Journal of Banking Regulation
https://doi.org/10.1057/s41261-024-00234-1

ORIGINAL ARTICLE

The audit of banks in the USA: Has it changed since the financial crisis?

Paul Tanyi[1] · **Jack Cathey**[1]

Accepted: 20 January 2024

Abstract
The most recent financial crisis exposed to the auditors the risk associated with the audit engagement of their banking clients. Because many banking clients failed and investors suffered trillions of dollars in losses, auditors are now defendants in numerous shareholder and regulatory lawsuits. There is consensus that the financial crisis was created by an abundance of credit, excessive risk taking through complex financial instruments, weak corporate structures, and ineffective regulatory mechanisms. In this study, we examine how the financial crisis has affected the audit engagements of banking clients. We examine audit fees, audit report lag, and auditor changes before and after the financial crisis with respect to specific bank risks like credit risk, interest rate risk, and liquidity. Overall, we find that auditors are more responsive to bank risks in the post-financial crisis period compared to the pre-financial crisis period.

Keywords Bank audits · Bank risks · Audit fees · Audit risks

Introduction

Banks play a number of very important roles in the financial system and the economy at large [12, 14, 16]. They extend credit to businesses to invest in growth and new ventures, thus fueling economic activity. Banks provide derivative products that permit businesses to hedge against interest rate and foreign currency risks [5]. In addition, banks provide brokerage and treasury services to support their customers. However, banking systems around the world and specifically in the USA faced a major crisis at the end of the first decade of the twenty-first century that lasted a number of years. This crisis is considered by many experts to be among the worst economic disasters since the Great Depression of 1929.[1] According to Fig. 1, prepared using bank failure data from the Federal Deposit Insurance Corporation's (FDIC),[2] only 10 banks failed between 2003 and 2007. However, in the period from 2008 to 2015, 515 banks failed. In fact, 297 banks failed

✉ Paul Tanyi
ptanyi@uncc.edu

Jack Cathey
jmcathey@uncc.edu

[1] Belk College of Business, University of North Carolina Charlotte, 262A 9201 University City Blvd, Charlotte, NC 28223, USA

[1] Ben Bernanke, the former head of the Federal Reserve, in a remark confidential testimony Bernanke made to the Financial Crisis Inquiry Commission (FCIC) in November 2009, said, "As a scholar of the Great Depression, I honestly believe that September and October of 2008 was the worst financial crisis in global history, including the Great Depression." (The Financial Crisis Inquiry Report, pg. 354 http://fcic-static.law.stanford.edu/cdn_media/fcic-reports/fcic_final_report_full.pdf).

Jamie Dimon, the CEO of JP Morgan Chase, in a testimony to FCIC about the crisis, said, "We could have survived it in my opinion, but it would have been terrible. I would have stopped lending, marketing, investing... and probably laid off 20,000 people. And I would have done it in three weeks. You get companies starting to take actions like that, that's what a Great Depression is." (The Financial Crisis Inquiry Report, pg. 353 http://fcic-static.law.stanford.edu/cdn_media/fcic-reports/fcic_final_report_full.pdf).

David Jones, a former Federal Reserve economist and the author of *Understanding Central Banking*, said, "The solvency of the whole banking system was in question. This was a crisis that went beyond anything that our academic Fed chair had ever dreamed of," https://money.cnn.com/2014/08/27/news/economy/ben-bernanke-great-depression/index.html

[2] See, https://www.fdic.gov/bank/individual/failed/banklist.html

Published online: 07 March 2024

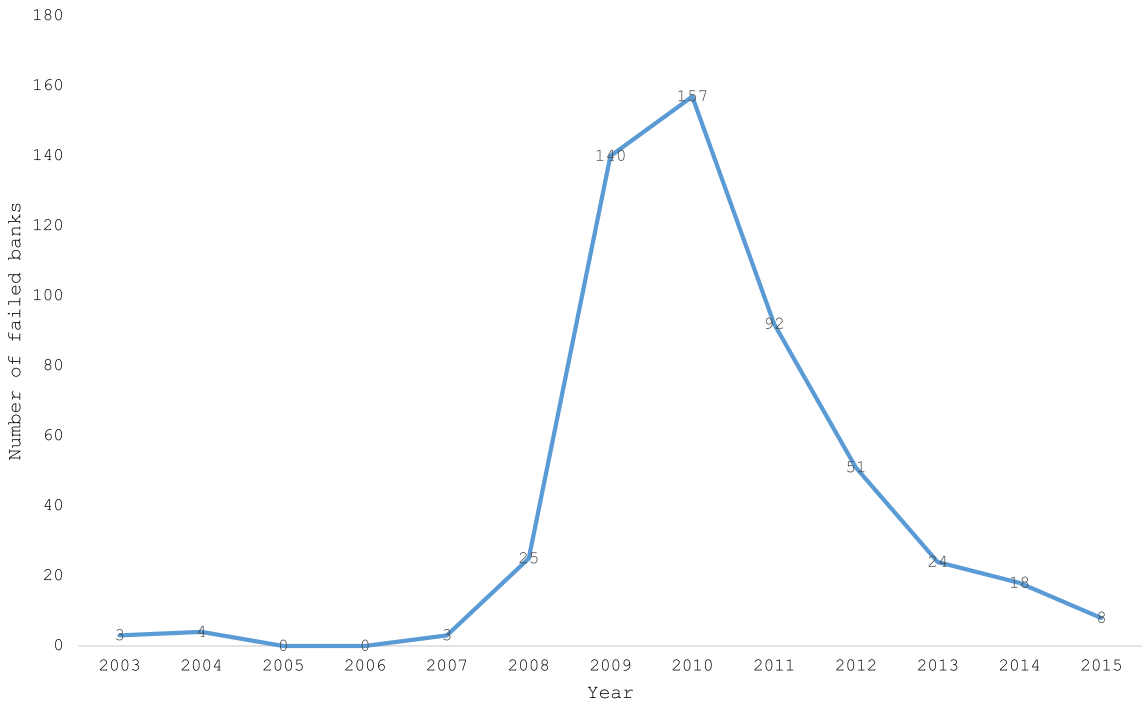

Fig. 1 Number of bank failures between 2003 and 2015 (We create Fig. 1 using the failed banks list from the FDIC website. See the following link: https://www.fdic.gov/bank/individual/failed/banklist.html)

in 2009 and 2010 alone, approximately 58% of the total from the crisis period.

In the aftermath of the financial crisis, US legislators, regulators, and investors have decried poor oversight on the part of independent auditors as one of the contributing factors to the crisis. In opening remarks to US Senate's Subcommittee on Securities, Insurance, and Investment hearings on the role of the accounting profession in preventing another financial crisis, Senator Jack Reed, the subcommittee chair, said, "…serious questions have been raised about the quality of financial reporting practices and about the quality of audits that should have revealed key financial irregularities or the poor status of these companies." [70]. A major criticism of auditors from the hearing was that many of the financial institutions that subsequently failed during the financial crisis received a clean bill of health in the years prior to their failure [6].

Because of this crisis, most of the large public accounting firms in the USA are defendants in significant lawsuits by investors and regulators. In 2010, the former Attorney General of the state of New York, Andrew Cuomo, filed civil-fraud charges against Ernst & Young. It was the first major lawsuit from the collapse of the Wall Street investment bank, Lehman Brothers [29]. Ernst & Young settled the lawsuit in 2015 with the state of New York for $10 million [28]. Ernst & Young also agreed to settle investors' claims for losses associated with the collapse of Lehman for $99 million. In 2011, KPMG settled a lawsuit from investors from its audits of Countrywide Financial Corp, now part of Bank of America, for $24 million [4]. In December 2017, the Federal Deposit Insurance Corporation (FDIC) won a major lawsuit against PricewaterhouseCoopers (PwC), a decision that could cost PwC, the auditor of Colonial Bank Group more than $1 billion in damages (McKenna 2018). The lawsuit was settled in 2019 for $335 million [23]. In 2011, the trustee overseeing the bankruptcy of Taylor, Bean & Whitaker Mortgage Corp. sued Deloitte & Touche LLP, seeking at least $7.6 billion in damages and arguing that the audit firm's "grossly negligent audits" played a role in the lender's collapse. Deloitte & Touche also agreed to pay $149.5 million to the federal government in a settlement over its role in the collapse of Taylor, Bean & Whitaker, which was one of the country's largest mortgage lenders.

Against this backdrop, the goal of this paper is to compare the audit engagements of banks before and after the financial crisis and evaluate, if any, the effects the financial crisis has had on bank audit engagements. We examine engagement pricing, the length of time auditors takes to complete audits, and auditor turnover in the banking sector in pre- and post-financial crisis periods. In addition, we compare these auditor responses relative to specific indicators of bank health (i.e., credit, interest rate, and liquidity risks) in the

pre- and post-financial crisis period. Our sample consists of 1670 bank-year observations over 2004–2015 (excluding the period of economic recession, 2008 to 2010)[3] and with complete data to estimate Office of the Controller of the Currency (OCC)'s bank heath (Canary) ratios. To examine auditor sensitivity to bank risk pre- and post-financial crisis, we estimate an OLS regression model that allows us to control for potential confounding effects in these two periods. We find that audit fees and audit report lag are more positively associated with bank credit and liquidity risks in the post-financial crisis period than in the pre-financial crisis period. We find that there is no difference in the association between audit fees, audit report lag and interest rate risks between the pre- and post-financial crisis periods. We also find that auditor turnovers are more positively associated with poor bank health in the post-financial crisis period than in the pre-financial crisis period. Auditor changes are more positively associated with credit risk, liquidity risk, and interest rate risk in the post-financial crisis period than in the pre-financial crisis period. Overall, our findings suggest auditors are more responsive to the risks associated with bank audits in the post-financial crisis compared to the pre-financial crisis period.

We performed several additional robustness checks. First, we consider auditor type (Big 4 = 1 and Big 4 = 0) and the proportion of total audit fees earned by the audit office from banking clients (High Bank Portfolio = 1 and High Bank Portfolio = 0).[4] Our results are robust with respect to Big 4 audit offices and non-Big 4 audit offices. We show separately that both Big 4 audit and non-Big 4 audit offices are more sensitive to bank risks in the post-financial crisis period compared to the pre-financial crisis period. However, only audit offices with a high banking client portfolio are more sensitive to credit and liquidity risks in the post-financial crisis period compared to the pre-financial crisis period. We also consider alternative Canary ratio measures of credit, liquidity, and interest rate risks and find consistent results. We consider other measures of bank risks examined in prior studies. For example, Doogar et al. [21] use the size of a bank's nonperforming loan portfolio and net charge-offs, which are both related to loan default risk, to examine whether auditors were able to adjust their fees for the risk associated with the audits of banks in the years leading up to the financial crisis. We find that auditors are more responsive to higher nonperforming loan portfolios and net charge-offs in the post-financial crisis period compared to the pre-financial crisis period. Following Chen et al. [13], we examine auditor sensitivity to bank earnings management measured using discretionary loan loss provision pre- and post-financial crisis. We do not find any statistically significant difference in auditor sensitivity to bank earnings management pre- and post-financial crisis. Finally, our results are robust after considering the quality of the bank's corporate governance.

Our findings provide additional insight into whether systemic crises can influence how auditors conduct audits. The call for examining the effect of systemic crises on audit engagements is echoed in Doogar et al. [21] and Chen et al. [13], who argue that auditors are theoretically expected to be both attentive and react to audit risks stemming from contemporary events. However, the extent to which auditors incorporate systemic risks into their audit judgments in practice has not received a lot of attention in the empirical audit literature. Several studies [13, 21, 22] have examined the audits of banks in the period around the financial crisis (see "Appendix 1"). However, these studies examined bank audits either in the period before the financial crisis [21] or after the financial crisis [13, 22] but not both. Doogar et al. [21] find that auditors were already increasing audit fees for their high-risk banking clients as the financial crisis was approaching. Chen et al. [13] document a significant positive association between discretionary loan loss provisions and audit fees during the financial crisis period but not after the crisis. Ettredge et al. [22] document a significant positive association between audit fees and proportions of total assets that are fair-valued using Level 2 or 3 inputs during the period of the crisis. What is missing from the current literature is how the crisis itself has changed the audits of banks. To do so, we compare the pre-crisis period to the post-crisis period.

Second, we also add to the accounting literature by examining how auditors respond to different types of bank risks pre- and post-financial crisis. We show that audit fees and audit report lag are more sensitive to credit and liquidity risks in the post-financial crisis compared to the pre-financial crisis period. However, we do not document any significant effect of the financial crisis on the relationship between audit fees, audit report lag, and interest rate risk. We show that the financial crisis has a significant effect the association between all three bank risks and subsequent auditor turnover.

Third, our findings contribute to the growing literature, e.g., Masciandro et al. [49], that empirically examines the role external auditors play as private financial supervisors in the banking sector particularly, in the post-financial crisis period. We show that an increase in the oversight of the

[3] Our focus is to examine auditor behavior post-financial crisis compared to pre-financial crisis. We exclude the period between 2008 and 2010 to remove the effect of economic decline due to the great recession on auditor decisions. Though the economic recession ended in June 2009 [62], the effects persisted into subsequent quarters. Our results are much stronger when we include the years 2008 to 2010.

[4] High Bank Portfolio is set equal to 1 if the bank clients represent largest portfolio of clients by total fees paid to the local audit office of the client in year *t*, 0 otherwise.

banking sector by auditors is associated with higher audit quality consistent with evidence from Masciandro et al. [49].

We present the remainder of this paper as follows. In Section "Background and related research," we provide background on the financial crisis, related literature and develop the hypotheses. In Section "Data and research design," we discuss the data sources and research design. In Section "Empirical results," we provide the descriptive statistics and empirical findings. We conclude in Section "Empirical results."

Background and related research

Background on the banking sector and the financial crisis

A smooth-functioning banking system is fundamental to any modern economy [19]. Banks, as financial institutions, are an intermediary between depositors and borrowers [18]. Deposits made by customers to banks provide the capital to make loans to borrowers. Banks report customer deposits on their balance sheet as liabilities because, upon demand, they must return it to depositors. On the other hand, loans made by banks to borrowers are assets because they are owed back to the bank. In receiving deposits and lending to borrowers, banks provide a service that is critical to the viability of the economy and market for capital. Banks play several other important roles to the economy such as investment banking where banks arrange for the sale of securities and debentures. Banks also facilitate trade by providing references and guarantees, on behalf of their customers, based on which suppliers can sell goods on credit to these customers.

For the reasons above, banks are subject to laws and regulations that restrict and regulate activities they can engage in, that set minimum capital and liquidity levels, and that govern other matters. Banking regulations in the USA is somewhat fragmented. First, the USA regulates banks at both the federal and state level. Second, at the federal level, a bank's regulator could be the Federal Deposit Insurance Corporation (FDIC), the Federal Reserve Board (FR), or the Office of the Comptroller of the Currency (OCC). The Federal Reserve is primarily responsible for monitoring, inspecting, and examining financial institutions like bank holding companies, state member banks, savings and loan holding companies, foreign banking organizations, and other entities to ensure that they all comply with federal banking rules and regulations. The FDIC is the regulator of federally insured state-chartered banks that are not members of the Federal Reserve System. Congress also established the FDIC as a deposit insurance scheme to stabilize the banking system and protect individual depositors in response to the banking panics of the 1930s. The OCC, an agency within the US Treasury Department, regulates national banks pursuant to the National Bank Act of 1863 and 1864.

Notwithstanding the regulations, the USA suffered a major financial crisis in 2008 that engulfed the entire banking system. The financial crisis in the USA began with declining home values and a credit bubble. This credit bubble and accompanying panic triggered mortgage defaults. Bank holdings of mortgage-backed securities and other risky loans fell in value and banks became illiquid. Concerns about illiquidity subsequently turned to potential insolvency as banks try to sell out of their positions. The federal government under the Troubled Asset Relief Program (TARP) committed more than $8.5 trillion to allow banks to borrow against illiquid positions [58]. Most of the money, approximately $5.5 trillion, came from the Federal Reserve. For some banks, the funds from the TARP program were not enough to offset their loans losses [19]. The crisis escalated with the collapse of Lehman Brothers, at the time, the fourth-largest investment bank in the USA. Subsequently, many other US banks fell. From 2007 to 2012, more than 450 banks failed across the USA [46], including major banks like Washington Mutual, IndyMac, and Colonial Bank.

Following the collapse of the banking system during the financial crisis, US authorities attempted to restore confidence in the country's financial institutions through regulatory reform of the banking system. One of the major reforms enacted by Congress in the aftermath of the financial crisis is the Dodd–Frank Wall Street Reform and Consumer Protection Act of 2010[5] (Dodd–Frank Act 2010). Dodd–Frank is the most significant reforms of financial regulation since the New Deal (Barr 2012). Prior to Dodd–Frank, financial institutions were mostly regulated according to their formal labels—as national banks, thrifts, investment banks, state member banks, bank holding companies—rather than according to what they did [69]. The Dodd–Frank Act authorized the Federal Reserve to supervise and regulate all financial institutions, regardless of legal form, whose failure could pose a threat to the financial system. The Act further requires banks and other financial institutions to build up their capital and liquidity buffers, constrain their relative sizes (too big to fail), and restrict their riskiest financial activities (Volcker Rule). The Act also includes authority (Financial Stability Oversight Council) for data collection and transparency across the financial market, to serve as an early warning system for identifying risks in the US financial system.

[5] https://www.cftc.gov/sites/default/files/idc/groups/public/@swaps/documents/file/hr4173_enrolledbill.pdf.

Early warning signals of poor bank health

One of the most challenging but very important aspects of a bank regulator's job is to identify banks in an early stage of financial distress [9]. A number of models or tools exist to help regulators monitor a bank's health. One specific tool, developed by the Office of the Comptroller of the Currency, is the Canary rating system. This system utilizes a number of financial statistics that are intended to capture early warning signs of poor bank health. This predetermined set of early warning tools are divided into three groups to reflect three very important risks banks face: credit risk, liquidity risk, and interest rate risk.

Credit risk is one of the most recognizable risks associated with banking (Basel 2000). It exists any time a bank's capital is extended, committed, invested, or otherwise exposed through actual or implied contractual agreements. It represents the risk to the bank arising from the borrower's failure to meet the terms of any contract with the bank as agreed. Liquidity is critical to any institution, but it is particularly very important to highly leveraged institutions like banks. Liquidity is a bank's capacity to readily meet its cash and collateral obligations at a reasonable cost [55]. Liquidity risk is the risk arising from the inability of a bank to meet its current and future obligations because of the bank's failure to recognize changes in market conditions that affect its ability to liquidate assets quickly and with minimal loss in value [56]. Movement in interest rates [1, 26] affects bank operations. Interest rate risk results from a mismatch in rate-sensitive assets versus rate-sensitive liabilities. Interest rate risk can have a significant negative effect on bank revenues, costs, and profitability if not properly managed [24].

Finally, several empirical studies (e.g., [20, 30, 31, 57, 71]) have examined the determinants of bank performance and probability of bank failures. Evidence from these studies suggest that a bank's credit risk, liquidity risk, and interest rate risk are associated with poor bank performance and a higher likelihood of bank failure.

The financial crisis, auditors, and the audit of banks—hypothesis development

The financial crisis and the collapse of numerous banks resulted in litigations against auditors and increased media and regulatory scrutiny of the auditing profession. This is because a salient feature of the financial crisis is that many prominent banks collapsed without any advance warning from their auditors. The most cited example in the financial and popular press is the audit of Lehman Brothers [35]. Lehman, with the approval of its auditor Ernst and Young, used Repo 105 transactions to move $50 billion of assets from its balance sheet, which in turn, reduced its financial leverage. Lehman filed for bankruptcy in September 2008 after receiving an unqualified audit report less than eight months earlier [45]. Investors and regulators questioned whether auditors failed to consider in their audit judgments and/or reports the implications of questionable practices by banks leading up to the crisis (e.g., [6, 34, 60, 65]). According to the Financial Crisis Inquiry Commission Report (FCIC 2011) and in testimonies made to the Senate Subcommittee on Securities, Insurance, and Investment [70], there were warning signs about the impending crisis that should have been obvious to the auditor.

Prior to the crisis, there was a sustained rise in housing prices and tremendous growth in the US credit card and mortgage debt markets [43]. At the same time, there was a significant decline in underwriting standards for most bank loans. Banks were making risky subprime lending with widespread reports of egregious and predatory lending practices [19]. Lowering lending standard results in a banking system with loan portfolios associated with higher credit and liquidity risk, thus enhancing the probability of financial instability with potentially negative welfare consequences. If housing prices or economic activity were to decline, the result would be high rates of default and subsequent banking failures [17].

Second, in the period before the financial crisis, there was also an explosion of securitization that distorted incentives for risk taking, as banks no longer had a skin in the game. There is empirical evidence (e.g., [3, 17, 47, 50, 52]) indicating that gains from asset securitization allowed for an increase in the supply of loans that ultimately led to higher delinquencies. Auditing standards, including PCAOB, AU Section 311.06, requires that "the auditor should obtain a level of knowledge of the entity's business that will enable him to plan and perform his audit in accordance with generally accepted auditing standards." Some observers argue that auditors should have incorporated into their audits and audit reports the likely implications of the above risks on the viability of some of their banking clients.

In this study, we empirically examine whether the responsiveness of auditors of banks respond to their clients differently in the pre- and post-financial crisis periods. The severity of the financial crisis including the failure of numerous banks and litigation against banks may likely have increased auditors' assessments of the risk any one bank poses to its client portfolio. Also, a major response to the financial crisis has been to increase the oversight of external auditors in the regulation of the banking sector [66]. New rules and regulations in the Dodd–Frank Act and key initiatives by the Basel Committee on Banking Supervision have encouraged a strong relationship between banking supervisors and external auditors in the USA and around the world that has enabled effective exchange of information [49]. Masciandro et al. [49] provide empirical evidence suggesting that an

increase auditor involvement in banking supervision is associated with higher audit quality. We argue that the higher risk associated with the audits of banking clients and change in the regulatory setting in the banking sector may force auditors to apply more extensive audit procedures and to invest more audit effort in the evaluation in the post-crisis period by either increasing audit effort through high audit fees (e.g., [25, 33, 51, 64], longer audit report lag (e.g., [8, 32, 38, 42], client realignment [15, 44, 48]).

It is also plausible that auditors were, in fact, well informed about bank risks in the pre-crisis period and, a result, the changes that are made in the audit procedures of the banking engagements may not be any different in the post-financial crisis period. For example, Doogar et al. [21] provide empirical evidence that is consistent with auditors recognizing and responding to evolving macroeconomic conditions years before the crisis. They find that between 2005 and 2007 auditor attention to various bank financial statement items varied in a way that it is in line with the changing risk profiles of the banking sector. Therefore, auditors in the pricing of the audit engagements may already have incorporated the risk associated with the audits of banks prior to the financial crisis. Additionally, the severity of post-crisis recession may be associated with pressures to reduce audit fees for banking clients that may persist after the financial crisis. Audit fee cuts could lead to reduced audit effort and shorter audit report lag. There is empirical evidence in the finance literature (e.g., [2, 7, 63]), suggesting the financial condition of most banks has improved and the degree of bank risk taking has reduced after the financial crisis. For example, Akhigbe et al. [2] show that measures of total and unsystematic risk for banks have significantly declined following the passage of Dodd–Frank. They observe that banks that engaged in riskier business strategies prior to Dodd–Frank experience the greatest risk reduction post-Dodd–Frank. They also find that banks alter their business practices by increasing their capital ratios and reducing their level of nonperforming loans, consistent with the requirement of Dodd–Frank. Balasubramnian and Cyree [7] also show that market discipline on banking firms improved after the Dodd–Frank. If there is an overall improvement in the systematic risk of the banking sector, auditors' assessment and response to the risk associated with the audit banks may be lower in the post-financial crisis period.

H1 External auditors are more responsive to risks associated with their banking client in the post-GFC period compared to the pre-GFC periods.

Table 1 Sample distribution by year

Year	Frequency	Percent
2004	183	10.96
2005	196	11.74
2006	170	10.18
2007	162	9.70
2011	166	9.94
2012	206	12.34
2013	211	12.57
2014	207	12.40
2015	170	10.18
Total	1670	100.00

Data and research design

Data

Our data cover the years 2003[6] to 2016 (excluding the period 2008 to 2010). Our initial data extraction includes 4696 banks with regulatory filing information to estimate Canary ratios from the S&P Global Market Intelligence (previously SNL Financial). We merge the bank regulatory filing information in the S&P Global Market Intelligence with auditor-related data in Audit Analytics' Opinion, Internal Controls, and Restatement databases. We also merge with data on banks total assets, nonperforming loans, and net charge-offs from Compustat Fundamental. We require firm-year observations to have non-missing and nonzero audit fee data from the Audit Analytics database. We also require firm-year observations to have non-missing data from Compustat Fundamental. Our final samples with available data for all variables for our analysis is 2410 firm-year observations (1362 observations firm-year for 2003–07 and 1048 observations for 2011–15). Table 1 reports the sample distribution by year.

Measures of bank risk

We use the following Canary ratio components from the OCC: Yield on Loans and Leases, Long-term Assets to Total Assets, and Onhand Liquidity to Total Liabilities as measures of credit risk, interest rate risk, and liquidity risk, respectively. We calculate *Yield on Loans and Leases* as the sum of interest income on loans and leases + tax-exempt income adjustment divided by average total loans and leases. This variable measures the yield of the bank's loan portfolio and reflects the risk of borrower default and loss in the underlying loans as well as risks in the loan portfolio. Banks with high-yield loan portfolios are associated with higher credit risk [10, 54].

[6] The sample selection begins in 2003 as 2003 represents the first year of the post-SOX era. We excluded the period 2008 to 2010 to remove the concurrent effect of the ongoing financial crisis.

Long-term Assets to Total Assets is the sum of debt securities that mature or reprice in over 5 years, bank loans that mature or reprice in over 5 years, and collateralized mortgage obligations (CMOs) with remaining maturity over 3 years divided total bank assets. Bank assets that are in the form of long-term loans can only be repriced after a long period of time. Since long-term interest rates at which banks lend and the short-term interest rates at which they borrow fluctuate, those assets could lose value and depreciate if short-term interest rates rise, because the long-term assets will be paying lower yields relative to prevailing market rates. Higher *Long-term Assets to Total Assets* is associated with higher interest rate risk.

We use *Onhand Liquidity to Total Liabilities* as a measure for bank liquidity. We calculate it as the sum of Interest-bearing Balances, Total Securities, and Fed Funds Sold and Reverse Repos less the sum of Fed Funds Purchase and Repos and Pledged Securities, all scaled by Total Liabilities. This ratio captures the ability of the bank to meet its liquidity needs from onhand liquid assets. Since the higher the ratio the lower the liquidity risk of the bank, in the regression analysis, we multiply the calculated value of the ratio by −1 (*-1XOnhand Liquidity to Total Liabilities*), which results in a higher value being associated with higher liquidity risk.

Research design

We examine how auditors of banks respond to the financial crisis using OLS specification. The regressions generally take the following form for three different measures of how auditors could respond to the financial crisis:

$$
\begin{aligned}
Ln(\textit{Audit Fees}) = {} & \alpha_0 + \alpha_1\, \textit{Post} + \alpha_2\, \textit{Yield on Loans and Leases} \\
& + \boldsymbol{\alpha_3 \textit{Post X Yield on Loans and Leases}} \\
& + \alpha_4\, \textit{Long-term Assets to Total Assets} \\
& + \boldsymbol{\alpha_5 \textit{Post X Long-term Assets to Total Assets}} \\
& + \alpha_6\, (\textit{-Onhand Liquidity to Total Liabilities}) \\
& + \boldsymbol{\alpha_7 (\textit{PostX-Onhand Liquidity to Total Liabilities})} \\
& + \alpha_8\, \textit{Ln(Assets)} + \alpha_9\, \textit{Securities} \\
& + \alpha_{10}\, \textit{Non-performing Loans to Total Loans} \\
& + \alpha_{11}\, (\textit{-Net-charge-offs to Total Loans}) \\
& + \alpha_{12}\, \textit{Efficiency} + \alpha_{13}\, \textit{TCAP} + \alpha_{14} \textit{Going Concern} \\
& + \alpha_{15}\, \textit{Busy Year-end} + \alpha_{16}\, \textit{Auditor Change} \\
& + \alpha_{17} \textit{Restatement} + \alpha_{18} \textit{ICW} + \alpha_{19} \textit{ICW Audit} \\
& + \alpha_{20} \textit{Accelerated filer} + \alpha_{21} \textit{Big 4} \\
& + \alpha_{22} \textit{High Bank Portfolio} + \textit{Firm Fixed Effects} \\
& + \textit{Year Fixed Effects} + e_{it}
\end{aligned}
\tag{1}
$$

$$
\begin{aligned}
\text{Ln}(\textit{Audit Report Lag}) = {} & \alpha_0 + \alpha_1\, \textit{Post} + \alpha_2 \textit{Yield on Loans and Leases} \\
& + \boldsymbol{\alpha_3 \textit{Post X Yield on Loans and Leases}} \\
& + \alpha_4\, \textit{Long-term Assets to Total Assets} \\
& + \boldsymbol{\alpha_5 \textit{Post X Long-term Assets to Total Assets}} \\
& + \alpha_6 (\textit{-Onhand Liquidity to Total Liabilities}) \\
& + \boldsymbol{\alpha_7 (\textit{Post X-Onhand Liquidity to Total Liabilities})} \\
& + \alpha_8 \text{Ln}(\textit{Assets}) + \alpha_9 \textit{Securities} \\
& + \alpha_{10} \textit{Non-performing Loans to Total Loans} \\
& + \alpha_{11} (\textit{-Net-charge-offs to Total Loans}) \\
& + \alpha_{12} \textit{Efficiency} + \alpha_{13} \textit{TCAP} + \alpha_{14} \textit{Going Concern} \\
& + \alpha_{15}\, \textit{Busy Year-end} + \alpha_{16}\, \textit{Auditor Change} \\
& + \alpha_{17} \textit{Restatement} + \alpha_{18} \textit{ICW} + \alpha_{19} \textit{ICW Audit} \\
& + \alpha_{20} \textit{Accelerated filer} + \alpha_{21} \textit{Big 4} \\
& + \alpha_{22} \textit{High Bank Portfolio} + \textit{Firm Fixed Effects} \\
& + \textit{Year Fixed Effects} + e_{it}
\end{aligned}
\tag{2}
$$

$$
\begin{aligned}
\text{Probability}(\textit{Auditor Change}) = {} & \alpha_0 + \alpha_1\, \textit{Post} + \alpha_2 \textit{Yield on Loans and Leases} \\
& + \boldsymbol{\alpha_3 \textit{Post X Yield on Loans and Leases}} \\
& + \alpha_4\, \textit{Long-term Assets to Total Assets} \\
& + \boldsymbol{\alpha_5 \textit{Post X Long-term Assets to Total Assets}} \\
& + \alpha_6 (\textit{-Onhand Liquidity to Total Liabilities}) \\
& + \boldsymbol{\alpha_7 (\textit{Post X-Onhand Liquidity to Total Liabilities})} \\
& + \alpha_8 \textit{Going Concern} + \alpha_9 \text{Ln}(\textit{Assets}) \\
& + \alpha_{10} (\textit{-Net-charge-offs to Total Loans}) \\
& + \alpha_{11} \textit{Efficiency} + \alpha_{12} \textit{TCAP} + \alpha_{13} \textit{Restatement} \\
& + \alpha_{14} \textit{ICW} + \alpha_{15} \textit{Big 4} + \alpha_{16} \textit{High Bank Portfolio} \\
& + \textit{Firm Fixed Effects} \\
& + \textit{Year Fixed Effects} + e_{it}
\end{aligned}
\tag{3}
$$

In Eqs. (1) and (2), we estimate the OLS regressions with the natural logarithm of total audit fees paid by the bank to the auditor and the natural logarithm of audit report lag as the dependent variables of interest, respectively. In Eq. (3), we estimate the logistic regression with the likelihood of an auditor change as the dependent variable of interest, respectively. In all three regressions, the independent variables of interest are *Post X Yield on Loans and Lease*s, *Post X Long-term Assets to Total Assets*, and *Post* X *Onhand Liquidity to Total Liabilities*. We interact *POST*, an indicator variable that takes the value 1 for the post-financial crisis period and 0 otherwise with the measures to banks risk to examine auditor sensitivity to bank risks post-financial crisis.

We control for several other bank characteristics that could also affect audit fees, audit report lag, and auditor changes. Prior studies on the audit of banks [13, 21, 22,

Table 2 Descriptive statistics (N = 1670)

	Mean	Median	Lower quartile	Upper quartile	Std. dev
Audit Fees ($)	991,389.78	302,000.00	170,000.00	657,000.00	5,107,356.11
Audit Report Lag (Days)	66.1862	68.0000	59.0000	74.0000	15.0270
Auditor change	0.0784	0.0000	0.0000	0.0000	0.2689
Post	0.6713	1.0000	0.0000	1.0000	0.4699
Yield on loans and leases	5.9228	5.7250	4.9800	6.7600	1.2748
Long-term assets to total assets	26.8066	25.6750	15.5000	37.5100	16.1007
Onhand liquidity to total Liabilities	11.1251	9.3250	3.3500	17.4400	11.4839
Assets ($ million)	17,534.98	1603.16	800.73	4685.81	137,003.72
Securities	0.7855	0.8028	0.7217	0.8613	0.1100
Nonperforming loans to total loans	0.0195	0.0113	0.0053	0.0238	0.0244
Net Charge-offs to total loans	−0.0040	−0.0018	−0.0040	−0.0007	0.0074
Efficiency	0.6769	0.6652	0.6011	0.7350	0.1290
Exempt	0.3251	0.0000	0.0000	1.0000	0.4686
TCAP	14.9208	14.0450	12.4400	16.2300	3.9719
Non-audit fee ratio	0.1904	0.1722	0.0974	0.2658	0.1291
Going Concern	0.0030	0.0000	0.0000	0.0000	0.0547
Busy year end	0.9407	1.0000	1.0000	1.0000	0.2362
Restatement	0.0401	0.0000	0.0000	0.0000	0.1963
ICW	0.0281	0.0000	0.0000	0.0000	0.1654
ICW audit	0.7533	1.0000	1.0000	1.0000	0.4312
Accelerated filer	0.7263	1.0000	0.0000	1.0000	0.4460
Big 4	0.3910	0.0000	0.0000	1.0000	0.4881
High Bank Portfolio	0.4377	0.0000	0.0000	1.0000	0.4963

The number of observations in the sample with **Post** = 0 is 549, and the number of observations in the sample with **Post** = 1 is 1121

25, 36] suggests that auditors' responsiveness to client risk should be a function of the size, operational complexity, and the quality of financial reporting. Following Kanagaretnam et al. [36], we control for complexity by including bank size (*Assets*) in the model. Following Doogar et al. [21], we control for loan retention risk by including the proportion of nonperforming loans (*Nonperforming loans to total loans*) and net loan charge-offs (− 1 X *Net-charge-offs to total loans*) in the model. Banks are required to maintain a certain minimum risk-adjusted capital ratio. We control for this capital risk by including the risk-adjusted capital ratio at the beginning of the year. We control for the efficiency ratio (*Efficiency*) as a proxy for operational risk.

We control for the quality of the bank's financial reporting by including indicator variables for whether the bank discloses a financial statement restatement (*Restatement*), whether the bank has material weakness in internal controls over financial reporting (ICW), whether the auditor jointly audits the financial statement, and internal controls (*ICW Audit*). We control for whether the bank has a December or January fiscal year end—a busy period audit (*Busy Year-end*). We also control for auditor-related characteristics such as whether the auditor is a Big 4 audit firm (Big 4) and whether banking clients represent a major component of the audit office's clients (*High Bank Portfolio*). We define all variables in "Appendix 1."

Empirical results

Descriptive statistics

Table 2 provides the descriptive statistics of variables used in our tests (pooled for years 2004–2015). We winsorize all ratio variables at the 1% and 99% levels. The average total audit fees and average audit report lag are approximately $991,390 and 66 days, respectively. Approximately 8% of banks in the sample had an auditor change between 2004 and 2015. Approximately 67% of the observations in the sample are in the post-financial crisis period. Figure 2 presents annual mean total audit fees paid by non-financial institutions and banks between 2004 and 2015. On average, banks paid lower audit fees compared to non-financial institutions in the pre-financial crisis period. However, after the financial crisis, banks, on average, paid higher

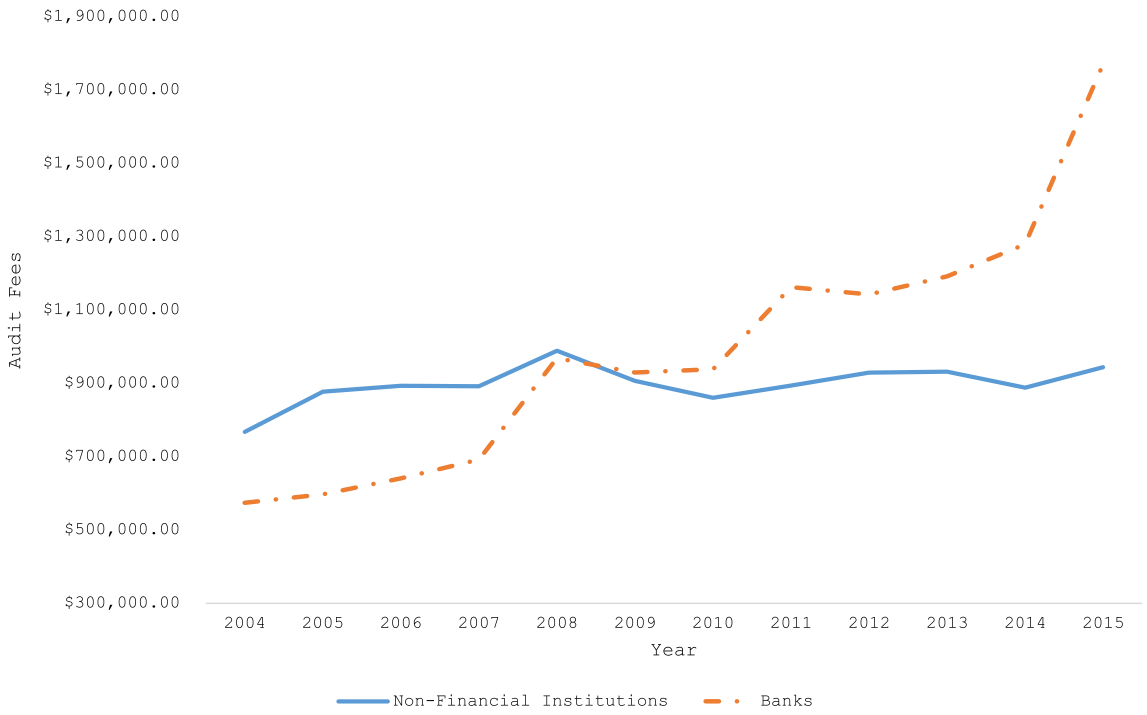

Fig. 2 Mean audit fees between 2004 and 2015 for banks and non-financial institutions

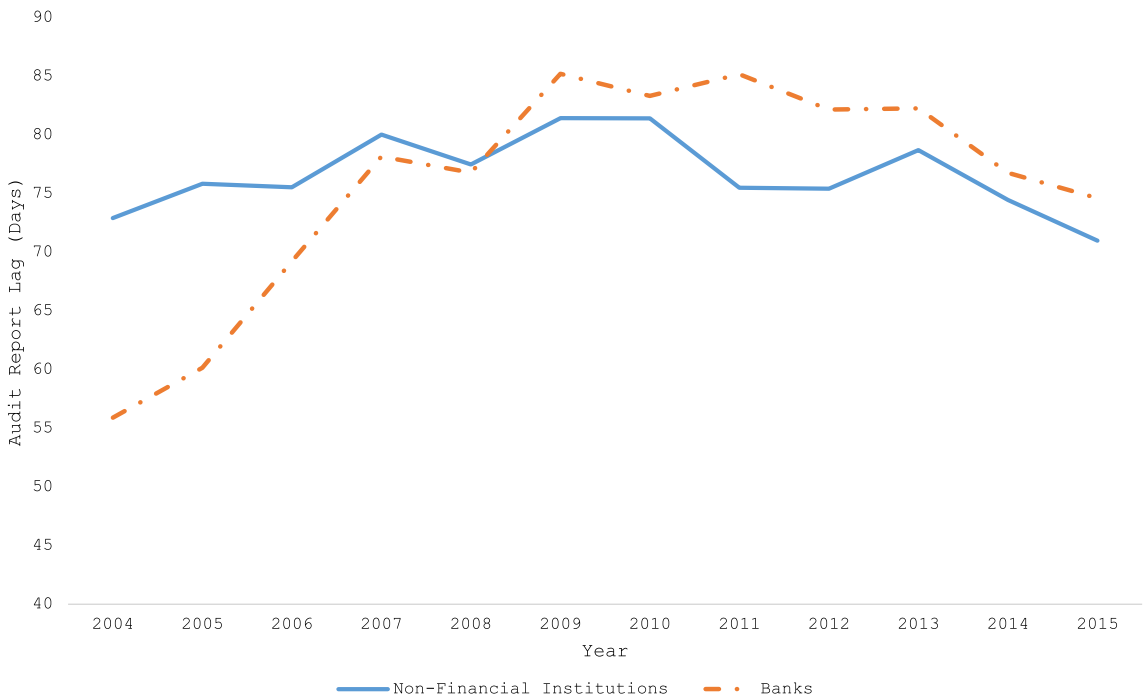

Fig. 3 Audit report lag between 2004 and 2015 for banks and non-financial institutions

audit fees compared to non-financial institutions. In addition, while non-financial institutions experience a slight decline in audit fees on average in the post-financial crisis period, there is a much positive slope for audit fees for banks in the same period.

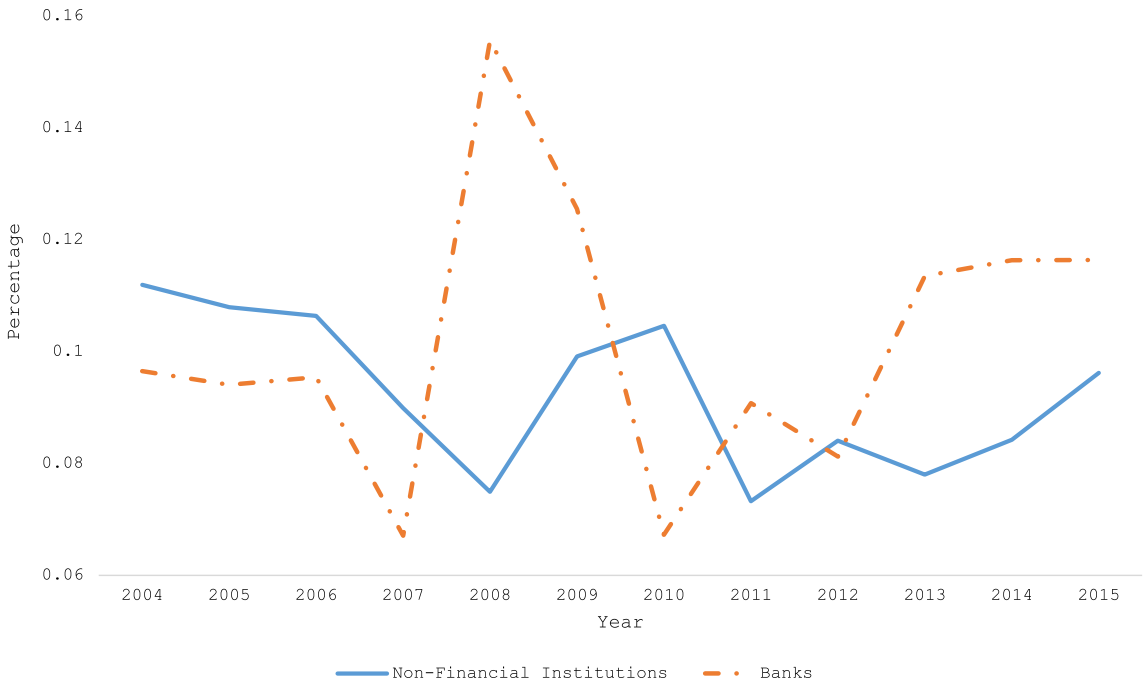

Fig. 4 Auditor changes between 2004 and 2015 for banks and non-financial institutions

In Fig. 3, we present annual mean audit report lags on the audit engagements of non-financial institutions and banks between 2004 and 2015. The trend of audit report lag from 2004 to 2015 is consistent with that of audit fees. Prior to the financial crisis, bank's audit engagements were completed in a shorter period compared to non-financial institution's audit engagements. However, after the financial crisis, the audit report lags for banks were, on average, somewhat longer than the audit report lags for non-financial institutions. In Fig. 4, we report the frequency of auditor changes in the banking sector and in non-financial institutions between 2004 and 2015. This figure shows that prior to the financial crisis, there were fewer audit auditor changes in the banking sector compared to non-financial companies. However, during the financial crisis, there is a jump in auditor changes in the banking sector and more auditor changes in the banking sector after the financial crisis compared to non-financial institutions. Overall, the trend of audit fees, audit report lag, and auditor changes suggest that the financial crisis had an impact on bank audit engagements. While auditors may have failed to incorporate systemic risk associated with their banking engagements into their audit judgments in the pre-financial crisis period, they do respond to changes in the audit risk associated these clients in the post-financial crisis period.

We also examine the movement of the specific bank risks over the period 2004 to 2015. In Fig. 5, 6, and 7, we present graphs that show the trend of credit, interest rate, and liquidity risks for US banks, respectively. In Fig. 5 and 7, we observe that there was a general increase in both credit risk proxied by *Yield on Loans and Leases* and liquidity risk proxied by *Onhand Liquidity to Total Liabilities* in the period before the crisis. This increase in both credit and liquidity risks in the pre-crisis period can be attributed to poor lending standards and declining loan quality. However, there was an overall decrease (improvement) in both bank credit risk and liquidity risk following the financial crisis. This is consistent with the tightening of banking regulations for bank lending and capital reserve requirements. However, in Fig. 6, we observe an increase in interest rate risk measured as *Long-term Assets to Total Assets* both before and after the financial crisis. The low interest rates in the period before the crisis and the exceptionally low interest rates in the period after the crisis are the primary driver of the increasing interest rate risks. Banks often borrow short, for example, by taking demand deposits, such as checking and savings deposits, which they must pay on demand by depositors. On the other hand, they lend long through long maturity loans, such as mortgages. This results in a duration mismatch that can cause banks having decreasing profits or losses if interest rates increase since the interest rate on deposits increases with the bank having no ability to negotiate a higher interest rate on already outstanding long maturity loans.

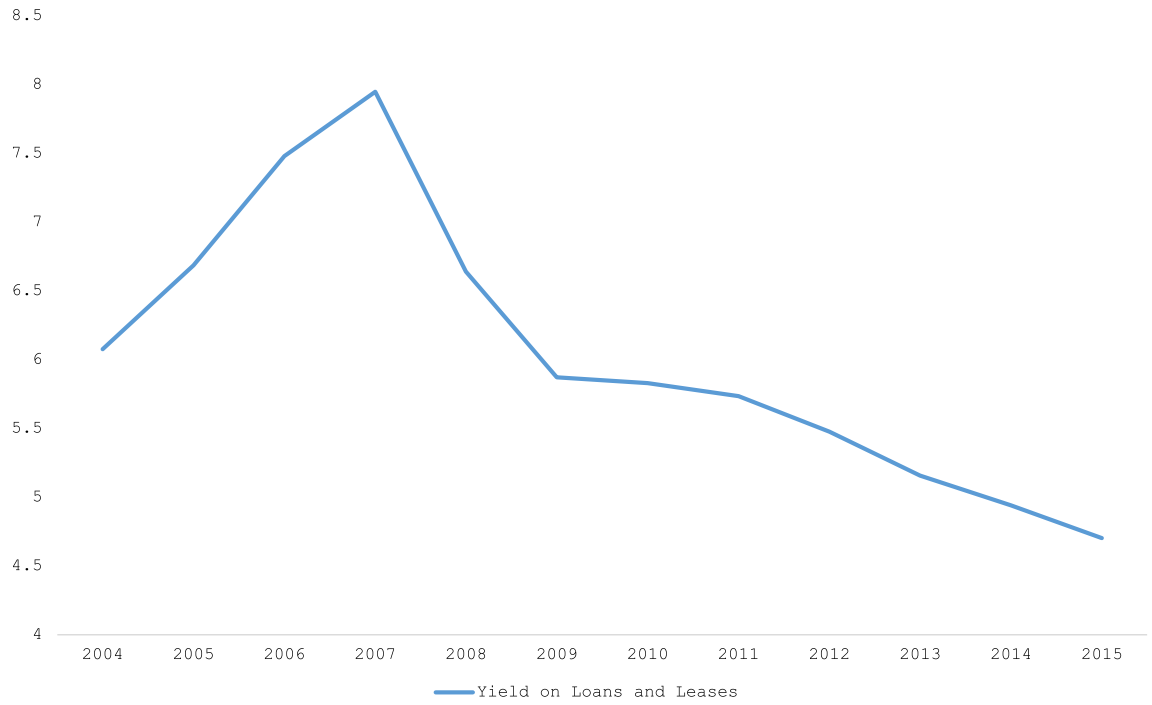

Fig. 5 Trend of credit risks from 2004 to 2015

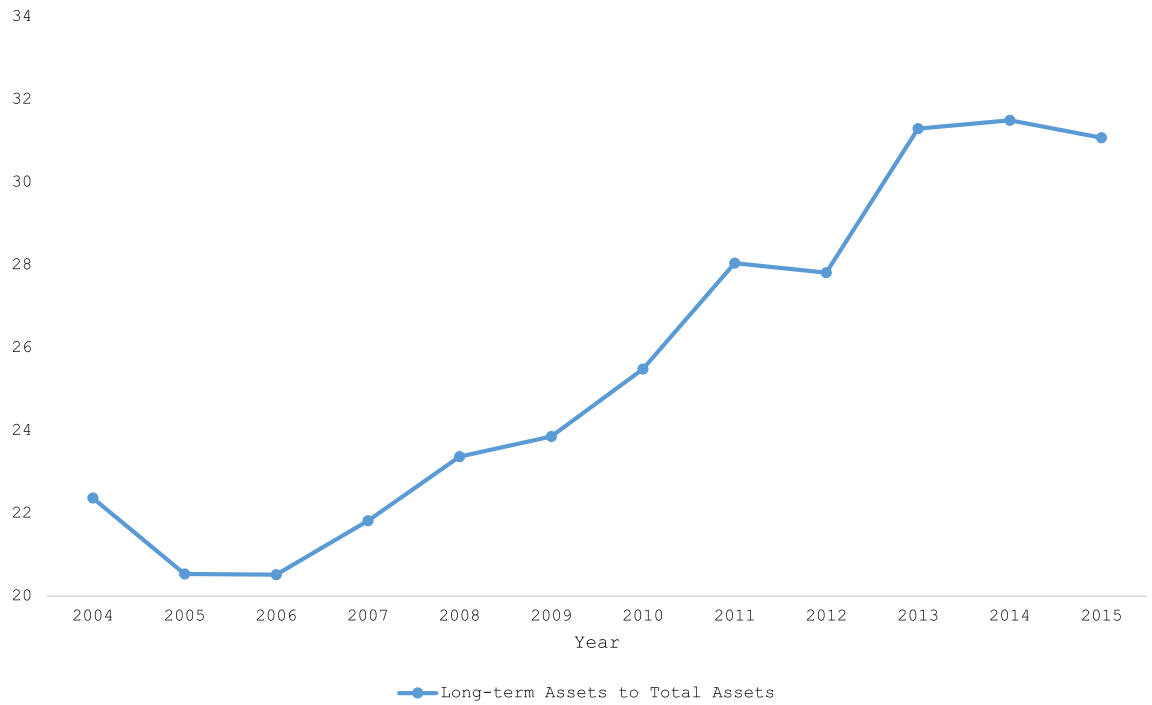

Fig. 6 Trend of interest rate risks from 2004 to 2015

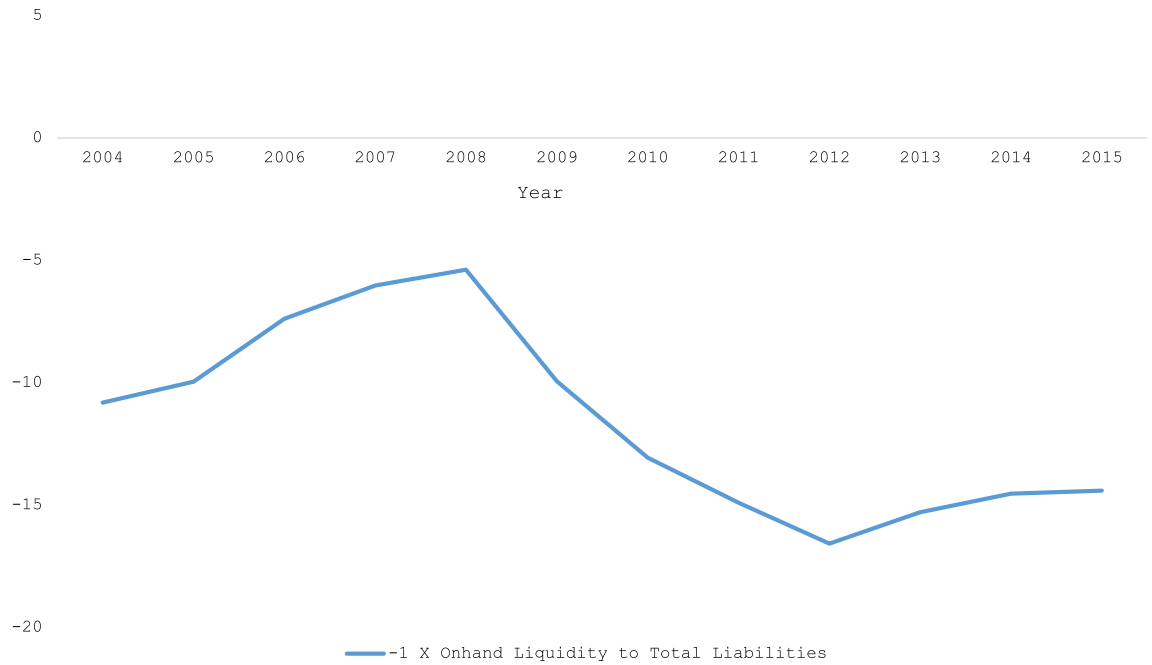

Fig. 7 Trend of liquidity risks from 2004 to 2015

Empirical results

Bank risks and audit fees

Table 3 presents the OLS results of estimating of Eq. (1) with firm fixed effects and firm-clustered standard errors. We estimate the OLS models with firm fixed effects and clustered standard errors. The independent variable of interest is the natural logarithm of total audit fees paid by the bank to the audit office. All models are significant at the 1% level and variance inflation factor (VIF) diagnostics do not suggest that a multi-collinearity problem exists. In untabulated results, the highest VIF value in all models is lower than 4.

Column (1) of Table 3 provides the results of the baseline model that examine audit fees paid in the banking sector before and after the financial crisis without considering the effect bank-specific risks. Overall, we find that audit fees are higher in the post-financial crisis period than in the pre-financial crisis period (coefficient = 0.1157, *t*-value = 2.25). The finding from the baseline model suggests auditor respond to the audits of their banking clients following the financial crisis by increasing audit fees. However, the baseline specification only captures temporal trends in audit fees with respect to the overall systematic risk associated with audit clients in the banking sector. The research design in columns 2–4 examines temporal changes in auditor response to changes in specific bank risks and takes into consideration the effect of other contemporaneous events.

In column (2) of Table 3, we examine auditors' audit fee responsiveness to credit risk. The coefficient of the variable of interest, *Post* X *Yield on Loans and Leases*, captures the effect of the financial crisis on the association between credit risk and audit fees paid by the bank. The coefficient of *Post* X *Yield on Loans and Leases* is positive and significant (coefficient = 0.0307, *t*-value = 2.93), suggesting auditors charge a higher amount of audit fees for the same level of bank credit risk in the post-financial period compared to the pre-financial crisis. Thus, auditors are more responsive to credit risk in the post-financial crisis period than in the pre-financial crisis period.

In column (3) of Table 3, we examine auditors' audit fee responsiveness to interest rate risk. The coefficient of the variable of interest, *Post* X *Long-term Assets to Total Assets*, captures the effect of the financial crisis on the association between interest rate risk and audit fees paid by the bank. The coefficient of *Post* X *Long-term Assets to Total Assets* is positive but not significant (coefficient = 0.0004, *t*-value = 0.03). This suggests that for the same level of interest rate risk, there is no difference in the amount of audit fees in the post-financial period compared to the pre-financial crisis. Thus, auditors are not significantly more or less sensitive to a bank's interest rate risk

Table 3 Results of regressions of bank risks and audit fees

	Ln (audit fees)													
	(1)			(2)			(3)			(4)			(5)		
Constant	7.6634	(11.58)	***	7.7407	(13.06)	***	7.8267	(15.41)	***	7.6588	(11.60)	***	7.8402	(11.06)	***
Post	0.116	(2.25)	**	0.0026	(0.01)		0.1519	(2.42)	**	0.1082	(1.95)	*	0.0209	(0.09)	
Yield on Loans and Leases				0.0101	(0.28)								0.0068	(0.19)	
Post X Yield on Loans and Leases				0.0307	(2.93)	***							0.0309	(2.95)	***
Long-term Assets to Total Assets							0.0029	(1.59)					0.0028	(1.60)	
Post X Long-term Assets to Total Assets							0.0004	(0.03)					0.0001	(0.05)	
− 1 X Onhand Liquidity to Total Liabilities										0.0048	(0.23)		0.0004	(0.24)	
Post X (− 1 X Onhand Liquidity to Total Liabilities)										0.0035	(2.17)	**	0.0053	(2.26)	**
Ln (Assets)	0.5082	(7.87)	***	0.4931	(7.71)	***	0.5063	(7.89)	***	0.5934	(7.36)	***	0.4645	(7.20)	***
Securities	0.5003	(2.94)	***	0.4694	(2.79)	***	0.403	(2.36)	**	0.5932	(2.71)	***	0.4089	(2.01)	**
Nonperforming Loans to Total Loans	0.0984	(0.13)		0.2115	(0.28)		0.131	(0.17)		0.1094	(0.14)		0.2661	(0.32)	
− 1 X Net-charge-offs to Total Loans	0.2271	(0.14)		0.3281	(0.21)		0.2903	(0.18)		0.2638	(0.16)		0.419	(0.26)	
Efficiency	0.6958	(4.00)	***	0.7223	(4.17)	***	0.2284	(3.53)	***	0.2226	(3.48)	***	0.2161	(3.42)	***
TCAP	0.0098	(1.92)	*	0.0071	(1.47)		0.0094	(1.89)	*	0.0094	(1.88)	*	0.0055	(1.31)	
Going Concern	0.2481	(2.20)	**	0.2646	(2.37)		0.0519	(0.54)		0.2498	(2.21)	**	0.0342	(0.36)	
Busy Year-end	0.3149	(1.70)	*	0.2388	(1.52)		0.35	(2.48)	**	0.289	(1.60)		0.3613	(2.40)	**
Auditor change	− 0.0326	(0.98)		− 0.0341	(1.01)		− 0.0268	(1.09)		− 0.0275	(1.11)		− 0.0237	(0.97)	
Restatement	0.1347	(2.45)	**	0.0877	(2.29)	**	0.0897	(2.36)	**	0.0884	(2.28)	**	0.0874	(2.27)	**
ICW	0.0707	(1.26)		0.107	(2.19)	**	0.1033	(2.16)	**	0.0686	(1.60)		0.1054	(2.16)	**
ICW Audit	0.3502	(8.22)	***	0.2842	(7.15)	***	0.2851	(7.10)	***	0.2881	(7.33)	***	0.2874	(7.39)	***
Accelerated filer	− 0.0428	(1.09)		− 0.0289	(0.94)		− 0.0274	(0.88)		− 0.0298	(0.95)		− 0.0302	(0.98)	
Big 4	0.308	(5.80)	***	0.3232	(6.10)	***	0.3158	(6.30)	***	0.3217	(6.08)	***	0.3222	(6.37)	***
High Bank Portfolio	0.002	(0.08)		0.0017	(0.08)		0.0008	(0.04)		0.0008	(0.04)		0.0011	(0.05)	
Obs	1670			1670			1670			1670			1670		
F Value	378.58	***		374.75	***		1814.61	***		249.03	***		306.51	***	
Adjusted R-Square	0.97			0.97			0.97			0.972			0.971		

in the post-financial crisis period compared to the pre-financial crisis period.

In column (4) of Table 3, we examine auditors' audit fee responsiveness to liquidity risk. The coefficient of the variable of interest, *Post* X (− 1 X *Onhand Liquidity to Total Liabilities*),[7] captures the effect of the financial crisis on the association between liquidity risk and audit fees paid by the bank. The coefficient of *Post* X (− 1 X *Onhand Liquidity to Total Liabilities*) is positive and significant (coefficient = 0.0035, *t*-value = 2.17). This suggests auditors charge a higher amount of audit fees for the same level of bank liquidity risk in the post-financial period compared to the pre-financial crisis. In column (5), we estimate the OLS regression with all key variables in the same model. The results are also consistent. Overall, we do find empirical evidence that suggests auditors are more responsive to specific bank client risks in the post-financial crisis than in the pre-financial crisis period. However, we only find auditor responsiveness to increase in credit and liquidity risks with respect to audit fees.

Bank risks and audit report lag

Table 4 presents the OLS results of estimating of Eq. (2) with firm fixed effects and firm-clustered standard errors. We estimate the OLS models with firm fixed effects and clustered standard errors. The independent variable of interest is the natural logarithm of the number of days from the end of the fiscal year to the date of completion of audit fieldwork (audit report lag). All models are significant at the 1% level and VIF diagnostics do not suggest that a multi-collinearity problem exists. In un-tabulated results, the highest VIF value in all models of 3.39. Column (1) provides the results of the baseline model that examines audit report lags in the banking sector before and after the financial crisis. Overall, we find that audit report lags are significantly longer in the post-financial crisis period than in the pre-financial crisis period (coefficient = 0.1290, *t*-value = 5.28) after controlling for other factors potentially correlated with audit report lag. This finding is consistent with the audit fee analysis and the results of the baseline model suggest auditors respond to the financial crisis by increasing audit effort and that can be observed in the longer audit completion timelines.

In column (2), we examine auditor efforts before and after the financial crisis with respect to bank's credit risk. The coefficient of *Post* X *Yield on Loans and Leases* is positive and significant (coefficient = 0.0122, *t*-value = 2.66), suggesting auditor effort measured is significantly higher for the same level of bank credit risk in the post-financial period compared to the pre-financial crisis. Thus, auditors are more responsive to a bank's credit risk in the post-financial crisis period than in the pre-financial crisis period. In column (2) of Table 4, we examine auditor efforts before and after the financial crisis with respect to a bank's interest rate risk. The coefficient of the variable of interest, *Post* X *Long-term Assets to Total Assets* is positive but not significant (coefficient = 0.0006, *t*-value = 0.37). This suggests that the financial crisis did not affect the responsiveness of auditors to a bank's interest rate risk. Thus, auditors are not significantly more or less sensitive to a bank's interest rate risk in the post-financial crisis period compared to the pre-financial crisis period.

In column (4), we examine auditors' responsiveness to liquidity risk with respect to audit report lags before and after the financial crisis. The coefficient of *Post* X (− 1 X *Onhand Liquidity to Total Liabilities*) is positive and significant (coefficient = 0.0063, *t*-value = 2.58). This suggests auditor report lag is higher for the same level of bank liquidity risk in the post-financial period compared to the pre-financial crisis. In column (5), we estimate the OLS regression with all key variables in the same model. The results are also consistent with that in columns 2, 3, and 4. Overall, the audit report analysis is consistent with that of the audit fee analysis. For both audit fee and audit report lag analyses, we do show that auditors are more responsive to specific bank client risks in the post-financial crisis than in the pre-financial crisis period.

Bank risks and audit changes

Table 5 presents the logistic regression results of estimating of Eq. (3) with firm fixed effects. The independent variable of interest, *Auditor Change*, is an indicator variable that takes the value 1 if there is an auditor change in year *t*, 0 otherwise. Column (1) provides the results of the baseline model that examine auditor changes in the banking sector before and after the financial crisis. Overall, we do not find any significant differences in auditor changes between the pre- and post-financial crisis period (coefficient = 0.0855, Chi. Sq. = 0.05).

In column (2), we examine changes before and after the financial crisis with respect to bank's credit risk. The coefficient of *Post* X *Yield on Loans and Leases* is positive and significant (coefficient = 0.4337, Chi. Sq. = 4.02). In column (3), we examine auditor changes before and after the financial crisis with respect to a bank's interest rate risk. The coefficient of the variable of interest, *Post* X *Long-term Assets to Total Assets* is positive and significant (coefficient = 0.0433, Chi. Sq. = 4.92). Finally, in column (4),

[7] We multiply *Onhand Liquidity to Total Liabilities* by -1 to maintain the same direction of inferences with the other bank risk variables. A higher value of Onhand Liquidity to Total Liabilities is consistent with lower liquidity risk and multiplying it by -1 is consistent with a higher value representing higher liquidity risk.

Table 4 Results of regressions of bank risks and audit report lag

	Ln (audit report lag)													
	(1)			(2)			(3)			(4)			(5)		
Constant	3.7914	(10.76)	***	3.4825	(8.45)	***	3.8396	(11.20)	***	3.7825	(11.13)	***	3.4648	(9.01)	***
Post	0.129	(5.28)	***	0.2128	(1.61)		0.1098	(2.43)	**	0.0874	(3.50)	***	0.1645	(1.06)	
Yield on Loans and Leases				0.033	(1.78)								0.0398	(2.07)	**
Post X Yield on Loans and Leases				0.0122	(2.66)	***							0.0136	(2.69)	***
Long-term Assets to Total Assets							0.0001	(0.05)					0.0011	(0.52)	
Post X Long-term Assets to Total Assets							0.0006	(0.37)					0.0002	(0.14)	
− 1 X Onhand Liquidity to Total Liabilities										0.0063	(2.58)	**	0.0057	(2.42)	**
Post X (− 1 X Onhand Liquidity to Total Liabilities)										0.0062	(2.48)	**	0.0067	(2.76)	***
Ln (Assets)	0.0495	(1.30)		0.0707	(1.52)		0.0455	(1.14)	***	0.0442	(1.13)		0.059	(1.26)	
Securities	0.2074	(1.05)		0.1209	(0.58)		0.2289	(1.10)	**	0.1209	(0.66)		0.1205	(0.60)	
Nonperforming Loans to Total Loans	0.8922	(1.66)	*	0.9612	(1.79)	*	0.9102	(1.68)	*	0.7701	(1.45)		0.8311	(1.56)	
− 1 X Net-charge-offs to Total Loans	0.4893	(0.48)		0.2687	(0.27)		0.5676	(0.56)		0.6759	(0.68)		0.5651	(0.57)	
Efficiency	0.1084	(1.04)		0.1388	(1.28)		0.1074	(1.03)		0.0833	(0.80)		0.1077	(1.00)	
TCAP	− 0.0013	(0.27)		− 0.0008	(0.18)		− 0.0014	(0.31)		− 0.0005	(0.11)		− 0.0007	(0.15)	
Going Concern	0.1655	(2.12)	**	0.1807	(2.28)	**	0.1598	(2.00)	**	0.1925	(2.26)	**	0.2051	(2.32)	**
Busy Year-end	0.2124	(2.37)	**	0.2159	(2.36)	**	0.2279	(2.21)	**	0.0549	(0.58)		0.0845	(0.79)	
Auditor change	0.0081	(0.25)		0.0084	(0.26)		0.0069	(0.22)		0.0071	(0.22)		0.0069	(0.22)	
Restatement	0.0587	(2.11)	**	0.053	(1.91)	*	0.0586	(2.12)	**	0.0528	(1.94)	*	0.0471	(1.77)	*
ICW	0.1375	(2.56)	***	0.1362	(2.58)	**	0.1392	(2.61)	***	0.1514	(2.64)	***	0.1516	(2.69)	***
ICW Audit	0.1486	(2.19)	**	0.1362	(2.01)	**	0.1484	(2.20)	**	0.1549	(2.32)	**	0.1423	(2.15)	**
Accelerated filer	− 0.0588	(0.98)		− 0.0636	(1.05)		− 0.0581	(0.97)		− 0.0681	(1.14)		− 0.073	(1.23)	
Big 4	− 0.1106	(2.34)	**	− 0.1143	(2.37)	**	− 0.1108	(2.36)	**	− 0.1185	(2.51)	**	− 0.1277	(2.70)	***
High Bank Portfolio	− 0.0084	(0.37)		− 0.0096	(0.41)		− 0.0088	(0.38)		− 0.0075	(0.33)		− 0.0092	(0.40)	
Obs	1670			1670			1670			1670			1670		
F Value	55.55	***		176.66	***		366.75	***		199.39	***		91.83	***	
Adjusted R-Square	0.501			0.506			0.502			0.512			0.519		

Table 5 Results of regressions of bank risks and auditor changes

	Auditor change													
	(1)			(2)			(3)			(4)			(5)		
Constant	1.6121	(8.02)	***	1.9091	(7.15)	***	1.6869	(12.11)	***	1.1217	(7.14)	***	1.8326	(9.14)	***
Post	0.0855	(0.05)		1.0627	(2.03)		1.2761	(3.59)	*	0.1445	(0.19)		0.9539	(0.16)	
Yield on Loans and Leases				0.1112	(0.17)								0.071	(0.07)	
Post X Yield on Loans and Leases				0.4337	(4.02)	**							0.2888	(8.53)	***
Long-term Assets to Total Assets							−0.0023	(0.01)					0.0072	(0.09)	
Post X Long-term Assets to Total Assets							0.0433	(4.92)					0.0394	(3.93)	*
−1 X Onhand Liquidity to Total Liabilities										0.0047	(0.28)		0.0019	(0.01)	
Post X (−1 X Onhand Liquidity to Total Liabilities)										0.1297	(5.03)	**	0.148	(4.13)	**
Ln (Assets)	−0.9451	(3.28)	*	−1.45	(6.05)	**	−1.2208	(4.85)	**	−0.7296	(3.36)	*	−1.4338	(5.80)	**
Securities	−3.1137	(1.74)		−3.0843	(1.61)		−2.5183	(1.02)		−1.2445	(0.44)		−3.2359	(1.36)	
Nonperforming Loans to Total Loans	−0.9737	(0.20)		−0.6979	(0.48)		−0.3852	(0.13)		−0.9246	(0.97)		−0.6557	(0.15)	
−1 X Net-charge-offs to Total Loans	0.4458	(0.16)		0.692	(0.09)		0.3931	(0.03)		−0.6057	(0.09)		0.6654	(0.06)	
Efficiency	1.246	(0.66)		1.0491	(0.44)		1.5311	(0.91)		0.7087	(1.55)		1.6924	(1.03)	
TCAP	−0.0191	(0.12)		−0.0482	(0.68)		−0.0436	(0.56)		−0.0326	(0.53)		−0.0518	(0.71)	
Going Concern	1.7954	(0.70)		1.4269	(0.44)		1.4531	(0.46)		1.4052	(0.19)		1.2783	(0.35)	
Non-Audit Fee Ratio	−4.4715	(10.64)	***	−4.4343	(10.29)	***	−4.7337	(11.59)	***	−2.8051	(9.34)	***	−4.6038	(10.84)	***
Ln (audit report lag)	0.0508	(0.01)		0.0383	(0.01)		0.0775	(0.02)		0.0228	0.00		0.1148	(0.05)	
Restatement	0.0812	(0.03)		0.1231	(0.06)		0.0744	(0.02)		0.8241	(5.18)	**	0.1142	(0.05)	
ICW	0.3007	(0.25)		0.4305	(0.51)		0.4839	(0.65)		0.6735	(1.78)		0.5345	(0.77)	
Big 4	−1.207	(6.81)	***	−1.14	(6.06)	**	−1.3098	(7.58)	**	−1.6538	(14.14)	***	−1.3081	(7.36)	***
High Bank Portfolio	−0.2988	(8.93)	***	−0.3494	(7.23)	***	−0.3269	(7.08)	***	−0.2081	(6.35)	**	−0.3369	(7.12)	***
Obs	1670			1670			1670			1670			1670		
Likelihood Ratio	328.42	***		332.72	***		336.9	***		328.7	***		338.82	***	
Pseudo-R-Square	0.422			0.427			0.432			0.423			0.4343		

Table 6 Results of regressions of auditor responses to bank risks—non-Big 4 versus Big 4

	Ln (auditor fees)				Ln (audit report lag)				Auditor change			
	Big 4 = 0		Big 4 = 1		Big 4 = 0		Big 4 = 1		Big 4 = 0		Big 4 = 1	
Constant	8.8468	***	6.8384	***	1.8479	***	4.4720	***	6.7329	**	92.8288	*
	(12.08)		(75.21)		(3.39)		(13.79)		(4.70)		(2.88)	
Post	0.0278		0.3170		0.8769	***	0.1037		0.3634		2.9405	
	(0.09)		(0.86)		(3.22)		(0.96)		(0.46)		(0.08)	
Yield on Loans and Leases	0.0038		0.0301		0.1475	***	0.0176		0.1449		0.3101	
	(0.09)		(0.57)		(4.63)		(1.11)		(0.16)		(0.06)	
Post X Yield on Loans and Leases	0.0306	***	0.0153	**	0.1163	***	0.1504	***	0.0520	**	0.0247	**
	(2.76)		(2.31)		(3.38)		(3.10)		(3.90)		(5.40)	
Long-term Assets to Total Assets	0.0030		0.0007		0.0023		0.0014		0.0194		0.0474	
	(1.39)		(0.19)		(0.75)		(0.93)		(0.31)		(0.13)	
Post X Long-term Assets to Total Assets	0.0004		0.0021		0.0039		0.0003		0.0817	**	0.0623	***
	(0.19)		(0.82)		(1.35)		(0.03)		(6.06)		(9.29)	
− 1 X Onhand Liquidity to Total Liabilities	0.0042		0.0020		0.0035		0.0013		0.0056		0.0090	
	(1.46)		(0.40)		(0.92)		(0.81)		(0.03)		(0.01)	
Post X (− 1 X Onhand Liquidity to Total Liabilities)	0.1517	**	0.1292	**	0.0067	*	0.0072	*	0.0380	*	0.0917	**
	(2.55)		(2.40)		(1.70)		(1.76)		(3.24)		(5.30)	
Other Controls Included	Yes		Yes		Yes		Yes		Yes		Yes	
Firm Fixed Effects	Yes		Yes		Yes		Yes		Yes		Yes	
Clustered Standard Errors	Yes		Yes		Yes		Yes					
Obs	1017		653		1017		653		1017		653	
F Value (Likelihood Ratio)	342.40	***	117.15	***	89.48	***	142.33	***	(288.87)	***	(225.42)	***
Adjusted R-Square (Pseudo-R-Square)	0.933		0.972		0.588		0.789		(0.505)		(0.725)	

we examine auditors' responsiveness to liquidity risk with respect to changes before and after the financial crisis. The coefficient of *Post* X (− 1 X *Onhand Liquidity to Total Liabilities*) is also positive and significant (coefficient = 0.1297, Chi. Sq. = 5.03). While we do not find any significant differences in auditor changes before and after the financial crisis, we do show that there is a difference in auditor response to specific bank risks before and after the financial crisis. A higher level of credit risk, interest rate risk, or liquidity risk is associated with a significant increase in the likelihood of an auditor change in the post-financial crisis period than in the pre-financial crisis period.

Additional analysis and robustness

Auditor size and type

We test the sensitivity of our previous findings based on whether the bank's auditor is a Big 4 auditor versus non-Big 4 and whether banking clients represent a majority of the audit clients of the local office of the audit firm. Unlike, other sectors, non-Big 4 accounting firms audit a significant proportion of clients in the banking sector. In our sample, Big 4 accounting firms audited approximately 39% of observations. This is consistent with prior studies [13, 21, 22, 36] that report Big 4 percentages in the banking sector ranging from 33 to 55%. There is also empirical evidence in the audit literature that suggests Big 4 auditors, however, may behave differently from non-Big 4 auditors [27, 37, 59]. Big 4 auditors are more concerned about engagement risk than non-Big 4 auditors because they have more quasi-rents or brand name capital to protect. Krishnan and Krishnan [41] find that auditors are more likely to resign from the engagement of risky clients. Hence, if the risk associated with the audit of banks in the post-financial crisis is an important concern for audit firms, then Big 4 auditors are more likely than non-Big 4 auditors to be concerned about this increase in perceived audit risk. To test whether our results are robust to auditor size, we divided the sample into clients of Big 4 and non-Big 4 audit firms and re-estimate Eqs. (1), (2), and (3) for the two samples. Our results are reported in Table 6. The results reported show that both samples are similar to and consistent with our main results. Thus, it does not appear that firm size is driving our results.

There is extensive empirical evidence in the audit literature (e.g., [39, 40, 61, 67]) that suggests specialization in a specific industry provides the auditor with unique industry knowledge and comparative advantages that non-industry

Table 7 Results of regressions of auditor response to bank risks—non-high bank portfolio versus high bank portfolio

	ln (auditor fees)		Ln (audit report lag)		Auditor changes	
	High Bank Portfolio = 0	High Bank Portfolio = 1	High Bank Portfolio = 0	High Bank Portfolio = 1	High Bank Portfolio = 0	High Bank Portfolio = 1
Constant	8.7443 ***	6.2598 ***	3.4804 **	2.3366 ***	4.8691	18.2790 ***
	(11.29)	(6.85)	(7.07)	(3.01)	(0.01)	(8.08)
Post	0.2558	0.3013	0.0416	0.8191 ***	-3.8775	5.6280 ***
	(0.92)	(0.98)	(0.23)	(2.54)	(1.15)	(7.57)
Yield on Loans and Leases	0.0164	0.0615	0.0253	0.1385 ***	0.2153	0.3204
	(0.45)	(1.35)	(1.18)	(3.53)	(0.26)	(0.21)
Post X Yield on Loans and Leases	0.0106	0.1409 ***	0.0001	0.1034 **	0.3051	0.3783 **
	(0.27)	(3.34)	(0.12)	(2.57)	(0.42)	(3.98)
Long-term Assets to Total Assets	0.0009	0.0054 *	0.0029	0.0049	0.0138	0.0002
	(0.36)	(1.89)	(0.93)	(1.40)	(0.13)	(0.01)
Post X Long-term Assets to Total Assets	0.0017	0.0040 **	0.0009	0.0151 **	0.0566 *	0.1186 **
	(0.83)	(2.15)	(0.38)	(2.47)	(3.60)	(5.64)
− 1 X Onhand Liquidity to Total Liabilities	0.0001	0.0052	0.0016	0.0140 ***	0.0116	0.0660
	(0.07)	(1.15)	(0.66)	(3.17)	(0.13)	(1.34)
Post X (− 1 X Onhand Liquidity to Total Liabilities)	0.0001	0.0057 **	0.0017	0.0179 ***	0.0198	0.0923 **
	(0.27)	(2.13)	(0.76)	(4.04)	(0.30)	(4.64)
Other Controls Included	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Clustered Standard Errors	Yes	Yes	Yes	Yes		
Obs	939	731	939	731	939	731
F Value (Likelihood Ratio)	96.83 ***	234.10 ***	236.06 ***	25.99 ***	(244.81) ***	(265.80) **
Adjusted R-Square (Pseudo-R-Square)	0.972	0.982	0.612	0.649	(0.549)	(0.624)

competitors cannot be replicate. All else being equal, auditor industry specialist should be in a better position to anticipate systemic risks in the banking sector be better able to incorporate into their audit judgments and the likely implications of their client's exposure before the crisis took place. If that is the case, we should not expect any difference in responsiveness for audit firms that are highly invested in the banking sector. However, it is also possible that a concentration of audit clients in a specific sector can expose the audit office to a heightened industry-specific risk in the event a sector-wide crisis like the financial crisis of 2008 where many banks failed, and many others were acquired or bailed out by the federal government. Thus, the financial crisis may have had a lesser exogenous effect on audit offices that are less invested in the banking sector than on audit offices with most clients in the banking sector. Therefore, we would expect the latter to respond to specific bank risks more likely in the post-financial crisis period by adjusting the nature, timing, and extent of audit procedures, potentially leading to higher audit fees, longer audit report lag, or a higher likelihood of an auditor change.

We test our predictions by dividing the sample into two groups: clients of audit offices that receive most audit fees from the banking industry and clients of audit office that do not receive a majority of audit fees from the banking industry. We present the results of this analysis in Table 7. We do not find any significant effect of the financial crisis on auditor responsiveness for audit engagements involving audit offices that do not receive most audit fees from the banking industry. However, we do find a significant effect of the financial crisis on auditor responsiveness for audit engagements involving audit offices that receive most audit fees from the banking industry. These results confirm that industry specialization and client concentration are related to a firm's response to the financial crisis.

Alternative canary ratio measures

For each type of specific bank risk, there are multiple proxies for the components of the Canary ratio. We conduct additional analysis to determine whether our results are robust to other measures. We use *Reserves to Total Loans* as an alternative measure of credit risk. It is calculated as the total allowance for loan and lease losses divided by total loans and leases (including held-for-sale loans). This ratio captures the proportion of loans or leases that may not be paid back by borrowers. A higher proportion of *Reserves to Total Loans* ratio is a signal of high loan credit risk. However,

Table 8 Results of Regressions of Auditor Responses to Bank Risks

	Ln (auditor fees)		Ln (audit report lag)		Auditor change	
	(1)		(2)		(3)	
Constant	7.2152	***	1.9656	***	1.8312	**
	(11.04)		(3.16)		(4.50)	
Post	0.1162		0.1231		0.4003	
	(1.37)		(2.29)		(0.23)	
Reserves to Total Loans	0.0086		0.0047		0.2518	
	(0.99)		(0.55)		(2.08)	
Post X Reserves to Total Loans	0.0345	***	0.0284	*	0.2376	**
	(2.92)		(1.94)		(4.17)	
− 1 X Non-maturing Deposits to Long-term Assets	0.0002		0.0001	*	0.0009	
	(0.24)		(1.90)		(0.80)	
Post X (− 1 X Non-maturing Deposits to long-term Assets)	0.0001		0.0014		0.0025	
	(0.10)		(1.56)		(1.64)	
Net Short-term Liabilities to Assets	0.0016	**	0.0036	*	0.1943	***
	(0.84)		(1.85)		(8.46)	
Post X Net Short-term Liabilities to Assets	0.0209	**	0.0205	**	0.1832	***
	(2.13)		(2.15)		(6.71)	
Other Controls Included	Yes		Yes		Yes	
Obs	1670		1670		1670	
F Value (Likelihood Ratio)	307.23	***	412.41	***	(297.92)	***
Adjusted R-Square (Pseudo-R-Square)	0.973		0.495		(0.415)	

Reserves to total loans, a measure of credit risk is estimated as allowance for loan and lease losses/total loans and leases (including held-for-sale loans); non-maturing deposits to long-term assets, a measure of interest rate risk is estimated as the sum of all transaction accounts, MMDAs, other savings deposits that mature or reprice in over 5 years, loans that mature or reprice in over 5 years and CMOs with remaining maturity over 3 years; net short-term liabilities to assets, a measure of liquidity risk is estimated as [Short-term Liabilities—Short-term Assets] / (Total Assets). See Table 1 for the definition of all variables

a low ratio may also suggest that a bank is not providing appropriate protection for the level of risk being booked. We use *Non-maturing Deposits to Long-term Assets* ratio as an alternative proxy for interest rate risk. We calculate the ratio as the total non-maturing deposits divided by long-term assets. Non-maturing deposits is the sum of all transaction accounts, money market deposit accounts, and other savings deposits. A low *Non-maturing Deposits to Long-term Assets* ratio suggests a bank's over-reliance on more rate-sensitive non-core funding sources, which are more likely to be sensitive to an interest rate increase. We multiple the *Non-maturing Deposits to Long-term Assets* ratio by − 1 such that a higher value is associated with higher interest rate risk.

Finally, we use *Net Short-term Liabilities to Assets* ratio as an alternative proxy for liquidity risk. We calculate this ratio as the difference between the bank's short-term liabilities and short-term assets, divided by total assets. The ratio measures the degree of exposure the bank takes on by funding assets with short-term liabilities. It is also referred to as roll-over risk. Generally, the higher the ratio, the more vulnerable a bank is to funding sources rolling out—and thus needing to come up with new funding for existing assets. We present the results of our analysis in Table 8. Overall, our findings are still consistent; auditors are more responsive to bank risk in the post-crisis period compared to the pre-crisis period.

Measures of bank risk used in other accounting studies

Doogar et al. [21] use nonperforming loan portfolio and net charge-offs to examine auditor responsiveness in the period before the crisis. A bank classifies a loan as nonperforming if the borrower has not made any payments for 90 days. Net charge-offs on the other hand is the difference between total amount of loan balance written less any subsequent delinquent recoveries. Both nonperforming loan portfolio and net charge-offs capture loan default risk. However, nonperforming loan portfolio is a better predictor of loan default risk in periods of economic growth while, net charge-offs is better at predicting loans losses in periods of economic slowdown [21]. We examine auditor response to both nonperforming loan portfolio and net charge-offs before and after financial crisis. We interact *Nonperforming loans to Total Loans*, *Net-charge-offs*

Table 9 Results of Regressions of Audit Responses to Bank Risks [21]

	ln (auditor fees)		Ln (audit report lag)		Auditor change	
	(1)		(2)		(3)	
Constant	7.6870	***	5.3089	***	2.0884	*
	(11.46)		(7.62)		(2.90)	
Post	0.1289	**	0.1163	***	0.6173	
	(2.35)		(3.79)		(1.65)	
Nonperforming Loans to Total Loans	0.2014		0.4971		0.9148	
	(0.06)		(1.52)		(1.92)	
Post X Nonperforming loans to Total Loans	0.3207	**	0.6263	***	0.9863	
	(4.01)		(3.23)		(2.16)	
− 1 X Net-charge-offs to total loans	0.7269		1.5632		0.9770	
	(0.89)		(0.88)		(0.19)	
Post X (− 1 X Net-charge-offs to total loans)	1.6915	***	1.5077	***	1.5402	**
	(2.87)		(4.96)		(3.89)	
Other Controls Included	Yes		Yes		Yes	
Firm Fixed Effects	Yes		Yes		Yes	
Clustered Standard Errors	Yes		Yes			
Obs	1670		1670		1670	
F Value (Likelihood Ratio)	319.79	***	142.84	***	(332.06)	***
Adjusted R-Square (Pseudo-R-Square)	0.978		0.504		(0.427)	

Nonperforming loans to total loans is total nonperforming loans divided by total loans at the beginning of the year; net-charge-offs to total loans is the amount of asset write-downs minus recoveries of previous write-downs scaled by total loans at the beginning of the year. If losses exceed recoveries, this value is shown as a negative amount. See Table 1 for the definition of all variables

to total loans, and *POST*. We report the results of this analysis in Table 9. The coefficient of *Post* X *Nonperforming loans to Total Loans* is positive and significant for Eqs. (1) and (2), only. The coefficient of *Post* X (− 1 *X Net-charge-offs to total loans*) is positive and significant for Eqs. (1), (2), and (3). Overall, we auditors are responsive to higher loan default risk in the post-crisis period compared to the pre-crisis period.

We also examine auditor responsiveness before and after the crisis to a bank's discretionary loan loss provision, a proxy for earnings management. We estimate the discretionary loan loss provision for each bank-year observation in the sample using the following OLS regression model with year and firm fixed effects and clustered standard errors:

$$\begin{aligned} \textit{Loan loss provision} = {} & \beta_0 + \beta_1 \textit{ Non-performing loans} \\ & + \beta_2 \textit{ Change in non-performing loans} \\ & + \beta_3 \textit{ Loans} + \beta_4 \textit{ Change in loans} \\ & + \beta_5 \textit{ Net charge offs} + \varepsilon \end{aligned} \tag{4}$$

Discretionary loan loss provision is the residual from estimating Eq. (4). We then interact the post variable with the *Discretionary loan loss provision*. We re-estimate Eqs. (1), (2), and (3). We report the results of this analysis in Table 10. In all three regressions, the coefficient of *Post* X *Discretionary loan loss provision* is not significant, suggesting for the same level of bank earnings management, there is no difference in auditor responsiveness between pre- and post-financial crisis period.

Controlling for corporate governance

A strong, independent, and knowledgeable corporate board is important to the long-term health of any bank, and particularly during a time of crisis, a strong board may be required for the bank's survival. The bank's board of directors sets the tone and direction of the bank as well as establishes guidelines on the nature and amount of risk the bank may assume [53]. The bank's board also ensures adequate controls and systems are in place to identify and manage risks and address problems. In an additional analysis, we include several proxies that are associated with good board governance. We include average director tenure, proportion of independent directors on the board, CEO tenure, and Eindex calculated following Bebchuk et al. [11]. After controlling for corporate governance, the sample size dropped by more than a half to 462 firm-year observations. In Table 11, we present the results of this analysis. Our results are consistent with our main findings.

Table 10 Results of Regressions of Auditor Responses to Discretionary Loan Loss Provision

	ln (auditor fees)		Ln (audit report lag)		Auditor change	
	(1)		(2)		(3)	
Constant	7.6560	***	1.3972		1.1180	***
	(11.35)		(0.79)		(8.30)	
Post	0.1154	**	0.1086	***	0.0368	
	(2.22)		(5.67)		(0.01)	
Discretionary loan loss provision	0.6042		0.0262		0.1171	
	(0.09)		(0.85)		(0.29)	
Post X Discretionary loan loss provision	0.2478		0.0876		0.0330	
	(0.17)		(0.32)		(0.02)	
Other Controls Included	Yes		Yes		Yes	
Firm Fixed Effects	Yes		Yes		Yes	
Clustered Standard Errors	Yes		Yes			
Obs	1670		1670		1670	
F Value (Likelihood Ratio)	286.28	***	61.84	***	(330.00)	***
Adj. R-Square (Pseudo-R-Square)	0.972		0.506		(0.424)	

We estimate the Discretionary loan loss provision for each bank-year observation in the sample using the following OLS regression model with year and firm fixed effects and clustered standard errors:

Loan loss provision $= \beta_0 + \beta_1$Nonperforming loans $+ \beta_2$Change in nonperforming loans $+ \beta_3$Loans $+ \beta_4$Change in loans $+ \beta_5$Net charge-offs $+ \varepsilon$

Loan loss provision: The amount charged against earnings to establish a reserve sufficient to absorb expected loan losses based upon knowledge of the loan portfolio as presently constituted and past loss experience divided by total assets;

Nonperforming loans: amount of loans that are considered nonperforming divided by total assets;

Change in nonperforming loans: Change in nonperforming loans from year $t-1$ to year t scaled by lagged total assets;

Loans: Total loans of the bank scaled by lagged total assets;

Change in loans: Change in total loans from year $t-1$ to year t scaled by lagged total assets; and

Net charge-offs: Net Credit or Charge to Reserves for Bad Debts from Loan Recoveries or Charge-Offs divided by lagged total assets

Conclusion

The financial crisis resulted in many prominent financial institutions including Lehman Brothers and Washington Mutual collapsing without any advance warning from their auditors. As a result, several large accounting firms found themselves as defendants in lawsuits by regulators and investors. The financial crisis ultimately brought to the attention of auditors the risk associated with the audits of banks. In this paper, we examine how the audits of banks is different before and after the 2008 financial crisis. We identify three key risks banks face (credit risk, interest rate risk, and liquidity risk) and examine differences in auditor responsiveness (audit fees, audit report lag, and auditor turnover) before and after the financial crisis with respect to these risks. Overall, our empirical analyses suggest that there is evidence that auditors are more responsive to higher bank risk in the post-financial crisis period compared to the pre-financial crisis period. Specifically, we demonstrate that auditors are more responsive to credit risk and liquidity risk in the post-crisis period.

Our study contributes to the literature examining risk implications of the macroeconomic shocks resulting from the financial crisis [13, 21]. Few studies have examined auditors' responses to the financial crisis. However, these studies separately examined bank audits in the period before the financial crisis. We add to this literature by using a research design that shows the shocks resulting from the financial crisis affected auditor responses to bank risks in a way that was significantly different from before the crisis. We also add to the literature by examining how auditor responsiveness varies by type of bank risks pre- and post-financial crisis. We show that audit fees and audit report lag are more sensitive to credit and liquidity risks in the post-financial crisis compared to the pre-financial crisis period. However, we do not document any significant effect of the financial crisis on the relationship between audit fees, audit report lag, and interest rate risk. Finally, we show that the financial crisis has a significant effect on the association between all three bank

Table 11 Results of regressions of auditor responses to bank risk

	Ln (auditor fees)			Ln (audit report lag)			Auditor change		
	−1			−2			−3		
Constant	6.3272	(9.46)	***	4.4427	(20.15)	***	1.777	(2.96)	*
Post	0.9026	(4.75)	***	0.2099	(2.14)	**	0.7698	(0.06)	
Yield on loans and leases	0.1238	(4.02)	***	0.0253	(2.04)	**	1.5602	(0.02)	
Post X Yield on loans and leases	0.0925	(3.55)	***	0.037	(2.86)	***	2.5337	(4.80)	**
Long-term assets to total assets	0.0024	(0.47)		0.0001	(0.07)		0.3136	(0.01)	
Post X Long-term assets to total assets	0.0001	(0.02)		0.0005	(0.31)		0.0066	(0.05)	
−1 X Onhand liquidity to total liabilities	0.0010	(1.21)		0.0016	(1.23)		0.0334	(2.93)	*
Post X (−1 X Onhand liquidity to total liabilities)	0.0129	(2.30)	***	0.0033	(3.00)	***	0.1992	(3.39)	*
ln (Average director tenure)	−0.0137	(1.35)		−0.0007	(0.20)		1.3442	(1.22)	
proportion of independent directors	0.199	(1.18)		−0.0299	(0.44)		−0.0831	(0.09)	
CEO tenure	0.0059	(1.41)		0.0004	(0.34)		−0.0864	(0.15)	
Eindex	0.0043	(0.34)		0.0025	(0.39)		−0.8561	(0.43)	
Other Controls Included	Yes			Yes			Yes		
Firm Fixed Effects	Yes			Yes			Yes		
Clustered Standard Errors	Yes			Yes					
Obs	462			462			462		
F Value (Likelihood Ratio)	208.03	***		562.38	***		−354.35	***	
Adjusted R-Square (Pseudo-R-Square)	0.981			0.859			−0.649		

Average director tenure is the average board member tenure; proportion of independent directors is the proportion of independent directors on the board; CEO tenure is the tenure of the CEO with the company; Eindex is the entrenchment index calculated following Bebchuk, et al. [11]. See Table 1 for the definition of all other variables

risks and subsequent auditor turnover. Overall, the findings from this study provide empirical evidence on how auditors behave in response to a major economic event, in this case, a major global banking crisis, which is of interest to regulators and outside investors.

The reader should note that the generalizability of our study findings and inferences is limited to the institutional settings in the USA. Our setting only uses data related to banks an auditor in the USA, and therefore, our findings may not apply to banks and auditors outside of the USA. The regulatory environment of banks and auditors in the USA is unique. We encourage similar studies in other regulatory settings. Also, as it has been almost 16 years since the great financial crisis, other studies can look at the long-term implication of the financial crisis on the oversight role of the auditor.

Appendix 1

Selected prior research on bank audit engagements and financial crisis.

Study	Sample Period	Bank Risk Variables	Auditor Response Examined	Main relationship observed
Doogar et al. [21]	2005–2007	Nonperforming loans, loan charge-offs, Retained residual interests from residential mortgage securitizations; Non-agency mortgage-backed securities	Total audit fees	Auditors were able to identify and respond to the potential macro-economic shocks to banks' business environment before the crisis became public

Study	Sample Period	Bank Risk Variables	Auditor Response Examined	Main relationship observed
Ettredge et al. [22]	2008–2011	Proportion of bank assets that is level 1, level 2, or level 3 fair value assets	Total audit fees	The positive association between audit fees and the proportions of total assets that are fair-valued using Level 3 inputs is greater than its positive association with the proportions of total assets that are fair-valued using Level 1 or Level 2 inputs
Chen et al. [13]	2008–2009 and 2010–2011	Discretionary loan loss provision	Total audit fees, Going concerns	A significant positive association between discretionary loan loss provisions and the amount of audit fees paid to the auditor during the crisis. No association between discretionary loan loss provisions and the amount of audit fees paid to the auditor after the crisis

Appendix 2: Definition of variables

Audit fees	Total audit fees paid by the bank to the audit independent auditor;
Audit report lag	The number of days between the end of the fiscal year and the audit report date;
Auditor change	1 if there is an auditor change, 0 otherwise;
Post	1 for the period between 2011 and 2015, 0 for the period between 2003 and 2007;
Yield on loans and leases (Credit risk)	[(interest income on loans and leases) + (tax-exempt income adjustment)]/(average total loans & leases);
Long-term assets to total assets (Interest rate risk)	[(debt securities that mature or reprice in over 5 years) + (bank loans that mature or reprice in over 5 years) + (collateralized mortgage obligations (CMOs) with remaining maturity over 3 years)]/(total bank assets);
Onhand liquidity to total liabilities (Liquidity risk)	[(Interest-bearing Balances) + (Total Securities) + (Fed Funds Sold and Reverse Repos) − (Fed Funds Purchase and Repos) − (Pledged Securities)]/[Total Liabilities];
Assets	total assets of the bank at the beginning of the year;
Securities	1 − (total securities/total assets at the beginning of the year);
Nonperforming loans to total loans	Total nonperforming loans divided by total loans at the beginning of the year;
Net-charge-offs to total loans	Amount of asset write-downs minus recoveries of previous write-downs scaled by total loans at the beginning of the year. If losses exceed recoveries, this value is shown as a negative amount;
Efficiency	Total operating expenses divided by total revenues;
TCAP	Total risk-adjusted capital at the beginning of the year
Lag Going Concern	1 if the bank received a going concern audit opinion in year t − 1, and 0 otherwise;
Busy year end	1 if the bank's fiscal year ends in December or January, 0 otherwise;
Restatement	1 if the bank announced a restatement in year t − 1 or year t, 0 otherwise;
ICW	1 if the bank has internal control weakness over financial reporting in year t, 0 otherwise;

ICW audit	1 if the bank has an integrated audit in year t, 0 otherwise;
Accelerated filer	1 if the bank is an accelerated filer in year t, 0 otherwise;
Big 4	1 if the bank is audited by a Big 4 audit firm in year t, 0 otherwise;
High Bank Portfolio	1 if bank clients represent largest portfolio of clients by total fees paid to the audit office, 0 otherwise;

Funding Open access funding provided by the Carolinas Consortium.

Declarations

Conflict of interest The authors have no competing interests to declare that are relevant to the content of this article.

References

1. Akella, S.R., and S.I. Greenbaum. 1992. Innovations in interest rates, duration transformation, and bank stock returns. *Journal of Money, Credit and Banking* 24(1): 27–42.
2. Akhigbe, A., A.D. Martin, and A.M. Whyte. 2016. Dodd-Frank and risk in the financial services industry. *Review of Quantitative Finance and Accounting* 47(2): 395–415.
3. Ashcraft, A. 2009. Are banks really special? New evidence from the FDIC-induced failure of healthy banks. *American Economic Review* 95: 1712–1730.
4. Aubin, D. 2011. Analysis: Big wins elude investors in auditor lawsuits. *Reuters*, April 15. Available online at https://www.reuters.com/article/us-lawsuits-auditors/analysis-big-wins-elude-investors-in-auditor-lawsuits-idUSTRE70K4WN20110121, retrieved March 12, 2020.
5. Baily, M. N. and D. J. Eliott. 2013. The role of finance in the economy: Implications for structural reform of the financial sector. *Brookings*. Available online at, https://www.brookings.edu/research/the-role-of-finance-in-the-economy-implications-for-structural-reform-of-the-financial-sector/, retrieved March 12, 2020.
6. Bajaj, V., and J. Creswell. 2008. A fender failed. Did its auditor? *The New York Times*, April 13, Available online at, https://www.nytimes.com/2008/04/13/business/13audit.html?_r=1&oref=slogin, retrieved March 12, 2020.
7. Balasubramnian, B., and K.B. Cyree. 2014. Has market discipline on banks improved after the Dodd-Frank Act? *Journal of Banking & Finance* 41: 155–166.
8. Bamber, E.M., L.S. Bamber, and M.P. Schoderbek. 1993. Audit structure and other determinants of audit report lag: An empirical analysis. *Auditing: A Journal of Practice & Theory* 12(1): 1–23.
9. Barth, J.R., G. Caprio, and R. Levine. 2013. Bank regulation and supervision in 180 countries from 1999 to 2011. *Journal of Financial Economic Policy* 5(2): 111–219.
10. Barton, J., L. D. Hodder, and M. L. Shepardson. 2015. Audits and bank failure: Do financial statement audits reduce losses to capital providers? Available at, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2719198.
11. Bebchuk, L., A. Cohen, and A. Ferrell. 2009. What matters in corporate governance? *The Review of Financial Studies* 22(2): 783–827.
12. Boo, E.F., and D. Sharma. 2008. The association between corporate governance and audit fees of bank holding companies. *Corporate Governance: The International Journal of Business in Society* 8(1): 28–45.
13. Chen, F., K. Lam, W. Smieliauskas, and M. Ye. 2016. Auditor conservatism and banks' measurement uncertainty during the financial crisis. *International Journal of Auditing* 20(1): 52–65.
14. Cole, R.A. 1998. The importance of relationships to the availability of credit. *Journal of Banking & Finance* 22(6–8): 959–977.
15. DeFond, M.L., and K.R. Subramanyam. 1998. Auditor changes and discretionary accruals. *Journal of accounting and Economics* 25(1): 35–67.
16. Demirguc-Kunt, A., E. Feyen, and R. Levine. 2011. The evolving importance of banks and securities markets. *The World Bank*. Available online at, https://doi.org/10.1596/1813-9450-5805, retrieved March 12, 2020.
17. Demyanyk, Y., and O. Van Hemert. 2011. Understanding the subprime mortgage crisis. *The Review of Financial Studies* 24(6): 1848–1880.
18. Diamond, D.W. 1984. Financial intermediation and delegated monitoring. *The Review of Economic Studies* 51(3): 393–414.
19. Diamond, D.W., and R.G. Rajan. 2009. The credit crisis: Conjectures about causes and remedies. *American Economic Review* 99(2): 606–610.
20. Dietrich, A., and G. Wanzenried. 2011. Determinants of bank profitability before and during the crisis: Evidence from Switzerland. *Journal of International Financial Markets, Institutions and Money* 21(3): 307–327.
21. Doogar, R., S.P. Rowe, and P. Sivadasan. 2015. Asleep at the wheel (again)? Bank audits during the lead-up to the financial crisis. *Contemporary Accounting Research* 32(1): 358–391.
22. Ettredge, M.L., Y. Xu, and S.H. Yi. 2014. Fair value measurements and audit fees: Evidence from the banking industry. *Auditing: A Journal of Practice & Theory* 33(3): 33–58.
23. Federal Deposit Insurance Corporation (FDIC). 2019. FDIC Settles with PricewaterhouseCoopers LLP on Audits of a Failed Bank. Available online at https://www.fdic.gov/news/news/press/2019/pr19019.html
24. Flannery, M.J. 1981. Market Interest rates and commercial bank profitability: An empirical investigation. *Journal of Finance* 36(5): 1085–1101.
25. Fields, L.P., D.R. Fraser, and M.S. Wilkins. 2004. An investigation of the pricing of audit services for financial institutions. *Journal of Accounting and Public Policy* 23(1): 53–77.
26. Flannery, M.J. 1983. Interest rates and bank profitability: Additional evidence: Note. *Journal of Money, Credit and Banking* 15(3): 355–362.
27. Francis, J.R., and M.D. Yu. 2009. Big 4 office size and audit quality. *The accounting Review* 84(5): 1521–1552.
28. Freifeld, K. 2015. Ernst & Young settles with N.Y. for $10 million over Lehman auditing. *Reuters*, April 15. Available online at, https://www.reuters.com/article/us-ernst-lehman-bros/

ernst-young-settles-with-n-y-for-10-million-over-lehman-auditing-idUSKBN0N61SM20150415, retrieved March 12, 2020.
29. Friedman, U. 2010. Should auditors shoulder blame for the financial crisis? A lawsuit against Ernst & Young over Lehman raises questions about the role of accounting in the Great Recession. *The Atlantic*. December 23. Available online at https://www.theatlantic.com/business/archive/2010/12/should-auditors-shoulder-blame-for-the-financial-crisis/342901/, retrieved March 12, 2020.
30. Gunsel, N. 2010. Determinants of the timing of bank failure in North Cyprus. *Journal of Risk Finance* 11(1): 89–106.
31. Heffernan, S., and M. Fu. 2008. The determinants of bank performance in China. Working Paper. Available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1247713, retrieved March 12, 2020.
32. Henderson, B.C., and S.E. Kaplan. 2000. An examination of audit report lag for banks: A panel data approach. *Auditing: A Journal of Practice & Theory* 19(2): 159–174.
33. Houston, R.W., M.F. Peters, and J.H. Pratt. 1999. The audit risk model, business risk and audit-planning decisions. *The Accounting Review* 74(3): 281–298.
34. Investor Advisory Group (IAG). 2011. Report from the working group on: Lessons learned from the financial crisis. PCAOB. Available online at http://pcaobus.org/News/Events/Pages/03162011_IAGMeeting.aspx, retrieved March 12, 2020.
35. Inman, P. 2010. Auditors' role in Lehmans collapse unites opposition in calls for reform. *The Guardian*, March 15. Available at, https://www.theguardian.com/business/2010/mar/15/auditors-role-lehman-collapse-critics, retrieved March 12, 2020.
36. Kanagaretnam, K., C.Y. Lim, and G.J. Lobo. 2010. Auditor reputation and earnings management: International evidence from the banking industry. *Journal of Banking and Finance* 34(10): 2318–2327.
37. Khurana, I.K., and K.K. Raman. 2004. Litigation risk and the financial reporting credibility of Big 4 versus non-Big 4 audits: Evidence from Anglo-American countries. *The Accounting Review* 79(2): 473–495.
38. Knechel, W.R., and J.L. Payne. 2001. Additional evidence on audit report lag. *Auditing: A Journal of Practice & Theory* 20(1): 137–146.
39. Krishnan, G.V. 2003. Audit quality and the pricing of discretionary accruals. *Auditing: A Journal of Practice & Theory* 22(1): 109–126.
40. Krishnan, J. 2005. Audit committee quality and internal control: An empirical analysis. *The Accounting Review* 80(2): 649–675.
41. Krishnan, J., and J. Krishnan. 1997. Litigation risk and auditor resignations. *The Accounting Review* 72(4): 539–560.
42. Krishnan, J., and J.S. Yang. 2009. Recent trends in audit report and earnings announcement lags. *Accounting Horizons* 23(3): 265–288.
43. Lang, W.W., and J.A. Jagtiani. 2010. The mortgage and financial crises: The role of credit risk management and corporate governance. *Atlantic Economic Journal* 38(2): 123–144.
44. Landsman, W.R., K.K. Nelson, and B.R. Rountree. 2009. Auditor switches in the pre-and post-Enron eras: Risk or realignment? *The Accounting Review* 84(2): 531–558.
45. Lattman, P. 2010. Cuomo sues Ernst & Young over Lehman, *The New York Times*, December 21. Available at, https://dealbook.nytimes.com/2010/12/21/cuomo-sues-ernst-young-over-lehman/, retrieved March 12, 2020.
46. Layden, L. 2018. Banks fell in the Great Recession, but they're stronger now. *USA Today*, March 14. Available at, https://www.usatoday.com/story/money/2018/03/14/banks-fell-great-recession-but-theyre-stronger-now/394354002/, retrieved March 12, 2020.
47. Loutskina, E., and P.E. Strahan. 2009. Securitization and the declining impact of bank finance on loan supply: Evidence from mortgage originations. *The Journal of Finance* 64(2): 861–889.
48. MacDonald, E. 1997. More accounting firms are dumping risky clients. Wall Street Journal, April 25: A2
49. Masciandaro, D., O. Peia, and D. Romelli. 2020. Banking supervision and external auditors: Theory and empirics. *Journal of Financial Stability* 46: 100722.
50. Mian, A., and A. Sufi. 2009. The consequences of mortgage credit expansion: Evidence from the US mortgage default crisis. *The Quarterly Journal of Economics* 124(4): 1449–1496.
51. Morgan, J., and P. Stocken. 1998. The effects of business risk on audit pricing. *Review of Accounting Studies* 3(4): 365–385.
52. Nadauld, T., and S. M. Sherlund. 2009. The role of the securitization process in the expansion of subprime credit. Available at SSRN 1410264 (2009).
53. Office of the Comptroller of the Currency (OCC). 2001. An Examiner's Guide to Problem Bank: Identification, Rehabilitation, and Resolution. January 2001
54. Office of the Comptroller of the Currency (OCC). 2004. Detecting red flags in board reports: A guide for directors. Comptroller's Handbook, Version 1.0.
55. Office of the Comptroller of the Currency (OCC). 2012. Safety and soundness: Liquidity. *OCC Director's Toolkit*. February 2004
56. Persaud, A. 2017. Have post-crisis financial reforms crimped market liquidity? *Financial Stability Review* 21. Available at, https://publications.banque-france.fr/sites/default/files/medias/documents/fsr21_web.pdf, retrieved March 12, 2020.
57. Poghosyan, T., and M. Čihak. 2011. Determinants of bank distress in Europe: Evidence from a new data set. *Journal of Financial Services Research* 40: 163–184.
58. Ponder, K. 2008. Government bailout hits $8.5 trillion. *San Francisco Gate*, November 26. Available online at, https://www.sfgate.com/news/article/Government-bailout-hits-8-5-trillion-3183181.php, retrieved March 12, 2020.
59. Rama, D.V., and W.J. Read. 2006. Resignations by the Big 4 and the market for audit services. *Accounting Horizons* 20(2): 97–109.
60. Richard, P. J. 2008. Where were auditors as companies collapsed? *American Banker*, October 10.
61. Reichelt, K.J., and D. Wang. 2010. National and office-specific measures of auditor industry expertise and effects on audit quality. *Journal of Accounting Research* 48(3): 647–686.
62. Schanzenbach, D. W., R. Nunn, L. Bauer, D. Boddy, and G. Nantz. 2016. Nine facts about the Great Recession and tools for fighting the next downturn. *Brookings*. Available online at, https://www.brookings.edu/research/nine-facts-about-the-great-recession-and-tools-for-fighting-the-next-downturn/, retrieved March 12, 2020.
63. Schoenmaker, D. 2017. What happened to global banking after the crisis? *Journal of Financial Regulation and Compliance* 25(3): 241–252.
64. Seetharaman, A., F.A. Gul, and S.G. Lynn. 2002. Litigation risk and audit fees: Evidence from UK firms cross-listed on US markets. *Journal of Accounting and Economics* 33(1): 91–115.
65. Sikka, P. 2009. Financial crisis and the silence of the auditors. *Accounting, Organizations and Society* 34(6–7): 868–873.
66. Singh, D. 2013. The role of external auditors in bank supervision: A supervisory gatekeeper? *The International Lawyer* 47(1): 65–97.
67. Solomon, I., M.D. Shields, and O.R. Whittington. 1999. What do industry-specialist auditors know? *Journal of Accounting Research* 37(1): 191–208.
68. United States Congress. Dodd-Frank Wall Street Reform and Consumer Protection Act: Conference Report (to Accompany

HR 4173). Vol. 111, no. 517. US Government Printing Office, 2010.
69. United States Government Accountability Office (GAO). 2009. Financial regulation: A framework for crafting and assessing proposals to modernize the outdated U. S. financial regulatory system, GAO-09-216. Available at, http://www.gao.gov/new.items/d09216.pdf, retrieved March 12, 2020.
70. United States Senate (US Senate). 2011. The role of the accounting profession in preventing another financial crisis. *Hearing before the Sub-committee on Securities, Insurance, and Investment of the Committee on Banking, Housing, and Urban Affairs. S. HRG. 112–76*. Available online at, https://www.hsdl.org/?view&did=690073, retrieved March 12, 2020.
71. Wheelock, D.C., and P.W. Wilson. 2000. Why do banks disappear? The determinants of U.S. bank failures and acquisitions. *The Review of Economics and Statistics* 82(1): 127–138.

Paul Tanyi is an associate professor in the Department of Accounting in the Belk College of Business at UNC Charlote. Prior to joining UNC Charlote, Dr. Tanyi was an assistant professor at the University of Nebraska—Lincoln where he taught auditing and assurance for four years. Dr. Tanyi's academic and research interests include auditing and corporate governance. He is interested in examining the roles of external auditors and corporate governance in the financial reporting process. Dr. Tanyi has presented his research at several national and international conferences. His research has appeared in top-tier accounting journals including Accounting Horizons and Auditing: A Journal of Practice and Theory. He has also served as an ad hoc reviewer for Managerial Auditing Journal and Auditing: A Journal of Practice and Theory. Dr. Tanyi is a member of the American Accounting Association and the European Accounting Association. He received his MBA (concentration in finance) and MSc. in accountancy from Illinois State University and his Ph.D. in business administration (accounting focus) from Florida International University.

Jack Cathey is a Certified Public Accountant in North Carolina whose professional experience includes working as a senior auditor with KPMG in Charlote, N.C. He has published articles in several professional and academic journals. Dr. Cathey speaks frequently to academic and professional groups on topics related to financial reporting and information systems. Dr. Cathey joined the Belk College faculty in 1988 and is currently serving as the program director for the MACC program. Dr. Cathey is an affiliate faculty member with the Doctorate in Administration program.