**Regulation, Subordinated Debt and Incentive Features of CEO Compensation in the Banking Industry**[1]

Kose John
Stern School of Business
New York University
44 West 4th Street
New York, NY 10012
Email: kjohn@stern.nyu.edu

Hamid Mehran
Federal Reserve Bank of New York
33 Liberty Street, 3rd Floor
New York, NY 10045
Email: hamid.mehran@ny.frb.org

Yiming Qian
Tippie College of Business
University of Iowa
Iowa City, IA 52245
Email: yiming-qian@uiowa.edu

August, 2003

[1] We thank Rajesh K. Aggarwal, Matthew Billett, Arturo Estrella, Jon A. Garfinkel, Jim Mahoney and Don Morgan for helpful comments.

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### Abstract

In this paper, we study how the pay-performance sensitivity in an optimally-designed, top management compensation structure in banks is affected by the characteristics of alternative mechanisms of corporate governance. Given the bank's claim structure, the subordinated debtholders and the regulator have the incentives to monitor the bank. We analyze theoretically whether the intensity of these monitoring mechanisms would play a complementary or substitute role to the strength of incentive features in top management compensation. Although the pay-performance sensitivity of bank CEO compensation decreases with the total leverage ratio, we show that the monitoring provided by either subordinated debtholders or regulators allow the bank to increase the pay-performance sensitivity in the optimal CEO compensation. Consistent with the theoretical predictions, we find empirical evidence that the pay-performance sensitivity decreases with banks' total leverage, but increases with its subordinated debt ratio and the intensity of regulatory monitoring, which is proxied by a poorer examination rating (BOPEC).

# 1. INTRODUCTION

The topic of corporate governance in general, and top management compensation in particular, has received enormous attention in recent years. Alignment of the incentives of top management with the interests of shareholders has been characterized as an important mechanism of corporate governance. In fact, there is a large theoretical and empirical literature on the role of incentive contracts in ameliorating agency problems.[2] However, there is less research on the design of managerial compensation structure taking into account its interaction with the other mechanisms of corporate governance.

In this paper, we examine the top management compensation in banking firms. In particular, we study theoretically and empirically the optimal design of compensation, taking into account the unique claim structure in banks, and consequently, the incentives of its claimholders to monitor management. Banks differ from firms in non-financial unregulated industries (e.g., manufacturing firms) in the structure of their claims. This, in turn, gives rise to monitoring mechanisms, which are very different from those in manufacturing firms. A lion's share of a bank's cash flow claims is in the form of debt held by dispersed depositors. Moreover, the Federal Deposit Insurance Corporation (FDIC) insures a large fraction of this debt. Consequently, unlike the case in manufacturing firms, the primary creditors in a bank are do not have sufficient incentives to monitor the bank. The deposit insurance is equivalent to a put option given to the depositors by the FDIC (see Merton (1977)). Therefore, the regulator has an incentive to monitor the bank, especially with respect to the risk choices of the bank. The banks may also hold subordinated debt in addition to the deposits. The subordinated debt is often held in a concentrated fashion by insurance companies and other financial institutions. The subordinated debtholders also have incentives to monitor the bank, and like regulators, especially with respect to its risk choices. In this paper, we examine the incentive features to be included in the top management compensation structure in banks in the presence of monitoring

[2] For example, see Murphy (1999) for a survey on this topic.

by regulators and by subordinated debtholders. Understanding how incentive features in management compensation are affected by these governance mechanisms in banks will provide insights useful in the larger context of firms in general.

The role of regulation as a governance mechanism in financial institutions and its interaction with other mechanisms of corporate governance has not been studied. For example, bank supervision that ensures the bank is compliant with regulatory requirements could play a general monitoring role. Is this monitoring a substitute or complement to other mechanisms of corporate governance? In particular, does regulatory monitoring decrease or increase the need for incentive features in managerial compensation? Understanding the nature of the interaction of regulation and corporate governance will give us insights about the optimal design of regulation and corporate governance for banks.

An important difference between banks and manufacturing firms lies with the incentives of debtholders to monitor the firms. When debt is present, the shareholders have risk-shifting incentives, i.e., they have the incentive to take excessive risk at the expense of debtholders. Therefore, debtholders, in general, will want to monitor the firm's risk choice. In manufacturing firms, it is usually the senior debtholder, its bank, which will perform most of the monitoring role.[3] The bank has the incentive, expertise and informational advantage to monitor the firm. However, the primary debtholders for a bank are its depositors. Under the current FDIC insurance system, a large proportion of deposits are fully insured. Therefore, the depositors do not have the incentive to monitor the banks vigorously. Instead, the regulator, who has sold an insurance put to the depositors, has incentives to monitor the bank. Another set of claimholders with incentives to monitor the bank is the bank's subordinated debtholders.

As claimants on junior and uninsured debt, subordinated debtholders stand to suffer heavy losses in the case of bank insolvency. They, therefore, have the incentive to monitor the bank closely and on an on-going basis. In this sense, in terms of the incentive to monitor, their interests, are

[3] There is a large body of literature on banks' specialness in monitoring, see James (1987).

therefore, more aligned with those of the deposit insurers. In fact, proposals for regulation requiring banks to hold certain, minimum levels of subordinated debt have been gaining support in recent years. For instance, subordinated debt requirements are the centerpiece of a proposal for reforming bank regulation from the U.S. Shadow Financial Regulatory Committee (SFRC, 2000). A comprehensive study from the staff at the Board of Governance (FRS, 1999) also supports a subordinated debt requirement as part of prompt corrective action.

It is argued that subordinated debt can discipline a bank's risk appetite through two channels. Subordinated debtholders can impose direct discipline on the bank by charging high funding costs once excessive risk-taking activities are detected. It can also impose derived discipline by providing risk signals to other market participants and to regulators who can then discipline the bank (See Evanoff and Wall (2001)).

Although the monitoring role of subordinated debt and its use in regulation have been discussed frequently, the interaction between subordinated debt and managerial incentives has not been formally studied. In particular, how would the presence of subordinated debt affect the optimal design of bank CEO compensation? Should it increase or decrease the pay-performance sensitivity of the compensation structure? John and John (1993) show that the pay-performance sensitivity of the CEO compensation structure should decrease in leverage, so that the CEO intends to maximize the firm value instead of equity value and the risk-shifting problem is mitigated. A naïve extrapolation of this result may suggest that, if the bank is asked to take on subordinated debt in addition to deposits, the managerial incentives for risk-shifting will increase. Therefore, the optimal CEO compensation should have even lower pay-performance sensitivity in the presence of subordinated debt. Such extrapolation ignores the monitoring role played by the subordinated debtholders.

In this paper, we study theoretically and empirically the interaction of managerial incentives and monitoring by regulation or subordinated debt. We separate the effects of total leverage and the monitored debt on the pay-performance sensitivity of bank CEO compensation. Our results show that, although the pay-performance sensitivity of the optimal CEO compensation structure decreases with total leverage, it actually increases with the subordinated debt ratio as well as the intensity of regulation. To our knowledge, this is the first paper to analyze the interaction between subordinated debt, regulation and bank CEO compensation. We also empirically estimate their relationship.

We present a model in which a bank CEO is in charge of investment decisions in the bank. She chooses between two types of loans: a safe loan and a risky loan. The CEO is subject to two types of agency problems: (1) the risk-shifting problem: the incentive to take on excessive risk at the expense of depositors and debtholders when the CEO is aligned with the shareholders through the incentive features of her compensation contract; and (2) the perk consumption problem: the incentive to consume perks at the expense of the shareholders when the CEO only holds a fraction of equity[4]. Although both of these agency problems have been studied in the corporate finance literature, their interaction has not been analyzed.[5] The interaction of the two agency problems in determining the optimal pay-performance sensitivity in the CEO compensation can be seen as follows. When the pay-performance sensitivity is high, the CEO's interest is closely aligned with equityholders and the risk-shifting incentives are high. On the other hand, the incentive to consume perks is low. When the pay-performance sensitivity is low, the CEO finds it optimal to consume a high level of perquisites but risk-shifting incentives are low. The severe risk-shifting also puts the perk consumption of the CEO at risk (the CEO does not get to consume perks in the insolvency state). This, in turn, provides some discipline on the risk-shifting incentives of the CEO. The trade-off between the needs to mitigate these two agency problems leads to an optimal pay-performance sensitivity in the CEO compensation structure.

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[4] Instead of the perk consumption problem, we could have modeled any conventional managerial agency problem that could be mitigated by higher CEO ownership. Unobservable costly managerial effort could be another example.

[5] Jensen and Meckling (1976) analyze managerial perk consumption as an agency cost of equity and the risk-shifting incentive as an agency cost of risky debt. However, they do not analyze the interaction of these agency problems, nor do they analyze the design of an optimal managerial contract in the presence of these agency problems.

We also model the monitoring function of regulation and that of subordinated debt. Our view of the two kinds of monitoring is as follows. The subordinated debtholders monitor the firm on an on-going basis with intensity proportional to the face value of their debt. On the other hand, the regulator monitors with intensity only when the bank deviates sufficiently from regulatory standards. In both cases, the monitoring takes the following form: when they detect the bank has extended a risky loan instead of a safe one, they are able to impose a penalty on the bank, which, in turn, imposes a managerial cost. This monitoring affects the interaction between the two agency problems the CEO is subject to, and hence, the optimal the amount of alignment to use in the CEO's compensation structure. Our results show that the more intense the monitoring is, the higher the optimal pay-performance sensitivity of CEO compensation.

We derive three testable hypotheses from the model: (1) the pay-performance sensitivity of bank CEO compensation decreases with total leverage; (2) the pay-performance sensitivity of bank CEO compensation increases with the subordinated debt ratio; (3) the pay-performance sensitivity of bank CEO compensation increases with the intensity of regulation. We empirically test these hypotheses and find supporting evidence for all of them.

In summary, we contribute to the compensation and banking literatures: (1) by providing a theoretical analytical framework to examine how monitoring by regulators or subordinated debtholders will affect the pay-performance sensitivity of optimally-designed, bank CEO compensation; and (2) by presenting empirical evidence on the relationship between subordinated debt and pay-performance sensitivity, and intensity of regulation and pay-performance sensitivity.

The rest of the paper is organized as follows: section 2 presents the theoretical model on the interaction between leverage, regulation, subordinated debt and bank CEO compensation. Section 3 presents the empirical results on the relationship between subordinated debt, regulation and pay-performance sensitivity. Section 4 concludes.

# 2. THE ANALYTICAL FRAMEWORK

## 2.1. The Model Setup

A detailed model of the asset-risk choices made by a bank under moral hazard and incomplete contracting is developed in this section. The model is designed to capture the essential issues in the design of bank CEO compensation in a simple framework. This model serves as the analytical framework to study the optimal incentive features in bank CEO compensation as a function of its capital structure and other governance mechanisms in place.

We begin with a representative depository institution (bank) under moral hazard and incomplete contracting. Consider a three-date, two-period model. At $t = 0$, the bank collects deposits and engages in residual financing through equity and subordinated debt (when it is present) subject to existing regulatory constraints. Deposits are fully insured by a regulatory agency (the FDIC) and the bank pays the relevant insurance premium, $\pi$. All associated contracts are written and "priced" at $t = 0$, given the information available at $t = 0$ and admissible contracting opportunities. The prices of the bank's financial claims (interest rates on deposits, the FDIC premium, $\pi$, and the price of equity and subordinated debt) are determined in a rational-expectations manner.

At $t = 1$, investment opportunities appear. This represents the possible loans that the bank can make (assets that the bank can choose). For simplicity, we assume that there are two investment opportunities: (1) a safe loan, which has no risk and a zero NPV, and (2) a risky loan that is characterized by the parameter q. Both investments require at $t = 1$ an amount I. The safe loan yields a return that is equal to I. The return from the risky loan has two possible outcomes: high or low (H dollars or L dollars, respectively), with $H > I > L > 0$, where q is the probability of the high outcome H, and $(1 - q)$ the probability of the low outcome, L. The bank's insiders, e.g., the CEO, observe the parameter q at $t = 1$ before they choose between the riskless loan and the risky loan. Outsiders do not observe the value of the parameter q, where outsiders are depositors, debtholders or regulators. This precludes any contracting contingent on the value of the parameter q. However, all the relevant parties know that q is distributed uniformly over the interval [0,1]. This modeling device captures the intuition that, given the level of monitoring undertaken by regulators and outside investors, the managers/owners of the bank have additional (inside) information about the prospects of the loan (captured in q).[6]

The amount $(I + \pi)$ needed by the bank for investment and payment of the FDIC premium is raised at t = 0, in the form of depository debt, subordinated debt and equity. For simplicity, we assume that the deposits are in the form of pure discount debt of promised payment $P_D$ due at t = 2. The depositors pay an amount $B_D$ at t = 0 into the bank, where $B_D$ represents the rational expectations price of the guaranteed promised payment $P_D$, incorporating the rationally anticipated loan choices to be made by the bank. In our framework, $\pi$ can also be determined in a rational expectations manner as the actuarially fair value of the deposit insurance premium for the bank. The subordinated debt, when it exists, will have a promised payment of $P_S$, and rational expectations price of $B_S$. We will denote the total promised payments of the deposits and the subordinated debt as P, i.e., $P = P_D + P_S$. We will assume that the combined face value is such that the firm only defaults in the L state of the world. For reasons that will be clear to the reader, we will assume that $L < P < (I + L)/2$.

At t = 2, loans mature and the proceeds are collected. Let T denote this terminal cashflow, which is equal to I if the riskless investment was chosen at t = 1, or equal to H or L depending on the outcome from the risky investment, if that choice was made at t = 1. The firm pays the depositors *min* $(P_D, T)$ and the deposit insurance agency (FDIC) honors its guarantee by paying the depositors *max* $(0, P_D - T)$. Thus, depositors are paid off fully, given our assumption that all deposits are insured. The subordinated debtholders receive *max* $(0, \min(T - P_D, P_S))$. In our model, depositors get paid $P_D$ independent of the investment policy of the bank, and hence, have no incentives to monitor the risk choices of managers. The claims held by the subordinated debtholders and the

[6] This informational friction gives rise to noncontractability of specific levels of q, and hence, of investment risk-choices. This results in the well-known risk-shifting incentives in the presence of risky debt. This modeling device is consistent with the literature on agency costs of debt. See Jensen and Meckling (1976).

federal depositor insurer (regulator) are affected by the risk choices of managers and they have incentives to monitor those risk choices. We abstract from discounting in all time periods by assuming that the riskless rate of interest is zero and we assume universal risk-neutrality.

In the rest of this section, we first characterize the Pareto-optimal investment policy. We then describe the factors that affect the bank CEO's incentives. Given that contracts specifying the value of the parameter q can not be written and enforced, the CEO will choose an investment policy to maximize her own objectives. The investment policy chosen by the CEO as a function of the compensation structure in place is solved. We finally characterize the optimal compensation features that will induce the first best investment policy.

## 2.2. The Pareto-Optimal Investment Policy

We start with a characterization of a generic investment policy (loan decision) of the bank.

**Definition 1:**

For a given cut-off value of $q^c$, $0 \leq q^c \leq 1$, an investment policy of investing in the risky asset (loan) for $q \geq q^c$ and in the riskless asset (loan) for $q < q^c$ will be denoted as an investment policy $[q^c]$.

**Lemma 1:**

*Given that q is uniformly distributed over [0, 1], an investment policy* $[\tilde{q}]$ *produces the distribution of a terminal cashflow as follows: H with a probability* $½[1-\tilde{q}^2]$, *I with a probability* $\tilde{q}$ *and L with a probability* $½\,[1-\tilde{q}]^2$.

**Proof:** Straightforward computation yields the probabilities of the outcomes, L, H, and I as stated.

**Lemma 2:**

*The investment policy* $[q^1]$ *is riskier than the investment policy* $[q^2]$ *if* $q^1 < q^2$.

**Proof:**

It is easy to verify that the cash flow distribution that is obtained with an investment policy $[q^1]$ has a higher variance than the cash flow distribution obtained from an investment policy $[q^2]$ given $q^1 < q^2$. The lemma holds for other measures of risk as well.[7]

The intuition for the result is straightforward. The investment policy $[q^1]$ involves investing in the risky project for all realizations of q under the investment policy $[q^2]$, plus for the additional realizations of $q \in [q^1, q^2)$. Therefore, the investment policy $[q^c]$ becomes increasingly riskier for lower values of $q^c$.

The value of the terminal cashflows resulting from an investment policy $[\tilde{q}]$ denoted $V(\tilde{q})$, can easily be specified:

$$V(\tilde{q}) = \tilde{q}I + \frac{L}{2}[1-\tilde{q}]^2 + \frac{H}{2}[1-\tilde{q}^2]$$

The Pareto-optimal investment policy $[\hat{q}]$ which maximizes $V(\tilde{q})$ is given by:

$$\hat{q} = \frac{I-L}{H-L} \qquad (1)$$

and the resulting value $V(\hat{q})$ can be specified as follows:

$$V(\hat{q}) = \hat{q}I + \frac{L}{2}[1-\hat{q}]^2 + \frac{H}{2}[1-\hat{q}^2]$$

The last equation above characterizes $V(\hat{q}),$ the firm value, which could have been achieved if q were perfectly observed by all parties (including investors and regulators) and if a complete set of enforceable contracts specifying the bank's investment policy could have been written. In other words, $V(\hat{q})$ is the highest value achievable in a full-information scenario with complete contracting. Thus, the investment policy $[\hat{q}]$ and the resulting value, $V(\hat{q}),$ form useful

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[7] In current regulation, other measures of bank risk, such as probability of default are often used. Since probability of default in our model is simply ½ $[1-\tilde{q}^2]$, it will also monotonically decrease in $\hat{q}$.

benchmarks to measure the distortions caused by risk-shifting incentives due to financing with deposits (debt).[8]

### 2.3. The CEO's Objective Function

Given that there is incomplete contracting with respect to risk choice, the investment decisions made by the CEO would be those that maximize her objective. Her objective, in turn, will be determined by her compensation structure, her incentives to consume perks, and the capital structure of the bank. The details of each one of these components are given below.

#### *2.3.1. CEO perk consumption*

The CEO is assumed to derive some benefits of control. The CEO is able to consume perquisites from the realized cash flows of the firm. For example, she can build herself a larger than optimal corner office, use luxury office furniture, buy an unnecessary corporate jet, etc. We make two assumptions regarding the CEO's perk consumption. First, we assume that the CEO cannot consume perks when the bank is insolvent, i.e., when $T < P$. This assumption is plausible for the intense scrutiny from the debtholders and the regulators in these states will make perk consumption very difficult.

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[8] The investment technology used in this paper is commonly used to study risk-shifting in agency models. Here, increases in risk are accompanied by declines in net present value. Under an alternative technology of mean (value) preserving spread, there is no decline in value as risk increases. In our technology, risk-shifting incentives induced by risky debt lead to agency costs in the form of value loss, whereas in the alternative technology, risky debt induces risk-shifting incentives, which are not accompanied by value loss, and hence, no agency costs obtain. We argue that the technology of this paper is appropriate for modeling risk-shifting in the banking context. Even when banks appear to have access to a menu of investment opportunities, which may allow for increases in risk without declines in value, our technology recognizes the incentive that bank managers have to continue to move into high risk projects despite their negative net present values. Some documented evidence also supports our characterization. Money center and wholesale banks may face a linear gross revenue function, (i.e., they can lend at rates close to LIBOR) but their cost functions appear to be nonlinear. Specifically, the empirical evidence suggests that there are "diseconomies of superscale" beyond $25 billion in assets (see, e.g., Berger and Mester (1997) and Allen and Rai (1993)). This is consistent with the nonlinear investment opportunity set, and with decreasing returns to scale considered in this paper. There is also evidence that real estate investments by both Japanese and US banks in the late 1980's and early 1990s were characterized by negative returns (see, e.g., Mei and Saunders (1997)).

Second, we assume that the CEO has declining marginal utility of perk consumption (See, e.g., Jensen and Meckling (1976)). In other words, the preference of the CEO for perks is represented by the concave and increasing function U(F), where F is the level of perks consumed. $U'(F) > 0$, $U''(F) < 0$. Combining these preferences with risk neutrality with respect to wealth, we will represent CEO's preference as [U(F) + W].

### *2.3.2. CEO compensation structure*

The incentives of the CEO are most directly influenced through her compensation structure. Although a large variety of compensation structures can be considered as candidates for bank CEO compensation contracts, we will consider a simple family of contracts with some important incentive features. This family is closely related to the structures observed in practice and includes among its members an optimal contract. In this sense, we believe that a restriction of the compensation structure to this piecewise linear family is without too much loss of generality.

The generic compensation structure is characterized as follows: the CEO gets a fixed cash salary, $S \geq 0$, and a fraction $\alpha$ of the equity of the bank. Such a compensation contract will be called the contract $\{S, \alpha\}$. For convenience, we will assume that the fixed salary component is paid out of the bank's operating cashflow, such that the terminal cashflow $T = \{I, H, L\}$ is residual to the fixed payments, S, to the CEO.

Clearly a contract of $\{S, \alpha\}$ has a pay-performance sensitivity of $\alpha$. Even though nominally we describe a contract where the CEO is given a fraction of the bank's equity, the contract will capture the incentive features of a larger class of compensation contracts, which have a pay-performance sensitivity of $\alpha$. It will be clear to the reader that, given the cash flow technology of this paper, our specialization to contracts with only salary and a fraction of equity is without loss of generality.

Our strategy in designing the optimal compensation structure for the CEO is as follows: we will characterize the investment policy *[$q^{\alpha}$]* implemented by the CEO for a given compensation contract {S, α}, and then examine the features of the optimal contract {S, $\hat{\alpha}$ } that induces the Pareto-optimal investment policy $\hat{q}$ .

### *2.3.3. Cash flows to equity*

The cash flows to equityholders depend on (1) the capital structure of the bank, and (2) perk consumption by the CEO. At t = 2, the cash flow to the firm, T, is realized. Out of these cash flows, the promised payment to depositors and subordinated debtholders, P, is first paid off. If the bank is solvent, the CEO will consume perks. Let F(α) be perk consumption of the CEO optimally chosen by her as a function of her ownership, α. The cash flow available for distribution to equityholders is max (0, T - P - F(α)).[9]

### *2.3.4. Monitoring by subordinated debtholders*

It is reasonable to argue that dispersed depositors have no comparative advantage in monitoring the loan decisions of the bank. Given that the deposits are insured, their incentives to monitor are also absent. The regulator who has guaranteed the deposits has incentives to monitor the risk choices of the bank. (Monitoring by the regulator is discussed in the next section.) As we have argued before, subordinated debtholders, whose claims are junior to that of the depositors, also have incentives to monitor the risk choices of the bank. Proposals for regulation requiring banks to hold certain minimum levels of subordinated debt have received some support in recent years. For instance, subordinated debt requirements are the centerpiece of a proposal for reforming bank regulation from the U.S. Shadow Financial Regulatory Committee (SFRC, 2000). A comprehensive study from the staff at the Board of Governors (FRS, 1999) also supports subordinated debt requirement as a part of

[9] It will be shown later in Lemma 3 that the perk consumption will not exceed (T-P) in solvent states.

prompt corrective action. Subordinated debt is attractive from the regulatory point of view because the subordinated debtholders can provide continuous monitoring of the banks.

As claimants on very junior debt, subordinated debtholders stand to suffer heavy losses in the case of bank insolvency. Therefore, they have strong incentives to monitor the bank closely and continuously. Their interests are aligned with those of the depositors and the deposit insurers. Moreover, the investors of bank subordinated debt are largely institutional investors. These debtholders have the ability to monitor banks by doing their own analysis of banks and demanding disclosures. A staff study at the Board of Governors (FRS, 1999) provides a discussion on the investors of the bank subordinated debt. It is also possible that there is concentrated holding of subordinated debt, such that the debtholders have more incentives and higher ability to monitor the bank as a large claimholder. The alignment of interests of the subordinated debtholders and the regulators would make it plausible that penalties are imposed on the bank when risk choices are detected to be excessive by the subordinated debtholders.

In the literature on subordinated debt, there are two ways the subordinated debt can impose discipline on the bank's risk choice through monitoring. Once excessive risk-taking activities are detected, the subordinated debtholders can impose direct discipline on the bank by charging high funding costs. It can also impose derived discipline by providing risk signals to other market participants and to regulators who can then discipline the bank. For more discussion, see Estrella (2000) and Evanoff and Wall (2001). Empirical studies also find evidence that subordinated debtholders have some ability to distinguish banks with different risk profiles and take those differences into account in pricing the debt, for example, see DeYoung, Flannery, Lang and Sorescu (2001) and Morgan and Stiroh (2001). In particular, Billett, Garfinkel and O'Neal (1998) show that the costs associated with market monitoring are more sensitive to risk increases than the costs associated with regulatory monitoring.

In our model, we make the following assumptions to capture the above characteristics of subordinated debt. When the subordinated debt is present, we assume the debtholders monitor the loan decisions of the bank with an intensity of $\lambda$, where $\lambda$ is increasing in the promised payment, $P_S$, to the subordinated debtholders. $\lambda$ is also assumed to be the probability of detecting the presence of the risky asset, given that the risky asset has been chosen by the bank.[10] Once the presence of the risky asset is detected, the bank will be subjected to a penalty, either by the market and/or by the regulatory system. That penalty could be higher funding costs or additional scrutiny from the regulators. When the bank is subjected to a penalty, it can impose pecuniary and nonpecuniary costs on the CEO. Let the cost to the CEO be $\phi$.[11] Therefore, the CEO incurs an expected penalty of $\lambda\phi$ when she chooses the risky loan.

Now that we have described the components of the managerial objective function, we can set up the optimization that determines the CEO's choice of perk consumption and investment policy. The timeline for our problem is as follows: at t = 0, the deposits are collected and the subordinated debt and equity are issued. The managerial compensation structure, $\{S, \alpha\}$, is put in place. The amount $[I + \pi]$ is raised and the FDIC premium, $\pi$, is paid. At t = 1, the CEO observes the quality of the risky project, q, and makes the investment decision, i.e., chooses between the risky project and the safe project. At t = 2, the cash flows T = H, I, or L are realized. In the solvent states, the CEO consumes perks of $F(\alpha)$ as a function of her ownership $\alpha$. ($F(\alpha)$ is optimally chosen as characterized in section 2.4.) Given the assumption that $P < (I + L)/2$, the firm will be insolvent only in the L state of the world. In that state, the entire cash flow is paid to the debtholders. In the solvent states, for T = H or I, a total amount of P is paid to the depositors and subordinated debtholders, and the cash flow $[T - P - F(\alpha)]$ is paid to equityholders, including the CEO.[12]

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[10] We are assuming the subordinated debtholders use a gross monitoring mechanism. That is, they can only detect the presence of the risky loan with some probability, but they cannot make the judgment whether or not there is risk-shifting activity. This is consistent with our assumption that the parameter q is private information to the CEO. However, the main results will hold even if we assume that the subordinated debtholders can detect risk-shifting with some probability.

[11] This is the simplest way to model the impact of subordinated debt monitoring on the CEO incentives. We can also model the penalty on the bank and its indirect effect on the CEO who holds partial ownership of the bank. The main results will not change.

[12] When $P < (I + L)/2$, it can be shown that $[I - P - F(\hat{\alpha})]$ is positive. See Lemma 3.

We solve for the optimal CEO compensation structure by backward recursion. We first solve the CEO's choice of perk consumption F(α) at t = 2, given a compensation contract {S, α} and capital structure, $P_D$ and $P_S$. Then, we substitute the optimal perk consumption into the CEO's objective at t = 1, to determine her choice of investment policy. Then we determine the optimal compensation structure, {S, $\hat{\alpha}$ }, to be put in place at t = 0.

### *2.3.5. Monitoring by the regulator*

Even though the dispersed depositors who hold insured deposits do not have incentives to monitor the bank, the regulator who has guaranteed the deposits has incentives to do so. In particular, it can be shown that the regulator's guarantee given to the bank is increasing in value in the riskiness of the investment policy of the bank. This gives the regulator incentives to monitor the risk choice of the bank. As in section 2.3.4, we assume that the regulator monitors the bank with intensity λ. Again, λ has the interpretation of the probability of detection of the presence of the risky project when the CEO has undertaken the risky project. The expected cost of regulatory scrutiny of intensity λ on the bank CEO is again λϕ. We will further assume that the intensity, λ, of regulatory monitoring will be higher the larger the deviation of the health of the bank from regulatory requirements. After the FDICIA (1991), bank regulators have developed a multi-dimensional ranking of a bank's deviation from the regulatory requirement, which is called CAMELS. In our empirical work, we will assume that intensity of regulatory monitoring is directly proportional to the CAMELS ratings (or the corresponding measure BOPEC for banking-holding companies.)

## 2.4. The CEO's Ex-Post Perk Consumption

At t = 2, the manager consumes perks optimally in all of the non-default states. The CEO's preferences for perks and wealth is assumed to have the following additive structure: U(F) + W.

The manager's problem of determining the optimal perk consumption F(α) from a cash flow T, T > P, can be specified as follows.

$$F(\alpha) = \arg\max_{F} \; U(F) + \alpha(T - P - F)$$

The first order condition for the optimization yields:

$$U'(F) = \alpha$$

We further assume that $U(F) = \sqrt{F}$ . This implies that the optimal level of perk consumption,

$$F(\alpha) = \frac{1}{4\alpha^2} \qquad (2)$$

The Pareto-optimal level of perk consumption corresponds to that of full ownership (α = 1) by the CEO, and is equal to ¼. (See e.g., Jensen and Meckling (1976)) For any fractional ownership by the CEO, she will consume more than the Pareto-optimal level of perk consumption, which leads to a deadweight value loss.

### 2.5. The CEO's Ex-Ante Investment Decision

The CEO makes the investment decision at t = 1. Since the value of q, the success probability of the risky project, is assumed to be non-verifiable, the investment decision of the manager is at her own discretion. She chooses between the riskless project and the risky project to maximize her objective function. Her objective function consists of two components: (1) the expected utility of her wealth and perk consumption, (2) the disutility of any penalties imposed by the regulator or subordinated debtholders.

If subordinated debt is present, the debtholders monitor the risk choices of the bank. As described in section 2.3.4 and 2.3.5, the subordinated debtholders or the regulator monitor the presence of the risky project with intensity λ and imposes expected costs of λϕ on the CEO if she chooses the risky project. The CEO's choice of the project, conditional on the observed level of q, depends on $\lambda\phi$, the deposit and debt obligation P, her ownership $\alpha$, and her optimal consumption of perks $F(\alpha)$ at t =2, as in equation (2). More specifically, the manager will choose the risky project if and only if:

$$-\lambda\phi + q[U(F) + \alpha(H - P - F(\alpha))] + (1-q)*0 \geq U(F) + \alpha(I - P - F(\alpha)) \quad (3)$$

The right-hand side of relation (3) is the expected utility level the CEO can derive from compensation and perk consumption if she chooses the risky project with a success probability of q. The left-hand side is the CEO's expected utility level if she chooses the safe project.

Rearranging relation (3), we see that the CEO will choose to invest in the risky project whenever $q \geq q(\alpha)$, where $q(\alpha)$ is specified below:

$$q(\alpha) = \frac{U(F(\alpha)) + \alpha(I - P - F(\alpha)) + \lambda\phi}{U(F) + \alpha(H - P - F(\alpha))} \quad (4)$$

Substituting for U(F) = $\sqrt{F}$ and $F(\alpha) = \frac{1}{4\alpha^2}$, we obtain

$$q(\alpha) = \frac{\frac{1}{2\alpha} + \alpha(I - P - \frac{1}{4\alpha^2}) + \lambda\phi}{\frac{1}{2\alpha} + \alpha(H - P - \frac{1}{4\alpha^2})} \quad (5)$$

For any level of ownership (pay-performance sensitivity) $\alpha$, the investment policy implemented by the CEO is characterized by the cut-off probability $q(\alpha)$, given above.

Dividing the numerator and the denominator of the right hand side of equation (5) by $\alpha$ and rearranging terms, we obtain

$$q(\alpha) = \frac{(I - P) + \frac{1}{4\alpha^2} + \frac{\lambda\phi}{\alpha}}{(H - P) + \frac{1}{4\alpha^2}} \quad (6)$$

From the above expression in equation (6), the following observations can be made about the asset choices of the bank CEO.

**Remark 1:** If there is no possibility of CEO perk consumption, and there is no monitoring of investment choice by subordinated debtholders or the regulator, i.e., $\lambda = 0$, then the cut-off investment, $q(\alpha)$, reduces to the following expression (which we will denote as $q(P)$):

$$q(P) = \frac{(I - P)}{(H - P)} \tag{7}$$

This investment policy is independent of the CEO ownership $\alpha$, for any level of $\alpha > 0$. Comparing equations (1) and (7), it is clear that $q(P) < \hat{q}$, since $P > L$, i.e., the debt is risky. From Lemma 2, $q(P) < \hat{q}$ implies that the investment policy undertaken is riskier than the Pareto-optimal investment policy. This is because for any level of $\alpha > 0$, the CEO is aligned with equityholders. Therefore, in the presence of risky debt, she undertakes an investment policy riskier than the one that maximizes firm value. This is the familiar risk-shifting incentives caused by risky debt.

The logic underlying capital regulation of banks can be seen from equations (6) and (7). It is seen that $q(\alpha)$ or $q(P)$ is decreasing in P, the leverage of the bank. Equivalently, $q(\alpha)$ or $q(P)$ is increasing in the level of capital of the bank. Since a higher value of $q(\alpha)$ implies less risk-shifting, higher capital requirements is a mechanism to curb the riskiness in the asset choice of banks.

**Remark 2:** Now let us consider the incremental effect of perk consumption on the implemented investment policy (Continue to assume that no monitoring is present). From equation (6), it is clear that the effect of the perk consumption is to increase the cut-off level $q(\alpha)$ such that $q(\alpha) > q(P)$. Again using Lemma 2, the CEO implements an investment policy, which is less risky than that in the absence of perks. The intuition for this result is that the possibility of losing the perks in the insolvent state, L, provides some discipline on the CEO from undertaking the risky project too often. Therefore, she implements an investment policy more conservative than she would without perks.

**Remark 3:** Next, we consider the effect of the presence of subordinated debt or regulatory monitoring on the investment policy of the bank. We assume here that perk consumption is not possible. From equation (6), the cut-off investment level, $q(\alpha)$, reduces to the following expression, which we will denote as $q(\lambda)$:

$$q(\lambda) = \frac{(I-P) + \dfrac{\lambda\phi}{\alpha}}{(H-P)} \qquad (8)$$

Clearly, q(λ) > q(P) and the CEO implements a safer investment policy in the presence of subordinated debt. The costs imposed on the CEO if the risky project is detected serves to discipline her risk choices such that she implements a safer investment policy in the presence of subordinated debt or regulatory monitoring. q(λ) is increasing in λ, the monitoring intensity, which in turn is increasing in the face value of subordinated debt. The larger the face value of subordinated debt, the safer the investment policy implemented. Similarly, in the case of regulatory monitoring with intensity λ, q(λ) is increasing in λ, which in turn increases with the extent of the bank's deviation from regulatory requirements.

**Remark 4:** The implemented investment policy is riskier as α increases. This can be readily seen from the expression for q(α) in equation (6), i.e., q(α) is decreasing in α. This is because the disciplining effect of perk consumption discussed in Remark (2) and the disciplining effect of subordinated debt or regulatory monitoring discussed in Remark (3) above are both decreasing functions of pay-performance sensitivity α.

The intuition for the declining effect of perk consumption with increasing α is as follows: with increased alignment with equity, the CEO reduces her perk consumption, which in turn has less disciplining effect on her risk-shifting incentives. Increases in α, therefore, lead to increased risk-shifting through the perks channel. The intuition for the declining effect of monitoring by subordinated debt with increasing α is as follows: with a large equity stake to benefit from a successful realization of the risky project, the CEO is more willing to pay the expected costs of implementing the risky project. Increases in α, therefore, ameliorate the discipline of monitoring by subordinated debt, and hence, leads to increased risk-shifting. Similar comments to regulatory monitoring apply.

### 2.6. Optimal Compensation Structure

Now we turn to the task of designing the optimal compensation structure for the CEO. Designing the optimal compensation structure, $\{S, \alpha\}$, involves determining the ownership fraction (pay-performance sensitivity) $\hat{\alpha}$, such that it induces the Pareto-optimal investment policy, $\hat{q}$. This is done by solving for the value of $\alpha = \hat{\alpha}$ such that $q(\hat{\alpha}) = \hat{q}$. Setting $q(\alpha) = \hat{q} = \frac{(I-L)}{(H-L)}$ yields,

$$\hat{\alpha} = \frac{\lambda\phi(H-L) + \sqrt{\lambda^2\phi^2(H-L)^2 + (P-L)(H-I)^2}}{2(P-L)(H-I)} \qquad (9)$$

**Proposition 1:**

$\{S, \hat{\alpha}\}$, where $\hat{\alpha}$ is as given in equation (9), is an optimal managerial contract that induces the Pareto-optimal investment policy, $[\hat{q}]$.

In the optimization leading up to Proposition I, we have assumed that $(I - P - F(\hat{\alpha})) \geq 0$ and $(H - P - F(\hat{\alpha})) \geq 0$. In the following lemma, we show formally that these inequalities hold.

**Lemma 3:**

For debt of face value $P \leq \frac{(I+L)}{2}$, the optimal level of managerial perk consumption under the optimal managerial compensation contract avoids default in states with T = I or H.

**Proof:**

Since $\lambda\phi \geq 0$, then $\hat{\alpha}^2 \geq \frac{1}{4(P-L)}$, which implies that $F(\hat{\alpha})$, the optimal perk consumption under this contract, is such that $F(\hat{\alpha}) \leq (P - L)$. This implies $(I - P - F(\hat{\alpha})) \geq 0$, for $P \leq \frac{(I+L)}{2}$.

Since H > I, we have that the optimal perk consumption under the optimal contract does not lead to default when T = H.

Some testable implications of the model can be derived from the form of the pay-performance sensitivity of this optimal contract.

**Proposition 2:**

The pay performance sensitivity in the optimal CEO compensation structure is decreasing in the total leverage of the bank.

**Proof:**

Straightforward but tedious computation of the derivative shows that $\frac{\partial \hat{\alpha}}{\partial P} < 0$.

**Remark 5:** The intuition behind Proposition 2 is straightforward. As leverage increases, q(P) (see equation (7)) decreases, leading to increased risk-shifting incentives. To offset this effect, we have to increase the discipline arising from CEO perks and the expected costs imposed by the monitoring of subordinated debt or the regulator. As discussed in Remark 4, both effects can be accomplished by decreasing the pay-performance sensitivity, $\alpha$.

**Proposition 3:**

The pay-performance sensitivity in the optimal CEO compensation structure is increasing in the level of subordinated debt.

**Proof:**

Straightforward computation shows that $\frac{\partial \hat{\alpha}}{\partial \lambda} > 0$. $\lambda$ is increasing in the face value of the subordinated debt.

By similar reasoning, we can relate the pay-performance sensitivity of the optimal CEO compensation to $\lambda$, the intensity of regulatory monitoring.

**Proposition 4:**

The pay-performance sensitivity in the optimal CEO compensation structure is increasing in the intensity of regulatory monitoring.

**Remark 6:** The intuition of Propositions 3 and 4 can be seen as follows: since monitoring imposes direct discipline on the CEO's investment choice in the optimal compensation structure, it is not necessary to work with indirect incentives of a smaller $\alpha$, and therefore, a larger perk consumption. In other words, the disciplining effect of monitoring by the subordinated debtholders or the regulator reduces the need to rely on the disciplining effect of perk consumption. Thus, it is possible to include large incentive features in the optimally designed CEO compensation. The larger the $\alpha$ included in the CEO's compensation induces her to consume fewer perks $F(\alpha)$. In addition to the direct discipline that it imposes on the riskiness of the investment policy, monitoring has the indirect effect of leading to a smaller deviation from the optimal perk consumption.

## 3. EMPIRICAL TESTS

In this section, we perform empirical tests of the main predictions in propositions 2, 3 and 4: (1) the pay-performance sensitivity of bank CEO compensation decreases with its total leverage; (2) the pay-performance sensitivity of bank CEO compensation increases with the subordinated debt ratio; (3) the pay-performance sensitivity of bank CEO compensation increases with the intensity of regulation. Since the institutional details underlying monitoring by subordinated debt and monitoring by the regulator are sufficiently different, we present our tests separately in two sections. In section 3.1, we present tests of hypotheses (1) and (2) relating the amount of total debt and the subordinated debt ratio to incentive features in bank CEO compensation. In section 3.2, we present a test of hypothesis (3) involving the relationship between pay-performance sensitivity and intensity of regulation.

### 3.1. Subordinated Debt and Incentive Features

In this section, we undertake tests of our hypotheses regarding the effects of the leverage ratio and the subordinated debt ratio on the pay-performance sensitivity of bank CEO compensation.

In section 3.1.1, we define the variables used and present data and summary statistics. In section 3.1.2, we present the regression results and their interpretations.

***3.1.1. Data and summary statistics:***

Compensation data for bank CEOs is obtained from the Standard and Poor's ExecuComp database. We start with a sample of 623 CEO-years from 1992 to 2000 for 120 bank-holding companies (firms with SIC codes from 6021 to 6029).[13] Stock returns and market values of common equity are retrieved from CRSP. Accounting data such as debt amount are obtained from Compustat. All three data sources are matched on a fiscal-year basis. If a stock is traded less than 200 days during a year, that firm-year is excluded from the sample. Six problematic data points are taken out of the sample.[14] The final sample contains 606 CEO-years. To remove the effect of inflation and make numbers comparable, we convert all the dollar-valued data to constant year-2000 dollars. The consumer price index used for this purpose is obtained from the web site of the Bureau of Labor Statistics.

The measure of bank CEO compensation that we use is comprehensive; it is defined as the sum of salary, bonus, other cash compensation, the change in value of option holdings[15], the change in value of restricted stock, profits from exercising options and the change in value of direct equity holdings. This measure captures all components of changes in the CEO's wealth related to the bank. Therefore, we call this measure of compensation "CEO's firm-related wealth change". In the 1990s, grants of stock options and restricted stocks constitute an important proportion of the total CEO compensation. Moreover, Hall and Liebman (1998) show that most

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[13] The sample starts from year 1992 because consistent disclosure of option portfolios began at that time.

[14] Five observations are taken out of the sample since the data indicates that the CEO became CEO after the end of the fiscal year. Another one indicates negative debt ratio.

[15] In ExecuComp, the value of the existing options is only reported for those options that are currently in the money. Therefore we use the value change of in-the-money options to approximate the value change of total option holdings. The direction and magnitude of the bias resulting from this reporting convention has been discussed in Aggarwal and Samwick (1999). They conclude that the direction of the bias is indeterminate and the net effect may not be severe.

of the pay-performance sensitivity in the compensation structure is associated with the change in value of existing option holdings (without considering direct equity holdings). Hence, it is important to use this comprehensive measure of compensation when it comes to testing the determinants of pay-performance sensitivity.

The leverage ratio used in the analysis is defined as one minus the ratio of common equity value over total assets. Consistent with the literature on subordinated debt, we measure the subordinated debt ratio as long-term (non-depository) debt relative to asset value (denoted as sub-debt). Depending on whether the book value or market value of common equity (and assets) is used, we obtain two measures for the leverage ratio and sub-debt ratio, respectively: the book (market) value of leverage ratio and the book (market) value of sub-debt ratio.

Table 1 reports the summary statistics of the bank characteristics and CEO compensation. The banks in the sample are big banks with a median market value of 3.5 billion (constant 2000) dollars and the largest one has a market value of almost 110 billion dollars. They perform well during the sample period with a median annual stock return of 21%. As expected, these banks are all highly levered. The distribution of the debt ratios is quite symmetric with the mean and median values close to each other. The mean and median book values of leverage are both 92%. The mean market value of leverage is 83% and the median value is 85%. Since deposits are the main sources of financing for banks, subordinated debt or market debt constitutes only a small part of the banks' borrowing. On average, the subordinated debt constitutes 6.3% of the book value of assets and 5.7% of the market value of assets.

The compensation data are highly positively skewed. The median values of salary, bonus, new grants of options, and value change of option holdings are of the same order of magnitude, at around 500 to 600 thousand dollars. However, the mean values of option grants and value change in option holdings are much bigger. They are $1.7 million and $3.2 million, respectively. It can be seen that the value change of direct equity holdings constitutes an important part of CEO's wealth change, with a mean value of $20 million and a median value of

$6 million each year. The following three variables can take on negative values and their ranges are quite wide: value change in option holdings, value change in restricted stock holdings and value change of direct equity holdings. This means that the CEO's firm-related wealth changes can be negative for bank CEOs.

Table 2 reports the summary statistics of subordinated debt ratios. Table 2A presents the mean (median) value of the subordinated debt ratios held by sample banks over the 1990s. As can be seen, the average use of subordinated debt increases over this decade. There is a steady increase from 1992 to 1999. The mean value of subordinated debt increases from 4.2% in 1992 to 9.0% in 1999. The median value of subordinated debt increases from 3.6% in 1992 to 8.6% in 1999. However, there is a drop in both the mean and median value of the subordinated debt ratio in the year 2000.

Table 2B compares the bank-years with and without subordinated debt. It shows that most banks have some subordinated debt in most years of the 1990s. In fact, there are only 32 out of 606 bank-years that do not have any subordinated debt. The two subsamples are similar in stock performance, stock return volatility and total leverage ratios. The striking difference between them lies with the bank size. The banks with positive subordinated debt are on average about 10 times the size of banks with no subordinated debt, both in terms of book value of assets and market value of equity. It is not surprising that larger banks have a higher level of compensation in terms of salary, bonus and even options and restricted stock grants. However, larger firms usually have smaller CEO ownership due to CEO wealth constraints and risk aversion. See Schaefer (1998) and Murphy (1999). In our sample, we also find that banks with above-median size have significantly lower CEO ownership (not reported in tables). When size is measured by market value of equity, the larger banks have a mean CEO ownership of 0.6% while the smaller banks have a CEO ownership of 2.1%. Similar results hold when size is measured as the book value of assets. Given the relationship between size and CEO ownership and the fact that banks with positive subordinated debt are much larger than banks without subordinated debt, it is striking to find that there is no significant difference in CEO ownership between these two groups. We believe this is evidence supporting our second hypothesis: subordinated debt allows for higher pay-performance sensitivity.

Table 2C divides the sample in an alternative way. It compares banks with different patterns of subordinated debt balances. We categorize banks into the following five types: type 1 banks do not have subordinated debt throughout the sample period; type 2 banks always have subordinated debt; type 3 banks started with no subordinated debt but later on took on subordinated debt. Type 4 banks started with positive subordinated debt but then eliminated all the subordinated debt. All other banks are included in type 5. Most banks fit into the second type. We focus on the comparison between type 1 and type 2 banks. The comparison is similar to the patterns we see in Table 2B. That is, type 2 banks are much bigger. However, the average CEO ownership in type 2 banks is even larger than that in type 1 banks. Again, this is consistent with the notion that the positive impact of subordinated debt on ownership may be important.

### *3.1.2. Regression results and interpretation*

To examine the effects of total leverage and subordinated debt on the pay-performance sensitivity of bank CEO compensation, we estimate the following regression:

$$\textbf{(CEO compensation)}_{it} = [b_1 + b_2 * X + b_3 * \text{leverage ratio} + b_4 * \text{sub-debt}] * \textbf{(returns to shareholders)}_{it} + b_5 * X + b_6 * \text{leverage ratio} + b_7 * \text{sub-debt} + \mu_i + \eta_t + \varepsilon_{it} \qquad \textbf{(10)}$$

As discussed before, we use the most comprehensive measure for CEO compensation, the CEO's firm-related wealth change. **X** refers to a vector of control variables that might affect the pay-performance sensitivity other than the variables of interest. There are two factors that researchers have argued affect the CEO pay-performance sensitivity: firm size and firm risk. For example, Schaefer (1998) models the relationship between firm size and pay-performance sensitivity and presents evidence that pay-performance sensitivity declines with firm size. Holmstrom and Milgrom (1987) argue that the optimal performance-related compensation component (the pay-performance sensitivity) for risk-averse managers should be inversely related to firm risk. We therefore include these two factors here as control variables and will demonstrate that the leverage ratio and subordinated debt ratio have explanatory power for pay-performance sensitivity over and above these variables. We measure size as natural log of the bank's book value of assets. Results are consistent if we measure size as the bank's market value of equity (not reported). Consistent with the literature, we measure returns to shareholders as the dollar change in the market value of the firm over the year. We measure firm risk as the standard deviation of daily dollar returns over the year.

In regression (10), the pay-performance sensitivity of CEO compensation is equal to the whole term in the squared brackets. It implies that the pay-performance sensitivity is a function of a constant term, the control variables, the total leverage and the sub-debt ratio. Our model predicts that higher leverage leads to lower pay-performance sensitivity, i.e., $b_3 < 0$; and that a higher sub-debt ratio leads to a higher pay-performance sensitivity, i.e., $b_4 > 0$. There is no theoretical prediction on the impact of leverage or sub-debt on compensation level. Therefore, we do not have a theoretical prediction on the signs of $b_6$ and $b_7$. However, by including leverage ratio and sub-debt ratio in the regression, we ensure that any relationship between leverage ratio (sub-debt) and the level of CEO compensation will not affect our estimates of b3 (b4).

We also include CEO-bank (i.e., a unique combination of CEO and bank) and year fixed effects in the regression, denoted as $\mu_i$ and $\eta_t$, respectively. By including these fixed effects, we are able to control potentially different average compensation levels for different CEOs and for different years. Therefore, only the variations in compensation and performance from their averages are used to identify the pay-performance sensitivities.

Regression results are reported in Table 3. In Table 3(a), the leverage ratio and the sub-debt ratio are measured in market value, i.e., the asset value is measured as the book value of assets minus the book value of equity, plus the market value of equity. The first (second) column demonstrates the impact of leverage ratio (sub-debt ratio) on pay-performance sensitivity without controlling for bank size and risk. As predicted, the coefficient for the cross-term between leverage ratio and the returns to shareholders, $b_3$, is negative and significant at the 1% level. The coefficient for the cross-term between sub-debt ratio and the returns to shareholders, $b_4$, is positive as predicted, although it is insignificant at the 10% level. Column (3) estimates the full regression that controls for size and risk. Consistent with our hypotheses, the coefficient $b_3$ is significantly negative and the coefficient $b_4$ is significantly negative.

In the regressions, CEO compensation is in thousands of dollars; returns to shareholders are in millions of dollars, and debt ratios are in percentage points. Therefore, the regression coefficient b3 (b4) can be interpreted as the dollar increase in CEO compensation for every $1000 increase in shareholder value, per percentage point increase in leverage ratio (sub-debt ratio). The coefficient $b_3$ shows that for each one percentage point increase in leverage ratio, the pay-performance sensitivity of CEO compensation will be $1.03 less per $1000 increase in shareholder value, everything else being equal. The coefficient $b_4$ implies that for each percentage point increase in the sub-debt ratio, the pay-performance sensitivity will increase by $0.65 per $1000.

Table 3(b) displays the regression results when the leverage ratio and subordinated debt ratio are measured in book value terms. In the "univariate" regressions involving leverage ratio and sub-debt ratio and in the full multivariate regressions that control for size and risk, we find that the coefficient on the cross-term of the leverage ratio and returns to shareholders is negative and significant. The coefficient on the cross-term of the sub-debt ratio and returns to shareholders is positive and significant.

Table 4 estimates the economic significance of these coefficients. That is, we calculate the changes in pay-performance sensitivity as a sensitivity-determinant increases by one standard deviation. When leverage and sub-debt ratios are measured in market value, one standard deviation increase in leverage ratio (7.7%) decreases the pay-performance sensitivity by $7.9 per thousand dollar increase in shareholder value. One standard deviation increase in sub-debt ratio

(4.8%) increases the pay-performance sensitivity by $3.1 per thousand dollars. The magnitudes are similar when leverage and sub-debt ratios are measured in book value. In comparison, where the regression coefficient is statistically significant, one standard deviation increase in size decreases the pay-performance sensitivity by $4.7 per thousand dollars. One standard deviation increase in risk decreases the pay-performance sensitivity by $1.2 per thousand dollars, where the regression coefficient is statistically significant.

To check the robustness of our results presented in Table 3, we run an alternative specification of regression (10) where the returns to shareholders are measured in percentages. Correspondingly, risk is measured as the daily stock return volatility. Under this specification, the pay-performance sensitivity is, therefore, thousands of dollars increase in CEO compensation for each percentage point increase in return to shareholders.[16]

These results are presented in Table 5. Table 5(a) presents the results when leverage ratio and subordinated debt ratio are measured in market value, while Table 5(b) presents results when the leverage ratio and subordinated debt ratio are measured in book value. In all nine specifications, the coefficient on the cross-term of leverage ratio and returns to shareholders is negative; and the coefficient on the cross-term of the sub-debt ratio and returns to shareholders is positive. All these coefficients are significant at conventional levels, except for the two "univariate" regressions involving book value of leverage ratio.

When debt ratios are measured in market value, we find that for each 1-percentage point increase in leverage ratio, the pay-performance sensitivity decreases by $25,320 per percentage point increase in shareholder value. For each 1-percentage point increase in the sub-debt ratio, the pay-performance sensitivity increases by $39,240 per percentage point increase in shareholder value. The magnitude of these coefficients is even larger when debt ratios are measured in book

[16] This specification assumes that the CEO compensation increase for each percentage point increase in shareholder value is independent of bank size. This may not be true in a cross-sectional setting. We are using this alternative measure for pay-performance sensitivity to be consistent with the previous literature. But we consider the specification using dollar returns to shareholders to be more appropriate. See Aggarwal and Samwick (1997) for more discussion.

value. Overall, we find our results with this alternative specification also to be consistent with our hypotheses (1) and (2).

## 3.2. Regulation and Incentive Features

In this section, we undertake tests of our hypothesis (3) relating the pay-performance sensitivity in bank CEO compensation and intensity of regulatory monitoring. In section 3.2.1, we describe some institutional background of regulation and the BOPEC rating. In section 3.2.2, we present data and summary statistics. In section 3.2.3, we present the regression results and their interpretations.

### *3.2.1. Regulation and BOPEC rating*

The regulator has incentives to monitor the risk choices of banks for several reasons. The regulatory monitoring may reflect public interest in safe and sound financial institutions. Moreover, as a guarantor of the depository debt, the regulator will not want the banks to take on excessive risk, and therefore, lead to a loss for the Federal Deposit Insurance Corporation. Capital requirements and mandatory restrictions on asset choice have been central features of recent US bank regulation. For example, the FDIC Improvement Act (FDICIA), passed in 1991, is a system based on capital requirements and prompt corrective action (PCA). As a bank's capital adequacy ratio declines – moving from well capitalized to under capitalized – regulators are likely to consider a number of mandatory and discretionary actions restricting the asset and liability activities of weakly capitalized banks, as well as imposing constraints on their payment of fees, dividends and management compensation.

A couple of papers have examined bank CEO compensation relative to non-bank industries. For example, Houston and James (1995) find that bank CEOs receive less cash compensation, and receive a smaller percentage of their total compensation in the form of options and stocks than do CEOs in other industries. John and Qian (2002) find that the pay-performance sensitivity in bank CEO compensation is lower than that in manufacturing. The difference can be largely attributed to the difference in leverage ratios. However, none of these papers examine the impact of the intensity of regulation on the pay-performance sensitivity of bank CEO compensation.

In the U.S., primary responsibility for monitoring bank holding companies falls to the Federal Reserve Banks. Full-scope on-site inspections of BHCs are a key element of the supervisory process. They are generally conducted once a year. At the conclusion of an inspection, the supervisors assign the BHC a composite rating summarizing their assessment of the BHC's overall health and financial condition. This rating is called BOPEC, and it stands for the five key areas of supervisory concern: the condition of the BHC's Bank subsidiaries, Other nonblank subsidiaries, Parent company, Earnings, and Capital adequacy. BOPEC ratings range from one (best) to five (worst). The poorer the BOPEC rating, the BHC is more of a regulatory concern and will be subjected to more scrutiny such as restrictions on asset choice and payout policies. In the following analysis, we use BOPEC rating as the measure for the intensity of regulatory monitoring.

#### *3.2.2. Data and summary statistics*

We obtain the BHC examination ratings data from the Board of Governors of the Federal Reserve System. We obtain 517 observations with a non-missing BOPEC value. To preserve as many observations as possible, we use the CAMELS rating (examination rating at the bank level) for the lead bank in the bank holding company instead, where the BOPEC rating is unavailable. CAMELS ratings are assigned by various bank supervisory agencies: the OCC for national banks, the FDIC for state banks that are not members of the Federal Reserve System, and the Federal Reserve for state member banks. As with BOPEC ratings, CAMELS ratings are assigned after bank examinations.[17] The composite CAMELS rating is like the BOPEC rating – scores are assigned one to five with one as the best rating and five as the worst. The lead bank's CAMELS rating is highly correlated with the BHC's BOPEC rating. The correlation is 0.82. And, the regression results are robust when these substitute ratings are excluded.

Table 6 compares banks with different BOPEC ratings. Due to data confidentiality, we do not provide summary statistics on BOPEC ratings. In the 1990s, most banks perform well and few banks have regulatory ratings larger than 2. Of the whole sample, there are two banks that received a BOPEC rating of 4 in 1992. Since these two observations have missing values on firm-related wealth change, they are not included in our regression analysis.

Several observations can be made from table 6. First, the stock volatility increases as the BOPEC rating increases (i.e., changes from good to bad). Second, the average annual stock return also increases as the BOPEC rating increases. The unusually high average stock return for banks with ratings equal to 3 and 4 (42% and 75%, respectively) might be due to the small sample size of these two groups. But the comparative performance is also consistent with the notion that these are banks that engage in high-risk activities and have high expected returns. Since the regulators' objective is to ensure the interests of depositors, they discourage such high-risk, high-return activities by assigning poor ratings to these banks and putting them under more regulatory scrutiny. Third, as the BOPEC rating deteriorates, the average leverage ratio, measured by both book value of leverage and market value of leverage, increases. Fourth, the subordinated debt ratio of banks with a rating of 3 is significantly lower than the ratio of banks with better ratings. This is consistent with the notion that banks with a rating of 3 can take on more risk, partially because they are subjected to less market monitoring.

Since most of our observations fall into the category with a rating 1 or 2, it would be insightful to compare the compensation structure of banks with a rating of 2, with banks with a

[17] The acronym CAMELS refers to the six key areas of concern: Capital adequacy, Asset quality, Management, Earnings, Liquidity, and Sensitivity to risk.

rating of 1. We can see that banks with a poorer rating grant more options and restricted stocks and have higher CEO ownership. Moreover, a higher proportion of compensation comes from the value changes of existing option holdings and stock holdings in these banks. This supports our hypothesis that banks with poorer ratings can have CEO compensation with higher pay-performance sensitivity. The story, however, may not hold for banks with a rating of 3. Compared to banks with better ratings (1 or 2), these banks grant less options and restricted stocks. CEOs of these banks earn less from exercising options, despite their good stock returns. However, the CEOs of these banks, on average, own a higher percentage of the firm, partly because these banks are relatively small, with an average market capitalization of $4.3 billion. Given the conflicting factors, the total pay-performance sensitivity of these banks may be lower or higher than that of the banks with better ratings. One way to reconcile the comparison between banks with a rating of 2 with that of banks with a rating of 1, and the comparison between banks with a rating of 3 and banks with ratings of 1 and 2, is as follows. When a bank's rating changes from 1 to 2, it is put on the regulator's watch list. In the following time period, such a bank may be subjected to more monitoring but no immediate intervention will be imposed. In this case, our model predicts that increased regulatory monitoring, which makes risk-taking more expensive for the bank CEO, will be accompanied by higher pay-performance sensitivity in equilibrium. However, when the rating deteriorates even more, the regulators will want to intervene directly to reduce the banks' risk. Regulators can not only impose mandatory asset choice, but also impose restrictions on payout to shareholders and management. In other words, regulators can put restrictions on grants of options and/or restricted stocks to reduce the pay-performance sensitivity directly. In this sense, a rating level much below the usual range can actually reduce the pay-performance sensitivity of CEO compensation due to factors that we have not modeled.

### *3.2.3. Regression results and interpretation*

In this section, we will use a regression specification similar to that in equation (10) to test hypothesis (3) directly. To estimate the effect of regulation on pay-performance sensitivity, we estimate the following regression:

$$\mathbf{(CEO\ compensation)_{it} = [b_1 + b_2{*}X + b_3 * leverage\ ratio + b_4 * sub\text{-}debt + b_5{*}BOPEC]{*}} \\ \mathbf{(returns\ to\ shareholders)_{it} + b_6{*}X + b_7 * leverage\ ratio + b_8{*}\ sub\text{-}debt} \\ \mathbf{+ b_9 * BOPEC + \mu_i + \eta_t + \varepsilon_{it}} \qquad \mathbf{(11)}$$

where X refers to a vector of control variables that include size and risk. Our model predicts that the higher the intensity of regulation, as proxied by a higher BOPEC rating, the higher the pay-performance sensitivity, i.e., $b_5 > 0$.

The regression results are presented in Table 7. Column (1) shows results of the regression where no control variables are included. Column (2) shows results of the regression where the effects of size and risk are controlled. Columns (3) and (4) show results of the regression where effects of size, risk, leverage and subdebt are controlled. In column (3), debt ratios (total leverage and subordinated debt) are measured in market value. In column (4), debt ratios (total leverage and subordinated debt) are measured in book value.

As can be seen, the coefficient of the interaction of the BOPEC rating and return to shareholders, $b_5$, is positive in all four specifications and is highly significant in all but the "univariate" regression. This supports our prediction that as regulatory monitoring increases due to poor rating, the pay-performance sensitivity of bank CEO compensation increases as well. As before, the regressions demonstrate a negative relationship between total leverage ratio and pay-performance sensitivity, and a positive relationship between the sub-debt ratio and pay-performance sensitivity.

The results are robust, when we only use data with a BOPEC rating equal to 1 or 2 (not reported). The results are also robust when we use the lagged value of BOPEC ratings. Due to the lack of observations with a BOPEC rating above 2, it is difficult to test our conjecture that the pay-performance sensitivity of bank CEO compensation will decrease if the bank gets a very poor rating and are subjected to intervention by regulators. A different sample period with more variation for this variable will be needed.

## 4. CONCLUSIONS

In this paper, we study how the pay-performance sensitivity in an optimally-designed top management compensation structure is affected by the characteristics of the alternative mechanisms of corporate governance. In particular, we study the top management compensation in banks, taking into account the unique claim structure in banks as well as the mechanisms of corporate governance that arises in banks, namely, monitoring by the regulator and monitoring by the subordinated debtholders.

The theoretical framework that we use models a bank with a capital structure consisting of a large fraction of insured deposits, subordinated debt and controlling residual equity. The bank CEO compensation is designed to mitigate two types of agency problems: the risk-shifting problem and the perk consumption problem. Given the bank's claim structure, the subordinated debtholders and the regulator have the incentives to monitor the bank. We analyze theoretically whether the intensity of these monitoring mechanisms would play a complementary or substitute role to the strength of incentive features in top management compensation. Although the pay-performance sensitivity of bank CEO compensation decreases with the total leverage ratio, we show that the monitoring provided by either subordinated debtholders or regulators allow the bank to increase the pay-performance sensitivity in the optimal CEO compensation. Consistent with the theoretical predictions, we find empirical evidence that the pay-performance sensitivity decreases with banks' total leverage, but increases with its subordinated debt ratio. In addition, we find that more intense regulatory monitoring (proxied by a poorer BOPEC rating) is associated with higher pay-performance sensitivity of bank CEO compensation.

An understanding of the interaction of the different governance mechanisms would be useful in formulating both regulatory policy and compensation policy in banks. Our theoretical results and empirical evidence in the context of banks would be useful in understanding the design of corporate governance in a broader setting. In particular, our results provide insights on the design of the optimal ways to incentivize managers taking into account the effect of alternative regulatory and monitoring mechanisms. In future research, it would be interesting to explore the impact of additional mechanisms of corporate governance such as takeovers and bank boards on incentive features in bank management compensation. It has been argued that the effectiveness of takeovers in the United States has declined in the 1990s. It would be interesting to study theoretically and empirically the effect of such decreased market discipline on the incentive features of bank management compensation. Similarly, innovations in the design of corporate boards have led to an increase in the effectiveness of boards in banks. It would be interesting to explore concurrent changes in the pay-performance sensitivity of bank CEO compensation.

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Table 1: Summary statistics on banks and CEO compensation

This table presents the summary statistics of bank characteristics and various components of compensation components. The sample consists of 606 bank CEO-years from year 1992 to 2000. Dollar values are in constant year 2000 dollars. Except for the numbers in percentage, compensation numbers in panel B are in thousands of dollars and numbers in panel A are in millions of dollars. Volatility of dollar return is equal to stock volatility times the average of a bank's beginning-of-year market value and its end-of-year market value. Dollar return to shareholders is equal to the bank's beginning-of-year market value times its annual stock return. Book value of leverage ratio is equal to one minus the ratio of book value of common equity relative to the total asset value. Market value of leverage ratio is equal to one minus the ratio of market value of common equity relative to the market value of assets, which is in turn defined as book value of assets minus book value of common equity plus market value of common equity. Subordinated debt is measured as a bank's long-term non-depository debt. Book value of subdebt ratio is subdebt divided by book value of assets. Market value of subdebt ratio is subdebt divided by market value of assets. CEO's firm-related wealth change is defined as the sum of salary, bonus, other cash compensation, change in value of option holdings, change in value of restricted stocks, profits from exercising options and change in value of direct equity holdings.

| Variable | Mean | Median | Std | Minimum | Maximum |
|---|---|---|---|---|---|
| Panel A: Bank Characteristics | | | | | |
| Book value of assets | 49913.68 | 20363.29 | 84116.06 | 1548.22 | 715348.00 |
| Market value of equity | 8033.76 | 3483.06 | 12811.46 | 198.36 | 109928.64 |
| Stock return volatility | 1.84% | 1.68% | 0.66% | 0.74% | 6.43% |
| Volatility of dollar return | 148.52 | 49.63 | 289.12 | 2.74 | 2467.05 |
| Annual stock return | 24.44% | 21.45% | 34.59% | -43.48% | 274.56% |
| Dollar return to shareholders | 1111.46 | 359.56 | 3398.51 | -27077.39 | 27028.99 |
| Book value of leverage ratio | 92.14% | 92.22% | 1.81% | 72.57% | 96.77% |
| Market value of leverage ratio | 83.28% | 84.72% | 7.70% | 37.92% | 96.19% |
| Book value of subdebt ratio | 6.26% | 4.97% | 5.36% | 0 | 27.07% |
| Market value of subdebt ratio | 5.66% | 4.56% | 4.77% | 0 | 25.79% |
| Panel B: Compensation components | | | | | |
| Salary | 664.08 | 650.00 | 240.85 | 140.00 | 2000.00 |
| Bonus | 972.91 | 506.93 | 1309.49 | 0 | 12080.94 |
| Other cash compensation | 283.75 | 4.14 | 823.68 | 0 | 8935.57 |
| Option grants | 1723.18 | 618.15 | 3923.17 | 0 | 47776.17 |
| Grants of restricted stocks | 577.60 | 0 | 2377.92 | 0 | 46202.52 |
| Value change of option holdings | 3198.87 | 621.69 | 11588.00 | -49646.83 | 94498.26 |
| Value change of restricted stocks | 499.80 | 0 | 3658.86 | -31115.86 | 30955.38 |
| Profits from exercising options | 1185.56 | 96.18 | 3302.74 | 0 | 43960.80 |
| Equity holding | 1.38% | 0.25% | 4.19% | 0 | 35.05% |
| Value change of equity holding | 12926.39 | 1296.57 | 73155.92 | -68584.59 | 937262.73 |
| CEO's firm-related wealth change | 20198.37 | 5978.32 | 82232.15 | -81430.81 | 1068716.38 |

Table 2: Summary statistics on subordinated debt

This table describes banks' holdings of subordinated debt over time (2A) and the characteristics of banks with different subordinated debt holdings (2B and 2C). The sample consists of 606 bank CEO-years from year 1992 to 2000. Dollar values are in constant year 2000 dollars. Except for the numbers in percentage, compensation numbers are in thousands of dollars and bank size-related are in millions of dollars. Subordinated debt is measured as a bank's long-term non-depository debt. Book value of subdebt ratio is subdebt divided by book value of assets. Market value of subdebt ratio is subdebt divided by market value of assets, which is in turn defined as book value of assets minus book value of common equity plus market value of common equity. Volatility of dollar return is equal to stock volatility times the average of a bank's beginning-of-year market value and its end-of-year market value. Dollar return to shareholders is equal to the bank's beginning-of-year market value times its annual stock return. Book value of leverage ratio is equal to one minus the ratio of book value of common equity relative to the total asset value. Market value of leverage ratio is equal to one minus the ratio of market value of common equity relative to the market value of assets. CEO's firm-related wealth change is defined as the sum of salary, bonus, other cash compensation, change in value of option holdings, change in value of restricted stocks, profits from exercising options and change in value of direct equity holdings.

2A: Summary of subordinated debt across years

| | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|---|---|---|---|---|---|---|---|---|---|
| Number of Observations | 33 | 62 | 75 | 69 | 73 | 72 | 78 | 74 | 70 |
| Mean Book value of subdebt | 4.17% | 4.30% | 4.80% | 5.00% | 5.58% | 6.37% | 7.67% | 9.03% | 7.94% |
| (Median) | (3.64%) | (3.49%) | (3.63%) | (3.83%) | (4.34%) | (5.35%) | (7.65%) | (8.59%) | (6.45%) |
| Mean Market value of subdebt | 4.01% | 4.18% | 4.67% | 4.86% | 5.01% | 5.35% | 6.54% | 8.04% | 7.10% |
| (Median) | (3.70%) | (3.39%) | (3.93%) | (3.80%) | (4.33%) | (4.60%) | (6.50%) | (7.21%) | (5.96%) |

2B: Bank-years with and without subordinated debt

| | subdebt=0 | subdebt>0 | difference | t-stat |
|---|---|---|---|---|
| Number of observations | 32 | 574 | | |
| Book value of assets | 4500.30 | 52445.00 | -47945.00 | -13.37 |
| Market value of equity | 792.66 | 8437.40 | -7645.00 | -13.95 |
| Stock return volatility | 1.90% | 1.84% | 0.06% | 0.60 |
| Volatility of dollar return | 14.12 | 156.01 | -141.90 | -11.44 |
| Annual stock return | 0.23 | 0.25 | -0.02 | -0.28 |
| Return to shareholders | 116.77 | 1167.00 | -1050.00 | -6.99 |
| Book value of leverage ratio | 91.27% | 92.19% | -0.90% | -3.73 |
| Market value of leverage ratio | 83.77% | 83.26% | 0.52% | 0.55 |
| Book value of subdebt ratio | 0.00% | 6.61% | -6.60% | -29.94 |
| Market value of subdebt ratio | 0.00% | 5.98% | -6.00% | -30.45 |
| Salary | 467.05 | 675.07 | -208 | -6.49 |
| Bonus | 355.95 | 1007.3 | -651.4 | -8.35 |

| | | | | |
|---|---|---|---|---|
| Other cash compensation | 16.23 | 298.66 | -282.4 | -7.94 |
| Option grants | 296.87 | 1800.20 | -1503.00 | -8.71 |
| Grants of restricted stocks | 108.23 | 603.77 | -495.50 | -4.61 |
| Value change of option holdings | 1348.40 | 3294.70 | -1946.00 | -1.98 |
| Value change of restricted stocks | 49.81 | 523.10 | -473.30 | -2.50 |
| Profits from exercising options | 432.31 | 1227.60 | -795.20 | -3.72 |
| Equity holding | 1.55% | 1.37% | 0.17% | 0.34 |
| Value change of equity holding | 2520.70 | 13477.00 | -10956.00 | -2.82 |
| CEO's firm-related wealth change | 5027.80 | 21001.00 | -15973.00 | -3.61 |

2C: Banks with different patterns of subordinated debt activities

This table compares firms with different patterns of subordinated debt activities. The sample consists of 120 banks and 606 bank-years from year 1992 to 2000. Type 1 banks never issue subordinated debt during the sample period. Type 2 banks have positive subordinated debt throughout the sample period. Type 3 banks started with no subordinated debt but later on took on subordinated debt. Type 4 banks started with positive subordinated debt but then eliminated all the subordinated debt. All other banks are included in type 5.

| | type 1 | type 2 | type 3 | type 4 | type 5 |
|---|---|---|---|---|---|
| Number of banks | 3 | 108 | 5 | 1 | 3 |
| Book value of assets | 3960.46 | 54995.56 | 5373.04 | 4466.60 | 6348.13 |
| Market value of equity | 657.12 | 8821.94 | 1141.40 | 980.10 | 1419.89 |
| Stock return volatility | 2.03% | 1.82% | 2.07% | 2.22% | 2.05% |
| Volatility of dollar return | 13.32 | 163.03 | 21.35 | 21.21 | 26.20 |
| Annual stock return | 20.95% | 24.39% | 31.20% | 12.41% | 20.50% |
| Return to shareholders | 74.36 | 1219.23 | 218.35 | 54.12 | 175.88 |
| Book value of leverage ratio | 90.79% | 92.23% | 92.01% | 90.96% | 90.95% |
| Market value of leverage ratio | 84.78% | 83.44% | 81.49% | 80.28% | 81.14% |
| Book value of subdebt ratio | 0.00% | 6.83% | 0.70% | 5.60% | 2.06% |
| Market value of subdebt ratio | 0.00% | 6.18% | 0.60% | 4.89% | 1.76% |
| Salary | 506.51 | 685.64 | 445.34 | 404.07 | 515.79 |
| Bonus | 266.41 | 1039.55 | 488.64 | 230.08 | 348.33 |
| Other cash compensation | 3.00 | 314.75 | 20.81 | 0.00 | 5.85 |
| Option grants | 212.38 | 1870.06 | 353.46 | 133.72 | 719.33 |
| Grants of restricted stocks | 213.45 | 635.88 | 34.48 | 0.00 | 32.08 |
| Value change of option holdings | 1640.03 | 3432.88 | 1020.19 | 480.39 | 1206.46 |
| Value change of restricted stocks | -21.67 | 554.41 | 18.99 | 0.00 | 68.53 |
| Profits from exercising options | 724.82 | 1279.49 | 339.18 | 134.25 | 204.17 |
| Equity holding | 0.49% | 1.27% | 1.26% | 1.32% | 5.61% |
| Value change of equity holding | 255.35 | 13860.75 | 3125.81 | -188.95 | 12382.47 |
| CEO's firm-related wealth change | 3145.62 | 21704.06 | 5488.26 | 1057.01 | 14781.79 |

Table 3: Effects of leverage and subdebt on pay-performance sensitivity:
Return to shareholders measured in dollars

The sample consists of 606 bank CEO-years from year 1992 to 2000. The dependent variable, CEO's firm-related wealth change, is defined as the sum of salary, bonus, other cash compensation, change in value of option holdings, change in value of restricted stocks, profits from exercising options and change in value of direct equity holdings. Among the independent variables, volatility of dollar return is equal to stock volatility times the average of a bank's beginning-of-year market value and its end-of-year market value. Return to shareholders is measured in dollar terms and is equal to the bank's beginning-of-year market value times its annual stock return. Book value of leverage ratio is equal to one minus the ratio of book value of common equity relative to the total asset value. Market value of leverage ratio is equal to one minus the ratio of market value of common equity relative to the market value of assets, which is in turn defined as book value of assets minus book value of common equity plus market value of common equity. Subordinated debt is measured as a bank's long-term non-depository debt. Book value of subdebt ratio is subdebt divided by book value of assets. Market value of subdebt ratio is subdebt divided by market value of assets. T-statistics are in parentheses. Regression estimates include CEO-bank (for each unique combination of CEO and bank) and year fixed effects. The sign * denotes significance at 10% level using two-tailed test; ** denotes significance at 5% level using two-tailed test; *** denotes significance at 1% level using two-tailed test.

3A: Debt ratios measured in market value

| Independent Variable | CEO's firm-related wealth change | | |
|---|---|---|---|
| | (1) | (2) | (3) |
| Size: log (book value of assets) | | | 44654.13 ** (2.52) |
| Risk: Volatility of dollar return | | | -35.12 ** (-2.09) |
| Market value of leverage | -2294.86 ** (-1.97) | | -1976.16 (-1.64) |
| Market value of subdebt ratio | | -1203.52 (-0.92) | -1166.19 (-1.01) |
| Return to shareholders | 66.99 *** (7.32) | -0.76 (-0.26) | 63.58 *** (2.97) |
| Size * Return to shareholders | | | 1.72 (0.71) |
| Risk* Return to shareholders | | | -0.004 * (-1.86) |
| Market value of leverage * Return to shareholders | -0.79 *** (-7.17) | | -1.03 *** (-6.28) |
| Market value of subdebt ratio * Return to shareholders | | 0.36 (1.32) | 0.65 *** (2.63) |
| $R^2$ | 0.31 | 0.15 | 0.36 |
| Number of observations | 438 | 438 | 438 |

3B: Debt ratios measured in book value

| Independent Variable | CEO's firm-related wealth change | | |
|---|---|---|---|
| | (1) | (2) | (3) |
| Size: log (book value of assets) | | | 37225.47 ** (2.19) |
| Risk: Volatility of dollar return | | | -21.09 (-1.32) |
| Book value of leverage | -2371.39 (-0.58) | | -7098.38 * (-1.74) |
| Book value of subdebt ratio | | -302.20 (-0.26) | 1057.61 (1.01) |
| Return to shareholders | 383.60 *** (7.62) | -8.18 *** (-2.83) | 385.62 *** (7.65) |
| Size * Return to shareholders | | | -3.74 ** (-2.08) |
| Risk* Return to shareholders | | | -0.001 (-0.56) |
| Book value of leverage * Return to shareholders | -4.13 *** (-7.57) | | -3.74 *** (-6.03) |
| Book value of subdebt ratio * Return to shareholders | | 0.97 *** (4.13) | 0.85 *** (4.07) |
| $R^2$ | 0.32 | 0.19 | 0.41 |
| Number of observations | 438 | 438 | 438 |

Table 4: Economic significance of the coefficient estimate

This table displays the change in the pay-performance sensitivity (dollar increase in CEO compensation per $1000 increase in shareholder value) as the listed explanatory variable increase by one standard deviation. It is calculated as the regression coefficient of the cross-term of a listed variable times dollar return to shareholders, times the standard deviation of the variable. The symbol ♣ denotes that the corresponding regression coefficient is insignificant at 10% level.

| | (1) leverage and subdebt in market value | (2) leverage and subdebt in book value |
|---|---|---|
| Size: log (book value of assets) | 2.18♣ | -4.74 |
| Risk: volatility of dollar return | -1.16 | -0.29♣ |
| Leverage | -7.92 | -6.78 |
| Subdebt ratio | 3.11 | 4.55 |

Table 5: Effects of leverage and subdebt on pay-performance sensitivity:
Return to shareholders measured by percentage return

The sample consists of 606 bank CEO-years from year 1992 to 2000. The dependent variable, CEO's firm-related wealth change, is defined as the sum of salary, bonus, other cash compensation, change in value of option holdings, change in value of restricted stocks, profits from exercising options and change in value of direct equity holdings. Among the independent variables, return to shareholders is measured as annual stock return. Book value of leverage ratio is equal to one minus the ratio of book value of common equity relative to the total asset value. Market value of leverage ratio is equal to one minus the ratio of market value of common equity relative to the market value of assets, which is in turn defined as book value of assets minus book value of common equity plus market value of common equity. Subordinated debt is measured as a bank's long-term non-depository debt. Book value of subdebt ratio is subdebt divided by book value of assets. Market value of subdebt ratio is subdebt divided by market value of assets. T-statistics are in parentheses. Regression estimates include CEO-bank (for each unique combination of CEO and bank) and year fixed effects. The sign * denotes significance at 10% level using two-tailed test; ** denotes significance at 5% level using two-tailed test; *** denotes significance at 1% level using two-tailed test.

5A: Debt ratios measured in market value

| Independent Variable | CEO's firm-related wealth change | | |
|---|---|---|---|
| | (1) | (2) | (3) |
| Size: log (book value of assets) | | | 48910.27 ***<br>(2.82) |
| Risk: Stock volatility | | | -27520.2 **<br>(-2.25) |
| Market value of leverage | -5264.11 ***<br>(-3.62) | | -4784.9 ***<br>(-3.26) |
| Market value of subdebt ratio | | | |
| Return to shareholders | 797.94<br>(0.94) | 200.64<br>(1.23) | 1375.42<br>(1.00) |
| Size * Return to shareholders | | | 53.96<br>(0.57) |
| Risk*Return to shareholders | | | -47.17<br>(-0.37) |
| Market value of leverage * Return to shareholders | -10.26<br>(-0.97) | | -25.32 **<br>(-2.09) |
| Market value of subdebt ratio *Return to shareholders | | 41.06 **<br>(2.34) | 39.24 *<br>(1.91) |
| $R^2$ | 0.19 | 0.16 | 0.24 |
| Number of observations | 438 | 438 | 438 |

5B: Debt ratios measured in book value

| Independent Variable | CEO's firm-related wealth change | | |
|---|---|---|---|
| | (1) | (2) | (3) |
| Size: log (book value of assets) | | | 42345.64 ** (2.48) |
| Risk: Stock volatility | | | -21749.21 * (-1.81) |
| Book value of leverage | -13308.45 *** (-3.07) | | -13686.08 *** (-3.08) |
| Book value of subdebt ratio | | -424.38 (-0.36) | 496.61 (0.42) |
| Return to shareholders | 8603.82 * (1.70) | 146.26 (0.90) | 11898.58 ** (2.29) |
| Size * Return to shareholders | | | 35.40 (0.38) |
| Risk*Return to shareholders | | | 264.06 ** (2.12) |
| Book value of leverage *Return to shareholders | -89.16 (-1.63) | | -139.51 ** (-2.40) |
| Book value of subdebt ratio *Return to shareholders | | 49.23 *** (3.16) | 58.29 *** (3.32) |
| $R^2$ | 0.19 | 0.17 | 0.26 |
| Number of observations | 438 | 438 | 438 |

Table 6: Summary statistics of banks with different BOPEC Rating

This table compares bank characteristics and CEO compensation structure for bank-years with different BOPEC ratings. The sample consists of 606 bank CEO-years from year 1992 to 2000. Dollar values are in constant year 2000 dollars. Except for the numbers in percentage, compensation numbers are in thousands of dollars and bank size-related are in millions of dollars. Volatility of dollar return is equal to stock volatility times the average of a bank's beginning-of-year market value and its end-of-year market value. Dollar return to shareholders is equal to the bank's beginning-of-year market value times its annual stock return. Book value of leverage ratio is equal to one minus the ratio of book value of common equity relative to the total asset value. Market value of leverage ratio is equal to one minus the ratio of market value of common equity relative to the market value of assets, which is in turn defined as book value of assets minus book value of common equity plus market value of common equity. Subordinated debt is measured as a bank's long-term non-depository debt. Book value of subdebt ratio is subdebt divided by book value of assets. Market value of subdebt ratio is subdebt divided by market value of assets. CEO's firm-related wealth change is defined as the sum of salary, bonus, other cash compensation, change in value of option holdings, change in value of restricted stocks, profits from exercising options and change in value of direct equity holdings. Due to data confidentiality, BOPEC ratings can not be disclosed.

| | BOPEC Rating | | | |
|---|---|---|---|---|
| Variables | 1 | 2 | 3 | 4 |
| Book value of assets | 34295.56 | 60838.81 | 60522.62 | 163386.30 |
| Market value of equity | 6457.72 | 9394.34 | 4311.16 | 7533.43 |
| Stock return volatility | 1.73% | 1.90% | 2.42% | 2.35% |
| Volatility of dollar return | 109.35 | 181.20 | 84.30 | 141.04 |
| Annual stock return | 23.82% | 23.93% | 42.19% | 74.52% |
| Return to shareholders | 1007.85 | 1188.20 | 878.59 | 3160.41 |
| Book value of leverage ratio | 91.88% | 92.28% | 93.27% | 95.12% |
| Market value of leverage ratio | 81.45% | 84.34% | 90.79% | 94.16% |
| Book value of subdebt ratio | 6.38% | 6.20% | 5.38% | 7.60% |
| Market value of subdebt ratio | 5.63% | 5.69% | 5.30% | 7.60% |
| Salary | 642.34 | 676.81 | 721.09 | 962.50 |
| Bonus | 823.25 | 1098.73 | 751.09 | 635.16 |
| Other cash compensation | 324.28 | 248.91 | 421.06 | 0.11 |
| Option grants | 1285.33 | 2101.01 | 760.33 | 1334.76 |
| Grants of restricted stocks | 396.39 | 733.94 | 232.15 | 0.00 |
| Value change of option holdings | 2733.65 | 3669.12 | 1036.39 | . |
| Value change of restricted stocks | 285.96 | 686.64 | 490.12 | . |
| Profits from exercising options | 1236.12 | 1172.45 | 699.38 | 38.16 |
| Equity holding | 1.01% | 1.57% | 4.72% | 0.18% |
| Value change of equity holding | 10774.70 | 15056.44 | 3159.06 | . |
| CEO's firm-related wealth change | 17105.11 | 23181.38 | 9781.77 | . |

Table 7: Effects of BOPEC rating on pay-performance sensitivity

The sample consists of 606 bank CEO-years from year 1992 to 2000. The dependent variable, CEO's firm-related wealth change, is defined as the sum of salary, bonus, other cash compensation, change in value of option holdings, change in value of restricted stocks, profits from exercising options and change in value of direct equity holdings. Among the independent variables, volatility of dollar return is equal to stock volatility times the average of a bank's beginning-of-year market value and its end-of-year market value. Return to shareholders is measured in dollar terms and is equal to the bank's beginning-of-year market value times its annual stock return. Book value of leverage ratio is equal to one minus the ratio of book value of common equity relative to the total asset value. Market value of leverage ratio is equal to one minus the ratio of market value of common equity relative to the market value of assets, which is in turn defined as book value of assets minus book value of common equity plus market value of common equity. Subordinated debt is measured as a bank's long-term non-depository debt. Book value of subdebt ratio is subdebt divided by book value of assets. Market value of subdebt ratio is subdebt divided by market value of assets. T-statistics are in parentheses. Regression estimates include CEO-bank (for each unique combination of CEO and bank) and year fixed effects. The sign * denotes significance at 10% level using two-tailed test; ** denotes significance at 5% level using two-tailed test; *** denotes significance at 1% level using two-tailed test.

| Independent Variable | CEO's firm-related wealth | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) leverage and subdebt in market value | (4) leverage and subdebt in book value |
| Size: log (book value of assets) | | 52833.96 *** | 41544.90 ** | 34112.78 ** |
| | | (2.91) | (2.40) | (2.05) |
| Risk: Volatility of dollar return | | -26.38 | -38.69 ** | -25.31 |
| | | (-1.56) | (-2.35) | (-1.62) |
| Leverage | | | | -7127.37 * |
| | | | | (-1.77) |
| Subdebt ratio | | | | 1382.85 |
| | | | | (1.35) |
| BOPEC rating | 19114.93 ** | 6647.45 | 6690.15 | 8814.83 |
| | (2.29) | (0.85) | (0.91) | (1.23) |
| Return to shareholders | 1.57 | 133.86 *** | 74.63 *** | 379.17 *** |
| | (0.37) | (6.98) | (3.51) | (7.69) |
| Size * Returns to shareholders | | -12.35 *** | -0.61 | -5.75 *** |
| | | (-7.04) | (-0.25) | (-3.06) |
| Risk* Returns to shareholders | | 0.01 ** | -0.01 ** | -0.00 |
| | | (2.52) | (-2.14) | (-0.86) |
| Leverage *Return to shareholders | | | | -3.55 *** |
| | | | | (-5.80) |
| Subdebt ratio *Return to shareholders | | | | 0.87 *** |
| | | | | (4.29) |
| Bopec*Return to shareholders | 0.73 | 8.79 *** | 8.09 *** | 7.56 *** |
| | (0.33) | (3.63) | (3.55) | (3.42) |
| $R^2$ | 0.16 | 0.31 | 0.40 | 0.45 |
| Number of Observations | 438 | 438 | 438 | 438 |