CEO Option Compensation, Risk-taking and the Financial Crisis: Evidence from the Banking Industry

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Abstract

This paper examines the relation between CEO option compensation and bank risk-taking, and the role of CEO option compensation in affecting bank performance during the 2007-2008 financial crisis. Through panel regressions, we find that over the sample period (1993-2011), option awards received by bank CEO and CEO option holdings lead to higher bank risk which is not rewarded by better performance. Bank CEOs take more risk by engaging more in financial innovation and maintaining more risky loan portfolios. Institutional investors favor high option compensation in their own interests of pursuing short-term stock price upswing, while a larger board corrects this excessive risk-taking by providing bank CEOs with less option compensation. Cross-sectional evidence shows that during the crisis period, the effect of option compensation in increasing risk-taking and worsening performance comes from exercisable option holdings. In addition to the findings regarding option compensation, stock awards are shown to affect bank risk and performance, while stock holdings play no role.

Keywords: CEO compensation, Option compensation, Bank governance, Excessive risk-taking, The financial crisis

EFM Classification Codes: 150, 190, 520, 790

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"CEO pay at banks is not to blame for the credit crisis."

— René Stulz

"... executive pay arrangements have contributed to the excessive risk-taking during the run-up to the financial crisis."

— Lucian Bebchuk[1]

1 Introduction

The 2007-2008 financial crisis witnesses the huge disaster brought by the failure of the banking system. Severe and widespread as the crisis is, extensive attention is attracted to the issue whether improper compensation mechanism in banks should be responsible for the financial crisis.

In a recent debate on World Bank All about Finance Blog, René Stulz[2] and Lucian Bebchuk[3] hold different opinions on this issue and speak out to take opposing sides. Throughout the debate, the role of bank CEO equity compensation is intensively discussed. In a widely cited recent paper (FS study hereafter), Fahlenbrach and Stulz (2011) show that better alignment of bank CEOs and shareholders interests[4] results in worse performance in crisis. Based on this result, Stulz argues that CEOs have strong incentives to maximize shareholder wealth, thus the financial crisis cannot be attributed to poor incentives provided by compensation; also option compensation is guiltless, since in FS study they find no evidence that higher sensitivity of bank CEOs option portfo-

[1]The two quotes are extracted from the World Bank All About Finance Blog Debate: Did executive compensation contribute to the financial crisis?. The debate lasted from January 30 to February 16, 2012, contents of which are available at http://blogs.worldbank.org/allaboutfinance/has-executive-compensation-contributed-to-the-financial-crisis.

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[3]Lucian Bebchuk is the William J. Friedman and Alicia Townsend Friedman Professor of Law, Economics, and Finance and Director of the Program on Corporate Governance at Harvard Law School.

[4]The degree of alignment is measured by the dollar change in a CEO's wealth for one percentage change in stock price.

lio to stock return volatility leads to lower return in crisis. Bebchuk disputes Stulz's opinion by underlining that "poor incentives" should not be referred to as insufficient equity holdings. Instead, deficiency of the compensation mechanism roots in rewarding short-term results and failing to link CEO payoffs to stakeholders other than the shareholders. Specifically, Bebchuk et al. (2010) find in their case study of compensation at Bear Sterns and Lehman Brothers that top executives actually fare well by being able to regularly cashing out equity compensation before crisis, despite of their losses due to stock price slump in crisis. CEOs under such designed equity compensation mechanism tend to "seek short-term increases in profits even when these came at the expense of piling up latent and excessive risks of an implosion later on". Noticeably, Bebchck points out that Bebchuk and Fried (2004) had already mentioned this problem in their book before the consequence of excessive risk-taking emerged.

This virtual debate on compensation and crisis ends with Bebchuk winning the majority votes from readers; while actual policy debates, also centering on incentives from equity compensation, started long before this and would still last. Murphy (2009) absolves compensation from causing the crisis: while observing a significant decline of bonuses and intrinsic value of options for CEOs from 2007 to 2008, he raises the opinion that the problem of asymmetric rewards and penalties to a certain extent does not exist and thus "there is nothing inherent in the current structure (of compensation in financial firms) that leads to obvious incentives to take excessive risks". While there seems to be more government officials imputing the crisis to compensation structure: Treasury Secretary Timothy Geithner argues that "I think that although many things caused this crisis, what happened to compensation and the incentives in creative risk taking did contribute in some institutions to the vulnerability that we saw in the financial crisis" (Geithner, 2009); also he elaborates that "At many financial firms, compensation structures were misaligned with the time horizons of risk: executives were rewarded for short-term performance, with

little attention to the risk of future losses. These practices ... encouraged high-risk activities that were designed to achieve short-term profitability" (Geithner, 2010). Also Ben Bernanke, Chairman of the Board of Governors of the Federal Reserve System, states that "Compensation practices at some banking organizations have led to misaligned incentives and excessive risk-taking, contributing to bank losses and financial instability" (Board of Governors of the Federal Reserve System, 2009). Similar views on compensation are expressed on a report of Board of Governors of the Federal Reserve System (2011) and also by Federal Deposit Insurance Corporation (FDIC) Chairman Sheila Bair at FDIC board meeting (January 2010).

The banking crisis and the following debates on compensation highlight the long overlooked importance of investigating equity compensation and risk-taking in banks. First, the moral hazard of increasing risk is more severe in banks as managers are provided with skewed incentives: "Heads, you become richer than Croesus ever imagined; tails, you receive a golden parachute that still leaves you richer than Croesus" (Blinder, 2009); this concern is even more relevant for banks shifting downside costs to the government with "too-big-to-fail" guarantees and deposit insurance (Bebchuck et al., 2010). Second, banks are more risky by nature in the sense that they incur substantial leverage leading to a systematic default risk; although originally proposed to mitigate the agency problem (Jensen and Meckling, 1976) arising between risk-averse managers and shareholders, improper equity compensation in inherently risky banks can possibly lead to excessive risk taken by CEOs and increased possibility of failure (Balachandran et al., 2010). Last but not least, as banks play a crucial role in facilitating capital flow and allocating economic resources, failure of the banking industry would cause a fatal damage to the real economy.

Despite the great significance of studying equity compensation and risk taking in the banking industry, empirical evidence was quite scarce before the crisis (see Chen 2006 as one exception). With hindsight after the crisis, several distinguished scholars take a stand

based on their empirical studies, trying to support the previous stated idea that equity compensation plays a part in causing the crisis. Balachandran et al. (2010) find that equity-based pay increases the probability of default. Two other papers, Mehran and Rosenberg (2008) and DeYoung et al. (2010) measure risk-taking incentives stemming from options with vega (Core and Guay, 2002), i.e. the sensitivity of option portfolio value to stock return volatility, and study the effect of bank CEO incentives on different aspects of banking characteristics and activities. These two studies provide generally consistent evidence that managers whose option portfolio value change more with stock return volatility take more risk by making more risky policy choices[5]. Although convincingly establishing the risk promoting role of equity compensation, these papers fail to directly address the issue whether this risk taking is excessive and thus leads to the crisis.

Meanwhile, in papers where this issue is studied, vega seems to lose its explanatory power. As already mentioned, Fahlenbrach and Stulz (2011) find no evidence that larger vega measured at the end of 2006 leads to lower return in crisis, and this is taken as one important argument to advocate the current equity compensation design. Their findings are confirmed by Tung and Wang (2011), who show in similar settings that CEOs' incentives from stock and option holdings do not matter in the presence of their inside debt measure; also Chesney et al. (2011) discover the same insignificant relationship between pre-crisis vega and crisis period write-downs.

From our point of view, although scholars fail to find a relationship between vega and bank performance in crisis, they seem to be a bit rush in arriving at the conclusion that option compensation does not matter at all. Fahlenbrach and Stulz (2011) argue that bank CEOs were unaware of the riskiness of the exposures they took by exploiting the fact that they suffered huge amounts of losses in crisis due to their still-held stocks

[5]Mehran and Rosenberg (2008) find vega increases bank risk, but use option portfolio value as the independent variable in analyzing bank investment and borrowing choice, yielding a bit controversial results that option portfolio value increases risky investments but decreases leverage and increases bank capital.

and vested unexercised under-water options; however, failing to realize the pending crisis timely does not mean they were unconscious of the possibility of a large loss down the road. Also, as Bebchuk has argued in the blog debate, they ignore the fact that bank CEOs actually regularly cashed out large amounts from equity sales during 2000-2007 due to high earnings and stock prices, which makes them fare much better than their long-term shareholders (Bebchuk et al., 2010). Same is observed by Bhagat and Bolton (2011) that CEOs of too-big-to-fail banks rescued early by TARP (Troubled Asset Relief Program) funds took much larger amounts "off the table" during 2000-2008 than their losses in 2008 as their banks continued with high risk but negative net present value trading and investment strategies in the whole period; in particular, the authors point out that CEOs typically pair option exercises with open market sales, and the value of shares acquired from option exercises constitutes as large as one third of market sales value, which uncovers an unneglectable role of option compensation in benefiting CEOs from short-termism. Also they show that compared with banks rescued late in TARP or not rescued in TARP, CEOs of these early rescued banks cashed out much larger amounts, while their shareholders suffered from lower returns and these banks as a group performed worse in crisis.

The confusing implications generated by the insignificance of vega in explaining crisis period performance, the lack of empirical evidence that directly supports Bebchuk's viewpoint and also the trading evidence well demonstrated above call for a reexamination of the role of option compensation in bank CEO risk-taking and bank performance in crisis. It is noteworthy that Chesney et al. (2011) find their constructed "asset vega" well explains crisis period write-downs, while the traditional "equity vega" fails to take into consideration asset risk. Flawed as the traditional incentive measure is, in this paper, we take an alternative approach and go back to the most intuitive and direct measures of option compensation. Specifically, we use the value of option awards to represent the

newly added amount of option compensation, and the value of option holdings as the stock of option compensation. As option holdings are the source of risk-taking incentives, they are expected to capture all possible derived features of themselves. Also, as option awards and option holdings values can both be easily controlled, empirical results generated by using them as independent variables can have clear and quick implications to policy makers.

In this paper, we firstly fill the gap of limited panel evidence on bank CEO option compensation and risk-taking. In panel regressions using a sample of 242 public traded banks from 1993 to 2011, we document a consistently significantly positive effect of CEO option awards and option holdings on bank risk. It is well established that financial innovation which facilitates whole sale financing, and non-interest income generating, as well as boosts the popularity of mortgage backed securities (MBS) and derivatives, increases bank risk and fragility (Blanchard, 2009; Huang and Ratnovski, 2010; Blundell-Wignalls and Atkinson, 2011; Brunnermeier et al., 2012). We reveal that option compensated bank CEOs take more risk by involving more in financial innovation; also they maintain more concentrated risky loan portfolios. What is more, we demonstrate this risk-taking is indeed excessive by showing that these bank CEOs accelerated by option compensation bring neither higher market return nor larger bank profits.

Showing bank CEOs heavily compensated with options engage in more risky activities and thus take on non-market-rewarded risk does not directly address the issue whether option compensation can be blamed for the crisis. In our regressions regarding the crisis period, we carry on Fahlenbrach and Stulz (2011)'s empirical settings of examining the effect of CEO incentives before crisis on bank performance in crisis, while we change the variables of interest into direct measures of option compensation, i.e. values of option awards and option holdings, and we consider crisis period risk-taking in addition to performance in crisis. In contrast with the insignificant results found by Fahlenbrach and

Stulz (2011), our results show that CEO option holdings are associated with a higher level of bank risk, a higher probability of bank failure and worse performance in crisis. This documented effect is proved to come from the exercisable part of option holdings, providing the first empirical evidence to our knowledge in support of a policy based argument that CEO option holdings should be restricted from vesting for a sufficient long period in order to supply bank CEOs with long-term value maximization incentives (Bhagat and Romano, 2009; Bebchuk et al., 2010; Bhagat and Bolton, 2011; Board of Governors of the Federal Reserve System, 2011).

When exploring culprits of crisis, compensation is by no means the only factor to consider. It is claimed that, to an important extent, the current financial crisis can be attributed to the failures and weaknesses of corporate governance arrangements (OECD, 2009); while corporate governance includes not only executive compensation, but also board structure, ownership structure and transparency (Li and Song, 2009). Recent papers document that board characteristics and ownership structure have explanatory power for performance in the financial crisis (e.g., Laeven and Levine, 2009; Erkens et al., 2010). As boards and shareholders can both affect executive compensation and banking activities, it is worth exploring whether the effect of bank governance on bank risk-taking comes from providing CEOs with different levels of risk-taking incentives or supervising CEOs behavior with different level of stringency. In Two-Stage Least Squares (2SLS) regressions, we assure the former affecting channel by showing that option compensation is an important factor that other bank governance mechanisms can influence to moderate or accelerate risk. Specifically, we observe that a larger board provides its CEO with less option compensation, while option compensation is taken by risk-seeking institutional holders as a tool to pursue short-term profits.

Overall, contribution of the current research mainly lies in the following three aspects: first, distinguished from the existing literature on the relation between equity compensa-

tion and bank risk-taking, we manage to address an important point that bank risk-taking induced by option compensation is indeed excessive by illustrating that option compensation do not bring corresponding high returns; also bank CEOs compensated with more options are shown to engage more in risky activities which are well documented to result in bank vulnerability; this result is crucial in judging option compensation, since it is excessive risk-taking, not risk-taking itself that poses a grave threat to stability of the banking industry. Second, by applying different but more direct measures of option compensation, we uncover that option compensation is actually highly responsible for high risk-taking and poor performance in crisis, which is not observed in previous studies where scholars merely rely on vega to capture the incentives arising from option compensation; with this evidence, we shed some new light on the intensely discussed issue whether the banking crisis can be at least partially attributed to improper compensation. Third, we utilize the special setting provided by the financial crisis to separate the effects of unexercisable options and exercisable options[6], and successfully disentangle that only exercisable options matter for CEO risk-taking decisions; this original finding together with our discovery that board characteristics and ownership structure matter in influencing compensation provide valuable references for policy makers[7].

The remainder of this paper is organized as follows. Section 2 reviews relevant literatures and develops key hypotheses. In Section 3 we discuss data sources, construction of variables and empirical methods used. Section 4 presents main empirical results, Section 5 shows results of further analysis, and Section 6 concludes.

[6]During normal times, unexercisable options would regularly become exercisable in a foreseeable time period, which results in similar effects of unexercisable and exercisable options on risk-taking; while in crisis, due to the threat of bankruptcy, unexercisable options become largely irrelevant to CEOs decisions, which enables us to separate the effects of unexercisable and exercisable options.

[7]Policy makers can correct bank excessive risk-taking arising from compensation by restricting the exercisability of options, or impose more regulation on bank boards and owners.

2 Literature and Hypotheses Development

2.1 CEO Option Compensation and Excessive Risk-taking

Due to separation of ownership and control in modern corporations, agency problem arises between stockholders and managers (Jensen and Meckling, 1976). Compared to normally well diversified shareholders, "risk-averse managers, who hold disproportionate amounts of their financial and human capital in the companies they manage, are likely to take fewer risks than are optimal" (Cohen et al., 2000), and thus may avoid risky positive NPV projects. Option compensation starts to be widely adopted since 1990s, and due to its convex payoff feature, it is believed to play a role in reducing managers' risk aversion and inducing their risk-taking behavior (Smith and Stulz, 1985; Guay, 1999). To be precise, as option value increases with stock return volatility, CEOs would pursue higher values of their option portfolio by taking on higher levels of risk.

Numerous studies regarding the non-financial industries show empirically the role of option compensation in promoting risk-taking: for example, Cohen et al. (2000) find that executives with more options and options that are more sensitive to volatility increase the volatility of the firms they control; Rajgopal and Shevlin (2002) capture a positive relationship between vega and future exploration risk taking in a sample of oil and gas producers; also, Hanlon et al. (2004) show that CEOs' vega incentive is statistically associated with greater risk-taking behavior as measured by future earnings and cash flow volatility.

In the field of financial industry, the evidence regarding option compensation and risk-taking is much less and shows up only quite recently: Chen et al. (2006) show that among commercial banks during 1992 to 2000, a higher percentage of option grant and a higher level of option based wealth lead to higher systematic and idiosyncratic risk; Mehran and Rosenberg (2008) and DeYoung et al. (2010) find that vega increases risk

for bank samples during 1992-2002 and 1994-2006 separately; also Balachandran et al. (2010) discover in a study of financial service firms from 1995 to 2008 that equity-based pay increases the probability of default.

Either from a theoretical or an empirical point of view, we would expect options to increase bank risk, even in a longer examination period including crisis times and in more strict settings.

Risk-taking stimulated by option compensation may largely be appreciated in non-financial industries as CEOs can be promoted to take on risky but value-enhancing net NPV projects (see the example of oil and gas industry in Rajgopal and Shevlin, 2002), which benefits shareholders and also the firm as a whole. But when it comes to banks, CEOs are more likely to engage in excessive risk-taking by launching projects that are value-diminishing but inflate short-term stock price (Bhagat and Bolton, 2011), since generally much more highly compensated bank CEOs accumulate more outside wealth and thus present less risk-averseness; also highly-levered banks are more risky in nature and the problem of shifting risk to debt holders (Bolton et al., 2010) and the government is more severe.

The possible existence of excessive risk-taking caused by option compensated CEOs is seldom addressed empirically. CEOs short-termism and high volatility chasing behavior giving little consideration to the possible bad consequences down the road can possibly lead to a extremely high return when market condition is good, but would also cause a fatal damage and a drastically low return when crisis hits, just as what Cheng et al. (2010) find in their study of bank CEO size-adjusted compensation. Due to the vulnerability of banks, we think the gain in good times would not be sufficient to subsidy the loss in crisis times; and thus on average we posit an insignificant or even negative relation between option compensation and bank performance.

Hypothesis 1a: Options awarded to bank CEO and bank CEO option holdings increase bank risk.

Hypothesis 1b: Options awarded to bank CEO and bank CEO option holdings do not improve bank performance.

2.2 CEO Option Compensation and Channels to Take Excessive Risk

The occurrence of banking crisis is inevitably related to financial innovation in the sense of both a broader range of activities and the continuously renewal of financial products. As pointed out by Beck et al. (2012), financial innovation is associated with higher bank fragility, which realizes as larger drops of profits in crisis.

With regard to financing, traditional banks obtain funding primarily from retail deposits, which are stable in crisis periods since they are sticky due to high switching cost and are usually guaranteed by government (Altunbas et al., 2012). Although comparing to deposits, funds from the wholesale markets can increase the flexibility of financing and probably introduce more market discipline, they expose banks to higher market risk and rollover risk. Huang and Ratnovski (2010) unveil the dark side of wholesale financing in a formal model that it can create significant risk in modern banks due to noisy public signals; also Ratnovski and Huang (2009) find that Canadian banks turn out to be more resilient in crisis mainly because of their higher levels of depository funding. From the aspect of investing, following deregulation[8], banks have been deviating from traditional interest generating activities and obtaining an increasing proportion of profits from non-interest related activities, such as trading, investment banking, brokerage, venture capital, fiducial business and non-hedging derivatives (Brunnermeier et al., 2012). Diversification

[8]The Gramm-Leach-Bliley Financial Services Modernization Act of 1999 allows the consolidation among banking companies, securities companies and insurance companies.

benefits brought by these activities seem to be rather limited (Stiroh, 2004); instead, they are demonstrated to be linked with higher revenue and earnings volatility (DeYoung and Roland, 2001), worsened risk-return trade-off (DeYoung and Rice, 2004) and also a larger contribution to systemic risk (Brunnermeier et al., 2012). Overall, modern banks that "go very far in the direction of non-interest income generation and funding through the wholesale capital market" are riskier than "traditional banks with a heavy reliance on interest income generation and deposit funding" (Demirgüç-Kunt and Huizinga, 2010).

Right behind the variety of financing and investing choices is the prevalence of innovative structural products. Under the "originate and distribute" business model, banks repackage, divide tranches, securitize their loans and get funded by selling these asset backed commercial papers to third parties. Although this process can help to reallocate and spread risk among market participants, these securitization products are far more riskier than rated due to their opacity and thus hard-to-value nature (Blanchard, 2009). The products most related to the crisis are mortgage backed securities (MBS), a large part of which get highly rated based on prosperity of the housing market. Accompany with the popularity of MBS and other more complicated derived collateralized debt obligations (CDOs) are the flourish of cheap credits and lowered standards of lending (Brunnermeier, 2009); the subsequent crisis was partly the realization of latent risk associated with these products when housing price collapses and borrowers default. Besides structural financial products, increasingly active participation in off-balance-sheet activities, particularly the soaring of derivatives usage is widely blamed for piling up potential risks and leading to the crisis. It is proved theoretically by Instefjord (2005) that credit derivatives threat bank stability even if they are used solely for hedging, since banks become more aggressive in acquiring risks when risks can be easily offloaded. What is more, banks hold derivatives actually not only for the purpose of hedging, but also to speculate and to carry out regulatory and tax arbitrages, which enable them to reduce capital and raise lever-

age (Blundell-Wignalls and Atkinson, 2011). The riskiness of derivatives is observed by Henderson and Webb (2008) in that banks' net credit derivatives positions are related to a higher stock return volatility; also banks that hold more derivatives are found to suffer from lower market returns in crisis (Cornett et al., 2009). On the whole, although appearing to transfer and disperse risk, innovative products and derivatives actually provide banks with the ability to lever up and repeatedly take on new risks; also cross holdings of these items make banks more interconnected, resulting in greater systemic risk.

The above described developments in the banking industry provide opportunities for compensation inspired bank CEOs to easily take on large amounts of risk. As adverse effects of excessive risk-taking related to these activities manifest in crisis, we believe option compensation has played a considerable role in inducing CEOs to take advantage of financial innovations. In detail, CEOs more accelerated by option compensation would obtain less funding from deposits, generate more income from non-interest related business, engage more in private-labeled risky MBS activities, and hold more off-balance-sheet derivatives.

As previously discussed, lending standards drop since loans can easily be funded through securitization and default risks can seemingly be transferred to other market participants. Thus it is reasonable to argue that option compensated CEO would make riskier lending decisions in the form of initiating lower quality loans and holding more concentrated loan portfolios (Wilson and Caprio, 2002[9]; Mehran and Rosenberg, 2008[10]), which we can observe from the data as larger shares of bad loans and greater amounts of loan loss provisions needed.

It is well documented in existing literature regarding non-financial industries that option compensation increases firm risk by inducing CEOs to make risky policy choices:

[9]Results in Wilson and Caprio (2002) indicate that "loan concentration can create a crisis-prone banking sector".

[10]Mehran and Rosenberg show in their paper that loan concentration is correlated with higher equity return volatility and higher asset volatility.

for example, option accelerated CEOs are shown to conduct more investment in R&D, less investment in PPE (Coles et al., 2006), maintain higher leverage and less cash holdings (Chava and Purnanandam, 2010) and carry more short-term debt (Brockman et al., 2010). Regarding banks, Mehran and Rosenberg (2008) find that bank CEOs make riskier investment choices as option portfolio value increases; DeYoung et al. (2010) show higher vega banks take more risk by obtaining more income from non-interest activities, having more assets in private mortgage securitizations, and having less assets in on-balance sheet loan portfolios; Li et al. (2011) discover that CEO risk-taking incentives affect a bank's contribution to systemic risk through involving in more non-interest income generating activities, financial innovations and maturity mismatch. All discussions above lead to the following two hypotheses:

Hypothesis 2a: Bank CEOs compensated with more options involve more in utilizing financial innovation, which appears as less deposit funding, more non-interest income, more private MBS holdings and more derivative holdings.

Hypothesis 2b: Option compensated bank CEOs take higher levels of risk by taking on more risky loans and constructing more concentrated loan portfolios.

2.3 CEO Option Compensation and Risk-taking: the Role of Bank Governance

Due to larger opaqueness and information asymmetry in the banking industry, corporate governance in banks is especially important (Levine, 2004; Andres and Vallelado, 2008). Besides executive compensation discussed in this paper, we believe ownership structure and board structure are two of the other governance mechanisms affecting bank risk and performance.

Institutional ownership is possibly the most intensively studied component of own-

ership structure. Institutional investors can affect firm decisions including CEO compensation indirectly through their preferences and trading (Hartzell and Starks, 2003); nowadays they become even more influential due to the say-on-pay rules adopted under Dodd-Frank Act (SEC news, 2011). However, Froot, Perold and Stein (1992) point out that institutional investors usually have their shares turned over in around one year and this time horizon is "much shorter than the necessary period for them to exert long-term discipline on firm managers". Bolton et al. (2006) support their idea by providing a formal model in which it is optimal for controlling shareholders to offer compensation contracts which stimulate managers to make early gains from a speculative stock price upswing without considering about the possibility of market value collapse later. Erkens et al. (2010) provide evidence for this theory in the context of crisis that financial firms with greater institutional ownership take more risk before crisis, which results in worse stock returns during the crisis period. Given the short-termist nature of institutional investors and their power to affect CEO compensation, we would expect institutional investors to promote CEOs' short-term risk-taking by supplying them with more options. This proposed relationship is documented by Ning et al. (2011), where they find in a sample of non-financial and non-utility firms that CEOs receive a higher percentage of equity compensation in firms with a higher level of aggregate institutional holdings.

Board size is a considerable feature of board structure. Some early studies take into account coordination problems and document a negative relationship between board size and firm value (e.g., Yermack, 1996); while Coles, Daniel and Naveen (2008) show that Tobin's Q increases in board size for some certain firms including diversified firms and high-debt firms. A recent paper by Andres and Vallelado (2008) establishes an inversed U-shape relation between bank performance and board size; also they argue that a larger board having a balanced number of insiders and outsiders increases bank value. Although the effect of board size on firm performance is uncertain, a larger board should reasonably

be more comprehensive and prudent. As it takes more effort for a larger group to reach consensus, a larger group would make less extreme decisions (Sah and Stiglitz, 1986, 1991). This conjecture is proved empirically by Cheng (2008) who shows that corporate performance varies less for firms with larger boards. We believe this evidence is more relevant in our context of excessive risk-taking in banking industry where stability is the main concern. Since the board's job includes hire, fire and compensate the CEO (Jensen 1993), and larger boards lead to lower risk, we posit a negative relation between board size and the level of CEO option compensation.

Hypothesis 3a: Banks with larger shares of stocks held by institutional investors take more risk by supplying CEOs with more option compensation.

Hypothesis 3b: Banks supervised by larger boards take less risk through providing CEOs with less option compensation.

2.4 CEO Option Compensation, Crisis Period Risk-taking and Performance

As discussed before, option compensated bank CEOs take excessive risk and excessive risk taken in banks would yield particularly bad results during bad times of the market; we predict that option compensation would be associated with a higher level of risk and a lower return in crisis. Although in panel regressions we posit that both option awards and option holdings induce bank risk-taking, we predict that only exercisable option holdings play a role in affecting crisis period bank risk-taking and performance. From the trading evidence (Bebchuk et al., 2010; Bhagat and Bolton, 2011) we have already described in the introduction part, it is obvious that the part of equity holdings which can turn into instantly available income would provide different incentives from equity holdings that are restricted from cashing out. Thus only exercisable options play the role of promoting

short-termism oriented risk-taking, since unexercisable options which are "locked" for several years would link CEOs' interest to the long-term. However, usually long-serving CEOs continuously receive option grants and continuously expect a part of unexercisable options to become exercisable every year (Bebchuk et al., 2010), and this phenomenon would transfer into a similar effect of unexercisable and exercisable option holdings on bank risk across the years. When crisis hits, unexercisable options would inevitably go underwater, and thus become largely irrelevant to CEO decisions. As there is a large probability of failure and stock price collapse in crisis, risk-taking CEOs can only inflate stock price and cash out at a certain point of time their exercisable options. With all above reasoning, we expect exercisable option holdings to increase bank risk and worsen bank performance in crisis; with exercisable options being the main part of option holdings, we predict the same but weaker effects associated with option holdings; while these effects cannot be found on option awards, since newly granted options are unexercisable.

Hypothesis 4a: Option holdings increase bank risk and worsen bank performance in crisis period.

Hypothesis 4b: Effects of option holdings on crisis period risk-taking and performance come from the exercisable part of holdings.

3 Data, Variable Construction and Empirical Methods

3.1 Data

This study starts with all banks with compensation information available from Compustat Execucomp Database. To be specific, we follow Fahlenbrach and Stulz (2011) in

identifying banks: we download all firm-year observations for firms with Standard Industry Classification (SIC) codes between 6000 and 6300; we exclude firms with SIC code 6282 (Investment Advice), and we manually go through firms with SIC code 6199 (Finance Services) and SIC code 6211 (Security Brokers and Dealers) to delete pure brokerage houses from our sample. For this list of banks, we hand collect additional compensation data from DEF 14A filings. Further, we obtain financial statement data from Compustat North America Fundamentals and FR Y-9C Consolidated Financial Statements for Bank Holding Companies[11], stock return data from CRSP, board data from Risk Metrics, and institutional holdings data from 13/F filings. For the purpose of calculating delta and vega, we in addition get daily market return and risk-free rate data from Kenneth French's data library, and treasury yield data from Federal Reserve Bank H15 Report. For a bank-year observation to remain in the sample, we require at least one calculated risk measures to be available. In the final sample we have 242 banks and 1906 bank-year observations covering the years from 1993 to 2011. For analysis involving FR Y-9C report or governance data, the sample period may be shortened due to data availability[12]. For the purpose of crisis period analysis, we have 120 bank observations[13].

3.2 Variable Construction

Firm risk measures: Stock return volatility is commonly used as a dependent variable in previous studies of equity incentive effects (e.g., Coles et al., 2006; Chen et al., 2006; Low, 2009; DeYoung et al., 2010). Here we calculate total volatility risk (vol_ret) by annualizing the standard deviation of the firm's daily stock return.

Besides stock return volatility, we also use bank Z-Score (as in Laeven and Levine,

[11]Banks are identified by RSSD numbers in FR Y-9C Reports; we use the CRSP-FRB linkage table provided by Federal Reserve Bank of New York to match banks.

[12]Specifically, we have board size data from year 1996 to year 2009; for regressions involving MBS activities, the sample period shrinks to 1994-2007; for regressions involving derivatives usage, the sample period starts at 1994.

[13]The list of sample banks for crisis period analysis is shown in Appendix Table 2.

2009), defined as the return on assets plus the capital asset ratio divided by the standard deviation of asset returns, to measure bank stability; Z-Score is essentially the inverse of probability of insolvency, thus a higher Z-Score indicates that the bank is more stable. In this study, Z-Score is calculated over a given fiscal year using quarterly financial statement data to capture the stability of a bank during this year; and Z-Score is taken a log transformation since the raw measurement is highly skewed.

For the purpose of this study on examining bank performance during bad time of the market, we in addition use Marginal Expected Shortfall (MES) proposed by Acharya et al. (2009) as a measure of tail risk. For a specific bank, we define its MES as the negative of average return on the bank's stock over the 5% worst days for S&P500 index through the bank's fiscal year period.

In order to investigate bank risk-taking during the crisis period, we calculate stock return volatility and MES for days from July 2007 to December 2008; and we calculate bank Z-Score using five quarters of data from the third quarter of 2007 to the third quarter of 2008. Definition of crisis period is the same as in Fahlenbrach and Stulz (2011).

Firm performance measures: For the purpose of panel data regressions, we use three indicators to measure bank performance over a given fiscal year: return on assets (ROA, defined as net income scaled by total assets), return on equity (ROE, defined as net income scaled by book equity) and buy-and-hold return (BAHR).

For the crisis period, we again follow Fahlenbrach and Stulz (2011) in defining crisis period and performance measures. ROA in crisis (ROA_crisis) is defined as cumulative net income from the third quarter of 2007 to the third quarter of 2008 scaled by total assets at the fiscal year end of 2006, ROE in crisis (ROE_crisis) is defined as cumulative net income in the same five quarters scaled by book equity at the fiscal year end of 2006 and BAHR in crisis (BAHR_crisis) is defined for the period from July 2007 to December 2008. Construction of the three measurements requires a bank to survive the crisis period,

and regressions leaving out failure banks miss out a most important hypothesis we want to test: whether option compensation is a driving force behind bank collapse in crisis. To address this concern, we establish a failure dummy as a dependent variable, which equals one for banks filing bankruptcy during the period 2007 to 2010, and equals zero for non-bankruptcy banks[14].

Compensation measures: Equity compensation for a bank CEO in a given year consists of stock grants and option grants. Although "option awards" is the main variable of interest, we include "stock awards" as a control. For years before 2006, computed Black-Scholes value of option granted and also stock grant value at fiscal year end are provided by Compustat[15]. Starting from 2006, when reporting requirements related to equity compensation changed[16], Compustat stopped providing data on these two items. So we instead use grant date fair values reported by the banks as proxies for option grants and stock grants[17].For companies that only report one value which is the sum of option grant and stock grant, Compustat takes this one value as option grant value and reports stock grant value to be zero. We correct this by hand collecting stock grant number and market price from DEF 14A filings; product of this two collected items gives the value of stock grant and subtracting stock grant value from the total grant value reported by the bank gives the value of option grant.

We get the value of stock awards (stockawards) from the process described in the previous paragraph, while in main tests we use self calculated Black-Scholes value[18] (bs_optawards) to measure the amount of newly granted options to avoid the possible inconsistency among bank reported fair values of new options after 2006. Option grant

[14]To identify failure banks, we first get delisting information from CRSP stock files, and then manually check whether a delisted bank goes bankruptcy during 2007 to 2010. The list of failure banks is shown in Appendix Table 2

[15]Compustat item OPT_AWARDS_BLK_VALUE gives the Black-Scholes value of option granted, and Compustat item RSTKGRNT directly measures dollar value of stock grant at fiscal year end.

[16]The reporting requirements change is due to the introduction of FAS 123R, which requires companies to report grant date fair value of stock and option awards.

[17]Namely, the two items are OPTION_AWARDS_FV and STOCK_AWARDS_FV.

[18]Details of calculation are discussed in the incentive measures part.

values obtained from the previous process are used for the purpose of robustness check.

Besides "option awards", we also use "option holdings", which is the accumulation of option grants, as an independent variable in our analysis. We examine the effect of CEO option holdings on bank risk and performance since they are the source of risk-taking incentives and they are expected to capture all possible dimensions of incentive effects; in contrast, the widely used incentive measure, vega, only captures CEO wealth change upon stock return volatility change. Also, another dimension of incentive effect stemming from option holdings, delta (the sensitivity of option holdings value to stock price change), is documented by some to decrease firm risk (Knopf et al., 2002; Chava and Purnanandam, 2010; Brockman et al., 2010); as in option holdings, this risk-reducing incentive coexists with the risk-inducing incentive vega, empirical results derived using vega as an independent variable do not provide direct insight into whether option holdings as a whole are risk-promoting. Applying the direct measure, value of option holdings, into regressions solves this problem and provides immediate policy implications.

For option holdings, we use Core and Guay (2002)'s "one-year approximation" method to estimate Black-Scholes values of CEO option holdings. All inputs into Black-Scholes (BS) formula are elaborated in the next part of incentive measures calculation. Values of the newly granted part of unexercisable option holdings, previously granted part of unexercisable option holdings and all exercisable option holdings are estimated separately; sum of the first two elements gives the BS value of unexercisable option holdings (bs_unex), the third element gives the BS value of exercisable option holdings (bs_ex), and sum of the three elements gives the BS value of total option holdings (bs_opt). In robustness checks, we use intrinsic values of option holdings instead of BS values. Specifically, we obtain directly from Compustat intrinsic values of unexercisable option holdings and exercisable option holdings[19]. Summing up these two items yields a measure of option holdings.

[19]Compustat items OPT_UNEX_UNEXER_EST_VAL and OPT_UNEX_EXER_EST_VAL capture the intrinsic values of unexercisable and exercisable option holdings respectively.

For the control variable measuring stock holdings, we get the aggregate number of shares held by the named executive officer and the number of restricted stock holdings from Compustat. Multiplying these two items by fiscal year end stock price yields the values of common stock holdings and restricted stock holdings respectively. As a measurement of total stock holdings (stockholdings), we add up these two parts. Due to ambiguous definitions of these two data items in Compustat[20], our measurement of common stock holdings might be biased upward, and our measurement of stock holdings may overestimate CEO stock holdings by counting actual restricted shares twice[21].

Incentive measures: To reconcile with concurrent literature, we use vega to measure risk-taking incentive in further analysis, and delta is taken as an control variable. Delta and vega of managers' equity portfolio are calculated closely following Core and Guay (2002). When calculating option delta and vega, they treat newly granted options, unexercisable option holdings and exercisable option holdings separately: for newly granted options, variables needed for Black-Scholes input: stock price, exercise price, time to maturity, risk-free rate, stock return volatility and dividend yield, are readily available or can be calculated easily[22]. For option holdings, they estimate the average exercise price using the number and realizable value of exercisable and unexercisable options, and they estimate the maturity as one year less than the maturity of newly granted options for unexercisable options and four years less for exercisable options. The estimated sensitivities of an option portfolio are equal to the sums of sensitivities of newly granted options, unexercisable option holdings (calculated with the value and amount of newly granted options subtracted) and exercisable options. Then delta of the equity portfolio (delta)

[20]According to Compustat, the item SHROWN_EXCL_OPTS includes both common stock holdings and actual restricted shares, while the item STOCK_UNVEST_NUM includes not only actual restricted shares but also restricted stock "units" or "performance shares" that are tied to the share price.

[21]Results on stock holdings should be cautiously interpreted due to imperfect measurements, although no significance shows up no matter we use our measure of common stock holdings or total stock holdings.

[22]For risk-free rate I use treasury bill yield as a proxy; and since Compustat stock return volatility and dividend yield data provided for Black-Scholes input has a lot of observations missing, I calculate 36-month stock-return volatility as a proxy for expected stock return volatility and 3-year average dividend yield as a proxy for expected dividend yield.

is defined as the sum of option delta, delta from common stock holdings and delta from restricted stock holdings. Following Coles et al. (2006), I use vega of the option portfolio to measure the total vega of stock and option portfolios (vega).

Channel variables: We take deposits to assets ratio (deposits/assets) as a measure of bank funding structure; the reliance on non-interest income generating activities (non-int_ratio) is defined as the ratio of non-interest income to interest income; private MBS and derivatives holdings scaled by total assets (privmbs/assets, deriv/assets) are used as proxies for engagement in the two sets of activities respectively.

To measure loan concentration (loan_concen), we follow Mehran and Rosenberg (2008) in defining it as the sum of squared loan shares. With hindsight, we use bad loan (non-accrual loans and loans past due ninety days or more) to assets ratio (badloans/assets) and loan loss provisions to assets ratio (lossprov/assets) to quantify loan quality.

Governance variables: The two governance variables we use are institutional ownership, which is the aggregate percentage of shares held by institutional investors; and board size, which is the number of directors on the board.

Control variables: For the ease of explanation, control variables measuring stock compensation have already been described previously in the compensation measures part. In addition we have the following three sets of controls: controls for bank fundamentals include logarithm of bank market value (lmkv), book to market ratio (book/market) and capital to asset ratio (capital ratio); CEO characteristics controls include CEO age (age), years in office (tenure) and a dummy indicating whether there is a change of CEO during the fiscal year (turnover); while we select bank characteristics controls from Altunbas et al. (2012), which contain deposit funding ratio (deposits/assets), loans to assets ratio (loans/assets), loan growth rate (loan_growth) and non-interest income ratio (non-int_ratio). The last set of controls is only included in part of the regressions in order to control for the possible differences in bank business models. Since CEOs compensated

with different levels of options may obtain different levels of risk by constructing different bank models, we remain conservative when explaining the coefficients in these regressions. In regressions where performance measures are taken as dependent variables, we in addition control for past year returns.

3.3 Empirical Methods

Panel data regressions (for years 1993-2011): We run OLS regressions with year fixed effects to account for changing macroeconomic and policy environments. Also we adjust for CEO-level clusters in examining the effect of compensation variables on bank risk and performance. In order to avoid reverse causality problem and to investigate how compensation schemes in a given fiscal year affect bank risk-taking and performance in the next year, we lag all independent variables and control variables by one year. In all regressions we control for stock compensation, bank fundamentals and bank characteristics; while in selected regressions we also control for additional bank characteristics. In performance regressions we in addition include past year return controls. To address how different components of option compensation affect risk differently before crisis and after crisis, we also carry out separate regressions for periods before 2006 and after 2007 (shown in Appendix Table 3).

$$Risk_{it}/Performance_{it} = \alpha_1 + \alpha_2 * Option\ Compensation_{it-1} + \alpha_3 * Controls_{it-1} + \epsilon_{it-1}$$

In order to explore the mechanisms through which CEO compensation affects bank risk-taking, we specify models on the channels of CEO risk-taking as follows:

$$Channel_{it} = \beta_1 + \beta_2 * Option\ Compensation_{it-1} + \beta_3 * Controls_{it-1} + \epsilon_{it-1}$$

We carry out Two-Stage Least Square (2SLS) regressions to corroborate the findings in main OLS regressions and to explore how different governance variables affect bank risk-taking through influencing CEO option compensation. Specifically, we estimate the following model in the first stage:

$$Option\ Compensation_{it} = \gamma_1 + \gamma_2 * Governance_{it} + \gamma_3 * Controls_{it} + \epsilon_{it}$$

Cross-sectional regressions (for crisis period): We investigate how compensation measures at the fiscal year end of 2006 affect risk-taking and performance in crisis by running the following OLS regressions. Again in all regressions we include stock compensation, bank fundamental controls and CEO characteristics controls, and in selected regressions we in addition control for bank characteristics. For regressions taking ROA, ROE or BAHR as the dependent variable, we also control for their lag values separately. Heteroskedasticity robust standard errors are reported.

$$Risk_{crisis\ period}/Performance_{crisis\ period} = \delta_1 + \delta_2 * Option\ Compensation_{2006} + \delta_3 * Controls_{2006} + \epsilon_{2006}$$

4 Empirical Results

4.1 Descriptive Statistics

Table 1 shows the distribution of banks over the sample period 1993-2011. Overall we have 242 banks, 397 CEOs and 1906 observations spanning quite evenly across the years.

Table 2 provides summary statistics for all the variables used in this study. According to statistics for the whole panel, on average, a bank CEO is highly compensated with 1.17 million of stocks and 2.42 million of options a year. At the mean level, a CEO holds shares

of the bank valued at 58.08 million[23]; while an average bank CEO has option holdings with Black-Scholes value 15.824 million, an overwhelming part of which are exercisable. Managers' wealth increases by 811 thousands of dollars (mean of delta) when stock price increases by one percent, and increases by 161 thousands of dollars (mean of vega) when stock return volatility increases by one percent; these surprising figures suggest that the large amounts of equity compensation in financial industry closely link CEOs' wealth to the stock market change. Noticeably, when we look at the difference between vega from unexercisable option holdings and exercisable option holdings, the magnitude is quite minor compared to what we observe when comparing Black-Scholes values of these two types of holdings. This indicates that the incentive measure vega may have overlooked some features of option holdings.

For the risk measures, banks have 0.358 annualized stock return volatility on average. Regarding bank stability, an average bank has a logarithm transformed Z-Score 5.264 and has a -2.6% return during the 5% worst days of market (as indicated by MES). Over the sample period, banks have an average return on assets 1.1%, return on equity 12.5% and buy-and-hold return 12.6%.

The banks we cover are quite large with a mean logarithm transformed market value 21.741, and there is no big size difference among the sample banks as reflected by a low standard deviation. The mean book to market ratio is 0.927 and the mean equity to asset ratio is 0.088. Bank CEO is usually quite experienced with an average age of 57 and an average tenure of 8.889 years.

The four columns in the right part of Table 2 shows statistics for risk and performance variables defined for the crisis period, and also other variables defined at fiscal year end of 2006. Compared to the whole sample period, CEOs do not seem to be compensated differently in 2006. During the crisis period, banks have higher stock return volatility and lower stability; also they suffer from obviously lower returns.

[23] As described in "Section 3.2 Variable Construction", this value may be slightly overvalued.

4.2 Option Compensation and Excessive Risk-taking: Panel Evidence from OLS Regressions

Table 3 reports how bank CEO option compensation affect bank volatility as measured by annualized stock return volatility, bank stability as measured by bank Z-Score and bank tail risk as measured by MES. In Panel A, we show the results using "bs_optawards" as the independent variable; while in Panel B, "bs_optholdings" is the main variable of interest. In Model 1, 3 and 5 of both panels, we control for stock compensation, bank fundamentals and CEO characteristics; while in Model 2, 4 and 6, we in addition control for bank characteristics. Consistent with previous evidence (e.g., Chen et al., 2006; Mehran and Rosenberg, 2008), in all models of both panels except Model 6, the coefficients on option awards and option holdings are at least significantly positive at 5% level, suggesting that bank CEOs react to option compensation by taking higher levels of risk realized as higher stock volatility, lower stability and worse tail performance. The economic significance of this relationship is quite large: for example, one standard deviation (10.66 million) increase in option awards would increase stock return volatility by about 0.07, which is around 21% of its mean value. Coefficients on control variables also show reasonable patterns: larger banks are generally more stable with lower stock return volatility and higher bank Z-Score, while they co-move more with the market and suffer more when market undergoes the worst days; banks with more growth opportunities, i.e. higher book-to-market banks, take more risk; banks with higher capital ratio make safer decisions; more deposits funded banks are more stable (Huang and Ratnovski, 2010; Altunbas et al., 2012); and banks generating more income from non-interest related activities are riskier in every aspect (DeYoung and Rice, 2004; Brunnermeier et al., 2012). By far, Hypothesis 1a is fully supported by results in Table 3.

In Table 4, we examine whether option compensation improve bank performance whilst boosting bank risk-taking. We observe that option awards and option holdings do not

seem to have a positive effect on bank performance no matter what measurement we use. In some models, option compensation is even significantly negatively related to bank performance. Table 3 and 4 show that bank risk-taking induced by high option compensation of bank CEOs is not awarded with a corresponding return, which highly supports Hypothesis 1b.

4.3 Option Compensation and Channels for Risk-taking: Panel Evidence from OLS Regressions

We show in Table 5 the results for testing the hypotheses that option compensation leads to excessive risk-taking through inducing bank CEOs to engage in financial innovation and maintain risky loan portfolios. It is clearly demonstrated in Model 1-4 of both panels that option awards and option holdings are significantly negatively related to the weight of deposit funding, and significantly positively associated with the ratio of non-interest income, relative MBS holdings and derivatives holdings. The magnitudes of effects are quite large; take the coefficient in the first column of Panel A as an example, when option awards increase by one standard deviation (10.66 million), all else equal the ratio of deposits to assets would decrease by 4.488 percentage points, which is around 6% of its sample mean (0.696). Thus hypothesis 2a is well supported. In Model 5-7 of both panels, hypothesis 2b is testified since option awards and option holdings exhibit to significantly increase loan concentration, bad loans to assets ratio and also the percentage of loan loss provisions relative to total assets.

4.4 Option Compensation, Bank Governance and Risk-taking: Panel Evidence from 2SLS Regressions

Previous regressions where we discover a role of option compensation in promoting bank risk-taking may suffer from endogeneity problems, since it is possible that fundamentally riskier banks would provide their CEOs with more option compensation. Although in previous regressions we have used lagged values on the right hand side of the equations to avoid reverse causality, in this part we confirm our previous findings by carrying out Two-Stage Least Squares (2SLS) regressions. In Table 6 and Table 7, we use the percentage of institutional holdings and board size as an instrument respectively. The number of observations decreases a lot in Table 7 since data on board characteristics is not available for years 1992-1995. Table 6 and Table 7 provide further and even better support for Hypothesis 1a. In almost all models of Table 6, option awards and option holdings are found to increase bank risk at 1% significance level with a large magnitude; more accurately, one million increase in option awards (option holdings) would result in 0.047 (0.005) increase in stock return volatility, 0.395 (0.041) decrease in bank z-score, and 0.384% (0.038%) increase in MES, which transfer into 13% (1%), 8% (1%), 15% (1%) of their mean values respectively. In Table 7 we obtain essentially the same results with magnitudes only slightly changed.

First stage regressions in Table 6 and Table 7 show us the role of bank governance variables in affecting CEO option compensation. According to Table 6, one standard deviation increase in institutional ownership would significantly increase option awards by about 0.6 million and option holdings by about 5.5 million, thus Hypothesis 3a is fully supported. Table 7 shows that option awards received by bank CEO and bank CEO option holdings significantly decrease as board size increases, thus Hypothesis 3b is also highly supported. Essentially, we show evidence that other bank governance mechanisms affect bank decisions through affecting the compensation mechanism, which provides some

insight for understanding the previous findings that bank governance matters in bank risk-taking and bank valuation (Laeven and Levine, 2009; Li and Song, 2009).

4.5 Option Compensation, Risk-taking in Crisis and Crisis Period Performance: Cross-Sectional Evidence

Table 8 and 9 provide support for Hypothesis 4a and 4b. In Table 8, we provide evidence on the effect of option compensation on risk-taking during the crisis period. We regress risk measures calculated over the crisis period on proxies for compensation measured at fiscal year end of 2006. In odd numbered models we control for stock compensation, bank fundamentals and CEO characteristics; and in even numbered models we in addition control for bank characteristics. We observe in Panel B that option holdings exhibit some pattern in reducing bank stability; however as shown in Panel A option awards do not appear to affect risk in crisis. Results in Panel C give an explanation to findings in Panel A and B: exercisable option holdings before the crisis generally increase all measures of risk in crisis, while unexercisable option holdings do not affect crisis period risk-taking or even show some stabilizing pattern; as newly granted options are basically unexercisable, they reasonably do not affect risk in crisis; and due to the opposing effects of unexercisable options and exercisable options, total option holdings may affect crisis period risk only slightly although exercisable options constitute the main part of total option holdings. Results in this table are consistent with what we have predicted in the hypothesis section.

Table 9 presents results on regressing the failure dummy and a set of crisis period performance measures on option compensation. For regressions with performance measures other than the failure dummy, we control for lag values of ROA, ROE and BAHR in 2006 respectively. While boosting risk-taking, option holdings add to the failing probability of banks in crisis, and they reduce crisis period return in the form of return on equity.

In Panel C we see that exercisable option holdings show even stronger effect on bank performance in significantly increasing the probability of bank collapse and decreasing crisis period return as reflected by lower book returns. Specifically, one million increase in exercisable options would lead to 0.002 increase in failing probability (calculated at the mean level of all variables), 0.018% decrease in ROA, 0.362% decrease in ROE, which is 1.5%, 9% and 40% of their mean values respectively (Their mean values are 0.133, 0.002 and 0.009 respectively). Whilst supporting the fourth set of hypotheses, results in this part also provide empirical evidence for the arguments that CEOs able to cash out equity holdings yearly are supplied with short-term incentives (Bebchuk et al., 2010; Bhagat and Bolton, 2011).

5 Further Analysis

5.1 Stock Compensation, Bank Risk-taking and Bank Performance

In main regressions of this paper, when we study the effect of option compensation on bank risk and performance, we include measures of stock compensation as controls. Although stock compensation is not of our main interest in this paper, regressions results do shed some light on how stock compensation influent bank risk and performance.

From Table 3, we discover that stock awards increase bank risk no matter what risk measures are used. However, stock holdings do not affect bank risk; this can possibly be explained by the fact that when CEOs' wealth is closely linked to stock price change by large amounts of common stock holdings, they may possibly increase risk due to incentive effects, also they may decrease risk due to large exposure to risk when they have extremely concentrated investments in their own firms (see the uncertain effect of delta explained by Knopf et al., 2002; Chava and Purnanandam, 2010; and Brockman et al., 2010). In Table

8 and Table 9, stock awards are found to promote risk-taking and worsen performance in crisis. These results are not surprising since most of the time managers can get the shares or equivalent cash only when specific performance target is met, and this urges managers to "play with fire" even in crisis.

To conclude, holding common stock do not necessarily give bank CEOs incentives to increase risk, while restricted stock granted imposing performance requirements on CEOs stimulate them to take risk.

5.2 Traditional Incentive Measures, Bank Risk-taking and Bank Performance

To reconcile with prevalent literature using vega to measure risk-taking incentive, we show in Table 10 that over the sample period, vega appears to raise firm risk by increasing bank volatility and reducing bank stability, which is consistent with previous literature that vega explains CEO risk-taking. But noticeably, we do not observe a significant effect of vega on bank performance during bad times of the market. In Table 11, we confirm the finding that vega has no explanatory power to bad time, i.e. crisis period, risk-taking. Also, the insignificance we observe is not due to the opposing effects of incentives from exercisable holdings and unexercisable option holdings, since decomposition of vega does not help to explain crisis period risk-taking and performance in crisis either.

Results in this part are consistent with the findings of Fahlenbrach and Stulz (2011) in that vega do not appear to affect bank performance in crisis. However, we do not agree with them in absolutely ruling out the possibility that option compensation can be related to crisis. Based on our previous results that option holdings value, especially the value of exercisable option holdings, significantly explains crisis period risk-taking and performance, we posit that the insignificance of vega does not equal to the irrelevance of option compensation. Possibly, in crisis, what matters is not the sensitivity to stock

return volatility; since as long as a bank CEO holds exercisable options, he would be promoted to take risk and boost recent stock price in order to get the most out of his holdings before the market totally collapses.

5.3 Robustness Checks

In Section 4.4 we have already shown the robustness of our panel regressions by carrying out Two-Stage Least Squares Regressions using governance variables as instruments. To further confirm all the empirical results we have found in previous analysis, we replace our calculated Black-Scholes values of options with option awards values and intrinsic values of option holdings reported on Compustat Execucomp database[24]. In all regressions where we use alternative measures as the main variables of interest, we get essentially the same results. Due to space limitations, we do not report the results here.

6 Conclusion

This paper carries out a comprehensive investigation into how option awards received by bank CEOs and how options held by bank CEOs affect bank risk-taking both from a general perspective and from a crisis point of view.

We find from panel regressions that bank CEO option compensation significantly whets CEOs' appetite for a higher level of risk as reflected by higher stock volatility, lower stability and higher expected loss in bad times. To pursue more risk, CEOs obtain less deposit funding, do more non-interest income generating business, hold more risky mortgage backed-securities and keep more derivatives. Also they take on lower quality and more concentrated loans. Although risk evoking, option compensation does not bring a corresponding return as shown by our panel evidence; it may even bring some nega-

[24]Detailed definitions of variables used in robustness checks are described in "Section 3.2 Variable Construction".

tive consequence to bank performance, since the excessive risk-taking in highly levered banking industry makes banks more fragile to exogenous shocks. We also observe that this excessive risk-taking is accelerated by institutional investors through providing CEOs with more option compensation, and banks with a larger board reduce risk by supplying their CEOs with lower amounts of options.

Our special tests of the crisis period show that option holdings still play a role in increasing risk-taking and they are demonstrated to worsen bank performance. "Option awards" loses its explanatory power since newly granted options are usually unexercisable for a considerable long period of time; when crisis is on the way, only cashable equity matters and these unexercisable options become irrelevant. Decomposition of option holdings sheds more light on this discovery in that we see exercisable options strongly affect crisis period risk-taking. In regressions taking crisis period performance as the dependent variable, we observe banks with managers holding more exercisable options perform significantly worse in crisis.

Further analysis shows that stock awards imposing performance requirements on bank CEOs increase their risk appetite, and this can partly explain the differences in crisis period risk-taking and performance. While in regressions with the same setups, vega and components of vega are always insignificant, indicating the limited explanatory power of vega in crisis.

Our analysis strongly supports equity compensation, especially option compensation, to be one of the underlying factors causing the financial crisis. Exercisable options turn out to be the most prominent part of CEO equity holdings that exacerbate risk-taking and performance decline in crisis. Even when we take a stand from an nineteen-year perspective (1993-2011), equity grants and option holdings bring only risk but not consistent returns.

We can derive from our findings that the most proper way to align CEOs' interests

to long-term shareholders is to grant them with bank shares restricted in the sense that managers cannot sell the shares before retiring; and the bank shares should not be restricted in the sense of tying to short term stock performance. In the cases when options need to be used in bank CEO compensation, they should also be kept unexercisable before managers' retiring, as exercisable options lead CEOs' attention to the short run especially during the crisis period.

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Table 1: Distribution of Sample Banks over the Years

This table shows the distribution of sample banks over the years. Overall we have 242 banks, 397 CEOs and 1906 observations spanning from year 1993 to 2011.

Year	No. of Banks
1993	37
1994	78
1995	107
1996	95
1997	96
1998	95
1999	101
2000	102
2001	103
2002	100
2003	104
2004	113
2005	104
2006	110
2007	120
2008	125
2009	110
2010	104
2011	102
Total	1,906

Table 2: Summary Statistics

This table shows summary statistics of our sample banks and sample CEOs. In the left part we provide statistics for the whole sample of 242 banks and 397 CEOs spanning from year 1993 to 2011; while in the right part, statistics for crisis period are presented, where we have 120 sample banks. Detailed definitions of variables are shown in Appendix Table 1.

		Statistics for Years 1993-2011				Statistics for Crisis Period*			
Variable	Description	N	Mean	Median	Std. Dev.	N	Mean	Median	Std. Dev.
Compensation Variables:									
bs_optawards	Black-Scholes value of option awards, in millions	1891	2.420	0.410	10.660	117	1.500	0.196	3.926
bs_opt	Black-Scholes value of option holdings, in millions	1906	15.824	4.852	33.788	120	21.966	5.387	63.419
bs_ex	Black-Scholes value of exercisable option holdings, in millions	1906	11.038	3.085	26.450	120	18.511	3.837	54.799
bs_unex	Black-Scholes value of unexercisable option holdings, in millions	1906	4.787	1.137	11.696	120	3.455	0.662	9.383
stockawards	Stock awards value	1905	1.170	0.000	3.517	119	1.969	0.112	5.036
stockholdings	Stock holdings value	1821	58.080	12.290	210.683	117	59.797	18.755	129.024
Incentive Variables:									
vega	Vega of option holdings, in millions	1906	0.159	0.041	0.678	120	0.386	0.039	2.471
vega_ex	Vega of exercisable option holdings, in millions	1906	0.091	0.015	0.568	120	0.292	0.018	2.148
vega_unex	Vega of unexercisable option holdings, in millions	1906	0.069	0.016	0.166	120	0.094	0.012	0.344
delta	Delta of option holdings and stock holdings, in millions	1821	0.811	0.231	2.342	117	1.037	0.302	2.402
Risk and Performance Variables:									
vol_ret	Stock return volatility	1842	0.358	0.294	0.230	116	0.792	0.684	0.343
lzscore	Logrithm of bank Z-Score	1899	5.264	5.400	1.356	112	4.216	4.350	1.353
MES	Marginal Expected Shortfall	1841	0.026	0.020	0.023	107	0.079	0.069	0.062
failure	Failure dummy	N/A	N/A	N/A	N/A	120	0.133	0.000	0.341
ROA	Return on Assets	1905	0.011	0.012	0.012	114	0.002	0.008	0.022
ROE	Return on Equity	1905	0.125	0.158	0.606	114	0.009	0.085	0.234
BAHR	Buy-and-Hold Return	1842	0.126	0.102	0.353	117	-0.347	-0.344	0.418

Table 2 Continued

Governance Variables:									
ins_holdings	Percentage of institutional holdings	1527	0.547	0.542	0.198	100	0.597	0.577	0.226
boardsize	Number of directors on board	1218	13.309	13.000	4.042	85	12.306	12.000	3.059
Channel Variables:									
deposits/assets	Deposits to assets ratio	1117	0.696	0.711	0.119	N/A	N/A	N/A	N/A
nonint_ratio	Non-interest income to interest income ratio	1149	0.410	0.272	1.110	N/A	N/A	N/A	N/A
privmbs/assets	Private MBS to assets ratio	672	0.019	0.004	0.041	N/A	N/A	N/A	N/A
deriv/assets	Derivatives to assets ratio	1020	0.111	0.019	0.363	N/A	N/A	N/A	N/A
loan_concen	Loan concentration	1149	0.456	0.429	0.166	N/A	N/A	N/A	N/A
badloans/assets	Bad loan to assets ratio	793	0.011	0.006	0.015	N/A	N/A	N/A	N/A
lossprov/assets	Loan loss provision to assets ratio	1027	0.006	0.003	0.008	N/A	N/A	N/A	N/A
Control Variables:									
lmkv	Logrithm of market value	1902	21.741	21.491	1.549	120	21.895	21.390	1.593
book/market	Asset book to market ratio	1902	0.927	0.937	0.068	120	0.911	0.919	0.049
capital ratio	Equity to asset ratio	1906	0.088	0.081	0.045	120	0.099	0.094	0.050
age	CEO Age	1901	56.993	57.000	6.635	120	57.267	58.000	6.765
tenure	Years CEO have been in office	1853	8.889	7.000	7.070	120	9.042	7.000	6.811
turnover	Dummy indicating CEO turnover	1906	0.081	0.000	0.273	120	0.133	0.000	0.341
deposits/assets	Deposits to assets ratio	1117	0.696	0.711	0.119	75	0.708	0.719	0.112
loans/assets	Percentage of loans in total assets	1149	0.633	0.664	0.129	75	0.659	0.689	0.138
loan_growth	Growth rate of total loans	1136	0.132	0.082	0.251	75	0.112	0.071	0.173
nonint_ratio	Non-interest income to interest income ratio	1149	0.410	0.272	1.110	75	0.327	0.258	0.274

* For crisis period statistics, risk and performance variables are measured over the crisis period, while other variables are measured at fiscal year end of 2006.

Table 3: Option Compensation and Bank Risk

This table reports OLS regression results for regressing various bank risk measures on CEO option compensation measures. Dependent variables are stock return volatility, bank Z-Score and Marginal Expected Shortfall, respectively. In Panel A we use Black-Scholes value of newly granted options (in millions) as a proxy for CEO option compensation, while in Panel B we use Black-Scholes value of option holdings (in millions). Both dependent and independent variables are winsorized at 1st and 99th percentile. Detailed definitions of variables are shown in Appendix Table 1.

Panel A: The effect of option awards on bank risk

	(1) vol_ret_t	(2) vol_ret_t	(3) $lzscore_t$	(4) $lzscore_t$	(5) MES_t#	(6) MES_t#
CEO Compensation:						
$bs\_optawards_{t-1}$	0.007***	0.006***	-0.058***	-0.044***	0.027***	0.007
	(3.98)	(3.55)	(-5.51)	(-3.57)	(2.68)	(0.52)
$stockawards_{t-1}$	0.011***	0.007**	-0.061***	-0.040**	0.066***	0.025
	(5.01)	(2.32)	(-4.67)	(-2.01)	(4.22)	(1.10)
Bank Fundamentals:						
$lmkv_{t-1}$	-0.033***	-0.030***	0.122***	0.146***	0.100***	0.135***
	(-6.15)	(-4.30)	(3.24)	(2.95)	(3.09)	(2.64)
$book/market_{t-1}$	0.383***	0.627***	-3.004***	-2.535**	3.042***	4.455***
	(2.60)	(3.16)	(-3.04)	(-2.08)	(3.02)	(3.20)
capital $ratio_{t-1}$	-0.789***	-1.982***	4.754**	12.847***	-2.252	-7.311***
	(-3.12)	(-5.30)	(2.50)	(4.75)	(-1.58)	(-2.61)
CEO Characteristics:						
age_{t-1}	0.000	0.002	0.013*	0.000	0.001	0.019**
	(0.06)	(1.39)	(1.65)	(0.02)	(0.18)	(2.19)
$tenure_{t-1}$	-0.000	-0.000	0.002	-0.001	-0.003	-0.007
	(-0.09)	(-0.48)	(0.25)	(-0.06)	(-0.48)	(-0.80)
$turnover_{t-1}$	0.042***	0.021	-0.416***	-0.375**	0.120	0.050
	(2.67)	(1.08)	(-3.92)	(-2.48)	(1.01)	(0.32)
Bank Characteristics:						
$deposits/assets_{t-1}$		-0.070		1.412***		-0.071
		(-1.00)		(3.03)		(-0.13)
$loans/assets_{t-1}$		0.079		-0.814**		0.138
		(1.03)		(-1.99)		(0.26)
$loan\_growth_{t-1}$		0.025*		0.015		0.131
		(1.73)		(0.09)		(0.86)
$nonint\_ratio_{t-1}$		0.020***		-0.189***		0.093**
		(3.71)		(-4.98)		(2.28)
Constant	0.663***	0.349	4.565***	3.501*	-3.596***	-6.392***
	(3.29)	(1.14)	(3.47)	(1.94)	(-2.71)	(-2.69)
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
CEO-level Cluster	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,781	1,059	1,793	1,038	1,772	1,053
R-squared	0.690	0.747	0.209	0.277	0.780	0.811

* Robust t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

#For the ease of tabulation, coefficients in MES regressions have been multiplied by 100.

Panel B: The effect of option holdings on bank risk

	(1) vol_ret$_t$	(2) vol_ret$_t$	(3) lzscore$_t$	(4) lzscore$_t$	(5) MES$_t$#	(6) MES$_t$#
CEO Compensation:						
bs_opt$_{t-1}$	0.002***	0.001***	-0.012***	-0.008***	0.006**	0.003
	(4.62)	(3.37)	(-5.68)	(-3.01)	(2.37)	(0.88)
stockholdings$_{t-1}$	0.000	-0.000	-0.000	0.000	0.001	-0.001
	(0.60)	(-0.88)	(-0.64)	(0.51)	(0.93)	(-1.19)
Bank Fundamentals:						
lmkv$_{t-1}$	-0.031***	-0.028***	0.117***	0.122***	0.120***	0.156***
	(-5.35)	(-3.89)	(2.93)	(2.61)	(3.45)	(3.15)
book/market$_{t-1}$	0.485***	0.741***	-3.476***	-3.146***	3.444***	4.875***
	(3.32)	(3.73)	(-3.67)	(-2.65)	(3.52)	(3.38)
capital ratio$_{t-1}$	-0.722***	-1.981***	4.273**	13.131***	-1.897	-7.413**
	(-2.86)	(-4.98)	(2.37)	(4.84)	(-1.38)	(-2.56)
CEO Characteristics:						
age$_{t-1}$	-0.000	0.001	0.015*	0.001	-0.001	0.018**
	(-0.25)	(1.15)	(1.94)	(0.12)	(-0.21)	(2.08)
tenure$_{t-1}$	-0.001	-0.001	0.005	-0.001	-0.007	-0.005
	(-0.85)	(-0.54)	(0.72)	(-0.16)	(-1.09)	(-0.61)
turnover$_{t-1}$	0.041**	0.021	-0.441***	-0.415***	0.109	0.032
	(2.49)	(1.00)	(-4.00)	(-2.72)	(0.87)	(0.19)
Bank Characteristics:						
deposits/assets$_{t-1}$		-0.074		1.500***		-0.126
		(-0.93)		(2.97)		(-0.22)
loans/assets$_{t-1}$		0.084		-0.878**		0.090
		(1.06)		(-2.08)		(0.17)
loan_growth$_{t-1}$		0.027*		0.014		0.149
		(1.79)		(0.09)		(0.96)
nonint_ratio$_{t-1}$		0.021***		-0.196***		0.095**
		(3.81)		(-5.12)		(2.29)
Constant	0.510**	0.205	5.022***	4.502**	-4.277***	-7.217***
	(2.43)	(0.66)	(3.63)	(2.55)	(-3.09)	(-3.08)
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
CEO-level Cluster	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,721	1,031	1,734	1,010	1,712	1,025
R-squared	0.687	0.745	0.209	0.284	0.779	0.809

* Robust t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

#For the ease of tabulation, coefficients in MES regressions have been multiplied by 100.

Table 4: Option Compensation and Bank Performance

This table reports OLS regression results for regressing various bank performance measures on CEO option compensation measures. Dependent variables are return on assets, return on equity and buy-and-hold return, respectively. In Panel A we use Black-Scholes value of newly granted options (in millions) as a proxy for CEO option compensation, while in Panel B we use Black-Scholes value of option holdings (in millions). Both dependent and independent variables are winsorized at 1st and 99th percentile. Detailed definitions of variables are shown in Appendix Table 1.

Panel A: The effect of option awards on bank performance

	(1) ROA_t	(2) ROA_t	(3) ROE_t	(4) ROE_t	(5) $BAHR_t$	(6) $BAHR_t$
CEO Compensation:						
$bs\_optawards_{t-1}$	-0.000	-0.000*	-0.001	-0.003**	0.001	-0.003*
	(-1.16)	(-1.78)	(-1.12)	(-2.19)	(0.76)	(-1.69)
$stockawards_{t-1}$	-0.000	-0.000	-0.001	-0.004*	-0.002	-0.013***
	(-0.65)	(-0.32)	(-0.60)	(-1.88)	(-0.88)	(-3.72)
Past Year Returns:						
ROA_{t-1}	0.280***	0.278***				
	(3.98)	(3.25)				
ROE_{t-1}			0.012	0.008		
			(1.04)	(1.07)		
$BAHR_{t-1}$					-0.011	0.033
					(-0.36)	(0.96)
Bank Fundamentals:						
$lmkv_{t-1}$	0.001***	0.001***	0.019***	0.023***	-0.003	0.011
	(3.01)	(2.65)	(3.93)	(3.45)	(-0.44)	(1.41)
$book/market_{t-1}$	-0.058***	-0.059***	-0.720***	-0.841***	0.166	0.343**
	(-6.31)	(-5.45)	(-8.96)	(-5.57)	(1.36)	(2.19)
$capital\ ratio_{t-1}$	0.028***	0.026	-0.049	0.211	0.597**	1.034***
	(4.04)	(1.42)	(-0.40)	(0.55)	(2.41)	(2.64)
CEO Characteristics:						
age_{t-1}	0.000	-0.000	-0.000	-0.000	-0.001	-0.001
	(0.95)	(-0.02)	(-0.16)	(-0.17)	(-0.54)	(-0.89)
$tenure_{t-1}$	-0.000	-0.000	-0.001	0.000	-0.000	0.000
	(-0.80)	(-0.31)	(-1.07)	(0.46)	(-0.42)	(0.27)
$turnover_{t-1}$	-0.002**	-0.004***	-0.026*	-0.057***	-0.036	-0.062*
	(-2.54)	(-3.10)	(-1.77)	(-3.10)	(-1.31)	(-1.85)
Bank Characteristics:						
$deposits/assets_{t-1}$		0.002		0.019		0.139
		(0.59)		(0.30)		(1.39)
$loans/assets_{t-1}$		-0.003		-0.103**		-0.273***
		(-0.95)		(-2.34)		(-3.63)
$loan\_growth_{t-1}$		-0.001		0.025*		-0.003
		(-0.43)		(1.80)		(-0.08)
$nonint\_ratio_{t-1}$		-0.001**		-0.011**		-0.008
		(-2.32)		(-2.26)		(-1.41)
Constant	0.049***	0.047***	0.449***	0.516**	0.022	-0.418
	(5.09)	(3.59)	(3.63)	(2.29)	(0.11)	(-1.59)
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
CEO-level Cluster	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,725	999	1,725	999	1,778	1,059
R-squared	0.540	0.538	0.428	0.490	0.469	0.519

* Robust t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Panel B: The effect of option holdings on bank performance

	(1) ROA_t	(2) ROA_t	(3) ROE_t	(4) ROE_t	(5) $BAHR_t$	(6) $BAHR_t$
CEO Compensation:						
bs_opt_{t-1}	-0.000*	-0.000	-0.000	-0.001	-0.000	-0.000
	(-1.93)	(-0.97)	(-1.44)	(-1.24)	(-0.56)	(-0.32)
$stockholdings_{t-1}$	0.000**	-0.000	0.000	-0.000	0.000	-0.000
	(2.10)	(-0.68)	(1.50)	(-1.02)	(1.64)	(-1.11)
Past Year Returns:						
ROA_{t-1}	0.278***	0.282***				
	(3.91)	(3.28)				
ROE_{t-1}			0.011	0.008		
			(1.04)	(1.05)		
$BAHR_{t-1}$					0.004	0.057
					(0.15)	(1.63)
Bank Fundamentals:						
$lmkv_{t-1}$	0.001***	0.001***	0.020***	0.022***	-0.004	0.002
	(2.77)	(2.64)	(3.77)	(3.26)	(-0.71)	(0.24)
$book/market_{t-1}$	-0.061***	-0.061***	-0.732***	-0.887***	0.113	0.290*
	(-6.48)	(-5.35)	(-8.76)	(-6.00)	(0.94)	(1.68)
$capital\ ratio_{t-1}$	0.029***	0.028	-0.022	0.247	0.580**	1.019**
	(4.05)	(1.48)	(-0.19)	(0.62)	(2.32)	(2.46)
CEO Characteristics:						
age_{t-1}	0.000	-0.000	-0.000	-0.000	-0.000	-0.001
	(0.97)	(-0.01)	(-0.24)	(-0.17)	(-0.15)	(-0.63)
$tenure_{t-1}$	-0.000	-0.000	-0.001	0.001	-0.001	0.000
	(-1.02)	(-0.29)	(-1.02)	(0.69)	(-0.77)	(0.30)
$turnover_{t-1}$	-0.002***	-0.004***	-0.031**	-0.062***	-0.035	-0.067*
	(-2.61)	(-3.21)	(-1.97)	(-3.18)	(-1.20)	(-1.92)
Bank Characteristics:						
$deposits/assets_{t-1}$		0.003		0.025		0.168*
		(0.71)		(0.39)		(1.67)
$loans/assets_{t-1}$		-0.004		-0.110**		-0.257***
		(-1.18)		(-2.39)		(-3.22)
$loan\_growth_{t-1}$		-0.001		0.025*		-0.014
		(-0.45)		(1.84)		(-0.40)
$nonint\_ratio_{t-1}$		-0.001**		-0.012**		-0.008
		(-2.60)		(-2.46)		(-1.42)
Constant	0.052***	0.043***	0.495***	0.492**	-0.037	-0.297
	(5.64)	(3.34)	(3.72)	(2.28)	(-0.20)	(-1.14)
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
CEO-level Cluster	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,668	972	1,668	972	1,717	1,031
R-squared	0.546	0.546	0.433	0.493	0.467	0.516

* Robust t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 5: Option Compensation and Channels for Risk-taking

This table reports OLS regression results for regressing various risky activity measures on CEO option compensation measures. Dependent variables are deposits to assets ratio, non-interest income to interest income ratio, private MBS holdings to assets ratio, derivative holdings to assets ratio, loan concentration, bad loans to assets ratio, and loan loss provision to assets ratio, respectively. In Panel A we use Black-Scholes value of newly granted options (in millions) as a proxy for CEO option compensation, while in Panel B we use Black-Scholes value of option holdings (in millions). Both dependent and independent variables are winsorized at 1st and 99th percentile. Detailed definitions of variables are shown in Appendix Table 1.

Panel A: The effect of option awards on risk-taking channels

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	deposits/assets$_t$#	nonint_ratio$_t$#	privmbs/assets$_t$#	deriv/assets$_t$#	loan_concen$_t$#	badloans/assets$_t$#	lossprov/assets$_t$#
bs_optawards$_{t-1}$	-0.421***	0.361	0.144***	1.983***	0.585***	0.055***	0.010*
	(-4.08)	(1.29)	(3.51)	(10.03)	(4.15)	(4.65)	(1.80)
stockawards$_{t-1}$	-0.532***	0.405	0.118	-0.022	0.002	0.003	0.006
	(-2.93)	(0.82)	(1.57)	(-0.06)	(0.01)	(0.17)	(0.63)
Bank Fundamentals Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CEO Characteristics Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	976	992	618	928	991	733	992
R-squared	0.283	0.278	0.161	0.303	0.355	0.483	0.481

Panel B: The effect of option holdings on risk-taking channels

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	deposits/assets$_t$#	nonint_ratio$_t$#	privmbs/assets$_t$#	deriv/assets$_t$#	loan_concen$_t$#	badloans/assets$_t$#	lossprov/assets$_t$#
bs_opt$_{t-1}$	-0.068***	0.124**	0.039***	0.386***	0.087***	0.010***	0.002*
	(-3.29)	(2.18)	(4.84)	(9.56)	(3.15)	(4.48)	(1.96)
stockholdings$_{t-1}$	-0.012**	-0.022	-0.004**	-0.037***	-0.003	-0.000	-0.000
	(-2.34)	(-1.55)	(-2.10)	(-3.76)	(-0.42)	(-0.73)	(-0.54)
Bank Fundamentals Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CEO Characteristics Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	946	958	587	894	957	712	958
R-squared	0.286	0.279	0.202	0.296	0.369	0.485	0.479

* Robust t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

#For the ease of tabulation, all coefficients have been multiplied by 100.

Table 6: Option Compensation and Bank Risk: Institutional Holdings as the Instrument

This table reports Two-Stage Least Square Regression results for regressing various bank risk measures on CEO option compensation measures, using percentage of institutional holdings as the instrument. Dependent variables are stock return volatility, bank Z-Score and Marginal Expected Shortfall, respectively. In Panel A we use Black-Scholes value of newly granted options (in millions) as a proxy for CEO option compensation, while in Panel B we use Black-Scholes value of option holdings (in millions). Both dependent and independent variables are winsorized at 1st and 99th percentile. Detailed definitions of variables are shown in Appendix Table 1.

Panel A: The effect of option awards on bank risk, instrumented with institutional holdings

	(1) 1st Stage $bs\_optawards_{t-1}$	(2) 2nd Stage vol_ret_t	(3) 1st Stage $bs\_optawards_{t-1}$	(4) 2nd Stage $lzscore_t$	(5) 1st Stage $bs\_optawards_{t-1}$	(6) 2nd Stage MES_t #
$bs\_optawards_{t-1}$		0.047***		-0.395***		0.384**
		(2.86)		(-3.14)		(2.57)
$ins\_holdings_{t-1}$	2.814***		3.048***		2.814***	
	(2.89)		(2.99)		(2.84)	
Bank Fundamentals Controls	Yes	Yes	Yes	Yes	Yes	Yes
CEO Characteristics Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
CEO-level Cluster	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,467	1,467	1,429	1,429	1,459	1,459
R-squared	0.333	0.458	0.342	0.198	0.332	0.573

Panel B: The effect of option holdings on bank risk, instrumented with institutional holdings

	(1) 1st Stage bs_opt_{t-1}	(2) 2nd Stage vol_ret_t	(3) 1st Stage bs_opt_{t-1}	(4) 2nd Stage $lzscore_t$	(5) 1st Stage bs_opt_{t-1}	(6) 2nd Stage MES_t #
bs_opt_{t-1}		0.005***		-0.041***		0.038***
		(3.51)		(-3.87)		(3.41)
$ins\_holdings_{t-1}$	27.493***		29.095***		27.539***	
	(4.53)		(4.56)		(4.47)	
Bank Fundamentals Controls	Yes	Yes	Yes	Yes	Yes	Yes
CEO Characteristics Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
CEO-level Cluster	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,480	1,480	1,442	1,442	1,472	1,472
R-squared	0.448	0.635	0.459	0.206	0.449	0.717

* Robust t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

#For the ease of tabulation, coefficients in MES regressions have been multiplied by 100.

Table 7: Option Compensation and Bank Risk: Board Size as the Instrument

This table reports Two-Stage Least Square Regression results for regressing various bank risk measures on CEO option compensation measures, using board size as the instrument. Dependent variables are stock return volatility, bank Z-Score and Marginal Expected Shortfall, respectively. In Panel A we use Black-Scholes value of newly granted options (in millions) as a proxy for CEO option compensation, while in Panel B we use Black-Scholes value of option holdings (in millions). Both dependent and independent variables are winsorized at 1st and 99th percentile. Detailed definitions of variables are shown in Appendix Table 1.

Panel A: The effect of option awards on bank risk, instrumented with board size

	(1) 1st Stage $bs\_optawards_{t-1}$	(2) 2nd Stage vol_ret_t	(3) 1st Stage $bs\_optawards_{t-1}$	(4) 2nd Stage $lzscore_t$	(5) 1st Stage $bs\_optawards_{t-1}$	(6) 2nd Stage MES_t #
$bs\_optawards_{t-1}$		0.028***		-0.139		0.228***
		(2.80)		(-1.59)		(2.62)
$boardsize_{t-1}$	-0.143***		-0.150***		-0.143***	
	(-2.93)		(-3.00)		(-2.93)	
Bank Fundamentals Controls	Yes	Yes	Yes	Yes	Yes	Yes
CEO Characteristics Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
CEO-level Cluster	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,186	1,186	1,159	1,159	1,178	1,178
R-squared	0.329	0.527	0.334	0.128	0.328	0.641

Panel B: The effect of option holdings on bank risk, instrumented with board size

	(1) 1st Stage bs_opt_{t-1}	(2) 2nd Stage vol_ret_t	(3) 1st Stage bs_opt_{t-1}	(4) 2nd Stage $lzscore_t$	(5) 1st Stage bs_opt_{t-1}	(6) 2nd Stage MES_t #
bs_opt_{t-1}		0.003***		-0.017		0.026***
		(2.73)		(-1.61)		(2.65)
$boardsize_{t-1}$	-1.210***		-1.243***		-1.212***	
	(-3.13)		(-3.16)		(-3.13)	
Bank Fundamentals Controls	Yes	Yes	Yes	Yes	Yes	Yes
CEO Characteristics Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
CEO-level Cluster	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,189	1,189	1,162	1,162	1,181	1,181
R-squared	0.433	0.658	0.440	0.184	0.433	0.740

* Robust t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

#For the ease of tabulation, coefficients in MES regressions have been multiplied by 100.

Table 8: Option Compensation and Bank Risk in Crisis

This table reports OLS regression results for regressing crisis period bank risk measures on CEO option compensation measures. Dependent variables are stock return volatility, bank Z-Score and Marginal Expected Shortfall measured over the crisis period, respectively. In Panel A we use Black-Scholes value of newly granted options (in millions) as a proxy for CEO option compensation, in Panel B we use Black-Scholes value of option holdings (in millions), and in Panel C we decompose option holdings into unexercisable and exercisable parts. Both dependent and independent variables are winsorized at 5th and 95th percentile. Detailed definitions of variables are shown in Appendix Table 1.

Panel A: The effect of option awards on bank risk in crisis

	(1)	(2)	(3)	(4)	(5)	(6)
	vol_ret_crisis	vol_ret_crisis	lzscore_crisis	lzscore_crisis	MES_crisis#	MES_crisis#
$bs\_optawards_{2006}$	-0.008	0.006	0.011	-0.097	-0.043	-0.239
	(-0.48)	(0.34)	(0.16)	(-1.31)	(-0.32)	(-1.42)
$stockawards_{2006}$	0.028***	0.025**	-0.088**	-0.122**	0.197***	0.234***
	(2.98)	(2.16)	(-2.33)	(-2.43)	(3.45)	(3.29)
Bank Fundamentals Controls	Yes	Yes	Yes	Yes	Yes	Yes
CEO Characteristics Controls	Yes	Yes	Yes	Yes	Yes	Yes
Bank Characteristics Controls	No	Yes	No	Yes	No	Yes
Observations	113	70	109	68	104	66
R-squared	0.350	0.374	0.236	0.262	0.414	0.438

Panel B: The effect of option holdings on bank risk in crisis

	(1)	(2)	(3)	(4)	(5)	(6)
	vol_ret_crisis	vol_ret_crisis	lzscore_crisis	lzscore_crisis	MES_crisis#	MES_crisis#
bs_opt_{2006}	0.002	0.002	-0.011*	-0.011	0.010	-0.000
	(1.34)	(0.75)	(-1.91)	(-1.25)	(0.83)	(-0.01)
$stockholdings_{2006}$	0.000	0.001	-0.000	-0.003	-0.000	-0.001
	(0.67)	(1.13)	(-0.26)	(-1.16)	(-0.05)	(-0.21)
Bank Fundamentals Controls	Yes	Yes	Yes	Yes	Yes	Yes
CEO Characteristics Controls	Yes	Yes	Yes	Yes	Yes	Yes
Bank Characteristics Controls	No	Yes	No	Yes	No	Yes
Observations	113	73	109	71	104	69
R-squared	0.324	0.355	0.215	0.244	0.370	0.368

Table 8 Continued

Panel C: Opposite effects of unexercisable and exercisable option holdings on bank risk in crisis

	(1)	(2)	(3)	(4)	(5)	(6)
	vol_ret_crisis	vol_ret_crisis	lzscore_crisis	lzscore_crisis	MES_crisis#	MES_crisis#
$bs\_unexopt_{2006}$	-0.008	-0.000	0.035	0.051	-0.097	-0.156
	(-0.86)	(-0.02)	(1.16)	(1.07)	(-1.49)	(-1.44)
bs_exopt_{2006}	0.004*	0.002	-0.018***	-0.022*	0.028**	0.037
	(1.69)	(0.80)	(-2.90)	(-1.86)	(2.00)	(1.16)
$stockholdings_{2006}$	0.000	0.001	-0.001	-0.003	-0.001	0.000
	(0.73)	(1.17)	(-0.28)	(-1.30)	(-0.15)	(0.01)
Bank Fundamentals Controls	Yes	Yes	Yes	Yes	Yes	Yes
CEO Characteristics Controls	Yes	Yes	Yes	Yes	Yes	Yes
Bank Characteristics Controls	No	Yes	No	Yes	No	Yes
Observations	113	73	109	71	104	69
R-squared	0.331	0.359	0.225	0.260	0.387	0.391

* Robust t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

#For the ease of tabulation, coefficients in MES regressions have been multiplied by 100.

Table 9: Option Compensation and Bank Performance in Crisis

This table reports regression results for regressing crisis period bank performance measures on CEO option compensation measures. Dependent variables are failure dummy, return on assets, return on equity and buy-and-hold return measured over the crisis period, respectively. Logit regressions are carried out when failure dummy is used as the independent variable, while OLS is used in other regressions. In Panel A we use Black-Scholes value of newly granted options (in millions) as a proxy for CEO option compensation, in Panel B we use Black-Scholes value of option holdings (in millions), and in Panel C we decompose option holdings into unexercisable and exercisable parts. Both dependent and independent variables are winsorized at 5th and 95th percentile. Detailed definitions of variables are shown in Appendix Table 1.

Panel A: The effect of option awards on bank performance in crisis

	(1) failure	(2) failure	(3) ROA_crisis#	(4) ROA_crisis#	(5) ROE_crisis#	(6) ROE_crisis#	(7) BAHR_crisis#	(8) BAHR_crisis#
$bs\_optawards_{2006}$	0.060	0.952*	0.004	-0.140	-0.385	-1.157	3.309	2.119
	(0.31)	(1.68)	(0.04)	(-1.19)	(-0.24)	(-0.86)	(1.39)	(0.93)
$stockawards_{2006}$	0.115	0.275*	-0.108*	-0.172**	-1.142	-1.484	-1.772*	-2.923**
	(1.23)	(1.78)	(-1.80)	(-2.03)	(-1.49)	(-1.65)	(-1.85)	(-2.46)
Past Year Returns Controls	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fundamentals Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CEO Characteristics Controls	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Bank Characteristics Controls	No	Yes	No	Yes	No	Yes	No	Yes
Observations	117	72	111	69	110	69	114	71
Pseudo R-squared/R-squared	0.372	0.500	0.259	0.401	0.219	0.427	0.303	0.396

Panel B: The effect of option holdings on bank performance in crisis

	(1) failure	(2) failure	(3) ROA_crisis#	(4) ROA_crisis#	(5) ROE_crisis#	(6) ROE_crisis#	(7) BAHR_crisis#	(8) BAHR_crisis#
bs_opt_{2006}	0.031*	0.099***	-0.011	-0.017	-0.258**	-0.166	0.031	0.038
	(1.89)	(3.88)	(-1.50)	(-1.46)	(-2.36)	(-1.34)	(0.16)	(0.17)
$stockholdings_{2006}$	0.002	0.043***	0.002	-0.005	-0.002	-0.054	-0.025	-0.123
	(0.31)	(2.71)	(0.51)	(-1.48)	(-0.04)	(-1.46)	(-0.44)	(-1.52)
Past Year Returns Controls	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fundamentals Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CEO Characteristics Controls	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Bank Characteristics Controls	No	Yes	No	Yes	No	Yes	No	Yes
Observations	117	75	111	72	110	72	114	74
Pseudo R-squared/R-squared	0.420	0.668	0.252	0.402	0.258	0.446	0.279	0.402

Table 9 Continued

Panel C: Opposite effects of unexercisable and exercisable option holdings on bank performance in crisis

	(1) failure	(2) failure	(3) ROA_crisis#	(4) ROA_crisis#	(5) ROE_crisis#	(6) ROE_crisis#	(7) BAHR_crisis#	(8) BAHR_crisis#
$bs\_unexopt_{2006}$	-0.001	0.744**	0.028	0.068	0.445	0.913	0.731	0.889
	(-0.01)	(2.14)	(0.57)	(0.84)	(0.75)	(1.12)	(0.84)	(0.70)
bs_exopt_{2006}	0.035*	0.067**	-0.018**	-0.033**	-0.362***	-0.376**	-0.061	-0.138
	(1.88)	(2.37)	(-2.20)	(-2.28)	(-3.17)	(-2.53)	(-0.27)	(-0.39)
$stockholdings_{2006}$	0.002	0.046***	0.002	-0.005	-0.003	-0.061	-0.026	-0.129
	(0.34)	(2.70)	(0.50)	(-1.61)	(-0.07)	(-1.66)	(-0.46)	(-1.59)
Past Year Returns Controls	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fundamentals Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CEO Characteristics Controls	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Bank Characteristics Controls	No	Yes	No	Yes	No	Yes	No	Yes
Observations	117	75	111	72	110	72	114	74
Pseudo R-squared/R-squared	0.419	0.706	0.256	0.416	0.268	0.466	0.281	0.404

* Robust t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

#For the ease of tabulation, coefficients in marked regressions have been multiplied by 100.

Table 10: Traditional Incentive Measures, Bank Risk and Bank Performance

This table reports OLS regression results for regressing bank risk and bank performance measures on traditional incentive measures. Bank risk measures are stock return volatility, bank Z-Score and Marginal Expected Shortfall, respectively; while bank performance measures are return on assets, return on equity and buy-and-hold return, respectively. In Panel A, we show results using bank risk measures as dependent variables, while in Panel B results are based on regressions using bank performance measures as dependent variables. Both dependent and independent variables are winsorized at 1st and 99th percentile. Detailed definitions of variables are shown in Appendix Table 1.

Panel A: Vega and bank risk

	(1)	(2)	(3)	(4)	(5)	(6)
	vol_ret_t	vol_ret_t	$lzscore_t$	$lzscore_t$	MES_t#	MES $_t$#
$vega_{t-1}$	0.086***	0.056	-0.798***	-0.039	-0.083	-0.231
	(2.83)	(1.48)	(-3.01)	(-0.14)	(-0.39)	(-0.88)
$delta_{t-1}$	0.014**	0.003	-0.105**	-0.069	0.079	-0.046
	(2.27)	(0.42)	(-2.29)	(-1.33)	(1.39)	(-0.71)
Bank Fundamentals Controls	Yes	Yes	Yes	Yes	Yes	Yes
CEO Characteristics Controls	Yes	Yes	Yes	Yes	Yes	Yes
Bank Characteristics Controls	No	Yes	No	Yes	No	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
CEO-level Cluster	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,721	1,031	1,734	1,010	1,712	1,025
R-squared	0.681	0.741	0.198	0.278	0.777	0.809

Panel B: Vega and bank performance

	(1)	(2)	(3)	(4)	(5)	(6)
	ROA_t	ROA_t	ROE_t	ROE_t	$BAHR_t$	$BAHR_t$
$vega_{t-1}$	0.000	0.003**	-0.026	0.003	-0.018	0.029
	(0.37)	(2.38)	(-1.20)	(0.14)	(-0.53)	(0.57)
$delta_{t-1}$	0.000	-0.001**	0.002	-0.009**	0.006	-0.008
	(0.46)	(-2.19)	(0.76)	(-2.16)	(1.48)	(-0.97)
Past Year Returns Controls	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fundamentals Controls	Yes	Yes	Yes	Yes	Yes	Yes
CEO Characteristics Controls	Yes	Yes	Yes	Yes	Yes	Yes
Bank Characteristics Controls	No	Yes	No	Yes	No	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
CEO-level Cluster	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,668	972	1,668	972	1,717	1,031
R-squared	0.543	0.547	0.432	0.490	0.467	0.516

* Robust t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

#For the ease of tabulation, coefficients in MES regressions have been multiplied by 100.

Table 11: Traditional Incentive Measures, Bank Risk and Bank Performance in Crisis

This table reports regression results for regressing crisis period bank performance measures on traditional incentive measures. Bank risk measures are stock return volatility, bank Z-Score and Marginal Expected Shortfall measured over the crisis period, respectively; while bank performance measures are failure dummy, return on assets, return on equity and buy-and-hold return measured over the crisis period, respectively. Logit regressions are carried out when failure dummy is used as the independent variable, while OLS is used in other regressions. In Panel A, we show results using crisis period bank risk measures as dependent variables, while in Panel B results are based on regressions using crisis period bank performance measures as dependent variables. Both dependent and independent variables are winsorized at 5th and 95th percentile. Detailed definitions of variables are shown in Appendix Table 1.

Panel A: The effect of vega and components of vega on bank risk in crisis

	(1)	(2)	(3)	(4)	(5)	(6)
	vol_ret_crisis	vol_ret_crisis	lzscore_crisis	lzscore_crisis	MES_crisis#	MES_crisis#
$vega_{2006}$	0.068		-0.261		1.499	
	(0.37)		(-0.43)		(1.03)	
$vega\_unex_{2006}$		-0.313		1.724		-2.357
		(-0.84)		(1.14)		(-0.90)
$vega\_ex_{2006}$		0.228		-1.587		3.659
		(0.77)		(-1.62)		(1.59)
$delta_{2006}$	0.056	0.074*	-0.193	-0.263	0.009	0.168
	(1.30)	(1.69)	(-1.22)	(-1.66)	(0.03)	(0.47)
Bank Fundamentals Controls	Yes	Yes	Yes	Yes	Yes	Yes
CEO Characteristics Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	113	113	109	109	104	104
R-squared	0.321	0.327	0.204	0.221	0.375	0.387

Panel B: The effect of vega and components of vega on bank performance in crisis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	failure	failure	ROA_crisis#	ROA_crisis#	ROE_crisis#	ROE_crisis#	BAHR_crisis#	BAHR_crisis#
$vega_{2006}$	-0.336		-0.878		-7.934		4.087	
	(-0.17)		(-1.15)		(-0.73)		(0.21)	
$vega\_unex_{2006}$		-0.248		0.478		11.120		48.699
		(-0.06)		(0.21)		(0.35)		(1.31)
$vega\_ex_{2006}$		-2.054		-1.878		-22.999		-16.098
		(-0.69)		(-1.41)		(-1.25)		(-0.51)
$delta_{2006}$	0.794**	0.850**	-0.024	-0.074	-3.273	-3.954	-2.740	-4.750
	(2.10)	(2.20)	(-0.10)	(-0.30)	(-1.10)	(-1.28)	(-0.57)	(-0.99)
Past Year Returns Controls	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fundamentals Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CEO Characteristics Controls	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Observations	117	117	111	111	110	110	114	114
Pseudo R-squared/R-squared	0.414	0.417	0.244	0.249	0.225	0.234	0.279	0.286

* Robust t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

#For the ease of tabulation, coefficients in marked regressions have been multiplied by 100.

Appendix Table 1: Variable Definition and Data Sources

Variable	Definition	Data Source
Compensation Variables:		
bs_optawards	Black-Scholes value of option awards calculated following Core and Guay(2002)	Compustat ExecuComp & Compustat Fundamentals & CRSP & Federal Reserve Bank H15 Report
bs_opt	Black-Scholes value of option holdings calculated following Core and Guay(2002)	
bs_ex	Black-Scholes value of exercisable option holdings calculated following Core and Guay(2002)	
bs_unex	Black-Scholes value of unexercisable option holdings calculated following Core and Guay(2002)	
stockawards	Restricted stock awards value	Compustat Execucomp & DEF 14A Filings
stockholdings	Stock holdings value, sum of the value of restricted stock and common stock holdings	Compustat Execucomp & DEF 14A Filings
Incentive Variables:		
vega	Sensitivity of option holdings to 1% change in stock return volatility	Compustat ExecuComp & Compustat Fundamentals & CRSP & Federal Reserve Bank H15 Report
vega_ex	Sensitivity of exercisable option holdings to 1% change in stock return volatility	
vega_unex	Sensitivity of unexercisable option holdings to 1% change in stock return volatility	
delta	Sensitivity of equity holdings to 1% change in stock price	
Risk and Performance Variables:		
vol_ret	Annualized daily stock return volatility calculated for a given year	CRSP
lzscore	Logrithm of bank Z-Score as in Laeven and Levine (2009); Z-Score calculated as the return on assets plus the capital asset ratio then divided by the standard deviation of asset returns, using quarterly data for a given year	Compustat North America Fundamentals
MES	Marginal Expected Shortfall as in Acharya et al. (2009), MES calculated as the negative of average return on the banks stock over the 5% worst days for S&P500 index through the banks fiscal year period	CRSP
vol_ret_crisis	Annualized daily stock return volatility calculated over the period July 2007 to December 2008	CRSP
lzscore_crisis	Logrithm of bank Z-Score calculated using five quarters of data from Quarter 3 of 2007 to Quarter 3 of 2008	Compustat North America Fundamentals
MES_crisis	Marginal Expected Shortfall calculated over the period July 2007 to December 2008	CRSP

Appendix Table 1 Continued

Risk and Performance Variables (Continued):		
ROA	Return on Assets for a given year	Compustat North America Fundamentals
ROE	Return on Equity for a given year	Compustat North America Fundamentals
BAHR	Buy-and-Hold Return for a given year	CRSP
failure	Failure dummy, which equals 1 for banks failed during 2007 to 2010; failure banks identified with CRSP delisting code and manual check	CRSP & Google
ROA_crisis	Return on Assets as in Fahlenbrach and Stulz (2011), calculated using five quarters of data from Quarter 3 of 2007 to Quarter 3 of 2008	Compustat North America Fundamentals
ROE_crisis	Return on Equity as in Fahlenbrach and Stulz (2011), calculated using five quarters of data from Quarter 3 of 2007 to Quarter 3 of 2008	Compustat North America Fundamentals
BAHR_crisis	Buy-and-Hold Return as in Fahlenbrach and Stulz (2011), calculated over the period July 2007 to December 2008	CRSP
Governance Variables:		
ins_holdings	Percentage of institutional holdings value to bank market value	Risk Metrics
boardsize	Number of directors on board	13/F filings
Channel Variables:		
deposits/assets	Total deposits to total assets ratio	FR Y-9C Report
nonint_ratio	Non-interest income to interest income ratio	FR Y-9C Report
privmbs/assets	Private MBS holdings to assets ratio; private MBS refers to MBS not issued or guaranteed by government	FR Y-9C Report
deriv/assets	Non-trading derivative holdings to assets ratio	FR Y-9C Report
loan_concen	Sum of squared loan shares	FR Y-9C Report
badloans/assets	Bad loans to assets ratio, including nonaccrual loans and still accruing loans that are past due 90 days or more.	FR Y-9C Report
lossprov/assets	Loan loss provision to assets ratio	FR Y-9C Report
Control Variables:		
lmkv	Logrithm of market value	Compustat North America Fundamentals
book/market	Asset book to market ratio	Compustat North America Fundamentals
capital ratio	Equity to asset ratio	Compustat North America Fundamentals
age	CEO Age	Compustat Execucomp & DEF 14A Filings
tenure	Years CEO have been in office	Compustat Execucomp & DEF 14A Filings
turnover	Dummy indicating CEO turnover	Compustat Execucomp & DEF 14A Filings
deposits/assets	Total deposits to total assets ratio	FR Y-9C Report
loans/assets	Percentage of loans in total assets	FR Y-9C Report
loan_growth	Growth rate of total loans	FR Y-9C Report
nonint_ratio	Non-interest income to interest income ratio	FR Y-9C Report

Appendix Table 2: Bank Sample for Crisis Period Analysis

Sample Banks (N=120)	
ANCHOR BANCORP INC/WI	JEFFERIES GROUP INC
ASSOCIATED BANC-CORP	KEYCORP
ASTORIA FINANCIAL CORP	LEHMAN BROTHERS HOLDINGS INC
BB&T CORP	M & T BANK CORP
BANCORPSOUTH INC	MAF BANCORP INC
BANK OF AMERICA CORP	MARSHALL & ILSLEY CORP
BANK OF HAWAII CORP	MERCANTILE BANKSHARES CORP
BANK MUTUAL CORP	MERRILL LYNCH & CO INC
BANK OF THE OZARKS INC	MORGAN STANLEY
BANK OF NEW YORK MELLON CORP	N B T BANCORP INC
BANKATLANTIC BANCORP -CL A	NARA BANCORP INC
BEAR STEARNS COMPANIES INC	NATIONAL CITY CORP
BOSTON PRIVATE FINL HOLDINGS	NATIONAL PENN BANCSHARES INC
BROOKLINE BANCORP INC	NEW YORK CMNTY BANCORP INC
CASCADE BANCORP	NORTHERN TRUST CORP
CATHAY GENERAL BANCORP	OLD NATIONAL BANCORP
CENTRAL PACIFIC FINANCIAL CP	PNC FINANCIAL SVCS GROUP INC
CHITTENDEN CORP	PACWEST BANCORP
CITIGROUP INC	PEOPLE'S UNITED FINL INC
CITY HOLDING CO	PINNACLE FINL PARTNERS INC
CITY NATIONAL CORP	PIPER JAFFRAY COS INC
COLONIAL BANCGROUP	POPULAR INC
COLUMBIA BANKING SYSTEM INC	PRIVATEBANCORP INC
COMERICA INC	PROSPERITY BANCSHARES INC
COMMERCE BANCORP INC/NJ	PROVIDENT BANKSHARES CORP
COMMERCE BANCSHARES INC	REGIONS FINANCIAL CORP
COMMUNITY BANK SYSTEM INC	S & T BANCORP INC
COMPASS BANCSHARES INC	SLM CORP
CORUS BANKSHARES INC	SVB FINANCIAL GROUP
COUNTRYWIDE FINANCIAL CORP	SIMMONS FIRST NATL CP -CL A
CULLEN/FROST BANKERS INC	SOUTH FINANCIAL GROUP INC
DIME COMMUNITY BANCSHARES	STERLING BANCSHRS/TX
DOWNEY FINANCIAL CORP	STERLING BANCORP/NY
EAST WEST BANCORP INC	STERLING FINANCIAL CORP/WA
FANNIE MAE	STIFEL FINANCIAL CORP
FIFTH THIRD BANCORP	SUNTRUST BANKS INC
FIRST BANCORP P R	SUSQUEHANNA BANCSHARES INC
FIRST COMMONWLTH FINL CP/PA	SYNOVUS FINANCIAL CORP
FIRST FINL BANCORP INC/OH	TCF FINANCIAL CORP
FIRST FINL BANKSHARES INC	TD BANKNORTH INC
FIRST HORIZON NATIONAL CORP	TOMPKINS FINANCIAL CORP
FIRST INDIANA CORP	TRUSTCO BANK CORP/NY
FIRST MIDWEST BANCORP INC	UCBH HOLDINGS INC
FIRST NIAGARA FINANCIAL GRP	UMB FINANCIAL CORP
FIRSTFED FINANCIAL CORP/CA	U S BANCORP
FIRSTMERIT CORP	UMPQUA HOLDINGS CORP
FLAGSTAR BANCORP INC	UNIONBANCAL CORP
FRANKLIN BANK CORP	UNITED COMMUNITY BANKS INC
FULTON FINANCIAL CORP	UNITED BANKSHARES INC/WV
GLACIER BANCORP INC	WACHOVIA CORP
GOLDMAN SACHS GROUP INC	WASHINGTON FED INC
GREATER BAY BANCORP	WASHINGTON MUTUAL INC
HANMI FINANCIAL CORP	WEBSTER FINANCIAL CORP
HUDSON CITY BANCORP INC	WELLS FARGO & CO
HUNTINGTON BANCSHARES	WESTAMERICA BANCORPORATION
INDEPENDENT BANK CORP/MI	WHITNEY HOLDING CORP
INDYMAC BANCORP INC	WILMINGTON TRUST CORP
INVESTORS FINANCIAL SVCS CP	WILSHIRE BANCORP INC
IRWIN FINANCIAL CORP	WINTRUST FINANCIAL CORP
JPMORGAN CHASE & CO	ZIONS BANCORPORATION

Appendix Table 2 Continued

Failed banks (N=16)	**Merged banks* (N=11)**
BEAR STEARNS COMPANIES INC	CHITTENDEN CORP
COLONIAL BANCGROUP	COMMERCE BANCORP INC/NJ
CORUS BANKSHARES INC	COMPASS BANCSHARES INC
COUNTRYWIDE FINANCIAL CORP	FIRST INDIANA CORP
DOWNEY FINANCIAL CORP	GREATER BAY BANCORP
FANNIE MAE	INVESTORS FINANCIAL SVCS CP
FIRSTFED FINANCIAL CORP/CA	MAF BANCORP INC
FRANKLIN BANK CORP	MERCANTILE BANKSHARES CORP
INDYMAC BANCORP INC	NATIONAL CITY CORP
IRWIN FINANCIAL CORP	PROVIDENT BANKSHARES CORP
LEHMAN BROTHERS HOLDINGS INC	TD BANKNORTH INC
MERRILL LYNCH & CO INC	
SOUTH FINANCIAL GROUP INC	
UCBH HOLDINGS INC	
WACHOVIA CORP	
WASHINGTON MUTUAL INC	

*We only include in this column banks that normally operate before mergers.

Appendix Table 3: Decomposed Option Holdings and Bank Risk: Different Patterns before and after Crisis

This table reports OLS regression results for regressing various bank risk measures on decomposed measurements of CEO option holdings. Dependent variables are stock return volatility, bank Z-Score and Marginal Expected Shortfall, respectively. Independent variables include Black-Scholes values of unexercisable and exercisable option holdings. In Model 1, 2 and 3 we show results for years before 2006, while in Model 4, 5 and 6 we present results for years after 2007. Both dependent and independent variables are winsorized at 1st and 99th percentile. Detailed definitions of variables are shown in Appendix Table 1.

	(1)	(2)	(3)	(4)	(5)	(6)
	Year<=2006			Year>=2007		
	vol_ret_t	$lzscore_t$	MES_t #	vol_ret_t	$lzscore_t$	MES_t #
bs_unex_{t-1}	0.002**	-0.024***	0.003	-0.001	0.013	-0.032**
	(2.39)	(-3.75)	(0.56)	(-0.44)	(0.95)	(-2.09)
bs_ex_{t-1}	0.001***	-0.007***	0.005	0.002**	-0.023***	0.008
	(3.02)	(-2.72)	(1.38)	(2.17)	(-3.06)	(0.98)
$stockholdings_{t-1}$	0.000**	-0.000	0.001***	-0.000	-0.000	-0.001
	(2.20)	(-1.08)	(2.75)	(-0.06)	(-0.60)	(-1.13)
Bank Fundamentals Controls	Yes	Yes	Yes	Yes	Yes	Yes
CEO Characteristics Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
CEO-level Cluster	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,168	1,202	1,168	553	532	544
R-squared	0.562	0.102	0.478	0.654	0.294	0.657

* Robust t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

#For the ease of tabulation, coefficients in MES regressions have been multiplied by 100.