CEO compensation and banks' risk-taking during pre and post financial crisis periods

Abstract

This study examines the impact of CEO compensation on banks' risk during both pre and post-financial crisis periods. Our results suggest a negative relationship between CEO bonuses and banks' risk in the pre-financial crisis period. Similarly, restricted shares and options granted to CEOs in the post-financial crisis period also appear to decrease banks' risk. In contrast, we observe a positive influence of the Troubled Asset Relief Program (TARP) on banks' risk. Our results also show that the length of time to maturity of options influences banks' risk-taking behavior. Our findings have useful implications for formulating and regulating CEO compensation structure.

Key Words: Compensation ; risk-taking; financial crisis; TARP

1. Introduction

Chief Executive Officer (CEO) compensation and its impact on firms' risk-taking has become a critical issue in the banking and finance literature, especially during the recent 2007-2008 financial crisis that engulfed economies worldwide. Even though banks operate in a regulated environment, they have opportunities to make their own decisions which influence the riskiness of these institutions (e.g., John et al. 1995). Among these decisions, setting up the level and structure of CEO compensation is a significant one that influences not only the risk-taking behavior of CEOs, but also affect firms' performance.

In the context of agency theory (Jensen and Meckling, 1976), executive compensation is viewed as an important tool in helping to overcome potential agency problems by aligning the interests of the principals (shareholders) with those of the agents (CEOs). By contrast, the managerial power theory considers executive compensation as an agency problem itself (see e.g., Bebchuk and Fried, 2004). According to the managerial power theory, CEOs may behave opportunistically by resorting to rent extraction through their compensation structure at the expense of shareholders' interests (Bebchuk and Fried, 2003). Sparked by the US sub-prime crisis, banks have suffered from dramatic collapse in asset values and stock prices. During mid to late 2002, large commercial banks shifted their focus from traditional banking to more volatile investment banking, which relied on loan securitization (DeYoung et al., 2010; Suntheim, 2010). Lack of sufficient understanding of risk by banks' executives and their failure to take appropriate measures to account for banks' risk had led these managers to oversights such as using short-term debt to finance long-term assets. In addition, the compensation policies in the banking sector are increasingly being criticized for inducing too much risk (see e.g., Turner 2009).

Although the level of compensation is not the same across firms, executive compensation packages typically contain components such as a base salary, an annual bonus tied to accounting performance, stock options, and long-term incentive plans (Murphy, 1999). Among these components of executive compensation, bonuses are regarded as one of the causes of the recent 2007-2008 financial crisis by many, including the US government. Consequently, after the financial crisis, the US government initiated various reforms (such as Troubled Assets Relief Program, TARP), intended to link compensation to long-run performance, as it believed that short-term incentives create conflicts of interests between

shareholders and executives.[1] Restricted shares and stock options are typical examples of compensation that are perceived to align the interests of executives with those of shareholders.

The use of executive stock options by US firms experienced a dramatic rise during the past few decades. The 2001 annual survey of executive pay by the Business Week estimates that options account for 80% of total CEO pay (Tian, 2004). However, it is not clear whether this common practice of executive compensation is in the best interests of shareholders. Consistent with the managerial power hypothesis, Tian and Yang (2014), for instance, provide evidence suggesting that powerful CEOs in US financial firms altered their compensation structure for their own benefit rather than acting in the interests of shareholders.[2] In line with this, a number of authors indicate that compensation structure have induced risk-taking behavior in the banking industry that largely contributed to the 2007-2008 financial crisis (e.g., Bebchuk et al., 2010; Berndt et al., 2010; Chen et al., 2011; Armstrong and Vashishtha, 2012; Bhagat and Bolton, 2014). In contrast, other studies (e.g., Fahlenbrach and Stulz, 2011; Hayes et al., 2012) report evidence suggesting that CEOs of financial institutions were unaware of the financial crisis, as they appeared to have huge investments in their own institutions even at the time of the financial crisis.[3]

As a consequence, this study aims to contribute to the relevant literature by exploring the relationship between various components of CEO compensation and banks' risk-taking, for a sample of US firms across both pre and post-financial crisis periods. In particular, we examine whether bonuses granted to CEOs in the 2002-2008 period had a positive impact on banks' risk-taking; and whether increased focus on encouraging equity compensation in the post-financial crisis period had any influence on aligning the interests between shareholders and executives as expected. We focus on CEOs only because CEOs are responsible for the firms' operations and decisions, and CEO compensation is the most debatable issue among various stakeholders of firms (Rajgopal and Shevlin, 2002). It is also believed that the form rather than the level of compensation is a significant incentive to CEOs (Mehran, 1995).

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[1] The 'Troubled Asset Relief Program' (TARP) was implemented by the US Treasury Department in 2008 to buy assets from, and infuse equity, into financial institutions, and to help them bolster their financial health. In order to obtain TARP funding from the government, banks have to comply with requirements set by TARP, including for instance, certain restrictions on executive pay.

[2] This is consistent with the 'managerial incentives hypothesis' posited by Bhagat and Bolton (2014), who argue that the CEO incentive structure may have contributed to excessive risk-taking by banks that resulted in benefiting the CEOs in the short run at the expense of long term shareholders' return.

[3] This notion is consistent with the 'unforeseen risk hypothesis' suggested by Bhagat and Bolton (2014).

In addition, we extend our analysis by exploring the impact of outside regulation, such as TARP on the compensation-banks' risk-taking relationship. While some extant literature (e.g., Belkhir and Chazi, 2010) suggests that regulation of compensation is indeed effective[4], other evidence suggests to the contrary. Houston and James (1995), for example, find that attempts initiated by government to control executives' short-term incentives in compensation packages are ineffective. The effectiveness of regulation in reducing risk- taking in general, and regulating compensation in particular, remains a controversial issue. The existing literature (e.g., Cadman et al., 2012; Elyasiani et al., 2011) is limited to studying the impact of TARP on banks' risk-taking, and report contradictory findings. Evidence on the effectiveness of TARP in regulating CEO compensation is, however, rather scarce. As a consequence, we explore whether TARP induces equity-based compensation in order to reduce banks' risk.

Our study differs from prior studies in a number ways. Firstly, we explicitly examine the impact of CEO compensation on several price-based risk-taking measures: total risk, systematic risk and idiosyncratic risk. Secondly, we use CEO compensation, including not only stock options and restricted shares, but also bonuses which are often considered as one of the causes of the recent financial crisis. It is argued that the effects of these various kinds of compensation components are different. Bonus, for instance, is generally considered a short-term incentive, while restricted shares and options are normally believed to be long-term incentives. The influence of restricted shares and options are also different as the former represent the current ownership and the latter represent future ownership. While Chen et al. (2006) examine the relation between option-based compensation and various measures of banks' risks, we extend their work by including bonuses and restricted shares in our analyses, which may also have played an important role in the recent financial crisis.

Thirdly, by examining the compensation-risk taking relationship across both pre and post-financial crisis periods would help us better understand the implications of various compensation reforms introduced after the 2007-2008 financial crisis. Our study helps to identify whether the increased emphasis on equity-based compensation has achieved the desired effects, especially in the post-financial crisis period. Further, we perform additional analyses to examine how outside regulation (TARP) influences the compensation and banks'

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[4] For example, Bührer (2010) finds that short-term compensation is partly shifted to long-term compensation when government regulation intends to reduce executives' short-term incentives. Supporting this view, Belkhir and Chazi (2010) suggest that regulation is effective in regulating CEO compensation and reducing excessive risk taking by banks.

risk-taking relationship for a sub-sample of firms. This analysis helps us gain an insight into whether the much highlighted initiative by the US government has been effective in alleviating some of the moral hazard problems faced by the banking sector. Finally, in order to conduct a detailed examination of the relation between options and risk-taking, we also examine the time to maturity of options in order to explore whether the time to maturity of options has an influence on banks' risk-taking[5].

Through the analysis of descriptive statistics and empirical results, several significant conclusions emerge. Firstly, in the 2002-2008 period, bonuses awarded to CEOs appear to reduce bank risk-taking, as measured by total risk and systematic risk, as well as idiosyncratic risk. This is inconsistent with the argument that bonuses may have been one of the causes of the recent financial crisis. Secondly, in the 2009-2013 period, both the restricted shares and options granted to CEOs decreased banks' risk. The intention of compensation reforms is to link CEO pay to long-term performance that would result in the alignment of interest of shareholders and executives. This result indicates that shares and options granted will not lead to excessive risk.

Results from our additional analyses reveal that TARP significantly increased banks' risk, which runs counter to the original premise that TARP would result in reducing banks' excessive risk-taking. This result may be explained by the fact that the restrictions in TARP on executive pay adversely influence important employees' retention, which is injurious to banks and increases their risk-taking (Cadman et al., 2012). Similarly, we also observe that options with time to maturity of more than four years strongly reduce banks' risk-taking, and there is no statistically significant evidence supporting the premise that options with less than four years' time to maturity reduce banks' risk.

The paper proceeds as follows. Section 2 provides a review of the relevant literature on the relationship between CEO compensation structure and banks' risk. Section 3 develops the research strategy including the hypotheses, data and methodology. Section 4 presents descriptive statistics, and discusses empirical results. Section 5 summarizes the major findings of our study.

2. Literature review and hypothesis development

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[5] While a number of studies provide evidence on the vesting period of options (e.g., Bhagat and Romano, 2009; Peng and Roell, 2014), evidence on the characteristic of time to maturity of options has been rather limited.

2.1 Compensation structure and risk-taking

We rely on the agency theory literature to make predictions about the association between CEO incentives and banks' risk-taking. According to the agency theory (Jensen and Meckling, 1976), CEOs are relatively more reluctant to take risks because CEOs have limited opportunities to spread out their risks as compared to shareholders, who can easily diversify their risks by holding diversified portfolios (Rajgopal and Shevlin, 2002).[6] Therefore, in order to encourage CEOs to take on more risky projects that have potential for growth and attracting higher returns in the future, shareholders compensate CEOs with stocks and options that are intended to link the interests of CEOs with those of the shareholders.

While the compensation structure is not the same across countries and sectors, compensation packages incorporate a wide variety of elements, including salary, bonuses, and stock holdings as well as a variety of stock option plans (Houston and James, 1995). The extent and structure of executive compensation has implications for risk-taking and for the agency relation between managers and shareholders, and it is in the interest of both regulators and shareholders to monitor the executive compensation (Chen et al., 2006).

The recent 2007-2008 financial crisis had influenced the entire corporate sector, and had a widespread adverse impact on the world economy as it unfolded. The banks' executive compensation is often blamed as the root cause of the financial crisis. Fahlenbrach and Stulz (2011) indicate three versions of the poor incentives explanation of the crisis, including CEOs' focus on short-term profits at the expense of the long-term future of the firm; the role of options in inducing excessive risk taking by banks; and CEOs' actions to increase their share value by increasing the volatility of assets because the shares are effectively options on the value of those assets.[7] The existing research has looked at the effects of compensation on performance, but studies on the compensation and risk-taking of financial institutions are rather limited, and the evidence is largely mixed and inconclusive.

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[6] Risk-neutral shareholders would therefore like executives to accept all projects with positive net present value (NPV) without considering the risk. However, unlike shareholders, executives are largely risk-averse and tend to avoid private losses by investing in less risky projects with positive NPV. Consequently, some projects which are under the consideration of shareholders may be refused. This creates the risk-related incentive problem.

[7] Bolton et al. (2010), for instance, indicate that CEO compensation which is designed to maximize shareholder value in a levered firm will encourage excessive risk taking as the value of stock is increasing with the volatility of the assets held by the firm. Therefore, it is in the interest of shareholders in leveraged firms to reduce managers' risk taking incentives in order to lower the cost of debt. However, even with this objective, managers' behavior will ultimately lead to risk shifting as their actions are unobservable.

While some studies support the view that the financial crisis was wholly unforeseen by CEOs (see, e.g., Houston and James, 1995; Fahlenbrach and Stulz, 2011; Hayers et al., 2012; Bhagat and Bolton, 2014), others argue in support of the view that executives used compensation packages to reduce their personal risks and gained substantial benefits, which was not consonant with ensuring firms' long-run profitability (see e.g., Core et al., 2003; Lorn and Saito, 2012; Acharya and Naqvi, 2012; Armstrong et al., 2013). Houston and James (1995), for instance, indicate that compensation in the banking industry did not promote risk-taking more than in other sectors. Cheng, Hong, and Scheinkman (2011), however, suggest a close relationship between banks' compensation and risk-taking. In addition, Fahlenbrach and Stulz (2011) conclude that banks with a better alignment of interests between executives and shareholders performed worse than others in the financial crisis. This is consistent with the perception that better aligned interest increased incentives for firms to take more risk that may have led to the financial crisis (Hakenes and Schnable, 2014).

2.1 Bonus and banks' risk-taking

Heavy reliance on bonuses has been one of the main features of compensation packages for decades, and the majority of firms on Wall Street kept their fixed costs under control by keeping base salaries low and paying most of the compensation in the form of bonuses that varied with profitability (Murphy, 2009). Bonuses are paid on the basis of past short-term performance and are awarded to executives only if accounting earnings exceed a threshold set by the company. The rewards and penalties of bonuses are asymmetric as there are high rewards for superior performance but no penalties are imposed for underperformance or even failure. The criticism of such reward initiatives is that these payments do not take long-term value creation into consideration. Accounting-based performance measures are advantageous by being easily verifiable, and consequently managers can conveniently link their actions to bonus payments. However, these measures can be manipulated and induce less optimal decision making as they are based on past rather than future performance. Therefore, measuring past performance is inherently subjective, and such plans will necessarily involve discretionary payment based on the subjective assessment of performance.

The evidence on compensation-induced risk-taking is mixed. Some studies report no evidence to support the claim in respect of the role of compensation in the financial crisis, and argue that banks' CEOs also faced heavy losses during the financial crisis (Fahlenbrach and Stulz, 2011). On the other hand, several other studies indicate a positive relation between bonuses and risk-taking (Deyong, Peng, and Yan, 2010; Cheng, Hong, and Scheinkman, 2011). From

the view that managers are sophisticated, while shareholders are unsophisticated, bonuses provided are consistent with shareholder preferences. However, Bannier et al. (2013) and Murphy (2009) conclude that incentives resulting from competition for talent will induce executives to take excessive risk not only from the society's perspective but also from the viewpoint of the banks themselves. Accordingly, we test the following hypothesis:

H_1: Bonuses awarded to CEOs have a positive influence on banks' risk.

2.2 Restricted shares and banks' risk-taking

Restricted shares are granted when performance criteria are met, and are regarded as long-term incentives over a horizon longer than one year (Suntheim, 2010). The influence of restricted shares on mangers' risk-taking behavior is complicated. Linking executive wealth to the value of the firm's stock is perceived to help reduce the conflict of interests between executives and shareholders (Jensen and Meckling 1976, Morck et al. 1988; Fahlenbrach and Stulz, 2011).[8] These shareholding executives may obtain benefit along with other shareholders through shifting risks to debt holders, and these share incentives may motivate executives to take on high risks (John and John, 1993). Compared with other incentives such as options, there is no downside limit for shares. However, rewarding executives with restricted shares links the payment to stock price movement, which may cause a decrease in executives' wealth. Therefore, undiversified executives who hold shares may be unwilling to take on high risk/high return projects (Smith and Stulz, 1985). Therefore, it is predicted that restricted shares awarded to CEOs are negatively related to banks' risk. We therefore test the following hypothesis:

H_2: Restricted shares granted to CEOs have a negative influence on banks' risk.

2.3 Options and banks' risk-taking

Options are the rights granted to CEOs to buy shares at a pre-specified price. The typical option contract has a maturity of 10 years, and these options granted to CEOs are regarded as long-term incentives (Suntheim, 2010). Usually, the exercise of an option is conditional on the achievement of pre-specified performance criteria. Awarding executives with common stock and stock options will make a difference. With the increase of variance, the value of an option calculated by the Black and Scholes model will go up, and consequently the value of an

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[8] However, one can also argue that share-based compensation may give CEOs an incentive to manipulate share prices, resulting in more risk-taking by banks; and therefore the agency problem remains unresolved.

executive's common stock and stock option will also increase.

Similarly, if executives hold large amounts of common stocks and options, the increase in option value will dominate, and they will have the incentive to accept high-risk projects with high returns. In addition, unlike shares which have unlimited downside risk moving along with share price movement, stock options restrict this downside risk exposure, which should encourage risky investment. Option awards make risk more acceptable to executives and help to mitigate risk-aversion problems (Jensen and Meckling 1976, Smith and Stulz 1985). However, this risk-shifting incentive will increase agency problems between debt-holders and shareholders which, in turn, reduce managers' risk-shifting behavior in the presence of executive stock options (Agrawal and Mandelker 1987). Therefore, it is not clear whether the option granted to executives will provide them with an incentive to increase risk.

There are numerous studies that examine the influence of stock options on risk-taking. The evidence, however, is largely mixed and inconclusive. Whereas some studies indicate that stock options create incentives to reduce firms' risk (e.g., Lambert et al. 1991, Carpenter 2000, and Tian 2004, Hayers et al., 2012), others report a positive relation between option incentives and risk taking (such as, Agrawal and Mandelker 1987, Defusco et al. 1990, William and Rao 2000, and Chen et al. 2006). Hayers et al., (2012), for instance, show that there is no positive relationship between the convexity in options and a firm's excessive risk-taking, which suggests that the use of options in remuneration packages did not contribute to the financial crisis. Lambert et al. (1991), however, criticizes the accuracy of market-based valuation formulas. These formulas are based on the risks that shareholders can diversify and therefore only undiversified risk is considered. However, due to the differential diversification ability between executives and shareholders, beside the systematic risk, executives also face idiosyncratic risk, which is not priced.

In this regard, Armstrong and Vashishtha (2013) find that stock options create an incentive to reduce idiosyncratic risk. Tian (2004) also indicates a positive relation between options granted and systematic risk, and argues that the increase in systematic risk will increase the expected return of the firm. The combined risk incentive is the result of the relative strength and interaction between the effects of systematic and idiosyncratic risk. However, it is critical to note that option incentive will not always induce risk-taking. Firstly, as the CEO has to bear the extra idiosyncratic risk, the value of options to CEOs is not equal to the cost calculated by shareholders (see e.g., Lambert et al. 1991). Secondly, a risk-averse CEO may value a stock option at a discount, which is positively correlated with his degree of risk aversion and the

stock return volatility (e.g., Hall and Murphy 2000, Ingersoll 2000, and Tian 2004). Thirdly, the CEO is assumed to be in a constant absolute risk-averse utility function, and therefore giving him more options increases the volatility of his personal portfolio. Consequently, the CEO tends to offset this increased volatility by reducing the volatility of the underlying asset portfolio (see e.g., Carpenter 2000). Finally, it is argued that the intention to increase stock price is only feasible when the options wealth does not exceed a certain proportion of total wealth (e.g., Tian 2004). Beyond this limit, more options will result in reducing incentive effects. In addition, stock options also increase the incentive to reduce idiosyncratic risk and increase systematic risk.

Therefore, the risk-taking hypothesis is as follows:

H_{3a}: CEO's stock option-based compensation has a positive influence on banks' risk.

The risk aversion hypothesis is as follows:

H_{3b}: CEO's stock option-based compensation has a negative influence on banks' risk.

2.4 Effectiveness of TARP

In response to the severe 2007-2008 financial crisis, various capital assistance programs were introduced by governments around the world. The 'Troubled Asset Relief Program' (TARP) is a famous one, which was implemented by the US Treasury Department in 2008 to buy assets from, and infuse equity into, financial institutions to help them strengthen their financial health. In order to obtain TARP funding from the government, banks have to comply with requirements set by TARP. One of these rules is about restriction on executive pay. Although there is some evidence of the impact of TARP on banks' risk, there is relatively little evidence of whether TARP is effective in regulating CEO compensation. The majority of the existing literature on the impact of TARP on banks' risk-taking provides contradictory evidence on the effectiveness of TARP (e.g., Cadman et al., 2012; Elyasiani et al., 2011). Cadman et al. (2012), for instance, suggest that the implementation of TARP does not reduce excessive risk-taking by banks, but instead encourages executives' incentive to increase risk. Harris et al. (2013) also argue that capital injections under TARP induced moral hazard behavior that resulted in the reduction of operating efficiency of the bailed out institutions. Similarly, Hoshi and Kashyap (2010) find that when firms accept bailouts from the government, outside investors may believe that these firms are in severe credit default. From this perspective, the funding from TARP is a bad signal to investors and this will reduce market confidence and increase

firms' risk. Using an event study methodology, Farruggio et al. (2013), find that capital injections under TARP may have decreased investors' confidence and increased banks' risk. Based on the TARP documentation, supported banks are required to follow TARP restrictions that impose limits on executive compensation. Therefore, the executive remuneration, which is thought to have been a driver of the financial crisis, will be reconstructed to help promote banks' financial stability. As a result, it is reasonably anticipated that TARP is designed and subsequently implemented to effectively regulate CEO equity-based compensation. Thus, the following two hypotheses are proposed:

H_{4a}: *TARP has a negative impact on volatility of banks' stock returns.*

H_{4b}: *TARP induced equity-based CEO's compensation has a negative impact on volatility of banks' stock returns.*

2.5 Length of time to maturity of options

Characteristics of options, like vesting period and time to maturity, are important elements that need to be considered when building a CEO compensation package. However, previous research has often focused on the vesting period of options only (e.g., Bolton et al., 2006; Bhagat and Romano, 2009; Chen et al., 2011; Peng and Roell, 2014), with the characteristic of time to maturity of options being relatively ignored.

In order to help regulators draw up further effective regulations on CEO compensation, the time to maturity of options is examined in this study and it is expected that the shorter the time to the maturity of options, the greater the risk-taking by banks. The reason supporting this argument is that executives often have different interests to those of shareholders (John and Qian, 2003), even though options are assumed to help align their interests, for executives still have incentives to benefit themselves at the expense of long-term firm performance. Therefore, if options are to be exercised in the short term, it is anticipated that executives will have incentives to manipulate share prices, which may lead to higher risk-taking by banks. Additionally, in order to simplify the analysis, this study makes an assumption that CEOs are not allowed to exercise their options until the expiration date. As a consequence, the hypothesis formulated is as follows:

H_{5a}: *Options with a short time to maturity increase banks' volatility of stock return.*

H_{5b}: *Options with a long time to maturity reduce banks' volatility of stock return.*

Overall, the review of relevant literature indicates that the bulk of the existing studies focus on the period before and during the crisis, without considering the post-financial crisis period. Similarly, it is also evident that there is limited evidence on directly examining the impact of regulation, such as TARP, on the compensation-risk taking relationship. As a consequence, the focus of the current study is to disentangle the impact of different components of executive compensation on various components of banks' risk, and also shed some light on the impact of outside regulation on the compensation-risk relationship.

3. Research strategy

3.1 Methodology and data

We begin with a sample period encompassing both pre-financial crisis period of 2002-2008, and post-financial crisis period of 2009-2013. Compensation data is obtained from Standard and Poor's (S&P) Execucomp. Following Fahlenbrach and Stulz (2011), the Standard Industry Classification (SIC) codes between 6000 and 6300 are adopted. Firms with SIC code 6282 (Investment Advice) are excluded as they are not in the lending business. In addition, firms with SIC code 6199 (Finance Services) and SIC code 6211 (Security Brokers and Dealers) are searched manually and excluded.

As a consequence, the sample consists of firms that have compensation information available from Execucomp with at least three years of data available during the sample period. The accounting data is obtained from Compustat, while the stock return data is taken from the Center for Research in Security Prices (CRSP). The pooled sample contains 287 firm-year observations for the period 2002-2008, and 389 firm-year observations for the period 2009-2013.

For the subsequent analysis we use a sub-sample of 345 firm-year observations between 2008 and 2013 to examine the impact of TARP. When selecting banks for the sample period, we use the TARP bailout list from the ProPublica website[9]. This list helps us to identify the banks receiving funding from TARP. When identifying and selecting banks which did not accept TARP funding, we follow Bhagat and Bolton (2014). Using volatility of stock return as a measure of banks' risk, we employ a dummy variable equal to 1 when a bank accepted TARP and zero otherwise. In total we classify 58 observations as TARP banks and 23 NO-TARP

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[9] The bailout list is from: http://projects.propublica.org/bailout/list

banks. Additionally, following Kini and Williams (2012), previous year's compensation data from 2007- 2012 is used for the period 2008-2013.

3.2 Empirical model

Our study analyzes the effects of CEO compensation structure on banks' risk-taking. The primary model examines the relation between executive compensation structure and risk-taking by modelling three market-based risk measures as a function of compensation structure and a set of control variables based on the existing literature.[10]

The primary model is specified as:

$$Risk = f[P_{Comp}, Ownership, Tenure, Ln(TA), Capital_{ratio}, Investment, Year\_dummy]$$
(1)

Where

$$P\_Comp \in \{\frac{Bonus}{Total\_comp}, \frac{Restircted\ Shares}{Total\_comp}, \frac{Options}{Total\_comp}\}$$

$$Risk \in \{\sigma_j, \beta_m, \sigma_{uj}\}$$

Where, *Risk* represents one of the three alternative measures of risk generated from the two-index model. σ_j is the total risk, β_m is the systematic risk, and σ_{uj} is the idiosyncratic risk. *P_comp* consists of three main categories of compensation including proportion of bonus (*P_bonus),* restricted shares (*P_RS*), and options (*P_option)* granted to CEOs, as a proportion of CEO's total compensation. In addition, *Ownership, Tenure, LnTA* (the natural logarithm of the total assets), *Capital_Ratio* (the equity-to-asset ratio), *Investment* (the market-to-book ratio) are included as control variables. Yearly dummy variables are also included to control for year effects.

Proxy for risk

The risk measures are obtained from the two-index market model and are estimated for each year using daily data for the relevant year obtained from the Center for Research in Security

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[10] Compensation may also be endogenously determined. It is debated in the extant literature that CEO of a more risky bank may prefer salary-based compensation because the equity-based compensation would be decreased under high volatility. However, others argue that higher risk serves as a measure of a firm's information asymmetry, and this opportunity can be maximized through equity-based compensation (Chen et al., 2006). Whereas, Garen (1994) finds none of his regression models substantiate this relation. Our research partly mitigates this concern by using one year lagged values of the independent variables, and including firm fixed effects. Our results suggest that causation runs from our independent variables to risk- taking.

Prices (CRSP) database (Saunders et al., 1990; Chen et al, 2006). The estimated model is:

$$R_j = \alpha + \beta_{mj}(R_m) + \beta_{Ij}(I) + u_j \tag{2}$$

Where, R_j is the bank's stock daily return; R_m is the daily return on the CRSP equally-weighted index; I is the daily three-month T-bill yield obtained from the Federal Reserve Bank of St. Louis; and u_j is a random error term.

The estimation of equation 2 results in systematic risk measurement, β_{mj}. The total risk and idiosyncratic risk are obtained by calculating the standard deviation of the stock return and residuals. Our approach is fundamentally different from previous studies on the relationship between CEO compensation and risk-taking, most of which focus on total risk, rather than decomposing risk into systematic risk and idiosyncratic risk so as to examine their individual distinctive features. As total risk is the result of the relative strength and interaction between the effects of systematic and idiosyncratic risk, decomposing total risk is helpful to identify the exact impact of compensation structure on risk.

Proxy for compensation structure

Recent literature has used both the absolute value of compensation components and the weights of each component in total compensation as proxies for CEO compensation structure (e.g., Bebchuk et al., 2010; Hayes et al., 2012; Bhagat and Bolton, 2014). In our study, we adopt the latter format because the weights would give full account of the contribution of each individual component of compensation. *P_bonus* is the weight of bonus in total compensation, which is defined as the sum of salary, bonus, options and restricted stock. *P_option* is the fraction of total compensation related to CEOs' outstanding options. The total value of options for each fiscal year is calculated using the modified Black-Scholes model and is the sum value of exercisable and unexercisable outstanding options. Furthermore, we also include restricted shares (*P_RS*) owned by CEOs in our model. In this regard, Bhagat and Romano (2009) provide evidence suggesting that utilising restricted stocks reduce firms' risk taking. In respect of CEOs' salaries, this study does not examine it separately due to the fact that it is always fixed in the compensation agreement. Instead, salary has been taken into account as a part of total compensation. A positive and significant coefficient on *P_comp* would support the risk-taking hypothesis. Conversely, a negative and significant coefficient would support the risk-aversion hypothesis.

Control variables

Following prior literature, we also control for CEO characteristics, CEO tenure and ownership, as well as for firm specific factors such as bank size, financial leverage and investment opportunity. A dummy variable is also included to control for year effects.

Tenure is the number of years that the CEO has spent in office. As the 1-year lagged tenure is used in our study, the basic assumption is that the CEO is the same person as the previous year. The *expertise* hypothesis suggests that a longer tenure is associated with greater experience and managerial skill (Vafeas, 2003). Therefore, CEOs with long-term engagement are more likely to be willing to undertake high risks as they are confident about their skills to generate high returns from these high risk projects. It is therefore argued that the duration of tenure is positively related to risk (see e.g., Bugeja et al., 2012). However, an entrenched CEO is likely to extract more private benefits from his firm (Belkhir and Chazi, 2010), and therefore the CEO with longer tenure becomes more risk-averse. In addition, a long-term engaged CEO cares more about his reputation. Therefore, the relationship between CEO tenure and risk may be predicted to be negative (see e.g., Armstrong and Vashishtha, 2012). It is therefore difficult to make an unambiguous prediction about the relation between CEO tenure and risk.

CEO Ownership percentage is the common shares owned by the CEO divided by the total number of common shares outstanding. If this percentage is more than 1%, CEO ownership is equal to 1; otherwise, it is equal to 0. By increasing CEO's stock ownership in the firm, the risk taking incentives become more closely aligned to those of shareholders, and therefore CEO stock ownership is predicted to be positively associated with risk taking. However, Saunders et al. (1990) argued that this relationship only exists when the shares owned by the CEO are not as large a proportion of their personal wealth, as this will make them overly concerned with the idiosyncratic risk of the bank. In addition, if the executives own a significant number of the firm's shares, they are expected to hedge more as their compensation is a linear function of the value of the firm (Smith and Stulz, 1985). Consequently, these undiversified executives have an incentive to reduce the variance of the firm's returns. Therefore, it is difficult to predict the relationship without considering the percentage of common shares owned to the CEO's total wealth.

LnTA is measured as the natural logarithm of the bank's total assets, representing the bank's size. Belkhir and Chazi (2010) argue that a more diffuse ownership is created when banks become large, and the shareholders are not capable of monitoring executives' behavior. As a result, managers are perceived to act in their own interests and reduce the variability of the bank's returns. In addition, as large banks own multiple product lines, they are more

diversified and less risky compared to smaller banks (Chen et al., 2006). Therefore, it is expected that a bank's size will be negatively correlated with bank risk. However, it is also debated that as larger banks have a greater capacity to assume more risk, a positive association is expected (Belkhir and Chazi, 2010). Therefore, it is not possible to predict the sign of the relationship between bank's size and risk.

Capital_Ratio is equity divided by total asset. From the traditional view, it is believed that the larger equity finance, the lower is a bank's risk. This is because higher equity finance will reduce default risk and debt cost (Chen et al., 2006). Therefore, it is predicted that Capital_Ratio is negatively correlated with a bank's risk.

MB (the market-to-book ratio) is the measure of investment opportunities. Firms with more growth opportunities generate value from future investments rather than from existing assets (Ryan and Wiggins, 2001). Therefore, it is predicted that investment opportunities are positively associated with risk.

In addition to estimating the primary model (1), we further extend our analysis to explore whether TARP is effective in reducing banks' risk taking and regulating CEO equity-based compensation packages from 2008 to 2013. As a consequence, we estimate the following model:

$$Risk\ Measure_t = \beta_0 + \beta_1\ P\_bonus_{t-1} + \beta_2\ P\_equity_{t-1} + \beta_3\ CEO\ tenure_t +$$

$$\beta_4\ M/B\ ratio_t + \beta_5\ TARP_t + \beta_6\ TARP*P\_equity_t + \beta_7\ ROA_{t-1} +$$

$$\beta_8\ Asset_t + \beta_9\ Ownership_t + \beta_{10}\ Year + \varepsilon_t \qquad (3)$$

Following extant literature (e.g., Laevena and Levine, 2009; Houston et al., 2010; Bugeja et al., 2012), volatility of stock returns is used as the dependent variable in model (3). Volatility of stock returns describes the market performance of banks, which is a less noisy measure for reflecting what investors think about banks (Cheng et al., 2010). Compared to model (1), model (3) includes additional variables *TARP*, *P_equity* and *TARP*P_equity*. *TARP* is a proxy describing whether a bank received funding from the Troubled Asset Relief Program. If a bank receives funding from TARP, the variable *TARP* is equal to 1; otherwise it is 0. In addition, in order to examine the impact of TARP on total equity compensation, this model does not separate *P_equity* into options and restricted shares. Moreover, the variable *TARP*P_equity* is incorporated into the regression. The sign of this variable reflects whether TARP effectively

regulates equity-based compensation to reduce banks' risk.

Furthermore, we also estimate time to maturity of options. Option value is divided into two groups, short-term value and long-term value. The model used in this analysis is:

$$Risk\ Measure_t = \beta_0 + \beta_1 P\_bonus_{t-1} + \beta_2 P\_Soption_{t-1} + \beta_3 P\_Loption_{t-1}$$
$$+\beta_4 P\_RS_{t-1} + \beta_5 CEO\ tenure_t + \beta_6 MB_t + \beta_7 ROA_{t-1}$$
$$+\beta_8 Asset_t + \beta_9 Ownership_t + \beta_{10} Year + \varepsilon_t \tag{4}$$

In this model, variable *P_Soption* is the weight of options with short time to maturity in total compensation, and variable *P_Loption* is for options with long time to maturity. Bhagat and Romano (2009) indicate that the vesting period of options is expected to be more than three or four years that helps to reduce CEO incentives to increase banks' risk taking. Therefore, we choose two years as a classification criterion to determine whether options are short-term. Additionally, four years and six years are used as two further classification criteria by which to divide options into two groups.

4. Empirical Results

4.1 Descriptive statistics

Table 1 presents descriptive statistics on risk, compensation structure, CEO characteristics and firm performance in our sample.

INSERT TABLE 1 HERE

During the period 2002-2008 (Table 1, Part A), the value of option granted to CEOs occupied the biggest proportion of total compensation, accounting for 70%. Restricted shares represent about 14% of total compensation, while the bonus contributes to 5.7%. On the contrary, in the period 2009-2013 (Table 1, Part B), the proportion of bonuses declined to 2.4% in mean value, while the value of restricted shares increased to 28% in mean value. This change reflects the fact that the regulators required banks to reduce bonuses granted to CEOs, because bonuses are regarded to be the cause of financial crisis. As for restricted shares, which are regarded as a vehicle for reducing excessive risk-taking by banks, banks enhanced their application after the financial crisis.

Comparing the risks between the period 2009-2013 and 2002-2008, total risk increases from

2.4% to 3.8% as a result of increases in both systematic risk and idiosyncratic risk. The increase in systematic risk means banks have become more sensitive to stock market movement. The rise in idiosyncratic risk indicates that on average executives have to bear more risks than in the pre-crisis period. The mean of capital ratio is 8.8% during 2002-2008, and became more than 9.9% during 2009-2013. This increase indicates that compared with previous years, banks adopted more equity to finance their operating activities. This would help to reduce the default risk and finance cost. This is largely consistent with the objectives of TARP, which is to stimulate banks' lending activities and promoting financial health (Farruggio et al., 2013). During the period 2002-2008, the mean of MB ratio is t 1.99, but declines shapely to 1.16 for the period of 2009-2013. This is consistent with the fact that external investors do not have enough confidence in banks' future development during the financial crisis.

4.2 Relationship between CEO compensation and banks' risk-taking

We apply the Hausman tests to determine whether the random effects or fixed effects model is more appropriate. Table 2 represents regression results for nine models in which we study the impact of different components of CEO compensation on the three risk measures.

4.2.1 Impact of CEO compensation on banks' risk-taking in the 2002-2008 period

During the period 2002-2008 (Table 2, Part A), the estimated coefficient of *P_bonus* is negative and statistically significant, suggesting that the CEOs' bonus reduces the banks' total risk. This is inconsistent with H_1 that a bonus provides an incentive to CEOs to take on more risks. In respect of the influence of CEO bonus on systematic risk and idiosyncratic risk separately, it is found that the coefficients are negative and statistically significant at 10% and 1% levels, respectively. Therefore, significant negative coefficient of total risk is the result of systematic risk and idiosyncratic risk. While only the systematic risk is likely to influence the banks' value, the reduction in idiosyncratic risk would cause CEOs to become less risk-averse. This is the intention of shareholders, as it aligns the interests of the latter with those of the CEO.

However, the results in Table 2, Part A, indicate that although bonuses granted to CEO help to reduce idiosyncratic risk that CEOs are exposed to, it may also cause a reduction in systematic risk. This reduction in systematic risk may be the result of hedging policies (Chan, 2005). As a result, more bonuses granted to CEOs appear to decrease banks' total risk.

Therefore, the assertion that the financial crisis was caused by the bonuses granted cannot be substantiated. Even though bonuses are given by the shareholders to executives to provide them with an incentive to accept risky projects with positive NPV, too generous bonuses will cause excessive risks. However, our results indicate that CEOs with bonus awards will reduce banks' risk exposure to the market while at the same time reducing idiosyncratic risk. Similarly, results of the relation between restricted shares granted, *P_RS*, and risk taking (although showing a negative sign) are not statistically significant during the 2002-2008 period. Therefore, it is concluded that there is no evidence to support H_2 that restricted shares granted to CEOs will decrease banks' risk-taking.

With regard to *P_option,* the percentage of options granted to total compensation, the coefficient of idiosyncratic risk is marginally significant, while the coefficients of total risk and systematic risk are insignificant. These results provide no evidence to support either the risk-aversion or the risk-taking hypothesis in the 2002-2008 period. Among the control variables during 2002-2008 period, *capital_ratio* serves as a measure of financial leverage. Banks with a higher capital ratio have a lower default risk as well as a lower cost of debt. Consequently, it is predicted that there is a negative relation between capital ratio and bank's risk. The negative and significant coefficient on capital ratio at the 1% level in all models is supportive of this argument. Similarly, large size banks have more opportunities to diversity their products and operations, and therefore will reduce the risk of the firm. Our results support this argument with negative and significant coefficient in all models, except the model for bonus on systematic risk.

Banks with a high *MB* ratio generate value from future investments rather than current operations. Our results indicate negative and statistically significant coefficients for *MB* in all models. The reason why firms have a higher market value is because investors believe that they will have a good performance in the future. Compared with firms having lower market value, such firms are believed to be less risky. Therefore, it is argued that this is likely to be the reason for the negative coefficient.

4.2.2 Impact of CEO compensation on banks' risk-taking in the 2009-2013 period

After the recent 2007-2008 financial crisis, it is generally argued that the bonus is the root cause of excessive risk-taking by banks and other financial institutions, resulting in the global financial crisis. Consequently, TARP was introduced to provide capital to the financial sector

when the requirements on compensation are complied with, and prohibits participants from granting cash bonuses to executives (Murphy, 2009). This change in regulation had an impact on the compensation structure and many firms switched to other forms of compensation. Table 2, Part B presents results for the period 2009-2013. The coefficients of the proportion of bonus to total risk, systematic risk and idiosyncratic risk are not statistically significant. This indicates that after the compensation structure adjustment as a result of financial crisis, there is no evidence to support the relationship between bonuses granted to CEOs and banks' risk.

With regard to the relationship between restricted shares awarded to CEOs and banks' risk, we found that the proportion of restricted shares to total compensation is negatively related to total risk and idiosyncratic risk in the 2009-2013 period at the 1% level. It means more restricted shares help to diversify CEO's portfolios and reduce the idiosyncratic risk they have to bear. However, restricted shares are granted when some specific criteria are met, such as the length of tenure. In addition, like other shares, there is no downside limit for restricted shares due to stock market movements. Consequently, it is likely that CEOs with more restricted shares prefer to refuse risky projects even with positive NPV. Therefore, it is concluded that restricted shares granted to CEOs appear to decrease the total risk and idiosyncratic risk of banks (see e.g., Smith and Stulz, 1985).

The empirical results in Table 2, Part B indicate that the options granted to a CEO decrease banks' total risk and the coefficient is statistically significant at the 1% level. In addition, the coefficient of idiosyncratic risk is also negative and statistically significant at the 1% level. As discussed earlier, the undiversified CEO bears extra idiosyncratic risk as compared to shareholders, and, therefore, the value of an option to them is not equal to the cost calculated by shareholders. Even though options granted reduce the idiosyncratic risk that a CEO bears, it does not reduce such risk to zero. In addition, CEOs discount the value of options and the discount is positively associated with their degree of risk aversion. Furthermore, it is argued that the intended incentive of options to take on risk is only feasible when used at a moderate level, beyond which granting more options reduces the incentive effects (see Tian, 2004). However, it is not clear whether the option currently granted is within or beyond such criteria. Therefore, these results support the risk-aversion hypothesis. It is concluded that options granted to CEOs do not provide them with an incentive to take on high risk projects, and

these options result in a decrease in banks' risk.

Among the control variables, *tenure* is positively associated with banks' risk and the coefficient is statistically significant. CEO with longer tenure would be more familiar with the firm's operating activities and business environment. Therefore, a CEO with a longer tenure is confident to deal with risk and consequently prefers to accept projects with a positive net present value, regardless of their risk (see Vafeas 2003). Similarly, our results indicate that the coefficients of *capital_ratio* for the post-financial crisis period are negative and statistically significant in all models, suggesting that the larger the equity capital, the lower the banks' risk (see Chen et al., 2006).

Dummy variables for 2009 through 2012 were positive and statistically significant indicating that risk after controlling for the effects of compensation structure and the other exogenous variables was higher during these years. Overall, both the descriptive statistics and empirical results suggest limited evidence to support the assertion that compensation structure is the cause of excessive risk in the banking sector.

4.2.3 Analysis of firms with low vs. high market-to-book ratio

Ryan and Wiggins (2001) provide evidence that firms with more growth opportunities generate value from future investments rather than the existing assets. They also indicate that as these firms derive a large portion of their value from assets not yet in place, controlling the agency problem through the monitoring mechanism is not easy. They argue that firms with a high market-to-book ratio prefer to adopt equity-based incentives to align the interests of CEOs to shareholders'. As a consequence, we rank firms based on market-to-book ratio, and divide the full sample into two subsamples – one including firms with a low *MB* ratio, and another comprising firms with a high *MB* ratio. We test the relation between total risk and the executive compensation structure of these two groups separately using the firm fixed effect model or random effect model as applicable, based on the Hausman test.

The regression results are displayed in Table 3. It is evident from Table 3, Part A, that during the 2002-2008 period, bonuses granted to CEOs are statistically significant and negatively related to banks' risk-taking for the low *MB* ratio subsample. However, we observe that the relation is statistically insignificant in the case of banks with a high *MB* ratio. As a result, more bonuses given to CEOs appear to reduce banks' risk in low *MB* ratio sub-sample during

2002-2008.

Results for the period 2009-2013 are presented in Table 3, Part B. It seems that as a result of compensation reforms under the regulation, both restricted shares and options are negatively related to risk for firms with fewer investment opportunities. Interestingly for the high *MB* ratio group, the coefficients are found to be statistically insignificant. We submit the following reasons. As discussed earlier, the TARP program restricts participants from granting cash bonuses to CEOs after the 2007-2008 financial crisis, and the influence of bonuses on banks' risk is insignificant in the main regression during the 2009-2013 period. However, after considering investment opportunities, the bonus is positively related to risk for the low *MB* firms sub-sample. For firms in the higher *MB* sub-sample, the relation remains insignificant. Therefore, in general, for the period 2009-2013, it is still concluded that investment opportunities do influence the relation between compensation structure and bank risk taking.[11]

INSERT TABLE 2 HERE

INSERT TABLE 3 HERE

4.2.4 Effectiveness of TARP in influencing banks' risk

Results from estimating model (3) show that TARP generates a statistically significant and positive impact on risk taking by banks, which is against the intended objective of the US government's initiative that TARP would result in reducing banks' excessive risk taking (see Table 4). Though this result does not support the hypothesis in this study, it is consistent with the findings of Cadman et al. (2012). As banks receiving funding from TARP will be strictly monitored by government, monitoring incentives of external investors may reduce accordingly, which may encourage executives to engage in more risk-taking behaviors, resulting in increasing banks' total risk.

INSERT TABLE 4 HERE

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[11] Given that years 2007-2008 are considered as the peak of the financial crisis, observations from these two years are likely to be the noise of our test. Consequently, as a check of the robustness of our results, we exclude the CEO- year observations for years 2007 and 2008. For the after financial crisis period, we also exclude the year 2009 for a similar reason. A large number of banks went bankrupt in that year, and it is believed that the market is in the way of recovering. Excluding that year helps to mitigate the influence of market on bank's return volatility. The results (unreported to conserve space) are largely consistent with the empirical results from our main regression.

Furthermore, column (1) in Table 4 also shows that the coefficients of *P_option*, and *P_RS* are statistically significant at the 1% and 5% levels, respectively. The result in Table 4 indicates that options granted to CEOs help to reduce banks' risk taking during 2009-2013. This result may be attributed to internal governance and risk management recommendations prescribed by the authorities (e.g., Basel Committee). After the financial crisis, banks are required to reduce excessive risk taking through changing executive compensation structure (Cadman et al., 2012), and by controlling for options granted to CEOs. Both the redesign of the expiration date or exercise price can alter the structure of options granted, which may help to decrease banks' risk taking. As for restricted shares, the result illustrates that rewarding restricted shares to CEOs after the financial crisis reduces total risk. Our finding is similar to that of Bührer (2010), which suggests restricted stock can align CEOs' interests with those of shareholders.

In respect of control variables, the coefficients of both ROA and market-to-book ratio are negative and statistically significant at the 1% level. For ROA, it is reasonable to observe such a negative sign, because good accounting performance is expected to be related to low risk taking by banks. For the market-to-book ratio, the negative coefficient may be explained by the fact that better investment opportunities will help reduce total risk.

Column (2) and column (3) show the results to the question of whether TARP is effective in regulating CEO equity-based compensation. To examine the impact of TARP on the total of the equity-based compensation package, this analysis does not separate the impact into its components. Column (2) illustrates that equity-based compensation statistically significantly reduces risk-taking by banks. In addition, receiving funding from TARP appears to increase banks' risk taking. Both of these findings are consistent with those obtained from column (1). As for column (3), the variable, *TARP*P_equity,* is included to test the impact of TARP on equity-based compensation rewards to CEOs. For *P_equity* and *TARP*, the coefficients are statistically significant and the signs are the same as those in column (2). As for the interaction variable *TARP*P_equity*, the coefficient is not statistically significant. However, this variable has the expected negative sign indicating that TARP may be effective in promoting equity-based compensation to reduce risk taking by banks, though the bailout program as a whole seems to increase the total risk of banks. Additionally, columns (2) and (3) show that the coefficients of market-to-book ratio and

ROA are statistically significant, which is consistent with the results presented in column (1).

4.2.5 The impact of time to maturity of options on banks' risk-taking

Finally, Table (5) presents the results for the estimation model (4), examining whether time to maturity of options granted to CEOs affects banks' risk-taking.

INSERT TABLE 5 HERE

In Table 5, Column (1) shows the results when options are divided into two categories: options with time to maturity of less than two years and options with time to maturity of greater than two years. Column (2) and column (3) show the regression results when four years and six years are used as classification standards respectively. Firstly, when using two years as the classification rule, the coefficient of variable *P_op>2y* is statistically significant, but the coefficient of *P_op<2y* is not. This result suggests that options with time to maturity of more than two years significantly reduce risk-taking by banks, which is similar to the view of Bolton et al. (2006), although their paper focuses on the vesting period of options. This result may be explained by the fact that an extended time to maturity can better help to align CEOs' interests with those of shareholders.

Furthermore, when using four years as the classification rule, only options with a time to maturity of more than four years are statistically significant and negative, indicating that they decrease a bank's risk levels. However, when six years is used to classify options, both options with time to maturity of less than or greater than six years reduce risk-taking by banks. This finding suggests that six years is long enough to reduce the 'risk effect' of options. In sum, our analysis does not present evidence supporting the idea that options with a time to maturity of less than four years decrease a bank's total risk, and suggest that regulators and banks should pay attention to this form of option and regulate it accordingly.

5. Conclusion

This study investigates the effects of the CEO compensation structure on banks' risk-taking during both pre and post financial crisis periods. We begin our analysis with examining components of CEO compensation with different market-based measures of risk including, total risk, systematic risk, and idiosyncratic risk. Three key findings emerge from our

analyses. Firstly, in the period 2002-2008, bonuses awarded to CEOs reduced banks' risk taking, measured by total risk and systematic risk, as well as idiosyncratic risk. Our study provides no evidence to support the argument that the bonus was the cause of the financial crisis.

Secondly, in the period 2009-2013, both the restricted shares and the options granted to CEOs appeared to decrease banks' risk taking. The intention of compensation reforms introduced by the US government was to link CEO pay to long-term performance, in order to align the interests of CEOs with those of shareholders. The results from our study indicate that shares and options granted will not lead to excessive risk. However, it remains unclear whether CEOs will refuse the high-risk/ high-return projects, which are consistent with the interests of risk-neutral shareholders. Our robustness tests based on the sub-samples confirm the results obtained from our main sample results.

Thirdly, this study finds no evidence to support the view that TARP is effective in regulating equity-based compensation. However, our subsequent findings provide strong evidence to support our hypothesis that options with a longer time to maturity reduce a bank's risk-taking, while options with a shorter time to maturity increase risk-taking by banks. Our findings complement recent literature in the field examining the issue of whether executive compensation structure led to banks' excessive risk taking before the financial crisis. Additionally, our research provides useful evidence on the effectiveness of TARP in regulating compensation and the impact of time to maturity of options on risk taking of banks. These results could be of interest to regulators who intend to monitor the banking system to help avoid the occurrence of another financial crisis. In addition, our findings have practical implications for a number of stakeholders, such as managers, shareholders and policy makers.

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Table 1

Descriptive statistics

Table 1: Part A					
Period (2002-2008)	Mean	Median	Std. Dev	Min	Max
Total risk	0.024	0.016	0.019	0.006	0.112
Systematic risk	1.223	1.185	0.408	0.395	2.619
Idiosyncratic risk	0.019	0.012	0.015	0.006	0.101

P_bonus	0.057	0.040	0.063	0.000	0.396
P_RS	0.138	0.040	0.197	0.000	0.958
P_option	0.702	0.754	0.226	0.000	1.000
Tenure	8.223	7.000	5.888	1.000	29.000
Capital_ratio	0.088	0.089	0.024	0.019	0.185
MB	1.990	1.971	0.893	0.000	5.145
LnTA	10.116	9.588	1.682	7.625	14.593

Table 1: Part B

Period (2009-2013)	Mean	Median	Std. Dev	Min	Max
Total risk	0.038	0.023	0.018	0.008	0.110
Systematic risk	1.481	1.406	0.419	0.686	3.258
Idiosyncratic risk	0.021	0.015	0.016	0.007	0.102
P_bonus	0.024	0.000	0.309	0.000	0.473
P_RS	0.279	0.272	0.239	0.000	0.929
P_option	0.422	0.433	0.068	0.000	0.992
Tenure	8.554	6.000	7.387	1.000	34.000
Capital_ratio	0.099	0.099	0.030	-0.111	0.186
MB	1.161	1.126	0.565	-0.725	3.337
LnTA	9.996	9.548	1.701	7.613	14.698

Notes: This table shows the descriptive statistics. *P_bonus, P_RS, P_option* are the weights of bonus, restricted shares, and options in total compensation. The option value is calculated using the Black-Scholes model. *Tenure* is the number of years that the CEO had spent in office. *Capital_ratio* is the equity-to-asset ratio, which is equal to the book value of equity divided by total asset, and it is the proxy of financial leverage. *MB* is the market-to-book ratio, representing the investment opportunity. *LnTA* is the natural logarithm of the total assets of the bank, and it is as the measure of bank size.

	Total Risk			Systematic Risk			Idiosyncratic Risk		
Table 2: Part A									
Relation between alternative risk measures and the CEO compensation structure for the period 2002-2008									
2002-2008									
P_bonus	-0.816***			-0.661*			-0.931***		
	(-3.09)			(-1.96)			(-3.49)		
P_RS		-0.069			-0.059			-0.066	
		(-0.92)			(-0.62)			(-0.83)	
P_option			-0.091			-0.008			0.126
			(-1.38)			(-0.09)			(1.84)*
Tenure	-0.003	-0.003	-0.003	-0.007	-0.004	-0.004	-0.002	-0.003	-0.003
	(-0.71)	(-1.24)	(-1.28)	(-1.29)	(-1.28)	(-1.28)	(-0.43)	(-0.97)	(-1.02)
Capital_ratio	-3.74***	-3.571***	-3.660***	-4.406***	-3.801***	-3.763***	-3.359***	3.410***	-3.553***
	(-3.54)	(-5.79)	(-5.86)	(-3.27)	(-4.96)	(-4.86)	(-3.15)	(-5.21)	(-5.38)
MB	-0.114***	-0.115***	-0.119***	-0.069**	-0.093***	-0.091***	-0.138***	-0.131***	-0.137***
	(-3.46)	(-5.77)	(-5.86)	(-1.65)	(-3.75)	(-3.63)	(-4.17)	(-6.17)	(-6.39)
Ownership	-0.012	-0.026	-0.033	0.0518	-0.039	-0.036	-0.049	-0.026	-0.038
	(-0.20)	(-0.71)	(-0.87)	(-0.69)	(-0.87)	(-0.77)	(-0.82)	(-0.67)	(-0.96)
LnTA	-0.142**	-0.055***	-0.058***	-0.055	-0.051***	-0.052***	-0.179***	-0.062***	-0.065***
	(-2.07)	(-5.11)	(-5.46)	(-0.63)	(-3.87)	(-4.07)	(-2.58)	(-5.31)	(-5.67)
Year Dummy	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*
Obs.	287	287	287	287	287	287	287	287	287

Table 2: Part B

Relation between alternative risk measures and the CEO compensation structure for the period 2009-2013

	Total Risk			Systematic Risk			Idiosyncratic Risk		
2009-2013									
P_bonus	0.289			0.232			0.246		
	(0.154)			(0.209)			(0.318)		
P_RS		-0.236***			-0.038			-0.305***	
		(0.001)			(0.562)			(0.001)	
P_option			-0.178***			-0.051			-0.237***
			(0.006)			(0.391)			(0.002)
Tenure	0.006**	0.005	0.008***	0.009***	0.009***	0.009***	0.008**	0.006	0.010***
	(0.032)	(0.127)	(0.010)	(0.001)	(0.001)	(0.001)	(0.024)	(0.106)	(0.006)
Capital_ratio	-4.477***	-4.665***	-4.175***	-1.886***	-1.877***	-1.767***	-5.152***	-5.422***	-4.780***
	(0.000)	(0.000)	(0.000)	(0.004)	(0.004)	(0.007)	(0.000)	(0.000)	(0.000)
MB	-0.042	-0.034	-0.045	-5.2E-05	0.0037	0.001	-0.049	-0.041	-0.055
	(0.272)	(0.364)	(0.231)	(0.989)	(0.913)	(0.976)	(0.290)	(0.369)	(0.219)
Ownership	-0.042	-0.026	-0.021	-0.024	-0.021	-0.018	-0.083	-0.063	-0.057
	(0.369)	(0.562)	(0.646)	(0.556)	(0.610)	(0.668)	(0.137)	(0.243)	(0.304)
LnTA	-0.082	-0.085	-0.041	0.061	0.067	0.078	-0.088	-0.097	-0.039
	(0.290)	(0.259)	(0.589)	(0.379)	(0.333)	(0.278)	(0.348)	(0.290)	(0.675)
Year Dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Obs.	389	389	389	389	389	389	389	389	389
R^2	0.735	0.729	0.776	0.282	0.271	0.270	0.665	0.660	0.714

Notes: This table shows the parameter estimates and p-values (in parentheses) for the nine models. *P_bonus, P_RS, and P_option* are the weights of bonus, restricted share, and options in total CEO compensation. The option value is calculated using the Black- Scholes model. *Tenure* is the number of years that the CEO had spent in office. *Capital_Ratio* is the equity-to-asset ratio, which is equal to the book value of equity divided by total asset, and it is the proxy of financial leverage. *MB* is the market-to-book ratio, representing the investment opportunity. *Ownership* is the common shared owned by the CEO as a percentage of total shares outstanding; it is equal to 1 if the percentage is equal or more than 1%, 0 otherwise. *LnTA* is the natural logarithm of the total assets of the bank, and it is as the measure of bank size. Yearly dummies are coded as 1 or 0 for each year from 2002 to 2013.

***, **, * indicates significance at the 1%, 5%, and 10% levels, respectively.

	Table 3: Part A						
	Regression results after considering the moderator for the period 2002-2008						
Total risk				**Total risk**			
2002-2008 (Low *MB*)				**2002-2008 (High *MB*)**			
P_bonus	-1.098***			*P_bonus*	-0.092		
	(0.009)				(0.719)		
P_RS		-0.148		*P_shares*		0.119	
		(0.111)				(0.328)	
P_option			0.181	*P_option*			-0.136
			(0.216)				(0.185)
Tenure	-0.013	-0.001	-0.006	*Tenure*	-0.006*	-0.006*	-0.006*
	(0.140)	(0.697)	(0.466)		(0.068)	(0.075)	(0.065)
Capital_ratio	-6.503***	-3.252***	-7.151***	*Capital_ratio*	-1.406	-1.476	-1.367
	(0.000)	(0.000)	(0.000)		(0.251)	(0.219)	(0.251)
MB	-0.504***	-0.256***	-0.565***	*MB*	-0.005	-0.003	0.002
	(0.000)	(0.000)	(0.000)		(0.881)	(0.913)	(0.960)
Ownership	-0.171*	-0.042	-0.177*	*Ownership*	0.001	0.0111	0.021
	(0.090)	(0.402)	(0.090)		(0.992)	(0.803)	(0.639)
LnTA	-0.158	-0.056***	-0.131	*LnTA*	-0.061***	-0.062***	-0.056***
	(0.135)	(0.000)	(0.239)		(0.000)	(0.000)	(0.000)
Year Dummies	*YES*	*YES*	*YES*		*YES*	*YES*	*YES*
Obs.	144	144	144		143	143	143
R^2	0.867	0.924	0.857		0.834	0.837	0.839

Table 3: Part B							
Regression results after considering the moderator for the period of 2009-2013							
Total risk				**Total risk**			
2009-2013 (Low *MB*)				**2009-2013 (High *MB*)**			
P_bonus	0.786**			*LnP_bonus*	-0.022		
	(0.011)				(0.994)		
P_RS		-0.216**		*P_RS*		-0.145	
		(0.021)				(0.148)	
P_option			-0.248***	*P_option*			-0.118
			(0.001)				(0.202)
Tenure	0.0037	0.0014	0.004	*Tenure*	0.007	0.007	0.007
	(0.448)	(0.632)	(0.151)		(0.140)	(0.148)	(0.122)
Capital_ratio	-5.821***	-5.282***	-5.009***	*Capital_ratio*	-4.537***	-4.767***	-4.181***
	(0.000)	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)
MB	-0.123	-0.183***	-0.182***	*MB*	0.0166	0.015	0.0191
	(0.178)	(0.004)	(0.003)		(0.749)	(0.772)	(0.712)
Ownership	-0.178**	-0.156***	-0.129***	*Ownership*	-0.009	-0.019	-0.015
	(0.012)	(0.002)	(0.010)		(0.913)	(0.795)	(0.842)
LnTA	-0.405***	-0.037***	-0.021	*LnTA*	0.1795	0.166	0.1740
	(0.005)	(0.003)	(0.113)		(0.125)	(0.145)	(0.127)
Year Dummies	*YES*	*YES*	*YES*		*YES*	*YES*	*YES*

Obs.	194	194	194		195	195	195
R^2	0.437	0.863	0.867		0.503	0.526	0.536

Notes: This table shows the parameter estimates and p-values (in parentheses) for the nine *P_bonus, P_RS, and P_option* models representing the weights of bonus, restricted share, and options in total CEO compensation. The option value is calculated using the Black- Scholes model. *Tenure* is the number of years that the CEO had spent in office. *Capital_Ratio* is the equity-to-asset ratio, which is equal to the book value of equity divided by total asset, and it is the proxy of financial leverage. *MB* is the market-to-book ratio, representing the investment opportunity. *Ownership* is the common shared owned by the CEO as a percentage of total shares outstanding; it is equal to 1 if the percentage is equal or more than 1%, 0 otherwise. *LnTA* is the natural logarithm of the total assets of the bank, and it is as the measure of bank size. Yearly dummies are coded as 1 or 0 for each year from 2002 to 2013.

***, **, * indicates significance at the 1%, 5%, and 10% levels, respectively.

Table 4

Effectiveness of TARP in regulating CEO compensation and reducing banks' risk 2008-2013

	(1)	(2)	(3)
P_bonus	-0.171	-0.172	-0.179
	(0.229)	(0.225)	(0.200)
P_option	-0.206***		
	(0.002)		
P_RS	-0.187**		
	(0.014)		
P_equity		-0.198***	-0.132*
		(0.003)	(0.091)
TARP	0.077***	0.078***	0.140*
	(0.007)	(0.003)	(0.071)
*TARP*P_equity*			-0.090
			(0.370)
Tenure	-0.001	-0.001	-0.001
	(0.413)	(0.383)	(0.357)
MB	-0.090***	-0.090***	-0.090***
	(0.001)	(0.001)	(0.001)
ROA	-5.812***	-5.812***	-5.731***
	(0.000)	(0.000)	(0.000)
LnTA	0.006	0.006	0.006
	(0.475)	(0.511)	(0.479)
Ownership	-0.001	-0.001	-0.006
	(0.977)	(0.963)	(0.824)
_cons	1.040***	1.044***	1.002***
	(0.000)	(0.000)	(0.000)
Year Dummies	YES	YES	YES
Obs.	345	345	345
R^2	0.769	0.768	0.770

Notes: This table presents parameter estimates and p-values (in parentheses) for model(s) testing whether TARP is effective in regulating CEO equity-based compensation and reducing banks total risk-taking from 2008 to 2013. The dependent variable is volatility of stock return. *P_bonus* is the weight of bonus in CEO's total compensation, *P_equity* represents the weight of equity compensation in CEO's total compensation. *Tenure* is the number of years that the CEO had spent in office. *MB* is the market-to-book ratio, representing the investment opportunity. *ROA* is return on assets to controls for firm performance. *LnTA* is the natural logarithm of the total assets of the bank, and it is as the measure of bank size. *Ownership* is the common shared owned by the CEO as a percentage of total shares outstanding; it is equal to 1 if the percentage is equal or more than 1%, 0 otherwise. *TARP* is a dummy variable equal to 1 if a bank receives funding from TARP, and 0 otherwise. We also control for year effect using year dummy variables.
***, **, * indicates significance at the 1%, 5%, and 10% levels, respectively.

Table 5

Impact of time to maturity of options on risk-taking by banks 2008-2013

	(1)	(2)	(3)
P_bonus	-0.172	-0.168	-0.174
	(0.282)	(0.291)	(0.278)
P_RS	-0.163**	-0.157**	-0.157*
	(0.041)	(0.050)	(0.051)
lnP_op<2y	-0.262		
	(0.105)		
P_op>2y	-0.203***		
	(0.006)		
P_op<4y		-0.169	
		(0.124)	
P_op>4y		-0.213***	
		(0.003)	
P_op<6y			-0.181*
			(0.058)
P_op>6y			-0.223***
			(0.003)
Tenure	-0.001	-0.001	-0.001
	(0.511)	(0.438)	(0.433)
MB	-0.095***	-0.096***	-0.095***
	(0.002)	(0.002)	(0.002)
ROA	-6.183***	-6.351***	-6.313***
	(0.000)	(0.000)	(0.000)
lnTA	0.011	0.011	0.011
	(0.192)	(0.202)	(0.186)
ownership	-0.011	-0.014	-0.014
	(0.645)	(0.569)	(0.577)
_cons	1.070***	1.077***	1.072***
	(0.000)	(0.000)	(0.000)
Year Dummies	YES	YES	YES
Obs.	345	345	345
R^2	0.758	0.759	0.759

Notes: This table presents parameter estimates and p-values (in parentheses) for model(s) testing whether time to maturity of options granted to CEOs affects banks risk-taking. The dependent variable is volatility of stock return. *P_bonus* is the weight of bonus in CEO's total compensation, *P_Soption* is the weight of options with short time to maturity in total compensation, and variable *P_Loption* is for options with long time to maturity, and *P_RS* are restricted shares owned by CEOs. Options are divided into two groups, and two years, four years and six years are used as standards (e.g., P_op<4y and P_op>4y). *Tenure* is the number of years that the CEO had spent in office. *MB* is the market-to-book ratio, representing the investment opportunity. *ROA* is return on assets to controls for firm performance. *LnTA* is the natural logarithm of the total assets of the bank, and it is as the measure of bank size. *Ownership* is the common shared owned by the CEO as a percentage of total shares outstanding; it is equal to 1 if the percentage is equal or more than 1%, 0 otherwise. We also control for year effect using year dummy variables.

***, **, * indicates significance at the 1%, 5%, and 10% levels, respectively.