Federal Reserve Bank of New York
Staff Reports

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Staff Report No. 768
March 2016
Revised May 2019

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JEL classification: G21, G28

Abstract

We explore the impact of supervision on the riskiness, profitability, and growth of U.S. banks. Using data on supervisors' time use, we demonstrate that the top-ranked banks by size within a supervisory district receive more attention from supervisors, even after controlling for size, complexity, risk, and other characteristics. Using a matched sample approach, we find that these top-ranked banks that receive more supervisory attention hold less risky loan portfolios, are less volatile, and are less sensitive to industry downturns, but do not have slower growth or profitability. Our results underscore the distinct role of supervision in mitigating banking sector risk.

Key words: bank supervision, bank regulation, bank performance

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To view the authors' disclosure statements, visit
https://www.newyorkfed.org/research/ author_disclosure/ad_sr768.

Supervision and regulation are critical tools for the promotion of stability and soundness in the financial sector. Despite supervision's key role, it is rarely examined separately from regulation and relatively little is known about the distinct impact of supervisory efforts. This paper exploits new supervisory data and develops a novel identification strategy to estimate the impact of greater supervision on bank risk-taking and performance. We find that more supervision adds value over and above the effects of regulation. Banks that receive more supervisory attention have less risky loan portfolios, are less volatile and less sensitive to industry downturns, but do not have lower growth or profitability.

While prior work has examined specific supervisory actions such as examinations or enforcement actions, little is known about the effectiveness of supervisors' more general efforts to promote sound risk management. For example, supervisors meet frequently with bank management, discussing both specific issues regarding activities at the firm and more general perspectives on the industry environment and outlook. These conversations, along with analysis of internal firm reports and external data, allow supervisors to understand bank risks and procedures and to put these in context relative to the industry. By focusing on a broad concept of supervisory attention, our analysis captures the breadth of supervisory efforts without restriction to a single supervisory program.

Reflecting the potential externalities of bank failures, supervisors seek to reduce failure risk relative to what banks themselves might otherwise choose. Our analysis is designed to evaluate whether supervisors achieve their objectives and at what cost to financial intermediation. Actual bank failures are infrequent, especially among the largest firms that receive the most supervisory attention, therefore we rely on a range of risk metrics covering lending activities (e.g., loan losses and reserving practices) as well as firm-wide metrics such as overall earnings volatility and market measures of riskiness.

The key empirical hurdle to identifying the impact of supervision is that larger and riskier firms receive more supervisory attention. We surmount this by exploiting the structure of supervisory responsibilities within the Federal Reserve System, under which bank holding

companies (BHCs or "banks") are geographically assigned to one of twelve Federal Reserve Districts. We hypothesize that within each district, the largest institutions receive more supervisory attention, ceteris paribus, than institutions that are not among the largest. Although supervisory hours do not capture all aspects of supervisory intensity, we validate this hypothesis with proprietary Federal Reserve data, showing that examiners spend more time at the largest firms in a district, even when controlling for firm characteristics like size, market share, complexity, and supervisory rating.

We match top-ranked bank holding companies in Federal Reserve districts by size, deposit market share, organizational complexity, types of banking subsidiaries, diversity of lending activities and other characteristics to similar banks in other districts that are not among the largest. Doing so allows us to construct a sample of banks that are observably similar but with varying ranks in their Federal Reserve districts. Our focus is on controlling for differences across banks that might be correlated with rank and performance, but to avoid matching on outcome variables that might be directly influenced by supervision. We thus compare outcomes for banks that are among the largest in a district to otherwise similar banks that are not among the largest in other districts, and interpret differences in outcomes as reflecting the impact of greater supervisory attention.

Our findings suggest that enhanced supervisory attention is associated with lower risk. Banks among the largest in a district have accounting earnings and market returns that are less volatile than otherwise similar BHCs. Top-ranked banks on average have non-performing loan ratios that are roughly 15-25% lower than peers that are not among the top in their district. These firms also appear to engage in more conservative loan loss reserving practices. The reduction in risk is greater during downturns, precisely when the externalities of failure are costlier. With respect to volatility, our findings suggest that a 20% increase in supervisory hours is associated with a 9-10% decrease in risk as measured by the volatility of earnings, a reduction in distance to default equivalent to 150-200 bps of additional capital.

Importantly, while top-ranked BHCs appear less risky, they do not have lower profitability

nor do they exhibit significantly slower loan or asset growth. There are no meaningful differences in market or accounting measures of profitability, including return on assets and excess stock price returns, between the top-ranked BHCs and their matches. Further, the market Sharpe ratio of top-ranked BHCs is similar to that of BHCs not among the top size-ranked firms. These findings are consistent with the notion that additional supervisory attention is associated with lower risk exposure but has a positive-to-neutral impact on the risk-adjusted performance of BHCs. Our results suggest that there are meaningful social welfare benefits to supervision in the form of decreased risk of failure of large banks without significant reduction in their intermediation activities.

Our identifying assumption is that being among the largest firms in a Federal Reserve District is not associated with other unobserved factors that also impact bank performance. We take a number of steps to account for other possibilities. For example, one critical difference might be related to differences in risk across districts. To better account for district-level differences, we consider an empirical specification that uses a larger matched sample and controls for district-quarter fixed effects to account for unobserved differences across districts and over time. Another difference could be in competitiveness and franchise value. We consider additional matching criteria, including recent firm performance and proxies for franchise value such as market-to-book. Our conclusions are robust to these various alternative specifications.

Our results suggest that increased supervisory attention results in lower risk without significantly reduced performance. Nevertheless, our empirical approach does not shed light on the specific actions by which supervision achieves these outcomes. One plausible mechanism is that supervision helps to resolve principal-agent problems within the firm. In particular, enhanced supervision may result in more weight being given inside the firm to concerns of risk managers, resulting in more disciplined risk-taking. In this way, supervisors may also improve a bank's risk culture, by fostering increased attention to risk as a balance to a focus on short-term profitability. Supervisory requests for risk and activity information may cause

banks to invest in data and technology systems that then enable them to manage their business more efficiently over the long run. Finally, because supervisors oversee many banks, they may transmit knowledge of best practices in the industry when they set expectations and provide feedback to banks about their risk management practices.

Much of the previous work on the supervision and regulation of banks focuses on the impact of regulation, though the distinction between supervision and regulation is not always clearly recognized or articulated.[1] Fewer papers focus specifically on supervision distinctly defined. Some of these papers examine the information content of supervisory ratings (Cargill, 1989; Cole and Gunther, 1995; Hirtle and Lopez, 1999; Berger, Davies, and Flannery, 2000) and examinations (Berger and Davies, 1998) but not specifically the impact of supervision on bank outcomes. Several papers have examined whether supervisory standards how tough examiners are in assessing risk at banks affect loan origination and loan growth (Peek and Rosengren, 1995; Swindle, 1995; Krainer and Lopez, 2009; Kiser, Prager, and Scott, 2012; Bassett, Lee, and Spiller, 2012; Bassett and Marsh, 2014) with most finding that tougher supervisory standards are associated with slower loan growth and/or higher origination standards. Others have examined the use of enforcement actions on bank sector risk (e.g. Delis and Staikouras, 2011). Relative to the extant literature, our use of supervisory attention allows us to estimate supervision's impact in a way that considers the breadth of supervisory interactions with firms.

A second contribution of our paper is that we develop a new identification strategy based on the structure of supervision at the Federal Reserve. Plausibly exogenous variation in supervisory attention allows us to go beyond correlations to discern the impact of supervision. The paper is similar in this spirit to recent work that examines state versus federal banking supervisors including Agarwal, Lucca, Seru, and Trebbi (2014), which finds persistent dif-

[1]For instance, there is a substantial body of work examining the impact of regulatory capital requirements (for a recent example, see Bridges, Gregory, Nielsen, Pezzini, Radia, and Spaltro, 2014) and of legislative changes that enabled previously prohibited cross-state bank mergers or mergers involving commercial banks and non-banking financial companies (see, for instance, Morgan, Bertrand, and Strahan, 2004; Jayaratne and Strahan, 1996).

ferences between state and federal banking supervisors in the rating of commercial banks, and Rezende (2011), which finds that banks switching between national and state banking charters typically receive an upgraded rating from their new supervisor. Most closely related, Rezende and Wu (2014) employ a regression discontinuity approach to look at a sample of U.S. banks and find that more frequent mandated examinations are associated with increased profitability and lower loan losses. Recent work investigating the impact of supervisory office closures (Gopalan, Kalda, and Manela, 2017; Hagendorff, Lim, and Armitage, 2017) suggests that a removal of nearby supervisors results in greater risk and lower profitability; to the extent closures are a proxy for a reduction in supervisory attentiveness, these studies corroborate our findings. In comparison to these papers, we focus on supervisory attention more broadly rather than a specific activity like examinations; we demonstrate variation in attention using novel data on the time supervisors spend at institutions; and, we are able to consider the impact on relatively large firms.

While we consider several alternative explanations for our results, it is difficult to capture constructs such as franchise value and market competition. To the extent our matching criteria fails to capture these factors, we cannot rule out the possibility that these forces could explain some of the reduction in risk that we attribute to supervisory attention. In addition, we cannot rule out other sources of unobserved heterogeneity empirically. For example, we do not observe the quality of supervision. While unlikely, if supervisory hours are more productive in districts with smaller banks, then supervisory quality could explain some of our findings.

The paper is organized as follows. Section I describes the role of prudential supervision within the Federal Reserve and develops hypotheses related to supervisory attention and bank outcomes. Section II outlines our identification strategy, describes the supervisory hours data and presents analysis of differences in supervisory hours for the largest firms in a district. Section III outlines our empirical methodology for assessing the impact of supervision, including identifying a matched sample of BHCs. Section IV summarizes our

core empirical results and Section V considers alternative empirical specifications. Section VI concludes.

I. Prudential supervision

The overarching objective of supervision is to identify and remediate conditions that could threaten banks' immediate health or long-term viability. Toward that end, prudential supervision encompasses a range of supervisory activities that support both traditional efforts to ensure compliance with law and regulation as well as more modern, "prudential" work to monitor for unsafe or unsound business practices. Federal Reserve supervisory expectations for certain activities, risk management or control procedures are often articulated in Supervision and Regulation Letters (SR Letters) published by the Board of Governors (Board of Governors of the Federal Reserve System, 2017c).

For many years, supervisors made their assessments based on a point-in-time analysis of a bank, typically once per year, in the form of an annual examination. This process was inherently backwards-looking because it focused on reviewing the quality of a bank's loans and other assets as of the exam date (Federal Deposit Insurance Corporation, 1997). Beginning in the early 1990s, however, there was a transition toward a more holistic, forward-looking approach to supervision, as supervisors sought to make institutions more robust in the face of rapid financial innovation (Mishkin, 2001). For example, in 1995 the Federal Reserve and the Office of the Comptroller of the Currency (OCC) formally announced that they would be assessing banks' risk management practices. Today a large share of the interactions between bankers and supervisors, particularly for large banks, centers on risk management, risk modeling and governance (Goldsmith-Pinkham, Hirtle, and Lucca, 2016).

Such forward-looking assessments of risk management and internal controls involve both quantitative analysis and qualitative evaluations, often incorporating significant judgment. These qualitative assessments are grounded in knowledge of industry standards and evolve

over time to adapt to financial innovation. Hence, modern supervisory activities rely on both soft and hard information and are inherently difficult to quantify, both in terms of the work that supervisors actually do and in terms of outcomes that focus on internal processes such as risk management, controls and governance. Our empirical strategy is designed to capture not only the impact of traditional, exam-based interactions but also the influence of these more difficult to quantify interactions that are central to modern supervisory efforts.

If a supervisory assessment identifies shortcomings, supervisors possess a range of responses to require the firm to rectify the problems, from formal enforcement actions and ratings downgrades, which can constrain bank activities, to more subtle warnings that work via moral suasion. Supervisors assign confidential supervisory ratings ("1" indicates the lowest level of supervisory concern, "5" indicates the highest) and issue supervisory actions that direct the bank and its management and board to remediate unsafe or unsound practices or conditions. Supervisory actions include matters requiring attention (MRAs), matters requiring immediate attention (MRIAs), other informal enforcement actions such as memoranda of understanding (MOUs), as well as written agreements, cease and desist orders, and fines. MRAs and MRIAs are the most common supervisory actions. In general, informal actions, such as MRAs and MRIAs are not publicly disclosed, while formal enforcement actions are disclosed by the Federal Reserve Board.

Supervisory actions describe the specific supervisory concern in detail and generally require a time table for remediation. Banks subject to an action typically develop a remediation plan, which is subject to approval by supervisors, who then track progress against the plan. Failure to address the concerns raised by supervisors in a timely way can result in escalation of the enforcement action from a confidential MRA or MRIA to a public enforcement action, for instance or in restrictions on asset growth, dividends and share repurchases, or mergers and acquisitions, as well as in fines ("civil money penalties"). Thus, supervisory actions can have real consequences on the growth and business activities of a bank that fails to comply

with its supervisor's directives.[2]

A. Hypotheses

Given externalities from bank failures, supervisors will prefer lower risk of failure or distress than bank managers, who do not internalize the costs of disruption of intermediation services, including reduced credit supply and fire-sale-related asset price declines. If supervisors are successful, banks that are subject to more intense supervision should take less risk and use more conservative risk management practices. Greater supervisory focus on risk management and governance could increase the influence of risk managers at the bank, whose perspectives may be more aligned with supervisors than business area heads, helping to solve an agency problem within the firm. Similarly, increased supervisory attention could foster a stronger risk culture at banks by encouraging greater focus on risk exposure as a counterbalance to incentives to generate short-run profits. Chaly, Hennessey, Menand, Stiroh, and Tracy (2017) argue that supervisors' impact on banks' "cultural capital" is an important channel for enhancing resiliency to foster stable provision of financial services. Hence, one hypothesis is that greater supervisory efforts, all else equal, result in less risky institutions.

Of course, there are many reasons that intense supervision might not result in safer banks. Supervisors could fail to achieve their objectives due to resource constraints that could make it difficult to work effectively at large and complex institutions, even with increased attention to those firms. Also, a bank may have influence over its supervisors, resulting in greater forbearance and, thus, more risk.

A second hypothesis is that increased supervisory attention results in less profitable, slower growing banks. Compliance costs can lower profitability, and cross-country analysis suggests supervision can reduce bank efficiency (e.g. Barth, Lin, Ma, Seade, and Song,

[2]Eisenbach, Haughwout, Hirtle, Kovner, Lucca, and Plosser (2017) contains a detailed description of the range of supervisory enforcement actions, the expectations on banks that are subject to such actions, and the consequences of failing to comply.

2013). Supervisory concerns about risk management could result in banks' having to make investments in technology and data with large up-front costs, depressing near-term profits. In addition, the empirical literature suggests that tougher supervisory standards are associated with slower loan growth (e.g. Peek and Rosengren, 1995).

Alternatively, however, performance at more intensely supervised banks could be better than at banks less closely supervised, especially on a risk-adjusted basis. For instance, investments in superior technology and information systems might enable business managers to make better risk-return decisions or identify operational inefficiencies. Tarullo (2016) argues that supervisory expectations from the Federal Reserve's Comprehensive Capital Analysis and Review (CCAR) program have resulted in large banks making significant improvements to their information and risk management systems. Indeed, a senior risk manager argued that consolidated risk management systems can allow banks to make better business decisions by incorporating risk and return considerations in pricing, product development and relationship management (Lam, 1999). Finally, since supervisors interact with a range of firms, they might transmit best practices in risk management and controls via feedback to firms about where they stand relative to supervisory expectations, fostering the spread of best practice across the industry.

II. Identification Strategy

Our empirical analysis seeks to examine these two questions. First, is there evidence that more intensive supervision is associated with lower risk? Second, do banks subject to more intensive supervision grow more slowly, intermediate less credit or experience lower profitability, either in absolute or risk-adjusted terms?

The primary empirical challenge in identifying the impact of supervision is that supervisory attention is endogenously related to current and expected bank performance: supervisors focus on poorly performing, risky BHCs. Supervisors also expend more resources on

large, complex institutions that pose a greater threat to financial stability.

In order to identify plausibly exogenous variation in supervisory attention, we exploit the geographic assignment of BHCs to Federal Reserve districts. Within the Federal Reserve, the Board of Governors has authority and responsibility for supervision of financial institutions, and the supervisory activities of the Reserve Banks are conducted under delegated authority from the Board. Under this delegated authority, day-to-day oversight of the firms is conducted by the twelve regional Reserve Banks, which employ dedicated supervisory teams responsible for the firms located in their respective districts. The location of the twelve banks and the boundaries of the districts were determined pursuant to the Federal Reserve Act of 1913 and reflect the various regions' importance as banking centers in 1913 (Ghizoni, 2013).

Since that time, the district boundaries have remained the same despite significant changes in the distribution of banks and the rise and fall of US banking centers. Consequently, both the number and size of BHCs vary considerably across districts. Table I shows the size of the largest BHCs in each of the 12 districts as of December 2014, along with information about the median asset size of BHCs with assets above $500 million.[3] The table contains consolidated information on the highest level BHC in each firm's corporate structure. The number of BHCs over $500 million ranges from a low of 57 in the Fourth District (Cleveland) to a high of 157 in the Seventh (Chicago). The size of the largest BHCs in a district also varies considerably, with the largest overall BHC in the Second District (New York) at $2.6 trillion and the largest BHC in the Eighth District (St Louis) at $26 billion.

[Place Table I about here]

Each of the twelve Federal Reserve Banks supervises the bank holding companies headquartered in its geographic district, hosting dedicated supervisory teams responsible for these

[3]We report information on BHCs with assets greater than $500 million because these are the institutions that are required to submit FR Y-9C financial reports with the Federal Reserve. These reports, which contain balance sheet and income statement information, are a critical data source for our empirical analysis.

firms. The Reserve Banks have their own managerial hierarchy which makes hiring, performance assessment and staff allocation decisions, subject to general oversight of its budget and activities by the Board of Governors (Board of Governors of the Federal Reserve System, 2017a). These staffing decisions include the number of supervisory staff and their educational and professional backgrounds, as well as the way that supervisory staff are organized to carry out their oversight objectives.

Some supervisory activities for BHCs are coordinated at the Federal Reserve System level via committees composed of senior supervisors from the Reserve Banks and staff at the Board of Governors. Starting in 2012, supervision of the very largest and most complex bank holding companies has been coordinated across Reserve Banks and the Board of Governors through the Large Institution Supervision Coordinating Committee (LISCC) program (Board of Governors of the Federal Reserve System, 2017b). As described more fully below, these firms drop out of our sample through the matching process. The nature of our analysis is cross-district and typically excludes the largest BHCs; therefore, the impact of system-wide programs is minimal to this study.

Given the district-level management of supervision, we posit that the largest BHCs in a given district, all else equal, receive more supervisory attention. There are several reasons why this might occur. Attention constraints on senior managers can require that they prioritize a discrete set of the most important BHCs in their district (i.e. Miller's Law[4]). This hypothesis is motivated by research on the concept of span of control and the allocation of managerial attention, such as Bolton and Dewatripont (1994), Garicano (2000), Geanakoplos and Milgrom (1991), and Radner (1993). In this context, district leaders are subject to cognitive costs, thus they focus attention on a discrete set of the largest firms (i.e. their span of control) within their geographic area of responsibility.

Another possible rationale for this behavior is that supervisory teams in each district are

[4]Miller's Law refers to the findings in a 1956 psychology paper "The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing Information." Miller (1956) describes various experiments on retaining sounds, colors, points, tastes, letters and numbers.

particularly concerned with large bank failures because they pose outsized negative externalities on the regional economy. As a result, supervisors could be allocated and incentivized to spend time in a way that seeks to ensure the safety of the largest institutions under the Reserve Bank's purview. In practice, we cannot differentiate among these competing motivations since they result in observationally equivalent outcomes.

Our analysis is ultimately indifferent as to which of these mechanisms results in greater supervisory attention as long as the largest BHCs within a district receive additional attention relative to similar BHCs for reasons unrelated to risk or performance each of the rationales we outline above suggest that the largest banks in a district will receive additional supervisory attention relative to otherwise similar firms.

A. Is Rank a Valid Proxy for Supervisory Attention?

We provide evidence in support of this hypothesis with a simple measure of supervisory scrutiny: the hours spent by Federal Reserve supervisors examining a particular institution. We use confidential Federal Reserve System managerial data on the time use of supervisors at the Reserve Banks. Supervision personnel are required to self-report time-use. As part of this reporting, they are instructed to indicate what hours of their time are spent directly supervising a particular institution (as opposed to broadly contributing to the supervision of a portfolio of banks or participating in other activities). The data include supervisory staff in all twelve Federal Reserve districts over the period 2006 to 2014. We do not capture hours that are not allocated to specific firms, or hours spent by Board of Governors supervisory staff. To the extent that these hours substitute for supervisory hours by the Federal Reserve Banks, their exclusion would serve to attenuate our results.

On a quarterly basis we aggregate the hours reported by examiners at each BHC and its subsidiaries to generate a measure of supervisory attention for an organization the total quantity of directly reported supervisory hours. Many BHC-quarters do not have directly reported hours. If the institution has never received directly reported hours, then hours are

left as missing, reflecting the fact that the firm was supervised by a team that oversees a portfolio of firms so supervisors did not directly record time use at individual institutions. However, if a BHC has had reported hours in a prior quarter, we assume that missing reported hours are zero.[5] In addition, reporting conventions can vary, in some cases making it difficult to compare hours across Federal Reserve districts or over time.[6] We will account for this variation when we analyze how hours vary with the size rank of a BHC.

We match the time-use data to the consolidated financials of the parent BHC. The financials are based on FR Y-9C reports submitted quarterly to the Federal Reserve. We start with the sample of firms that are above the median of total assets each quarter, as firms below this threshold rarely receive reported hours and our attention measure is focused on the largest firms that do receive hours. Using this sample of BHCs, we calculate the asset size rank of each BHC within its geographic Federal Reserve district.

Our approach to identify the impact of supervision is to compare outcomes of BHCs that are similar except for their assigned Federal Reserve district and their size rank within that district. Thus, after calculating ranks, we exclude a small number of atypical institutions (e.g. payment processors, credit card banks, automobile lenders) that are difficult to compare to firms of similar size due to the relatively small number of such firms.[7] Excluding these firms drops 8% of BHC-quarters from 2006 to 2014. We also exclude BHCs with foreign parents (2.5% of the firm-quarters) and BHCs that are assigned to a supervisor that is distinct from their geographic district (1.5%), as these characteristics can influence reported hours or supervisory attention.

With this sample, we estimate an empirical model to describe the allocation of supervisory

[5]Approximately 40% of BHC quarters do not receive directly reported supervisory hours. On average, BHCs without reported hours are significantly smaller (average asset size of $1.1 billion) than BHCs with reported hours (average asset size of $22.1 billion).

[6]We explicitly correct for one such instance: In the time period for which we have data, the Second District reported hours based on a 35 hour work week whereas the other districts used a 40 hour work week; therefore we rescale Second District hours by 40/35.

[7]We exclude BHCs where retail deposits are less than 25% of liabilities, trading assets are more than 7.5% of assets, or credit card or automobile loans are more than 30% of total loans. These firms typically fail to match on a common support in the analysis that follows. Hence we choose to exclude them here as well. The exclusions affect a small number of firms and do not have a significant impact on our key findings.

hours based on firm characteristics such as size, complexity, and business mix. Then, using this description as a benchmark, we test whether top ranked banks receive supervisory hours above and beyond what is predicted by firm characteristics. The empirical model is a pooled cross-sectional regression of log hours for BHC i in quarter t,

$$\log(hours_{it}) = \mathbf{\Gamma} BankCharacteristics_{it} + \mathbf{\Pi}_{dt} + \varepsilon_{it}, \tag{1}$$

where $BankCharacteristics_{it}$ is a vector of various BHC-level features that summarize aspects of a firm that should influence supervisors' time allocation. We include quarter fixed effects, $\mathbf{\Pi}_d$, to capture aggregate variation in supervisory hours over time and in some specifications we include a vector of district-quarter fixed-effects, $\mathbf{\Pi}_{dt}$, where d refers to each BHC's supervisory district. The former facilitates cross-district comparisons of hours and the latter within district comparisons. The sample is the set of bank holding companies with reported hours between 2006Q1 and 2014Q4: excluding BHCs below the median of total assets each quarter, atypical institutions, BHCs with foreign parents, and BHCs that are assigned to a supervisor that is distinct from their geographic district. Standard errors are clustered by BHC.

We assemble our benchmark with a lengthy list of variables intended to capture the features of BHCs that should attract supervisory attention. In particular, it is important for us to capture those features that are also correlated with rank to minimize concerns of omitted variable bias and to allow us to interpret rank as an exogenous indicator for supervisory attention. To this end, the first types of bank characteristics that should be associated with supervisory hours are size and complexity. Larger, more complex institutions demand more resources to properly supervise and present a greater threat to financial stability if adversely shocked. We use the log of assets to capture size in a way where the marginal need for supervision is decreasing with scale.[8] We also consider a specification that includes

[8]This benchmark and estimated coefficients are consistent with the theoretical model of supervision of (Eisenbach, Lucca, and Townsend, 2016).

an optimized fractional polynomial in assets to further generalize the relationship between supervisory hours and assets. We distinguish complexity from size by including the log of the number of legal entities controlled by the bank holding company.[9]

Our second set of controls captures the underlying bank charters using asset composition. In addition to BHCs, the Federal Reserve has supervisory responsibility over state-chartered commercial banks that are members of the Federal Reserve System (State Member Banks or SMBs), hence BHCs with SMB subsidiaries should receive additional Federal Reserve scrutiny. SMBs with assets greater than $10 billion are examined jointly by the Federal Reserve and state banking supervisors, while SMBs with less than $10 billion in assets rotate examinations with state supervisors (Agarwal et al., 2014). Therefore, we construct two control variables using Call Report data: the percent of BHC assets in SMB subsidiaries with assets greater than or equal to $10 billion and the percent of assets in SMB subsidiaries with assets below $10 billion. We also control for the percent of BHC assets in nationally chartered banks, as these banks are supervised by the Office of the Comptroller of the Currency (OCC). Public firms are also subject to market scrutiny which could substitute or complement supervisory attention; hence we include an indicator to identify public firms.

The third set of controls we consider contains basic information on business activities that might merit supervisory attention. We consider the percent of assets that are loans as well as the percent of liabilities that are deposits to control for potential differences in the supervisory hours related to lending and deposit-taking. In addition, we control for the diversity of asset mix using the Herfindahl-Hirschman Index (HHI) of assets, with the thought that more business complexity (being in more types of assets) can necessitate more supervisory attention.[10] Lastly, we account for the market power of the firm in the areas

[9]The data is based on quarterly regulatory filings and constructed by the Statistics Department at the Federal Reserve Bank of New York. See Cetorelli and Stern (2015) for a description of the data. The entity data ends in 2013; we extend the series by assuming entity numbers are the same for 2014 as in 2013Q4. Given the series is highly persistent we are comfortable with this extrapolation, particularly since the analysis is focused on cross-sectional variation. Our findings are robust to restricting our analysis to pre-2013Q4.

[10]The HHI of assets is calculated as the sum of the squares of the percentage of assets in the following categories: Credit card loans, residential real estate loans, commercial real estate loans, commercial and industrial loans, investment securities, and trading assets. (See Kovner, Vickery, and Zhou (2014) for an

in which it operates by using the standard metric: the deposit market share of the BHC (e.g. James and Wier, 1987). We measure market share at the firm-level by calculating the weighted sum of county-level deposit share where the weights are the level of local deposits. Data for local deposits are from the FDIC's Summary of Deposits.

The fourth and fifth sets of controls include bank performance and risk characteristics. In later analysis we consider many of these variables as outcomes of supervisory attention, but we include them in order to present a comprehensive description of supervisory hours and to present a strict test of whether rank results in additional supervisory attention. The fourth set of controls includes a bank's recent performance and perceived riskiness. We include the lagged four quarter average return on assets (ROA), year-over-year asset growth, the Tier 1 capital ratio, the percent of loans that are non-performing, and the standard deviation of ROA over the last eight quarters. We trim ROA, the standard deviation of ROA and asset growth variables at the top and bottom 1% to remove extreme outliers.

The final set of variables includes the Federal Reserve's most recent composite rating for the BHC. These ratings are included as indicators for a rating of 2, 3, 4, or 5, where 1 is the omitted category. A rating of 1 is considered the best (safest), where a rating of 5 is the worst. By conditioning on supervisory rating we capture the perceived riskiness of the BHC based on supervisory assessments that not only include publicly available information, but also information only available to supervisors.

[Place Table II about here]

Table II summarizes our findings. Column 1 considers the simplest possible benchmark model of the allocation of supervisory hours, including our size and subsidiary bank type controls in the presence of time fixed effects. As expected, supervisory hours increase with assets and the number of legal entities. They also are greater the more state member bank assets in a firm, whether those assets are in an SMB that is rotated with state supervisors or not. We do not find evidence that national bank assets or having publicly traded equity are

analysis of the impact of concentration on BHC operating efficiency.)

related to supervisory hours. Note that the R-squared for this regression is quite high, 47%, consistent with the inference that the allocation of supervisory hours is mostly a function of bank size, complexity and type. Time fixed effects alone generate an R-squared of only 1%.

Progressing across the columns, we consider the remaining additional variables conditional on those in Column 1 and then all together in Column 5. None of the business controls are statistically significant in Column 2, suggesting that the broad composition of assets and liabilities is not critical to understanding the allocation of supervisory hours. In Column 3, recent ROA and asset growth are negatively correlated with supervisory hours while the share of non-performing loans and the standard deviation of ROA are positively correlated. Hence, firms with greater earnings or asset growth receive relatively less supervisory attention, while poor performing or risky firms receive more attention. When we consider supervisory ratings in Column 4, not surprisingly we find that BHCs judged to be the riskiest by supervisors (ratings 3 through 5), receive 2 to 3 times as many supervisory hours as do highly rated firms. Having considered these categories separately, Column 5 includes all of our proposed explanatory variables for supervisory hours. The results are largely similar, although greater asset concentration is now significantly, negatively correlated with hours and some performance measures, asset growth and the standard deviation of ROA, are no longer statistically significant. The specification in Column 5 serves as our preferred empirical benchmark for the allocation of supervisory hours. We can explain approximately 53% of the variation in supervisory hours by these measures alone. Not only does this specification include publicly observable controls, but it also includes supervisory ratings that are based on confidential information available to supervisors. Thus, the benchmark not only explains a significant portion of the variation in hours, but it also relies on bank characteristics that are consistent with what we know about supervisory objectives.

For robustness, we develop two alternatives. The first includes an optimized fractional polynomial for assets rather than the log of assets, in Column 6. This specification allows for greater flexibility in the relationship between hours and assets, which increases the R-

squared by a negligible amount to 54%. The second alternative specification, Column 7, includes district-quarter fixed effects, which allow us to make within district comparisons. Rank may be associated with greater attention across districts, but also within a district conditional on the benchmark model of supervision. This specification allows us to account for changes over time by district in hours reporting patterns.[11]

[Place Figure 1 about here]

We are then able to use these benchmarks for the allocation of supervisory hours to test the validity of our hypothesis that the top ranked BHCs in a Federal Reserve district receive more attention. Conditional on the benchmark model from Column 5, we estimate and plot the value of size rank dummies in Figure 1(a). Consistent with our hypothesis that higher ranked BHCs in a district receive more supervisory attention, we see that BHCs ranked one through nine have on average more hours and that the 95% confidence interval for these ranks does not include zero. This is conditional on both public observables and supervisory assessments. In summary, top-ranked banked receive more attention than can be explained by their size, complexity, performance or supervisory assessments of riskiness. The top five banks receive almost twice as many hours as banks six through nine. Therefore, one candidate for excess attention is simply a dummy variable indicating a bank is within the top five in its district.

B. Top Ranked Measure

However, our hypothesis that higher ranked banks receive more attention does not rely on a sharp discontinuity at any particular rank. Indeed, in some districts, the distribution of banks may be such that the sixth or seventh largest bank is similar in size to the fifth largest and we would expect these banks to receive similar attention from supervisors. Therefore, we define a *Top* BHC to include the top five as well as BHCs whose assets are within 25% of

[11] We do not consider a polynomial in assets specification in combination with district-quarter fixed effects as a sufficiently flexible polynomial in assets within a district is indistinguishable from asset rank.

the assets of fifth largest BHC in the district. Figure 1(b) displays these firms separately and labels them "5+". We can see that the banks that are close in size to the fifth largest banks also receive greater supervisory attention on average and that separating these banks reduces the excess hours observed for banks ranked six through ten.[12] Similar results hold when we consider a specification with district-quarter fixed effects in Internet Appendix Figure IA1.

[Place Table III about here]

We formally test whether this group of *Top* ranked BHCs receive outsized attention by adding an indicator that identifies them to equation 1. The results of this exercise are summarized in Table III. We only present the coefficient on our rank indicator variables, which summarizes the difference in hours these banks receive relative to our empirical benchmark model. Column 1 includes our size, complexity and charter controls (Column 1 in Table 2) and Column 2 considers the full gamut of controls for performance, asset composition and risk rating (Column 5 in Table 2). We find a statistically significant coefficient greater than 1 in both specifications. The coefficient increases as we add controls, suggesting that omitted unobservable factors are not correlated with our top rank dummy. The magnitude suggests that these *Top* firms receive more than twice as many supervisory hours as predicted by the empirical model (for reference, a difference in log hours of 0.69 implies 100 percent more supervisory hours).

In Columns 3 through 9 we confirm that our finding is robust to alternative specifications and samples. Column 3 adds an additional dummy variable for the top fifteen firms. In this specification, the *Top* dummy tests whether the highly ranked BHCs are statistically different than the remaining top fifteen BHCs conditional on BHC characteristics. The very largest BHCs in the treatment groups are not on a common size support with the untreated groups, therefore we repeat the analysis excluding those BHCs that are larger than the largest non-

[12] An added benefit of this measure is that when the 5th and 6th largest banks are very close in size they may enter in and out of a simpler "Top 5" measure. This measure better captures the common sense notion that districts focus attention on the largest firms, but without a sharp rank rule that results in volatility in hours when a bank remains relatively similar but moves up or down slightly in rank.

Top Five BHCs (Column 4). In the fifth column, we use the fractional polynomial in assets specification to more flexibly account for size and in the sixth we include district-quarter fixed effects. Column 7, excludes the New York district (District 2), as this district has a unique distribution of very large banks. Lastly Columns 8 and 9 further restrict the sample to banks ranked in the top 15 with and without district-quarter fixed effects, respectively. In each of these alternative specifications, the coefficient on the *Top* ranked indicator remains positive and statistically significant at the 1% level with a magnitude that suggests *Top* ranked banks receive at least two times the supervisory hours as their peers. Table IAI in the Internet Appendix confirms the robustness of these results using the simple top five rank dummy rather than our *Top* indicator.

The results support the validity of our hypothesis that highly ranked banks within a district receive outsized supervisory attention. Using hours as a proxy for attention we find highly ranked banks receive two to three times more supervisory hours than similar BHCs. One concern might be that certain types of BHCs opportunistically switch districts to reduce supervisory attention. However, BHCs rarely switch districts, as this would require relocating their headquarters. Such switches generally occur in the context of cross-district mergers, where the merged entity opts to locate its headquarters in the district of the acquired firm. During the period from 1991 to 2014, of 353 unique BHCs that ever appear in the top 10 between 1991 and 2014, only 5 move districts (less than 2%).

Another concern is that our measure of hours does not capture the quality of supervision. Within a district, we expect that more experienced or skilled supervisors would be allocated toward the largest firms. If that is the case, supervisory hours understates the additional attention allocated to highly ranked firms. Across districts, supervisory talent might be clustered in districts with more banking assets. Districts with large banks supply fewer *Top* firms because the largest banks do not match to non-*Top* banks in other districts. However these districts supply many matches for the treatment group in the analysis that follows. If supervisory talent is higher in districts with more banking assets, this would bias our results

against finding differences in outcomes because the additional hours spent by supervisors at *Top* banks would be offset by those hours being of lower quality relative to their matches in larger districts.

III. Measuring the Impact of Supervision

Given the empirical evidence of the prior section, we proceed with our analysis using status as a *Top* BHC in a district as an indication that a firm receives greater supervisory attention. We identify a sample of similar, untreated BHCs (that is, BHCs that are not among the largest in a district and thus do not receive the "treatment" of additional supervisory attention) using a matching procedure. We then compare outcomes across these two samples in order to test our hypotheses related to bank risk and performance. By using *Top* status to identify variation in supervisory attention, we are able to conduct our analysis over a much longer sample period, 1991 to 2014, rather than being limited to the 2006 to 2014 sub-period for which we have supervisor hours data.

A. Matching

To estimate the impact of greater supervisory attention, we use propensity score matching (Rosenbaum and Rubin, 1983) to construct a sample of BHCs that are not in the treatment group (i.e., not *Top* by size rank). We choose a matching methodology for several reasons. First, our treatment sample is naturally restricted to some of the largest, most complex BHCs. As a result, there may not be a comparable BHC in the untreated group. Matching allows us to restrict our comparisons to a common support of similar BHCs. Second, a semi-parametric matching procedure can better account for nonlinearities between control variables and bank outcomes, reducing our dependence on the assumption of linearity implied by OLS.

We begin with the sample of banks described in Section II.A. Our analysis relies on our

presumption that size rank within a district provides exogenous variation in supervisors' attention. Hence, our matching variables are meant to control for factors that correlate with rank but could also impact bank risk and performance. Thus we match on size, complexity, balance sheet characteristics, and the presence of State Member Banking or national chartered banking assets. We also match on a dummy variable indicating whether the BHC has publicly traded stock to incorporate a potential role for market discipline. Finally, we match on market share, the value weighted deposit market share of the BHC based on Summary of Deposits data. Matching on market share allows us to ensure that we are comparing BHCs with similar market power, since market power or deposit franchise value could affect profitability and risk (Demsetz, Saidenberg, and Strahan, 1996). Each of these variables, which are defined in more detail below, enters as a control in Table II Column 2.

To confirm the robustness of our results, we consider an alternative matched sample that also includes lagged asset growth, lagged return on assets, and market-to-book (franchise value). Our main results are qualitatively similar when these additional controls are added. However, matching on these controls both limits the sample of banks and restricts us from considering these variables as outcome measures. Therefore, we prefer to match on fewer characteristics in the main analysis. Results from this sample are discussed in Section IV.D.

We estimate a logistic regression in each quarter, where the dependent variable is a dummy indicating whether a BHC is in the treatment sample, i.e. *Top* in its district, and the independent variables are our bank-level controls. Using these estimates we calculate predicted values, also known as propensity scores. For each treatment observation, we select two nearest neighbors with respect to propensity score.[13] The nearest neighbors must be non-treatment observations in a different Federal Reserve district than the treatment BHC. The result is that for each *Top* BHC in a quarter, we have two other BHCs with similar

[13]The optimal choice of the number of nearest neighbors reflects a tradeoff between seeking similar matches (fewer neighbors), and the noise introduced by a very small number of matches (more neighbors). We select two nearest neighbors because this appears to optimize the tradeoff. As we increase the number of nearest neighbors the incremental increase in unique BHCs as matches declines as does match quality. We repeat the analysis using 1 to 5 nearest neighbors and results are qualitatively similar.

characteristics that are not among the *Top* of another district. Matches are made with replacement; therefore, a BHC may appear multiple times in the control sample if it has been matched to multiple treatment observations. Our standard errors calculation explicitly accounts for repeated observations.

[Place Figure 2 about here]

For this matching to succeed, the size distribution of BHCs must vary across Federal Reserve districts (see Table I). Figure 2 illustrates the geographic diversity of *Top* and matched BHCs by asset size across Federal Reserve districts. Note that the geography of Federal Reserve districts is not necessarily aligned with other geographic regions. For instance, each district spans multiple states and district borders do not necessarily conform to state borders, so that state-chartered banks in BHCs in a particular Federal Reserve district may fall under the jurisdiction of different state supervisors and banks under the jurisdiction of individual state supervisors may fall into different Federal Reserve districts. Further, the *Top* firms in a district do not necessarily align with firms that are the highest size ranked in a state or census region. Finally, the geographic regions of other federal supervisory agencies do not align with the twelve Federal Reserve districts.

[Place Table IV about here]

Table IV compares our treatment group and their matches. Over the entire sample period we have 2,959 treatment BHC-quarters for which we are able to find two nearest neighbors on a common support. Many treatment BHCs are not matched because there are not BHCs with a similar propensity score that are untreated. In particular, the very largest BHCs are not included in the treatment sample because there are no similar BHCs in other districts that are not among the *Top* banks in that district. The largest BHC in the treatment group with matches has assets of just under $100bn. The median rank of a treatment bank with a match is 4.

We verify that these two samples are balanced by testing for differences in the matching covariates (the far right columns) where standard errors are clustered by BHC to account for correlations within BHCs over time as well as for repeated observations of matched BHCs. The treatment BHCs are slightly smaller than their matches, have slightly more deposit market share, comprise fewer entities, contain more large-SMB assets and use more deposit funding; however, none of these differences are of sizable magnitudes or approach statistical significance at standard levels. These differences are significantly smaller than an unmatched sample, summarized in Internet Appendix Table IAII. The average rank of a treatment banks is 4.3, the average rank of their match is 10.6. Hence the difference in rank is on average 6.3. For the subset of quarters for which we have hours data, we find that on average *Top* firms receive roughly twice as many supervisory hours per quarter, a difference that is statistically significant and consistent with our findings in the linear models in Table III Columns 5 and 6. A list of banks and their matches are available upon request.

B. Financial Outcome Measures

We focus our analysis on financial measures related to our two hypotheses: that supervisory attention reduces bank risk and supervisory attention reduces bank performance or growth. We examine both accounting-based measures as well as market measures at supervised institutions. Accounting-based measures are constructed using quarterly regulatory filings (FR Y-9C reports). Variable definitions are detailed in the Data Dictionary in Internet Appendix A.

We consider measures of risk that are reflected in the balance sheet of the firm, as well as measures based on income statement items. With respect to the balance sheet, we examine the risk-weighted assets (RWA) of the BHC relative to total assets, the Tier 1 capital ratio (a measure of risk-weighted leverage), the percent of non-performing loans (NPLs), and the ratio of loan loss reserves to total loans. Total NPLs may obscure loan mix so we also look at NPL rates within the following categories of loans: residential real estate (RRE), commercial

real estate (CRE), commercial and industrial (CI) and consumer. We exclude loan-category NPL percentages if the category is less than 1% of a bank's total lending.

If *Top* firms are less risky, we expect them to have lower RWA/Assets, higher Tier 1 capital ratios, and lower NPLs. More conservative firms will have higher loan reserves given a similar NPL profile. We also consider the variability of NPLs and loan loss reserves by calculating the standard deviation over an eight-quarter forward horizon. Greater variability in NPLs is consistent with greater risk, whereas greater variability in loan loss reserves may reflect less conservative provisioning practices. Finally, we test whether supervisors inhibit growth by examining the one-year-forward asset and loan growth of the firm.

With respect to earnings, we focus on the return on assets (ROA). We use the annualized level of ROA in a quarter as a measure of performance. For risk, we calculate the standard deviation of ROA over an eight quarter forward horizon. We use a forward horizon since we expect supervisory attention to affect outcomes in the future, although results are similar when we use backward-looking measures, possibly due to the persistence of treatment status. If supervision imposes costs or reduces risk-taking, we would expect a lower ROA. However, reduced risk-taking would also reduce variability in ROA. We also consider two measures that relate performance to riskiness: the Sharpe Ratio of ROA and the log Z-score of the firm. We construct the Sharpe Ratio as the average ROA over the next eight quarters relative to the standard deviation of ROA over that period. The Z-score measures distance to default as it is the number of standard deviations ROA would need to fall in order to wipe out book equity.[14]

While supervisors are concerned with risk, they are particularly sensitive to failures. Unfortunately for our econometric exercise, failures are exceptionally rare in our treatment and control groups, limiting its value as an outcome variable. Therefore we generate tail risk indicators for several variables to capture whether the most extreme realizations of a particular BHC are impacted by *Top* status. The variables we consider are nonperforming

[14]Z-scores were popularized by Altman (1968) for industrial firms. See also Hannan and Hanweck (1988) and Boyd, Graham, and Hewitt (1993) for the use of Z-scores in the banking context.

loan percentage (for all loans and by loan type), the standard deviation of ROA, and ROA. We define tail events as realizations in the 5th percentile over the full sample. For NPLs and the standard deviation of ROA, we flag tail events as those in the top 5th percentile, whereas for ROA we flag them in the bottom 5th percentile.

We supplement the accounting-based measures with market prices. Accounting-based measures are subject to discretion and may lag market developments, especially for loan portfolios, which are generally reported as historical book values. In contrast, market prices impound investor beliefs relatively quickly and therefore represent an important additional source of information about bank performance. In addition, regulation is typically oriented towards accounting measures; hence, supervisors and supervised institutions might target accounting measures without influencing the firm's risk as assessed by the market. Market outcomes are rarely an explicit target of regulation and cannot be as easily "gamed".

We obtain daily stock returns from the Center for Research in Security Prices (CRSP) and we match to public BHCs using the New York Fed PERMCO-RSSD dataset. We calculate market-to-book ratios, which measure the extent to which the current market valuation of the firm differs from its book value; low market-to-book values may signal distress at a firm that is not yet recognized in accounting-based measures whereas high market-to-book may signal greater anticipated future profits (or higher franchise value). We construct quarterly excess returns with respect to a standard Fama-French three-factor model (Fama and French, 1993). We also calculate daily return volatility to assess the riskiness of returns. Similar to the accounting measures, we consider return per unit of risk using Sharpe Ratios. For each quarter, we scale the average daily return in excess of the risk free rate by its standard deviation. Lastly, we consider the worst performers in any given quarter by creating an indicator for firms with excess returns in the bottom decile. Our approach to defining tail risk here differs from the accounting based variables in order to reflect that the performance measure here reflects idiosyncratic returns that are independent of the firm's exposure to Fama-French factors.

IV. Empirical Results

A. Differences in Means

We begin by comparing the means of these financial measures between the *Top* BHCs in a district and their matches. Assuming that *Top* BHCs receive greater supervisory scrutiny but are otherwise similar to the matched sample, we attribute the differences between these two samples to differences in supervisory attention. We calculate standard errors that are clustered by BHC which accounts for within correlations within BHC over time as well as repeated matches. If a treatment BHC is missing the variable of interest, then both the treatment BHC and its matched observations are excluded. The results of this analysis are reported in Table V.

[Place Table V about here]

Beginning with balance sheet measures of the risk-return profile of BHCs, the largest firms in a district do not have RWA/Assets or Tier 1 capital ratios that are statistically different from matched firms. However, we do find that the average percentage of non-performing loans (NPLs) is 48 basis points lower for *Top* firms relative to matched peers, or 25% lower relative to the matched peer sample, and that the difference is statistically significant at the 10% level. Also, the *Top* ranked banks are less than half as likely to experience an NPL bank-quarter in the highest 5th percentile, a difference that is statistically significant at the 5% level. The variability of non-performing loans is 25% lower (0.32% versus 0.44%) relative to the matched BHCs at statistical significance levels of less than 5%. So while these BHCs appear comparable based on risk-weighted assets and capital, the largest firms in a district appear to have higher quality loans whose performance is less volatile.

When we consider NPLs by loan type, we find *Top* BHCs have lower levels of NPLs on all but consumer loans (the difference is statistically significant at the 5% level for CI and at the 11% and 12% levels for residential and commercial real estate, respectively).

Despite having safer loans on average, loan loss reserves at *Top* BHCs are not significantly different than their matches, suggesting that they are more conservative than their peers. Finally, *Top* BHCs grow slightly faster than their matches, although the differences are not statistically significant, and these BHCs are less likely to have asset growth in the lowest 5% tail, suggesting that they achieve this risk profile without sacrificing overall asset or loan growth.

Overall earnings also suggest that the *Top* ranked BHCs in a district are less risky with little trade-off in terms of profitability. While the level of ROA is similar between *Top* BHCs and their matches, the standard deviation of ROA for *Top* BHCs is 60% that of their peers. This difference is significant at the 5% level. Treated firms are half as likely to appear in the highest 5th percentile and this difference has a p-value of roughly 10%.

Given that returns are similar but volatility is lower, it is not surprising that the accounting Sharpe ratio (SD ROA/ROA) is greater for the *Top* BHCs. Similarly, Z-scores at *Top* BHCs are significantly higher than those at matched firms, suggesting that these BHCs hold higher amounts of capital relative to the riskiness of their earnings streams and are therefore less likely to default. Note, however, that the actual capital ratios do not differ significantly between the two sets of firms. The difference is primarily driven by the standard deviation of ROA. Overall, top-ranked BHCs that are subject to more intense supervision have a better risk-return trade-off than lower size-ranked institutions.

The market-based measures echo these results, albeit at lower levels of statistical significance. In particular, *Top* ranked BHCs are less likely to appear in the bottom decile of returns (p-value of 12%), while average excess returns, the Sharpe ratio and the market-to-book ratio are higher. For these measures inference is based on a smaller sample as approximately 10% of our matched sample is not publicly traded.

Overall, the results suggest that *Top* BHCs those subject to greater supervisory attention are less risky and enjoy a better risk-return trade-off than otherwise similar BHCs not among the *Top* ranked in their district. The results are stronger for accounting-based measures than

for market-based measures.

B. Systemic Benefits of Supervisory Attention

The results in Table V suggest that *Top* firms experience less volatile earnings and better loan performance consistent with the hypothesis that supervisory attention reduces risk but with little evidence of a trade-off in terms of profitability or growth. To better understand the timing of these differences across the business cycle we compare the time-series of performance of the treated and control banks over the sample period from 1991 to 2014. Figure 3 illustrates sample averages for *Top* banks and their matches for ROA, SD ROA, and NPL percentages.

[Place Figure 3 about here]

Patterns in ROA between *Top* ranked banks and their matches look similar in Figure 3(a), consistent with the results in in Table V. Differences between the two samples emerge in the remaining figures. The standard deviation of ROA, shown in Figure 3(b), suggests *Top* banks are less risky around three recessionary periods: the early 1990s, 2001 and the Great Recession. Similar patterns emerge for NPLs, Figure 3(c), particularly residential real estate during the crisis, Figure 3(d), commercial real estate in the early 1990s and the crisis, Figure 3(e), and CI during all three recessions, Figure 3(f). We do not show consumer loans as we did not detect differential performance in this category. Specific loan types vary in the degree to which they experienced a downturn in each of the recessions, but generally *Top* firms are less sensitive to systematic declines in loan performance.

The graphical evidence suggests that there is a cyclical nature to the benefits of supervisory attention: in normal times differences are smaller, but during downturns the more closely supervised firms exhibit better loan performance and lower earnings volatility. Of course, the patterns illustrated in Figure 3 may not be statistically significant; we use a regression framework to test for the differential sensitivity of profitability and risk during

periods of industry stress. The pooled-cross-sectional regression uses the sample of *Top* ranked BHCs-quarters and their matches. We regress our profitability and risk variables on an indicator for *Top* status, an indicator for an industry downturn, and an interaction term between the two. The interaction term coefficient estimates the differential sensitivity of *Top* BHCs to the downturn relative to normal times.

Defining the industry downturn to match time when banks experience high losses, rather than in recessions is key to the results. We define downturns using industry aggregates for our outcome variables of interest. A downturn quarter is determined by whether a symmetric 5-quarter moving window has at least 3 quarters that are above (or below in the case of ROA) the median for the entire sample period. The moving window eliminates higher frequency switching between states and creates downturn indicators that accord with periods of industry distress in the specific variable of interest. See Internet Appendix Figure IA2 for an illustration of our downturn periods by variable. Our results are qualitatively similar if we simply use an indicator for realizations above the median. We do not use official recession timing to identify downturns, because outcomes for banks, such as losses and nonperforming loans, are realized late and tend to remain elevated well after the recession is over.

[Place Table VI about here]

Table VI summarizes the regression results. With respect to profitability (ROA), we find that *Top* firms earn more than their matches during downturns, but the coefficient is not statistically significant. Unconditionally, *Top* firms have significantly less variation in ROA during good times and this magnitude is even greater during downturns, although the p-value on the interaction coefficient is only 0.16. For NPLs, we find that *Top* firms have lower NPL percentages in downturns. This is true in total loans, reflecting lower NPLs in in residential real estate, in commercial real estate and in CI lending and is statistically significant in each of these categories. Hence, the regression analysis supports the statistical significance of the patterns observed in Figure 3: supervisory attention appears to reduce bank risk,

particularly during industry downturns. The remainder of the paper further explores these relationships using an econometric approach that accounts for differences across districts over time.

C. Controlling for District Effects

A key limitation of the difference in means analysis is that we compare BHCs across Federal Reserve districts. While the BHCs in our sample have geographically diverse operations, if there are unobserved district-level effects and our sample of treatment and controls is unbalanced across districts, then our results may be biased. For example, those districts with smaller *Top* banks might experience less economic volatility and be less exposed to systematic risk than those districts with large *Top*-ranked banks that tend to populate the control sample.

To account for time-varying district-level differences, we construct a larger sample of BHCs that allows us to specify an empirical model that includes district-quarter fixed effects. We augment our matched sample by propensity score matching non-*Top* BHCs of size rank six through fifteen to banks not among the *Top* of another district, where matches are based on the same propensity score matching described in Section III.A. Hence, in this analysis, the sample grows to include each top fifteen bank that we can match to two other banks in another district. This allows us to include district-time fixed effects that capture average differences in performance in district both for *Top* banks' districts and for matched banks' districts. Internet Appendix Table IAIII demonstrates that there are not significant differences between top fifteen banks and their matches.

We estimate the differential impact of *Top* status (additional supervisory attention) in a panel of top fifteen BHCs and their matches,

$$Y_{ijt} = \mathbf{\Pi}_{dt} + \alpha_{jt} + \beta Top_{it} + \varepsilon_{ijt}. \tag{2}$$

The dependent variable, Y_{ijt}, is the value of the outcome measure at time t; i indexes the BHC out of the set of all BHCs in the sample (*Top* BHCs, Non-*Top* BHCs ranked 6 to 15, and matches for both); and, j indexes each "match group" where a firm in the top fifteen enters once ($i = j$) and a firm that is a match to a top fifteen may enter multiple times in different match groups (i.e. with different j). $\mathbf{\Pi}_{dt}$ is a vector of district-quarter fixed-effects that varies with i which allows the fixed effects to be informed by top-ranked BHCs, BHCs not among the top-ranked but in the top fifteen, and matches for both. The district fixed effects control for average quarterly conditions in both the district of the *Top* banks as well as the comparison banks. Fixed effects, α_{jt}, for each match group capture average levels of the dependent variable for each BHC and its matches. This means that in addition to differences across the districts, we control for the way in which banks that are matched are different from other matched sets, on average. Top_{it} is a dummy equal to one if a BHC is in the top five in its district or within 25% of the asset size of the fifth ranked bank and zero if it is a non-*Top* bank or, by construction, a match. The coefficient of interest, β, estimates the within district-quarter difference between a BHC and its matches for a *Top* ranked firm relative to a top fifteen firm. Standard errors are clustered by BHC.

The resulting estimates in Table VII are broadly consistent with the difference-in-means results in Table V. *Top* BHCs continue to have less volatile NPLs and are less likely to appear in the top tail of NPL realizations at 1% and 10% statistical significance levels, respectively. They also have lower NPLs on average, although the coefficient has a p-value of 16%. As with the simple matching approach, *Top* ranked firms are less likely to have a negative asset growth outcome, consistent with a lower likelihood of severe distress. We do not find a statistically significant difference in asset or loan growth at *Top* BHCs, although they on average grow 50 to 60 bps slower. As before, we cannot conclude that lower risk is coming at the expense of credit provision.

[Place Table VII about here]

By type of loan, *Top* banks have lower NPLs at the 10% significance level for residential and commercial real estate loans. The only category of loans for which *Top*-ranked banks do not have lower NPLs is consumer loans. This may reflect the fact that consumer lending is a credit score driven business, with less of a role for supervisory insights or soft information, or that we are not correctly accounting for subcategories of consumer lending such as credit cards and auto loans. Similar to Table V, *Top* BHCs have less volatile ROA, a higher accounting Sharpe Ratio and a higher Z-score, each of which is significant at the 5% level.

The market-based results are considerably stronger in these specifications relative to Table V, with *Top* BHCs having less volatile daily returns, and a smaller probability of being in the lowest decile of returns at the 1% and 10% significance levels, respectively. The lower risk is not accompanied by a performance trade-off, as *Top* BHCs display similar Sharpe Ratios and significantly higher market-to-book ratios. Thus, the lower risk we observe in accounting returns is mirrored in market price data, suggesting that increased supervisory attention is associated with less risky firms, and not driven by differences across districts. Internet Appendix Table IAIV demonstrates that these results are robust to excluding the New York district matches and Internet Appendix Table IAV shows that the cyclical variation is qualitatively similar using this sample and method as the findings summarized in Table VI.

D. Robustness to Alternative Explanations

While our primary matching specification conditions on a number of variables that could be associated with rank as well as bank performance, *Top* status is not randomly assigned. There may be other unobservable heterogeneity that explains better performance by *Top* banks.

Some examples of unobserved heterogeneity that might result in omitted variable bias are managerial talent, firm culture, or franchise value. With respect to managerial talent, if there is a national market for banking management talent, this should be accounted for in our size match, for example when CEOs talent is sorted by firm size (Gabaix and Landier,

2008). If, instead, the market for talent is based on local market share, since we are also matching on that characteristic, *Top* banks and their matches should have a similar appeal to attract managerial talent. Similarly, if market share is indicative of franchise value, we already control for management sorting along that dimension.

Another solution to unobserved heterogeneity would be to include firm-level fixed effects in order to exploit entry and exit from *Top* ranked status or to consider an event study around changes in status. However, this analysis faces several challenges. First, *Top* status changes infrequently; (96% of BHCs that are in the *Top* in a district remain in the *Top* in the next quarter) and tend to involve a small set of firms, hence these tests have insufficient power. Second, entry and exit is likely to be endogenous to firm performance. Firms that enter (leave) the *Top* are likely to be growing faster (slower) than their peers in the same district. Firms that enter the *Top* due to an acquisition of a large firm by an out-of-district firm may be facing a change in the competitive environment. Third, we do not have a strong prior on the time that it takes for increased supervisory attention to result in different outcomes. As observed in Figure 3, the differences in risk are concentrated in industry downturns, therefore it may be years before entry or exit is reflected in bank performance. This biases us against finding anything both in our main analysis and in an event study context, where the effect of supervisory attention is unlikely to be instantaneous.

While we cannot exploit within firm variation, we can consider an expanded set of matching criteria that includes recent firm performance using the latest twelve months ROA, asset growth and the franchise value of the firm as measured by market-to-book. Recent profitability and asset growth should capture heterogeneity in firm profitability and growth, whereas franchise value captures the market's expectations of future earnings relative to book equity. These metrics can proxy for managerial talent (ROA, market-to-book, growth), expectations of future growth (market-to-book), and franchise value (market-to-book). While the sample size drops due to the more stringent matching criteria and the restriction to public firms (see Internet Appendix Table IAVI), the results in Appendix Table IAVII which includes

district-quarter fixed effects are consistent with our findings in Tables V and VII: *Top* firms exhibit lower NPLs but similar loan loss reserves and they are less volatile, even when we consider market measures. The robustness of our results extends to the cyclicality results as summarized in Internet Appendix Table IAVIII. Thus, controlling for recent performance and franchise value does not change our earlier findings, alleviating several concerns related to potential omitted variables.

V. Additional Analyses

In this section of the paper we further explore the nature of the differences in earnings volatility and other risks between *Top* firms and their matches using the district-time fixed effects specification of the model. We also implement a 2SLS specification that is restricted to the 2006 to 2014 period.

A. Understanding Earnings Volatility

One of our more robust results is the finding that *Top* BHCs have lower earnings volatility than otherwise comparable BHCs that are not among the largest in their districts. In this section, we explore that finding in more detail to identify the sources of lower earnings volatility for *Top* BHCs. We decompose net income (the numerator of ROA) into four key components: net interest margin (NIM), non-interest income such as fees and trading revenue, loan loss provisions (LLP), and other non-interest expense (non-interest expense excluding compensation and fixed asset expenses).[15] Each of these is scaled by total assets. We calculate the standard deviation of each of the resulting ratios over an eight-quarter forward horizon. Using these outcome variables, we repeat the analysis of differences between *Top* BHCs and the matched sample, controlling for district-time effects (as in Table VII).

[15]We calculate non-interest expense net of compensation and fixed asset expense to focus on the more volatile components of non-interest expense. This includes corporate overhead, IT and data processing, consulting and advisory, some legal expenses and other expenses as well as one-time losses not otherwise categorized.

These results are reported in the top four rows of Table VIII.

[Place Table VIII about here]

Consistent with the overall results for the volatility of ROA, the volatility of each of these key net components is lower for *Top* BHCs than for the matched sample. The differences are statistically significant for net interest margin, non-interest income, and loan loss provisions, though not for other non-interest expense. The lower volatility of provisions is consistent with the finding that *Top* BHCs have less volatile NPLs and could reflect that these firms hold less risky loan portfolios and are more conservative over time. The lower volatility of net interest income might also reflect this finding to some extent, as more stable loan portfolios can generate less volatile interest income on loans and could reflect better management of interest rate risk. The lower volatility of non-interest income at *Top* BHCs suggests that the impact of supervision extends beyond the impact on BHCs' lending to other activities at the firm. The pervasive nature of the lower volatility is consistent with efforts on the part of supervisors to foster better governance and risk management throughout the bank.

In addition to examining reported income and expense, we calculate a series of variables intended to isolate the discretionary portions of net income. Firms have discretion over the recognition of some parts of income and expense, to the extent that these components rely on models or management judgment. These areas include the timing of loan loss provisions and net charge-offs, the timing of losses on securities held in the available-for-sale portfolio, and reserving for events such as legal settlements (part of non-interest expense). For this reason, we try to distinguish between decreased volatility that arises from lower risk and decreased volatility that reflects earnings management.

Following practices in the accounting literature (e.g. Moyer, 1990), we estimate discretionary accounting behavior by using deviations from predicted values for loan loss provisions and realized security gains. We estimate discretionary behavior in the broadest sample of above median asset size BHCs and estimate deviations as follows: For loan loss provisions,

we regress changes in the ratio of loan loss provisions to average loans held in a quarter on changes in the ratio of NPLs to loans, the change in net charge offs to loans, the level of loan loss reserve to total loans and district-quarter fixed effects. Discretionary loan loss provisions are the residuals from this regression, and thus measure the deviation from the time period average after adjusting for the firm's loss experiences. Similarly, for security gains, we regress quarterly realized security gains/losses scaled by assets on unrealized security gains in the available-for-sale portfolio scaled by assets and time fixed effects. We focus on the absolute value of these residuals to measure the discretionary activity. Lastly, we estimate total discretionary earnings as discretionary security gains less discretionary loan loss provisions scaled by assets. The results for the discretionary measures are reported in the bottom four rows of 8.

The net impact of the discretionary items is lower earnings for *Top* BHCs than for matched firms, with statistically significant differences for the discretionary loan loss provisions, as well as for discretionary securities gains. Hence, top size-ranked firms are less likely to deviate from typical provision levels given their experiences. Once again, this finding is consistent with the idea that BHCs subject to greater supervisory attention, as proxied for by *Top* status, take a more conservative approach to reserving for loan losses. This is not driven by earnings management of provisioning since they are less likely to deviate from predictions based on observables.

B. Other Risks

While we find lower accounting measures of risk, we may be concerned that banks substitute other risks that are more difficult to observe. The market based measures such as stock price volatility suggest that market participants do not perceive an increase in other risks. We also find decreased volatility in both ROA and noninterest income, two accounting measures which might be correlated with off balance sheet risks. However, we do additional analysis to understand if banks that receive more supervisory attention are taking in other

risks that may not be well-captured by the accounting and market measures.

First, we look for measures of off-balance sheet activity. Unfortunately, many measures of off-balance sheet activity were only added to regulatory reports after 2009, so we examine only the subset of measures that are available over our full sample period. Results of regressions on the matched sample including district quarter fixed effects are shown in the top panel of Table IX. We look at unused loan commitments, securitization income and non-interest income, all normalized by assets. These measures should capture activities where income is not as closely linked to balance sheet activities. *Top* BHCs do not earn more net securitization income, nor do they have more noninterest income. We do find that *Top* BHCs have higher amounts of unused loan commitments. This suggests additional liquidity risk, since these firms have similar ratios of loans to assets; however, this result is also consistent with the idea that more supervisory attention does not reduce intermediation, since loan commitments are a critical channel of credit supply.

[Place Table IX about here]

C. Governance and Supervisory Outcomes

In addition to these financial measures of risk, we look at non-financial measures that may relate to firm risk. First, we examine the governance structure of the firm, particularly as it relates to risk management. We also look at supervisory actions. Greater scrutiny, all else equal, may increase the degree to which supervisors use ratings and enforcement actions to influence a bank's behavior. However, it is also possible that increased supervisory attention means that firm behavior may be influenced without need for more formal actions.

While there is a wealth of data on BHCs' financials, information on internal governance is not as easily to measure over a long time horizon. We attempt to characterize the importance of risk management at a BHC by determining whether it has a Risk Committee or a Chief Risk Officer (CRO). We match public BHCs to their proxy filings and then conduct text

searches on these filings. If the filing mentions a Risk Committee or a Chief Risk Officer, we construct an indicator variable that notes their presence.[16] CROs are extremely rare in filings prior to 2006; therefore, we only use this indicator from 2006 onward. Our presumption is that a BHC with a Risk Committee or a CRO places more managerial focus on the importance of monitoring and mitigating risk. Hence, we can test whether supervisory attention results in greater risk governance.

The last category of comparison is supervisory tools. We are able to measure several tools that supervisors use to influence BHC behavior. The first are MRAs and MRIAs. As described previously, MRAs and MRIAs are supervisory actions intended to ensure that firms remediate unsafe or unsound practices or conditions and regulatory violations. MRAs and MRIAs are by far the most common type of supervisory action (Eisenbach et al., 2017) and are assigned to banks much earlier than public enforcement actions. We construct variables for the number of open MRAs and MRIAs at the end of each quarter, as well as the number of new MRAs and MRIAs generated by supervisors during the quarter. These data are available over the period from 2009:Q4 to 2014:Q4.

The third tool we use is BHC supervisory ratings. As described above, supervisors assign composite ratings to BHCs reflecting the overall extent of concerns about the institution, where a rating of "1" is the lowest level of concern and "5" is the highest.[17] A high rating can result in restrictions on BHC activities, including, but not limited to, the acquisition of another institution or expansion into new activities. We examine the level of the rating, to see if supervisory attention induces lower ratings, as well as the frequency of ratings changes, as more supervisory attention might lead to a greater use of this tool to influence bank behavior.

[16]Specifically, a BHC is said to have a CRO if the proxy filing mentions "Risk Officer", "Chief Risk", "Chairman of Risk", or "Chair of Risk". A BHC is said to have a Risk Committee if the proxy mentions "Risk Committee".

[17]The composite ratings used in the analysis span two different rating methods used by the Federal Reserve. The BOPEC rating system was replaced with the RFI rating system in 2006:Q1. While the specifics of the two systems differ, both generate "1 to 5" ratings with similar overall interpretations about the degree of supervisory concern associated with a given composite rating level.

These results are reported in Table IX. There are no significant differences in the governance measures or most supervisory measures between *Top* BHCs and other firms. Therefore, even though supervisors are devoting more attention to these firms, this extra attention does not result in more supervisory actions. That being said, given these firms are in fact less risky, it may be that conditional on risk more closely supervised firms receive more MRAs and MRIAs. Also, about half of an additional MRA/MRIA is closed at *Top* BHCs per quarter and the difference has a p-value of 0.11, a finding consistent with the idea that increased supervisory attention might allow BHCs and supervisors to address and resolve supervisory concerns more quickly.

D. Two-Stage Least Squares

Our underlying identification assumption, that the top ranked firms in Federal Reserve districts receive more attention all else equal, can be applied in an alternative empirical framework. Rather than estimating reduced form estimates based on the *Top* dummy, we instrument for log hours using two-stage least squares (2SLS). This methodology comes at a cost, as we are restricted to the smaller sample period for which we have hours, 2006 to 2014. But, 2SLS allows us to verify our results using an alternative estimation procedure and to quantify changes in bank outcomes in terms of our proxy for attention, supervisory hours.

An uninstrumented regression of outcomes on hours (Appendix Table IAX) reveals that more risky firms receive more supervisory hours. Hours are positively associated with higher NPLs, higher volatility, and more supervisory issues. Firms that grow more slowly, have lower ROA, or lower market returns also receive more supervisory hours. This suggests that our matching exercise, as well as the 2SLS results discussed below, help ameliorate the underlying identification problem that risky, poor performing firms receive more supervisory attention.

Table X presents the results of 2SLS estimations for the primary financial outcome and

non-financial outcome measures discussed in earlier in this section. Similar to the earlier analysis on hours, we begin with a sample of all bank holding companies above median size and exclude those that are larger than the largest untreated bank to minimize the impact of extremely large banks that are not on a common support (as in Table III, Col. 4-6); findings are similar if we include the largest firms. We instrument for supervisory hours with *Top*, and maintain the controls in Table II, Column 2 which are also the same controls we use in our primary matching specification (e.g. TableIV). The F-statistics are reported in the third column of Table 10, and satisfy standard tests for weak instruments (all greater than 10).

[Place Table X about here]

Results from the 2SLS analysis are similar to those in Tables V and VII, although with somewhat lower statistical significance, reflecting the lowering of statistical power from the shorter time series. An increase in supervisory hours of 20 percent is associated with 14 basis point lower non-performing loan rate, equal to a 5% reduction relative to the mean. Increased supervisory hours are also associated with significantly less volatile ROA, which results in higher accounting Sharpe Ratios and higher Z-scores. A 20% increase in hours reduces the volatility of BHC earnings by 7 basis points, a reduction of 9% relative to the mean. Increased supervisory hours are associated with lower standard deviation of returns, however these results are not statistically significant in this time period. In this specification, we find that that higher hours are associated with lower Tier 1 ratios, suggesting that more supervised firms hold less Tier 1 capital. This result was not robust to the various other specifications in the paper. The findings are qualitatively similar if we include district-time fixed effects (Internet Appendix Table IAXI).

The 2SLS lend further support to our findings in the longer time period, both in terms of statistical significance and directional impact. However, the quantification should be interpreted cautiously. First, while we believe that hours data are a useful proxy for supervisory attention, hours data fail to capture information on the quality of hours. While

our prior is that quality and quantity of supervisory hours are positively related, the reverse could attenuate our estimated coefficients. In addition, the hours data are only available for 2006 onward, thereby limiting our statistical power. This time period is also one that is particularly volatile for financial performance.

E. Quantifying the Impact of Supervision

Across each of these empirical specifications there is an implied relationship between supervisory attention and bank outcomes. While our measure of hours is only a proxy for supervisory attention, we can relate hours to differences in outcomes to attempt to quantify the local average treatment effect of additional hours on bank risk. For instance, a 20% increase in hours results in a 9% reduction in volatility based on the two-stage least squares results in Table X. If we take the incremental hours for top-ranked banks in the 2006 to 2014 portion of the sample (top-ranked banks have roughly two-times the hours) and apply it to the matched differences for the longer time period (Tables V and VII), the implications are similar. A 20% difference in hours suggests a 9-10% decline in earnings volatility.[18]

One implication of the distance to default statistic (Z-score) is that we can calculate how much additional capital a non-*Top* ranked bank would need in order to have the same distance to default as a *Top*-ranked bank that receives more supervisory hours. Based on the two-stage least squares results, the log difference in Z-scores for a 20% change in hours is roughly 0.08, which equates to a Z-score difference in levels of 2.3. Assuming the sample average for the 2SLS ROA, 0.66, and standard deviation of ROA, 0.76, then a bank would need 1.6% higher equity-to-asset ratio to close this gap. A similar exercise using the matched sample results in Tables V and VII and suggests a capital ratio difference of 1.4% to 1.8%.[19]

While we do not intend for these estimates to suggest that simply raising hours by 20%

[18]The difference in log hours between treatment and matches is 0.67, 27% of that value is the equivalent to a 20% difference in hours. In Tables V and VII top-ranked banks have on average 35% lower volatility; 27% of 35% is 9.5%.

[19]Converting the log differences to levels suggests a difference in Z-score of 10 to 13. 27% of that suggests a difference in Z-score of 2.8 to 3.5. Multiplying the difference by the typically untreated std. dev. of ROA, 0.53. and subtracting the average quarterly ROA, 0.24 implies a capital ratio difference of 1.4% to 1.8%.

can account for a lower level of capital, they do suggest that the differences we reveal are sizable and that an emphasis on supervision can make firms safer on a level that is significant relative to the capital levels of these institutions.

VI. Conclusions

We exploit the geographic assignment of supervisory responsibilities in the Federal Reserve System to examine the impact of supervision. We demonstrate that the largest bank holding companies in a Federal Reserve District receive greater supervisory attention in the form of more dedicated supervisory hours, even after controlling for factors such as the size, complexity and market share of the institution. Leveraging this result, we compare these top-size-ranked firms within a district to similar firms in other districts to assess the impact of greater supervisory attention. Our results are consistent with increased supervisory attention resulting in lower risk as measured by less risky lending, lower earnings volatility and more conservative accounting practices. Given these institutions are subject to similar regulatory regimes, our findings provide novel evidence that supervision matters. The magnitudes we estimate suggest a role for supervision to reduce banking losses in downturns and to bolster the ability of similarly capitalized banks to avoid default.

Our findings are subject to a few important caveats. First, as with any natural experiment, if there are unobserved differences between *Top* ranked status and bank performance, then we may be misattributing the improvements in bank performance to supervision. Second, we do not attempt to measure the social welfare benefits of supervision in this paper, such an analysis would require both a comprehensive measure of costs of supervision and benefits of financial stability. That said, at current levels of supervision, we do not find a tradeoff between the provision of credit and financial stability. This reflects our finding that the risk-return tradeoff seems to be better at more supervised firms.

Third, our objective to capture the broad benefits of supervisory attention hinders our

ability to identify the specific actions that supervisors take to accomplish these goals. We hypothesize that the improved risk-return frontier might be explained by the presence of supervisors resolving governance problems within firms, effectively improving their overall performance. This could arise through increased power of risk managers or increased board engagement spurred by contact with supervisors. To explore any of these avenues further, we would require more detailed information about supervisors' communications, and the costs of the supervisors' time. Some information of this type is available in confidential Federal Reserve supervisory data (e.g., from systems intended to assist management of the supervisory areas of the System) and our hope is to explore these data in future work.

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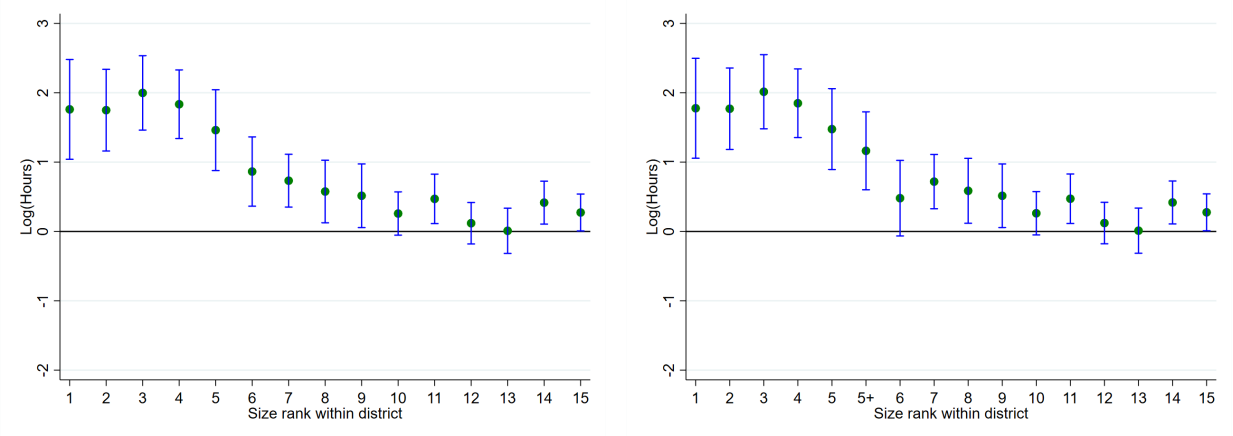
Figures



(a) Size rank

(b) Size rank with 5+ category

Figure 1. Variation in supervisory hours by asset size rank

Plots estimated coefficients from a regression of the log of supervisory hours on dummy variables indicating the asset size rank of a bank in a district. Additional explanatory variables include those in the benchmark model of supervisory time allocation (Table II, Column 5) and include proxies for size, complexity, charter asset mix, recent performance and riskiness. The 5+ category in Fig. 1(b) includes banks ranked 6-15 but within 25% of the asset size of the fifth ranked bank in their district. Banks included in 5+ are excluded from rank categories 6 through 15. Lines illustrate 95% confidence intervals, where standard errors have been adjusted to correct for clustering within banks.

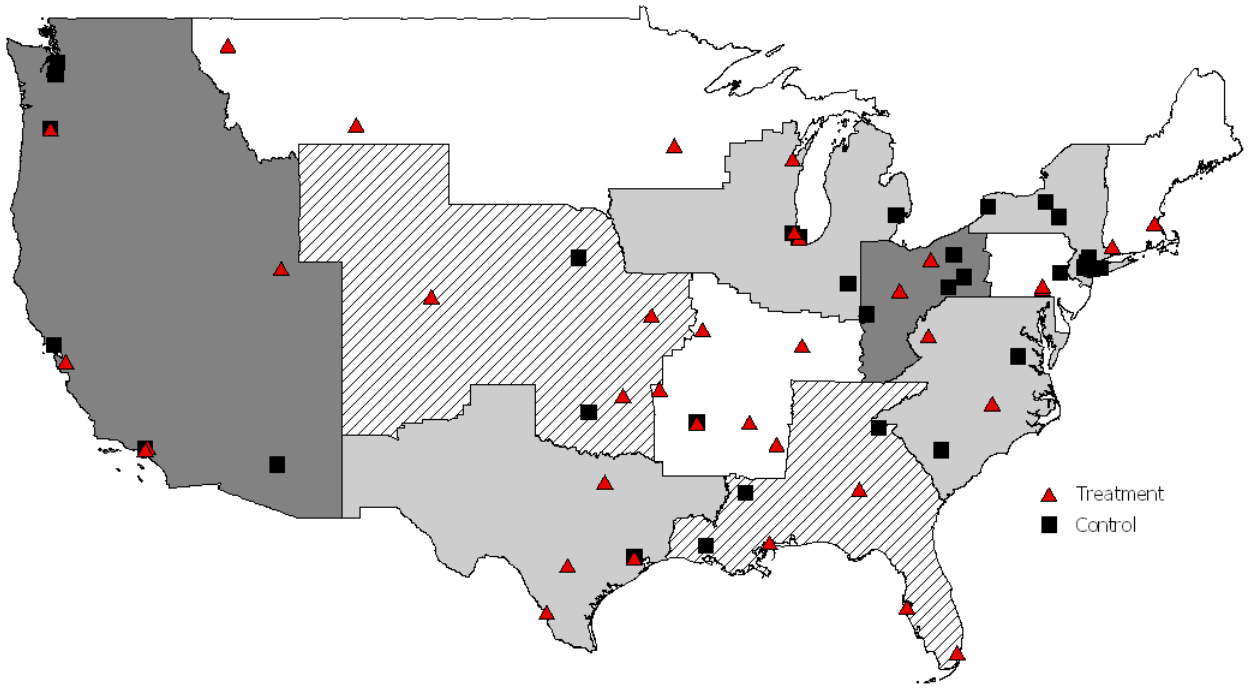
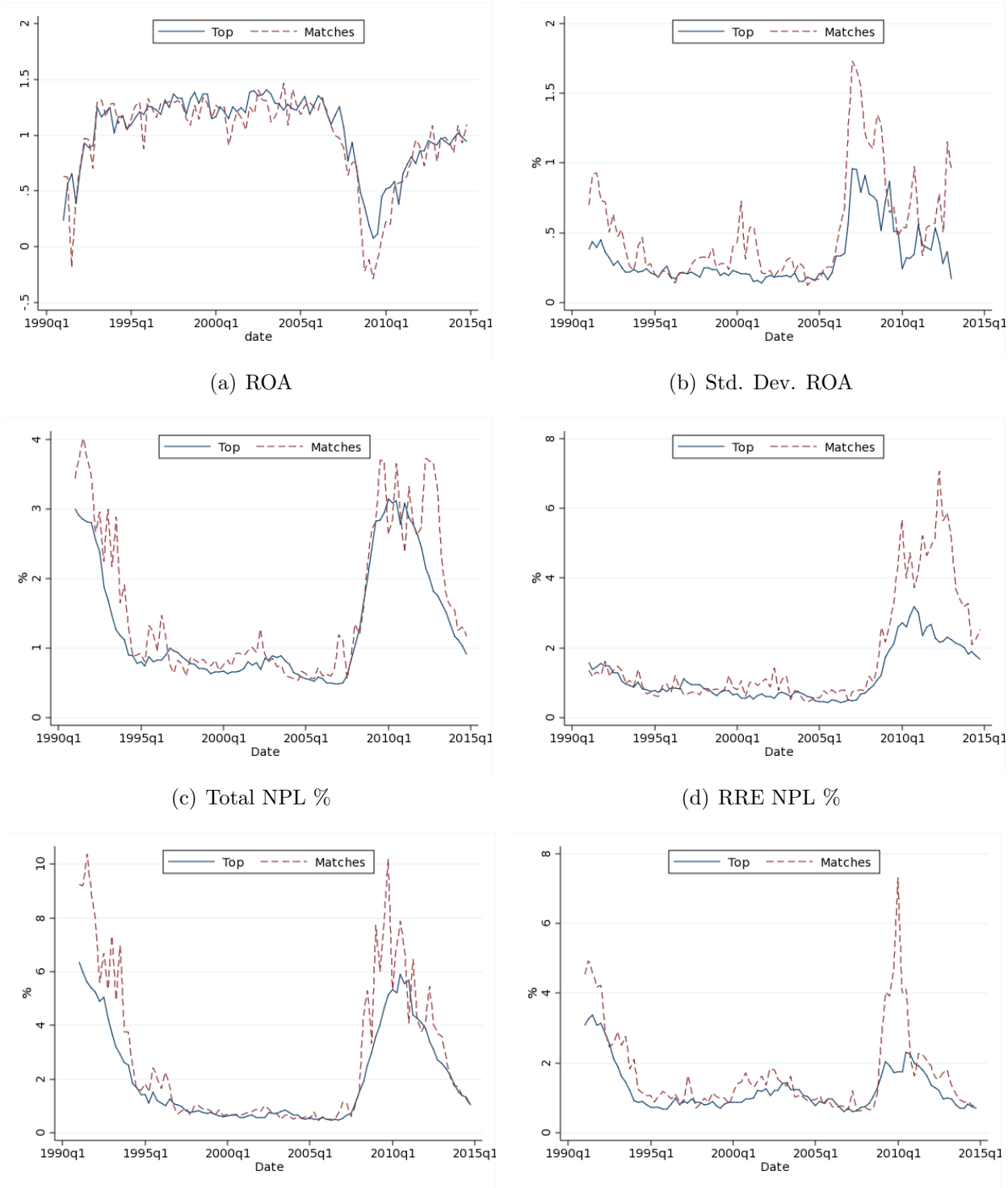


Figure 2. *Top* and Matched BHCs by Federal Reserve District

Illustrates the headquarter location of *Top* BHCs and their matches in 2014. Treatment are *Top* BHCs which includes the top five-ranked with respect to book assets in a district-quarter plus BHCs ranked 6-15 but within 25% of the asset size of the fifth ranked bank in their district. Control are matches to the treatment BHCs. Borders and shading delineate Federal Reserve Districts.



(a) ROA

(b) Std. Dev. ROA

(c) Total NPL %

(d) RRE NPL %

(e) CRE NPL %

(f) C&I NPL %

Figure 3. Time-series comparison of *Top* and matched sample

Plots the average for treatment (*Top* banks) and their matches over the sample period. Standard deviation calculated using an 8 quarter horizon (forward). Based on sample described in Table IV.

Tables

Table I
Asset size by rank across Federal Reserve districts

Table summarizes the asset size of the largest BHCs within each Federal Reserve district. Dollars are in billions. The sample consists of FR Y-9C filers in 2014Q4.

Reserve	Size rank					Mean	Sample	
District	1st	2nd	3rd	4th	5th	6th-10th	Median	N
1	274.1	133.0	118.4	22.5	9.5	6.2	1.1	82
2	2572.8	1842.2	856.3	801.5	515.6	291.3	3.2	92
3	248.1	115.9	25.0	18.7	17.1	6.2	1.0	61
4	345.2	138.7	93.9	66.3	24.9	10.0	1.0	57
5	2106.8	309.1	186.8	30.1	12.3	5.8	1.0	89
6	190.4	119.9	27.1	24.3	21.6	15.2	0.9	136
7	151.8	109.9	83.1	26.8	20.0	11.4	1.0	157
8	25.7	24.0	15.0	13.3	11.6	7.9	0.9	98
9	402.5	19.4	9.2	8.6	8.3	2.6	0.9	63
10	29.1	24.0	17.5	17.5	14.5	7.7	0.9	89
11	130.4	83.2	69.5	28.3	21.5	10.6	1.2	100
12	1687.2	154.6	89.8	57.2	39.4	27.9	1.5	98

Table II
OLS: Log of supervisory hours on bank characteristics

Table contains results from regressions of the log of supervisory hours on potential bank-level determinants of supervisory activity. Observations are BHC-quarters from 2006Q1 to 2014Q4. *SMB Share* is the ratio of state members bank assets to total assets, where the SMB is either above or below $10bn. *National bank share* is the share of assets in a National bank. *Public* is an indicator for publicly traded banks. *HHI of Assets* is based on asset shares for credit card loans, residential real estate loans, commercial real estate loans, commercial and industrial loans, investment securities, and trading assets. *Market Share* is estimated using a weighted average of county-level deposit share. ROA is annualized. Asset growth is year-over-year asset growth. *NPL share* is non-performing loans divided by total loans. *SD ROA* is the standard deviation of ROA over the next 8 quarters. Rating categories are based on supervisory CAMELs ratings where 1 is considered the best rating and 5 the worst. Columns 1-6 include quarter fixed effects; Column 7 includes district-quarter fixed effects. Column 6 uses a best-fit fractional polynomial in assets (a): a^{-1}, $a^{-1}\ln(a)$, $a^{-1}(\ln(a))^2$. Standard errors are clustered by BHC. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
log(Assets)	0.911***	0.885***	0.953***	0.956***	0.962***		0.957***
	(0.07)	(0.07)	(0.06)	(0.07)	(0.06)		(0.05)
log(Entities)	0.412***	0.438***	0.379***	0.360***	0.353***	0.314***	0.345***
	(0.08)	(0.07)	(0.06)	(0.07)	(0.05)	(0.05)	(0.05)
% SMB (>$10b) Assets	0.022***	0.022***	0.023***	0.021***	0.022***	0.018***	0.022***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
% SMB (≤$10b) Assets	0.034***	0.034***	0.034***	0.033***	0.034***	0.034***	0.034***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
% National Bank Assets	-0.000	0.000	0.000	-0.000	-0.000	-0.000	0.001
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Public	0.086	0.110	0.075	0.025	0.090	0.129	0.084
	(0.10)	(0.09)	(0.09)	(0.09)	(0.08)	(0.08)	(0.08)
Loans/Assets (%)		0.002			0.003	0.004	0.001
		(0.00)			(0.00)	(0.00)	(0.00)
Deposit/Liabilities (%)		0.004			0.007	0.008	0.001
		(0.01)			(0.00)	(0.01)	(0.00)
HHI of Assets		-0.414			-1.212***	-1.161***	-0.265
		(0.51)			(0.42)	(0.43)	(0.37)
Deposit Market Share		-0.332			0.401	0.406	-0.094
		(0.39)			(0.32)	(0.31)	(0.29)
ROA (%)			-0.138***		-0.069**	-0.060*	-0.088***
			(0.04)		(0.03)	(0.03)	(0.03)
Asset Growth (%)			-0.006***		-0.001	-0.000	-0.002
			(0.00)		(0.00)	(0.00)	(0.00)
Tier 1 Ratio (%)			-0.007		0.024**	0.029**	0.022*
			(0.01)		(0.01)	(0.01)	(0.01)
NPL (%)			0.097***		0.044***	0.047***	0.018
			(0.02)		(0.02)	(0.02)	(0.02)
SD ROA			0.150***		0.050	0.060	0.035
			(0.05)		(0.04)	(0.04)	(0.04)
Rating of 2				0.368***	0.340***	0.341***	0.280***
				(0.08)	(0.08)	(0.08)	(0.08)
Rating of 3				1.393***	1.332***	1.301***	1.219***
				(0.11)	(0.11)	(0.11)	(0.10)
Rating of 4				1.900***	1.711***	1.686***	1.686***
				(0.16)	(0.18)	(0.19)	(0.18)
Rating of 5				2.241***	2.024***	1.996***	1.896***
				(0.28)	(0.28)	(0.29)	(0.23)
Asset Polynomial	No	No	No	No	No	Yes	No
Quarter FEs:	Yes	Yes	Yes	Yes	Yes	Yes	No
District-Quarter FEs:	No	No	No	No	No	No	Yes
Observations	14,909	14,785	13,575	14,909	13,489	13,489	13,489
R-squared	0.47	0.48		0.51	0.53	0.54	0.58

Table III
OLS: Log of supervisory hours on *Top* indicator

Table contains results from regressions of the log of supervisory hours on bank-level determinants of supervisory activity and an indicator for top ranked BHCs. Observations are BHC-quarters from 2006Q1 to 2014Q4. *Top* BHCs are those within the top five in a Reserve Bank district-quarter based on assets or within 25% of the top five. Size & Charter controls include log of assets, log of legal entities, SMB shares (<$10bn and >$10bn), National bank share, and a public indicator. Business controls include loan-to-assets, deposit-to liabilities, HHI of assets, and deposit-based market share. Performance controls include ROA, asset growth, Tier 1 ratio, NPL share, and the s.d. of ROA. Rating controls include an indicator for the most recent CAMELs rating. Columns 4, 5, and 6 exclude banks that are larger than the largest non-treatment bank. Column 7 further excludes District 2 banks. Columns 8 and 9 include only banks ranked in the Top 15. Columns 1-5, 7 and 8 include quarter fixed effects. Column 5 uses a best-fit fractional polynomial in assets as in Table II (and excludes log of assets from size controls). Columns 6 and 9 include district-quarter fixed effects. Standard errors are clustered by BHC. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

				Ex. Large			**Ex. Large & 2nd District**	**Top 15 Only**	
Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
Top Rank	1.050***	1.169***	1.175***	1.158***	0.828***	0.779***	0.930***	0.823***	0.891***
	(0.19)	(0.18)	(0.18)	(0.18)	(0.19)	(0.16)	(0.17)	(0.17)	(0.19)
Top 15			0.308***	0.295***	0.490***	-0.025	0.090		
			(0.10)	(0.11)	(0.11)	(0.10)	(0.10)		
Controls:									
Size & Charter	Yes	Yes	Yes	Yes	Ex. assets	Yes	Yes	Yes	Yes
Business	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Performance	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Rating	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Asset Polynomial	No	No	No	No	Yes	No	No	No	No
Fixed Effects:									
Quarter	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No
District-Quarter	No	No	No	No	No	Yes	No	No	Yes
Observations	14,909	13,489	13,489	13,343	13,343	13,343	12,541	4,364	4,364
R-squared	0.48	0.54	0.54	0.52	0.53	0.56	0.53	0.56	0.63

Table IV
Summary statistics for *Top* sample and matches

Table compares sample means between the *Top* BHCs (treatment) and their matches. *Top* BHCs are those within the top five in a Reserve Bank district-quarter based on assets or within 25% of the top five. Matching chooses the two nearest neighbor for each treatment observation based on the listed control variables (rows 1-10). The difference in means is the treatment less the matches. p-values are calculated using standard errors clustered by BHC. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	***Top* Ranked**				**Matches**					
Variables	**Mean**	**Median**	**SD**	**N**	**Mean**	**Median**	**SD**	**N**	**Δ Means**	***p*-value**
Log(Assets)	16.06	16.11	0.85	2,959	16.11	16.2	0.9	5,918	-0.05	0.69
Log(Entities)	3.13	3.22	0.80	2,959	3.20	3.22	0.86	5,918	-0.08	0.47
% SMB (>$10B) Assets	5.85	0.00	22.72	2,959	5.42	0.00	21.82	5,918	0.43	0.87
% SMB (≤$10B) Assets	7.28	0.00	22.40	2,959	8.73	0.00	24.37	5,918	-1.45	0.64
% National Bank Assets	40.15	8.67	44.14	2,959	40.48	10.37	44.73	5,918	-0.33	0.96
Loans/Assets (%)	61.19	63.68	12.70	2,959	61.98	64.46	10.69	5,918	-0.79	0.63
Deposits/Liabilities (%)	83.90	85.33	9.11	2,959	83.13	85.27	10.15	5,918	0.77	0.59
HHI of Assets	0.19	0.17	0.07	2,959	0.19	0.17	0.08	5,918	0.00	0.98
Public	0.84	1.00	0.37	2,959	0.85	1.00	0.36	5,918	-0.01	0.84
Deposit Market Share	0.17	0.17	0.08	2,959	0.16	0.16	0.09	5,918	0.01	0.25
District Rank	4.30	4.00	1.72	2,959	10.63	9.00	5.34	5,918	-6.33	0.00
Log(hours)	5.84	6.17	1.92	1,131	5.16	5.68	2.43	2,253	0.67	0.04

Table V
Difference in means between *Top* and matches

Table compares sample means between the *Top* BHCs (treatment) and their matches. *Top* BHCs are those within the top five in a Reserve Bank district-quarter based on assets or within 25% of the top five. Standard deviations of accounting variables are calculated on a rolling basis using eight quarters (forward). Growth is one-year (forward). Tail measures are calculated at the top or bottom 5th percentile. Further details on variable construction can be found in the Data Appendix. The difference in means is the treatment less the matches. p-values are calculated using standard errors clustered by BHC. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	***Top* Ranked**				**Matches**					
Variables	**Mean**	**Median**	**SD**	**N**	**Mean**	**Median**	**SD**	**N**	**Δ Means**	***p*-value**
Balance Sheet										
RWA Assets (%)	71.20	71.71	11.93	2,221	70.98	71.84	12.71	4,442	0.22	0.91
Tier 1 Ratio (%)	11.76	11.48	2.92	2,221	12.14	11.32	3.94	4,442	-0.38	0.38
NPL (%)	1.43	0.94	1.52	2,959	1.90	1.06	2.48	5,918	-0.48*	0.08
NPL Top Tail	0.03	0.00	0.16	2,959	0.08	0.00	0.28	5,918	-0.06**	0.03
SD NPL (%)	0.32	0.18	0.40	2,430	0.44	0.22	0.57	4,817	-0.11**	0.05
Loan Loss Reserves (%)	1.74	1.54	0.75	2,957	1.78	1.56	1.00	5,913	-0.04	0.70
SD LLR/Loans	0.15	0.09	0.16	2,399	0.16	0.09	0.19	4,836	-0.02	0.40
Asset Growth (%)	10.99	7.81	13.84	2,902	10.72	7.00	14.75	5,632	0.27	0.77
Asset Growth Bottom Tail	0.03	0.00	0.17	2,661	0.09	0.00	0.28	5,365	-0.06**	0.02
Loan Growth (%)	12.46	8.82	19.69	2,940	11.76	7.96	25.90	5,879	0.7	0.68
NPL % by Loan Type										
Residential RE	1.22	0.75	1.45	2,945	1.81	0.81	2.76	5,855	-0.59	0.12
Commercial RE	2.21	1.14	2.78	2,936	3.05	1.17	5.28	5,895	-0.84	0.11
C&I	1.28	0.93	1.27	2,950	1.79	1.08	2.83	5,779	-0.50**	0.01
Consumer	0.67	0.46	1.30	2,792	0.64	0.45	0.70	5,144	0.03	0.75
Earnings										
ROA (%)	1.02	1.11	0.62	2,934	0.97	1.08	0.76	5,791	0.05	0.42
ROA Bottom Tail	0.04	0.00	0.19	2,959	0.05	0.00	0.23	5,918	-0.02	0.18
SD ROA	0.33	0.17	0.57	2,346	0.53	0.22	0.87	4,846	-0.20**	0.02
SD ROA Top Tail	0.04	0.00	0.19	2,446	0.08	0.00	0.27	4,916	-0.04	0.10
Sharpe Ratio of ROA	8.70	6.46	7.63	2,331	7.21	4.96	6.89	4,796	1.49**	0.04
Log Z-Score	3.95	4.07	1.01	2,338	3.67	3.87	1.18	4,779	0.28**	0.03
Stock Market										
Market Cap/Equity	1.74	1.61	0.75	2,442	1.63	1.50	0.75	4,907	0.1	0.27
Excess Return (%)	0.01	0.01	0.12	2,381	0.01	0.00	0.13	4,859	0.003	0.51
SD Daily Return	0.02	0.02	0.01	2,404	0.02	0.02	0.01	4,905	-0.001	0.44
Sharpe Ratio	0.04	0.04	0.11	2,443	0.04	0.04	0.11	4,978	0.004	0.45
Bottom Return Decile	0.07	0.00	0.25	2,421	0.09	0.00	0.28	4,966	-0.02	0.12

Table VI
Difference in means between *Top* and matches during downturns

Table contains estimates from regressions of bank outcome variables on a *Top* BHC indicator, a dummy indicating an industry downturn for that variable, and an interaction between *Top* status and the downturn dummy. The interaction coefficient estimates the differential performance of top banks during downturns. The sample is *Top* BHCs and their matches as summarized in Table IV. *Top* BHCs are those within the top five in a Reserve Bank district-quarter based on assets or within 25% of the top five. Industry downturns for each variable are defined using industry aggregates where a downturn is defined for a quarter if its symmetric 5Q moving window has at least three quarters that are above (or below) the median. Examples of these designations can be found in Figure IA2. Standard deviations of accounting variables are calculated on a rolling basis using eight quarters (forward). Further details on variable construction can be found in the Data Appendix. The difference in means is the treatment less the matches. p-values are calculated using standard errors clustered by BHC. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Dependent Variable	*Top* Coefficient	Standard Error	p-value	*Top* × Downturn Coefficient	Standard Error	p-value	N	R-Squared	Sample Means: Full	Sample Means: Downturn
ROA (%)	0.016	(0.04)	0.69	0.074	(0.072)	0.31	8,725	0.22	0.98	0.70
SD ROA	-0.087**	(0.037)	0.02	-0.19	(0.133)	0.16	7,192	0.05	0.46	0.62
NPL (%)	-0.115	(0.072)	0.11	-0.677*	(0.370)	0.07	8,877	0.281	1.74	2.58
RRE NPL (%)	-0.099	(0.090)	0.27	-0.898*	(0.462)	0.05	8,800	0.278	1.61	2.34
CRE NPL (%)	-0.051	(0.067)	0.45	-1.431**	(0.723)	0.05	8,831	0.254	2.77	4.38
C&I NPL (%)	-0.179**	(0.072)	0.01	-0.619*	(0.318)	0.05	8,729	0.159	1.62	2.24
Consumer NPL (%)	0.048	(0.083)	0.57	-0.057	(0.065)	0.38	7,936	0.111	0.65	0.68

Table VII
OLS: *Top* status controlling for district

Table contains estimates from regressions of bank outcome variables on a *Top* BHC indicator, a dummy indicating the matching group, and district-quarter fixed effects. The sample is top fifteen BHCs and their matches. Standard deviations of accounting variables are calculated on a rolling basis using eight quarters (forward). Growth is one-year (forward). Tail measures are calculated at the top or bottom 5th percentile. The coefficient on *Top* can be interpreted as the differential impact of being a top-ranked BHC within a district-quarter. Standard errors are clustered by BHC. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Dependent Variable	*Top* Coefficient	Standard Error	*p*-value	N	R-Squared	Sample Mean
Balance Sheet						
RWA Assets (%)	-0.565	(1.491)	0.71	23,943	0.26	71.18
Tier 1 Ratio (%)	-0.421	(0.367)	0.25	23,933	0.16	12.54
NPL (%)	-0.223	(0.157)	0.16	29,544	0.30	1.68
NPL Top Tail	-0.034*	(0.018)	0.06	29,544	0.21	0.06
SD NPL (%)	-0.106***	(0.039)	0.01	23,883	0.35	0.40
Loan Loss Reserves (%)	-0.115	(0.071)	0.11	29,517	0.30	1.72
SD LLR/Loans	-0.013	(0.014)	0.34	23,823	0.30	0.15
Asset Growth (%)	-0.551	(0.782)	0.48	28,460	0.16	11.08
Asset Growth Bottom Tail	-0.039**	(0.017)	0.02	26,550	0.13	0.06
Loan Growth (%)	-0.634	(1.373)	0.65	29,233	0.15	12.65
NPL % by Loan Type						
Residential RE	-0.289*	(0.160)	0.07	29,366	0.29	1.41
Commercial RE	-0.680*	(0.378)	0.07	29,412	0.37	2.38
C&I	-0.093	(0.143)	0.52	29,045	0.24	1.67
Consumer	0.061	(0.060)	0.31	26,047	0.18	0.59
Earnings						
ROA (%)	-0.015	(0.046)	0.75	28,946	0.27	0.95
ROA Bottom Tail	-0.011	(0.012)	0.349	29,544	0.20	0.05
SD ROA	-0.147**	(0.064)	0.02	23,755	0.19	0.47
SD ROA Top Tail	-0.019	(0.020)	0.328	24,350	0.15	0.07
Sharpe Ratio of ROA	1.280**	(0.585)	0.03	23,599	0.22	7.40
Log Z-Score	0.223**	(0.101)	0.03	23,530	0.22	3.76
Stock Market						
Market Cap/Equity	0.175***	(0.052)	0.00	21,050	0.55	1.64
Excess Return (%)	0.001	(0.005)	0.77	20,408	0.41	0.01
SD Daily Return	-0.002***	(0.001)	0.00	20,891	0.67	0.02
Sharpe Ratio	0.003	(0.004)	0.36	21,154	0.51	0.04
Bottom Return Decile	-0.028*	(0.016)	0.072	20,840	0.15	0.09

Table VIII
OLS: *Top* status and earnings volatility controlling for district

Table contains estimates from regressions of bank outcome variables on a *Top* BHC indicator, a dummy indicating the matching group, and district-quarter fixed effects. The sample is top fifteen BHCs and their matches. Tail risk indicators are based on being in the top or bottom 5th percentile of the full sample over the entire time period. Standard deviations of accounting variables are calculated on a rolling basis using eight quarters (forward). For further details on variable construction see the Data Appendix. The coefficient on *Top* can be interpreted as the differential impact of being a top-ranked BHC within a district-quarter. Standard errors are clustered by BHC. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Dependent Variable	*Top* Coefficient	Standard Error	*p*-value	N	R-Squared	Sample Mean
Earnings Volatility						
SD NIM/Assets	-0.006*	(0.003)	0.09	23,687	0.15	0.05
SD Nonint. Income/Assets	-0.017***	(0.007)	0.01	23,916	0.13	0.06
SD LLP/Assets	-0.012*	(0.007)	0.09	23,945	0.29	0.07
SD NIE less Comp. & FA/Assets	-0.004	(0.010)	0.69	23,816	0.12	0.07
Discretionary Earnings						
|Disc. LLP %|	-0.008**	(0.004)	0.05	27,977	0.21	0.06
|Disc. Security Gains|	-0.002*	(0.001)	0.08	25,101	0.14	0.01
Discretionary Earnings	-0.002	(0.003)	0.47	23,995	0.11	0.00
|Disc. Earnings|	-0.003	(0.002)	0.29	23,995	0.22	0.04

Table IX
OLS: *Top* status, governance, and supervisory tools controlling for district

Table contains estimates from regressions of bank outcome variables on a *Top* BHC indicator, a dummy indicating the matching group, and district-quarter fixed effects. The sample is top fifteen BHCs and their matches. For further details on variable construction see the Data Appendix. The coefficient on *Top* can be interpreted as the differential impact of being a top-ranked BHC within a district-quarter. Standard errors are clustered by BHC. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Dependent Variable	*Top* Coefficient	Standard Error	*p*-value	N	R-Squared	Sample Mean
Off-Balance Sheet						
Net Securitiz. Inc./Assets	-0.000	(0.001)	0.73	29,544	0.08	0.00
Unused Commitments/Assets	0.003**	(0.001)	0.03	29,544	0.10	0.02
Non-interest Inc./Assets	0.021	(0.025)	0.40	29,124	0.14	0.33
Governance						
Risk Committee	-0.033	(0.094)	0.73	7,206	0.28	0.26
Risk Manager	0.030	(0.097)	0.76	7,206	0.29	0.46
Supervisory						
Total MRA/MRIAs	-0.370	(2.022)	0.86	8,163	0.07	3.16
New MRA/MRIAs	0.059	(0.482)	0.90	8,163	0.12	0.68
Closed MRA/MRIAs	0.493	(0.311)	0.11	8,163	0.06	0.42
Enforcement Actions	0.095	(0.084)	0.26	29,544	0.16	0.27
Rating	0.006	(0.059)	0.92	29,483	0.29	1.82
Rating Change Dummy	-0.004	(0.006)	0.47	29,483	0.09	0.03

Table X
2SLS: *Top* as an instrument for supervisory hours, 2006-2014

Table contains estimates from two-stage least squares regressions of various dependent variables on log of supervisory hours where the instrument is the *Top* BHC indicator. Controls include log assets, log entities, asset share by charter type, loans/assets, deposits/liabilities, HHI of assets, a public indicator, and deposit market share (see Table II, Column 2). Includes quarter fixed effects. Sample is 2006:Q1-2014Q4 BHCs excluding BHCs larger than the largest non-*Top* bank (consistent with the sample in Table III Columns 4-6). For details on variable construction see the Data Dictionary. F-Stats are tests for weak instruments. Standard errors are clustered by BHC. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Dependent Variable	*log(hours)* Coefficient	Standard Error	*F*-statistic	N	Sample Mean
Balance Sheet					
RWA Assets (%)	1.23	(1.09)	29.63	14,617	73.47
Tier 1 Ratio (%)	-0.92**	(0.46)	29.58	14,615	12.77
NPL (%)	-0.75*	(0.39)	29.63	14,617	2.49
SD NPL (%)	-0.11	(0.09)	22.62	10,324	0.7
Loan Loss Reserves (%)	-0.04	(0.11)	29.62	14,612	1.74
SD LLR/Loans	-0.00	(0.03)	21.36	10,419	0.22
Asset Growth (%)	-0.68	(1.24)	29.83	14,524	8.29
Loan Growth (%)	-0.90	(1.40)	29.83	14,524	7.96
NPL % by Loan Type					
Residential RE	-0.62	(0.38)	29.80	14,509	2.17
Commercial RE	-0.85	(0.54)	29.61	14,582	3.25
C&I	-0.56**	(0.25)	28.27	14,465	1.68
Consumer	0.09	(0.17)	23.31	10,797	0.62
Earnings					
ROA (%)	0.01	(0.07)	30.86	14,105	0.66
SD ROA	-0.37**	(0.19)	19.82	10,346	0.76
Sharpe Ratio of ROA	1.87*	(1.11)	21.98	10,286	4.08
Log Z-Score	0.40*	(0.24)	20.90	10,092	3.31
Stock Market					
Market Cap/Equity	-0.04	(0.08)	27.09	7,601	1.25
Excess Return (%)	-0.00	(0.00)	27.65	7,281	0.0
SD Daily Return	-0.00	(0.00)	26.41	7,518	0.03
Sharpe Ratio	-0.00	(0.00)	26.78	7,757	0.02
Bottom Return Decile	0.00	(0.02)	28.17	7,630	0.10

Internet Appendix for "The Impact of Supervision on Bank Performance"

BEVERLY HIRTLE, ANNA KOVNER, and MATTHEW PLOSSER[1]

[1]Citation format: Hirtle, Beverly, Anna Kovner, and Matthew Plosser, Internet Appendix for "The Impact of Supervision on Bank Performance," *Journal of Finance* [DOI STRING]. Please note: Wiley-Blackwell is not responsible for the content or functionality of any supporting information supplied by the authors. Any queries (other than missing material) should be directed to the authors of the article.

Appendix A. Data dictionary

VARIABLE	DEFINITION	SOURCE	TIME PERIOD
Balance Sheet:			
Log(Assets)	Log of total assets (BHCK2170).	FR-Y9C	1991Q1- 2014Q4
Loans/Assets (%)	Percentage ratio of total loans (BHCK2122) to total assets (BHCK2170).	FR-Y9C	1991Q1- 2014Q4
Deposit/Liabilities (%)	Percentage ratio of deposits (BHDM6631 + BHDM6636 + BHFN6631 + BHFN6636) to total liabilities (BHCK2948).	FR-Y9C	1991Q1- 2014Q4
HHI of Assets	HHI of credit card loans (BHCKB538), residential real estate loans (BHDM5367 + BHDM5368 + BHDM1797), commercial real estate loans (BHCKf158 + BHCKf159 + BHDM1460 + BHCKf160 + BHCKf161), commercial and industrial loans (BHCK1763 + BHCK1764), investment securities (BHCK1754 + BHCK1773), and trading assets (BHCK3545).	FR-Y9C	1991Q1- 2014Q4
RWA Assets (%)	Percentage of risk weighted assets (BHCAA223) to total assets (BHCK2170).	FR-Y9C	1996Q1- 2014Q4
Tier 1 Ratio (%)	Percentage of Tier 1 Capital (BHCA8274) to risk weighted assets (BHCAA223).	FR-Y9C	1996Q1- 2014Q4
NPL (%)	Percentage ratio of non-performing loans (BHCK5525 + BHCK5526 - BHCK3506 - BHCK3507) to total loans (BHCK2122).	FR-Y9C	1991Q1- 2014Q4
NPL Top Tail	Indicator for top 5th percentile of NPL (%) over the entire period.	FR-Y9C	1991Q1- 2014Q4
SD NPL (%)	Standard deviation of the % ratio of non-performing loans to total loans over the next 8 quarters. Trimmed at top and bottom 1%.	FR-Y9C	1991Q1- 2014Q4
Loan Loss Reserves (%)	Percentage ratio of loan loss reserves (BHCK3123) to total loans (BHCK2122).	FR-Y9C	1991Q1- 2014Q4
SD LLR/Loans	Standard deviation of the % ratio of loan loss reserves to total loans over the next 8 quarters. Trimmed at top and bottom 1%.	FR-Y9C	1991Q1- 2013Q4

VARIABLE	DEFINITION	SOURCE	TIME PERIOD
Asset Growth (%)	Percentage year over year total asset (BHCK2170) growth. Trimmed at top and bottom 1%.	FR-Y9C	1991Q1- 2014Q4
Asset Growth Bottom Tail	Indicator for bottom 5th percentile of Asset Growth (%) over the entire period.	FR-Y9C	1991Q1- 2014Q4
Loan Growth (%)	Percentage year over year total loan (BHCK2122) growth. Trimmed at top and bottom 1%.	FR-Y9C	1991Q1- 2014Q4
NPL by Loan Types:			
Residential RE	Percentage ratio of non-performing residential real estate loans (BHCK5399 + BHCKC237 + BHCKC239 + BHCK5400 + BHCKC229 + BHCKC230) to total residential real estate loans (BHDM5367 + BHDM5368 + BHDM1797). Exclude BHCs where the category is <1% of total loans.	FR-Y9C	1991Q1- 2014Q4
Commercial RE	Percentage ratio of non-performing commercial real estate loans (BHCKF174 + BHCKF175 + BHCKF176 + BHCKF177 + BHCK3500 + BHCK3501 + BHCKF180 + BHCKF181 + BHCKF182 + BHCKF183) to total commercial real estate loans (BHCKf158 + BHCKf159 + BHDM1460 + BHCKf160 + BHCKf161). Exclude BHCs where the category is <1% of total loans.	FR-Y9C	1991Q1- 2014Q4
C&I	Percentage ratio of non-performing commercial and industrial loans (BHCK1607 + BHCK1608) to total commercial and industrial loans (BHCK1763 + BHCK1764). Exclude BHCs where the category is <1% of total loans.	FR-Y9C	1991Q1- 2014Q4
Consumer	Percentage ratio of non-performing consumer loans (BHCKB576 + BHCKK214 + BHCKK217 + BHCKB577 + BHCKK218 + BHCKK215) to total consumer loans (BHCKB538 + BHCKB539 + BHCKK137 + BHCKK207). Exclude BHCs where the category is <1% of total loans.	FR-Y9C	1991Q1- 2014Q4
Structure:			
Log(Entities)	Log of the total number of subsidiaries.	FR-Y6, FR-Y10	1991Q1- 2014Q4
% SMB >$10b) Assets	Share of assets of state member bank subsidiaries for state member banks that are above $10B.	FR-Y6, FR-Y10, Call Report, FR-Y9C	1991Q1- 2014Q4
% SMB (≤$10b) Assets	Share of assets of state member bank subsidiaries for state member banks that are below $10B.	FR-Y6, FR-Y10, Call Report, FR-Y9C	1991Q1- 2014Q4

VARIABLE	DEFINITION	SOURCE	TIME PERIOD
% National Bank Assets	Share of assets in a national bank.	FR-Y6, FR-Y10, Call Report, FR-Y9C	1991Q1- 2014Q4
Public	Indicator for publicly traded bank.	FRBNY - PERMCO Match	1991Q1- 2014Q4
Deposit Market Share	Weighted average share of deposits in counties, weighted by BHC deposit levels in each county (BHCK2170).	Summary of Deposits	1991Q1- 2014Q4
Earnings:			
ROA (%)	Annualized percentage ratio of net income (BHCK4340) to total assets (BHCK2170). Trimmed at top and bottom 1%.	FR-Y9C	1991Q1- 2014Q4
ROA Bottom Tail	Indicator for bottom 5th percentile of ROA (%) over the entire period.	FR-Y9C	1991Q1- 2014Q4
ROA LTM (%)	Average ROA (%) of past four quarters.	FR-Y9C	1991Q1- 2014Q4
SD ROA	Standard deviation of ROA over the next 8 quarters. Trimmed at top and bottom 1%.	FR-Y9C	1991Q1- 2014Q4
SD ROA Top Tail	Indicator for top 5th percentile of SD ROA (%) over the entire period.	FR-Y9C	1991Q1- 2014Q4
Sharpe Ratio of ROA	Ratio of the next 8 quarters' average of return on assets to the standard deviation of the next 8 quarter's return on assets. Trimmed at top and bottom 1%.	FR-Y9C	1991Q1- 2014Q4
Log Z-Score	Z-Score is defined as the ratio of the sum of the average of the next 8 quarters' return on assets and the average of the next 8 quarters' ratio of equity BHCK3210+BHCK3000) to assets (BHCK2170) to the standard deviation of the next 8 quarters' return on assets. Trimmed at top and bottom 1%.	FR-Y9C	1991Q1- 2014Q4
Stock Market:			
Market Cap/ Equity	Ratio of the product of stock price(PRC) and shares outstanding (SHROUT) to book equity (BHCK3210 + BHCK3000). Trimmed at top and bottom 1%.	CRSP, FR-Y9C	1991Q1- 2014Q4
Excess Return (%)	Excess return based on a 3-Factor model (Market, SMB, HML). Betas calculated using daily returns over rolling 12 month period. Trimmed at top and bottom 1%.	CRSP, Ken French's Website	1991Q1- 2014Q4
SD Daily Return	Standard deviation of daily returns in a quarter. Trimmed at top and bottom 1%.	CRSP	1991Q1- 2014Q4
Sharpe Ratio	Defined as next quarter's ratio of the average daily return subtracted by the risk free rate to the standard deviation of daily excess return. Trimmed at top and bottom 1%.	CRSP, Ken French's Website	1991Q1- 2014Q4

VARIABLE	DEFINITION	SOURCE	TIME PERIOD
Bottom Return Decile	Indicator that is equal to 1 if the observation's value of quarterly excess return is in the quarter's bottom 10th percentile.	CRSP, Ken French's Website	1991Q1- 2014Q4
Earnings Volatility:			
SD NIM/Assets	The standard deviation of the percentage of net interest income (BHCK4074) to total assets (BHCK2170) over the next 8 quarters. Trimmed at top and bottom 1%.	FR-Y9C	1991Q1- 2013Q4
SD Nonint. Income/Assets	The standard deviation of the percentage of noninterest income (BHCK4079) to total assets (BHCK2170) over the next 8 quarters. Trimmed at top and bottom 1%.	FR-Y9C	1991Q1- 2013Q4
SD LLP/Assets	The standard deviation of the percentage of loan loss provision (BHCK4230) to total assets (BHCK2170) over the next 8 quarters. Trimmed at top and bottom 1%.	FR-Y9C	1991Q1- 2013Q4
SD NIE less Comp. and FA/Assets	The standard deviation of the percentage noninterest expense less compensation and fixed assets (BHCK4093-BHCK4135-BHCK4217) to total assets (BHCK2170) over the next 8 quarters. Trimmed at top and bottom 1%.	FR-Y9C	1991Q1- 2013Q4
|Disc. LLP %|	The absolute value of the discretionary loan loss provision. Discretionary LLP is calculated as the residual from a regression of loan loss provisions to average loans (BHCK2122) on district-quarter fixed effects, the change in non-performing loans (BHCK5525+BHCK5526-BHCK3506-BHCK3507) to loans, the change in net charge offs (BHCK4635-BHCK4605) to loans, and the level of loan loss reserves (BHCK3123) to loans.	FR-Y9C	1991Q1- 2014Q4
|Disc. Security Gains|	The absolute value of the discretionary realized security gains/losses. Discretionary gains/losses calculated as the residual from a regression of realized securities gains/losses (BHCK3521 + BHCK3196) over average assets (BHCK2170) on quarter fixed effects and the unrealized gains/losses on AFS securities (BHCKA221) over average assets.	FR-Y9C	1994Q1- 2014Q4
|Disc. Earnings|	Absolute value of the sum of discretionary realized security gains/losses and discretionary loan loss provisions (normalized by assets).	FR-Y9C	1994Q1- 2014Q4
Discretionary Earnings	Sum of discretionary realized security gains/losses and discretionary loan loss provisions (normalized by assets).	FR-Y9C	1994Q1- 2014Q4

Appendix B. Tables and Figures

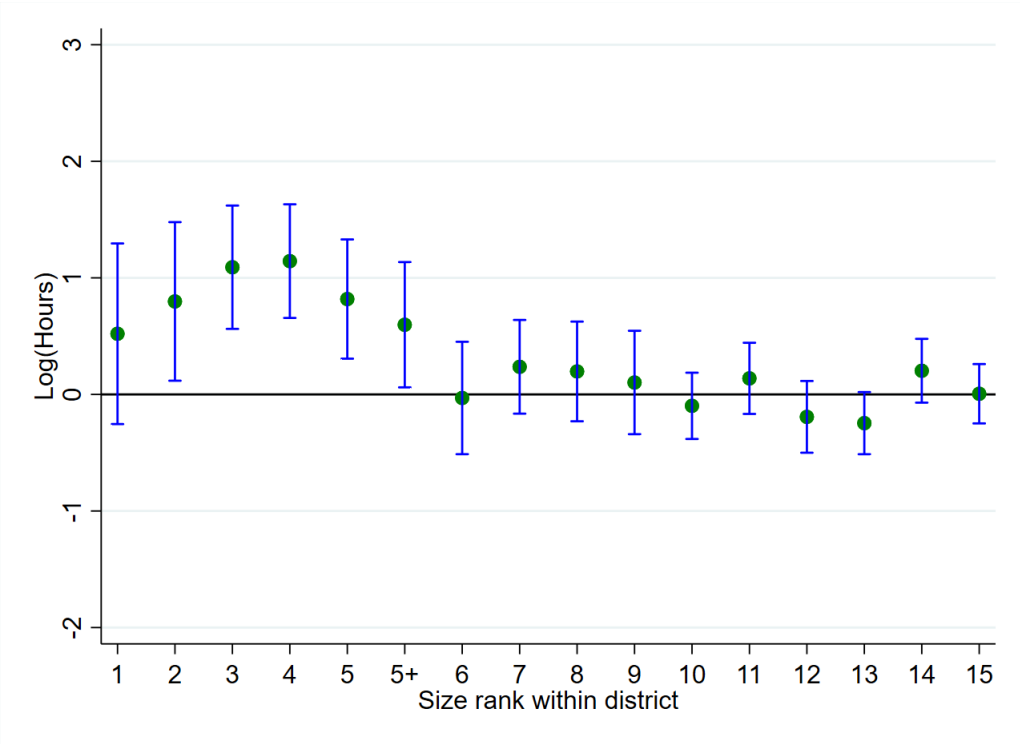


Figure IA1. Variation in supervisory hours by size rank with 5+ category and district-quarter fixed effects

Plots the average excess log(hours) based on the size rank of a bank within a district. Excess hours are conditional on the benchmark model of log hours including district-quarter fixed effects (Table II, Column 7). Rank dummies are included in the benchmark model to estimate the average excess hours for each rank. Circles signify the value of the coefficient on rank dummies 1 through 15 and the 5+ category. The 5+ category includes banks ranked 6-15 but within 25% of the asset size of the fifth ranked bank in their district. Banks included in 5+ are excluded from rank categories 6 through 15. Lines illustrate 95% confidence intervals based on the standard errors of the coefficients.

Table IAI
OLS: Log of supervisory hours on top five rank indicator

Table contains results from regressions of the log of supervisory hours on bank-level determinants of supervisory activity and an indicator for top ranked BHCs. Observations are BHC-quarters from 2006Q1 to 2014Q4. *Top Five* BHCs are those within the top five in a Reserve Bank district-quarter based on assets. Size controls include log of assets, log of legal entities, SMB shares (<$10bn and >$10bn), National bank share, and a public indicator. Business controls include loan-to-assets, deposit-to liabilities, HHI of assets, and deposit-based market share. Performance controls include ROA, asset growth, Tier 1 ratio, NPL share, and the s.d. of ROA. Rating controls include an indicator for the most recent CAMELs rating. Columns 4, 5, and 6 exclude banks that are larger than the largest non-treatment bank. Column 7 further excludes District 2 banks. Columns 8 and 9 include only banks ranked in the Top 15. Columns 1-5, 7 and 8 include quarter fixed effects. Column 5 uses a best-fit fractional polynomial in assets (and excludes log of assets from size controls). Columns 6 and 9 include district-quarter fixed effects. Standard errors are clustered by BHC. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

				Ex. Large			Ex. Large & 2nd District	Top 15 Only	
Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
Top Five	1.032***	1.141***	1.184***	1.169***	0.770***	0.763***	0.933***	0.850***	0.889***
	(0.20)	(0.18)	(0.18)	(0.18)	(0.20)	(0.17)	(0.17)	(0.17)	(0.17)
Top 15			0.352***	0.327***	0.502***	0.001	0.113		
			(0.11)	(0.11)	(0.12)	(0.10)	(0.10)		
Controls:									
Size & Charter	Yes	Yes	Yes	Yes	Ex. Assets	Yes	Yes	Yes	Yes
Business	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Performance	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Rating	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Asset Polynomial	No	No	No	No	Yes	No	No	No	No
Fixed Effects:									
Quarter	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No
District-Quarter	No	No	No	No	No	Yes	No	No	Yes
Observations	14,909	13,489	13,489	13,361	13,361	13,361	12,559	4,382	4,382
R-squared	0.48	0.54	0.54	0.52	0.53	0.56	0.54	0.57	0.63

Table IAII
Top BHCs and full sample prior to matching

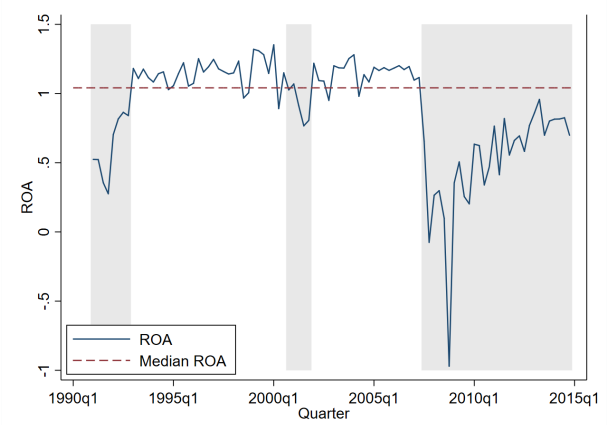
Table compares sample means between the *Top* BHCs (treatment) and their matches. *Top* BHCs are those within the top five in a Reserve Bank district-quarter based on assets or within 25% of the top five. Matching chooses the two nearest neighbor for each treatment observation based on the listed control variables (rows 1-9). The difference in means is the treatment less the matches. p-values are calculated using standard errors clustered by BHC. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	***Top* Ranked**				**Remaining Sample**					
Variables	**Mean**	**Median**	**SD**	**N**	**Mean**	**Median**	**SD**	**N**	**Δ Means**	***p*-value**
Log(Assets)	16.71	16.62	1.28	4,835	13.75	13.6	0.9	55,355	2.95***	0.00
Log(Entities)	3.73	3.58	1.23	4,707	1.47	1.39	0.89	54,290	2.26***	0.00
% SMB (>$10B) Assets	9.15	0.00	27.45	4,835	0.23	0.00	4.65	55,355	8.92***	0.00
% SMB (≤$10B) Assets	4.77	0.00	18.04	4,835	14.19	0.00	33.45	55,355	-9.43***	0.00
% National Bank Assets	40.96	16.49	43.70	4,835	26.28	0.00	41.30	55,355	14.68***	0.00
Loans/Assets (%)	62.70	65.12	12.08	4,835	64.89	66.26	12.26	55,355	-2.18**	0.05
Deposits/Liabilities (%)	81.43	82.33	9.65	4,835	88.89	90.90	8.60	55,355	-7.46***	0.00
HHI of Assets	0.17	0.16	0.07	4,835	0.22	0.21	0.09	55,353	-0.05***	0.00
Public	0.86	1.00	0.34	4,835	0.43	0.00	0.49	55,355	0.44***	0.00
Deposit Market Share	0.18	0.18	0.07	4,781	0.16	0.14	0.13	52,926	0.02**	0.01
District Rank	3.68	4.00	1.84	4,835	41.35	34.00	29.93	55,355	-37.67***	0.00

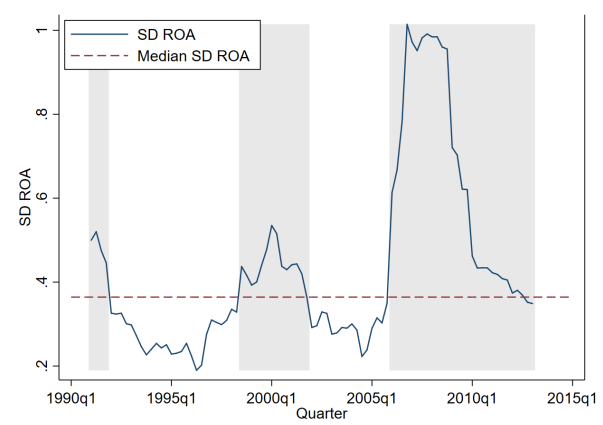
Table IAIII
Top fifteen BHCs and matches

Table compares sample means between the top fifteen BHCs (treatment) and their matches. Top fifteen BHCs are those within the top fifteen in a Reserve Bank district-quarter based on assets. Matching chooses the two nearest neighbors for each treatment observation based on the listed control variables (rows 1-9). The difference in means is the treatment less the matches. p-values are calculated using standard errors clustered by BHC. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

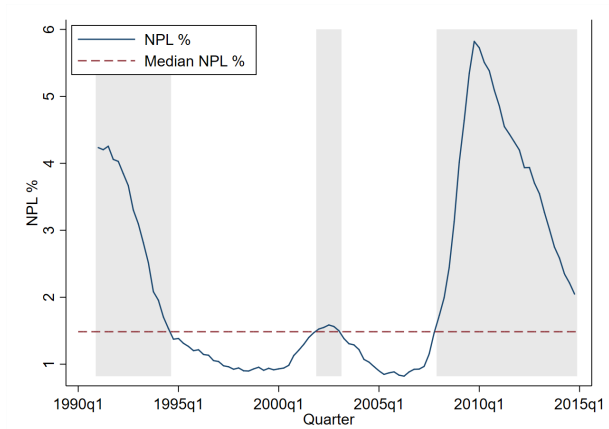
	Top 15				**Matches**					
Variables	**Mean**	**Median**	**SD**	**N**	**Mean**	**Median**	**SD**	**N**	**Δ Means**	***p*-value**
Log(Assets)	0.17	0.16	0.11	9,848	0.17	0.2	0.1	19,696	0.004	0.52
Log(Entities)	15.15	15.03	0.93	9,848	15.16	15.04	0.96	19,696	-0.01	0.84
% SMB (>$10B) Assets	2.44	2.40	0.88	9,848	2.46	2.40	0.93	19,696	-0.03	0.66
% SMB (≤$10B) Assets	1.76	0.00	12.74	9,848	1.63	0.00	12.22	19,696	0.13	0.87
% National Bank Assets	13.91	0.00	32.30	9,848	14.83	0.00	33.02	19,696	-0.92	0.53
Loans/Assets (%)	31.61	0.00	42.38	9,848	31.43	0.00	42.45	19,696	0.18	0.94
Deposits/Liabilities (%)	63.74	65.86	12.19	9,848	64.10	65.91	11.16	19,696	-0.37	0.59
HHI of Assets	85.52	87.55	9.13	9,848	85.26	87.22	9.40	19,696	0.25	0.65
Public	0.20	0.19	0.08	9,848	0.20	0.19	0.08	19,696	-0.0005	0.92
Deposit Market Share	0.72	1.00	0.45	9,848	0.73	1.00	0.44	19,696	-0.01	0.79
District Rank	9.27	10.00	4.03	9,848	15.69	13.00	9.51	19,696	-6.42***	0.00



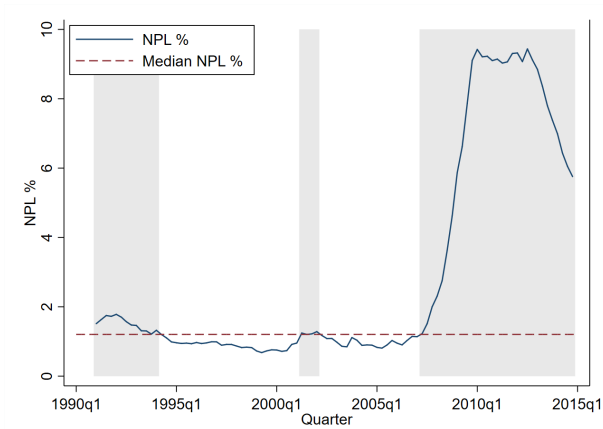
(a) ROA



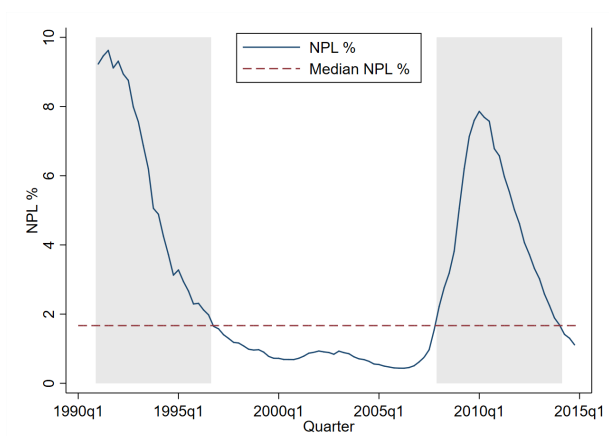
(b) Std. Dev. ROA



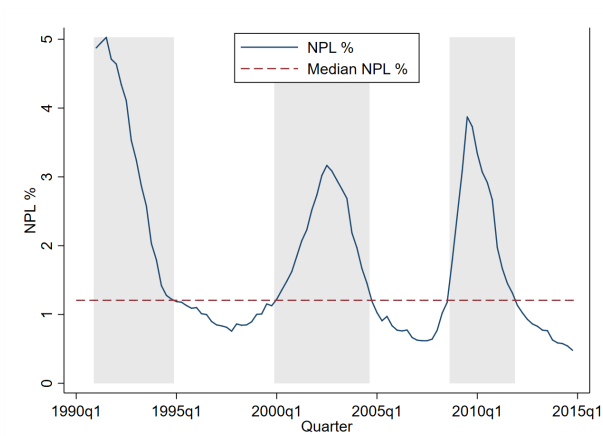
(c) Total NPL %



(d) RRE NPL %



(e) CRE NPL %



(f) C&I NPL %

Figure IA2. Industry time series and defined downturn periods

Plots the industry performance of key variables over time with shading indicating the periods defined as downturns. Industry downturns for each variable are defined using industry aggregates where a downturn quarter is determined by whether its symmetric 5Q moving window has at least three quarters that are above (or below in the case of ROA) the median.

Table IAIV
OLS: *Top* status excluding the Second district

Table contains estimates from regressions of bank outcome variables on a *Top* BHC indicator, a dummy indicating the matching group, and district-quarter fixed effects. The sample is top fifteen BHCs and their matches, as in Table VII, but excludes Banks in the Second District. For further details on variable construction see the Data Appendix. The coefficient on *Top* can be interpreted as the differential impact of being a top-ranked BHC within a district-quarter. Standard errors are clustered by BHC. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Dependent Variable	*Top* Coefficient	Standard Error	*p*-value	N	R-Squared	Sample Mean
Balance Sheet						
RWA Assets (%)	0.086	(1.402)	0.951	21,280	0.26	72.07
Tier 1 Ratio (%)	-0.822**	(0.347)	0.018	21,272	0.16	12.42
NPL (%)	-0.099	(0.125)	0.429	26,327	0.30	1.63
NPL Top Tail	-0.027*	(0.016)	0.091	26,327	0.24	0.05
SD NPL (%)	-0.106***	(0.041)	0.009	21,419	0.35	0.4
Loan Loss Reserves (%)	-0.149**	(0.062)	0.017	26,306	0.29	1.74
SD LLR/Loans	-0.015	(0.014)	0.299	21,317	0.30	0.15
Asset Growth (%)	-1.274	(1.252)	0.309	26,071	0.11	12.44
Asset Growth Bottom Tail	-0.028*	(0.016)	0.084	23,728	0.14	0.06
Loan Growth (%)	0.140	(1.238)	0.910	26,071	0.14	12.54
NPL % by Loan Type						
Residential real estate	-0.002	(0.099)	0.981	26,189	0.31	1.31
Commercial real estate	-0.812**	(0.403)	0.045	26,276	0.36	2.32
C&I	0.007	(0.104)	0.949	26,191	0.25	1.6
Consumer	0.064	(0.054)	0.236	23,733	0.32	0.57
Earnings						
ROA (%)	-0.006	(0.048)	0.900	25,799	0.28	0.95
ROA Bottom Tail	-0.007	(0.013)	0.591	26,327	0.21	0.05
SD ROA	-0.125*	(0.066)	0.060	21,294	0.22	0.47
SD ROA Top Tail	-0.012	(0.021)	0.560	21,833	0.17	0.07
Sharpe Ratio of ROA	0.864	(0.578)	0.135	21,108	0.24	7.47
Log Z-Score	0.187*	(0.105)	0.075	21,095	0.24	3.77
Stock Market						
Market Cap/Equity	0.168***	(0.052)	0.001	18,535	0.56	1.63
Excess Return (%)	0.002	(0.006)	0.711	17,898	0.41	0.01
SD Daily Return	-0.002***	(0.001)	0.008	18,361	0.66	0.02
Sharpe Ratio	0.005	(0.004)	0.231	18,590	0.51	0.04
Bottom Return Decile	-0.022	(0.018)	0.225	18,301	0.15	0.1

Table IAV
OLS: *Top* status during industry downturns controlling for district

Table contains estimates from regressions of bank outcome variables on a *Top* BHC indicator and an interaction between *Top* status and dummy indicating an industry downturn in the dependent variable as well as a dummy indicating the matching group, and district-quarter fixed effects. The interaction coefficient estimates the differential performance of *Top* banks during downturns. The sample is top fifteen BHCs and their matches as described in Table IAIII. *Top* BHCs are those within the top five in a Reserve Bank district-quarter based on assets or within 25% of the top five. Industry downturns for each variable are defined using industry aggregates where a downturn is defined for a quarter if its symmetric 5Q moving window has at least three quarters that are above (or below) the median. Examples of these designations can be found in Figure IA2. Standard deviations of accounting variables are calculated on a rolling basis using eight quarters (forward). Further details on variable construction can be found in the Data Appendix. p-values are calculated using standard errors clustered by BHC. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

									Sample Mean	
Dependent Variable	***Top* Coefficient**	**Standard Error**	***p*-value**	***Top* × Downturn Coefficient**	**Standard Error**	***p*-value**	**N**	**R-Squared**	**Full**	**Downturn**
ROA (%)	-0.033	(0.043)	0.45	0.042	(0.074)	0.58	28,946	0.27	0.95	0.71
SD ROA	-0.095**	(0.041)	0.02	-0.10	(0.113)	0.38	23,755	0.19	0.47	0.64
NPL (%)	-0.026	(0.064)	0.69	-0.38	(0.271)	0.16	29,544	0.30	1.68	2.50
RRE NPL (%)	-0.017	(0.082)	0.84	-0.527**	(0.264)	0.05	29,470	0.30	1.42	2.06
CRE NPL (%)	0.092	(0.074)	0.22	-1.392**	(0.663)	0.04	29,502	0.37	2.38	3.88
C&I NPL (%)	-0.005	(0.084)	0.95	-0.19	(0.254)	0.45	29,428	0.24	1.67	2.20
Consumer NPL (%)	0.155**	(0.077)	0.04	-0.03	(0.117)	0.82	29,530	0.08	0.65	0.63

Table IAVI
Summary statistics for alternative top-ranked sample and matches

Table compares sample means between the *Top* BHCs (treatment) and their matches. *Top* BHCs are those within the top five in a Reserve Bank district-quarter based on assets or within 25% of the top five. Matching chooses the two nearest neighbor for each treatment observation based on the listed control variables (rows 1-13). ROA is the average of the last four quarters and asset growth is the annual growth rate over the past year. The difference in means is the treatment less the matches. p-values are calculated using standard errors clustered by BHC. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	***Top* Ranked**				**Matches**					
Variables	**Mean**	**Median**	**SD**	**N**	**Mean**	**Median**	**SD**	**N**	**Δ Means**	***p*-value**
Log(Assets)	16.16	16.17	0.76	2,228	16.19	16.2	0.8	4,456	-0.04	0.78
Log(Entities)	3.17	3.22	0.73	2,228	3.23	3.18	0.77	4,456	-0.06	0.59
% SMB (>$10B) Assets	5.41	0.00	21.85	2,228	6.19	0.00	23.54	4,456	-0.78	0.80
% SMB (≤$10B) Assets	6.37	0.00	20.78	2,228	6.64	0.00	22.06	4,456	-0.27	0.90
% National Bank Assets	44.08	18.02	45.08	2,228	44.64	21.12	45.41	4,456	-0.56	0.94
Loans/Assets (%)	62.04	63.95	11.61	2,228	62.93	65.05	9.27	4,456	-0.89	0.61
Deposits/Liabilities (%)	83.52	84.79	8.77	2,228	82.32	84.35	10.13	4,456	1.19	0.47
HHI of Assets	0.18	0.17	0.05	2,228	0.18	0.17	0.07	4,456	0.00	0.97
Public	1.00	1.00	0.00	2,228	1.00	1.00	0.00	4,456	0.00	0.00
Deposit Market Share	0.17	0.17	0.08	2,228	0.16	0.16	0.09	4,456	0.01	0.53
Market Cap/Equity	1.72	1.60	0.73	2,228	1.74	1.55	0.83	4,456	-0.02	0.80
ROA LTM (%)	0.98	1.08	0.68	2,228	1.00	1.13	0.72	4,456	-0.02	0.79
Asset Growth (%)	11.64	7.64	16.75	2,228	12.37	7.81	19.80	4,456	-0.72	0.60
District Rank	4.18	4.00	1.70	2,228	10.24	9.00	4.08	4,456	-6.06***	0.00

Table IAVII
OLS: *Top* status using additional matching criteria

Table contains estimates from regressions of bank outcome variables on a *Top* BHC indicator, a dummy indicating the matching group, and district-quarter fixed effects. The sample is top fifteen BHCs and their matches as described in Table IAVI. Standard deviations of accounting variables are calculated on a rolling basis using eight quarters (forward). Growth variables are are annual. The coefficient on *Top* can be interpreted as the differential impact of being a top-ranked BHC within a district-quarter. Standard errors are clustered by BHC. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Dependent Variable	*Top* Coefficient	Standard Error	*p*-value	N	R-Squared	Sample Mean
Balance Sheet						
RWA Assets (%)	0.257	(2.086)	0.90	7,734	0.20	72.21
Tier 1 Ratio (%)	-0.484	(0.463)	0.30	7,729	0.27	13.12
NPL (%)	-0.484**	(0.236)	0.04	7,734	0.44	2.08
NPL Top Tail	-0.036**	(0.017)	0.04	19,560	0.22	0.04
SD NPL (%)	-0.103***	(0.037)	0.01	15,770	0.40	0.38
Loan Loss Reserves (%)	0.090	(0.086)	0.30	7,734	0.44	1.603
SD LLR/Loans	-0.014	(0.013)	0.28	15,684	0.32	0.15
Asset Growth (%)	0.267	(1.118)	0.81	19,560	0.18	12.62
Asset Growth Bottom Tail	-0.012	(0.014)	0.37	17,529	0.15	0.05
Loan Growth (%)	1.410	(1.169)	0.23	19,560	0.21	12.81
NPL % by Loan Type						
Residential RE	-0.309*	(0.164)	0.06	19,460	0.34	1.35
Commercial RE	-0.614*	(0.370)	0.10	19,535	0.44	2.20
C&I	-0.087	(0.122)	0.47	19,368	0.30	1.57
Consumer	0.091	(0.082)	0.27	17,332	0.18	0.60
Earnings						
ROA (%)	-0.006	(0.047)	0.90	19,292	0.28	0.98
ROA Bottom Tail	-0.013	(0.010)	0.206	19,560	0.195	0.04
SD ROA	-0.064	(0.054)	0.24	15,540	0.23	0.42
SD ROA Top Tail	-0.016	(0.017)	0.343	15,965	0.197	0.06
Sharpe Ratio of ROA	0.375	(0.688)	0.59	15,502	0.29	8.13
Log Z-Score	0.181*	(0.097)	0.06	15,443	0.28	3.86
Stock Market						
Market Cap/Equity	0.059	(0.045)	0.19	19,560	0.59	1.65
Excess Return (%)	-0.002	(0.005)	0.67	18,711	0.40	0.01
SD Daily Return	-0.002***	(0.000)	0.00	19,126	0.67	0.02
Sharpe Ratio	-0.002	(0.004)	0.56	19,304	0.52	0.04
Bottom Return Decile	-0.024*	(0.013)	0.08	19,044	0.15	0.09

Table IAVIII
OLS: *Top* status during industry downturns using additional matching criteria

Table contains estimates from regressions of bank outcome variables on a *Top* BHC indicator and an interaction between *Top* status and dummy indicating an industry downturn in the dependent variable as well as a dummy indicating the matching group, and district-quarter fixed effects. The interaction coefficient estimates the differential performance of *Top* banks during downturns. The sample is top fifteen BHCs and their matches as described in Table IAVI. *Top* BHCs are those within the top five in a Reserve Bank district-quarter based on assets or within 25% of the top five. Industry downturns for each variable are defined using industry aggregates where a downturn is defined for a quarter if its symmetric 5Q moving window has at least three quarters that are above (or below) the median. Examples of these designations can be found in Figure IA2. Standard deviations of accounting variables are calculated on a rolling basis using eight quarters (forward). Further details on variable construction can be found in the Data Appendix. p-values are calculated using standard errors clustered by BHC. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

									Sample Mean	
Dependent Variable	***Top* Coefficient**	**Standard Error**	**p-value**	***Top* × Downturn Coefficient**	**Standard Error**	**p-value**	**N**	**R-Squared**	**Full**	**Downturn**
ROA (%)	-0.025	(0.052)	0.64	0.041	(0.063)	0.51	19,292	0.28	0.98	0.77
SD ROA	-0.078	(0.053)	0.14	0.027	(0.098)	0.78	15,540	0.23	0.42	0.56
NPL (%)	0.084	(0.056)	0.14	-0.554***	(0.198)	0.01	19,560	0.48	1.51	2.18
RRE NPL (%)	0.120	(0.076)	0.12	-0.781***	(0.269)	0.00	19,460	0.35	1.35	1.92
CRE NPL (%)	0.189**	(0.089)	0.03	-1.424**	(0.635)	0.03	19,535	0.45	2.20	3.54
C&I NPL (%)	-0.049	(0.106)	0.65	-0.072	(0.183)	0.69	19,368	0.30	1.57	1.98
Consumer NPL (%)	0.085	(0.064)	0.18	0.015	(0.096)	0.88	17,332	0.18	0.60	0.61

Table IAIX
Additional difference in means between *Top* and matches

Table compares sample means between the *Top* BHCs (treatment) and their matches. *Top* BHCs are those within the top five in a Reserve Bank district-quarter based on assets or within 25% of the top five. Standard deviations of accounting variables are calculated over the an 8Q horizon. Further details on variable construction can be found in the Data Appendix. The difference in means is the treatment less the matches. p-values are calculated using standard errors clustered by BHC. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	***Top* Ranked**				**Matches**					
Variables	**Mean**	**Median**	**SD**	**N**	**Mean**	**Median**	**SD**	**N**	**Δ Means**	**p-value**
Earnings Volatility										
SD NIM/Assets	0.05	0.04	0.03	2,376	0.06	0.04	0.04	4,767	-0.01*	0.07
SD Nonint. Income/Assets	0.06	0.04	0.06	2,431	0.07	0.04	0.08	4,775	-0.01	0.12
SD LLP/Assets	0.05	0.02	0.07	2,428	0.06	0.03	0.10	4,813	-0.02*	0.08
SD NIE less Comp. & FA/Assets	0.06	0.04	0.08	2,388	0.08	0.04	0.13	4,830	-0.01	0.31
Discretionary Earnings										
|Disc. LLP %|	0.05	0.03	0.07	2,848	0.06	0.03	0.08	5,527	-0.004	0.34
|Disc. Security Gains|	0.01	0.01	0.02	2,405	0.02	0.01	0.02	4,789	-0.002*	0.07
Discretionary Earnings	0.00	0.00	0.05	2,340	0.00	0.01	0.06	4,577	0.00	0.91
|Disc. Earnings|	0.03	0.02	0.04	2,340	0.04	0.02	0.05	4,577	-0.004	0.16

Table IAX
OLS: Bank outcomes and supervisory hours, 2006-2014

Table contains estimates from regressions of bank outcome variables on log of supervisory hours and quarter fixed effects. Controls include log assets, log entities, asset share by charter type, loans/assets, deposits/liabilities, HHI of assets, a public indicator, and deposit market share (Table II, Column 2). Sample is 2006:Q1-2014Q4 BHCs excluding BHCs larger than the largest non-*Top* bank (consistent with the samples in Table III Columns 4-6 and the 2SLS analysis in Tables X and IAXI). For details on variable construction see the Data Dictionary. Standard errors are clustered by BHC. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Dependent Variable	*log(hours)* Coefficient	Standard Error	*p*-value	N	R-Squared	Sample Mean
Balance Sheet						
RWA Assets (%)	0.31***	(0.09)	0.00	14,617	0.63	73.47
Tier 1 Ratio (%)	-0.07	(0.07)	0.35	14,615	0.24	12.77
NPL (%)	0.31***	(0.04)	0.00	14,617	0.19	2.49
SD NPL (%)	0.05***	(0.01)	0.00	10,534	0.16	0.80
Loan Loss Reserves (%)	0.07***	(0.01)	0.00	14,612	0.20	1.74
SD LLR/Loans	0.01***	(0.00)	0.00	10,526	0.16	0.24
Asset Growth (%)	-0.76***	(0.12)	0.00	14,524	0.06	8.29
Loan Growth (%)	-0.90***	(0.13)	0.00	14,524	0.13	7.96
NPL % by Loan Type						
Residential RE	0.24***	(0.05)	0.00	14,509	0.12	2.17
Commercial RE	0.38***	(0.04)	0.00	14,582	0.20	3.25
C&I	0.16***	(0.03)	0.00	14,465	0.08	1.68
Consumer	0.04***	(0.01)	0.00	10,797	0.07	0.62
Earnings						
ROA (%)	-0.09***	(0.01)	0.00	14,389	0.18	0.55
SD ROA	0.09***	(0.02)	0.00	10,511	0.15	0.89
Sharpe Ratio of ROA	-0.31***	(0.04)	0.00	10,484	0.21	3.76
Log Z-Score	-0.11***	(0.01)	0.00	10,354	0.23	3.20
Stock Market						
Market Cap/Equity	-0.04***	(0.01)	0.00	7,724	0.42	1.21
Excess Return (%)	-0.00***	(0.00)	0.01	7,462	0.20	-0.01
SD Daily Return	0.00***	(0.00)	0.00	7,616	0.58	0.03
Sharpe Ratio	-0.00**	(0.00)	0.01	7,757	0.39	0.02
Bottom Return Decile	0.01***	(0.00)	0.00	7,630	0.02	0.10

Table IAXI
2SLS: *Top* as an instrument, 2006-2014, controlling for district

Table contains estimates from two-stage least squares regressions of various dependent variables on log of supervisory hours where the instrument is the *Top* BHC indicator. Controls include log assets, log entities, asset share by charter type, loans/assets, deposits/liabilities, HHI of assets, a public indicator, and deposit market share (Table II, Column 2). Includes district-quarter fixed effects. Sample is 2006:Q1-2014Q4 BHCs excluding BHCs larger than the largest non-*Top* bank (consistent with the sample in Table III Columns 4-6). For details on variable construction see the Data Dictionary. F-Stats are tests for weak instruments. Standard errors are clustered by BHC. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Dependent Variable	*log(hours)* Coefficient	Standard Error	*F*-statistic	N	Sample Mean
Balance Sheet					
RWA Assets (%)	1.37	(1.56)	16.74	14,616	73.47
Tier 1 Ratio (%)	-1.39*	(0.78)	16.67	14,614	12.77
NPL (%)	-1.40**	(0.65)	16.74	14,616	2.49
SD NPL (%)	-0.22	(0.16)	11.44	10,324	0.72
Loan Loss Reserves (%)	-0.16	(0.17)	16.76	14,611	1.74
SD LLR/Loans	-0.04	(0.05)	10.32	10,419	0.22
Asset Growth (%)	-2.31	(1.96)	17.31	14,523	8.29
Loan Growth (%)	-1.85	(2.17)	17.31	14,523	8.0
NPL % by Loan Type					
Residential RE	-1.06*	(0.57)	16.88	14,508	2.17
Commercial RE	-1.68*	(0.89)	16.78	14,581	3.25
C&I	-0.99**	(0.44)	15.93	14,464	1.68
Consumer	0.05	(0.30)	11.77	10,796	0.62
Earnings					
ROA (%)	0.04	(0.11)	18.09	14,104	0.66
SD ROA	-0.74*	(0.39)	8.85	10,346	0.76
Sharpe Ratio of ROA	3.47*	(1.96)	10.33	10,286	4.08
Log Z-Score	0.72*	(0.44)	9.59	10,092	3.31
Stock Market					
Market Cap/Equity	-0.13	(0.10)	18.17	7,600	1.25
Excess Return (%)	-0.01*	(0.01)	18.54	7,280	-0.01
SD Daily Return	-0.00	(0.00)	17.60	7,517	0.03
Sharpe Ratio	-0.01	(0.01)	17.29	7,756	0.02
Bottom Return Decile	0.00	(0.02)	18.96	7,629	0.10