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Abstract

I study investor responses to the 2020 bank stress tests that included restrictions on shareholder payouts. I find that banks subject to the stress tests and payout restrictions experienced both immediate and persistently lower excess stock price returns. In the cross-section, I find that excess stock returns declined with bank size but cannot otherwise be explained by pre-pandemic bank or payout characteristics, suggesting that investors penalized banks likely to experience greater regulatory scrutiny. However, the excess stock return penalties are smaller than those previously estimated in the literature examining voluntary payout reductions that signal bank distress. The results show that using supervisory discretion to take preventative actions during a crisis is less costly than waiting to take actions when banks are distressed.

Keywords: bank payout policy, stress testing, bank supervision
JEL Codes: G21, G28, G35

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1 Introduction

Commercial bank stress tests are an important supervisory tool. Stress tests help ensure financial stability by providing a quantitative way for supervisors to determine the banking system's ability to withstand a severe macroeconomic shock. Additionally, the public release of stress test results aims to build broad confidence in the banking system. Unsurprisingly, stress test results are highly anticipated by investors because they reveal supervisors' inside information about the tested banks.

In this paper, I assess shareholder responses to the June 2020 release of the Comprehensive Capital Analysis and Review (CCAR) test results conducted by the Federal Reserve. The 2020 tests were the first conducted since the onset of the COVID-19 pandemic, a period marred by sharp declines in economic activity, a financial crisis, and great uncertainty over the probability of extensive loan losses. In such an environment, the results themselves are likely to have a large impact on bank stocks. However, the results were, in some sense, mixed from an investor's perspective. The core stress test results were favorable and all banks passed easily. However, additional testing revealed concerns about the U.S. economy's recovery from the COVID-19 pandemic that were worrisome for large banks. In response, supervisors took additional actions that limited the size and type of payouts large U.S. banks could conduct.

The expected effect of these mixed results on bank stock prices is ambiguous. Broadly, the results showed that bank performance might fare poorly under certain recovery scenarios and banks were still facing the possibility of large loan losses. Thus, the results may have impacted investors' earnings expectations. More generally, supervisors imposed greater oversight on stress tested banks, and bank share prices might respond negatively if investors perceive that supervisory pressure will continue to increase in the future. Greater supervisory oversight may reduce future bank profitability by constraining risk-taking, either through limiting risky lending directly or incentivizing banks to adjust their portfolio composition to safer assets as existing loans runoff. Increased capital requirements can also erode returns on equity and, should banks need to issue additional equity shares, dilute existing shareholders. Alternatively, increased oversight that requires banks to build additional capital buffers during a time of great uncertainty may be viewed favorably by investors if it materially reduces the failure probability of the institutions.

More specifically, payout limitations themselves could create information asymmetries and agency problems between shareholders and bank management. For example, theory predicts that firms can increase payouts to signal improved profitability expectations to market participants [Bhattacharya, 1979; Miller and Rock, 1985]. Empirically, Bessler and Nohel [1996] find that investors respond negatively to news of dividend cuts by reducing bank stock prices. Similarly, repurchase programs have been found to provide positive signals about bank profitability and risk [Vermaelen, 1981, 1984; Hirtle, 2004]. Payouts might also reduce agency problems between shareholders and firm management when firms credibly commit to future payments [Jensen and Meckling, 1976; Jensen, 1986]. Indeed, both Laderman [1995] and Hirtle [1998] find evidence that banks use payouts, and in particular repurchase programs, to achieve internal capital targets, providing some empirical support to free cash flow and optimal investment theories.

Investors may also take a negative signal about the banking industry more widely from supervisory actions that require the largest and most systemically important banks to increase capital. Most directly, supervisory fears that bank earnings are at-risk from loan losses can spillover to other, unaffected banks if the shock is considered common to all banks. Bessler and Nohel [2000] find evidence of such dynamics in dividend reductions where cuts by one bank negatively affect other banks that do not take dividend actions. Additionally, proactive supervisory actions on one set of banks could raise concerns that supervisory pressure will increase across the banking system.

Empirically, separating out the supervisory and earnings channels inherent in stress test announcements is difficult. However, the 2020 stress test results should provide better identification than prior regulatory or firm payout announcements that are typically used in the empirical literature. First, the shock was likely a surprise to banking investors because it represented, by some measures, a more draconian supervisory response to the pandemic than might otherwise be expected. Recent changes to how the Federal Reserve's stress test results are incorporated into bank capital planning made judgmental actions such as those that imposed payout restrictions seemingly less likely. Importantly, stock price estimates around an unexpected supervisory announcement should not suffer from pre-trends caused by the anticipation of such changes or preexisting concerns about firm default which can plague similar studies. Second, the announcement of the stress test results occurred during the early part of the COVID-19 crisis but after much of the initial financial turmoil induced by the pandemic had subsided. Moreover, large banks had performed well during the severe financial stress in the preceding months and loan losses were limited to date. Thus, the stress test announcement was likely the most relevant news affecting share prices at the time, providing a clean way to identify causal changes.

I find that the announcement of the stress test results and the associated limitations on payouts had a negative impact on excess stock returns of affected banks. Using the event study methodology of Boehmer, Masumeci, and Poulsen [1991], I find that cumulative abnormal returns on stress tested bank stocks were about 2 percent lower on the days immediately following the announcement. Over longer windows up to a full trading quarter, excess returns on affected bank stocks were as much as 6 percent lower. Conversely, banks unaffected by the policy had positive excess returns in the days immediately following the announcement. Over the medium term, I find that unaffected banks did experience negative excess returns but these effects were generally short-lived.

Next, I use bank characteristics to explain abnormal returns in the cross section of banks following the methodology of Bessler and Nohel [1996]. Using this methodology, I am able to investigate a number of possible mechanisms that could be driving the bank stock price result related to both the test results and the payout restrictions. Thus, I am able to separate the effects of the impact on payout restrictions, expected earnings, and changes in default probabilities using bank variation in cross sectional data.

I first test for the impact of the payout restrictions. Previous work has found that investors respond negatively to news of dividend cuts while larger repurchase program announcements are generally met with positive stock price movements (Bessler and

Nohel [1996] and Laderman [1995], respectively). In baseline tests, I find that banks that paid larger dividends relative to equity capital prior to the pandemic, and were therefore more insulated from the restrictions, had larger excess returns than those paying smaller dividends per share. I find no link however, between pre-pandemic repurchase activity and excess returns following the announcement of limitations on repurchase programs. This result reflects the fact that most banks had already curtailed repurchase programs prior to the regulatory announcement. Moreover, the procyclicality of repurchase programs are well known in the empirical literature and investors probably expected that banks would cut these programs in times of stress [Jagannathan, Stephens, and Weisbach, 2000; Hirtle, 1998, 2016; Floyd, Li, and Skinner, 2015].

In subsequent tests, I explore the dividend result more fully to understand whether relatively larger dividend payments are driven by signaling of higher future profits or an ability to circumvent the payout restrictions. I first find that the main result is robust to controls for business model mix. Banks with greater non-interest income or loan-to-asset shares still saw higher abnormal returns if they paid higher dividends as a share of equity capital. However, I find that the result is not robust to controls for lending and investment opportunities. Specifically, controlling for the geographic dispersion of deposits, which proxies for the diversity of a bank's lending market, or a bank's level of maturity transformation, which proxies for their interest rate sensitivity, nullifies the dividend result. Therefore, it is likely that higher dividends simply reflect greater business opportunities and therefore higher expected earnings, consistent with signaling theories of payouts such as Bhattacharya [1979]. I conclude that the payout limitations did not drive the negative abnormal return result.

Next, I investigate two other channels through which the stress tests could have affected bank stock prices– expected earnings and default probability. Stress tests might have affected future earnings by showing that banks were susceptible to losses in some recovery scenarios. Similarly, the stress test results could have driven market expected failure probabilities higher or, by imposing capital conservation measures through payout restrictions, implied that any federal support to large banks would be limited. I find that pre-pandemic expected earnings and default probabilities do not explain negative abnormal returns either.

Instead, I find that across all specifications, abnormal returns are strongly, negatively related to bank size. This result indicates that the threat of increased supervisory stringency likely lowered stock returns. Indeed, I find that stress tested banks all had negative abnormal returns over both short- and medium- event horizons. For unaffected banks, abnormal returns declined as bank size increased. Therefore, among non-stress tested banks, those closer to the supervisory threshold were most likely to have experienced negative abnormal returns, reflecting a higher likelihood of increased supervisory stringency.

The results are important for understanding how regulators and supervisors should respond to future crises. First, the results show that supervisory and regulatory changes made after the Global Financial Crisis were helpful during the onset of the COVID pandemic. Banks were reluctant to cut dividends during the previous financial crisis which spurred regulators to limit dividends and prefer repurchase programs as the primary payout mechanism for banks in the post crisis period [Kohn and Liang, 2019; Liang, 2020]. This was done because it was believed that banks could quickly cut repurchases without the severe financial market penalties associated with dividend cuts. I find only limited evidence that supervisory limitations on payouts reduced abnormal stock returns, especially across the universe of publicly traded banks. Moreover, the estimated total decline in excess returns was smaller than previous studies examining divided cuts suggesting that supervisory and regulatory goals were achieved in that regard. Second, the results suggest that the need for supervisory flexibility is key during crises. The results clearly show that optimal supervisory capital targets were higher than market participants preferred, even given the high level of uncertainty that was pervasive at the time. Although this study cannot resolve what the optimal capital level should be, the results do suggest that supervisory discretion worked against market participant desires, resulting in lower abnormal returns. In particular, the supervisory restrictions considered in this paper increased capital at a time when bank managers would have been under market pressure to further reduce capital despite extreme economic uncertainty. Given the prevailing levels of realized loan losses and bank profits, only supervisory discretion, and not the automated capital distribution limitations that were put in place in early 2020, could achieve this result.

The remainder of the paper is as follows. Section 2 discusses the actions regulators took during the pandemic to limit shareholder distributions at large banks. Section 3 describes the empirical methodology used to assess excess stock returns. Section 4 describes the data used and summary statistics. Section 5 presents the results. Section 6 concludes.

2 Regulatory Actions During COVID-19

The COVID-19 pandemic posed a serious risk to the banking system. Business activity dropped resulting in reduced revenue for firms and joblessness for many households. The sharp income decline for both businesses and households threatened to increase loan defaults significantly across banks' loan portfolios. At the same time, financial system panic took hold. Both equity and bond markets faced severe disruptions. This panic was marked by a distinct preference for cash by economic actors which threatened even relatively safe banking assets such as U.S. Treasury securities as well as non-deposit liabilities of bank funding.

For its part, the Federal Reserve first sought to buoy concerns about the banking system by acting in its traditional lender of last resort function. Taking a page from its Global Financial Crisis playbook, the Federal Reserve lent funds from the discount window and utilized banking relationships to advance funding to mutual funds and other non-bank intermediaries. The surge of liquidity helped to stabilize the financial system and return markets to more orderly functioning. On the credit side, fiscal authorities authorized funding for businesses, consumers, and state and local governments which likely helped to stabilize non-financial balance sheets. As a result, delinquency and charge-off rates on bank loans actually fell to new lows for many portfolios rather increasing sharply as predicted.

Nonetheless, the threat to bank balance sheets from loan losses persisted throughout 2020. The unemployment rate remained above its pre-pandemic level, reflecting continued stress among some households, and firm revenues were affected by behavioral changes among consumers and measures taken by local authorities to contain the virus. While bank revenues outperformed relative to early expectations, bank regulators and supervisors were cautious given the fragility of the nascent economic recovery.

The potentially heightened regulatory and supervisory scrutiny and uncertainty around future earnings was the backdrop for the announcement of the 2020 Comprehensive Capital Analysis and Review (CCAR) results. The results were highly anticipated both because they would inform investors about the current strength of bank balance sheets and provide some guidance on how supervisors would oversee banks during the pandemic.

On the one hand, the results confirmed what many analysts and commentators already believed given the high levels of capital that banks had built up since the Global Financial Crisis– that banks could withstand the hypothetical stress test scenario. Figure 1 shows that stressed common equity tier 1 capital ratios remained above the required minimum levels for all banks. Global systemically important banks ("GSIBs") – the largest and most complex financial institutions in the United States– performed particularly well with the lowest minimum ratios at these banks still considerably above regulatory requirements. But foreign banking organizations ("FBOs") and smaller domestic banks also performed well with median stress tested capital ratios significantly above regulatory minimums.

Due to the on-going pandemic, however, supervisors were concerned about the short-term outlook for bank loan losses and conducted an additional "sensitivity analysis". That analysis revealed that under certain assumed pandemic recovery scenarios, bank capital could be depleted more than the standard severely adverse scenario predicted. Under at least one of those alternatives, the bottom quartile of stress tested banks was projected to have minimum common equity tier 1 ratios at or below 4.8 percent, suggesting it was likely that some banks would fall below their regulatory minimum levels and require additional capital support should loan losses rise.[1]

[1] Individual bank results for the sensitivity analysis were not published by the Federal Reserve Board.

In response to these potentially adverse conditions, supervisors took steps to limit capital payouts by CCAR participants. These actions prohibited stock repurchase programs and limited dividends to the lesser of the amount paid in the second quarter of 2020:Q2 or average net income over the previous four quarters. Given prevailing profitability levels and payouts, the limitations were strong capital preservation tools. Figure 2 shows that capital distributions at CCAR participants were near record levels going into the pandemic, particularly for repurchase programs. The eight GSIBs paid out nearly $40 billion in aggregate capital distributions in the quarters prior

Figure 1: Minimum Capital Ratios Under Severely Adverse CCAR Scenarios

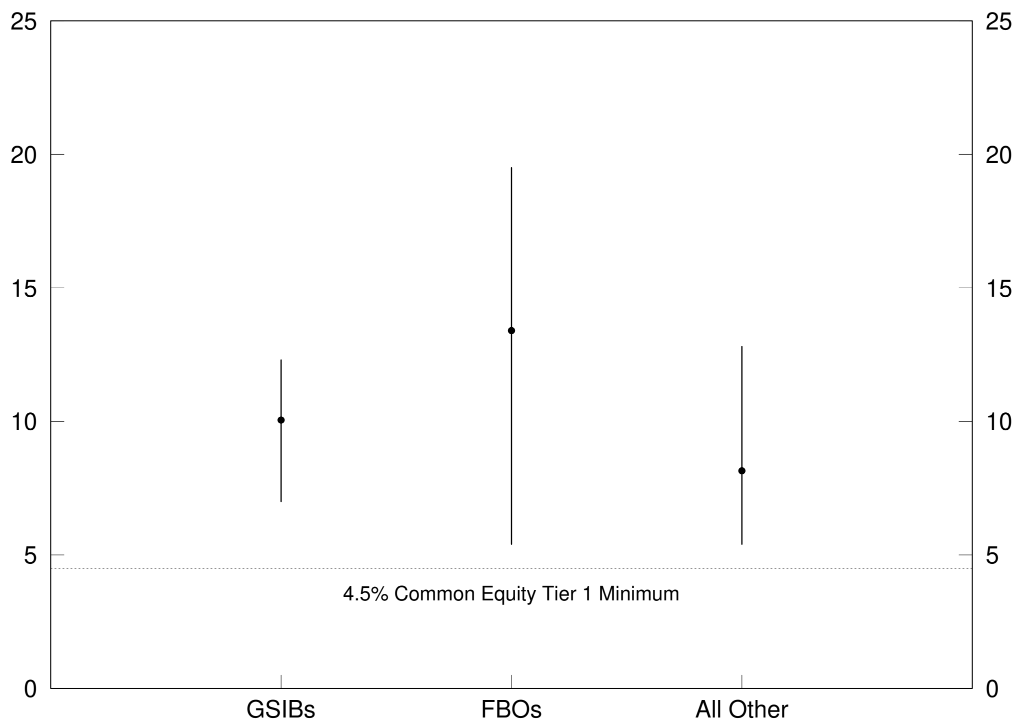


Chart shows the distribution of minimum common equity tier 1 capital (CET1) ratios under the 2020 CCAR's severely adverse scenario by bank group. FBOs denote intermediate holding companies tested. Dashed line is the required minimum CET1 capital ratio.
Source: Federal Reserve Board.

to the pandemic. Other banks subject to these regulations were paying out nearly $10 billion per quarter. In many cases, recent payouts exceeded income available to shareholders, reducing capital buffers.

Figure 2: CCAR Firm Payouts

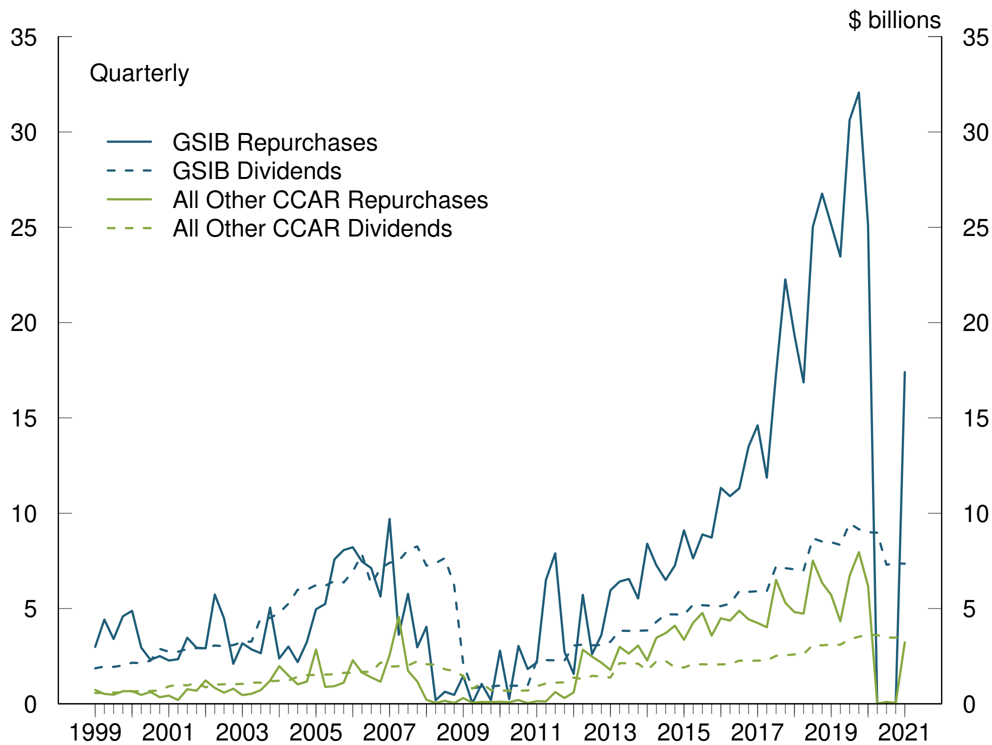


Chart shows aggregate dollar amount of shares repurchased and dividends paid by global systemically important banks (GSIB) and banks that are not considered GSIBs but still participate in the Comprehensive Capital Assessment Review (CCAR). Solid lines denote dollar amount of stock repurchases. Dashed lines denote aggregate dividends paid.
Source: FR Y-9C.

While payout restrictions were defensible given the level of uncertainty, perhaps more importantly, news of payout restrictions should have been surprising for investors in some ways. In March 2020, regulators had finalized new capital rules that implemented the so-called "stress capital buffer". Under these rules, stress tested banks are required to hold common equity tier 1 capital equal to 4.5 percent of risk weighted assets plus a stress capital buffer.[2] The stress capital buffer consists of 1) the difference between the starting common equity tier 1 ratio and the minimum ratio achieved during the stress test plus 2) four quarters of planned dividend payments expressed as a share of risk-weighted assets. Banks that fall below these minimum required levels are subject to capital distribution restrictions. These new rules were meant to automatically restrict payouts and reduce the need for judgmental supervisory assessments of bank capital planning. Investors were likely surprised by the intervention in June 2020 because the payout restrictions essentially amounted to a judgmental assessment outside the stress capital buffer rules which were intended to curb such actions.

That said, there are also reasons to believe the intervention would have no market impact. On March 15, the Financial Services Forum, an interest group who's membership consists of the eight U.S. GSIBs, announced that their members would not repurchase shares for the first and second quarters of 2020.[3] Several large regional banks followed suit voluntarily after this announcement. Therefore, news of similar supervisory restrictions on share repurchases should only be market moving if investors suspect that supervisors will keep the cessation in place longer than anticipated.

A second reason to expect that news of payout restrictions would not be market moving is because these crisis actions were telegraphed well in advance by supervisors and regulators. Prior to the finalization of the stress capital buffer rule, the stress test program had enforced a soft cap on dividends of 30 percent of total income[Kohn and Liang, 2019]. Banks that wished to pay dividends above this level had to get approval from supervisors to do so. In all likelihood, the soft cap was in place to encourage banks to make capital distributions via share buybacks rather than dividends [Liang, 2020]. By doing so, regulators implicitly signaled their preference for share repurchases over dividends. The preference ordering occurred because it was thought that repurchases could be cut easily during crisis without a severe market

[2]Banks deemed systemically important must also hold an additional capital buffer called the GSIB surcharge that varies by bank.

[3]The announcement can be viewed on the Financial Services Forum's website.

penalty on stock prices. Dividend cuts, on the other hand, are associated with severe penalties by market participants as demonstrated by both academic research as well as the experience of the Global Financial Crisis. Supervisors and regulators want to avoid severe stock price declines because they can hinder a bank's ability to raise new equity if needed during the crisis.

3 Empirical Strategy

The announcement of dividend cuts and repurchase restrictions by supervisors presents at least three testable hypotheses. First, investors may interpret the announcement itself as negative news about future bank earnings for the stress tested banks because supervisors hold inside information. Under this hypothesis, affected bank stock prices should fall. Second, investors may react negatively to the perception of increased supervisory stringency if it is thought to affect either expected payments to shareholders or constrain future earnings and growth. Bank stock prices would fall in this scenario as well. Finally, there may be spillover effects to other banks that are not directly targeted by the announcement. These unaffected banks could experience stock price declines if investors thought that supervisory actions for the largest banks conveyed information about future earnings for all banks or if the actions increased expectations about additional supervisory or regulatory actions that might weigh on bank earnings or payouts. To investigate these various mechanisms, I first estimate the effect of the stress test announcement on bank stock prices. I then examine differences in stock prices across banks in a regression framework.

Figure 3: Event Study Methodology

To estimate the effect of the announcement on stock prices, I use a standard event study methodology as shown graphically in Figure 3. The methodology first requires determination of an estimation period that consists of dates prior to the event date. This estimation window is used to estimate the correlation between an individual bank's stock price and the market return. That market beta is then used to predict returns during the event window. The gap is a short period between the estimation window and the event window. Any pre-trends that occur prior to the event will not affect the estimation of the market beta with an appropriate gap size.

For this analysis, I use an estimation window of 50 days and a gap of 10 days so that there are a total of 60 days before the start of the event window. The 10 day gap is widely used in the literature (see for example Bessler and Nohel [1996]). The 50 day event window, however, is somewhat shorter than usual (for example, Bessler and Nohel [1996] use a 100 day estimation window). I choose this shorter window though, for the simple reason that early 2020 was marred by the onset of COVID, a financial panic, and extraordinary responses from both monetary and fiscal authorities. The bulk of these events happened in late March and early April. In order to avoid the impact of these events, I choose a window that begins after these events had likely been priced into stock markets.

I estimate the beta for each bank stock during the estimation window using the market model as shown in equation 1. The market model regresses the stock return, $R_{i,t}$, of bank i at day t on the market return, $R_{m,t}$, and a constant, α_i. This market beta is estimated for each bank i during the estimation window, producing a bank specific beta, β_i.

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \varepsilon_{i,t} \tag{1}$$

Next, I estimate the daily abnormal return, $AR_{i,t}$, for each bank stock i and day t in the event window. The abnormal return is simply the forecast error between the realized return on stock i, denoted $R_{i,t}$, and the predicted return from the model in equation 1. The abnormal return calculation is shown in equation 2.

$$AR_{i,t} = R_{i,t} - (\hat{\alpha}_i + \hat{\beta}_i R_{m,t}) \tag{2}$$

The cumulative abnormal return (CAR) is calculated by summing the daily abnormal returns over the event window as shown in equation 3. The CAR can be standardized using the error variance from the forecast model estimation as shown in equation 4.

$$CAR_i = \sum_t AR_{i,t} \tag{3}$$

$$SCAR_i = \frac{CAR_i}{\sqrt{\sum \varepsilon_{it}^2}} \tag{4}$$

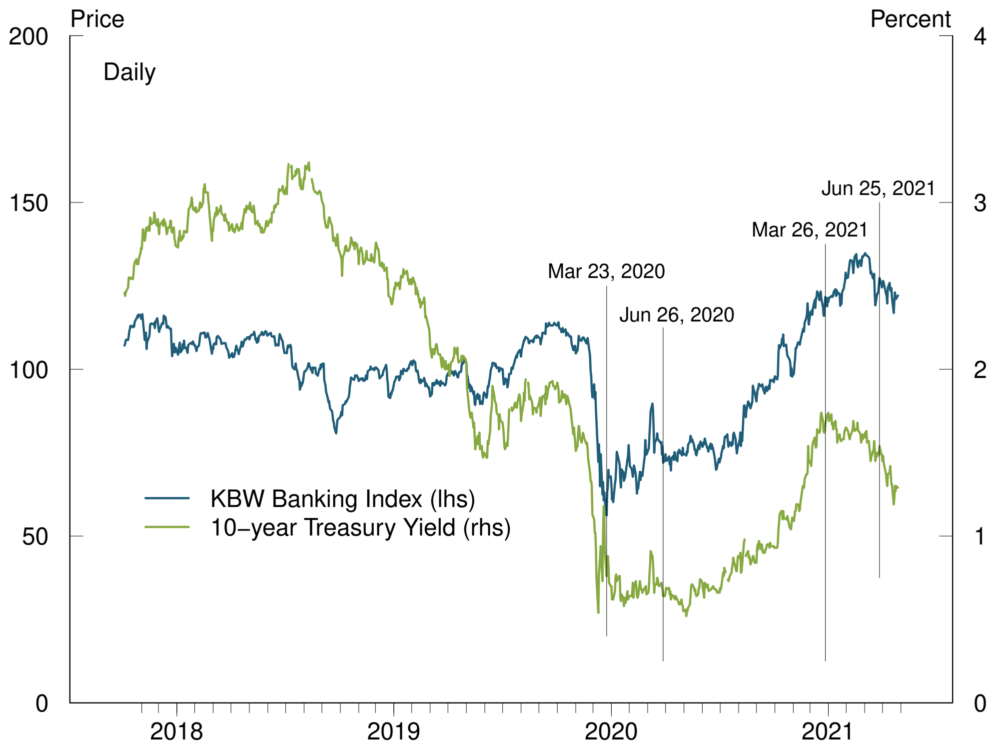
Statistical significance under the null hypothesis that the standardized abnormal return is zero is determined by calculating a t-statistic using the methodology of Boehmer et al. [1991]. Event study simulations have shown that clustered event times, such as those associated with accounting or regulatory rule changes, increase the variance of stock returns [Brown and Warner, 1980, 1985]. As such, standard errors are typically too small and lead to rejection of the null too often. Boehmer et al. [1991] provide a standard error that is robust to event-date clustering. This statistic is formed by first standardizing residuals by the estimation period's standard deviation adjusted for the event period forecast error. The test statistic scales the average event period standardized residuals by the cross-sectional standard error.[4]

Regarding identification, the methodology assumes that the event– in this case the stress test result announcement– is the main market moving news during the event window. Under very short event windows, this is likely a valid assumption. As stated above, the estimation window was constructed to not capture any of the initial COVID related financial panic and response. At the time of the event, both bank stock prices and 10-year Treasury rates had already reached their troughs as shown by Figure 4. Bank stocks as measured by the KBW index, in fact, had started to rise above that trough in the weeks prior to the announcement. Additionally, the introduction of the stress capital buffer likely made investors consider interventions of the sort completed in June 2020 less probable, leading to a larger market reaction.

[4]The event studies are estimated using the code available from WRDS as modified by Kai Chen.

However, the medium run impact of the announcement is also of interest. Unfortunately, over longer event windows the assumption that stress tests are fully driving price movements is poor. To estimate these longer run impacts, I compare the CARs of the affected banks with the CARs of the unaffected banks using a simple Wilcoxon t-test. The assumption under this test is that general market news affects all banks equally so that any differences between affected and unaffected banks over medium

Figure 4: Bank Stocks and Long-term Interest Rates



Notes: Dates denote key events for banks during the COVID-19 pandemic. The Federal Reserve's Federal Open Market Committee (FOMC) restarted their large scale asset purchases and announced a suite of facilities backing key financial markets on March 23, 2020 . The Federal Reserve Board announced capital payout restrictions on large banks after the market close of June 25, 2020. Partial relaxation of these restrictions was announced after market close on March 25, 2021. The restrictions were fully lifted after market close on June 24, 2021.
Source: S&P Market Intelligence and Federal Reserve Board, H.15 Release.

term windows is due to the cumulative effect of the stress test result announcement.

Finally, I investigate the mechanisms described at the start of this section by evaluating the stock price reactions across bank characteristics following Bessler and Nohel [1996]. For each event study window, I take the cross section of standardized CARs and regress them on a set of bank characteristics that proxy for various mechanisms as shown by equation 5. The standardized CAR is represented by $SCAR_i$ and the matrix, X_i, represents a set of bank characteristics. I include pre-pandemic measures of bank size and regulatory capital in nearly all specifications. In alternative specifications, I also include measures that proxy for business model differences, earnings variability, analyst profit expectations, and default probabilities. I also estimate the effects of the payout restrictions design by including pre-pandemic measures of bank payouts.

$$SCAR_i = \alpha_0 + \beta_2 X_i + \varepsilon_i \tag{5}$$

As discussed in more detail below, the bank stock sample is limited. There are only 33 bank holding companies (BHCs) required to undergo the stress test in the United States. Moreover, only a limited number of BHCs are publicly traded. Due to the small sample size, I use robust standard errors calculated using the HC_3 method. As discussed in Michler and Josephson [2021], Angrist and Pischke [2009] suggest that this methodology produces more conservative standard errors relative to the true variance. Nonetheless, robust standard errors can still be problematic in small sample sizes. Therefore, I follow Angrist and Pischke [2009]'s heuristic approach and compare the HC_3 standard errors with conventional, non-robust standard errors. HC_3 standard errors are reported in all tables below. Conventional standard errors are typically smaller than those that are reported.

4 Data

Bank stock prices used to estimate the event studies around the payout restriction announcements are from the CRSP database. The bank stock sample is drawn from the list of company and security identifiers in the Federal Reserve Bank of New York's permco-IDRSSD database.[5] The base stock sample includes all company and security identifiers that traded on June 26, 2020 which is the first open trading day after the announcement of the CCAR results (i.e. the event day in the event study terminology). I keep shares that are listed as common and are associated with bank holding companies in the NY Fed database and exclude those missing closing prices. For company and stock combinations that have multiple regulatory report identifiers ("IDRSSD") listed, I use the stock that has the largest number of average outstanding shares between 2019 and 2021:Q1. I manually add the company and bank identifiers for stocks associated with intermediate holding companies owned by foreign banking organizations that are excluded from the New York Federal Reserve database to complete the event study sample.[6] In total, I am able to identify stocks for 32 of the 33 CCAR participants listed in the 2020 stress test results.[7] My complete stock sample includes 194 bank holding companies.

I pair these data to the quarterly regulatory bank holding company reports ("FR Y9C") to complete the cross sectional analysis. In this sample, I drop the 10 stress tested banks that are associated with foreign banking organizations. For U.S. banks, the FR Y9C collects information about the highest holding parent of these institutions, including detailed information on income, equity, and other balance sheet measures. The highest holding parent is also typically the institution that sets payout policy for the organization. For intermediate holding companies, this information is less relevant since it is not the highest tiered holding company. Instead, there is little information available on the top tiered foreign holding companies in U.S. regulatory reports. Moreover, payouts for intermediate holding companies (IHC) occur between the IHC and the top tiered parent, thus IHCs typically utilize internal capital markets and not the external markets that are the primary consideration in this analysis.[8]

[5] The Federal Reserve Bank of New York's permco-IDRSSD database is available here.

[6] The complete list of identifiers across datasets is listed in Appendix A.

[7] BNP Paribas is the only stock not available in CRSP because it is not exchange traded in the United States.

[8] European banking agencies also instituted dividend restrictions on BHCs during this time. For

I also pair the sample with Wall Street analysts' quarterly earnings per share from I/B/E/S. These data show the median analyst's annualized earnings expectation over the coming fiscal period. I use the one year ahead expectation. This seems most appropriate for pricing stocks given the unusual amount of uncertainty over even short horizons in the period I consider. Finally, I calculate the daily Merton distance from equity values for sample banks and average these over 2019 to gauge a bank's pre-pandemic default probability. Eleven banks in the sample do not have analyst expectations and one does not have a Merton distance. The cross-section of banks has 172 banks total as a result.

There are a number of issues related to measuring payouts in practice.[9] As an illustrative example, the Compustat database, a commonly used database of financial metrics, reports quarterly dividends paid by both the ex-date and the pay date. Occasionally, these dates can appear in the same quarter which results in double counting of the paid dividend when compared to the announced dividend. The following quarter however will have no reported paid dividends. Another issue with dividend accounting is that some banks pay dividends quarterly while some pay dividends less frequently, such as semiannually. In these cases, even though dividend payments are typically smooth over reasonably long periods, picking a single quarter or similarly short accounting period may misrepresent the total dividends paid. To alleviate these issues, I simply sum total common dividends paid within a calendar year (between 2019:Q1 and 2019:Q4) and divide by average equity capital reported at each quarter-end on the FR Y9C. This accounting should produce a standardized, average quarterly dividend rate during the last pre-pandemic year.

A second issue related to payout accounting is measuring repurchases. Repurchase programs are publicly announced, but generally only the total target amount over a specific horizon is reported. Moreover, the actual repurchases may not be conducted in a smooth manner and the total repurchase amount may be more or less than the announced repurchase program. An additional issue is that the FR Y9C

more information, see the European Central Bank press release. Identifying effects across different regulatory agencies and actions would be challenging.

[9]For a discussion of measurement issues, see Allen and Michaely [2003].

does not report total common stock repurchases but instead reports total repurchases including preferred stock shares. I follow Hirtle [2016] to calculate repurchases as the sum of treasury stock purchases and net common stock retirements. Hirtle [2016] reports that this metric closely follows the repurchase data reported in Compustat. I scale repurchases by net income available to common shareholders which is defined as total net income less preferred dividends paid. Similar to dividends, I sum repurchases to common shareholders over the entirety of 2019 to get an annual repurchase amount and scale it by average total equity reported at quarter-ends.

For all the remaining balance sheet and income variables used in the cross-sectional analysis, I take the quarterly average over 2019. Taking the average is again meant to reduce any volatility that results from window dressing particular quarters, such as year end, or quarters that are affected by one-time events.[10] As basic measures of bank characteristics, I use the tier 1 capital ratio as a measure of capitalization and the average of log total assets as a bank size measure. I also construct variables for non-interest income share of total net revenue and the share of loans to total assets to more directly control for differences in business models.[11] To account for differences in potential earnings sources, I construct a maturity/repricing gap as described by English, den Heuvel, and Zakrajšek [2018] as a measure of a bank's interest rate sensitivity and a Herfindhal-Hirschman Index (HHI) of a bank's internal deposit market using Summary of Deposits data at the county level.[12] The HHI measures the geographic dispersion of a BHC's deposit base. Deposit concentration increases with the HHI, denoting less geographic dispersion.

Table 1 reports summary statistics for the cross-sectional sample using FR Y9C data. The observations have been broken into three groups: Global Systemically Important Banks ('GSIBS"), All Other CCAR banks, and the non-CCAR banks that constitute the remainder of the sample. The table shows that, by definition,

[10] All balance sheet and income variables from the FR Y9C are merger-adjusted using the methodology of English and Nelson [1998].

[11] Net revenue is net interest income plus gross non-interest income.

[12] The HHI is constructed by calculating the bank's market share of deposits in a county relative to its total deposit base. The HHI is the sum of the squared market shares over all the bank's operating counties.

banks that participate in the CCAR program are significantly larger than non-CCAR banks. GSIB banks average total assets of more than $1 trillion while the smaller CCAR participants average about $200 billion in total assets. Non-CCAR banks average only about $14 billion in assets though there is considerable variation within that sample. Larger banks also tend to have higher Tier 1 capital ratios. This is due to additional regulatory capital requirements on CCAR banks through stress testing as well as additional capital requirements imposed on GSIBs. For example, GSIBs are subject to capital surcharges and additional leverage capital requirements that banks deemed non-systemically important are not subject to. Large banks also tend to have slightly larger maturity/repricing gaps than smaller banks. Interestingly, smaller banks have more geographically diverse deposit bases. This could be explained by the fact that large banks book many deposits at their headquarters, resulting in large concentrations near their headquarters.

Turning to payouts, large banks payout significantly more than small banks through both the repurchase channel but payout smaller dividends as a share of capital. For GSIBs, average dividends paid in 2019 were 2.86 percent of total equity capital with a standard deviation of about 1 percent. Repurchases however accounted for 9 percent of equity capital. Smaller CCAR banks had dividends rates of about 4 percent of equity capital in 2019 and repurchased shares that amounted to about 8 percent of total equity capital, but with substantial variability. Non-CCAR banks had significantly smaller total payout programs. Dividends averaged about 3 percent of equity capital as with CCAR banks but repurchases were only about 2 percent of equity capital.

Finally, forecasted earnings are substantially higher for the largest banks compared to all other banks. Analysts expected GISBs to earn $4.60 per share annually as of June 2020, down significantly from their 2020:Q1 levels. Smaller banks were expected to earn only about half that level. The higher earnings expectations for the largest banks reflect their size and diverse business models. GSIBs typically have large capital markets and trading operations in addition to more traditional lending businesses. During heavy market volatility and sharp recoveries such as the one that occurred in 2020, large banks are able to profit from these non-lending businesses.

Table 1: Summary Statistics for Cross Sectional Analysis

	(1) GSIB		(2) Other CCAR		(3) All Other	
	Mean	SD	Mean	SD	Mean	SD
Assets ($ in billions)	1438.29	943.29	215.27	123.66	13.61	13.66
ln *Assets*	20.80	0.90	19.05	0.50	16.02	0.89
Tier 1 Ratio	14.46	1.88	11.63	1.12	12.79	2.51
Non-Interest Income Share	62.89	21.33	40.17	17.83	22.18	12.20
Loans to Assets	27.67	15.10	65.49	13.29	71.65	9.84
GAP	5.58	2.29	4.54	2.16	5.04	1.77
HHI	0.42	0.33	0.30	0.39	0.26	0.25
Dividend Rate	2.86	0.93	3.86	1.28	3.13	1.73
Repurchase Rate	8.68	2.17	7.78	4.93	2.21	3.18
Default Distance	1.36	0.88	1.40	0.44	1.53	0.75
Earnings Forecast 2020:Q2	4.60	3.99	2.31	2.53	1.92	1.54
Earnings Forecast 2020:Q1	8.44	7.02	6.23	4.20	3.00	2.01
Observations	8		14		150	

Notes: Earnings expectations are median one year ahead earnings-per-share expectations from IBES. Balance sheet measures are 2019 averages. Income variables are 2019 cumulative sums. *HHI* is the Herfindahl-Hirschman index of a bank's internal deposit market at the county level as measured by the Summary of Deposits data. *GAP* is the maturity and repricing gap of English et al. [2018]. Dividend and repurchase rates are annual dividends paid and dollar amount of common shares repurchased in 2019 relative to average total equity capital, respectively.

Smaller firms that are restricted to more traditional lending activities however, are more subject to the level of interest rates and the slope of the yield curve. In sharp downturns, interest rates tend to be low and the yield curve relatively flat, meaning bank profitability is more likely to suffer. Figure 4 shows that bank stocks throughout the pandemic have followed the 10-year Treasury yield fairly closely.

5 Results

5.1 The Market Model

The results of the event study using the market model are shown in Table 2. The table reports the average cumulative abnormal return ("CAR") for CCAR banks as well as for banks that are not CCAR participants. The last column reports the Wilcoxon Z statistic comparing the two groups under the null hypothesis they are equal. The rows report various event windows with the event date being $t = 0$.

Table 2: Market Model Mean Cumulative Abnormal Returns

Window	Mean Cumulative AR		Two-way
	CCAR Banks	Non-CCAR Banks	Wilcoxon Z-Stat
(0,1)	-2.17	3.03	-7.64
	(-5.33)	(13.61)	(0.0001)
(-1,1)	-0.43	4.93	-6.63
	(-0.68)	(19.37)	(0.0001)
(0,4)	-5.17	-2.66	-4.26
	(-7.45)	(-9.91)	(0.0001)
(0,21)	-5.43	-0.88	-3.81
	(-5.44)	(-0.85)	(0.0001)
(0,65)	-6.10	5.80	-3.43
	(-2.19)	(3.81)	(0.0007)
Bank Count	32	162	

Notes: Table shows average cumulative abnormal returns based on the difference between realized equity returns and predicted returns from a market model that includes CRSP total market returns. For CARs, Boehmer et al. [1991] t-statistic is shown in parentheses. For the Wilcoxon Z statistic, p-value is shown in parentheses. The payout restriction date is considered June 26, 2020, the first trading day following the announcement of the restrictions.
*p<0.1; **p<0.05; ***p<0.01

The first row shows that CCAR participants had an average CAR of -2.17 percent over the two days following the stress results and payout restriction announcement. Comparatively, banks not subject to the CCAR stress testing requirements had a positive abnormal return of 3.03 percent during the same two day window. These differences are statistically different. The result demonstrates that, at least unconditionally, the announcement of the stress test results and the payout restrictions had a negative impact on the stock prices of the affected banks. There is little evidence in these fairly simple tests that there were spillovers to unaffected banks.

The second row reports the CARs for the affected and unaffected groups over a three day window centered around the announcement day. In this window, the impact on CCAR participants is negligible and statistically insignificant from zero while the estimated CARs for non-CCAR banks are positive and statistically significant. The fact that the abnormal returns are near zero for CCAR participants when including the day prior to the event suggests that the announcement itself was a driving factor in the negative abnormal returns seen in the smaller two day window. The reason is that the three day window includes the CAR for the day prior to the event plus the negative effect of the following two day window. This suggests that CARs were positive the day before the event and then turned negative after the stress test results and payout restrictions were announced.

The third row looks at the impact over a full week of trading days starting with the announcement day. The abnormal returns are more negative over this longer window for CCAR participants. The estimated CAR of -5.17 percent is more than double the estimated CAR for affected banks from the two day window. This result shows that while some information was priced in quickly upon the announcement, it took some time for the market to fully digest the consequences of the stress test results and restrictions. Additionally, at this time horizon there appear to be spillovers into smaller, non-CCAR participant banks. Non-CCAR banks report negative CARs of -2.66 percent on average. The difference between the two bank groups are statistically significant at the 1 percent level.

The fourth row looks that the effect over a trading month and finds similar effects as found in the trading week. In this horizon, CCAR participants have a -5.43

percent cumulative abnormal return compared to an abnormal return that is indistinguishable from zero for non-CCAR participants over this horizon. The differences between the participants and non-participant groups is statistically different from zero. This result shows that announcement effects on CCAR participants were priced in fairly quickly, within one trading week, but were very persistent. Conversely, the announcement did not affect smaller banks except in a transitory way.

Finally, the last row estimates cumulative abnormal returns over a trading quarter. Non-CCAR participants have an estimated cumulative abnormal return of nearly 6 percent over the trading quarter, showing that CCAR participant stocks vastly under performed expectations based on the market model. Conversely, non-CCAR banks ended the trading quarter following the payout restrictions with a positive CAR. Differences between the stress tested banks and the non-stress tested banks were significantly different.

According to the market model results, the announcement of payout restrictions had a sizable negative contribution on affected bank stock prices. The immediate announcement effect was rather sizable at about 2 percent and this decline in CARs grew over time. However, much of the pricing action appears to have been accounted for within the first trading week. Longer term announcement effects are slightly larger compared to shorter frequencies but the majority of the announcement effect appears to have been priced in fairly quickly. Non-CCAR banks, on the other hand appear to have suffered temporary declines in stock price CARs during the weeks following the announcement. Over the full trading quarter, however, these banks performed better than expected by the market model.

In terms of magnitude, these effects are smaller than those previously found for a cut in dividends by banks. Bessler and Nohel [1996], for example, find that a dividend cut leads to about an 8 percent decline in CARs over a two day period compared to the 2 percent found here. Over a full trading week, Bessler and Nohel [1996] found that the effects moderated a bit to about 7.5 percent but still smaller than the 5 percent impact found here. The cumulative impact over a trading quarter for the payout restrictions is also smaller than Bessler and Nohel [1996]'s estimates. Importantly, the stress test announcement does not appear to have been priced in prior to the event. The three day symmetric window finds a negligible effect. This contrasts with Bessler and Nohel [1996]'s research on dividend cuts that finds a clear decline in stock performance leading up to the actual announcement of the cut. This suggests that, during mid-2020, the announcement was driving the stock price performance and not rising concerns about the viability of large, stress tested banks.

5.2 The Fama-French Model

The market model assumes that the market fully prices in common events. More explicitly, the market model assumes the return on the market as a whole is a good predictor of individual returns. If so, then the excess return generated by a forecast reflects only idiosyncratic factors specific to the stock. Banks, however, may be special in some ways that other market participants are not. In particular, bank stocks are more sensitive to interest rate fluctuations. The period around the onset of the COVID crisis is also a particularly volatile time for interest rates so controlling for these factors is important.

To do so, I reestimate the cumulative abnormal returns for each group of banks using the Fama-French model shown in equation 6. In this equation, the return on bank i's stock at time t is represented by $R_{i,t}$. The Fama-French model regresses this return on a constant, α_0, as well as the difference in the market return, $R_{m,t}$, less the risk-free rate, $R_{f,t}$. This difference provides an excess market return over the risk free rate, providing a simple proxy for equity risk premia. Moreover, by forward expectations, the risk free short-term rate will also convey information about longer term rates that are important for bank profitability. The model also includes differentials between small and large cap stock returns, SMB_t, as well as differentials between growth and value stocks, HML_t. These factors should control for the size differences between CCAR participants and non-participants when estimated at the security level.

$$R_{i,t} = \alpha_0 + \beta_{i,1}(R_{m,t} - R_{f,t}) + \beta_{i,2}SMB_t + \beta_{i,3}HML_t + \varepsilon_{i,t} \tag{6}$$

Table 3 shows the average cumulative abnormal returns for each bank group using the Fama-French model. The table again reports t-statistics for cumulative abnormal returns as derived by Boehmer et al. [1991] and Wilcoxon t-statistics to compare across the two groups.

Table 3: Fama-French Mean Cumulative Abnormal Returns

Window	Mean Cumulative AR		Two-way
	CCAR Banks	Non-CCAR Banks	Wilcoxon Z-Stat
(0,1)	-3.34	-0.10	-6.52
	(-7.56)	(-0.57)	(0.0001)
(-1,1)	-1.63	1.76	-5.69
	(-3.48)	(8.45)	(0.0001)
(0,4)	-3.16	-0.18	-4.36
	(-4.88)	(-0.61)	(0.0001)
(0,21)	-9.09	-3.64	-4.36
	(-8.24)	(-4.94)	(0.0001)
(0,65)	-10.6	3.51	-4.22
	(-4.43)	(2.18)	(0.0001)
Bank Count	32	162	

Notes: Table shows average cumulative abnormal returns based on the difference between realized equity returns and predicted returns from a Fama-French three factor model. For CARs, Boehmer et al. [1991] t-statistic is shown in parentheses. For the Wilcoxon Z statistic, p-value is shown in parentheses. The payout restriction date is considered June 26, 2020, the first trading day following the announcement of the restrictions.
*p<0.1; **p<0.05; ***p<0.01

Over the short two day window, the results are similar to the results generated using the market model. I estimate that cumulative abnormal returns for CCAR banks over this window are -3.34 percent, slightly larger than those estimated using the market model, and statistically different from zero. For non-participants, the abnormal returns are slightly negative but indistinguishable from zero. The difference between the groups is also statistically significant.

Over a symmetric three day window, I estimate a negative abnormal return for CCAR participants, but it is only about half the size of the estimates from a two day window that includes only the post announcement days. This again suggests that the excess returns are being driven by the announcement itself. Non-CCAR participants had a somewhat sizable 1.76 percent increase in cumulative abnormal returns when the day prior to the announcement is included.

Over longer horizons, I find results similar to those estimated from the market model. For the weekly, monthly, and quarterly windows, I find that CCAR participants had negative excess returns ranging from -3 to -10 percent. This supports the evidence from the market model that investors slowly priced in announcement effects over a longer horizon. However, using the Fama-French model, the effects are larger over longer horizons and more persistent. For smaller banks, there again appears to be a transitory effect though it is somewhat more persistent than suggested by the market model. After a full trading month, non-CCAR participants had excess returns of -3.64 percent, well below the shorter event windows estimates and below the market model estimated for a monthly frequency. After a trading quarter though, those negative returns are wiped out and these banks enjoy about a 3.5 percent cumulative excess return. All differences between CCAR participants and non-participants are statistically non-zero.

The estimated abnormal returns provide evidence that the announcement of the stress test results and associated payout restrictions on large banks negatively impacted their stock prices. Evidence is minimal that there were longer-term spillovers for smaller, non-CCAR participant banks. However, banks may have been impacted in different ways depending on their balance sheet characteristics and business models.

5.3 Cumulative Abnormal Returns Cross-Sectional Analysis

I first investigate the effect of the announced payout restrictions on bank stock prices directly. Because participant banks showed strong performance in the severely adverse scenario, the restrictions are likely the prevailing "news" in the stress test result announcement. Moreover, the lack of detailed bank-level information for the additional exercise might make it hard for the market price bank specific effects of the test results.

I test whether the restriction parameters are important by regressing the cumulative abnormal returns over the two day event window on payout information from 2019. All regressions control for the bank's pre-pandemic size, as measured by the log of assets, and capitalization, as measured by the Tier 1 capital ratio. Table 4 reports the regression results.

Table 4: Impact of Regulatory Constraints on Daily CARs

	(1)	(2)	(3)
Dividend Rate	3.65*		3.85**
	(1.91)		(1.91)
Repurchase Rate		-0.79	-1.00
		(0.79)	(0.79)
ln *Assets*	-34.76***	-33.26***	-33.42***
	(2.42)	(2.79)	(2.79)
Tier 1 Ratio	1.24	1.21	1.21
	(1.58)	(1.56)	(1.57)
Constant	588.93***	578.56***	569.64***
	(42.80)	(47.41)	(47.21)
Observations	172	172	172
Adjusted R^2	0.65	0.65	0.65

Notes: Dependent variable is the standardized cumulative abnormal return from a two day window that includes the trading day following the CCAR announcement and the next day. Bank assets and tier 1 capital ratio are 2019 averages. Dividend and repurchase rates are dividends paid and dollar amount of common shares repurchased in 2019 relative to average total equity capital, respectively.

Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Column (1) shows that banks paying higher dividends had higher cumulative abnormal returns over the two days following the announcement. A one percent increase in dividends as a share of total equity capital increased standardized abnormal returns about 4 basis points. This effect is significant at the 10 percent level. However, the bank size effect is much larger and more significant. Cumulative abnormal returns declined 35 basis points for each one percent increase in total assets.

Column (2) reports the same results using the repurchase rate. I find no statistically significant effect of the repurchase restriction on bank stocks. I do, however, again find a large and significant effect for bank size that is close to the effects found in column (1).

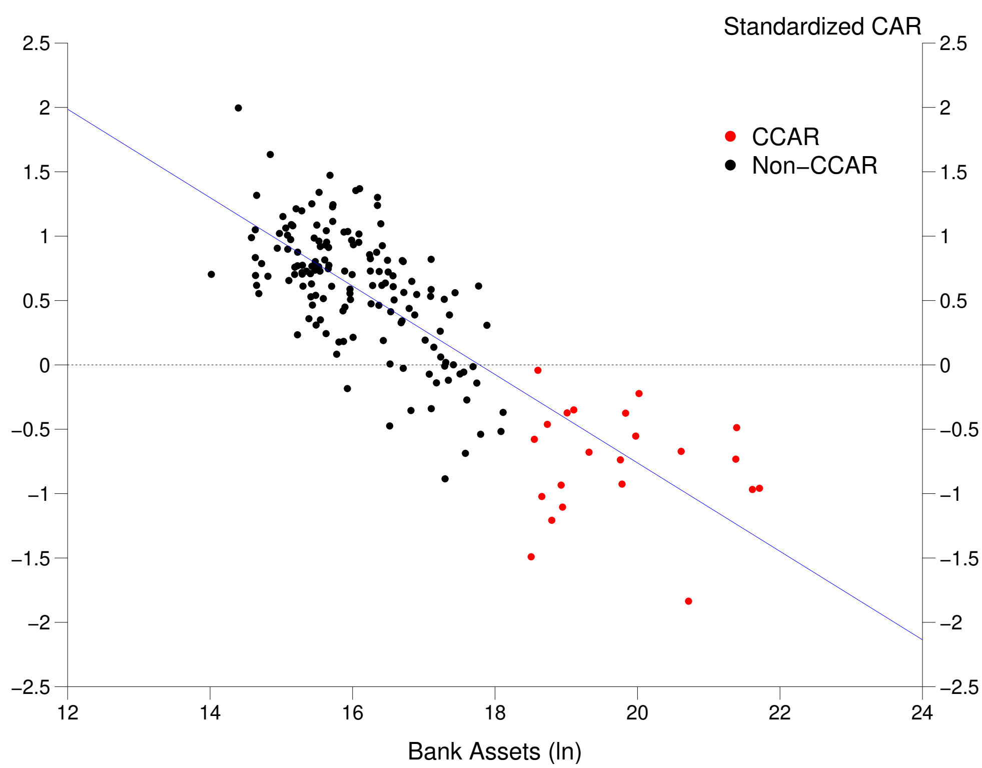
Column (3) puts the dividend and repurchase rates together in the same specification along with size and capital controls. I find that the earlier results hold. Higher dividends had a modest, positive effect on abnormal returns. Repurchases and capital had no statistically significant effects. Bank size explains most of the variation in abnormal returns.

These results indicate, at least preliminarily, that the parameters of the announced restrictions may have affected bank stock prices. Under the restrictions, current dividends were unaffected unless bank income fell dramatically. Thus, banks with larger dividend payments had the ability to reduce excess free cash flow and avoid the disincentives problem described by Jensen and Meckling [1976] and Jensen [1986]. On the other hand, it is likely that the repurchase rate did not affect cumulative returns because banks had already voluntarily stopped repurchasing shares to conserve capital. Finally, the capital ratio may not be important because the test results showed that under the severely adverse event scenario, all banks would have sufficient capital.

The major takeaway from this exercise however is that bank size explains a large portion of the observed cumulative abnormal returns. This result suggests that banks more likely to face increased supervisory pressure had lower returns. Investors likely assumed that supervisors would push banks to increase relative capital positions, which may require a reduction in some risky, but profitable lending. I explore whether this result can be explained by business models, expected earnings, or default probabilities in subsequent tests.

The raw cumulative returns however suggest that the explanation of higher supervisory oversight for larger banks is compelling. Figure 5 shows the two day, cumulative abnormal returns for CCAR banks in red and non-CCAR banks in black compared to the log bank assets. The best fit line is shown in blue. First, the figure shows that all CCAR banks had negative returns that ranged from just below zero to 2 percent. Alternatively, the majority of non-CCAR banks had positive cumulative returns which similarly ranged from 0 to 2 percent. Only a handful of non-CCAR banks had negative returns and they were predominately near the upper end of the size distribution. Collectively, the visual evidence suggests that banks closest to the CCAR size threshold were more likely to have negative effects because they appeared most at risk of heightened supervisory oversight. The CCAR banks, for which it was already revealed would be subject to heightened oversight, all had negative returns.

Figure 5: Estimated Two-day Standardized Cumulative Abnormal Returns



5.4 Business Model Differences

I next investigate whether the previous results are driven by differences in business models or the richness of a bank's earnings opportunities. To do so, I supplement the previous regression by adding controls for the relative size of the bank's lending portfolio and the share of its net revenue – that is net interest income plus gross non-interest income– that is generated by fees, capital markets activity, and other non-interest income sources. These controls are meant to measure variation across banks that might have large dealer or investment banking businesses compared to banks with large core lending portfolios. Second, I control for the diversity of income opportunities by adding the sensitivity of a bank's interest earning portfolio to interest rate changes and the geographic dispersion of their deposit base. The geographic dispersion is measured as the bank's internal HHI of booked deposits from the Summary of Deposits data. A similar measure was used by Goetz, Laeven, and Levine [2013] to study risk-taking and geographic diversification. I control for interest rate sensitivity using the repricing and maturity gap from English and Nelson [1998]. This measure captures the gap between when a bank's assets reprice or mature compared to the average maturity of its liabilities. Banks with a larger gap are engaged in greater maturity transformation and thus will benefit more when the yield curve steepens.

These results are intended to disentangle signaling theories of payouts from the influence of the payout restrictions. The finding that higher dividends are associated with higher cumulative abnormal returns could be due to the fact that dividends simply signal more profitable opportunities. If, after controlling for these opportunities, I continue to find dividends boosted returns, the evidence will suggest that the market rewarded banks with higher dividends, and thus were less affected by supervisory constraints.

The results are shown in Table 5. Column (1) add controls for the share of assets devoted to lending and the non-interest income share. Both of these controls are insignificant and the earlier results still hold. Larger banks and those with relatively higher dividends as a share of equity capital both had higher cumulative abnormal returns.

Table 5: Daily CARs and Business Model Controls

	(1)	(2)	(3)	(4)
Dividend Rate	3.71*	2.42	2.79	1.84
	(1.96)	(1.90)	(1.99)	(1.98)
Repurchase Rate	-0.79	-0.20	-0.70	-0.21
	(0.82)	(0.83)	(0.81)	(0.79)
ln *Assets*	-32.14***	-33.12***	-31.91***	-32.79***
	(3.44)	(3.32)	(3.29)	(3.18)
Tier 1 Ratio	1.83	2.41	1.61	2.15
	(1.85)	(1.75)	(1.68)	(1.64)
Non-Interest Income Share	-0.37	-0.23	-0.21	-0.11
	(0.26)	(0.26)	(0.27)	(0.28)
Loans to Assets	-0.12	-0.05	0.10	0.12
	(0.29)	(0.28)	(0.30)	(0.30)
HHI		-31.88***		-27.43**
		(11.12)		(11.09)
GAP			4.21**	3.52*
			(1.95)	(1.84)
Constant	557.88***	569.27***	519.25***	535.38***
	(72.86)	(69.00)	(67.77)	(65.17)
Observations	172	172	172	172
Adjusted R^2	0.65	0.66	0.66	0.67

Notes: Dependent variable is the standardized cumulative abnormal return from a two day window that includes the trading day following the CCAR announcement and the next day. Balance sheet measures are 2019 averages. Income variables are 2019 cumulative sums. HHI is the Herfindahl-Hirschman index of a bank's internal deposit market at the county level as measured by the Summary of Deposits data. GAP is the maturity and repricing gap of English et al. [2018]. Dividend and repurchase rates are annual dividends paid and dollar amount of common shares repurchased in 2019 relative to average total equity capital, respectively.
Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Column (2) adds the control for geographic dispersion of a bank's operating market. Banks with higher internal HHIs are more concentrated in a set of counties and thus have fewer diverse lending opportunities. I find that banks with less geographic dispersion have much lower cumulative abnormal returns during the two day window.

Moreover, the coefficient on dividends becomes insignificant.

Column (3) adds the interest rate gap measure. The results show that banks engaged in more maturity transformation had higher abnormal returns. Thus, banks that were likely to benefit from a steeper yield curve or that were less sensitive to further reductions in interest rates, because their assets reprice less frequently, were rewarded by the market. I again find that including this measure makes the coefficient on dividends insignificant.

Column (4) adds both these measures to the model. Both are significant and signed correctly while dividends continue to be insignificant. Thus, we can conclude that higher dividends likely signal greater earning opportunities consistent with theories by Bhattacharya [1979] and do not signal an ability to circumvent supervisory rules. Interestingly though, the log of bank assets remains significant and economically large in all models. This could still signal a market price penalty for greater supervisory oversight for affected banks and the threat of more oversight for unaffected banks.

5.5 Expected Earnings Effects

Next, I investigate an alternative to the interpretation that the bank size penalty reflects greater oversight. As shown in Table 1, larger banks had higher expected earnings prior to the pandemic. The stress test results, especially the result that certain pandemic recovery scenarios would generate large loan losses, could have signaled to investors that earnings were likely to fall significantly for these banks.

To unravel these two competing theories, I add the median analyst earnings forecast one year ahead from IBES. I consider forecasts as of both 2020:Q1, prior to the stress test release, and those from 2020:Q2. The results are reported in Table 6. Columns (1) - (3) show the regression with forecasted earnings from 2020:Q1, at the onset of the pandemic but likely before severe financial market stress occurred, while columns (4)-(6) show earnings forecasts from 2020:Q2 after the severe financial market stress.

Across all specifications, higher expected earnings had lower abnormal returns but

Table 6: Earnings Expectations and Daily CARs

	(1)	(2)	(3)	(4)	(5)	(6)
2020Q1 Earnings Forecast	-1.53	-1.15	-0.27			
	(1.68)	(1.74)	(1.59)			
2020Q2 Earnings Forecast				-0.28	-0.21	0.38
				(2.44)	(2.31)	(1.92)
ln *Assets*	-32.91***	-32.46***	-32.63***	-34.37***	-33.43***	-32.77***
	(2.90)	(3.17)	(3.53)	(2.46)	(2.89)	(3.17)
Dividend Rate		3.64**	1.81		3.85**	1.84
		(1.82)	(1.96)		(1.89)	(1.99)
Repurchase Rate		-0.92	-0.19		-1.02	-0.21
		(0.80)	(0.80)		(0.80)	(0.79)
Tier 1 Ratio			2.14			2.17
			(1.64)			(1.63)
Non-Interest Income Share			-0.11			-0.12
			(0.28)			(0.28)
Loans to Assets			0.11			0.14
			(0.28)			(0.29)
HHI			-27.19**			-27.38**
			(10.99)			(11.22)
GAP			3.45*			3.56*
			(1.87)			(1.87)
Constant	591.33***	573.63***	534.71***	610.60***	585.70***	532.66***
	(44.02)	(47.96)	(67.13)	(39.54)	(44.94)	(62.47)
Observations	172	172	172	172	172	172
Adjusted R^2	0.65	0.65	0.67	0.64	0.65	0.67

Notes: Dependent variable is the standardized cumulative abnormal return from a two day window that includes the trading day following the CCAR announcement and the next day. Earnings expectations are median one year ahead earnings-per-share expectations from IBES. Balance sheet measures are 2019 averages. Income variables are 2019 cumulative sums. HHI is the Herfindahl-Hirschman index of a bank's internal deposit market at the county level as measured by the Summary of Deposits data. GAP is the maturity and repricing gap of English et al. [2018]. Dividend and repurchase rates are annual dividends paid and dollar amount of common shares repurchased in 2019 relative to average total equity capital, respectively.
Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

these effects were not significant. Therefore, there was some earnings content taken on board from the stress test results but the effect is statistically indistinguishable from zero. I find these results hold across parsimonious models that only control for bank size and more detailed models that include payout effects and bank business model differences.

Interestingly, in columns (2) and (4), controlling for expected earnings results in a more signficant coefficient for dividends. However, as found before, controlling for a bank's business model mix and geographic dispersion, makes this effect insignificant, even after adding the control for expected earnings.

Finally, the results continue to show a large and negative effect of bank size on cumulative abnormal returns. This continues to suggest a size penalty for affected banks and those near heightened supervisory stringency. I investigate on additional explanation of this effect in the next regression.

5.6 Default Distance Effects

Finally, one driver of the negative and significant effect on the size coefficient could be a repricing of any implicit guarantees that larger, stress tested banks may enjoy. Due to their size and systemic importance, stress tested banks may enjoy benefits to equity and liabilities pricing due to the perception that these banks are "too big to fail" [Financial Crisis Inquiry Commission, 2010]. If this is the case, then regulatory or supervisory actions that compel banks to raise additional capital may, conversely, suggest that regulators will be unwilling to bail out large banks should their survival be threatened.

In Table 7, I control for the Merton distance to default. This measure provides the number of standard deviations above failure implied by market equity returns. The Merton distance is estimated using a two-step procedure as described by Bharath and Shumway [2008]. I use the Merton distance implied by stock prices as of the end of the month in May 2020 for all banks in the sample. If the supervisory actions weighed on investor perceptions of too big to fail, then banks with higher default distances prior to the restriction announcement should have seen smaller excess returns, all else equal. Without properly controlling for these default probabilities however, changes in perceived benefits would show up in the size coefficient.

After controlling for default distance, the main results continue to hold. Larger banks had smaller excess returns. This result holds in models controlling only for default and in models that also include business model differences, diversity of potential earnings, and expected profitability. The economic effects are also consistent with previous findings. Cumulative abnormal returns declined about 35 basis points for each 1 percent increase in asset size.

The previous regressions have ruled out the size variable proxying for business model differences, geographic dispersion of deposit taking, expected earnings, and default subsidies. Therefore, I conclude that the negative size coefficeint simply reflects the impact of greater supervisory oversight. Investors may have feared that increased oversight would require banks to build up greater capital levels, reducing returns on equity while perhaps engaging in less risk-taking.

5.7 Differences Between Affected and Unaffected Banks

In a final exercise on the immediate effects of the stress test results, I split the sample by stress tested and non-stress tested banks. Despite controls for business models, geographic dispersion, expected default, and projected earnings, there could still be significant differences across CCAR and non-CCAR firms. In addition, splitting the sample allows for investigation of differential effects of supervisory threats. CCAR firms are not under threat of additional supervision but have already had additional supervision imposed. However, large non-CCAR firms may be under additional supervisory threats that have not yet manifested while banks farther from the CCAR size threshold should be less affected. If this is indeed the case we would expect to find a larger bank size penalty in the non-CCAR group.

Table 8 reports the results of various model specifications for CCAR banks only. Column (1) looks only at bank size along with payout measures. None of these measure are significant in explaining abnormal returns over the two-day announcement window. Column (2) controls for relative loan volume and non-interest earnings capacity. Column (3) adds the profitability mix measures. Column (4) adds expected earnings, and column (5) adds default distance.

Across all these specifications, I find no statistically significant effects. This implies that CCAR bank stocks were more or less uniformly punished for increased supervisory stringency. Indeed, Figure 5 shows that all CCAR abnormal returns were negative and the effects are fairly tightly clustered together.

Table 9 reports the same specifications for non-CCAR firms. Across each of these specifications, I find the same size penalty that has been consistently found in earlier tests. Namely, abnormal returns declined around 35 basis points per percent increase in bank size. This result holds controlling for expected earnings, business differences, and default risk.

Looking across the two subsamples also reveals that the average effect of the two groups was different. In Table 8, the constant term is negative, but insignificant, indicating that on average, the abnormal returns were negative for CCAR banks. For non-CCAR banks, the constant is positive and very large indicating that, on average, non-CCAR bank stocks were boosted by the stress test announcement. However, this boost declined with increasing bank size. In other words, as the bank got closer to the CCAR threshold, and thus was under greater threat of increased supervisory stringency, the stock price benefit declined. This provides further support to the graphical evidence presented in Figure 5.

6 Conclusion

I review investor reactions to the 2020 stress test program results which included an additional "sensitivity analysis" related to the COVID economic recovery and restrictions on bank payouts. I find evidence that investors responded negatively overall to the stress test results. Specifically, I find evidence that banks with high expected earnings just prior to the pandemic experienced smaller excess returns following the announcement of the stress test results. I also find that banks that paid more dividends per share, and were thus more insulated from the payout restrictions had larger excess returns. However, much of the decrease in excess returns among banks is explained by bank size. I show that this effect persists even after controlling for expected earnings and default probabilities, suggesting that investors responded negatively to increased supervisory pressure. Moreover, a size penalty exists even after controlling for directly affected banks, suggesting that this increase in supervisory pressure spilled over to unaffected banks.

The results have important implications for capital and contingency planning for supervisors and regulators. Changes made to supervisory and regulatory rules after the Global Financial Crisis incentivized banks to prefer repurchase programs over higher dividends because they could be cut easily during crisis but not incur sharp stock price penalties. The results confirm that the observed declines in excess returns are lower than those previously estimated in the literature for dividend cuts.

Moreover, the results highlight the challenges that supervisors face when trying to remove judgmental assessments from capital planning. The fact that investors penalized bank stock prices when more capital was demanded by supervisors shows that market-based incentives may not lead to optimal capital outcomes, even when economic uncertainty is very high. Similarly, the baseline stress tests, which recently removed many judgmental assessment components, would not have required banks to increase capital by significant amounts. Instead, supervisory flexibility was needed to increase capital at a time when profits were high but expectations of loan losses were still elevated.

Table 7: Market Implied Default Probabilities and Daily CARs

	(1)	(2)	(3)
Default Distance	-1.21	-3.95	-6.70
	(4.34)	(4.51)	(4.43)
ln *Assets*	-34.48***	-33.45***	-33.15***
	(2.43)	(2.81)	(3.53)
Dividend Rate		4.26**	2.38
		(1.85)	(1.92)
Repurchase Rate		-1.15	-0.36
		(0.81)	(0.83)
2020Q1 Earnings Forecast			-0.01
			(1.58)
Tier 1 Ratio			2.32
			(1.58)
Non-Interest Income Share			-0.08
			(0.28)
Loans to Assets			0.08
			(0.29)
HHI			-30.39***
			(11.17)
GAP			3.64**
			(1.84)
Constant	613.72***	590.73***	550.41***
	(40.83)	(45.12)	(67.41)
Observations	172	172	172
Adjusted R^2	0.64	0.65	0.67

Notes: Dependent variable is the standardized cumulative abnormal return from a two day window that includes the trading day following the CCAR announcement and the next day. DD is the Merton model default distance from 2019. Earnings expectations are median one year ahead earnings-per-share expectations from IBES. Balance sheet measures are 2019 averages. Income variables are 2019 cumulative sums. HHI is the Herfindahl-Hirschman index of a bank's internal deposit market at the county level as measured by the Summary of Deposits data. GAP is the maturity and repricing gap of English et al. [2018]. Dividend and repurchase rates are annual dividends paid and dollar amount of common shares repurchased in 2019 relative to average total equity capital, respectively.

Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: Cross Sectional Analysis of Daily CARs at CCAR Firms

	(1)	(2)	(3)	(4)	(5)
ln *Assets*	-5.85	-3.76	-7.56	-11.35	-10.37
	(7.91)	(11.68)	(22.30)	(30.26)	(31.68)
Dividend Rate	-0.16	-0.95	1.12	3.03	0.93
	(12.93)	(14.57)	(17.62)	(17.44)	(19.55)
Repurchase Rate	4.07	4.27	4.91	5.34	5.42
	(3.62)	(4.63)	(6.70)	(7.57)	(7.97)
Tier 1 Ratio		-1.35	1.36	2.04	4.76
		(10.85)	(12.44)	(17.90)	(23.17)
Non-Interest Income Share		-0.15	-0.13	-0.20	0.23
		(1.09)	(1.28)	(1.68)	(1.91)
Loans to Assets		0.06	0.23	0.20	0.64
		(1.02)	(1.23)	(1.61)	(2.12)
HHI			17.63	15.37	-7.40
			(47.72)	(56.14)	(94.60)
GAP			7.82	10.67	9.27
			(9.34)	(13.33)	(15.41)
Default Distance					-16.43
					(53.62)
2020Q1 Earnings Forecast				1.70	1.78
				(6.23)	(6.42)
Constant	6.70	-12.16	-38.27	-2.59	-55.79
	(159.74)	(299.00)	(397.56)	(485.83)	(575.56)
Observations	22	22	22	22	22
Adjusted R^2	0.02	-0.14	-0.14	-0.19	-0.26

Notes: Dependent variable is the standardized cumulative abnormal return from a two day window that includes the trading day following the CCAR announcement and the next day. DD is the Merton model default distance from 2019. Earnings expectations are median one year ahead earnings-per-share expectations from IBES. Balance sheet measures are 2019 averages. Income variables are 2019 cumulative sums. HHI is the Herfindahl-Hirschman index of a bank's internal deposit market at the county level as measured by the Summary of Deposits data. GAP is the maturity and repricing gap of English et al. [2018]. Dividend and repurchase rates are annual dividends paid and dollar amount of common shares repurchased in 2019 relative to average total equity capital, respectively.

Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9: Cross Sectional Analysis of Daily CARs at Non-CCAR Firms

	(1)	(2)	(3)	(4)	(5)
ln *Assets*	-34.11***	-32.91***	-32.56***	-32.02***	-32.56***
	(3.86)	(4.78)	(4.21)	(4.38)	(4.46)
Dividend Rate	4.44**	4.32**	2.00	1.92	2.48
	(1.89)	(1.96)	(1.96)	(1.94)	(1.94)
Repurchase Rate	-1.56	-1.51	-1.16	-1.08	-1.27
	(0.94)	(0.92)	(0.77)	(0.76)	(0.79)
Tier 1 Ratio		1.23	1.99	1.91	1.97
		(2.09)	(1.80)	(1.80)	(1.73)
Non-Interest Income Share		-0.25	-0.04	-0.01	0.01
		(0.29)	(0.28)	(0.29)	(0.29)
Loans to Assets		0.04	0.40	0.35	0.27
		(0.35)	(0.32)	(0.33)	(0.33)
HHI			-39.36***	-38.47***	-40.58***
			(12.08)	(12.15)	(12.43)
GAP			3.33*	3.27*	3.51*
			(1.91)	(1.91)	(1.90)
Default Distance					-6.65
					(4.74)
2020Q1 Earnings Forecast				-1.05	-0.81
				(1.53)	(1.68)
Constant	596.64***	565.05***	519.28***	517.44***	537.76***
	(59.55)	(96.41)	(85.12)	(85.51)	(86.83)
Observations	150	150	150	150	150
Adjusted R^2	0.44	0.43	0.48	0.48	0.48

Notes: Dependent variable is the standardized cumulative abnormal return from a two day window that includes the trading day following the CCAR announcement and the next day. DD is the Merton model default distance from 2019. Earnings expectations are median one year ahead earnings-per-share expectations from IBES. Balance sheet measures are 2019 averages. Income variables are 2019 cumulative sums. HHI is the Herfindahl-Hirschman index of a bank's internal deposit market at the county level as measured by the Summary of Deposits data. GAP is the maturity and repricing gap of English et al. [2018]. Dividend and repurchase rates are annual dividends paid and dollar amount of common shares repurchased in 2019 relative to average total equity capital, respectively.
Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

A CCAR Firm Ids

Table A1: List of CCAR Firms and Dataset Identifers

	Name	ID RSSD	Permco	Permno	GVKEY
GSIBs					
	BANK OF AMER CORP	1073757	3151	59408	007647
	BANK OF NY MELLON CORP	3587146	20265	49656	002019
	CITIGROUP	1951350	20483	70519	003243
	THE GOLDMAN SACHS GROUP	2380443	35048	86868	114628
	JPMORGAN CHASE & CO	1039502	20436	47896	002968
	MORGAN STANLEY	2162966	21224	69032	012124
	STATE STREET CORP	1111435	4260	72726	010035
	WELLS FARGO & CO	1120754	21305	38703	008007
FBOs					
	BANCO SANTANDER S A	3981856	20260	75152	014140
	BANK MONTREAL QUE	1245415	29146	81284	015580
	BARCLAYS PLC	5006575	20269	69761	012673
	CREDIT SUISSE GROUP	1574834	42125	89154	028838
	DEUTSCHE BANK A G	2816906	42291	89199	015576
	H S B C HOLDINGS PLC	3232316	35175	87033	015509
	MITSUBISHI UFJ FINANCIAL GP INC	1378434	22107	75811	252940
	ROYAL BANK CANADA MONTREAL QUE	5280254	29151	82654	015633
	TORONTO DOMINION BANK ONT	3606542	29152	83835	015706
	U B S GROUP A G	4846998	55100	15054	144496
All Other					
	M&T BK CORP	1037003	1689	35554	004699
	KEYCORP	1068025	2535	64995	009783
	HUNTINGTON BSHRS	1068191	2093	42906	005786
	PNC FNCL SVC GROUP	1069778	3685	60442	008245
	FIFTH THIRD BC	1070345	1741	34746	004640
	TRUIST FC	1074156	4163	71563	011856
	U S BC	1119794	1645	66157	004723
	CITIZENS FNCL GRP	1132449	55006	14889	021825
	NORTHERN TR CORP	1199611	3275	58246	007982
	AMERICAN EXPRESS CO	1275216	90	59176	001447
	ALLY FNCL	1562859	53687	14558	005072
	CAPITAL ONE FC	2277860	30513	81055	030990
	REGIONS FC	3242838	1620	35044	004674
	DISCOVER FS	3846375	52396	92121	177376

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