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Abstract:

We investigate whether the observable actions of four information intermediaries (short sellers, credit rating agency, sell-side analysts, and auditors) in the months prior to the 2008 banking crisis were sensitive to the leading indicators of bank distress constructed from the banks' publicly-available financial statements. We find that the mean level of short interest in our sample of banks increased steadily from 0.66% at the end of 2002 to 4.0% at the end of 2007. However, we observe little meaningful change in the mean credit rating, mean analysts' recommendation and mean audit fees over this period. Further analysis reveals that the level of short interest in particular and analysts' stock recommendations to some extent, exhibit a much stronger association with the leading financial statement based indicators of bank distress over the period 2005-2007 relative to an earlier period of 2002-2004. Unlike short sellers and analysts, the rating actions of a credit rating agency (S&P) and auditors' fees do not appear to be sensitive to the warning signals of the crisis from the financial statements.

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"Everybody missed it — academia, the Federal Reserve, all regulators."
Former Federal Reserve Chairman Alan Greenspan, April 2, 2010

1.0 Introduction

In this paper, we investigate two research questions: (i) did financial statements of banks provide an early warning of their upcoming distress during the 2008 financial crisis when stock prices of banks fell precipitously? (ii) whether the observable actions of four information intermediaries (short sellers, a credit rating agency, sell-side equity analysts and auditors) leading up to the 2008 financial crisis are associated with financial statement-based leading indicators of banks' distress?

During the recent financial crisis, numerous banks in the U.S failed. Many others would have failed, absent governmental intervention. These bank failures resulted in a substantial contraction of credit available to businesses and households and had a devastating effect on the economy. The speed and the scale of the bank failures have raised two concerns among academics, investors, regulators and standard setters.

The first concern is whether the financial statements of the banks provided an early warning or an indication of their upcoming distress. Commentators have argued that inadequate transparency about the risks assumed by banks allowed them to mask their deteriorating health and thereby compromised the usefulness of their financial statements (e.g., Herz 2008, Ryan 2008, Turner 2008, Rajan 2010, Norris 2009, Group of Thirty 2009, among others). In fact, Linsmeier (2011) points out that virtually all of the failed banks reported positive net worth and were considered adequately capitalized prior to their failure.[1]

The second concern as expressed in the quote above by former Fed Chair Alan Greenspan is why no one was sensitive to the potential warning indicators of the impending problems as the banks? The United States has the most developed financial system in the world with arguably the most sophisticated intermediaries. Hence it is especially important to examine their actions to understand whether they were

[1] A report issued by the GAO in 1991 subsequent to the S&L crisis in the U.S., also argued that U.S accounting rules allowed banks considerable latitude in determining the carrying amounts of problem loans and thereby delaying the recognition of losses.

sensitive to indicators of distress, particularly those in the bank's publicly reported financial statements.[2] Our purpose in this paper is to provide empirical evidence on these two concerns.

The current banking crisis is not the first time the U.S has experienced bank failures on a massive scale. For example, in a survey of empirical literature on bank failures, Demirguc-Kunt (1989) reports that from 1933 to 1989, there were over 1,500 bank failures in the U.S. Prior research in financial economics has identified several financial statement based indicators that can serve as leading indicators of bank distress and failure (Demirguc-Kunt 1989, FDIC 1997, Gonzalez-Hermassillo 1999, among others). For example, items such as reporting of non-performing loans, over which managers have relatively little discretion, have been shown to be an important leading indicator of bank failure in prior work (Liu and Ryan 1995). If the financial reports of banks served as leading indicators of impending trouble during the prior financial crises, then it is important to first examine whether they provided warning signals prior to the recent banking crisis as well.

Next, we examine whether the observable actions of four information intermediaries (short sellers, a credit rating agency, equity analysts and auditors) leading up to the 2008 crisis are associated with the information in the financial statement based leading indicators of bank distress. Specifically, we investigate whether short positions in bank stocks, credit ratings issued by Standard and Poor, buy-sell recommendations of sell-side analysts and audit fees (a proxy for increased audit risk) charged by banks' auditors leading up to the collapse of banks' stock prices in 2008 are associated with the information in the leading indicators. Although we recognize that each of these intermediaries has different objectives and obligations, they all clearly had (i) obligations to act in a timely manner if the future survival of the bank was in doubt; and (ii) access to publicly available financial statements of the banks, from which we draw our leading indicators.

In particular, we focus on two sets of ex-ante financial statement indicators: (i) a set of traditional

[2] To investigate this issue, the U.S Congress set up hearings to probe whether various financial intermediaries could have served as potential whistleblower for the impending crisis (http://www.fcic.gov/hearings/ and http://www.house.gov/apps/list/hearing/financialsvcs_dem/cpthrg_05212010.shtml).

financial statement variables identified by prior research to be associated with past bank failures; and (ii) a set of non-traditional financial statement indicators identified as unique to the current crisis based on a synthesis of comments made by several academics, practitioners and regulators. To account for the availability of value-relevant information drawn from sources other than financial statements, we control for contemporaneous stock returns and several other variables such as size, market-to-book, leverage and stock returns volatility in the empirical specification.

Gonzalez-Hermosillo (1999) argues that the five major risks affecting banks are (i) credit risk or the risk that borrowers will default; (ii) market risk or the risk that particular sectors of the economy where the bank has lent money happen to fail; (iii) liquidity risk or the vulnerability to a liquidity crisis stemming from banks transforming illiquid assets to liquid liabilities; (iv) interest rate risk due to the duration mismatch of the bank's assets and liabilities; and (v) moral hazard risk from excessive reliance on loans that have huge upfront fees or high interest rates but the future difficulties associated with collecting such loans are passed off to a third party. We review prior work in accounting and financial economics to identify a parsimonious set of financial statement variables that can be expected to be correlated with the above mentioned risks/signs of distress in a bank (e.g., FDIC 1997 and other citations in section 3.2 and 3.3). Credit risk is surrogated by the ratio of (i) loans to total assets; and (ii) non-performing loans to total loans. Market risk is proxied by the ratio of commercial loans, residential loans and consumer loans to total loans. Liquidity risk is proxied by the ratio of large deposits to assets. Interest rate risk is captured by the duration mismatch of banks' on-balance sheets and liabilities. We rely on interest and fee income from loans deflated by total assets to proxy for the moral hazard risk.

In terms of variables that have been argued to be specifically associated with the crisis of 2008, we rely on comments by regulators, practitioners and academics (see Rajan 2005, Herz 2008, Kashyap et al. 2008, Acharya and Schnabl 2009, Diamond and Rajan 2009, Financial Crisis Inquiry Commission 2010) to identify two potential indicators: (i) moving from an "originate to hold" world where banks used to originate loans and hold them on their books to an "originate to distribute" securitization model which in turn leads to temporarily off-balance sheet assets albeit with continued exposure to risks in these

securitized assets; and (ii) excessive reliance on qualified special purpose entity (QSPE) type structures to hide significant but risky off-balance sheet assets thereby engaging in regulatory arbitrage (Acharya, Schnabl and Suarez 2010). We particularly focus on measures of banks' involvement in securitization of residential mortgages, off-balance sheet commitments to fund real estate and the bank's holding of capital-light assets designed to circumvent banking regulations.

Our analysis proceeds in two steps. First, we validate the leading financial statement based indicators of bank distress by empirically demonstrating that these leading indicators are indeed associated with subsequent bank failures. Second, we relate observable actions of the four intermediaries to these leading indicators to examine whether the information set of the intermediaries is correlated with the information contained in the leading indicators. Our main findings are easily summarized. The mean level of cross-sectional short interest increases steadily from 0.66% at the end of 2002 to 4.0% at the end of 2007 and especially exhibits a sharp spike in 2006 and 2007. However, we do not observe a meaningful change in the cross-sectional mean in the average credit rating, average analysts' recommendation and average audit fees over this period. Cross-sectional analysis of the intermediaries' actions with financial statement variables reveals that the association between the level of short interest and the financial statement indicators strengthens significantly from the 2002-2004 period to the 2005-2007 period suggesting that short sellers became more sensitive to leading financial statement indicators in the quarters leading up to 2008. In particular, short sellers increased their emphasis on non-performing loans, the extent of construction loans, residential loans, the magnitude of interest and fee income and duration mismatch of banks' on-balance sheet assets and liabilities during the 2005-2007 period. The adjusted R-squared from a model of short interest on financial statement variables and controls increases dramatically in the 2005-2007 period (32.3%) relative to the 2002-2004 period (10.8%).

An examination of sell-side analysts' recommendations shows that while they were not as responsive as short sellers to the information in banks' financial statements, especially during the 2005-2007 period, their stock recommendations did reflect increased sensitivity to duration mismatch of banks' on-balance sheet assets and liabilities and bank's holding of capital-light assets designed to circumvent

banking regulations, over the 2005-2007 period relative to the 2002-2004 period.

In contrast, we are unable to document a consistent association between such financial statement measures and (i) the credit ratings of Standard and Poor, and (ii) audit fees charged by auditors. Further analysis via a panel-data vector auto regressive (VAR) procedure reveals that the changes in short interest predict the changes in analyst recommendations but not vice-versa. Moreover, the changes in analyst recommendations predict the changes in credit ratings but the opposite does not hold. That is, short interest is timelier in responding to new information than analysts' buy/sell recommendations, which, in turn, are timelier than credit ratings. In sum, the evidence suggests that the actions of short sellers and equity analysts, to some extent, were sensitive to the warning signals of banks' distress whereas the actions of the credit rating agency and auditor fees were not.

We believe our findings have the potential to inform the debate on the potential predictability of bank distress and on the regulation of financial intermediaries. First, our work suggests that bank specific financial statement variables can serve as leading indicators of an impending distress and are not as uninformative as some commentators have alleged. Second, our findings, prima facie, suggest that the negative of view of short sellers held by many as well as arguments for restrictions on short selling proposed by politicians, regulators and CEOs (e.g., Mack 2008, Fuld 2008, Senators Kaufman, Isakson, Tester and Specter 2009) need to be tempered in light of the evidence reported in our study. Our evidence suggests that short sellers were sensitive to red flags of upcoming bank distress and their actions provided a timely warning of the fragility of the banking system.

Finally and more important, our results raise questions about why the analysts to some extent and auditors and credit rating agencies in particular, failed to fully appreciate the leading indicators of the upcoming bank distress from publicly available financial statements. Perhaps, as Rajan (2010) points out, each intermediary acted rationally, given the incentives they faced, but collectively they failed to act in response to the warning signals of the crisis despite mounting evidence that things were going wrong.

The rest of the paper is organized as follows. Section 2 presents background discussion related to claims about the crisis and the incentives of the four investigated intermediaries to unearth red flags

related to the crisis. Section 3 lays out the empirical methodology. Section 4 reports results from our empirical work and section 5 concludes.

2.0 Institutional Background

2.1 Predictability of bank failure and financial crisis

The banking crisis of 2008 led to a spate of questions from the media, academics, and politicians wondering why no one had seen it coming (e.g., Krugman 2009). Some (e.g., Cochrane 2010) have counter-argued that such a crisis was unpredictable. However, a significant body of academic research has examined whether a banking crisis can be predicted from macroeconomic as well as firm-specific indicators, usually derived from financial statements. For instance, Kaminsky, Lizondo and Reinhart (1998) and Kaminsky and Reinhart (1999) attempt to predict banking and/or capital account crises using a series of macroeconomic variables and financial indicators.[3] Prior research in financial economics (e.g., FDIC 1997 and other citations detailed in section 3.2 and 3.3) has identified several financial statement based indicators for the risks facing a bank (e.g., credit risk, market risk, liquidity risk and moral hazard risk) as leading indicators of bank distress. In particular, Gonzalez-Hermosillo (1999) documents that several of the financial statement indicators we rely on are empirically useful in identifying bank failures in the U.S., Mexico and Colombia over the years 1982-1993. In addition, Rajan (2005) relied partly on financial statements to warn that banks were becoming riskier despite the growth of securitization that was meant to take risky loans off banks' balance sheets. This suggests that one should expect to see footprints of the impending bank failures or distress to show up in banks' financial statements.

However, several academics and practitioners have argued that banks' financial statements did not adequately reflect their performance (Linsmeier 2011) and the opaque nature of the financial statements did not reveal the banks' true exposures to risky assets such as subprime mortgage and other asset backed securities. This lack of transparency of banks' financial statements has been mentioned as one of the factors that contributed to the financial crisis (Ryan 2008, Shadow Financial Regulatory Committee 2008,

[3] Our focus is on firm-specific indicators of bank distress and not on macro-economic factors. Macro-economic factors should be a cross-sectional constant while evaluating the actions of individual information intermediaries.

Laux and Leuz 2009, Herz 2008, Turner 2008, Rajan 2010, Norris 2009, Group of Thirty 2009, among others).

Thus, we examine whether bank financial statements reveal signs of distress in the quarters leading up to the 2008 crisis. If bank financial statements reveal signs of distress in the quarters leading up to the crisis then the criticism that financial statements failed to reveal the increased risk of the banks is somewhat mitigated. Consistent with prior work, we find that a set of firm-specific indicators are strongly associated with subsequent bank failures (see section 4.2 for evidence). This finding then begs the question of whether the market participants were sensitive to such information in the banks' financial statements.

2.2 The role and incentives of the information intermediaries

We examine observable decisions of four intermediaries to evaluate if they were able to detect the banking sector's problems based on leading indicators observed from banks' financial statements. On the information supply side, we consider whether auditors were able to unearth these issues and on the information demand side, we evaluate whether short sellers, credit rating agencies and sell-side analysts picked up footprints of bank distress from their financial statements. We acknowledge that the list of intermediaries we consider is incomplete. For instance, we do not examine the role played by audit committees or boards of directors or bank regulators in failing to see the crisis partly because their decisions are not readily observable to the researcher. We discuss the incentives of these respective intermediaries in the following subsections.

2.2.1 Short sellers

Prior research has shown that (i) on average, short sellers are able to identify overvalued stocks (Dechow et al. 2001, Desai et al. 2002); and (ii) short sellers appear to be sensitive to indicators of earnings quality and information in financial statements. For instance, Desai et al. (2006) and Karpoff and Lou (2010) document increased short selling activity in the months leading up to an earnings restatement or an SEC enforcement action and more importantly show that short selling is related to ex-ante indicators of earnings quality. However, a number of CEOs [John Mack (2008) of Morgan Stanley

and Dick Fuld (2008) of Lehman Brothers] and Congressmen (Kaufman, Isakson, Tester and Specter 2009) have questioned the "watchdog" role played by short sellers.

We examine the activities of short sellers in the quarters leading up to the crisis to assess whether short positions were associated with ex-ante indicators of distress from banks' financial statements. Our empirical measure for short selling activity, abnormal short interest ABSI_5F, is the residual monthly short interest ratio after adjusting for five factors known to affect short interest (see the appendix for variable details). If we were to find no association between abnormal short positions and bank risk measures constructed from financial statements, then the case for opaque financial statements of banks and/or unfair targeting of banks stocks by short sellers becomes stronger.[4]

2.2.2 Rating agencies

A U.S. Senate subcommittee report dated April 13, 2011 identified inaccurate credit ratings as one of key causes of the financial crisis of 2008 (Wall Street and Financial Crisis: Anatomy of Financial Collapse 2011). The report argues that conflict of interests at the rating agencies resulting from the "issuer pays" model resulted in credit rating agencies weakening their standards and competing to provide the most favorable rating to achieve greater market share and higher revenue. Former chief of Moody's, Tom McGuire, explains, "The banks pay only if (the ratings agency) delivers the desired rating… If Moody's and a client bank don't see eye-to-eye, the bank can either tweak the numbers or try its luck with a competitor like S&P, a process known as ratings shopping."[5]

However, one can counter-argue that rating agencies committed an honest mistake in evaluating an inherently complex basket of securitized assets. Skreta and Veldkamp (2008) point out that all rating agencies potentially underestimated the correlation of defaults, particularly in residential mortgage-

[4] We consider short sellers to be information intermediaries in the sense that they transmit information about potentially over-valued stocks via their short positions to other market participants.

[5] Beaver et al. (2006) point out that ratings of Egan Jones Ratings Co. (EJR), which are paid for by investors, will be very sensitive to information while the ratings of agencies such as Moody's and S&P, whose ratings are paid for by the issuers themselves, may not respond in a speedy manner to adverse information. However, data limitations cause us to rely on ratings issued by S&P.

backed securities, which may have led them to assign such assets inflated ratings. Moreover, rating agencies insist that their ratings are only as good as the information they receive (Sy 2009). Cantor and Mann (2009) suggest that credit ratings are, in principle, more stable than "point in time" indicators such as those related to bond and equity prices, which may capture transitory market expectations and volatile risk premiums.

Our empirical measure of ratings, RATING, is the S&P domestic long term issuer credit rating for the month from COMPUSTAT monthly Ratings file, coded as 1 for "AAA", 2 for "AA+", 3 for "AA", 4 for "AA-", and so on, and 23 for "D".[6]

2.2.3 Sell side equity analysts

A long standing concern in the literature is that sell-side analysts suffer from potential conflicts of interest stemming from trying to maintain their unhindered access to management (e.g., Lim 2001, Francis and Philbrick 1993). Moreover, analysts are known to be optimistic in their earnings forecasts and their stock recommendations especially for their employer's investment banking client or potential client (e.g., Lin and McNichols 1998, Michaely and Womack 1999, Dechow, Hutton and Sloan 2000). Also, sell side analysts failed to warn investors about Enron's impending failure nor did they question Enron's high valuations (Healy and Palepu 2003).

Our primary empirical measure of the sell-side analysts' perception of banking stocks is the average analyst recommendation for the month, MEANREC, as reported on I/B/E/S Consensus Recommendations file where a higher number indicates a more favorable perception (1 denotes "Strong Buy", 2 denotes "Buy", 3 denotes "Hold", 4 denotes "Underperform" and 5 denotes "Sell", according to the standardized Thomson Reuters recommendation scale). To account for potential conflict of interests, we also examine the ratings of affiliated and un-affiliated analysts to see if the latter group provided warnings about the performance of the bank stocks.

[6] Note that these are corporate ratings for the banks themselves and not those of the structured financing products that the banks allegedly sought good credit ratings for. We are unable to find a machine-readable data source of the ratings for such structured products. However, ratings for structured products sold by banks would eventually have to be reflected in the credit rating for the bank itself.

2.2.4 Auditors

Prior literature finds that audit fees are responsive to the risk of their clients. Using proprietary data on audit firms' assessment of client risk, O'Keefe et al. (1994) and Bell et al. (2001) document an association between the level of audit fees and the client's inherent risk. Bedard and Johnstone (2004) show that audit firms increase their fees in response to higher earnings management and corporate governance risk of the clients. Hribar et al. (2009) posit that unexpected audit fees are a proxy for poor earnings quality. These papers would suggest that audit fees paid by banks should increase in response to the increased risk of the bank failure reflected in several key financial statement ratios related to bank distress.

Although prior evidence seems to suggest that a client's risk is priced in audit fees, critics of the audit industry allege that the profession is too beholden to their clients, on account of the large sums of audit fees at stake, to be objective about their audit opinions. Arnold (2009) reports that the major accounting firms, as advisers to investment banks, performed due diligence work and offered accounting and tax advice on off-balance sheet entities, securitization and assisted with the setting up of several trillions of dollars of investments in mortgage backed securities (MBS) and collateralized debt obligations (CDOs). It is not obvious whether audit firms were aware of hidden risks in these structured finance activities, as evidenced by their decisions to charge greater audit fees of their bank clients who set up structured financing vehicles themselves or held securities in these vehicles.

In our empirical work, we rely on audit fees (LOGAUDITFEE) as a continuous measure of the inherent risk perceived by the auditor in their banking clients. We could have used going concern opinions but we found that such opinions were rarely, if ever, issued for banks during the years 2002-2007 (only one observation each for 2002-2004 and 2005-2007 respectively). The absence of such opinions, by itself, suggests that auditors did not perceive bank distress to be a significant concern during the years leading up to the crisis.

3.0 Data and Methodology

3.1 Sample and data sources

Our sample starts with 9,214 bank-quarters (536 bank holding companies) from 2002 to 2007 that are covered by the Bank Holding Companies database and have matching financial information in CRSP and COMPUSTAT. The Bank Holding Companies database collects quarterly financial data from the regulatory Y-9C reports that U.S. bank holding companies with total consolidated assets of $150 million or more have to file with the Federal Reserve.[7] As Chen, Liu and Ryan (2008) point out, Y-9C reports provide "far more standardized and detailed" information about banks than financial report data. All of our financial statement leading indicators are constructed using the data items in the Y-9C report (see Appendix A for details).

We obtain monthly short interest data from NASDAQ and NYSE.[8] We obtain monthly S&P domestic long term issuer credit rating data from COMPUSTAT Ratings file, and monthly analyst recommendation data from I/B/E/S Consensus Recommendations file. Data on auditor going concern opinion, auditor name and audit fees are collected from Audit Analytics database. We collect daily and monthly returns as well as stock price and number of shares outstanding data from CRSP. Finally, institutional ownership data are collected from Thomson Reuters Institutional Holdings file.

The consolidated financial statements for bank holding companies (form Y-9C) are required to be submitted within 40 calendar days after the end of calendar quarters March 31, June 30, and September 30 ("as of" dates) and within 45 calendar days after the December 31 quarter end "as of" date.[9] We measure short interest, credit rating, and analyst recommendation variables in the third month after the end of the bank's Y-9C reporting quarter so that short sellers, credit rating agencies and financial analysts

[7] The total asset threshold has been increased to $500 million beginning March 2006.

[8] We purchased short interest data directly from NASDAQ. Short interest data for NYSE firms were originally obtained from two sources: (1) shortinterestsite.com, and (2) Professor Adam Kolasinski at University of Washington. We noticed that COMPUSTAT recently added short interest data on its Security Monthly File and we cross-checked our data with COMPUSTAT short interest data for accuracy.

[9] The Federal Reserve requires bank holding companies to prepare consolidated financial statements as of the end of the calendar quarter, regardless of their actual fiscal year end.

have about a month to take positions or update their ratings (recommendations) after the banks' quarterly financial statements become publicly available. For example, if the accounting information on the Y-9C report is as of December 31, 2006, the report has to be filed with Federal Reserve by February 14, 2007, and our variables of interests: short interest, credit rating and analysts' recommendations are measured in March 2007. According to NASDAQ and NYSE, the monthly short positions reported are as of settlement on the 15th of each month, or the preceding business day if the 15th is not a business day. So the short interest activity as of March 15, 2007 or earlier will be matched with the accounting data as of December 31, 2006, while we allow the matching credit ratings and analyst recommendations to be updated as late as March 31, 2007, potentially granting these intermediaries an edge over the short sellers.

Auditor variables from Audit Analytics are matched with the Y-9C data of each bank-quarter by requiring the signature date of the auditor opinion to fall in the three-month window starting from the end of the Y-9C report quarter.[10] So the auditor's opinion date could theoretically be as late as March 31, 2007 for the matched financial statement information as of December 31, 2006. Following the prior literature, institutional ownership and momentum returns are matched to the short interest report month. All other variables are measured on the Y-9C report "as of" date.

3.2 The traditional financial statement variables

Based on the extensive literature on bank distress, we identify following sources of bank risk: credit risk, market risk, interest rate risk, liquidity risk and moral hazard. We discuss the proxies intended to capture these risk below.

3.21 Credit risk

The FDIC (1997) finds that loan-to-total assets ratio (LAS) was one of the most significant ratios associated with bank failures in the United States over the period 1980-1988. Hence, we use loans-to-total assets ratio as one of the indicators of credit risk. We also rely on the ratio of non-performing loan-to-total loans (NPL) as an indicator of credit risk. An important feature of this ratio is that managers have

[10] Auditor going concern and audit fees are reported annually. In most cases they are matched with financial statement information as of December 31 on the Y-9C report.

relatively little discretion over this measure as typically loans that are more than 90-days past due are classified as non-performing (Liu and Ryan, 1995). Several papers in the accounting and economics literatures have relied on NPL as an indicator of credit risk taken by the bank (e.g., Beaver, Eger, Ryan and Wolfson 1989, Barth, Beaver, and Stinson 1991, Wahlen 1994, Beatty, Chamberlain, and Magliolo 1995, and Peek and Rosengren 1997).

3.22 Market risk

The proxies for higher market risk denote a greater concentration of loans in sectors of the economy that are most prone to booms and busts or in sectors where returns earned by the bank are much higher than that earned by the market as a whole. We use the following three ratios to capture market risk: (i) LCOMRE: the ratio of construction loans plus loan secured by multifamily, nonresidential, and farm real estate to total loans; (ii) LRESI: the ratio of residential loans secured by 1-4 family real estate to total loans; and (iii) LCON: the ratio of consumer loans to total loans. Barth, Beaver and Landsman (1996) and Liu and Ryan (1995), in the accounting literature, suggest that loan portfolio affects default risk.

3.23 Interest rate risk

Relying on prior research (Flannery and James 1984, Avery and Berger 1991, Schrand 1997), we capture interest rate risk using the short-term maturity mismatch of bank's assets and liabilities. Specifically, we calculate the mismatch as the difference in assets and liabilities expected to re-price within the next 12 months scaled by total assets (labeled GAP). If banks are asset sensitive, their earnings are less likely to change if interest rates go up or down. Hence, banks with more positive GAP are less sensitive to interest rate risk.

3.24 Liquidity risk

We also employ the ratio of large certificate of deposits ($100,000 or more) to total assets to capture liquidity risk (DEPLGE). Large deposits are unlikely to be insured under the FDIC guarantee and are hence more likely to be recalled by depositors at the first hint of trouble at the bank.

Note that the GAP measure discussed above in the context of interest rate risk can also serve as a

measure of liquidity risk. Negative GAP values imply that banks are more liability sensitive than asset sensitive. Hence, if short term funding dries up and the bank is unable to roll-over its short-term debt, then negative GAP values could suggest a liquidity problem for the bank. One of the significant risks peculiar to the 2008 crisis was the duration mismatch between short term liabilities and long term assets in banks' special investment vehicles (SIVs) exposing them to rollover or refinancing risk. Although these comments refer to the duration mismatch of SIVs, data on such mismatch are not readily available. However, we believe that our GAP measure, discussed above, will capture this risk, albeit with measurement error.

3.25 Moral hazard risk

Akerlof and Romer (1993) suggest that banks might be willing to lend money on projects where the probability of a positive payoff in the future is small but the present payoff is very high in the form of originating fees and an extremely high interest rate on a loan. The incentive to lend money on such projects is expected to be higher when a third party is expected to bear the future liability while the bank can reflect the current income in its financial statements. We represent this type of moral hazard via a measure termed INTAS (the ratio of interest and fee income on loans and leases to total assets) to capture the extent of reliance on high upfront fees, commissions and high interest rates on loans although the long-term viability of loans is not expected to be sound.

3.3 Indicators of concerns related to the 2008 crisis

We attempt to capture some of the important risks specific to the 2008 crisis as highlighted by several regulators and academics (Rajan 2005, Herz 2008, Kashyap et al. 2008, Acharya and Schnabl 2009, Diamond and Rajan 2009, Acharya, Schnabl and Suarez 2010, Financial Crisis Inquiry Commission 2010). We specifically focus on the following two key risks specific to the 2008 crisis detailed below.

3.3.1 Off balance sheet structures

Acharya and Schnabl (2009) argue that banks indulged in regulatory arbitrage to build up high leverage in a manner that escaped regulatory scrutiny by setting up special investment vehicles (SIVs)

and conduits funded by asset-backed commercial paper (ABCP) that was guaranteed by banks through liquidity and credit enhancements. To capture such regulatory arbitrage of banks and the associated risk, we construct two variables: REG_ARB and COMMIT-RE.

REG_ARB is defined as the sum of total assets, derivatives and off-balance sheet items in the 20% risk weight category, divided by the sum of total assets, derivatives and off-balance sheet items in all risk weight categories. The intuition here is that banks holding a greater proportion of assets that were assigned a smaller risk weight as per Basel I capital guidelines and hence a lower charge for capital (capital-light assets) are more likely to engage in regulatory arbitrage (Acharya and Schnabl 2009). Such regulatory arbitrage was accomplished by holding senior tranches of securities issued by SIVs that received AAA ratings from credit rating agencies and hence carried a lower regulatory capital charge but nonetheless offered substantially higher returns relative to other comparable AAA rated securities. Diamond and Rajan (2009) argue that higher returns coupled with low capital charge caused banks to become large investors in these securities resulting in (i) increase in banks' exposure to these mispriced securities; and (ii) concentration of such risk in the banking sector instead of spreading such risk to other sectors or investors best capable of bearing such risks. We expect REG_ARB to be positively associated with the probability of bank distress.

COMMIT_RE is defined as off-balance-sheet commitments to fund commercial real estate, construction and land development, scaled by total assets. COMMIT_RE attempts to capture contingent lines of credit devoted to the real estate business which was one of the sectors characterized by overinvestment and hence misallocation of resources. We expect this variable to be positively associated with bank distress risk.[11]

[11] We considered two other proxies for off-balance sheet structures, but we decided to not pursue them because of very limited data availability. First, we obtained reports by the rating firm Moody's on ABCP administrators published between March 1999 and March 2007. However, that report is restricted to only the top 20 such administrators. Hence, the ABCP variable was only populated for a handful of banks in our sample. Second, to ascertain exposure to SIVs in general, we obtained a report published by Credit Suisse First Boston (2003) on the anticipated impact of FIN 46, Consolidation of Variable Interest Entities, on S&P 500 firms based on these firms' public disclosures. FIN 46 provides guidance on whether a firm should consolidate its off-balance sheet entity with on-balance sheet accounts and was effective from July 1, 2003. The report identifies the maximum potential VIE

3.3.2 Reliance on securitization

We attempt to capture the extent of the bank's involvement in securitization via SEC_RESI or the outstanding principal balance of 1-4 family residential loans sold and securitized with servicing retained or with recourse or other seller-provided credit enhancements, scaled by total assets. Consistent with prior work (e.g., Niu and Richardson 2004, Chen, Liu and Ryan 2008), we considered several other proxies for securitization activity such as securitized consumer loans, non-performing securitized loans, and retained interest from asset securitizations (measured as the sum of interest only strips and subordinated asset-backed securities) scaled by total securitized assets. However, we did not use these measures in our empirical analysis because these proxies are highly correlated with SEC_RESI and with one another.[12] We expect SEC_RESI to be positively associated with banks' risk.[13]

3.4 Control variables

In all regressions where intermediaries' actions are dependent variables (short interest, credit ratings, audit fees, analyst recommendations), we use contemporaneous stock return for the holding period relevant to that test (CUR_RET) as a control for the availability of information other than those captured by the financial statement indicators discussed above. In addition, we include a set of control

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liability amount expected to be brought on-balance sheet as reported by firms. Again, however, this measure of FIN46 liabilities is available for only one year in the sample (2003) and is also not populated for most of the banks in our sample. We acknowledge that we might have handicapped the predictive ability of financial statement indicators by not incorporating explicit proxies for ABCPs and SIVs in our analysis.

[12] For instance, the Spearman correlation is 0.71 between SEC_RESI and retained interest, 0.73 between SEC_RESI and non-performing securitized loans, 0.53 between SEC_RESI and securitized consumer loans and 0.80 between securitized consumer loans and non-performing securitized loans for our sample. Consistent with our findings, Chen, Liu and Ryan (2008) reports a Spearman correlation of 0.93 between securitized consumer loans and non-performing securitized consumer loans for their sample.

[13] Herz (2008) suggests that managers tend to avoid recognizing fair value based impairments. To capture that sentiment, we attempted to compute two variables based on fair value data. First, we considered the sum of amortized cost of held-to-maturity securities and available-for-sale securities scaled by the sum of the fair value of held-to-maturity securities and available-for-sale securities, as a measure of the extent of fair value impairments in securities that are not taken by managers. Second, we considered the sum of FAS 157 based level 2 and level 3 fair value assets drawn from COMPUSTAT Bank Quarterly tapes and scaled by total assets, as a proxy for illiquid assets that are not actively traded in markets and are hence more susceptible to impairments not booked by managers. However, we do not tabulate results using these two variables because data on fair values is only available for a very small part of the sample period. In particular, FAS 157 data is not available for most banks on COMPUSTAT until March 2008. Data on the book-to-market ratios of securities is available only from September 2006.

variables in each of our regressions to control for the well established relations from prior literature. Following Gonzalez-Hermasillo (1999), we control for bank profitability (NI: the ratio of trailing twelve month net income to average total assets) and bank size (SIZE: logarithm of total assets) in most of our regressions to ensure that our financial statement variables are not merely picking up the impact of operating performance and size.

For the regression analysis of short interest levels, we further control for book-to-market ratio (BTM), institutional ownership (INSTHOLD) and momentum return (MOMRET). Dechow, Hutton, Muelbroek and Sloan (2001) show that short sellers target firms that are priced highly relative to fundamentals such as the book-to-market ratio. Asquith, Pathak and Ritter (2005) and Nagel (2005) argue that institutional ownership is a proxy of stock loan supply for the purpose of short selling. Ali and Trombley (2006) find that the magnitude of momentum return is positively related to short sale constraints identified by D'Avolio (2002). As noted by Nagel (2005), institutional ownership is strongly correlated with size, so we drop SIZE from the regression analysis to mitigate multi-collinearity concerns.[14]

In the regression analysis of credit ratings, we follow Ahmed, Billings, Morton and Stanford-Harris (2002) and use leverage ratio (LEVERAGE), idiosyncratic equity risk (STDRESID), profitability (NI) and the log of total assets (SIZE) as control variables. To ensure comparability, we include the same set of control variables in the regression of analysts' stock recommendation as that in the short interest regression, except that we replace INSTHOLD with SIZE. Finally, following Hribar et al. (2009), we further control for profitability (NI), SIZE, book-to-market ratio (BTM), default risk (LEVERAGE) and idiosyncratic equity risk (STDRESID) as other determinants of audit fees. After deleting observations that report missing values on all financial statement indicators and control variables, we are left with a final sample of 8,253 bank-quarters used in the regressions.

[14] The Spearman correlation between INSTHOLD and SIZE is 0.74 in our sample. The results are qualitatively the same if we include SIZE in the regression.

4.0 Results

4.1 Summary statistics

Our analysis is conducted over the period 2002-2007. We stop in the year 2007 because stock prices of banks fell precipitously in the year 2008. Since the time period spanning 2002-2007 is unlikely to be homogenous in terms of how the banking crisis developed, we do not expect the associations between our intermediaries' actions and leading indicators to be inter-temporally constant. Thus, we divide the sample period from 2002-2007 into two equal time periods of 2002-2004 and 2005-2007. Table 1 reports the statistics for the full sample of bank holding companies (panel A) as well as a smaller sub-sample of 33 bank holding companies that failed over the period 2008-2010 for which the relevant data are available on form Y9-C (panel B).[15]

Statistics in Panel A of Table 1 show that the mean level of short interest rises from 0.89% over 2002-2004 to 2.57% over 2005-2007. An examination of mean short interest by year (not tabulated) shows an increase in short interest from 0.66% in 2002 to 4% in 2007. To benchmark the level of short-interest, we also examine a measure of abnormal short interest that controls for firm characteristics that have been shown to be associated with short interest by prior work. Specifically, ABSI_5F controls for three firm characteristics: firm size, book-to-market ratio, and momentum, and two additional variables that have been shown to be related to short-sale constraints: turnover and institutional ownership (see Karpoff and Lou 2010 for details on these measures). An examination of the abnormal short interest shows that the increase in mean abnormal short interest over 2005-2007, relative to 2002-2004, is even more pronounced than the increase in raw short interest (from 0.42% to 2.11%).

Although short interest in our sample increases over the years leading up to the crisis, there is little change in the time-series averages of observable actions of the other three intermediaries. The mean credit rating (RATING) becomes more favorable over time, going from 7.44 over 2002-2004 to 6.99 over 2005-2007. The median RATING remains the same across the two periods. The mean analysts'

[15] A total of 322 banks failed during 2008-2010, among which only 33 are bank holding companies that meet the $500 million asset threshold and have matching Y9C report data.

recommendation (MEANREC) increases (becomes less favorable) slightly from 2.59 over 2002-2004 to 2.66 over 2005-2007. Un-tabulated statistics show that percentage of sell recommendations for the banks was higher in 2003 (9.75%) relative to 2007 (6.58%). Mean audit fee (AUDIT_FEE) shows a modest increase from $1.70 million over 2002-2004 to $1.79 million over 2005-2007. Un-tabulated data also show, that over the period 2002-2007, there were only two going concern opinions issued, one in 2002-2004 and the other in 2005-2007.

In general, these statistics suggest that in the view of the short sellers, valuations of bank stocks were too high over the period 2005-2007 and likely not sustainable. In contrast, the outputs of the other information intermediaries such as credit rating agencies, sell-side analysts and auditors are not that different in the period 2005-2007, before the 2008 crash in stock prices, relative to the earlier 2002-2004 period.

We turn next to financial indicators of bank distress. As noted earlier, there is no look-ahead bias in our analysis as we ensure that the actions of intermediaries are measured after the public availability of financial statement information so that such information is potentially decision-relevant to these intermediaries. In particular, short interest (SI_RATIO), credit rating (RATING), and analyst recommendations (SELLPCT, MEANREC and MEDREC) are measured in the third month after the end of the bank's form Y-9C reporting quarter because the Y-9C filing is the source of most of our accounting information. Auditor variables (AUDITOR_GC, AUDITFEE, BIG4) are matched with the Y-9C data of each bank-quarter by requiring the signature date of the audit report to fall in the three-month window starting from the end of the Y-9C report quarter. INSTHOLD and MOMRET are matched to the short interest report month. All other variables are measured as of the Y-9C report quarter.

We find that some of the key indicators of banks' fragility such as those related to credit risk, market risk, interest rate risk and liquidity risk have increased over time. Panel A of Table 1 shows that, for the entire sample of firms, the average ratio of total loans-to-total assets (LAS) increases from 0.64 (64%) over 2002-2004 to 0.69 (69%) over 2005-2007. The biggest driver of this increase is LCOMRE, or construction loans to total loans, that increases from 0.42 to 0.48. The ratio of residential loans to total

loans (LRESI) falls slightly from 0.28 to 0.27. The mean non-performing loans to total loans ratio (NPL) also shows a decrease from 0.86% over 2002-2004 period to 0.71% over 2005-2007. However, an examination of NPL year-by-year shows that it increases dramatically from 0.6% in 2006 to 0.93% indicating a sharp increase in credit risk in 2007. Liquidity risk, proxied by banks' reliance on large unsecured deposits (DEPLGE), also increased over the sample period (from 11% of total assets in 2002-2004 to 14% in 2005-2007). The GAP measure shows a modest decline from 2002-2004 (0.11) to 2005-2007 (0.10) suggesting an increase in asset/liability maturity mis-match and hence an increase in interest rate risk. Activity in loans that result in higher upfront fees and commissions (and hence induce moral hazard), as indicated by INTAS, also increased over the sample period (from 2.57% in 2002-2004 to 2.97% in 2005-2007). Turning to key measures unique to the recent crisis, we find that banks' off-balance sheet commitment to fund real estate, construction and land development (COMMIT_RE) shows a sharp increase (from 4.65% in 2002-2004 to 6.36% in 2005-2007), consistent with the banks' growing exposure to commercial real estate – both on and off-balance sheet. In contrast, both SEC_RESI and REG_ARB show a modest decrease from 2002-2004 to 2005-2007. Panel B of Table 1 reports the same variables for the sample of 33 bank holding companies that failed from 2008 to 2010. The increase in risk suggested by the leading indicators from financial statements is much clearer for this sample. For example, indicators such as NPL, LCOMRE and INTAS show large increases in the latter period (2005-2007).

Overall, the descriptive statistics reveal a trend in the various financials that are indicative of increased risk exposure of the banks over the period 2005-2007 relative to 2002-2004. The statistics also show that abnormal short interest jumps from 0.42% (2002-2004) to 2.11% (2005-2007), while the observable outputs from three other intermediaries do not change much over the two periods and if anything evidence shows that mean credit ratings actually became more favorable in the latter period. Table 2 reports the Pearson and Spearman correlation among all the independent variables. Several of the loan related variables such as LCOMRE, LRESI, LCON and LAS are correlated with one another, as expected. LCOMRE is strongly correlated with COMMIT_RE (Spearman correlation is 0.54), since both

variables capture the bank's exposure to the real estate sector. REG_ARB is also highly correlated with LAS (Spearman correlation is 0.7). These correlations suggest that an assessment of the total number of financial statement variables that are significant in any regression is as important as the specific variables that turn out to be significant.

4.2 Validation of the indicators

Although, our selection of the leading indicators of the bank distress and fragility is guided by prior research as well as by the comments and analysis of several prominent academics and regulators regarding the proximate causes of the recent crisis, we first validate these variables by examining their association with subsequent bank failures. We estimate a logistic model where the dependent variable, BANK_FAILURE is coded as 1 when a particular bank failed during 2008-2010 and as zero otherwise. The independent variables are measured up to 2007 such that there is no look-ahead bias. The results of the logistic model, reported in Table 3, show that nine out of the 11 independent variables are significantly associated with bank failure in the predicted direction. These results clearly suggest that the leading indicators of distress drawn from financial statements and motivated by prior work and theory exhibit a strong association with subsequent bank failures. This analysis raises the question of whether the information set of the four information intermediaries we examine was correlated with these leading indicators.

4.3 An analysis of short selling activity in bank stocks

Table 4 reports the results of a regression of abnormal short interest, ABSI_5F, on the discussed financial statement indicators of bank distress and the control variables such as book-to-market ratio, momentum, profitability, and institutional ownership that prior research has shown to be related to short interest (Dechow et al. 2001, D'Avolio 2002)). We emphasize the inclusion of CUR_RET or stock returns contemporaneously measured with short interest as a control variable for non-accounting information available to market participants.

The results over the period 2002-2004 show that none of the financial statement indicator variables is associated with abnormal short interest over this time period. Over this period, the short selling activity

in the bank stocks was modest and most of the variation in the abnormal short interest is explained primarily by the control variables, BTM, MOMRET and INSTHOLD. However, when we estimate this specification over the period 2005-2007, we see a dramatic improvement in the explanatory power of the model, as evidenced by an increase in adjusted R-square from 10.8% over 2002-2004 to 32.3% over 2005-2007. This suggests that short sellers became particularly sensitive to information in these leading indicators over the period 2005-2007. As the leading indicators began to show signs of distress, the short sellers responded to these changes by increasing their positions. For example, proxies for credit risk such as non-performing loans (NPL) and proxies for market risk such as exposure to commercial real estate loans (LCOMRE) and residential real estate loans (LRESI) demonstrate a positive significant association with abnormal short interest (t-statistics of 2.99, 2.39 and 2.33 respectively). INTAS, the proxy for moral hazard, also exhibits a significant association with abnormal short interest (t-statistic = 3.78). The coefficient on GAP, the proxy for interest rate risk (duration mismatch between assets and liabilities), is negative and significant (t-statistic = -2.05), suggesting that short sellers are sensitive to short-term funding problems that may arise for the bank in case of a liquidity shock and to banks' interest rate risk. Turning to the non-traditional indicators, we find a significant positive association between REG_ARB and abnormal short interest (t-statistic = 1.7). This finding implies that short sellers are sensitive to banks' exposure to securities issued by SIVs even though the risk posed by banks' exposure to these securities would not be explicitly reflected either in the banks' financial statements or in their regulatory ratios.

To statistically contrast the sensitivity of short interest to financial statement indicators of bank risks in the two sub-periods, we pool data for the time periods and estimate whether the coefficient on these indicators is statistically different in the latter period relative to the earlier one. The coefficient on the interaction terms on the variables NPL, LCOMRE, LRESI, INTAS and GAP is statistically significant in the expected direction. Increased emphasis on two other variables, COMMIT_RE and REG_ARB, is approaching statistical significance (t-statistics of 1.55 and 1.53, p-value = 0.06, one-tailed). This result further confirms the greater emphasis placed by short sellers on the financial statement indicators of bank

distress in the quarters leading up to 2008.

4.4 The association between credit ratings and the risk proxies

As argued in section 2.2.2, inaccurate credit ratings due to conflict of interests have been identified as one of key causes of the financial crisis. Table 5 reports the results of an ordinal logistic regression of credit ratings on the same set of financial indicators discussed in Table 4. Note that a higher numerical rating indicates a weaker credit rating. The results over the period 2002-2004 show that three of the 11 indicators (LCOMRE, INTAS and REG_ARB) are associated with bank credit ratings in the predicted direction (z-statistics of 3.14, 2.44 and 2.14 respectively).

Next, we examine whether credit ratings became more sensitive to leading indicators similar to short interest as we move to the latter time period (2005-2007). The results in the latter period reveal that four of the 11 indicators are associated with credit ratings. The four variables are NPL, LCOMRE, GAP, and REG_ARB with t-statistics of 2.66, 2.31, -1.95 and 2.55 respectively. It is not clear why INTAS loses significance in the latter period. Moreover, when we compare the differences in coefficients between the two periods, we find that ratings are more sensitive to NPL over 2005-2007 compared to 2002-2004. But there is no significant change in the sensitivity of credit ratings to other financial indicators from 2002-2004 to 2005-2007. In addition, the explanatory power of the model does not increase from 2002-2004 to 2005-2007 period. Overall, the results suggest unlike short interest, credit ratings do not exhibit increased sensitivity to financial statement indicators over 2005-2007.[16] While we do not investigate the reason for the lack of increased sensitivity of the ratings to indicators of bank distress over the 2005-2007 period, this evidence along with the fact that the mean credit rating of the sample of banks actually becomes more favorable from 2002-2004 to 2005-2007 (panel A, Table 1)

[16] We also considered whether credit default swaps (CDS) picked up footprints of the crisis before 2007. One of the limitations of considering data on CDS instruments is that CDS are available only for a very select set of banks. More interesting, CDS spreads are virtually constant up to June 2007. These spreads jump to a significantly higher level in July 2007 and beyond till 2008. This time-series trend is observed for Bank of America, Citigroup, JPMorgan Chase, Wells Fargo, Goldman Sachs, Morgan Stanley and all other banks that have complete CDS time-series from 2002 to 2008 on Bloomberg database. The trend is further confirmed by the ABX-HE-07-1 index, which is based on a basket of 20 credit default swaps referencing residential mortgage-backed securities containing subprime mortgages.

seems consistent with the concerns that rating agencies failed to act in a timely manner to reflect the increased risk of the banks.

4.5 The association between analysts' consensus recommendations and the risk proxies

Table 6 reports the results related to whether the mean consensus analysts' recommendation for banks is correlated with financial statement indicators of impending bank distress. We are interested in examining whether the analysts' recommendations responded to the increased risk of the banks due to rapid growth in loans, increased exposure to construction loans and investments in securities issued by SIVs, which together precipitated a dramatic decline in the performance of the banks in 2008. Note that a higher numerical rating is a weaker rating as a "strong buy" rating is coded as 1 and a "sell" rating is coded as 5.

The results reported in panel A of Table 6 show that over the 2002-2004 period, NPL and REG_ARB are significantly associated with the with mean recommendation of analysts in the predicted direction (t-statistics of 1.72 and 2.38 respectively). In addition, coefficients on three other indicators, DEPLGE, SEC_RESI and COMMIT_RE are negative with t-statistics of -3.30, -3.48 and -2.65, respectively. However, the predicted sign for these coefficients is positive, for example, banks with higher ratio of large deposits to total assets have higher liquidity risk. Also, banks with higher securitization of residential mortgages and greater off-balance sheet commitment to fund commercial real estate, construction and land development are riskier and should be associated with higher numerical recommendation (less favorable opinion).

Over the 2005-2007 period, five of the 11 indicators are significant (NPL, LAS, INTAS, GAP and REG_ARB), suggesting that sell-side analysts became more sensitive to banks' risks over time. However, even during this period, the coefficient on DEPLGE is significant but in the opposite direction. A comparison of the coefficients across the two time periods suggests that sell-side analysts' recommendations exhibit a stronger association with GAP and REG_ARB in the latter period. The increase in the emphasis on two variables, NPL and LAS, is also approaching statistical significance (t-statistics of 1.47, p-value = 0.07, one-tailed). The relative explanatory power of the estimated model is

much higher in the latter period (9.4% relative to 6.5%). Thus, sell-side analysts appear to be more sensitive to some of the financial statement based risk indicators in the months leading up to the crisis. Also, analysts appear to have increased emphasis on non-traditional risk measures of bank distress such as the bank's reliance on capital-light assets. Overall, although the mean of the analysts' recommendation did not change meaningfully from the 2002-2004 period to 2005-2007 (Table 1), the results of the regression analysis in panel A of Table 6 indicate an increased sensitivity of recommendations to some of the leading indicators of financial indicators of bank distress over the period 2005-2007.

One possibility for the lack of any meaningful change in mean recommendation over the two periods could be that instead of issuing an unfavorable recommendation, the analysts drop the coverage of the firm (McNichols and O'Brien 1997). To examine this conjecture, we define COV_DROP, our dependent variable, as one if the number of analysts issuing a recommendation for the quarter decreases relative to the prior quarter and zero otherwise. The independent variables are the same as the previous regression. Results from the logistic regression estimated and reported in Table 6, panel B are generally not supportive of the conjecture that analysts dropped coverage of riskier firms.

Another possibility is that conflict of interests may have affected the recommendations of the affiliated analysts. There is a large literature on the potential conflicts of interest faced by sell-side analysts that lead them to issue biased and overly optimistic forecasts and recommendations (Lin and McNichols 1998 and Michaely and Womack 1999). For example, Healy and Palepu (2003) report that two months prior to Enron's filing for bankruptcy, the mean analyst recommendation on Enron's stock was 1.9 (1=strong buy and 5=sell). To investigate this possibility, we examine whether unaffiliated analysts' recommendations have a stronger association with the financial statement indicators of risk than underwriter-affiliated analysts who tend to be favorably biased in their stock recommendations. Following Jacob, Rock and Weber (2008), we use the I/B/E/S Broker Translation file to find the brokerage firm employing each analyst in the I/B/E/S Recommendations Detail file and the SDC Global New Issues database. Next, we identify whether the brokerage firm has underwriting relationships with the firm that the analyst follows. We define an analyst as "affiliated" if its employer was the lead

manager on an equity issue by the firm that he/she follows at any time during the period 2001-2008, and "unaffiliated" if no such underwriting relationship exists during the period.[17] We then construct a dichotomous variable, AFFILIATED, taking value 1 if the dependent variable is the average recommendation of "affiliated" analysts for the bank-quarter observation, and zero if the dependent variable is the average recommendation of "unaffiliated" analysts for the bank-quarter observation. Finally, we estimate a fully interactive model where AFFILIATED is interacted with all independent variables. To conserve space, these results are not tabulated.

It turns out that none of the interaction terms is statistically significant, and the main effects of the financial statement variables are qualitatively the same as those reported in Table 6, panel A. In addition, we conducted a comparison of mean recommendations by affiliated analysts and unaffiliated analysts each year, focusing on a sub-sample where the bank-quarter has at least one affiliated analyst and at least one unaffiliated analyst. The differences between these recommendations are not statistically significant for any of the years from 2002 to 2007. Thus, our results are unlikely to be explicitly driven by conflicts of interest affecting affiliated analysts.

Overall, the results show that although on average analysts issued fewer sell recommendations over 2005-2007 period relative to 2002-2004 period (discussed earlier), the evidence does suggest that analysts' recommendation became more sensitive to some of the financial indicators of bank distress over the 2005-2007 period.

4.6 The association between auditor fees and the risk proxies

In this section we assess whether auditors increased their audit fees in response to the growing risk faced by the banks as indicated by the change in their key ratios over time. As discussed earlier in section 2.3.4, prior literature seems to suggest that auditors charge higher fees in response to an increase in the client's inherent risk. Although the time trends in audit fees reported in Table 1 did not indicate an increase in audit fees over time, we address this issue more formally by regressing natural logarithm of

[17] As a robustness check, we use an alternative definition where an analyst is defined as "affiliated" if its employer was the lead manager on an equity issue by the firm that he/she follows during the three-year window (-2, +1) surrounding the analyst recommendation date. The results are qualitatively the same.

audit fees (LOGAUDITFEE) on the financial statement variables.

The results reported in Table 7 show that audit fees are positively related to firm size and return volatility for the years 2002-2004, consistent with prior evidence. However, only one of the risk proxies, INTAS, is statistically significant in the predicted direction for the 2002-2004 period (t-statistic = 1.76), while coefficients on LCON and LAS have sign opposite to the prediction. The results do not improve much in the 2005-2007 period as the only risk proxy that turns out to be statistically significant is DEPLGE (t-statistic = 2.81). Similar to the well known result in the literature, we also find very high adjusted R-squared for both time periods (77.3% and 80.5%, respectively), primarily due to the inclusion of firm size in the regression. Overall, we are unable to document a reliable and/or meaningful association between financial statement indicators of bank risk and audit fees.[18]

Finally, we examine whether the weak results are driven by the possibility that non-audit fees may have compromised the independence of external auditors (Ashbaugh, LaFond and Mayhew 2003, Kinney, Palmrose and Scholz 2004). We construct a dummy variable, HIGHBIAS, taking value 1 if a bank-quarter's ratio of non-audit fee to the sum of auditor fee and non-audit fee is above the sample median, and zero otherwise. We then run a fully interactive model where HIGHBIAS is interacted with all independent variables in Table 7. None of the interaction terms is statistically significant. In the interest of brevity, these results are not tabulated.

4.7 Lead-lag relations among intermediaries' actions

The results presented thus far suggest the following patterns. First, short sellers exhibit increased sensitivity to financial indicators of bank distress in the 2005-2007 period. This conclusion stems from the increased coefficients in the regression of short interest on five risk proxies (NPL, LCOMRE, LRESI, INTAS, and GAP). Second, the analysts' recommendation exhibit increased sensitivity to GAP and REG_ARB over 2005-2007, although the mean recommendation for the full sample does not change

[18] A recent paper by Doogar, Rowe and Sivadasan (2012) models audit fees especially for the banking industry. We add our risk proxies to their model to evaluate whether a customized audit fee model for the banking industry would make a difference to our prior results. Un-tabulated findings suggest that their enhanced model does not change our inferences.

meaningfully over the sample period. Third, the credit ratings do not appear to be sensitive to the increased risk of banks during the latter time period. Finally, there is virtually no association in either period between audit fees and financial statement indicators of bank distress. Thus, the actions of short-sellers and to some extent, those of sell-side analysts, appear to be more responsive to indications of greater risk in banks' financial statements leading up to the collapse of banks' stock prices in 2008.

To provide more evidence on which of these intermediaries' actions were ahead of the others in appreciating the onset of distress, we examine the lead–lag relation between the quarterly time-series of short-sellers' positions and (i) credit ratings; and (ii) analysts' recommendations. The idea is to assess for each bank whether the quarterly average of short interest leads or lags the quarterly average of credit ratings and analyst recommendations. We do not estimate these models for audit fees because (i) fee data are available only on an annual basis; and (ii) fee data does not appear to be sensitive to the risk proxies drawn from financial statements, as discussed in section 4.6.

In particular, these lead-lag relations are estimated using a bivariate panel-data vector auto-regression (VAR) methodology, as proposed by Holtz-Eakin, Newey and Rosen (1988) and implemented more recently by Love and Ziccino (2006). This technique combines the traditional time-series VAR approach, which treats all the variables in the system as endogenous, with the panel-data approach, which allows for unobserved individual heterogeneity.[19]

In particular, we specify a first-order bivariate VAR model as follows: $Z_{i,t} = \beta_0 + \beta_1 Z_{i,t-1} + f_i + \varepsilon_t$, where Z_{it} ($Z_{i,t-1}$) is one of the following three bivariate vectors, {SI_RATIO, MEANREC} or {SI_RATIO, RATING} or { RATING, MEANREC}, for bank i measured at quarter t (quarter t-1), f_i is bank fixed effects included to allow for heterogeneity for each cross-sectional unit. To illustrate the general structure of these models, consider the following specifications involving short interest and analyst recommendations:

[19] We obtain similar but slightly weaker results using the traditional time series VAR approach, in which cross-sectional quarterly average of SI_RATIO, MEANREC and RATING are calculated first for each quarter assuming the underlying structure is the same for each bank and then the VAR estimation is based on only 24 quarterly observations reducing the power of the test.

$$SI\_RATIO_{it} = \beta_0 + \beta_1 SI\_RATIO_{it-1} + \beta_2 MEANREC_{it-1} + f_i + \varepsilon_t \quad (1)$$

$$MEANREC_{it} = \beta_0 + \beta_1 SI\_RATIO_{it-1} + \beta_2 MEANREC_{it-1} + f_i + \varepsilon_t \quad (2)$$

In equation (1), SI_RATIO_{it} is the short interest ratio for bank i in quarter t and $MEANREC_{it}$ is the analyst recommendation for bank i in quarter t.

Since the fixed effects may be correlated with the lagged dependent variables, we follow Love and Ziccino (2006) and use forward mean-differencing ("Helmert Procedure") to remove only the forward mean, i.e., the mean of all the future observations available for each bank-quarter. This transformation preserves the orthogonality between transformed variables and lagged regressors. Finally, we estimate models simultaneously by system-wide Generalized Method of Moments (GMM).

Table 8 presents the panel-data VAR estimates. Panel A shows that the SI_RATIO series is very persistent. For example, the lagged SI_RATIO has coefficient estimate of 0.96 (t-statistic= 70.14) in predicting the current SI_RATIO. More important, we find that lagged SI_RATIO can predict the current levels of MEANREC while lagged MEANREC is not significant predictor of current SI_RATIO. Thus, actions of short sellers appear to lead analysts' recommendations. Turning to Panel B, we find no evidence of any lead-lag relation between short interest and credit rating suggesting that information set of rating agencies is not correlated with the information set of short sellers. Finally, when we consider the lead-lag relation between credit ratings and analyst recommendations in panel C, we find that credit ratings lag analyst recommendations suggesting that their information sets are correlated. Overall, the evidence indicates that short sellers are the first to act among the intermediaries examined followed by analysts. Credit ratings appear to be sluggish and auditors do not appear to be responding to risk indicators that have been identified as leading indicators of bank distress.

5.0 Conclusion

The banking/financial crisis of 2008 resulted in a massive failure of banks and had devastating effect on the U.S economy resulting in a large decline in value of not just the bank stocks but also in the value of debt and equity securities overall.

Our analysis attempted to address two important questions that were raised by academics, investors, regulators and standard setters in the aftermath of the banking crisis: (i) did financial statements of banks provide an early warning of their upcoming distress during the 2008 financial crisis when stock prices of banks fell precipitously?; and (ii) whether financial/information intermediaries were sensitive to the increased riskiness of the banks as reflected in the banks' financial statements?

Our results show that several indicators of bank distress identified from prior literature in financial economics are associated with subsequent bank failures during the 2008 crisis suggesting that financial statements of banks did indeed provide early warning signs regarding the unsustainable performance of the banks leading up to 2008. With regards to the second question, we study observable actions of four intermediaries (short sellers, credit rating agencies, analysts and auditors) to test if they were sensitive to the increased riskiness of the banks in the months leading up to the crisis. Our results show that short sellers were particularly sensitive to the leading indicators of bank distress as they increased their positions in the banks stocks in the months leading up to 2008 and more importantly their positions exhibited a strong association with the financial statement based indicators of bank distress during 2005-2007. An examination of recommendations of sell-side analysts shows that though not as timely as short sellers' actions, analysts' recommendations showed increased sensitivity to the financial indicators of bank distress. In contrast, evidence on the responsiveness of credit rating agencies is weak and in case of auditors there is no reliable association between the financial statement risk indicators and audit fees.

In sum, our evidence suggests that the actions of short sellers, and equity analysts to a lesser extent, provided an early warning about the unsustainable performance and build up of risk in the banking sector. This suggests that the negative rhetoric directed at short sellers is not wholly supported by the evidence and if anything, the evidence suggests that their actions were informative about the fragility of the banking system. Our evidence also raises questions as to why credit rating agencies and auditors were not sensitive to the indicators of bank distress that were reflected in publicly available financial statements.

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Appendix A. Variable Definitions

1. Dependent variables:

SI_RATIO: monthly short interest normalized by the number of shares outstanding, expressed in percentage points.

ABSI_5F: abnormal short interest, defined as the residual SI_RATIO after adjusting for five factors (size, book-to-market, momentum, turnover and institutional ownership) as in Karpoff and Lou (2010).

RATING: S&P domestic long term issuer credit rating for the month from COMPUSTAT Ratings file, coded as 1 for "AAA", 2 for "AA+", 3 for "AA", 4 for "AA-", and so on, and 23 for "D". Note that higher rating score denotes higher default risk.

MEANREC: the mean analyst recommendation for the month, as reported on I/B/E/S consensus recommendations file. According to standardized Thomson Reuters recommendation scale, 1 denotes "Strong Buy", 2 denotes "Buy", 3 denotes "Hold", 4 denotes "Underperform" and 5 denotes "Sell". Note that higher score denotes weaker consensus analyst recommendation.

COV_DROP: analyst coverage drop, equal to 1 if the number of analyst issuing the recommendation for the quarter decreases, 0 otherwise.

LOGAUDITFEE: logarithm of total audit fee for the year reported by Audit Analytics.

BANK_FAILURE: taking value 1 if the bank holding company fails during 2008-2010, 0 otherwise.

2. *Traditional financial statement indicators to identify a brewing banking crisis*

NPL: nonperforming loans (bhck5525+bhck5526), scaled by total loans (bhck 2122).

LCOMRE: construction loans plus loan secured by multifamily, nonresidential, and farm real estate (bhck1410-bhdm1797-bhdm5367-bhdm5368), scaled by total loans (bhck2122).

LRESI: loans secured by 1-4 family real estate (bhdm1797+bhdm5367+bhdm5368), scaled by total loans (bhck2122).

LCON: the ratio of consumer loans (bhdm1975) to total loans (bhck2122).

LAS: the ratio of total loans (bhck2122) to total assets (bhck2170).

DEPLGE: the ratio of large certificates of deposit (bhcb2604: time deposits of $100,000 or more) to total assets (bhck2170).

INTAS: interest and fee income on loans and leases (bhck4010+bhck4059+bhck4065), scaled by total assets (bhck2170).

GAP: the difference between assets that reprice or mature within one year and liabilities that reprice or mature within one year (bhck3197 – bhck3296 – bhck3298 – bhck3408 – bhck3409), scaled by total assets (bhck2170).

3. Proxies for concerns specific to the 2008 crisis:

SEC_RESI: outstanding principal balance of 1-4 family residential loans sold and securitized with servicing retained or with recourse or other seller-provided credit enhancements (bhckB705), scaled by total assets (bhck2170).

REG_ARB: the sum of total assets, derivatives and off-balance sheet items in the 20% risk weight category, divided by the sum of these items in all risk weight categories (bhckB697/(bhckB696+bhckB697+bhckB698+bhckB699)).

COMMIT_RE: off-balance-sheet commitments to fund commercial real estate, construction and land development (bhck3816+bhck6550), scaled by total assets (bhck2170).

4. Control variables:

CUR_RET: contemporaneous stock return for the holding period relevant to the test. For example, for the short interest regression, CUR_RET is the stock return for the 3-month window ending on short interest report date.

NI: The ratio of trailing twelve month net income to average total assets.

SIZE: logarithm of total assets (bhck2170).

BTM: book value of equity (bhck3210) divided by market value of equity.

MOMRET: momentum return, measured as cumulative stock return from month -6 to month -1 relative to the fiscal quarter end.

INSTHOLD: institutional ownership, calculated as the total number of shares held by institutions (from Thomson Reuters Institutional Holdings file) divided by the number of shares outstanding at the quarter end, then expressed in percentage points.

LEVERAGE: bank's tier-1 leverage ratio (bhck7204), defined as tier-1 equity capital divided by average total assets.

STDRESID: standard deviation of market model residual of daily returns during the quarter.

Notes: Specific data items on Federal Reserve Y-9C regulatory report used in constructing each variable are identified in the parenthesis wherever appropriate.

Table 1
Descriptive Statistics

Table 1 reports summary statistics for two samples: (1) the full sample of 8,253 bank-quarters in panel A; (2) a smaller subsample of 33 bank holding companies that failed during 2008-2010 in panel B. We divide the sample period of 2002-2007 into two equal time periods: 2002-2004 and 2005-2007. For each sample and each sub-period, we report the mean, median and standard deviation (Std. Dev) of the observable actions of the four information intermediaries, the financial statement indicators and the control variables. See Appendix A for variable definitions.

Panel A: Full sample

	2002-2004			2005-2007		
Variable	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.
SI_RATIO (%)	0.89	0.42	1.45	2.57	1.38	3.56
ABSI_5F (%)	0.42	0.09	1.27	2.11	0.63	3.33
RATING	7.44	7	1.91	6.99	7	2.10
MEANREC	2.59	2.67	0.62	2.66	2.86	0.61
Auditor Fee ($ million)	1.70	0.32	6.84	1.79	0.34	7.26
NPL (%)	0.86	0.63	0.86	0.71	0.49	0.87
LCOMRE	0.42	0.40	0.19	0.48	0.48	0.19
LRESI	0.28	0.28	0.16	0.27	0.26	0.16
LCON	0.08	0.05	0.09	0.06	0.03	0.08
LAS	0.64	0.66	0.14	0.69	0.71	0.14
DEPLGE	0.11	0.10	0.07	0.14	0.12	0.09
INTAS (%)	2.57	2.43	1.33	2.97	2.82	1.59
GAP	0.11	0.10	0.18	0.10	0.10	0.18
SEC_RESI (%)	0.93	0	5.66	0.90	0	6.07
COMMIT_RE (%)	4.65	3.53	4.77	6.36	5.19	5.38
REG_ARB	0.23	0.22	0.10	0.20	0.19	0.10
BTM	0.58	0.53	0.26	0.62	0.56	0.33
MOMRET	0.12	0.10	0.17	0.01	0.01	0.14
INSTHOLD (%)	24.7	18.7	20.0	30.8	26.4	21.9
LEVERAGE (%)	9.11	8.49	4.95	9.48	8.87	12.65
STDRESID	0.02	0.01	0.01	0.02	0.01	0.01
NI	0.03	0.03	0.02	0.03	0.03	0.02
CUR_RET	0.05	0.04	0.12	-0.01	-0.00	0.12
Total Assets ($ million)	19,493	1,194	100,349	29,095	1,540	155,051
# of Observations		4,005			4,248	

Panel B: 33 bank holding companies that failed during 2008-2010

	2002-2004			2005-2007		
Variable	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.
SI_RATIO (%)	1.29	0.60	2.28	3.83	1.45	6.41
ABSI_5F (%)	0.75	0.15	2.17	3.47	1.17	6.24
RATING	7.5	7.5	2.55	7.42	7	2.48
MEANREC	2.46	2.5	0.70	2.61	2.75	0.69
Auditor Fee ($ million)	1.30	0.72	1.80	0.94	0.45	1.51
NPL (%)	0.74	0.58	0.74	0.88	0.52	1.33
LCOMRE	0.57	0.58	0.21	0.68	0.70	0.20
LRESI	0.22	0.19	0.18	0.16	0.13	0.13
LCON	0.05	0.02	0.06	0.03	0.01	0.04
LAS	0.71	0.72	0.13	0.77	0.79	0.12
DEPLGE	0.13	0.13	0.08	0.20	0.19	0.11
INTAS (%)	2.91	2.79	1.43	3.59	3.46	1.79
GAP	0.20	0.16	0.24	0.17	0.17	0.20
SEC_RESI (%)	3.19	0	9.85	1.77	0	8.80
COMMIT_RE (%)	8.38	4.21	11.1	11.8	8.36	9.85
REG_ARB	0.20	0.18	0.11	0.16	0.14	0.11
BTM	0.63	0.58	0.23	0.71	0.61	0.44
MOMRET	0.14	0.11	0.21	-0.02	-0.01	0.19
INSTHOLD (%)	25.1	20.9	19.3	31.1	31.6	21.2
LEVERAGE(%)	9.49	8.23	3.07	9.83	9.46	2.32
STDRESID	0.02	0.02	0.01	0.02	0.02	0.01
NI	0.03	0.02	0.02	0.02	0.02	0.01
CURRENT_RET	0.07	0.05	0.14	-0.04	-0.02	0.15
Total Assets ($ million)	9,628	1,863	27,526	9,344	1,365	32,233
# of Observations		224			349	

Table 2
Correlation Analysis

Table 2 reports the correlation coefficients between financial statement predictors based on the full sample of 8,253 bank-quarters during 2002-2007. Pearson (Spearman) correlation coefficients are below (above) the diagonal. Bolded value indicates statistical significance at 5% level. See Appendix A for variable definitions.

	NPL	LCOMRE	LRESI	LCON	LAS	DEPLGE	INTAS	GAP	SEC_RESI	COMMIT_RE	REG_ARB
NPL	1	**-0.17**	**0.03**	**0.20**	**-0.05**	**-0.03**	**0.06**	-0.01	**0.18**	**-0.15**	0.02
LCOMRE	**0.06**	1	**-0.60**	**-0.52**	**0.36**	**0.39**	**0.21**	**0.03**	**-0.22**	**0.54**	**-0.21**
LRESI	-0.01	**-0.59**	1	**0.21**	**-0.17**	**-0.30**	**-0.10**	**-0.23**	**0.08**	**-0.31**	**0.12**
LCON	**0.05**	**-0.48**	0.02	1	**-0.17**	**-0.17**	**-0.06**	0.02	**0.15**	**-0.29**	0.10
LAS	**-0.08**	**0.36**	**-0.13**	**-0.18**	1	**0.36**	**0.41**	**0.08**	**-0.13**	**0.44**	**-0.70**
DEPLGE	0.02	**0.35**	**-0.30**	**-0.16**	**0.32**	1	**0.18**	**-0.11**	**-0.12**	**0.30**	**-0.20**
INTAS	**0.06**	**0.22**	**-0.12**	**-0.07**	**0.45**	**0.16**	1	0.01	**-0.09**	**0.21**	**-0.30**
GAP	**-0.06**	**0.03**	**-0.26**	0.00	**0.03**	**-0.10**	0.01	1	**0.14**	**0.16**	**-0.13**
SEC_RESI	**0.18**	**-0.10**	**0.08**	**0.03**	**-0.10**	-0.02	**-0.03**	**0.05**	1	**-0.10**	0.01
COMMIT_RE	**-0.11**	**0.51**	**-0.30**	**-0.26**	**0.35**	**0.22**	**0.18**	**0.15**	**-0.06**	1	**-0.32**
REG_ARB	**0.06**	**-0.18**	**0.14**	**0.08**	**-0.71**	**-0.15**	**-0.32**	**-0.15**	-0.00	**-0.25**	1

Table 3
Validation of financial statement indicators

Table 3 examines the association of the financial statement indicators with subsequent bank failures during and after the recent crisis. In models (1) and (2), we estimate a logistic model where the dependent variable, BANK_FAILURE, is coded as 1 when the particular bank holding company failed during 2008-2010, zero otherwise. *t*-statistics are reported in the bracket. *** and ** indicate statistical significance at the 1% and 5% level (one-sided or two-sided, where appropriate) respectively. See Appendix A for variable definitions.

	Pred. Sign	Logit Regression Dependent Variable =BANK_FAILURE	
		Model (1)	Model (2)
NPL	+	21.17*** (4.30)	14.70*** (2.83)
LCOMRE	+	7.66*** (13.46)	6.50*** (10.82)
LRESI	+	4.31*** (6.69)	3.50*** (5.32)
LCON	+	2.80** (2.24)	2.31** (1.87)
LAS	+	2.63*** (5.25)	5.89*** (5.62)
DEPLGE	+	3.83*** (6.69)	3.37*** (5.66)
INTAS	+	3.88 (1.16)	4.03 (1.19)
GAP	_	3.16 (10.61)	2.75 (8.93)
SEC_RESI	+		5.14*** (8.51)
COMMIT_RE	+		4.02*** (5.09)
REG_ARB	+		3.74*** (3.10)
Intercept		-11.17*** (-18.62)	-13.58*** (-12.77)
N		8,253	8,253
Pseudo R^2		0.202	0.225

Table 4
The association of abnormal short interest with financial statement indicators

Table 4 examines whether short sellers respond to financial statement indicators of bank risk. The dependent variable is ABSI_5F, the abnormal short interest. We use fully interactive model to test for the differences in regression coefficients between the two periods (column 1 and column 2) and report the results in the last column. We follow Thompson (2011) and report t-statistics based on two-way clustered standard errors by bank and by year. *** and ** indicate statistical significance at the 1% and 5% level (one-sided or two-sided, where appropriate) respectively. See Appendix A for variable definitions.

	Pred. Sign	2002-2004	2005-2007	Coeff. Difference (t-statistic)
NPL	+	1.55	38.75***	37.20***
		(0.33)	(2.99)	(3.04)
LCOMRE	+	0.39	3.21**	2.82**
		(0.62)	(2.39)	(2.21)
LRESI	+	0.26	1.80**	1.54**
		(0.48)	(2.33)	(1.97)
LCON	+	-1.14	0.64	1.78
		(-1.89)	(0.46)	(1.43)
LAS	+	0.58	1.21	0.63
		(1.05)	(0.94)	(0.51)
DEPLGE	+	0.90	1.23	0.33
		(1.24)	(1.05)	(0.31)
INTAS	+	0.66	14.40***	13.74***
		(0.21)	(3.78)	(3.07)
GAP	-	-0.02	-1.03**	-1.01**
		(-0.12)	(-2.05)	(-2.27)
SEC_RESI	+	0.64	0.49	-0.15
		(0.73)	(0.21)	(0.07)
COMMIT_RE	+	-0.52	8.76	9.28
		(-0.45)	(1.54)	(1.55)
REG_ARB	+	0.87	4.74**	3.87
		(1.34)	(1.70)	(1.53)
BTM		-0.47***	-0.86**	-0.39
		(-2.91)	(-2.45)	(-1.14)
MOMRET		0.39***	-3.35**	-3.74**
		(2.87)	(-2.42)	(-3.01)
INSTHOLD		0.02***	0.07***	0.05***
		(2.90)	(3.00)	(2.43)
NI		-0.74	10.87	11.61
		(-0.47)	(1.89)	(1.85)
CUR_RET		-0.14	-3.27**	-3.13**
		(-0.45)	(-2.45)	(-2.55)
Intercept		-0.65	-5.08**	-4.43**
		(-0.82)	(-2.30)	(-2.16)
N		4,005	4,248	
Adj. R-squared		0.108	0.323	

Table 5
Ordinal logistic regression of credit rating on financial statement indicators

Table 5 examines whether credit rating agencies are sensitive to financial statement indicators of bank risk. The dependent variable is S&P credit rating score (RATING). In columns 1 and 2, we use ordinal logistic regression and report Z-statistics calculated based on robust standard errors clustered at the bank level. We use fully interactive model to test for the differences in odds ratio between the two periods and report the Z-statistic in the last column. *** and ** indicate statistical significance at the 1% and 5% level (one-sided or two-sided, where appropriate) respectively. See Appendix A for variable definitions.

	Pred. Sign	2002-2004	2005-2007	Z-statistic of the diff. in odds ratio
NPL	+	18.76	92.06***	1.85**
		(0.58)	(2.66)	
LCOMRE	+	6.01***	4.09**	-1.11
		(3.14)	(2.31)	
LRESI	+	3.01	0.15	-1.14
		(1.18)	(0.07)	
LCON	+	2.62	-2.50	-0.86
		(0.56)	(-0.54)	
LAS	+	2.17	1.70	-0.13
		(1.18)	(1.05)	
DEPLGE	+	2.56	-0.13	-0.29
		(0.50)	(-0.02)	
INTAS	+	17.11**	-8.06	-2.93
		(2.44)	(-1.21)	
GAP	-	-0.90	-2.77**	-1.20
		(-0.69)	(-1.95)	
SEC_RESI	+	-0.90	-0.11	0.27
		(-0.42)	(-0.05)	
COMMIT_RE	+	0.93	5.96	0.58
		(0.07)	(0.51)	
REG_ARB	+	6.90**	9.22**	0.68
		(2.14)	(2.55)	
LEVERAGE		0.23**	0.13	-0.80
		(2.38)	(1.15)	
STDRESID		87.52***	3.51	-3.11***
		(3.82)	(0.13)	
SIZE		-0.92***	-1.15***	-1.02
		(-3.86)	(-5.39)	
NI		-54.03**	-23.32	1.36
		(-2.56)	(-1.53)	
CUR_RET		1.47**	-0.64	-1.70
		(2.47)	(-0.64)	
N		729	694	
Pseudo R^2		0.254	0.283	

Table 6
The responses of sell-side analysts to financial statement indicators

Table 6 examine whether sell-side analysts are sensitive to financial statement indicators of bank risk. In panel A, the dependent variable is MEANREC, the consensus (mean) analyst recommendation. We use OLS regression and fully interactive model to test for the differences in regression coefficients between the two periods (column 1 and column 2) and report the results in the last column. We follow Thompson (2011) and calculate t-statistics based on two-way clustered standard errors by bank and by year. In panel B, the dependent variable is COV_DROP, a dichotomous variable for analyst coverage drop. We use logistic regression and report Z-statistics calculated based on robust standard errors clustered at the bank level. We use fully interactive model to test for the differences in odds ratio between the two periods and report the Z-statistic in the last column. *** and ** indicate statistical significance at the 1% and 5% level (one-sided or two-sided, where appropriate) respectively. See Appendix A for variable definitions.

Panel A: The association between consensus analyst recommendation and leading indicators

	Pred. Sign	2002-2004	2005-2007	Coeff. Difference (t-statistic)
NPL	+	6.15**	10.34***	4.19
		(1.72)	(3.75)	(1.47)
LCOMRE	+	0.14	0.07	-0.07
		(0.59)	(0.50)	(-0.32)
LRESI	+	0.12	0.13	0.01
		(0.49)	(0.69)	(0.06)
LCON	+	0.08	-0.18	-0.26
		(0.31)	(-0.45)	(-0.67)
LAS	+	0.19	0.54***	0.35
		(0.80)	(2.72)	(1.47)
DEPLGE	+	-0.99	-0.93	0.06
		(-3.30)	(-4.96)	(0.21)
INTAS	+	1.36	1.79***	0.43
		(0.97)	(2.64)	(0.31)
GAP	-	0.29	-0.16**	-0.45**
		(1.11)	(-1.84)	(-1.92)
SEC_RESI	+	-1.01	-0.15	0.86**
		(-3.48)	(-0.45)	(2.15)
COMMIT_RE	+	-1.08	-0.93	0.15
		(-2.65)	(-1.94)	(0.21)
REG_ARB	+	0.69**	1.35***	0.66**
		(2.38)	(4.05)	(1.97)
BTM		-0.16	-0.03	0.14
		(-1.54)	(-0.75)	(1.58)
MOMRET		-0.32	-0.06	0.26
		(-1.90)	(-0.69)	(1.59)
SIZE		-0.01	0.05**	0.06***
		(-0.65)	(2.51)	(3.08)
NI		-1.53**	0.44	1.97
		(-2.01)	(0.23)	(1.15)
CUR_RET		-0.53***	-0.33***	0.20
		(-3.08)	(-4.51)	(1.24)
Intercept		2.57***	1.69***	-0.88**
		(5.56)	(6.05)	(-2.04)
N		3,083	3,210	
Adj. R-squared		0.065	0.094	

Panel B: the association between analyst coverage drop and leading indicators

	Pred. Sign	2002-2004	2005-2007	Z-statistic of the diff. in odds ratio
NPL	+	-3.18 (-0.45)	7.10 (1.19)	1.15
LCOMRE	+	-0.80 (-1.77)	-0.14 (-0.37)	1.19
LRESI	+	-0.93 (-1.72)	-0.33 (-0.71)	0.90
LCON	+	0.15 (0.25)	-0.47 (-0.63)	-0.69
LAS	+	1.04** (2.06)	0.75 (1.23)	-0.39
DEPLGE	+	-0.88 (-1.02)	0.06 (0.09)	0.89
INTAS	+	-14.47*** (-2.95)	10.37*** (3.01)	4.02***
GAP	-	0.16 (0.43)	-0.56 (-1.81)	-1.53
SEC_RESI	+	-0.77 (-1.26)	0.47 (0.46)	1.25
COMMIT_RE	+	0.63 (0.43)	-1.60 (-1.64)	-1.38
REG_ARB	+	0.04 (0.06)	1.38 (1.88)	1.40
BTM		0.03 (0.20)	-0.41 (-1.87)	-1.67
MOMRET		0.31 (0.81)	-0.28 (-0.81)	-1.12
SIZE		0.35*** (8.89)	0.37*** (9.51)	0.50
NI		4.83** (2.27)	1.33 (0.47)	-1.09
CUR_RET		-0.30 (-0.55)	-0.21 (-0.48)	0.13
Intercept		-4.58*** (-7.22)	-5.18*** (-6.89)	-0.63
N		2,964	3,151	
Pseudo R^2		0.082	0.063	

Table 7
The association of Audit Fees (LOGAUDITFEE) with leading indicators

Table 7 examines whether auditors increases audit fees in response to the growing risk as indicated by the key financial statement variables. The dependent variable is LOGAUDITFEE, measured as the logarithm of AUDITFEE. We use fully interactive model to test for the differences in regression coefficients between the two periods (column 1 and column 2) and report the results in the last column. We follow Thompson (2011) and calculate t-statistics based on two-way clustered standard errors by bank and by year. *** and ** indicate statistical significance at the 1% and 5% level (one-sided or two-sided, where appropriate) respectively. See Appendix A for variable definitions.

	Pred. Sign	2002-2004	2005-2007	Coeff. Difference (t-statistic)
NPL	+	-0.56	0.06	0.61
		(-0.55)	(0.05)	(0.37)
LCOMRE	+	-0.23	-0.15	0.08
		(-1.95)	(-1.19)	(0.60)
LRESI	+	-0.23	-0.07	0.17
		(-2.10)	(-0.50)	(1.20)
LCON	+	-0.62	-0.12	0.50**
		(-3.39)	(-0.52)	(2.14)
LAS	+	-1.49	-1.73	-0.23
		(-6.92)	(-6.58)	(-0.76)
DEPLGE	+	0.28	0.33***	0.06
		(1.58)	(2.81)	(0.34)
INTAS	+	3.74**	-0.05	-3.79
		(1.76)	(-0.04)	(-2.51)
GAP	-	-0.01	0.17	0.18
		(-0.11)	(2.36)	(2.15)
SEC_RESI	+	0.40	0.38	-0.03
		(1.38)	(0.99)	(-0.07)
COMMIT_RE	+	0.46	0.04	-0.42
		(1.51)	(0.19)	(-1.73)
REG_ARB	+	-1.37	-1.87	-0.50
		(-5.38)	(-6.48)	(-1.47)
BTM		0.25	-0.08	-0.33***
		(1.84)	(-0.69)	(-3.08)
LEVERAGE		0.00	0.00	-0.00
		(0.19)	(0.22)	(-0.16)
STDRESID		3.29***	2.23	-1.07
		(3.37)	(1.71)	(-0.44)
SIZE		0.32***	0.30***	-0.01
		(16.91)	(16.33)	(-1.07)
NI		0.10	-0.83	-0.93
		(0.10)	(-1.03)	(-1.04)
CUR_RET		0.08	0.09	0.00
		(1.18)	(0.49)	(0.01)
Intercept		-0.76***	-0.21	0.54
		(-2.83)	(-0.68)	(1.68)
N		1,099	1,037	
Adj. R-squared		0.773	0.805	

Table 8
Panel-data VAR Estimation to Assess Leads and Lags in Intermediaries' Actions

Table 8 uses a panel-data vector auto-regression (VAR) methodology (Love and Ziccino 2006; Holtz-Eakin et al. 1988). This technique combines the traditional VAR approach, which treats all the variables in the system as endogenous, with the panel-data approach, which allows for unobserved individual heterogeneity. We specify a first-order bivariate VAR model as follows: $Z_{i,t} = \beta_0 + \beta_1 Z_{i,t-1} + f_i + \varepsilon$, where Z_{it} ($Z_{i,t-1}$) is one of the following three bivariate vectors, {SI_RATIO, MEANREC} or {SI_RATIO, RATING} or { RATING, MEANREC}, for bank i measured at quarter t (quarter t-1), f_i is bank fixed effects included to allow for heterogeneity for each cross-sectional unit. Since the fixed effects may be correlated with the lagged dependent variables, we use forward mean-differencing ("Helmert Procedure") to remove only the forward mean, i.e., the mean of all the future observations available for each bank-quarter. This transformation preserves the orthogonality between transformed variables and lagged regressors. The model is estimated by system GMM and t-statistics are reported in the bracket. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level respectively. See Appendix A for variable definitions.

Panel A:

	$SI\_RATIO_{i,t-1}$	$MEANREC_{i,t-1}$
$SI\_RATIO_{i,t}$	0.96***	-1.23
	(70.14)	(-1.38)
$MEANREC_{i,t}$	0.11***	0.47***
	(2.51)	(4.03)

Panel B:

	$SI\_RATIO_{i,t-1}$	$RATING_{i,t-1}$
$SI\_RATIO_{i,t}$	0.97***	0.39
	(8.06)	(0.29)
$RATING_{i,t}$	-0.02	0.59***
	(-1.53)	(3.77)

Panel C:

	$RATING_{i,t-1}$	$MEANREC_{i,t-1}$
$RATING_{i,t}$	1.02***	0.13*
	(13.75)	(1.86)
$MEANREC_{i,t}$	-0.03	0.81***
	(-0.42)	(15.76)