP BHC</b>	<b>Initial Disclosure Date</b>	<b>U.S.-Owned BHC?</b>
Ally Financial Inc.	Yes	2009	Yes
American Express Company	Yes	2009	Yes
Bank of America Corporation	Yes	2009	Yes
BB&T Corporation	Yes	2009	Yes
BBVA Compass Bancshares, Inc.	No	2014	No
BMO Financial Corp.	No	2014	No
The Bank of New York Mellon Corporation	Yes	2009	Yes
Capital One Financial Corporation	Yes	2009	Yes
Citigroup Inc.	Yes	2009	Yes
Citizens Financial Group, Inc.	No	2014	Yes
Comerica Incorporated	No	2014	Yes
Deutsche Bank Trust Corporation	No	2015	No
Discover Financial Services	No	2014	Yes
Fifth Third Bancorp	Yes	2009	Yes
The Goldman Sachs Group, Inc.	Yes	2009	Yes
HSBC North America Holdings Inc.	No	2014	No
Huntington Bancshares Incorporated	No	2014	Yes
JPMorgan Chase & Co.	Yes	2009	Yes
KeyCorp	Yes	2009	Yes
M&T Bank Corporation	No	2014	Yes
Morgan Stanley	Yes	2009	Yes
MUFG Americas Holdings Corporation	No	2014	No
Northern Trust Corporation	No	2014	Yes
The PNC Financial Services Group, Inc.	Yes	2009	Yes
Regions Financial Corporation	Yes	2009	Yes
Santander Holdings USA, Inc.	No	2014	No
State Street Corporation	Yes	2009	Yes
SunTrust Banks, Inc.	Yes	2009	Yes
U.S. Bancorp	Yes	2009	Yes
Wells Fargo & Company	Yes	2009	Yes
Zions Bancorporation	No	2014	Yes

**Table 2: Market Impact of Stress Testing Disclosures**

	SCAP 2009 Before May 8, 2009 (1)	SCAP 2009 After May 8, 2009 (2)	CCAR 2011 Mar 18, 2011 (3)	CCAR 2012 Mar 14, 2012 (4)	DFAST 2013 Mar 8, 2013 (5)	CCAR 2013 Mar 15, 2013 (6)	DFAST 2014 Mar 21, 2014 (7)	CCAR 2014 Mar 27, 2014 (8)	DFAST 2015 Mar 6, 2015 (9)	CCAR 2015 Mar 12, 2015 (10)	All Events (with SCAP before) N/A (11)	All Events (with SCAP after) N/A (12)	All Events Except 2009 N/A (13)
Event date													
<b>Panel A: Averages of Cumulative Abnormal Returns (CAR)</b>													
Stress tested banks	2.3944	3.2745	-2.3076	4.2872	0.8160	-0.3485	-0.4283	-0.8292	2.0092	1.5240	0.7607	0.8452	0.5871
Other public banks	1.6147	1.9672	-0.9027	2.4235	0.0020	-0.4865	-0.7007	-0.8597	2.2879	0.1198	0.3780	0.4153	0.2320
Difference (CCAR - Other public banks)	0.7797	1.3073	-1.4049	1.8637	0.8140	0.1380	0.2724	0.0305	-0.2787	1.4043	0.3827	0.4300	0.3552
Hypothesis: Stress tested event date = stress tested estimation window													
T-test	0.285	<b>0.001</b>	<b>0.000</b>	<b>0.000</b>	<b>0.051</b>	0.403	0.145	<b>0.005</b>	<b>0.000</b>	<b>0.000</b>	<b>0.011</b>	<b>0.000</b>	<b>0.000</b>
Hypothesis: Other public banks event date = other public banks estimation window													
T-test	<b>0.044</b>	<b>0.001</b>	<b>0.003</b>	<b>0.000</b>	0.941	<b>0.024</b>	<b>0.001</b>	<b>0.000</b>	<b>0.000</b>	0.569	<b>0.003</b>	<b>0.000</b>	<b>0.009</b>
Hypothesis: Stress tested event date = other public banks event date													
T-test	0.798	0.669	<b>0.001</b>	<b>0.018</b>	<b>0.081</b>	0.795	0.566	0.931	0.489	<b>0.000</b>	0.285	0.233	<b>0.086</b>
Stress tested N	17	17	17	17	17	17	23	23	23	23	177	177	160
Other public banks N	73	73	77	79	82	82	75	75	74	74	691	691	618
<b>Panel B: Averages of Absolute Value Cumulative Abnormal Returns (ICAR)</b>													
Stress tested banks	9.5265	9.4450	2.4699	4.2872	1.6683	1.4683	1.9905	1.1701	2.1117	1.7516	2.7780	2.7701	2.0609
Other public banks	5.6301	5.7368	1.3832	2.8087	1.1723	1.2738	1.4405	1.3467	2.4443	1.0020	2.0319	2.0432	1.6069
Difference (CCAR - Other public banks)	3.8965	3.7082	1.0867	1.4786	0.4960	0.1945	0.5500	-0.1765	-0.3326	0.7496	0.7461	0.7269	0.4540
Est. window mean (stress tested)	6.4849	2.6235	1.6101	1.8161	1.2178	1.2150	1.0453	1.0453	1.0665	1.0665	2.0851	1.5214	1.3230
Est. window mean (other public banks)	4.6809	3.0324	1.7512	1.7579	1.3101	1.3081	1.2939	1.2939	1.2164	1.2164	1.9717	1.7227	1.4700
Hypothesis: Stress tested event date = stress tested estimation window													
T-test	<b>0.028</b>	<b>0.000</b>	<b>0.007</b>	<b>0.000</b>	<b>0.063</b>	0.194	<b>0.000</b>	0.266	<b>0.000</b>	<b>0.001</b>	<b>0.003</b>	<b>0.000</b>	<b>0.000</b>
Wilcoxon	0.523	<b>0.002</b>	<b>0.004</b>	<b>0.000</b>	<b>0.016</b>	0.133	<b>0.008</b>	0.637	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>
Corrado	0.493	<b>0.029</b>	<b>0.034</b>	<b>0.001</b>	<b>0.076</b>	0.268	<b>0.080</b>	0.603	<b>0.044</b>	<b>0.055</b>	0.103	<b>0.059</b>	<b>0.081</b>
Hypothesis: Other public banks event date = other public banks estimation window													
T-test	<b>0.055</b>	<b>0.000</b>	0.941	<b>0.000</b>	0.817	0.589	0.172	0.367	<b>0.000</b>	0.909	0.297	<b>0.000</b>	<b>0.018</b>
Wilcoxon	0.362	<b>0.000</b>	0.692	<b>0.000</b>	0.825	0.778	<b>0.030</b>	<b>0.060</b>	<b>0.000</b>	0.967	<b>0.098</b>	<b>0.001</b>	<b>0.001</b>
Corrado	0.465	<b>0.032</b>	0.625	<b>0.037</b>	0.635	0.630	0.269	0.300	<b>0.002</b>	0.752	0.301	0.150	0.283
Hypothesis: Stress tested event date = other public banks event date													
T-test	<b>0.062</b>	<b>0.074</b>	<b>0.000</b>	<b>0.017</b>	<b>0.064</b>	0.320	<b>0.044</b>	0.755	0.828	<b>0.001</b>	<b>0.008</b>	<b>0.010</b>	<b>0.001</b>
Wilcoxon	0.181	0.256	<b>0.002</b>	<b>0.006</b>	<b>0.009</b>	0.137	0.227	0.941	0.686	<b>0.000</b>	<b>0.000</b>	<b>0.001</b>	<b>0.000</b>
Stress tested N	17	17	17	17	17	17	23	23	23	23	177	177	160
Other public banks N	73	73	77	79	82	82	75	75	74	74	691	691	618

**Table 2: Market Impact of Stress Testing Disclosures**

	SCAP 2009 Before	SCAP 2009 After	CCAR 2011 Mar 18, 2011	CCAR 2012 Mar 14, 2012	DFAST 2013 Mar 8, 2013	CCAR 2013 Mar 15, 2013	DFAST 2014 Mar 21, 2014	CCAR 2014 Mar 27, 2014	DFAST 2015 Mar 6, 2015	CCAR 2015 Mar 12, 2015	All Events (with SCAP before)	All Events (with SCAP after)	All Events Except 2009
Event date	May 8, 2009 (1)	May 8, 2009 (2)	Mar 18, 2011 (3)	Mar 14, 2012 (4)	Mar 8, 2013 (5)	Mar 15, 2013 (6)	Mar 21, 2014 (7)	Mar 27, 2014 (8)	Mar 6, 2015 (9)	Mar 12, 2015 (10)	N/A (11)	N/A (12)	N/A (13)
<b>Panel C: Averages of Cumulative Abnormal Volume (CAV)</b>													
Stress tested banks	7.1497	10.2405	0.7486	2.7186	0.2399	0.0737	0.9745	0.2801	0.2950	0.5231	1.3191	1.6160	0.6996
Other public banks	0.6068	-1.0249	-0.5235	0.2572	0.1272	0.4946	0.2893	-0.2521	0.0861	0.1651	0.1399	-0.0325	0.0848
Difference (CCAR - Other public banks)	6.5429	11.2654	1.2721	2.4613	0.1127	-0.4209	0.6852	0.5322	0.2089	0.3580	1.1792	1.6485	0.6149
Hypothesis: Stress tested event date = stress tested estimation window													
T-test	<b>0.000</b>	<b>0.000</b>	<b>0.031</b>	<b>0.000</b>	0.256	0.730	<b>0.000</b>	<b>0.032</b>	<b>0.049</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>
Hypothesis: Other public banks event date = other public banks estimation window													
T-test	<b>0.022</b>	0.267	<b>0.006</b>	<b>0.055</b>	0.285	<b>0.000</b>	<b>0.006</b>	<b>0.016</b>	0.505	0.202	<b>0.010</b>	0.792	0.084
Hypothesis: Stress tested event date = other public banks event date													
T-test	<b>0.003</b>	<b>0.000</b>	<b>0.010</b>	<b>0.000</b>	0.823	0.487	<b>0.047</b>	<b>0.022</b>	0.152	<b>0.018</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>
Stress tested N	17	17	17	17	17	17	23	23	23	23	177	177	160
Other public banks N	73	73	77	79	82	82	75	75	74	74	691	691	618
<b>Panel D: Averages of Absolute Value Cumulative Abnormal CDS Spread ( CACDS )</b>													
Stress tested banks	15.5581	13.2925	6.3505	5.8028	1.3699	2.2441	2.0672	2.7805			4.5974	4.6870	3.3282
Other public banks	10.0182	5.9911	3.1661	1.2536	1.6639	2.4433	1.4171	1.4877			2.8132	2.5754	1.9898
Difference (CCAR - Other public banks)	5.5399	7.3014	3.1844	4.5492	-0.2940	-0.1992	0.6501	1.2928			1.7841	2.1116	1.3384
Est. window mean (stress tested)	7.7817	6.3364	3.5073	4.3310	2.5100	2.5053	2.8712	2.8712			3.9445	3.8746	3.2768
Est. window mean (other public banks)	5.1835	3.3813	3.5594	2.5586	1.7116	1.7100	1.7861	1.7861			2.8408	2.6120	2.4333
Hypothesis: Stress tested event date = stress tested estimation window													
T-test	<b>0.001</b>	<b>0.001</b>	<b>0.007</b>	0.129	0.900	0.616	0.621	0.514			0.178	0.123	0.473
Wilcoxon	<b>0.010</b>	<b>0.001</b>	0.107	<b>0.073</b>	0.862	0.358	0.584	0.536			0.462	0.253	0.512
Corrado	<b>0.099</b>	<b>0.025</b>	0.253	0.247	0.754	0.527	0.578	0.576			0.414	0.272	0.474
Hypothesis: Other public banks event date = other public banks estimation window													
T-test	0.168	0.177	0.545	0.831	0.518	0.221	0.589	0.572			0.514	0.518	0.685
Wilcoxon	0.170	0.102	0.304	0.762	0.225	0.350	0.532	0.141			0.274	0.201	0.337
Corrado	<b>0.018</b>	<b>0.052</b>	<b>0.025</b>	0.766	0.194	0.311	0.785	0.180			0.294	0.211	0.352
Hypothesis: Stress tested event date = other public banks event date													
T-test	0.237	<b>0.090</b>	0.221	<b>0.010</b>	0.653	0.578	0.359	0.306			<b>0.083</b>	<b>0.041</b>	<b>0.077</b>
Wilcoxon	0.217	<b>0.026</b>	0.166	<b>0.006</b>	0.471	0.447	0.360	0.763			<b>0.085</b>	<b>0.034</b>	0.102
Stress tested N	11	15	14	15	16	16	17	17			106	110	95
Other public banks N	4	6	7	7	6	7	4	4			39	41	35

The sample includes the 100 largest publicly traded banking firms by total 2013:Q3 equity market capitalization with available data. The events are the nine Federal Reserve stress testing (SCAP, CCAR, and DFAST) disclosures between 2009 and 2015. Abnormal market activity (CAR, CAV, and CACDS) is calculated by estimating a market model over a six month period ending at the end of the month before the event. The abnormal market activity is then calculated over a three day window around the event. CAR is the cumulative abnormal return measured in percent based on a Fama-French three-factor market model (based on Fama and French 2003). CAV is the cumulative abnormal trading volume measured in percent, where volume is normalized by shares outstanding. CACDS is the cumulative abnormal percent change in percent of the spread on a firm's 5Y CDS. CAV and CACDS use market models that relate a firm's normalized volume or change in CDS spread to the normalized volume of the CRSP Total Index or change in spread of the CDX North America Investment Grade CDS index respectively. Results in the columns labeled "SCAP 2009 Before" and "SCAP 2009 After" are based on market models using the six-month period before and after the disclosure of the 2009 SCAP results, respectively. The rows labeled T-test, Wilcoxon and Corrado present the p-values of hypothesis tests based on a standard t-test, Wilcoxon rank sum test, and Corrado (1989) non-parametric test, respectively. Results for CAR and CAV are against the null hypothesis that the measures are equal to zero, while results for |CAR| and |CACDS| are against the null hypothesis that the statistics equal their average values in the estimation window. P-values of less than 10 percent are highlighted in bold text.



**Table 3: Summary Statistics**

	Stress Tested			Non-Stress Tested			Stress Tested – Non-Stress Tested		All Firms		
	N	Mean	Standard Deviation	N	Mean	Standard Deviation	Difference	Sig. Diff	N	Mean	Standard Deviation
Assets (\$B)	177	613.95	734.50	596	22.45	36.95	591.51	***	773	157.89	431.15
Equity Market Cap. (\$B)	177	60.58	64.19	691	4.77	8.68	55.81	***	868	16.15	37.45
Log(Share Price)	177	3.56	0.80	691	3.21	0.78	0.35	***	868	3.28	0.80
Dummy: 1 if Firm in Stress Test	177	1.00	0.00	691	0.00	0.00	1.00		868	0.20	0.40
Tier 1 Capital/RWA (%)	177	13.03	2.23	531	14.77	6.85	-1.74	***	708	14.34	6.08
Market Value/Total Assets	177	0.13	0.10	596	0.21	0.40	-0.08	***	773	0.20	0.36
SD/Mean Share Price (%)	177	8.50	7.47	691	8.61	6.83	-0.11		868	8.59	6.97
Rolling 8Q SD ROA	173	0.11	0.16	555	0.14	0.29	-0.03		728	0.13	0.27
RWA/Total Assets (%)	177	69.47	18.38	532	71.23	13.44	-1.77		709	70.79	14.84
Mean Loss (07:Q3-08:Q4)/Assets (Ann. %)	146	-0.93	0.63	491	-1.16	2.78	0.23		637	-1.11	2.46
Liquidity Coverage (1 - LSR) (%)	177	53.77	10.39	596	64.13	11.78	-10.36	***	773	61.76	12.27
(Sec. + Trad. + Cash)/Assets (%)	177	34.09	17.67	596	29.47	14.79	4.62	***	773	30.53	15.61
Number of Analysts	177	24.23	4.74	691	10.77	5.97	13.46	***	868	13.52	7.90
SD of Analyst Estimates	177	0.12	0.26	664	0.16	2.23	-0.05		841	0.15	1.99

Summary statistics of bank characteristics for the 100 largest publicly traded banking firms by total 2013:Q3 equity market capitalization with one observation per bank-event date (as available). The events are the nine Federal Reserve stress testing (SCAP, CCAR, and DFAST) disclosures between 2009 and 2015. Summary statistics are reported separately for stress tested firms and for non-stress tested firms. Income statement and balance sheet data are from regulatory data filings from the quarter prior to the event date (e.g. 2014:Q4 regulatory data for events in 2015:Q1). Detailed definitions of variables are available in Appendix A. \*, \*\*, and \*\*\* indicate difference between stress tested and non-stress tested firms is significant at the 10%, 5%, and 1% level, respectively.

**Table 4: |CAR| and Leverage, Risk, and Liquidity**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Stress Tested Firm	0.8073** [0.354]	2.3153 [1.831]	1.5466** [0.755]	-0.5416 [1.274]	0.2143 [0.730]	1.7296 [1.382]	1.7023** [0.736]	0.0248 [1.561]	1.3619 [0.845]	-0.0112 [1.470]	1.3118 [1.189]	-6.8438 [9.372]
<b>Leverage</b>												
Tier 1 Capital/RWA (%)		-0.0310** [0.014]									-0.0668*** [0.022]	-0.0721 [0.072]
Tier 1 Ratio * Stress Tested		-0.1207 [0.117]									-0.0890 [0.125]	0.4931 [0.308]
Market Value/Assets			-0.3420* [0.174]							-0.1596 [0.184]		-1.0551 [1.441]
Market Value/ Assets * Stress Tested			-6.0964 [3.677]							-2.5087* [1.476]		1.3383 [20.627]
<b>Risk</b>												
SD/Share Price (%)				0.2015*** [0.053]						0.2102*** [0.063]		0.1709*** [0.052]
SD/Share Price (%) * Stress Tested				0.1449 [0.179]						0.1144 [0.186]		0.2348 [0.237]
8Q SD ROA					2.9911* [1.587]						3.2796* [1.689]	3.2674* [1.821]
8Q SD ROA * Stress Tested					7.0547 [8.742]						6.8226 [8.872]	1.2376 [5.658]
RWA/Total Assets (%)						0.0357*** [0.013]						0.0438** [0.018]
RWA/Assets * Stress Tested						-0.0124 [0.023]						-0.0238 [0.057]
Mean Loss (07:Q3-08:Q4) / Assets							0.0800*** [0.024]					-0.1036 [0.115]
Crisis Losses * Stress Tested							0.7590* [0.455]					0.0308 [0.815]
<b>Liquidity</b>												
Liquidity Coverage (%)								-0.0009 [0.010]				0.0036 [0.019]
Liquidity Coverage (%) * Stress Tested								0.0134 [0.024]				0.0572 [0.070]
(Sec. + Trad. + Cash)/Total Assets (%)									-0.0107 [0.009]			0.0244** [0.010]
Liquid Assets (%) * Stress Tested									-0.0163 [0.018]			-0.0696 [0.044]

**Table 4: |CAR| and Leverage, Risk, and Liquidity (continued)**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
<b>Year Fixed Effects</b>												
Dummy: 1 if year == 2009	4.6324*** [1.001]	5.3302*** [1.180]	5.2202*** [1.164]	0.7154 [0.737]	4.3794*** [0.830]	5.2780*** [1.178]	5.5236*** [1.251]	5.3640*** [1.206]	5.3004*** [1.182]	1.1695 [0.872]	4.3120*** [0.816]	0.8970 [0.891]
Dummy: 1 if year == 2011	-0.1474 [0.145]	-0.0035 [0.152]	-0.0911 [0.152]	-2.4351*** [0.715]	-0.7907* [0.439]	0.0939 [0.158]	0.0162 [0.163]	-0.0321 [0.163]	-0.0483 [0.158]	-2.3703*** [0.817]	-0.7551* [0.448]	-2.5289*** [0.942]
Dummy: 1 if year == 2012	1.3464*** [0.276]	1.4604*** [0.315]	1.3307*** [0.315]	0.6123* [0.356]	1.1799*** [0.329]	1.5471*** [0.321]	1.4858*** [0.336]	1.3868*** [0.320]	1.3919*** [0.318]	0.6208 [0.403]	1.2492*** [0.338]	0.8285** [0.400]
Dummy: 1 if year == 2013	-0.4375*** [0.116]	-0.4878*** [0.120]	-0.4259*** [0.125]	-1.8997*** [0.444]	-0.7494*** [0.156]	-0.4097*** [0.125]	-0.5745*** [0.123]	-0.4073*** [0.127]	-0.3989*** [0.122]	-1.8805*** [0.495]	-0.7047*** [0.164]	-1.8770*** [0.487]
Dummy: 1 if year == 2014	-0.3333*** [0.104]	-0.3108*** [0.117]	-0.2982*** [0.110]	-0.6083*** [0.138]	-0.4485*** [0.136]	-0.2857** [0.119]	-0.3650*** [0.125]	-0.3221*** [0.114]	-0.3256*** [0.111]	-0.5740*** [0.152]	-0.4200*** [0.151]	-0.5647** [0.217]
Constant	1.5812*** [0.130]	1.9623*** [0.247]	1.6364*** [0.135]	1.0053*** [0.247]	1.3629*** [0.179]	-1.0861 [0.886]	1.5821*** [0.149]	1.5944** [0.648]	1.8588*** [0.294]	0.9564*** [0.290]	2.2622*** [0.230]	-2.1412 [2.245]
Observations	868	708	773	868	728	709	637	773	773	773	692	625
Adjusted R-squared	0.172	0.197	0.195	0.278	0.270	0.206	0.205	0.189	0.193	0.286	0.279	0.367
SE Clustering	FIRM	FIRM	FIRM	FIRM	FIRM	FIRM	FIRM	FIRM	FIRM	FIRM	FIRM	FIRM
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Sample includes the 100 largest publicly traded banking firms by total 2013:Q3 equity market capitalization with one observation per bank-event date (as available). The events are the nine Federal Reserve stress testing (SCAP, CCAR, and DFAST) disclosures between 2009 and 2015. The dependent variable is the absolute value of cumulative abnormal return calculated by estimating a Fama-French three-factor market model over a six month period ending at the end of the month before the event. The abnormal market activity is then calculated over a three day window around the event. Detailed definitions of variables are available in Appendix A. Regressions include fixed effects for each year. Standard errors are clustered by firm. \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% level, respectively.

**Table 5: CAV and Leverage, Risk, and Liquidity**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Stress Tested Firm	1.3431*** [0.369]	3.9030** [1.746]	2.2628*** [0.808]	-1.3079 [1.179]	-0.0778 [0.651]	-1.0651 [1.196]	2.5998*** [0.685]	2.7373 [1.778]	2.6308*** [0.817]	-1.0210 [1.352]	2.5498** [1.263]	-14.8819** [6.920]
Log(Share Price)	-0.4215** [0.165]	-0.3815** [0.179]	-0.3576* [0.186]	-0.2631 [0.159]	-0.1456 [0.120]	-0.3579** [0.159]	-0.2357 [0.168]	-0.4791** [0.201]	-0.4303** [0.183]	-0.1886 [0.179]	-0.0852 [0.118]	0.1795 [0.195]
<b>Leverage</b>												
Tier 1 Capital/RWA (%)		0.0130 [0.022]									-0.0167 [0.016]	-0.0386 [0.050]
Tier 1 Ratio * Stress Tested		-0.1967* [0.112]									-0.2062 [0.124]	0.4622 [0.288]
Market Value/Assets			0.1075 [0.118]							0.0497 [0.104]		0.0402 [0.940]
Market Value/ Assets * Stress Tested			-7.1623* [4.219]							-1.9839 [1.432]		1.4950 [20.288]
<b>Risk</b>												
SD/Share Price (%)				0.0600 [0.043]						0.0635 [0.051]		0.0459 [0.045]
SD/Share Price (%) * Stress Tested				0.2977* [0.167]						0.2903* [0.172]		0.4185* [0.212]
8Q SD ROA					0.7513 [1.169]						0.8704 [1.274]	1.3677 [1.531]
8Q SD ROA * Stress Tested					13.4554* [7.731]						13.4816* [7.879]	5.4846 [4.082]
RWA/Total Assets (%)						-0.0016 [0.010]						0.0065 [0.013]
RWA/Assets * Stress Tested						0.0343* [0.020]						0.0250 [0.052]
Mean Loss (07:Q3-08:Q4) / Assets							0.0162 [0.028]					-0.0138 [0.108]
Crisis Losses * Stress Tested							1.0892** [0.430]					0.6244 [0.715]
<b>Liquidity</b>												
Liquidity Coverage (%)								0.0218** [0.010]				0.0109 [0.014]
Liquidity Coverage (%) * Stress Tested								-0.0218 [0.028]				0.1072* [0.061]
(Sec. + Trad. + Cash)/Total Assets (%)									0.0113 [0.007]			0.0024 [0.008]
Liquid Assets (%) * Stress Tested									-0.0400** [0.016]			-0.0277 [0.036]

**Table 5: CAV and Leverage, Risk, and Liquidity (continued)**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
<b>Year Fixed Effects</b>												
Dummy: 1 if year == 2009	1.4696* [0.833]	1.8041* [0.996]	1.7450* [0.976]	-0.6807 [0.612]	1.1894* [0.644]	1.8726* [1.010]	2.1289** [1.043]	1.9161* [1.005]	1.8349* [1.006]	-0.6220 [0.744]	1.1245* [0.631]	-0.4572 [0.702]
Dummy: 1 if year == 2011	-0.5691*** [0.198]	-0.4801** [0.229]	-0.5204** [0.214]	-1.8414*** [0.669]	-1.0001** [0.396]	-0.4130* [0.226]	-0.3629 [0.239]	-0.4837** [0.225]	-0.5046** [0.218]	-1.8906** [0.772]	-0.9799** [0.402]	-1.9485** [0.847]
Dummy: 1 if year == 2012	0.4216* [0.216]	0.6411** [0.260]	0.5889** [0.249]	-0.0142 [0.286]	0.5579** [0.278]	0.7028** [0.270]	0.7487** [0.284]	0.6322** [0.261]	0.6095** [0.256]	0.1509 [0.329]	0.5854** [0.289]	0.4350 [0.322]
Dummy: 1 if year == 2013	0.0822 [0.158]	0.0856 [0.142]	0.1330 [0.170]	-0.6243 [0.397]	-0.1662 [0.117]	0.1647 [0.148]	-0.0071 [0.098]	0.1323 [0.167]	0.1569 [0.155]	-0.5811 [0.442]	-0.1519 [0.127]	-0.6188 [0.411]
Dummy: 1 if year == 2014	-0.0309 [0.105]	0.0490 [0.114]	0.0431 [0.107]	-0.1841 [0.134]	-0.0243 [0.120]	0.0788 [0.114]	0.1122 [0.123]	0.0106 [0.111]	0.0044 [0.106]	-0.1389 [0.145]	0.0060 [0.130]	0.0122 [0.213]
Constant	1.3413** [0.558]	0.9508 [0.624]	1.0673* [0.609]	0.9353* [0.498]	0.4378 [0.388]	1.1300 [0.859]	0.5896 [0.550]	0.0618 [0.559]	0.9797* [0.527]	0.6403 [0.543]	0.4652 [0.413]	-1.3642 [1.606]
Observations	868	708	773	868	728	709	637	773	773	773	692	625
Adjusted R-squared	0.060	0.066	0.068	0.175	0.189	0.069	0.087	0.062	0.066	0.173	0.193	0.316
SE Clustering	FIRM	FIRM	FIRM	FIRM	FIRM	FIRM	FIRM	FIRM	FIRM	FIRM	FIRM	FIRM
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Sample includes the 100 largest publicly traded banking firms by total 2013:Q3 equity market capitalization with one observation per bank-event date (as available). The events are the nine Federal Reserve stress testing (SCAP, CCAR, and DFAST) disclosures between 2009 and 2015. The dependent variable is the cumulative abnormal trading volume calculated by estimating a market model over a six month period ending at the end of the month before the event. The abnormal market activity is then calculated over a three day window around the event. Detailed definitions of variables are available in Appendix A. Regressions include fixed effects for each year. Standard errors are clustered by firm. \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% level, respectively.

**Table 6: Equity Analysts**

	(1)	(2)	(3)	(4)	(5)	(6)
	Number of Analysts	Number of Analysts	Mean Forecast Error (%)	Mean Forecast Error (%)	Estimate SD/Mean (%)	Estimate SD/ Mean (%)
<b>Time Periods X BHC Group</b>						
(SCAP BHC)*(Post SCAP)	3.1357*** [0.587]	2.9948*** [0.324]	-39.81*** [14.175]	-40.88*** [14.135]	192.6353** [76.767]	188.4166** [76.716]
(CCAR 2011 BHC)* (Post CCAR 2011)	1.9488** [0.772]	1.8292*** [0.426]	17.84 [18.609]	19.71 [18.569]	30.1267 [100.693]	24.0158 [100.740]
(CCAR 2012 BHC)* (Post CCAR 2012)	1.1518 [0.869]	1.1032** [0.479]	-1.73 [21.012]	-1.15 [20.949]	-245.5295** [113.321]	-246.0258** [113.276]
(CCAR 2013 BHC)* (Post CCAR 2013)	-1.1299 [0.828]	-1.1111** [0.456]	0.26 [20.305]	0.32 [20.238]	-5.8918 [107.972]	-6.6529 [107.873]
(CCAR 2014 BHC)* (Post CCAR 2014)	-1.0139 [0.769]	-0.9935** [0.424]	-1.38 [21.608]	-1.04 [21.536]	19.2607 [100.472]	17.7386 [100.399]
<b>Time Period Fixed Effects</b>						
Post SCAP (q > 2009q2)	2.9248*** [0.253]	2.9789*** [0.141]	17.82*** [6.203]	20.16*** [6.267]	-19.1317 [33.975]	-21.8983 [34.307]
Post CCAR 2011 (q > 2011q1)	1.0064*** [0.328]	0.9232*** [0.181]	-25.34*** [7.978]	-28.60*** [7.985]	-3.6274 [43.459]	-4.7891 [43.657]
Post CCAR 2012 (q > 2012q1)	-0.6208* [0.362]	-0.6074*** [0.200]	-4.30 [8.821]	-5.78 [8.820]	16.1315 [48.000]	17.5096 [48.184]
Post CCAR 2013 (q > 2013q1)	-0.4191 [0.357]	-0.4218** [0.197]	-2.19 [8.744]	-3.27 [8.723]	-2.5612 [47.423]	-0.5859 [47.452]
Post CCAR 2014 (q > 2014q1)	-0.9857** [0.397]	-1.0046*** [0.219]	1.36 [11.135]	1.78 [11.101]	-0.0411 [52.836]	0.4928 [52.826]
<b>Other Control Variables</b>						
BHC in SCAP-CCAR 2013	4.4296*** [0.446]		41.63*** [10.805]		86.1190 [58.289]	
New BHC in 2014	8.9008*** [0.366]		17.85** [8.908]		-14.2291 [47.681]	
Log(Market Cap/Index Value)	2.1332*** [0.088]	1.5592*** [0.128]	-5.46** [2.159]	3.02 [5.762]	-20.1481* [11.616]	-59.7989* [31.548]
Actual Earnings < 0	2.1247*** [0.317]	0.9930*** [0.191]	66.24*** [7.655]	49.23*** [8.426]	-79.6764* [42.027]	-100.5982** [45.927]
Absolute Value of CAR	1.6044*** [0.499]	1.2789*** [0.285]	46.43*** [12.347]	40.44*** [12.779]	50.5555 [67.212]	29.4415 [69.428]
CAR < 0	-0.0297 [0.162]	-0.0574 [0.091]	2.72 [4.042]	-0.40 [4.120]	-8.7250 [21.591]	-8.1302 [22.040]
Constant	26.5140*** [0.813]	23.1329*** [1.086]	-30.17 [19.945]	55.21 [48.736]	-166.1328 [107.404]	-480.6140* [266.413]
Observations	3,241	3,241	3,051	3,051	3,100	3,100
Adjusted R-squared	0.648	0.369	0.065	0.009	0.005	-0.030
Firm FE	NO	YES	NO	YES	NO	YES
Non-Stress Tested BHC Marginal Effect	1.91***	1.87***	-12.64	-15.70	-9.23	-9.27
SCAP BHC Marginal Effect	6.00***	5.69***	-37.45**	-38.75**	-18.63	-31.78
New BHC Marginal Effect	0.89	0.87**	-14.02	-16.74	10.03	8.47
Number of firm_id		99		99		99

The sample includes the 100 largest BHCs by total asset size in 2014:Q3 with publicly traded equity with quarterly observations from 2007:Q1 to 2014:Q1 (as available). SCAP BHC is a binary variable equal to one in 2009 and thereafter for all firms that were included in the 2009 SCAP. CCAR T is a binary variable equal to one in year T and thereafter for all firms that were included in the year T CCAR. Post SCAP is a binary variable equal to 1 for all quarters including and after March 2009. Post CCAR T is a binary variable equal to 1 for all quarters including and after CCAR year T. The dependent variable in the first two specifications is *Number of Analysts*, the number of equity analysts producing at least one earnings estimate for the firm in the quarter. This variable is 0 for firms with no equity analyst coverage in I/B/E/S. The dependent variable in the next two specifications is *Mean Forecast Error*, the mean forecast error for earnings in that quarter as a percentage of actual earnings per share. The dependent variable in the final two specifications is *Estimate SD/Mean*, the standard deviation of analysts' estimates normalized by the mean analyst estimate. *Firm in SCAP-CCAR 2013* is a binary variable equal to one in every quarter for all of the 18 BHCs that were included in SCAP and all the subsequent CCAR events. *New BHC* is a binary variable equal to one in every quarter for the 6 BHCs that were included in the CCAR events subsequent to 2013. Standard errors are clustered by firm. \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% level, respectively.

**Table 7, Panel A: Interbank Borrowing**

VARIABLES	(1) FF+Repo. Liab./Total Assets (%)
<b>Time Periods X BHC Groups</b>	
(SCAP Firm)*(Post SCAP)	1.4112 [1.394]
(CCAR 2011 Firm)*(Post CCAR 2011)	0.0913 [0.355]
(CCAR 2012 Firm)*(Post CCAR 2012)	0.6998* [0.405]
(CCAR 2013 Firm)*(Post CCAR 2013)	0.0499 [0.238]
(CCAR 2014 Firm)*(Post CCAR 2014)	-0.4798 [0.383]
<b>Time Period Fixed Effects</b>	
Post SCAP (q > 2009q2)	-1.7385*** [0.332]
Post CCAR 2011 (q > 2011q1)	-0.6157*** [0.230]
Post CCAR 2012 (q > 2012q1)	-0.7666** [0.346]
Post CCAR 2013 (q > 2013q1)	-0.3519*** [0.131]
Post CCAR 2014 (q > 2014q1)	-0.1554 [0.128]
<b>Other Control Variables</b>	
Firm in SCAP-CCAR 2013	-0.5655 [1.355]
New BHC	-2.4818*** [0.686]
Constant	6.9136*** [0.620]
Observations	2,681
Adjusted R-squared	0.095
Years	2007-2014
SE Clustering	Firm

The sample includes the 100 largest BHCs by total asset size in 2014:Q3 with publicly traded equity with quarterly observations from 2007:Q1 to 2014:Q1 (as available). SCAP Firm is a binary variable equal to one in 2009 and thereafter for all firms that were included in the 2009 SCAP. CCAR T Firm is a binary variable equal to one in year T and thereafter for all firms that were included in the year T CCAR. Post SCAP is a binary variable equal to 1 for all quarters including and after March 2009. Post CCAR T is a binary variable equal to 1 for all quarters including and after CCAR year T. The dependent variable in Panel A is the total fed funds and repo liabilities normalized by total assets. Firm in SCAP-CCAR 2013 is a binary variable equal to one in every quarter for all of the 18 BHCs that were included in SCAP and all the subsequent CCAR events. "New BHC" is a binary variable equal to one in every quarter for the 6 BHCs that were included in the CCAR events subsequent to 2013. Standard errors are clustered by firm. \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% level, respectively.



**Table 7, Panel B: Change in Interbank Borrowing After Stress Test Disclosure**

VARIABLES	(1) %Chng FF+Repo Bal.	(2) %Chng FF+Repo Bal.	(3) Change FF+Repo Rate	(4) Change FF+Repo Rate
Dummy: 1 if Firm in Stress Test	-13.0834 [17.489]	-12.9771 [17.534]	-147.9772 [97.467]	-148.8154 [97.518]
Quantitative Failure	2.1646 [5.575]		-11.7436 [11.448]	
Negative Outcomes		0.4820 [4.899]		-0.8430 [10.441]
Constant	18.9747 [17.165]	18.9747 [17.165]	133.6204 [97.117]	133.6204 [97.117]
Observations	521	521	511	511
Adjusted R-squared	-0.004	-0.004	-0.001	-0.001
SE Clustering	FIRM	FIRM	FIRM	FIRM

The sample includes the 100 largest BHCs by total asset size in 2014:Q3 with publicly traded equity with quarterly observations from 2007:Q1 to 2014:Q1 (as available). The dependent variable in the first two specifications is the percent change in fed funds and repo balances between Q4 and Q1. The dependent variable in the second two specifications is the change in basis points in the interest rate (calculated as interest expense on fed funds and repo normalized by quarter end balances of fed funds and repo), Panel A is the total fed funds and repo liabilities normalized by total assets. Stress test is a binary variable equal to one if the firm is included in the stress test in that year. *Quantitative failure* is a binary variable equal to 1 if the BHC had at least one stressed capital ratio fall below a minimum target level in that year. *Negative Outcomes* is a binary variable equal to 1 if the BHC had at least one stressed ratio below minimum target levels, changed its initial capital distribution request, or had its capital plan objected to in the CCAR. Standard errors are clustered by firm. \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% level, respectively.

**Table 8: Supervisory Stress Tests and BHC Portfolio Choice**

<b>Panel A: Fed-BHC Loss Rate Gap and Loan Growth by Loan Type</b>								
<b>"GAP": Fed - BHC</b>	Total Loans	First Liens	Junior Lien/ HELOCs	Commercial Real Estate	Commercial and Industrial	Credit Cards	Other Consumer Loans	Other Loans
<b>All Observations</b>								
Fed – BHC Loss Rate	-0.000 (0.007)	0.000 (0.012)	0.069 (0.072)	0.033** (0.013)	0.006*** (0.002)	-0.003** (0.001)	-0.015* (0.007)	-0.005 (0.007)
Observations	48	43	42	44	45	35	45	46
R-squared	0.051	0.000	0.078	0.084	0.044	0.067	0.072	0.069
<b>Material Portfolios</b>								
Fed – BHC Loss Rate		0.000 (0.012)	-0.002 (0.002)	0.001 (0.024)	0.006*** (0.002)	-0.005 (0.005)	-0.010 (0.008)	-0.006 (0.008)
Observations		43	33	36	45	14	36	43
R-squared		0.000	0.141	0.010	0.044	0.157	0.020	0.025
<b>Panel B: BHC-Fed Minimum Capital Ratios and Pre-tax Net Income and Asset and Loan Growth</b>								
<b>"GAP": BHC - Fed</b>	<b>Asset Growth</b>			<b>Loan Growth</b>				
Pre-tax Net Income/Assets	-1.286* (0.736)				0.155 (1.038)			
Tier 1 Common Ratio Minimum		-0.018*** (0.006)				-0.000 (0.012)		
Tier 1 Leverage Ratio Minimum			-0.013 (0.010)				0.004 (0.010)	
Observations	48	48	48	48	48	48	48	
R-squared	0.143	0.301	0.098	0.051	0.051	0.051	0.052	

Panel A reports the results of regressions relating the difference between the Federal Reserve's and each BHC's projected loan loss rate on loan growth in 3 quarters following release of the stress test results (from Q1 to Q4), while Panel B reports the results of regressions relating the difference between the Federal Reserve's and each BHC's projected pre-tax net income/assets and minimum regulatory capital ratios on asset and loan growth in the subsequent 3 quarters. "Material loans portfolios" are defined as those portfolios representing at least 3% of the total loan portfolio. Loan categories are based on Y-9C definitions, which might not perfectly match definitions used in the stress tests. The sample includes 18 BHCs for the 2013 stress test results and 30 BHCs for the 2014 stress test results. All regressions include year fixed effects. Residuals are clustered at the BHC level. Standard errors are in parentheses. The symbols \*, \*\*, and \*\*\* represent statistical significance at the 10%, 5% and 1% levels, respectively.

## Appendix A: Variable Definitions

Tier 1 Risk Based Capital/RWA (%)	Tier 1 Risk-Based Capital - Basel III - BHCA8274 (if available) or Basel I bhck8274
Market Value/Total Assets	Market value of equity (price*shares outstanding) / Total Assets (bhck2170)
Market Value/Book Value	Market value of equity (price*shares outstanding)/ Book value of equity (Equity bhck3210 – Perpetual Preferred Stock bhck3283 – Goodwill bhck3163 – other intangible assets bhck0426)
SD/Mean Share Price in Prev. Year (%)	Standard deviation of closing split-adjusted share price in previous calendar year/ mean of closing split-adjusted share price in previous calendar year
NPL/Total Loans (%)	Total Nonperforming loans((bhck552 - bhck3506) + (bhck5526 -bhck3507))/Total Loans net of unearned income (bhck2122)
Rolling 8Q SD ROA	Standard Deviation of Net Income (bhck4340) /Total Assets (bhck2170) over previous 8 quarters
RWA/Total Assets (%)	Total Weighted Assets - Combined Basel I&III bhcaa223 if available else
Mean Loss (Net Inc. * -1) (07:Q3-08:Q4) / Assets (07:Q2) (Ann. %)	Net income (bhck4340) / Total Assets (bhck2170)
Subdebt Rating	Median subdebt rating from Mergent
Trading Assets/Total Assets (%)	Trading Assets (bhck3545) / Total Assets (bhck2170)
Cash and Deposits/Total Assets (%)	[Cash (bhck0081 + bhck0395 + bhck0397) + Total Deposits (bhdm6631 + bhdm6636 + bhfn6631 + bhfn6636)]/ Total Assets (bhck2170)
Fixed Assets/Total Assets (%)	Fixed Assets (bhck2145) / Total Assets (bhck2170)
Loans/Total Assets (%)	Total Loans Net of Unearned Income (bhck2122) / Total Assets (bhck2170)
Number of Analysts in Previous Quarter	Number of unique analyst IDs that have 1Q ahead estimates for EPS in the previous quarter in IBES
SD of Analyst Estimates in Previous Quarter	SD of last 1Q ahead EPS estimates of each analyst ID in IBES
Recent BHC (first Y9C >= 2009:Q1)	1 if first Y9C filing is >= 2009:Q1
Liquidity Coverage (1 - LSR) (%)	LSR = (Weighted Liabilities + Weighted Off Balance Sheet Items)/Weighted Assets
(Sec. + Trad. + Cash)/Total Assets (%)	Securities (UST [bhck0211 + bhck1289 + bhck1294 + bhck1287 + bhck1293 + bhck1298] + MBS [bhckg300 + bhckg304 + bhckg308 + bhckg312 + bhckg316 + bhckg320 + bhckk142 + bhckk146 + bhckk150 + bhckk154 + bhckg303 + bhckg307 + bhckg311 + bhckg315 + bhckg319 + bhckg323 + bhckk145 + bhckk149 + bhckk153 + bhckk157] + All Other Securities [bhck1737 + bhck1742 + bhckc026 + bhckg336 + bhckg340 + bhckg344 + bhck1741 + bhck1746 + bhcka511 +

	$\frac{\text{bhckc027} + \text{bhckg339} + \text{bhckg343} + \text{bhckg347} + \text{bhck8496} + \text{bhck8499}}{\text{Total Assets (bhck2170)}} + \text{Trading Assets (bhck3545)} + \text{Cash [bhck0081} + \text{bhck0395} + \text{bhck0397}]$
Quarterly Change in FF+Repo Balance (%)	Quarter over quarter change in Fed Funds and Repo Balance (bhdmb987,bhckb989)
Quarterly Change in FF+Repo Exp. Ratio (%)	Quarter over quarter change in [Fed Funds and Repo Expenses (bhck4180) / Fed Funds and Repo Balance (bhdmb987,bhckb989)]