Bank CEO Optimism and the Financial Crisis*

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Abstract

I test theories of the recent financial crisis by studying how banks' pre-crisis investments connect to their CEOs' beliefs. Using different proxies for beliefs, I find banks with larger housing investments and worse crisis performance had CEOs who were more optimistic ex ante. Banks with the most optimistic CEOs experienced 20 percentage points higher real estate loan growth, and 15 percentage points lower crisis period stock returns. Bank decisions appear consistent with CEO beliefs. CEOs' optimism contributed to credit expansions and crisis losses. I do not find evidence that CEOs made housing investments due to agency frictions while aware of impending problems.

JEL classification: G01, G20, G21, G32.

Key words: Financial crisis; CEO optimism; Real estate loans; Bank performance.

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1 Introduction

The real estate investments of US banks played a central role in the recent financial crisis. They were a major cause of severe bank losses that led to financial panics, large-scale contractions in lending, and disruptions in real economic activities (Ivashina and Scharfstein, 2010; Chodorow-Reich, 2014; Greenstone and Mas, 2012). Why did banks build up so much risk exposure to real estate? There are two prominent views on this question. One view highlights agency problems: bank managers and employees had incentive structures which focused on short-term performance and encouraged excessive risk taking (Acharya, Philippon, Richardson, and Roubini, 2009; Dowd, 2009). Another view emphasizes bounded rationality: bank decision-makers extrapolated on past trends of house prices and underestimated the probability of price declines (Barberis, 2013; Gennaioli, Shleifer, and Vishny, 2012; Cheng, Raina, and Xiong, 2014).

In this paper, I test alternative theories of the crisis by studying bank CEOs' pre-crisis beliefs, and importantly, how CEOs' beliefs connect to their banks' investments in the housing boom and ultimately to bank performance during the crisis. The key observation is that the above two classes of theories have different predictions about whether a bank's investment decision would be consistent with its manager's personal view of bank prospects. If real estate investments were driven by managerial beliefs, then we would expect to see a positive correlation between the aggressiveness of investments and the CEO's optimism about their future payoffs. However, if investments were instead driven by agency problems or other frictions, then CEOs at banks with more investments do not need to appear more optimistic. In the case where managers were aware of the impending collapse in the housing market, CEOs at banks with more real estate investments should even exhibit greater pessimism in their private beliefs about their banks' prospects. Therefore, the relationship between managers' beliefs and bank decisions may shed further light on the factors contributing to the financial crisis.

In this analysis, the belief that I focus on is the CEO's view of future returns to his own bank's real estate exposures. For simplicity, I refer to this belief as "CEO Optimism". To measure such beliefs, I take a revealed-belief approach and construct proxies using CEOs' holding decisions with respect to their own banks' equity.[1] The primary measure I use is

[1] I choose equity-based measures for several reasons. First, CEOs' equity holdings link firm performance to personal wealth, so equity holding decisions should be closely related to CEOs' true beliefs

based on the log change in CEOs' total holdings of their banks' stocks and delta-weighted options in the boom years of 2002 through 2005.[2] Additionally, I check the robustness of the results using an alternative measure based on whether CEOs choose to exercise vested deeply-in-the-money options, following Malmendier and Tate (2005, 2008). Essentially, equity-based measures capture CEOs' beliefs about future returns of their banks' stocks. Because a major part of commercial banks' assets are real estate related,[3] and bank stock returns in the past two decades have been significantly influenced by the large swing in housing prices, beliefs about returns to real estate assets and returns to bank stocks should be highly correlated in this period.

Using both proxies for beliefs, I find that CEO optimism is positively correlated with the increase of real estate loans in bank assets during the boom, and negatively correlated with bank stock performance in the crisis. Banks with the most optimistic quintile of CEOs had on average 20 percentage points higher real estate loan growth from 2002 to 2005 and 15 percentage points lower stock returns from 2007 to 2009 compared to banks with the least optimistic quintile of CEOs. The results suggest that banks' ex ante business decisions were consistent with their CEOs' personal beliefs. CEOs' optimism contributed to real estate exposures, and exacerbated bank losses during the crisis.

The consistency between bank decisions and managerial beliefs appears less supportive of the view that bank executives made housing investments due to misaligned incentives, despite their awareness of impending problems. If this view were true, managers at banks with the most real estate investments should be most active in selling their equities to cash out in the pre-crisis period, which is the opposite of what I find in the data.

The main results are well-exemplified by a comparison of US Bancorp and SunTrust Bank, the 9th and 10th largest US banks in early 2000s. These two banks offered similar services, but were quite different in their CEOs' judgment during the housing boom. While SunTrust's pre-crisis CEO Phillip Humann explicitly expressed optimistic views, US Bancorp's CEO Jerry Grundhofer was more cautious, telling shareholders that the company was taking steps to reduce risks. Humann increased his personal equity holding

about their firms' prospects. Second, equity generally has low transaction costs and is liquid enough to allow for frequent adjustments. Third, equity-based measures are easy to construct using publicly available data on insider equity transactions.

[2]The selection of the boom period follows Mian and Sufi (2009), but results are little changed for alternative time periods such as 2002 to 2006.

[3]For the median bank, loans backed by real estate alone account for about 50% of assets in the 2000s.

by 29% from 2002 to 2005 while Grundhofer's holding increased by 11%. Consistent with their views, SunTrust's real estate loans grew by 97% from 2002 to 2005 whereas the corresponding growth for US Bancorp was only 20%. In the crisis, SunTrust lost 73% of its share value from 2007 to 2009 while US Bancorp lost 30%, which was relatively light compared to a loss of 57% for the median bank in my sample.

A small number of large, systematically important banks are central to this crisis, and the same pattern also holds among these institutions. Equity holding increase from early 2002 to early 2006 is substantial for most CEOs at the poor-performing banks, including James Cayne of Bear Stearns, Stanley O'Neal of Merrill Lynch, Kenneth Lewis of Bank of America, and Charles Prince of Citigroup. The change is modest for Henry Paulson of Goldman Sachs and William Harrison of JPMorgan Chase. Philip Purcell, who was forced by Morgan Stanley partners to resign in 2005 because of his refusal to aggressively increase risk and leverage, decreased his holdings substantially. The only exception is Richard Fuld of Lehman Brothers, who decreased his holdings slightly.

While there is a strong positive correlation between CEOs' measured optimism and bank real estate investments, one might worry about omitted variable biases. The primary concern is that CEOs sometimes may not be able to fully adjust their equity positions due to equity disposition restrictions, in which case equity-based measures would be affected by the amount of equity compensation and the degree of disposition constraints. At the same time, certain uncontrolled factors can affect both bank investments and equity compensation policies.[4]

I address this concern in several different ways. First, to make sure the results are not driven by equity compensation in the pre-crisis period, I construct a counterfactual variable that measures how much CEOs' equity holdings would have changed if they just passively accumulated equity awards and did not make any adjustments. I show that this variable alone is not correlated with the outcomes of interest, and controlling for this variable does not change the main results.[5] Second, results are also little different when

[4]For example, banks that specialize in riskier businesses or are eager to expand might choose to pay more equity compensation, or to discourage equity disposition through explicit and implicit company rules. Meanwhile, these banks might also be more likely to make large real estate investments during the housing boom. Alternatively, banks in roaring housing markets might experience higher real estate loan growth due to higher demand. These banks may also be temporarily more profitable and have higher CEO compensation. If CEOs are not able to fully adjust their equity holdings, they could have higher equity holding increase and be mislabeled as "optimistic".

[5]This is equivalent to decomposing the total holding change into a passive part (effect of equity awards) and an active part (effect of adjustments). I find the results are driven by the active part.

controlling for CEOs' measured optimism in other time periods. To the extent that the unobservables are relatively persistent, the residual explanatory power of optimism in the boom period should be less susceptible to bank-level and CEO-level omitted variable problems.

Additionally, I address the concern that housing market dynamics in a bank's geographic area could affect both the bank's real estate loan growth and the CEO's equity holding change (through equity compensation coupled with disposition restrictions). In the data, measured optimism is not significantly correlated with local house price appreciation. The results are also robust to taking out county fixed effects using detailed loan-level data. Lastly, I perform the analysis for CEOs on CFOs and COOs; I find weak results using the measured optimism of COOs, and no results using that of CFOs. Since all top executives are generally subject to the same set of firm policies, these tests further alleviate concerns about bank-level unobservables.

In the aftermath of the crisis, there is a vibrant literature exploring the causes of financial institutions' risk exposures (Beltratti and Stulz, 2012; Fahlenbrach, Prilmeier, and Stulz, 2012; Ellul and Yerramilli, 2013; Minton, Taillard, and Williamson, 2014). This paper contributes to the ongoing discussion by documenting the link between managerial beliefs and bank actions. Indeed, while policy-makers on the front line of crisis resolution have noted that beliefs of financial institutions are central to understanding the housing boom and the crisis (e.g. Geithner (2014)), empirical research on this issue is relatively sparse, especially compared to the extensive literature on agency problems and moral hazard in the banking sector. In a pioneering paper, Cheng et al. (2014) study personal housing transactions records of mid-level Wall Street securitization managers, and point out that this group of financial industry insiders appear to have held distorted beliefs about the housing market in the boom. My paper complements their work. My findings highlight that bank decision-makers' beliefs are closely connected with banks' investment decisions and the associated losses. In addition, while Cheng et al. (2014) study financial intermediaries as one group, I also look more closely at the substantial cross-sectional differences among banks in their investments and crisis performance, and how this heterogeneity relates to differences in bank executives' beliefs.[6]

[6]To closely connect personal views and institutional decisions, I focus on CEOs rather than mid-level managers since CEOs' opinions are more likely to be relevant for firm policies (Bertrand and Schoar, 2003; Malmendier and Tate, 2005), and the beliefs and incentives of lower level employees are possibly influenced by the views and actions of top executives (Bolton, Brunnermeier, and Veldkamp, 2013;

Several recent papers study the housing boom and the financial crisis from other angles, and find evidence that hints at the role of over-optimism. For instance, Fahlenbrach and Stulz (2011) investigate bank CEOs' incentive structure, and show that the degree of incentive alignment cannot explain bank performance in the financial crisis. Adelino, Schoar, and Severino (2015a), Adelino, Schoar, and Severino (2015b) and Foote, Gerardi, and Willen (2012) study patterns in loan origination and mortgage delinquency, and argue the facts are most consistent with a narrative of the credit boom that emphasizes distorted beliefs. These findings may not be conclusive, and many have sparked lively debates. Yet it is evident from these debates the value to understand beliefs and how they relate to bank actions.

Finally, my paper contributes to research on beliefs, corporate investment, and macroeconomic outcomes (Eisner, 1978; Malmendier and Tate, 2005; Cummins, Hassett, and Oliner, 2006; Greenwood and Hanson, 2015; Kozlowski, Veldkamp, Stern, and Venkateswaran, 2015). In recent work, Gennaioli, Ma, and Shleifer (2015) show that executives' expectations are the primary determinant of firm investment, and that these expectations exhibit systematic biases. This general insight can be particularly important in the context of the banking sector, given that banks' decisions determine the availability of credit in the economy, and credit is well known to be a key driver of fluctuations and crises (Reinhart and Rogoff, 2009; Schularick and Taylor, 2012; Jorda, Schularick, and Taylor, 2015).

The rest of the paper proceeds as follows. Section 2 describes the sample of banks and the data; Section 3 explains the optimism measures; Section 4 presents the main results and robustness checks; Section 5 discusses the illustrative case and examines CEO optimism among the largest banks; Section 6 concludes.

2 Data

I collect three types of data on banks: 1) data on executive equity holdings and transactions to construct proxies for executive beliefs, 2) bank balance sheet and loan originations data to evaluate pre-crisis investment decisions, and 3) data on bank stocks to measure crisis performance and control for other stock characteristics.

The initial sample of banks includes publicly listed bank holding companies, commer-

Benabou, 2013; Caillaud and Tirole, 2007).

cial banks, and firms with SIC codes from 6200 to 6299. Then I review firm descriptions on Reuters and exclude 1) banks whose major markets are outside of the US, 2) banks that do not have exposures to the real estate market, such as banks that specialize in student loans and auto loans, 3) asset management firms, and 4) other institutions excluded in Fahlenbrach and Stulz (2011). Because investment banks, brokers, and dealers may not be directly comparable to commercial banks, I also exclude them in the main sample.[7] The supplementary appendix reports the list of firms excluded from the initial sample of banks, as well as the remaining sample after the drops.

The measures of CEO optimism are based on equity holdings and option transactions. I obtain these data from Thomson Reuters' Insider Filing dataset. This dataset records all insider transactions of stocks and derivatives reported to the SEC (including initial holdings, equity awards, purchases, sales, transfers, option exercises, periodic statements of current holdings, etc.). For each transaction, the dataset also provides information on the security involved, including the exercise date, expiration date and exercise price of options.[8] Construction of optimism measures is discussed in detail in Section 3.

To measure banks' pre-crisis real estate exposure, I collect detailed balance sheet data from FR Y-9C filings, supplemented with loan-level data from the Home Mortgage Disclosure Act (HMDA) dataset. Since FR Y-9C forms are only filed by bank holding companies, this analysis is restricted to the subsample of bank holding companies.[9] In addition, I obtain data on basic bank characteristics for the whole sample from Compustat.

To measure banks' performance during the financial crisis, I use holding period returns of bank stocks from January 2007 to December 2009. The starting point is January 2007 since banks' stock prices started to decline in early 2007 with the development of the subprime crisis. The end point is December 2009 because the severe impact of the crisis

[7]Results are similar if they are included. Since the largest investment banks played an important role in the crisis, I also discuss them individually along with the largest commercial banks in Section 5.2.

[8]Before 2006, Thomson Reuters' Insiders Database is the only publicly available source (to my knowledge) that provides information on option expiration dates and exercise prices, which are needed to calculate option deltas. The data is based on SEC forms 3, 4, and 5, which all corporate insiders are required to file for their equity transactions and holdings. Starting in 2006, companies are also required to report the expiration dates and exercise prices of options currently held by executives in their annual proxy statements. The proxy statement data are recorded by Execucomp. To cross check the accuracy of my optimism measures constructed using Thomson Reuters data, I also compute the measures using Execucomp data from 2006 onwards. The measures computed using these two sources are very highly correlated.

[9]The list of included banks in the supplementary appendix also shows which institutions are bank holding companies.

lasted through 2009 for many banks (especially for smaller banks).

For tractability and consistency, most of the analysis relies on banks that had the same CEO during the height of the housing boom (2002 to 2005). There are 184 such firms and they are bolded in the list of included banks in the supplementary appendix. Table 1 Panel A summarizes the balance sheet and stock characteristics for this subsample of banks that had the same CEO from 2002 to 2005. It shows that this subsample covers both small and large banks. The median total asset as of 2002 is $1 billion, which is moderate. The sum of assets for banks in this subsample is $2.1 trillion as of 2002 and $3.5 trillion as of 2007. The median bank in this subsample had 47% of assets in real estate loans as of 2002, which increased to 53% by the end of 2006. These banks generally experienced significant stock price appreciation in the pre-crisis period, with a median holding period return of 52% from January 2003 to December 2006. They then suffered serious losses during the crisis, and the median holding period return became -54%. I also verify that the characteristics of banks in this subsample are not different from those of the banks in the full sample.

3 Measures of Executive Optimism

3.1 General Framework

This section discusses proxies of CEO optimism. I construct two measures from CEOs' holding decisions with respect to their own banks' equity. The primary measure is the change in total holdings of bank stocks and delta-weighted options. The alternative measure, following Malmendier and Tate (2005, 2008), is based on decisions to exercise vested, deeply-in-the-money options. In essence, both measures reflect CEOs' attitude towards equity accumulation, and therefore their beliefs about future returns to their banks' stocks. To the extent that a substantial portion of US commercial banks' assets are real estate related and these assets have been a main driver of bank performance due to the large swing in house prices, beliefs about future stock returns should be highly correlated with beliefs about the future performance of real estate related assets.

To further illustrate the connection between equity-based optimism measures and bank real estate investments, consider the following three cases. In the first case, suppose that real estate investments are related to CEO optimism. When a CEO becomes more

optimistic about returns to real estate related assets, he will want to make more real estate investments to increase expected firm profits (and the value of his existing equity holdings). As expected firm value increases according to his beliefs, the CEO will also be willing to hold more firm equity. Thus, we would expect to see a generally positive correlation between the CEO's willingness to hold bank equity and the bank's real estate investments.

In the second case, suppose that real estate investments are driven by other factors such as the CEO's short-term incentives from making these investments,[10] but the CEO is aware of a possible future collapse and is therefore pessimistic about their long-term returns. In this situation, the bank's real estate investments will increase with the short-term incentives. However, as the CEO is pessimistic about their longer-term prospects, the more investments the bank makes, the more he will want to reduce his personal exposure to bank equity. Accordingly, we would expect to see a generally negative correlation between the CEO's willingness to hold bank equity and the bank's real estate investments.

In the third case, suppose there are short-term incentives for real estate investments and the CEO is also sufficiently optimistic. Like in the previous case, the short-term incentives will lead to an increase in investments. As investments expand, an optimistic CEO may also think that the expected value of firm assets has become higher, and his desired equity holding may increase. In this situation, the CEO's short-term gains from housing investments could amplify the influence of optimism, and both incentives and optimism would contribute to over-investments. Thus, a positive relationship between measured optimism and real estate investments does not necessarily rule out short-term incentives coexisting with optimism. Nonetheless, it would be inconsistent with the second case where the CEO is aware of the danger yet invests due to misaligned incentives.

Taken together, if real estate investments are related to CEO optimism, we would expect to see a positive correlation between investment growth and the CEO's measured optimism. However, if agency frictions play a dominant role while the CEO anticipates the downside, we would expect to see a negative correlation between investment growth and the CEO's measured optimism. One caveat is that while a positive correlation

[10]These short-term incentives can include, for example, cash bonus or relief of career concerns due to higher current revenue and increased market share relative to competitors (Gorton and He, 2008; Holmstrom, 1999; Brickley, Linck, and Coles, 1999).

suggests the role of CEO optimism and goes against the hypothesis of CEO awareness, it does not necessarily rule out the possibility that short-term incentives might coexist with over-optimism and even amplify the effect of optimism.

3.2 The Equity Holding Measure

My first measure of executive optimism is the log change of total equity holding from 2002 to 2005. Total equity holding consists of stocks and delta-weighted options.[11] For each year, I calculate total holding by month end for each executive and take the median month-end holding in that year to be the annual holding measure. I do this instead of using the year-end holding to avoid the possibility that an executive may have a large holding at a particular time because he just received an equity award but has not had the time to adjust positions to a desired level. There are some outliers, potentially due to reporting errors, and I winsorize the largest and smallest 5% holding change observations.

The first ten columns of Table 2 Panel A report CEOs' annual holding changes from 2000 to 2009. Annual equity holding increases are highest around 2001 and 2002, and they remain relatively high through 2003 and 2004. They are lowest around 2008 where the median becomes negative. The last column of Table 2 Panel A reports CEOs' holding change from 2002 to 2005. Table 2 Panel B shows the correlation between the annual holding change measured in different years. The annual changes are somewhat but not highly correlated across adjacent years.

In Table 1 Panel B, I divide banks into quintiles by their CEOs' equity holding change from 2002 to 2005, and summarize bank characteristics for each quintile. It shows that bank characteristics are fairly similar across quintiles. As of 2002, banks in each quintile have similar size, market capitalization, real estate loan to total asset ratio, and dividend yield ratio. Growth of real estate loans and stock returns during the boom increase by quintile, and stock returns during the financial crisis decrease by quintile.

In practice there might be other factors that influence executives' equity holdings (such as firm policies, risk aversion, outside wealth, etc.), some of which may not be observable. I will address this issue in depth in the empirical analysis of Section 4. In

[11] Total equity holding includes both vested and non-vested equity. Since most CEOs have enough vested equity to allow for a sufficient level of adjustment, I consider both because from a portfolio choice perspective it is the total holding that matters. However, an important concern is that firms might have implicit rules limiting the feasible level of adjustment. I will address this concern in detail in Section 4.

addition, I construct another optimism measure for robustness checks.

3.3 The Option Exercise Measure

My second proxy for beliefs, following Malmendier and Tate (2005), is based on whether the CEO exercises vested options that are enough in-the-money. The theoretical framework is provided by Hall and Murphy (2002). Since CEOs generally have large equity positions in their firms, under-diversification and risk aversion make it optimal for a rational CEO to exercise options that are enough in-the-money immediately after vesting (Hall and Murphy, 2002; Malmendier and Tate, 2005). Here, as in Malmendier and Tate (2005), I take the in-the-money threshold to be 67%; results are similar for thresholds from 50% to more than 90%.

For each year, I look at all the vested options held by the CEO. I construct a binary variable "Opt" which takes value 1 in a certain year if the CEO does not exercise any of his vested options that are more than 67% in-the-money in that year; it takes value 0 if the CEO exercises at least some vested options that are more than 67% in-the-money; it is set to missing if the CEO does not have any vested options that are more than 67% in-the-money in that year. I exclude any options that expire in the current year.

It is important to note the difference between my approach and the original Malmendier and Tate measure. The goal of Malmendier and Tate is to capture the "permanent" and "habitual" trait of *overconfidence*, whereas I would like to measure the degree of *optimism* at a given point in time (and the level of optimism may fluctuate over time). Accordingly, I categorize CEOs as "optimistic" on an annual basis, while the Malmendier-Tate overconfidence dummy is constructed by looking at the entire history of option exercises to find persistent late exercise behavior. In addition, the annual proxy I use also makes it easier to control for exercise behavior in other time periods, which helps to make sure that the results are not driven by "rules-of-thumb" or by bank policies.

Table 3 Panel A summarizes the total number of CEOs with at least 67% in-the-money vested options and the number of them exercising such options. In a typical year, the fraction of CEOs not exercising these options is quite high, similar to what is found in Malmendier and Tate (2005). As discussed in Malmendier and Tate (2005), this measure is not a conservative one. In addition, this binary variable will not be able to capture the full range of optimism. Therefore, I use it to roughly differentiate the relative level

of optimism among CEOs, which serves as robustness checks.

There could be concerns that CEOs' option exercises are influenced by certain firm policies. To see whether this possibility poses serious problems, I check the cross-year correlation of option exercise measure in Table 3 Panel B. The correlations are moderate, similar to the case of the equity holding measure, which may alleviate some concerns. I will address this issue in more detail in the empirical analysis.

4 Main Results

4.1 CEO Optimism and Pre-Crisis Real Estate Investments

A. Background

In this section, I analyze how CEO optimism relates to bank real estate investments during the housing boom. I begin with the growth of real estate loans in bank assets. Real estate loans are informative for at least two reasons. First, real estate loans had become the largest component of commercial banks' assets by the 2000s, accounting for about 50% of assets for the median bank. This amount is substantial compared to the share of securities (20% for the median bank and 25% for all commercial bank assets), or the share of commercial and consumer loans combined (14% for the median bank and 20% for all commercial bank assets). Thus, banks' decision about real estate exposure through the loan portfolio is important, and it is likely to be closely related to CEOs' beliefs.

Second, ex post evidence suggests that bank performance during the crisis was significantly negatively correlated with pre-crisis housing loan growth, and charge-offs on real estate loans were a major part of banks' losses. For banks in my sample, the median net charge-off on real estate loans over 2008 and 2009 was 0.83% of assets (the mean was 1.34%), which is quite large compared to banks' 1% ROA in normal years. Thus, exposure to the housing market through real estate loans is also highly relevant to the crisis. Nonetheless, there may be other aspects to banks' real estate exposure and vulnerability, and the total loss could result from a combination of factors (such as liquidity, capital structure, borrower compositions etc.). Therefore, in Section 4.2 I also use bank stock returns during the financial crisis as a more holistic ex post proxy for overall risk exposure.

Many narratives of the crisis also emphasize the role of credit derivatives (Coval, Jurek, and Stafford, 2009; Gorton, 2010). However, this test is difficult to implement because credit derivatives are concentrated in a small number of large banks. As of 2005, no more than 25 US banks held credit derivatives (Minton, Stulz, and Williamson, 2005). This small number does not allow for systematic cross-sectional analysis. Nonetheless, one might be able to get some sense about how optimism relates to investments in credit derivatives in the discussion of the largest banks in Section 5.2.

B. Basic Results

In Table 4 column (1), I start with a regression of the growth of loans backed by real estate on the first measure of pre-crisis CEO optimism (the log change in total equity holdings). The coefficient on the equity holding measure is positive and significant. A 1% higher equity holding change corresponds to about 0.31% higher housing loan growth in this period. The solid line in Figure 1 plots the average log housing loan growth by equity holding change quintiles. The plot shows that the average growth of real estate loans increases by quintile, consistent with the regression results. Average housing loan growth from 2002 to 2005 is about 20% higher for the top quintile compared to that for the bottom quintile. In column (2), I control for dividend yield and return volatility as stock valuation and volatility could affect equity holding decisions. In addition, I control for general bank characteristics such as size and the fraction of real estate loans in total assets at the start of the sample period.

One concern about these baseline regressions is that certain unobservable factors could affect both the CEO's equity holding and the growth rate of real estate loans. For example, banks that specialize in riskier business or those that are eager to expand might use more equity compensation (Cheng, Hong, and Scheinkman, 2015), discourage equity disposition through explicit and implicit company rules, or hire CEOs who are less risk averse, which could result in faster accumulation of CEO equity holdings. Meanwhile, these banks might also be more likely to make large real estate investments during the housing boom.

To address this concern, in column (3) I control for the CEO's equity holding change in the previous three years, as well as the historical growth rate of real estate loans. The raw correlation between the equity holding change from 2002 to 2005 and that from 1998 to 2001 is 0.05, with a p-value of 0.6. This suggests that CEOs' equity holding changes are

not necessarily persistent, which alleviates some concerns of firm policies driving observed holding changes. Column (4) reports the regression with all the aforementioned controls. These controls do not have much impact on the coefficient of the equity holding measure.

C. Influence of Local Housing Market Dynamics

Another concern about the baseline regressions may come from heterogeneity in banks' geographical areas. One might worry that for banks in roaring housing markets, real estate loan growth is likely to be higher because of higher demand or larger loan size (resulting from higher prices). At the same time, these banks may also become more profitable, which then translates into more CEO compensation. If CEOs are not able to fully adjust their equity holdings, they could experience faster equity accumulation and be mislabeled as "optimistic".

To examine this concern, I first construct an estimate of house price changes in each bank's geographic areas. For house prices, I use state-level index provided by the Federal Housing Finance Agency (FHFA).[12] To determine a bank's geographical area, I use the Home Mortgage Disclosure Act (HMDA) data to aggregate the share of total originated mortgages from each state as of 2002. I then use this share as the weight to compute a weighted average of FHFA index change from 2002 to 2005 for each bank (the variable "FHFA Index Change"), which will be a proxy for local housing market dynamics.[13]

In Figure 2 I plot the relationship between the CEO's equity holding change and the average change of house prices in the bank's geographic markets. It shows that there is no obvious correlation between the local house price dynamics and the measured CEO optimism, which mitigates concerns about house prices affecting measured optimism. In column (5) of Table 4 I add "FHFA Index Change" as a control variable and the results remain. In the supplementary appendix, I also divide the CEOs into the "more optimistic" group (equity holding change above median) and the "less optimistic" group (equity holding change below median), and calculate a matching estimate with "FHFA Index Change" as well as other bank characteristics as matching covariates. The matching results show that the growth rates of real estate loans during the housing boom are

[12]The FHFA also provides a housing price index at the MSA level, but the MSA coverage is very limited, so it is difficult to use the MSA level indices here.

[13]Instead of using the share of total originated HMDA mortgages, I can also use the share of total originated and held on balance sheet mortgages. This does not change the results. I weigh by the share as of 2002 to avoid complications from banks potentially shifting their businesses according to local housing market dynamics, which could be correlated with CEO beliefs. However, using the share from the current year does not change the results either.

significantly different for these two subsamples.

The analysis above measures house price changes only at the state level, due to limited data coverage for house prices at lower levels. One might still worry about heterogeneity within a state. To control for local housing market dynamics and loan demand shocks at a finer level, I perform the following test using the HMDA dataset, which documents loan-level information that allows me to track loan originations by banks at the county level.[14] First, using the HMDA data, I compute total loans originated and held on balance sheet by each bank in each county from 2002 to 2005, and that from 1998 to 2001.[15] Then I take the log difference of these two amounts: $\Delta_{ij} = \log(\text{loan0205}_{ij}) - \log(\text{loan9801}_{ij})$. Next I perform a decomposition similar to Greenstone and Mas (2012):

$$\log(\text{loan0205}_{ij}) - \log(\text{loan9801}_{ij}) = b_i + c_j + \epsilon_{ij} \tag{1}$$

where b_i is a full set of bank fixed effects, and c_j is a full set of county fixed effects which absorbs changes in local conditions. With this decomposition, the bank fixed effects b_i should capture the expansion of housing loans by each bank beyond the influence of local conditions. Lastly I use the bank fixed effects b_i as the dependent variable in the regressions in Table 5. Columns (1) and (2) show that the b_i calculated from originated-and-held HMDA loans is significantly positively correlated with CEO optimism.

D. Influence of Pre-Crisis Equity Compensation

Many concerns discussed above are related to the influence of executive compensation on the equity holding measure. To address this important issue most directly, in Table 6 I construct a "counterfactual" variable, Log Holding Change (No Action), which measures how much the CEO's equity holdings would have changed from 2002 to 2005 if he had not taken any action but passively accumulated his equity awards (including both stocks and options). This variable captures the influence of equity compensation; it would also be the realized holding change in the limiting case where CEOs are completely restricted from selling firm equity. Thus, this variable can help to check that my results are not driven by differences in equity compensation among CEOs due to bank policy, profitability, etc.

[14] Loans reported to HMDA account for over 80% of total loans in number and over 90% in dollar volume. 116 out of 142 bank holding companies in the subsample of banks with the same CEO from 2002 to 2005 have complete HMDA reporting data from 1998 to 2005.

[15] Here I use originated-and-held loans because they contribute to banks' direct real estate exposure through their assets. In Part E of this section I also discuss loans originated and sold for securitization.

From Table 6 columns (1) and (2), we can see that the counterfactual variable by itself does not seem to correlate with the growth of real estate loans. Columns (3) and (4) show that this variable does not account for the explanatory power of the actual change in equity holdings.[16] This "No Action" control is also used in columns (3) and (4) of Table 5, which tease out the impact of local conditions on loan growth at the county level (as explained above), and the results are the same.

E. Additional Results

Part C of this section uses HMDA data on loan originations to control for local housing market shocks in banks' business areas. A nice feature of the HMDA dataset is that it reports whether the loans are sold for securitization as opposed to held on bank balance sheets. This allows me to also examine how CEO optimism affects banks' involvement in securitization. This exercise can shed some light on whether managerial beliefs are related to profits from the securitization business, as opposed to profits directly from real estate loans. In the supplementary appendix, I perform the same tests as those in Table 5, with the bank fixed effect b_i calculated based on originated-and-*sold* loans rather than originated-and-held loans. The growth of loans sold for securitizaion is also positively correlated with CEO optimism, but the relationship is not significant. This result suggests that while banks with more optimistic CEOs generally increase real estate exposures in their own assets, they are not necessarily more aggressive in selling off loans for securtization.

Finally, there are several alternative specifications of the main tests which are presented in the supplementary appendix. First, I add outstanding credit commitments for loans backed by real estate. These are credit lines that can be drawn down at previously agreed rates by real estate loan borrowers, and they could be another source of exposure to real estate-related risks.[17] Results including loan commitments are not much different. Second, I use the log change in the *share* of real estate loans in total asset instead of the log change of the amount of real estate loans. If the CEOs' optimism is primarily about the housing market, then we would expect to see real estate loans "crowd out" other assets. In the data, there is indeed a significant correlation between the change

[16] Indeed, note that the actual holding change can be broken into two components: the passive change, which is measured by the "No Action" variable, and the active change. After controlling for the "No Action" variable, the coefficient on the realized holding growth is the same as the coefficient on the active change.

[17] The median ratio of real estate loan commitments over total assets is about 6%.

in the *share* of real estate loans and the measured optimism. Third, I exclude the four states that had the most extraordinary housing booms (Arizona, California, Florida and Neveda) and the results remain after the exclusions. Lastly, I use the alternative time period of 2002 to 2006. In this case, both the equity holding change and real estate loan growth are measured from 2002 to 2006, and the results are also similar.

4.2 CEO Optimism and Bank Performance during the Financial Crisis

Results in the previous section provide evidence on the connection between CEOs' beliefs and bank real estate investments. In this section I examine how ex ante beliefs relate to banks' ex post performance during the financial crisis. Ex post performance can be a more holistic measure of risk exposures that banks accumulated through the boom years. In addition, the test may also shed light on the extent to which CEOs had anticipated the severity of their banks' problems. The primary proxy for performance is the holding period return of bank stocks from January 2007 to December 2009. I focus on stock returns because the measures of CEO optimism essentially relate to CEOs' beliefs about the future returns of bank stocks. The starting point is January 2007 since banks' stock prices generally started to decline in early 2007 with the development of the subprime crisis. The end point is December 2009 because the impact of the crisis lasted through 2009 for many banks, as can be seen from their loan losses and stock performance (the net charge-off reported in 2009 was about twice as large as that in 2008 for the median bank).

Column (1) of Table 7 reports the baseline regression result. It shows that a larger increase in the CEO's pre-crisis equity holding is associated with worse ex post stock performance. A 1% higher increase in equity holding corresponds to 0.21% lower returns on average. The dashed line in Figure 1 plots the average crisis period return by equity holding change quintiles, which shows a similar negative relationship. The average return for the largest equity holding quintiles is about 15 percentage points lower than that for the smallest quintiles.

Similar to the analysis in the previous section, in column (2) I control for dividend yield and volatility, which could affect equity holding decisions; I also add the beta of the bank stock, which could affect stock returns. In column (3), I add bank size and the share

of real estate loans in asset prior to 2002. In column (4), I also use the CEO's equity holding change in the three years before 2002 to control for firm-level and individual-level unobservables, as well as real estate loan growth in the three previous years to control for the bank's general tendency of real estate loan expansion. Column (5) includes all the aforementioned controls. In all specifications, the coefficient on the equity holding measure is large and negative.

Overall, the findings above suggest that worse-performing banks appear to be associated with CEOs who were relatively more optimistic during the height of the housing boom. In the next section, I perform further tests using the alternative optimism measure.

4.3 Results Using the Option Exercise Measure of Executive Optimism

In this section, I use the alternative measure to check the robustness of the previous results. As described in Section 3.3, this measure (variable "Opt") is based on the executive's decision to keep or exercise options that are deeply in-the-money. Because this measure derives from option exercises, it should be less affected by equity compensation. If anything, CEOs who have more equity compensation should have stronger incentives to exercise their in-the-money options, in which case they will be classified as "non-optimistic" by the option exercise measure.

I start by verifying the relationship between CEO optimism and the growth of housing loans. Table 8 reports the results, both without controls and controlling for bank size, dividend yield and volatility.[18] It shows that from 2003 to 2005, banks whose CEOs are relatively optimistic in the previous year have about 0.04 to 0.07 log points higher growth of housing loans in the following year. There is a lag in this relationship, possibly because it takes some time to run advertisement, open new branches, and build the infrastructure that translates the CEO's decision into higher loan volume. The annual difference of 0.04 to 0.07 log points is largely consistent with the finding using the equity holding measure—the largest holding growth quintile (most optimistic) had 0.15 log points higher real estate loan growth from 2002 to 2005 than the smallest holding growth quintile (least optimistic).

[18]The tests here are year-by-year due to the nature of the option exercise measure. Since the measure is an annual dummy, it is much harder to meaningfully aggregate through the boom years, whereas the equity holdings measure can naturally be cumulative.

I then verify the results on CEO optimism and crisis performance using the option exercise measure. Table 9 Panel A presents the baseline regressions. Table 9 Panel B adds additional controls, including factors that can affect option exercise decisions (dividend yield and return volatility), stock beta, and bank size. The option exercise measure from 2001 to 2006 is always significantly negatively correlated with crisis performance. One possible concern, however, is that option exercise decisions may be driven by rules-of-thumb, risk aversion, or wealth in firm equity. To deal with this possibility, I also control for historical values of the option exercise measure for each CEO. With these controls, this measure is still significant in some years, although not in all years.[19]

4.4 Non-CEO Executives

Given the previous results on CEO optimism, it would be interesting to also analyze the relationship between the measured optimism of other senior executives and bank investments and outcomes. This analysis can serve two purposes. While the CEO is certainly the top decision-maker in a firm, other senior executives' opinions may also matter. Moreover, one central concern in the previous analysis is that the optimism measures could be affected by bank-level unobservables such as compensation policies and restrictions on equity dispositions. Since the bank-level unobservables generally apply to other senior executives as well, the analysis in this section can shed further light on whether these issues pose serious problems.

Specifically, I replicate the previous analysis for the CFO and the COO/President, excluding CFOs and COOs who were simultaneously CEOs. With the equity holding measure, the correlation is 0.24 between the CEO and the CFO, 0.63 between the CEO and the COO, and 0.31 between the CFO and the COO. Tables in the supplementary appendix report the results of replicating the regressions in Table 4 and Table 7 on CFOs and COOs. The measured optimism of the CFO is not significantly correlated with either the pre-crisis growth of real estate loans or the bank's performance during the crisis. There is a modest relationship between the measured optimism of the COO and those two variables.[20]

[19] I interpret this as evidence for the robustness of this measure, but not necessarily that optimism in certain years is necessarily more relevant to that in other years.

[20] In unreported results, I also perform the replication with the option exercise measure. Similarly it shows no significant results for the CFO and modest results for the COO.

Since the measured optimism for CEOs, CFOs and COOs are not always significantly correlated, it further alleviates concerns that equity holding changes are driven by firm policies as opposed to individual choices. It is also interesting that COOs behave more like CEOs than CFOs do, and COOs' optimism seems more relevant. This is plausible given that COOs are generally involved in decisions on firm strategies and personnel, whereas CFOs might focus more on technical financial and accounting issues.[21] In addition, like-minded people are more likely to be chosen as COOs given that COOs are usually the "heir-apparents" to CEOs in the banking industry. Perhaps one of the best-known examples of highly like-minded yet unsuccessful CEO-COO partnerships is Richard Fuld and Joseph Gregory of Lehman Brothers. In comparison, the ever-changing CFOs played a less important role in the firm.

Taken together, results using both proxies for beliefs show that banks with more real estate investments are associated with CEOs who were more optimistic ex ante. The evidence supports the hypothesis that optimism of bank managers contributed to the housing credit expansion and the associated losses. It appears inconsistent with the view that banks' real estate exposures were driven by incentive frictions, yet CEOs had rational expectations about the housing market and were aware of the impending problems. In the following section, I provide some specific examples that substantiate the main results.

5 Discussion

5.1 An Illustrative Example

The main results in Sectio 4 are well illustrated by the example of US Bancorp and SunTrust Bank, two banks that are otherwise similar but quite different in their CEOs' judgement during the housing boom. As of 2002, US Bancorp and SunTrust were the 9th and the 10th largest banks in the US, with $171 billion and $105 billion assets respectively. They both had operations across the country and offered similar product lines; US Bancorp's major market areas covered the central and western states while SunTrust was more concentrated in the south-eastern states. Before the crisis, the CEO

[21] This result also connects to the recent evidence by Malmendier and Zheng (2012) that executives' biases are more relevant for decisions within the realm of their duties, and in this case CEOs and COOs are more responsible for investment decisions than CFOs.

of US Bancorp was Jerry Grundhofer, who took the position in 2001 and retired in December 2006; SunTrust's CEO was Phillip Humann, who had been in the position since 1998 and also stepped down from the CEO position in December 2006.

Prior to the crisis, SunTrust was very optimistic about the outlook of the housing market. In the letter to shareholders in the 2005 Annual Report, Humann wrote "SunTrust grew mortgages over the prior year and achieved record production volume...We are optimistic about our prospects as we look to 2006 and beyond." In comparison, Grundhofer highlighted the goal of lowering credit risks in his letter to shareholders in US Bancorp's 2005 Annual Report. "The steps we have taken to reduce the company's risk profile we believe will enable us to minimize the impact of future changes in the economy, keep our credit costs lower than our peers and thereby lower the volatility of operating results," wrote Grundhofer in the letter.

During their CEO terms, both Humann and Grundhofer had about a half of their insider positions in stocks and another half in options. Before the crisis, Humann had four options with amounts 9,900, 75,000, 150,000 and 150,000 that were exercisable starting in 1995, 2002, 2003 and 2004 respectively. He only exercised the 1995 option and never sold the stocks after exercise, nor did he sell any of his 600,000+ shares among which only 150,000 were unvested by 2006; this resulted in a continuing increase in Humann's position. Grundhofer had 9 different vested options; he regularly exercised the options and subsequently sold the shares, which kept his total position largely unchanged. Figure 3 Panel A plots the equity holding change of Grundhofer and Humann respectively.

As shown in Figure 3 Panel B, SunTrust expanded its real estate loan portfolio significantly in the boom years, which grew by 97% from 2002 to 2005. Meanwhile, the growth of real estate loans in US Bancorp remained at about the same rate as the historical trend; its total loans backed by real estate grew by 20% from 2002 to 2005. Starting in late 2006, SunTrust began to suffer from the consequences of poor underwriting standards in residential mortgages, construction loans and commercial real-estate. It reported net income of $796 million in 2008, down more than 50% from 2007, and net loss of $1,564 million in 2009. Its stock prices fell by 73% from January 2007 to December 2009. In comparison, US Bancorp reported net income of $2,946 million and $2,205 million in 2008 and 2009 respectively, with a decrease of about 25% from 2007. Its stock price fell by 30% from January 2007 to December 2009, which was relatively light compared to a loss

of 57% for the median bank in the sample. Figure 3 Panel C shows the stock price series for US Bancorp and SunTrust.

5.2 CEO Optimism among the Largest Banks

Given their size and systemic importance, investment decisions and performance of the largest banks are particularly relevant to financial stability. In this section I study the largest banks and examine the beliefs of their CEOs individually.

Table 10 shows pre-crisis equity holdings of CEOs of the five largest investment banks (Lehman Brothers, Merrill Lynch, Goldman Sachs, Morgan Stanley and Bear Stearns) and the three largest commercial banks (Bank of America, Citigroup and JPMorgan Chase). Because Thomson Reuters does not maintain data for delisted firms, I obtain the records from banks' proxy statements. However, prior to 2006, proxy statements did not include information on the details of the options (exercise price and expiration date), so the options are not delta-weighted and the total holding might not exactly reflect the effective amount of equity.[22]

We see large differences among the CEOs' equity holding changes from early 2002 to early 2006. CEOs who had the largest holding increases are James Cayne of Bear Stearns, Stanley O'Neal of Merrill Lynch, Kenneth Lewis of Bank of America, and Charles Prince of Citigroup. Henry Paulson of Goldman Sachs and William Harrison of JPMorgan Chase increased their holdings slightly. Richard Fuld of Lehman Brothers decreased his holdings slightly, and Philip Purcell—who was forced by Morgan Stanley partners to resign in 2005 because of his refusal to aggressively increase risk and leverage, enter the sub-prime mortgage business and make acquisitions—decreased his holdings substantially.

These patterns are generally consistent with biographical narratives of these CEOs' personalities and pre-crisis judgment. For example, Alan Greenberg, ex-Chairman and CEO of Bear Stearns who was also a mentor of Jimmy Cayne, wrote:

> [W]hen I referred to the firm's ruling triumvirate I had a nickname for each: Ego, Smarts and Smoothie. Ego obviously was Jimmy, a self-important tough talker whose listening skills diminished in inverse proportion to our stock price and the number of shares he owned... [T]he run-up in real estate prices wasn't

[22]For this reason, in Table 10 I show stocks and options holdings separately but do not add them up to compute total holdings.

> originally perceived as a bubble. And when such apprehensions did begin to surface, they were neutralized by a chronic wishful optimism, an outlook colored by the tremendous success of our fixed-income divisions... Jimmy's megalomania was expressed most blatantly in his approach to the company stock. As far as I know, he never sold anything. The shares he held the day JPMorgan bought us consisted mainly of a career's worth of accumulated deferred compensation (Greenberg, 2010).

The patterns in Table 10 are also consistent with the results in Section 4. CEOs at the worse-performing banks generally had larger ex ante increases in equity holdings, while CEOs at the better-performing banks had smaller increases.[23]

6 Conclusion

In this paper I test alternative theories of the financial crisis by studying the relationship between banks' real estate investments during the housing boom and their CEOs' pre-crisis beliefs. I find that banks with larger increases in real estate related assets and worse crisis performance had CEOs who were more optimistic ex ante. Banks with the most optimistic quintile of CEOs experienced on average 20 percentage points higher real estate loan growth in the boom and 15 percentage points lower stock returns from 2007 to 2009, compared to banks with the least optimistic quintile of CEOs. The result shows that banks' pre-crisis business decisions are consistent with their CEOs' private beliefs. It provides evidence that CEOs' ex ante optimism influenced bank investments, and contributed to losses during the financial crisis. The consistency between bank behavior and managerial beliefs is less supportive of the view that housing investments resulted from agency frictions while bank executives were systematically aware of the impending collapse.

These findings underscore the role of beliefs in the buildup to the recent financial crisis. They complement the theoretical work of Simsek (2013) which emphasizes how *lenders'* beliefs can be central to credit booms. This points to the importance of understanding

[23]The only exception is perhaps Richard Fuld of Lehman Brothers. Although Richard Fuld still held a substantial amount of Lehman stocks by the time the firm declared bankruptcy, he did not seem to display significant optimism through his own equity holding decisions. While this discussion helps provide more concrete information about the CEOs at the most systematically important banks, one should be careful not to read too much into any single data point.

the formation and evolution of managerial beliefs at financial institutions, especially in extraordinary times like the years before the crisis. In particular, it is an open question why some CEOs appear to have had better judgment during the housing boom (or other similar episodes)—whether it is due to personality traits, past experiences, luck, or some corporate mechanisms that encouraged risk monitoring. Future research that sheds light on these questions may help inform policies aimed at enhancing financial stability.

References

Acharya, V., T. Philippon, M. Richardson, and N. Roubini. 2009. The financial crisis of 2007—2009: Causes and remedies. *Financial markets, institutions & instruments* 18:89–137.

Adelino, M., A. Schoar, and F. Severino. 2015a. Loan originations and defaults in the mortgage crisis: Further evidence. Working Paper .

Adelino, M., A. Schoar, and F. Severino. 2015b. Loan originations and defaults in the mortgage crisis: The role of the middle class. Working Paper .

Barberis, N. 2013. Psychology and the financial crisis of 2007—2008. In M. Haliassos (ed.), *Financial innovation: Too much or too little?* MIT Press.

Beltratti, A., and R. Stulz. 2012. The credit crisis around the globe: Why did some banks perform better? *Journal of Financial Economics* 105:1–17.

Benabou, R. 2013. Groupthink: Collective delusions in organizations and markets. *Review of Economic Studies* 80:429–462.

Bertrand, M., and A. Schoar. 2003. Managing with style: The effect of managers on firm policies. *Quarterly Journal of Economics* 118:1169–1208.

Bolton, P., M. Brunnermeier, and L. Veldkamp. 2013. Leadership, coordination, and corporate culture. *Review of Economic Studies* 80:512–537.

Brickley, J., J. Linck, and J. Coles. 1999. What happens to CEOs after they retire? New evidence on career concerns, horizon problems, and CEO incentives. *Journal of Financial Economics* 52:341–377.

Caillaud, B., and J. Tirole. 2007. Consensus building: How to persuade a group. *American Economic Review* pp. 1877–1900.

Cheng, I.-H., H. Hong, and J. Scheinkman. 2015. Yesterday's heroes: Compensation and risk at financial firms. *Journal of Finance* 70:839–879.

Cheng, I.-H., S. Raina, and W. Xiong. 2014. Wall Street and the housing bubble. *American Economic Review* 104:2797–2829.

Chodorow-Reich, G. 2014. The employment effects of credit market disruptions: Firm-level evidence from the 2008—09 financial crisis. *Quarterly Journal of Economics* 129:1–59.

Coval, J., J. Jurek, and E. Stafford. 2009. The economics of structured finance. *Journal of Economic Perspectives* 23:3–26.

Cummins, J., K. Hassett, and S. Oliner. 2006. Investment behavior, observable expectations, and internal funds. *American Economic Review* 96:796–810.

Dowd, K. 2009. Moral hazard and the financial crisis. *Cato Journal* 29:141.

Eisner, R. 1978. *Factors in business investment.* National Bureau of Economic Research.

Ellul, A., and V. Yerramilli. 2013. Stronger risk controls, lower risk: Evidence from US bank holding companies. *Journal of Finance* .

Fahlenbrach, R., R. Prilmeier, and R. Stulz. 2012. This time is the same: Using bank performance in 1998 to explain bank performance during the recent financial crisis. *Journal of Finance* 67:2139–2185.

Fahlenbrach, R., and R. Stulz. 2011. Bank CEO incentives and the credit crisis. *Journal of Financial Economics* 99:11–26.

Foote, C., K. Gerardi, and P. Willen. 2012. Why did so many people make so many ex post bad decisions? The causes of the foreclosure crisis. Working Paper .

Geithner, T. 2014. *Stress test: Reflections on financial crises*. Crown Publishers.

Gennaioli, N., Y. Ma, and A. Shleifer. 2015. Expectations and investment. *NBER Macroeconomics Annual* .

Gennaioli, N., A. Shleifer, and R. Vishny. 2012. Neglected risks, financial innovation, and financial fragility. *Journal of Financial Economics* 104:452–468.

Gorton, G. B. 2010. Questions and answers about the financial crisis. NBER Working Paper .

Gorton, G. B., and P. He. 2008. Bank credit cycles. *Review of Economic Studies* 75:1181–1214.

Greenberg, A. 2010. *The rise and fall of Bear Stearns*. Simon & Schuster.

Greenstone, M., and A. Mas. 2012. Do credit market shocks affect the real economy? Quasi-experimental evidence from the Great Recession and normal economic times. Working Paper .

Greenwood, R., and S. G. Hanson. 2015. Waves in ship prices and investment. *Quarterly Journal of Economics* 130:55–109.

Hall, B., and K. Murphy. 2002. Stock options for undiversified executives. *Journal of Accounting and Economics* 33:3–42.

Holmstrom, B. 1999. Managerial incentive problems: A dynamic perspective. *Review of Economic Studies* 66:169–182.

Ivashina, V., and D. Scharfstein. 2010. Bank lending during the financial crisis of 2008. *Journal of Financial Economics* 97:319–338.

Jorda, O., M. Schularick, and A. Taylor. 2015. Betting the house. *Journal of International Economics* 96:S2–S18.

Kozlowski, J., L. Veldkamp, N. Stern, and V. Venkateswaran. 2015. The tail that wags the economy: Belief-driven business cycles and persistent stagnation. Working Paper .

Malmendier, U., and G. Tate. 2005. CEO overconfidence and corporate investment. *Journal of Finance* 60:2661–2700.

Malmendier, U., and G. Tate. 2008. Who makes acquisitions? CEO overconfidence and the market's reaction. *Journal of Financial Economics* 89:20–43.

Malmendier, U., and H. Zheng. 2012. Managerial duties and managerial biases. Working Paper .

Mian, A., and A. Sufi. 2009. The consequences of mortgage credit expansion: Evidence from the US mortgage default crisis. *Quarterly Journal of Economics* 124:1449–1496.

Minton, B., R. Stulz, and R. Williamson. 2005. How much do banks use credit derivatives to reduce risk? Working Paper .

Minton, B., J. Taillard, and R. Williamson. 2014. Financial expertise of the board, risk taking, and performance: Evidence from bank holding companies. *Journal of Financial and Quantitative Analysis* 49:351–380.

Reinhart, C., and K. Rogoff. 2009. *This time is different: Eight centuries of financial folly*. Princeton University Press.

Schularick, M., and A. Taylor. 2012. Credit booms gone bust: Monetary policy, leverage cycles, and financial crises, 1870-2008. *American Economic Review* 102:1029.

Simsek, A. 2013. Belief disagreements and collateral constraints. *Econometrica* 81:1–53.

A Figures

Figure 1: Equity Holdings, Growth of Housing Loans, and Crisis Performance

This figure groups banks into quintiles based on the log equity holding change of their CEOs, and plots the median log housing loan growth (solid line) as well as the median holding period return during the financial crisis (dashed line) for each quintile.

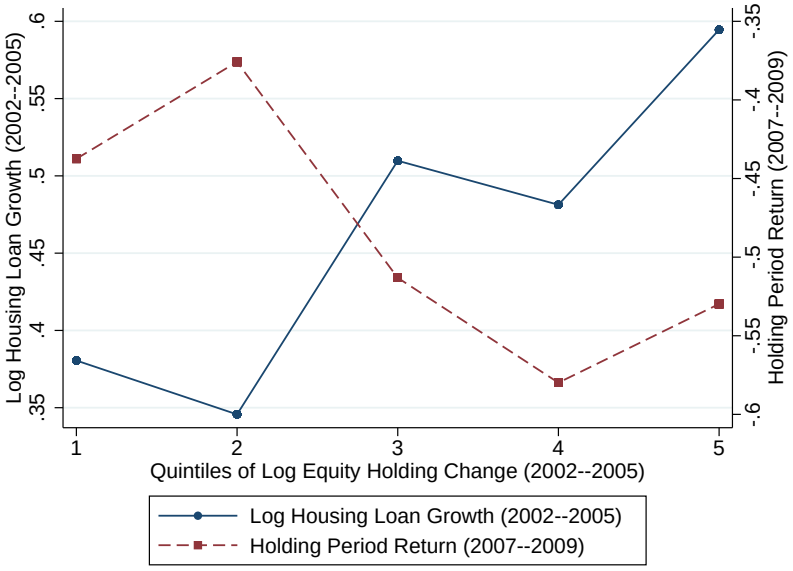


Figure 2: Change in Equity Holding and Regional House Price Appreciation

This figure plots the relationship between a given bank's CEO equity holding change and the FHFA index change in its business areas. The FHFA index change is calculated using the FHFA house price index at the state level and weighted by the fraction of HMDA mortgages originated in each state in 2002. Label is bank ticker followed by the state of its headquarters.

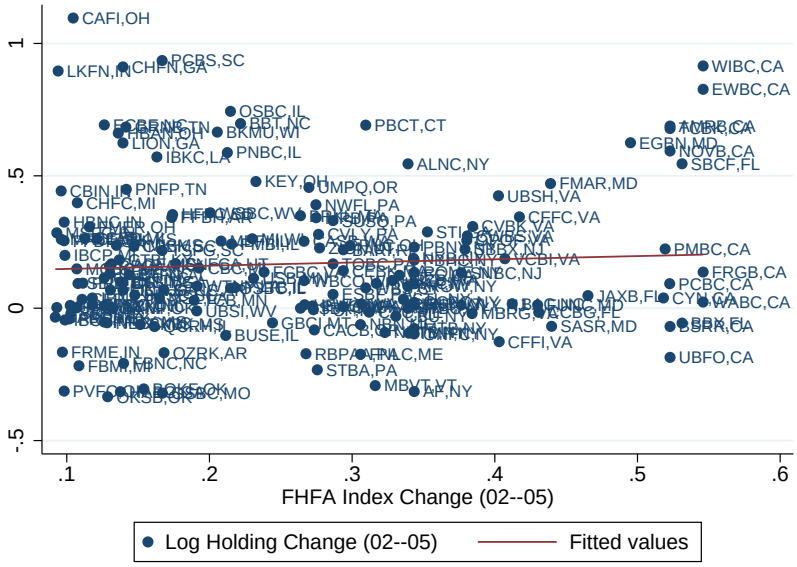
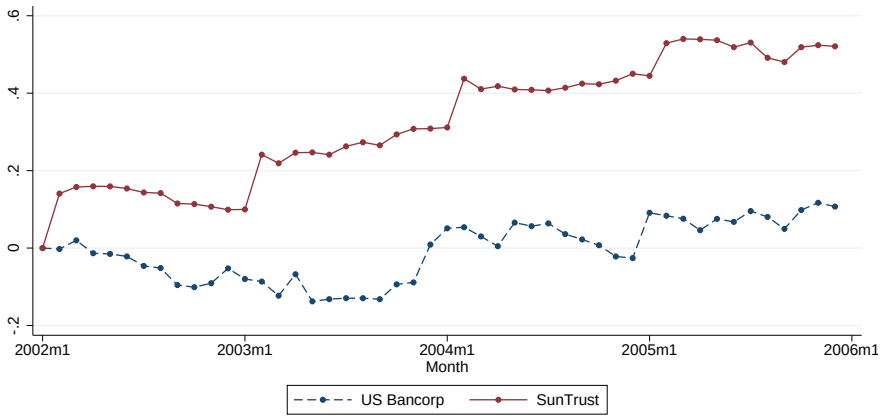


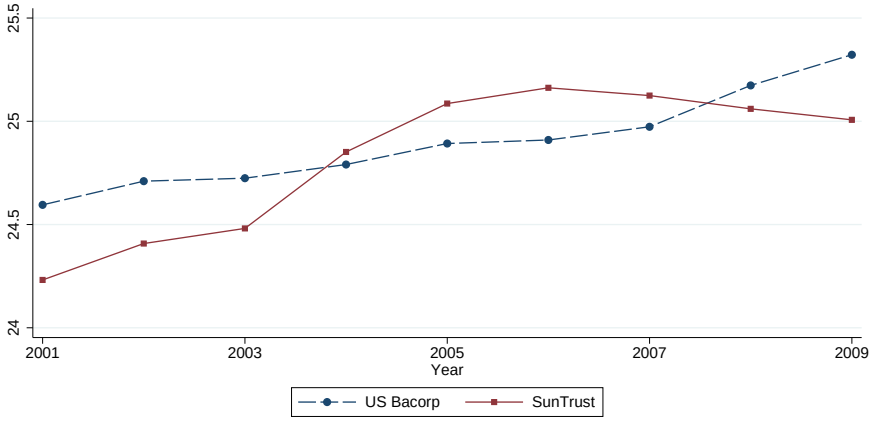
Figure 3: Comparisons of US Bancorp and SunTrust

Panel A plots the log equity holding change of Grundhofer (US Bancorp) and Humann (SunTrust) since January 2002. Panel B plots the the log of the total amount of loans backed by real estate held by US Bancorp and SunTrust from 2001 to 2009. The slope is approximately the annual growth rate. Panel C plots the stock prices of these two firms from 1998 to 2012.

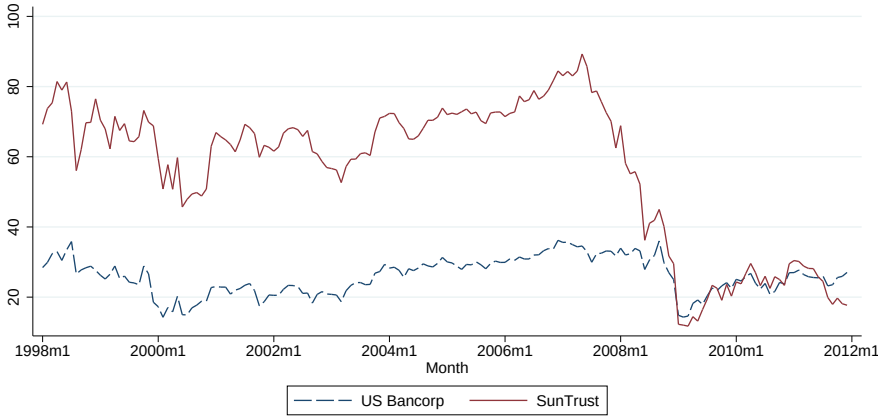
Panel A. Equity Holding Change of
Grundhofer (US Bancorp) and Humann (SunTrust)



Panel B. Log Loans Backed by Real Estate of US Bancorp and SunTrust



Panel C. Stock Prices of US Bancorp and SunTrust



B Tables

Table 1: Bank Characteristics

Panel A displays summary statistics for the subsample of banks that had the same CEO from 2002 to 2005. Mean, median, standard deviation, and selected percentiles are presented. Total assets and market capitalization are in millions of current dollars. Log growth of housing loans is calculated from December of the starting year to December of the end year. Holding period return is calculated from January of the starting year to December of the end year. Panel B groups banks into quintiles based on their CEOs' equity holding change and tabulates the median bank characteristics for each quitile. The quintiles are generated after winsorizing the largest and smallest 5% holding change observations.

Panel A. All Banks with the Same CEO from 2002 to 2005

	Median	Mean	SD	5%	25%	75%	95%
Total Assets as of 2002	1,010	10,537	53,141	203.3	481.7	2,509	28,500
Loans Backed by Real Estate/Asset as of 2002	0.47	0.47	0.13	0.26	0.37	0.54	0.68
Log Growth of Housing Loans (2002–2005)	0.43	0.46	0.29	0.07	0.27	0.59	1.02
Log Growth of Housing Loans (1998–2001)	0.45	0.47	0.29	0.10	0.25	0.64	1.05
Market Capitalization as of 2002	108.6	2,165	10,170	19.93	52.84	461.5	6,825
Dividend Yield as of 2002	0.03	0.03	0.02	0.00	0.02	0.04	0.05
Holding Period Return (2007–2009)	-0.54	-0.50	0.34	-0.97	-0.77	-0.26	0.09
Holding Period Return (2003–2006)	0.52	0.45	1.35	-2.42	0.22	0.92	1.82

Panel B. Median Bank Characteristics by Log CEO Equity Holding Change Quintiles

Quintile	1	2	3	4	5
Total Assets as of 2002	973	1,225	1,298	706.7	994.2
Loans Backed by Real Estate/Asset as of 2002	0.49	0.38	0.47	0.51	0.46
Log Growth of Housing Loans (2002–2005)	0.36	0.34	0.43	0.43	0.58
Log Growth of Housing Loans (1998–2001)	0.45	0.36	0.55	0.38	0.46
Market Capitalization as of 2002	141.3	113.3	189.9	66.11	122.2
Dividend Yield as of 2002	0.03	0.03	0.02	0.03	0.03
Holding Period Return (2007–2009)	-0.45	-0.38	-0.69	-0.66	-0.56
Holding Period Return (2003–2006)	0.51	0.46	0.67	0.46	0.62

Table 2: Summary Statistics of CEO Equity Holding Changes

In Panel A, the first ten columns report the annual log holding change from the previous year. The last column reports the log holding change from 2002 to 2005. Median and other selected percentiles are presented. N is the number of CEOs in the sample with corresponding records. The summary statistics are generated before winsorizing the largest and smallest 5% holding change observations. Panel B displays cross-correlations among annual CEO equity holding changes. For example, the cell at the intersection of 2002 and 2006 is the correlation between equity holding change from 2001 to 2002 and that from 2005 to 2006 (for those individuals who are CEOs during both time periods). Top and bottom 5% extreme values are winsorized.

Panel A. Distribution of Annual Holding Changes

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2002-2005
Median	0.026	0.065	0.071	0.049	0.031	0.015	0.019	0.000	-0.013	0.024	0.104
5%	-0.161	-0.040	-0.053	-0.131	-0.191	-0.143	-0.185	-0.309	-0.539	-0.359	-0.390
25%	-0.008	0.008	0.012	0.001	-0.004	-0.011	-0.021	-0.059	-0.115	-0.047	-0.016
75%	0.127	0.198	0.162	0.131	0.121	0.086	0.104	0.047	0.058	0.164	0.325
95%	1.075	0.622	0.642	0.550	0.646	0.682	0.971	0.869	0.494	0.952	1.300
N	218	232	241	255	275	296	309	316	331	305	189

Panel B. Correlations among Annual Holding Changes

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008
2001	0.254								
2002	0.084	0.326							
2003	0.267	0.044	0.187						
2004	0.081	0.205	0.177	0.296					
2005	0.094	0.223	0.274	0.255	0.213				
2006	-0.140	-0.066	0.062	0.131	0.048	0.284			
2007	-0.053	-0.047	-0.022	-0.056	0.165	0.087	0.291		
2008	-0.231	-0.296	-0.042	0.073	-0.039	-0.079	0.104	0.183	
2009	-0.246	-0.122	0.005	-0.042	0.104	0.061	0.271	0.286	0.221

Table 3: Summary Statistics of the Option Exercise Measure

Panel A shows CEO option exercises by year. An option qualifies for consideration in a given year if it is vested, has more than 1000 units remaining, not in the expiration year, and is at least 67% in-the-money. The optimistic dummy is generated only for CEOs who hold qualified options. The first line counts the number of all qualified CEOs in a given year. The second line counts the number of qualified CEOs who exercise at least one of the qualified options, thus being labeled as not overoptimistic (Opt=0). The third line counts the number of qualified CEOs who do not exercise any of the qualified options, thus being labeled as not overoptimistic (Opt=1). The last line is the third line divided by the first line. Panel B displays cross-correlations among option exercise-based optimism indicators. For example, the cell at the intersection between 2002 and 2006 is the correlation between the indicator value in 2002 and that in 2006 (for those individuals who are CEOs during both time periods).

Panel A. Distribution of the Option Exercise Measure

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
# of CEOs with options at least 67% in the money	135	155	182	195	207	223	213	188	139	66
# of CEOs exercising options at least 67% in the money (Opt=0)	32	40	58	63	76	79	67	47	33	17
# of CEOs NOT exercising options at least 67% in the money (Opt=1)	103	115	124	132	131	144	146	141	106	49
% Optimistic	0.76	0.74	0.68	0.68	0.63	0.65	0.69	0.75	0.76	0.74

Panel B. Cross-year Correlations of the Option Exercise Measure

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008
2001	0.478								
2002	0.075	0.263							
2003	-0.013	0.043	0.145						
2004	0.067	0.213	0.164	0.467					
2005	0.020	0.156	-0.108	0.275	0.279				
2006	0.279	0.239	0.051	0.064	0.099	0.248			
2007	-0.066	-0.054	-0.122	-0.072	-0.029	0.165	0.202		
2008	0.225	0.338	-0.061	0.019	0.063	0.275	0.206	0.281	
2009	0.098	0.119	0.000	0.179	0.156	0.333	0.321	0.050	0.249

Table 4: CEO Optimism and Pre-Crisis Growth of Real Estate Loans

Cross-sectional regressions of the log change of loans backed by real estate from 2002 to 2005 (dependent variable) on the equity holding measure of CEO optimism and other controls. Loans backed by real estate is obtained through FR-Y9C filings (item BHCK1410), and it is the amount of all such loans held on balance sheet at the time of reporting. Log holding change from 2002 to 2005 is the main measure of CEO optimism, and its construction is explained in Section 3.2. Dividend yield and volatility of bank stock are measured at the end of December 2001. Real estate loans as a share of total assets and log total assets (item BHCK2170) are bank characteristics at the end of December 2001. For banks with the same CEOs from 1998 to 2005, columns (3) to (5) control for CEOs' log holding change in the earlier period of 1998 to 2001, along with real estate loan growth in that period. FHFA Index Change is the state-level house price index change weighted with the fraction of HMDA mortgages originated in that state in 2002.

	Log Change Loans Backed by Real Estate (02–05)				
	(1)	(2)	(3)	(4)	(5)
Log Holding Change (02–05)	0.305***	0.267***	0.340***	0.300***	0.275**
	(0.0781)	(0.0748)	(0.121)	(0.111)	(0.105)
Dividend Yield as of 2002		-4.477***		-1.717	-1.521
		(1.489)		(2.653)	(2.566)
Volatility as of 2002		0.200		0.431	0.422
		(0.283)		(0.326)	(0.308)
RE Loans/Assets by 2002		-0.123		-0.254	-0.262
		(0.166)		(0.183)	(0.174)
Size (log assets) by 2002		-0.0203		-0.0272*	-0.0290**
		(0.0140)		(0.0143)	(0.0138)
Log Holding Change (98–01)			-0.0330	-0.0444*	-0.0400*
			(0.0202)	(0.0242)	(0.0211)
RE Loan Growth (98–01)			0.304**	0.254**	0.249**
			(0.137)	(0.111)	(0.109)
FHFA Index Change (02–05)					0.386
					(0.252)
Constant	0.411***	0.656***	0.272***	0.519***	0.441**
	(0.0246)	(0.190)	(0.0564)	(0.181)	(0.181)
Observations	142	136	77	76	76
R-squared	0.076	0.170	0.204	0.304	0.339

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5: CEO Optimism and Pre-Crisis Growth of Real Estate Loans
(Robustness Check with HMDA Loans and County Fixed Effects)

The dependent variable is the bank fixed effect b_i estimated from $\log(\text{loan0205}_{ij}) - \log(\text{loan9801}_{ij}) = b_i + c_j + \epsilon_{ij}$, where loan0205_{ij} is the total originated-and-held HMDA loans made in 2002—2005 by bank i in county j, loan9801_{ij} is the total originated-and-held HMDA loans made in 1998—2001 by bank i in county j, and c_j is the county fixed effect. The control variables are explained in detail in Table 4 and Table 6.

	Bank Fixed Effect b_i			
	(1)	(2)	(3)	(4)
Log Holding Change (02–05)	0.661***	0.791***	0.681***	0.811***
	(0.245)	(0.282)	(0.250)	(0.292)
Log Holding Change (No Action)			-0.0414	-0.0358
			(0.177)	(0.174)
Dividend Yield as of 2002		-0.0803		-0.153
		(5.021)		(5.100)
Volatility as of 2002		0.165		0.159
		(0.584)		(0.583)
Size (log assets) by 2002		0.0410		0.0422
		(0.0419)		(0.0419)
RE Loans/Assets by 2002		0.725		0.727
		(0.533)		(0.536)
Constant	-0.232***	-0.964*	-0.227***	-0.965*
	(0.0770)	(0.560)	(0.0823)	(0.563)
Observations	116	108	116	108
R-squared	0.054	0.087	0.055	0.088

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6: CEO Optimism and Pre-Crisis Growth of Real Estate Loans
(Robustness Check with the "No Action" Counterfactual)

Cross-sectional regressions of the log change of loans backed by real estate from 2002 to 2005, comparing actual holding change to the "no action" counterfactual. "Log Holding Change (No Action)" is the counterfactual variable that measures how much CEOs' equity holding would have changed if they only passively accumulate equity awards. In this counterfactual, the 2002 holding is the actual holding and the 2005 holding is the holding that CEOs would have had if they had not done anything to their equity holding since 2002. The counterfactual holding by 2005 consists of two parts: 1) stocks held in 2002 plus all stocks awarded from 2002 to 2005, and 2) options held in 2002 plus all options awarded from 2002 to 2005 minus options that had expired by 2005, delta weighted using their deltas in June 2005. All other control variables are the same as in Table 4.

	Log Change in Real Estate Loans (02–05)			
	(1)	(2)	(3)	(4)
Log Holding Change (02–05)			0.344***	0.292***
			(0.0846)	(0.0814)
Log Holding Change (No Action)	-0.0118	0.0233	-0.0982	-0.0559
	(0.0475)	(0.0537)	(0.0595)	(0.0431)
Dividend Yield as of 2002		-4.249**		-4.576***
		(1.659)		(1.487)
Volatility as of 2002		0.285		0.192
		(0.274)		(0.286)
Size (log assets) by 2002		-0.0198		-0.0183
		(0.0142)		(0.0142)
RE Loans/Assets by 2002		-0.158		-0.116
		(0.174)		(0.167)
Constant	0.458***	0.665***	0.424***	0.652***
	(0.0272)	(0.190)	(0.0266)	(0.191)
Observations	142	136	142	136
R-squared	0.000	0.110	0.088	0.174

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7: CEO Optimism and Stock Performance during the Financial Crisis

Cross-sectional regressions of holding period returns of bank stocks from January 2007 to December 2009 (dependent variable) on the equity holding measure of CEO optimism and other controls. Beta is calculated based on monthly stock returns from 1996 to 2006. All other variables are the same as in Table 4.

	Holding Period Return (2007–2009)				
	(1)	(2)	(3)	(4)	(5)
Log Holding Change (02–05)	-0.213**	-0.200**	-0.217**	-0.300**	-0.333**
	(0.0838)	(0.0871)	(0.105)	(0.133)	(0.165)
Dividend Yield as of 2002		2.747	0.842		1.566
		(1.903)	(1.909)		(2.289)
Volatility as of 2002		-0.200	-0.337		-0.295
		(0.197)	(0.252)		(0.265)
Pre-Crisis Beta		-0.0621	-0.0657		0.178
		(0.122)	(0.151)		(0.221)
RE Loans/Assets by 2002			-0.900***		-0.714**
			(0.250)		(0.288)
Size (log assets) by 2002			-0.00607		0.0230
			(0.0219)		(0.0278)
Log Holding Change (98–01)				-0.00163	-0.0235
				(0.0300)	(0.0291)
Constant	-0.451***	-0.426***	0.129	-0.433***	-0.275
	(0.0317)	(0.110)	(0.281)	(0.0417)	(0.306)
Observations	166	160	135	94	78
R-squared	0.029	0.053	0.178	0.040	0.236

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8: Alternative Measure of CEO Optimism and Pre-Crisis Growth of Real Estate Loans

Cross-sectional regressions of the annual growth of loans backed by real estate (dependent variable) on the option exercise measure of CEO optimism and other controls. "Opt" is an annual optimism indicator and its construction is explained in Section 3.3. It takes value 1 for CEOs identified as "over-optimistic", and value 0 for CEOs identified as "not over-optimistic". Control variables are the same as in Table 4.

	Growth of Loans backed by Real Estate (t to $t+1$)									
$t =$	2002	2002	2003	2003	2004	2004	2005	2005	2006	2006
Opt (year $t-1$)	-0.0438	-0.0632	0.0752**	0.0669**	0.0706***	0.0536**	0.0672***	0.0402**	0.0342	0.0178
	(0.0429)	(0.0502)	(0.0310)	(0.0300)	(0.0262)	(0.0269)	(0.0240)	(0.0188)	(0.0227)	(0.0215)
Opt (year t)	0.0154	0.0150	-0.0300	-0.0464	0.00539	-0.0192	-0.00286	-0.00158	0.0216	0.0175
	(0.0302)	(0.0323)	(0.0306)	(0.0284)	(0.0317)	(0.0328)	(0.0249)	(0.0206)	(0.0234)	(0.0236)
Opt (year $t+1$)	-0.0180	-0.0213	0.0316	0.0343	0.0379	0.0100	-0.0240	-0.00541	-0.0203	-0.00547
	(0.0317)	(0.0310)	(0.0292)	(0.0312)	(0.0271)	(0.0262)	(0.0320)	(0.0264)	(0.0258)	(0.0269)
Divident Yield (year t)		-2.708***		-4.324***		-1.566**		-3.956***		-3.145***
		(0.969)		(1.587)		(0.732)		(0.948)		(0.936)
Volatility (year t)		0.229		0.512		0.462		0.0787		0.248
		(0.173)		(0.312)		(0.295)		(0.106)		(0.157)
Size (log assets) as of 2002		-0.0147		0.0108		0.00338		0.00477		0.0140*
		(0.0110)		(0.0176)		(0.0115)		(0.00765)		(0.00836)
RE Loan/Asset as of 2002		-0.0916		-0.154		0.104		0.0537		-0.0377
		(0.156)		(0.125)		(0.0841)		(0.0932)		(0.0842)
Constant	0.185***	0.351**	0.168***	0.138	0.118***	-0.00374	0.132***	0.134	0.107***	0.0262
	(0.0601)	(0.145)	(0.0336)	(0.198)	(0.0208)	(0.159)	(0.0288)	(0.0916)	(0.0346)	(0.115)
Observations	102	102	117	115	139	128	129	118	123	108
R-squared	0.018	0.088	0.043	0.168	0.040	0.087	0.041	0.190	0.017	0.096

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 9: Alternative Measure of CEO Optimism and Stock Performance during the Financial Crisis

Cross-sectional regressions of holding period returns of bank stocks from January 2007 to December 2009 (dependent variable) on the option exercise measure of CEO optimism and other controls. "Opt2006", for example, is the value of the option exercise measure in 2006. Controls include dividend yield, bank stock volatility, bank stock beta and bank size (log assets), which are defined in the same way as in Table 7.

	Holding Period Return (2007–2009)								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A. No Controls									
Opt2006	-0.142***							-0.126**	-0.101
	(0.0493)							(0.0603)	(0.0679)
Opt2005		-0.0814*					-0.115*	0.0214	-0.0325
		(0.0467)					(0.0591)	(0.0622)	(0.0708)
Opt2004			-0.140***				-0.0389	-0.149**	-0.0633
			(0.0468)				(0.0603)	(0.0657)	(0.0726)
Opt2003				-0.121**			-0.0420	-0.0886	-0.0898
				(0.0506)			(0.0673)	(0.0720)	(0.0765)
Opt2002					-0.191***		-0.268***		-0.238***
					(0.0536)		(0.0603)		(0.0748)
Opt2001						-0.122*			
						(0.0644)			
Panel B. With Controls									
Opt2006	-0.122**							-0.127*	-0.106
	(0.0499)							(0.0657)	(0.0737)
Opt2005		-0.0808*					-0.0924	0.0224	-0.0221
		(0.0477)					(0.0602)	(0.0650)	(0.0729)
Opt2004			-0.139***				-0.0391	-0.137**	-0.0498
			(0.0475)				(0.0592)	(0.0691)	(0.0737)
Opt2003				-0.118**			-0.0497	-0.0698	-0.0779
				(0.0521)			(0.0704)	(0.0766)	(0.0796)
Opt2002					-0.180***		-0.242***		-0.225***
					(0.0546)		(0.0623)		(0.0806)
Opt2001						-0.148**			
						(0.0646)			

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 10: CEO Equity Holdings of the Largest Banks

This table presents the equity holdings of CEOs of the largest commercial and investment banks. Since Thomson Reuters does not maintain data for delisted firms, numbers presented here are taken directly from the firms' proxy filings. Before 2006, firms did not disclose information on the properties (exercise price and expiration date) of the options in the proxy filings, so the options are not delta-weighted, and include both exercisable and unexercisable options. For this reason, I do not add up stocks and options to compute total equity holdings. All numbers are as of the beginning of the specified year.

Firm	**Executive**	**CEO Term**	**Stock (b.2002)**	**Options (b.2002)**	**Stock (b.2006)**	**Options (b.2006)**
Bear Stearns	**James Cayne**	**1993–2008**	**4,702,840**	**211,864**	**5,909,483**	**761,165**
Lehman Brothers	Richard Fuld	1994-2008	4,239,658	2,906,640	4,473,624	1,700,000
Merill Lynch	**Stanley O'Neal**	**2003–2007**	**73,209**	**2,108,157**	**1,189,614**	**2,523,919**
Morgan Stanley	Philip Purcell	1997–2005	2,442,416	3,433,120	2,198,315	1,910,948
Goldman Sachs	Henry Paulson	1999–2006	3,997,960	361,043	4,032,743	680,474
Citigroup	**Charles Prince**	**2003–2007**	**752,618**	**1,067,851**	**1,485,983**	**1,137,411**
Bank of America	**Kenneth Lewis**	**2001–2009**	**536,168**	**3,580,000**	**486,872**	**5,580,000**
JPMorgan Chase	William Harrison	2002–2005	1,078,141	5,060,747	802,571	5,929,369