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Managerial Incentives and the Choice between Public and Bank Debt

BY

Costanza Meneghetti

A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree

Of

Doctor of Philosophy

In the Robinson College of Business

Of

Georgia State University

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ACCEPTANCE

This dissertation was prepared under the direction of Costanza Meneghetti Dissertation Committee. It has been approved and accepted by all members of that committee, and it has been accepted in partial fulfillment of the requirements for the degree of Doctoral of Philosophy in Business Administration in the Robinson College of Business of Georgia State University.

H. Fenwick Huss

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ABSTRACT

Managerial Incentives and the Choice between Public and Bank Debt

BY

Costanza Meneghetti

August 2008

Committee Chair: Jayant R. Kale

Major Academic Unit: Department of Finance

This paper proposes that managerial incentive compensation affects the firm choice between public and bank debt. To motivate the case I analyze a simple model with complete and perfect information that implies a positive relation between managers' incentive compensation and preference toward bank debt. Using firm-level data over the period 1992-2005, I empirically examine the relation between managerial incentives and financing decisions. Specifically, I examine whether managers whose compensation is tied to firm performance choose bank over public debt as a commitment mechanism to reduce the cost of debt. Consistent with a monitoring role of banks, I find that the probability of choosing bank over public debt is positively related to the level of incentive compensation. Further, I find that public lenders price the incentive alignment between manager and shareholders by increasing the cost of debt, while the overall cost of bank loan does not depend on the manager's incentive compensation. Finally, I find that banks are more likely to include a collateral provision in the debt contract if the manager's compensation is tied to firm performance.

JEL classification: G32, G34, J33, D82.
Keywords: managerial incentives, asset substitution, stockholder-bondholder conflicts, bond yields, loan spread.

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1. Introduction

Bank loans and public bonds are today the main source of external financing for U.S. corporations. According to the Flow of Funds Accounts of the United States, at the end of the fourth quarter of 2007 the net flows from non-financial non-farm corporate bonds and bank loans were $509.5 billion, while the net flow from new equity issues was a negative $1,157.6 billion. Net flows from new equity issues have been consistently negative in the past 10 years. Due to the importance of debt as a financing source for U.S. corporations, it is important to understand the determinants of the firm debt structure decisions. In this paper, I try to contribute with both theory and evidence. I develop a simple theoretical model of the role of managerial incentives on the choice between public and bank debt, and present strong empirical evidence that the manager's incentive compensation is a determinant of the firm financing choices.

This paper proposes that managers' compensation structure affects the firm choice between public and bank debt. To motivate this case I develop a simple dynamic model with complete and perfect information where shareholders cannot directly control the firm financing and investing decisions, but rely on managers' choices. Tying compensation to stock performance aligns managers' and shareholders' preferences, but it also provides managers with the incentive to benefit shareholders at the expense of lenders by substituting risky assets for safe ones. Lenders cannot observe managers' investing choices, but they can anticipate the asset substitution incentives and demand a higher return, thereby imposing a cost on the firm. Banks, as opposed to public lenders, can monitor managers' investing choices by receiving a costly signal. Thus, they can prohibit managers from investing in risky projects, and punish the firm if a violation of this provision is detected. The probability of being detected and the extent of the punishment limit managers' incentives to engage in asset substitution activities. Banks can also limit managers' risk-shifting incentives by collateralizing the loan. Rational lenders anticipate that the incentives for asset substitution are weaker and require a lower rate. The model predicts that managers whose compensation is tied to firm performance choose bank loans and submit to bank monitoring as a commitment mechanism to reduce the cost of debt.

The main results of this paper are empirical. Three hypotheses can be built from the model. First, managers whose interests are aligned with shareholders' through incentive compensation commit to limit asset substitution activities by submitting to bank monitoring to reduce the firm financing costs. Second, bondholders increase the cost of debt to be compensated for the asset substitution incentives of an aligned manager, while banks monitor the firm to limit managers' incentives. Finally, banks are more likely to include a collateral provision in the debt contract if the manager's compensation is tied to firm performance. I gather firm-level data on 631 bank loans and 1567 straight bonds over the period 1992-2005 and study the effect of managers' Pay-Performance-Sensitivity on firm choice between public and bank debt, borrowing costs, and inclusion of a collateral provision in the debt contract. I find evidence that a manager with high Pay-Performance-Sensitivity prefers bank over public debt. I also find that bondholders charge a higher interest rate to managers with high Pay-Performance-Sensitivity, while the overall cost of loans does not depend on the manager's incentive compensation. Finally, I find that banks include a collateral provision in the debt contract more often if the manager's Pay-Performance-Sensitivity is high.

The article is organized as follows: in Section 2 I review the literature; in Section 3, I develop the model; in Section 4 I describe the data. In Sections 5 and 6 I test my hypotheses; Section 7 concludes the paper.

2. Literature Review

My paper is directly related to research describing the effect of incentive compensation on the choice of the firm financing sources (see, e.g., Hoshi, Kashyap, and Scharfstein, 1993; Zwiebel, 1996; Almazan and Suarez, 2003; Denis and Mihov, 2003; Khurana, Nejadmalayeri, and Pereira, 2005). I show that managers whose compensation is tied to firm performance have incentives to engage in asset substitution activities; also, I show that aligned managers commit to avoid risk-shifting activities by choosing bank over public debt. My study contributes to this literature by presenting strong evidence that manager's incentive compensation is a determinant of the choice of the firm financing sources, and by

providing an alternative explanation of the link between managerial incentive compensation and preference for bank debt.

My paper combines ingredients from different strands of the literature. The intuition behind the relation between asset substitution and incentive compensation comes from a strand of literature (see, e.g., Jensen and Meckling, 1976; Galai and Masulis, 1976; Myers and Majluf, 1984; Parrino and Weisbach, 1999) that shows that shareholders of a levered firm have incentives to substitute safe assets with risky ones to expropriate lenders. Additionally, Amihud and Lev (1981) show that the preferences of the person in charge of the firm financing and investing decisions, the manager, are not necessarily aligned with the preferences of the firm owners. There are recent empirical papers (Datta, Iskandar-Datta, and Raman, 2001; Ryan and Wiggins, 2001) that find evidence consistent with the intuition that the asset substitution problem is more severe when the manager's compensation is tied to firm performance.

My paper also builds on the insights of theoretical (see, e.g., Leland and Pyle, 1977; Diamond, 1984; Fama, 1985; Berlin and Loeys, 1988; Yosha, 1993; Chemmanur and Fulghieri, 1994) and empirical papers (see, e.g., Houston and James, 1996; Johnson, 1997a and 1997b; Cantillo and Wright, 2000; Santos and Winton, 2005) that investigate the role of banks as information producers. More specifically, I follow the literature that examines the role of banks as ex-post monitors of the firm actions (see, e.g., Mayers, 1977; Diamond, 1991; Rajan, 1992). This choice is supported by empirical research that presents evidence of the banks' ability to reduce ex-post information asymmetries through monitoring (see, e.g., Krishnaswami, Spindt, and Subramaniam, 1999; Liu, 2004), and the monitoring ability of banks with respect to public debt (see, e.g., Best and Zhang, 1993; Datta, Iskandar-Datta and Patel, 1999).

This paper also contributes to the research on the determinants of borrowing costs. Empirical studies (see, e.g., Dennis, Nandy, Sharpe, 2000; John, Lynch, and Puri, 2003; Gottesman and Roberts, 2004; Booth and Booth, 2006) examine the impact of borrower and bank characteristics and loan features on loan pricing. There are papers (see, e.g., Bhojraj and Sengupta, 2003; Cremers, Nair, and Wei, 2004; Klock, Mansi, and Maxwell, 2005) that examine the effect of board composition, presence of institutional investors and takeover vulnerability on bond yields. Ortiz-Molina (2005) investigates the hypothesis of a

positive and concave relation between incentive compensation and cost of public debt. I contribute to this literature by finding evidence of a positive relation between bond yields and incentive compensation, and no relation between loan spreads and incentive compensation. My findings support Ortiz-Molina (2005) result on the relation between incentive compensation and bond yields. To my knowledge, the relation between incentive compensation and overall cost of loans has not been investigated before.

My model raises a novel prediction regarding the link between managerial incentive compensation and the inclusion of a collateral provision in the debt contract. There are theoretical and empirical papers (see, e.g., Berger and Udell, 1990; Berger and Udell, 1995; Carey, Post, and Sharpe, 1998; John, Lynch, and Puri, 2003; Booth and Booth, 2006) that suggest that collateral is a risk-reducing feature that can be included in a debt contract to reduce borrowing costs. My model contributes to this strand of the literature by showing that lenders include a collateral provision in the debt contract to reduce the risk-shifting incentives induced by the manager's compensation. In the empirical tests I find support for the model prediction of a positive relation between collateral and managerial incentive compensation. To my knowledge, this relation has not been investigated before.

3. The Model

3.1 Model Setup

Two projects are available to the firm, *R* and *S*. *R* yields a terminal cash flow *Z* with probability $p \geq 0.5$, and 0 otherwise. S yields a terminal cash flow of *H* with probability $q \geq 0.5$, and 0 otherwise. $Z > H$, but $pZ < qH$. Both projects require an initial investment of *I* and have a positive net present value: $E(R) = pZ - I > 0$ and $E(S) = qH - I > 0$. These parametric assumptions imply that project *R* has the highest variance. I also assume that the discount rate is 0.

As in Almazan and Suarez (2003), the manager is in charge of the investment and financing decisions, has no wealth, is protected by limited liability, and has a 0 reservation level of utility. His compensation consists in a semi-fixed salary that depends on the outcome of the project, and in an

incentive component given by a fraction $0 < \alpha < 1$ of the firm value. Following John and John (1993), the semi-fixed salary is W if the project succeeds and $W - \xi$, with $W - \xi > 0$, if the project fails. ξ can be interpreted as a salary reduction imposed on the manager when the firm is in financial distress. The firm is assumed to have only equity in the balance sheet and an initial value of E, with $W < E < I$, so that the manager can receive the fixed salary even if the project fails. The firm can raise I by either issuing public bonds or receiving a bank loan. All lenders are assumed to be competitive. I assume that banks monitor the manager's project choice at a fixed cost c. Public lenders, on the other hand, cannot observe the manager's project choice. I describe the monitoring technology in section 3.3.1. Bondholders and banks can also require collateral from the firm. If a collateral provision is included in the contract and the firm defaults, all collateralized assets are transferred to the lender. Employers generally have priority over creditors in case of bankruptcy; however, if outside creditors have collateralized claims, they have priority over everybody else. Thus, if debt is collateralized, even the fixed component of the manager's compensation is at risk.

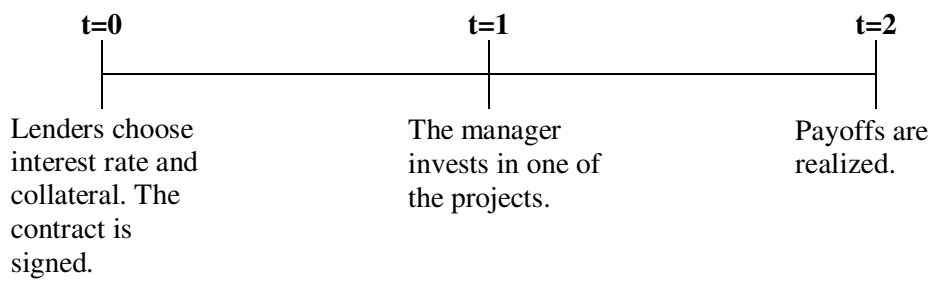
The parameters of the model (Z, H, E, I, q, p, W, ξ, and α) and the players' utility functions are common knowledge. However, lenders cannot observe the manager's project choice. The final outcome is assumed to be observable but not verifiable: lenders can observe a success or a failure, but cannot infer the manager's project choice. Thus, a contract between the lenders and the firm cannot be written on the final outcome of either project.

3.2 Public debt

Assume for now that the firm can only raise money by issuing straight bonds, and that investors cannot monitor the project choice. The timing of the game is as follows: in t=0 lenders decide what interest rate to charge the firm, and if a collateral provision should be included in the contract. The manager observes the terms of the loan. The contract is signed. In t=1 the manager invests in one of the

projects. His decision is not observable by bondholders. Finally, in t=2, all payoffs are realized. Figure 1 describes the timing of the game.

Figure 1: timing of the game



3.2.1 Public debt - The manager's investment choice

I now use backwards induction to find the equilibrium interest rate and project choice. I start with the manager's decision in t=1. The manager knows the interest rate offered by the lenders in t=0, and with that information chooses the project that maximizes his expected profit $E_j^M(P_i, r_j)$ such that $E_j^M(P_i, r_j) \geq 0$, where P_i, with $i = \{S, R\}$, indicates the project choice, and r_j, with $j = \{NC, C\}$, indicates the interest rate offered by lenders and the inclusion of a collateral provision. *NC* indicates non-collateralized debt, while *C* indicates collateralized debt. Given this payoff structure, the manager's choice depends on the interest rate offered by bondholders. The manager's reaction function is described in Lemma 1 (all proofs are in the Appendix):

Lemma 1

(i) If public lenders do not require collateral, the manager's reaction function is

$$f_M(r_{NC}) = \begin{cases} R \text{ if } & r > r_{NC}^* \\ S \text{ if } & r < r_{NC}^* \end{cases} \qquad \text{where } r_{NC}^* = \frac{(qH - pZ)}{(q-p)I} + \frac{E-W}{I} + \frac{\xi}{\alpha I} - 1$$

(ii) If public lenders do require collateral, the manager's reaction function is

$$f_M(r_C) = \begin{cases} R \text{ if } & r > r_C^* \\ S \text{ if } & r < r_C^* \end{cases} \qquad \text{where } r_C^* = \frac{(qH - pZ)}{(q-p)I} + \frac{E-W}{I} + \frac{W}{\alpha I} - 1$$

To focus on non trivial results, I assume that $r_C^*(\alpha = 1) \cong 0$: this is equivalent to assuming that with perfect alignment the manager always prefers the risky project. Lemma 1 states that if the interest rate charged by bondholders is above the threshold r_{NC}^* (r_C^*), the manager invests in the risky project *R*; otherwise he invests in the safe project *S*. Thus, the manager sometimes invests in the project with lower net present value and higher volatility.

The reason lies in the manager's compensation structure. The manager's compensation is partly fixed. If he invests in the risky project *R*, his profit is *W* with probability *p* and *W*- ξ with probability *(1-p)*. On the other hand, if he invests in the safe project *S*, his profit is *W* with probability *q* and *W*- ξ with probability *(1-q)*. If the fixed component is the only component of the compensation, the manager will always choose the safe project *S*, because for that project the probability of the highest outcome *W* is higher. The same logic applies to collateralized debt.[1] The manager's compensation also consists of an incentive component given by a fraction α of the firm value. For that component alone, the preference toward one of the projects depends on the firm borrowing costs. Intuitively, if the rate is above the threshold, the manager's payoffs in case of project success and failure are not very different: if the project succeeds most of the output goes to the lenders through the interest rate, while if the project fails the manager is left with nothing because the firm defaults. Therefore, the manager's optimal choice is to invest in the project with the highest payoff in case of success. On the other hand, if the interest rate is below the threshold, the manager prefers the project with the highest probability of success.[2] [3]

[1] The situation of a manager that receives only a fixed salary can be captured by the model by setting the parameter α to 0. Notice that, if α=0, the thresholds tend to infinity: therefore, the condition to choose S is always satisfied.

[2] Notice that, when collateral is included, the threshold rate is greater: when the fixed compensation is at risk because of the collateral provision, the manager has more incentive to invest in the project with the highest probability of success (the safe project *S*).

The manager's final choice depends on the combination of the two components of the compensation. Comparative statics shows that if the manager's incentives become more aligned with the shareholders' through a higher level of incentive compensation α, the threshold interest rate r_{NC}^{*} (r_{C}^{*}) becomes smaller, and the condition to invest in the safe project *S* more difficult to satisfy. In other words, aligned managers have more incentives to invest in the risky project. The reason is that, as α increases, the incentive compensation becomes more important with respect to the fixed component, *ceteris paribus*. [4]

3.2.2 Public debt - Bondholders' interest rate choice

Since bondholders can also solve the manager's optimization problem, they anticipate the manager's reaction to each interest rate they offer. Competitive bondholders charge an interest rate that, given the manager's reaction function, guarantees them a non-negative expected profit. Thus, bondholders charge the interest rate r_j that solves $E^L\left(r_j, f_M\left(r_j\right)\right) = 0$, where r_j, with $j = \{NC, C\}$, indicates the interest rate offered by bondholders and the inclusion of a collateral provision. Lenders' expected utility function changes depending on the manager's anticipated project choice. Lenders know that if they offer $r_{NC} < r_{NC}^{*}$ ($r_C < r_C^{*}$), the manager invests in the safe project *S*. Thus, they charge the interest rate r_{NC} that solves $E^L(S, r_{NC}) = qI(1 + r_{NC}) + (1-q)(E + \xi - W) - I = 0$ (with collateral they charge the interest rate r_C that solves $E^L(S, r_C) = qI(1 + r_C) + (1-q)E - I = 0$).

On the other hand, lenders know that the manager's optimal response to $r_{NC} > r_{NC}^{*}$ ($r_C > r_C^{*}$) is to invest in the risky project *R*. Thus, in that case, they charge the interest rate r_{NC} that solves

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[3] It can be shown that the shareholders' threshold interest rates are lower than the manager's thresholds: they prefer the safe project less often. The reason is that shareholders do not receive any fixed compensation.

[4] Comparative statics also shows that when the initial investment *I* increases, the manager has more incentive to invest in the risky project and try to recover the higher project cost. Also, if the probability of success of the safe project *q* increases, the safe project becomes more attractive; on the other hand, if the probability of success of the risky project *p* increases, the manager has more incentive to invest in the risky project. Similarly, if the successful outcome of the safe (risky) project *H* (*Z*) increases, the safe (risky) project becomes more attractive.

$E^L(R, r_{NC}) = pI(1 + r_{NC}) + (1-p)(E + \xi - W) - I = 0$ (if a collateral provision is included, they charge the interest rate r_C that solves $E^L(R, r_C) = pI(1 + r_C) + (1-p)E - I = 0$).

3.1.3 Public debt - The equilibrium project choice and interest rate

In what follows I describe the backwards-induction outcomes (P_i, r_j^i), where P_i, with $i = \{S, R\}$, indicates the manager's project choice, and r_j, with $j = \{NC, C\}$, indicates the interest rate offered by bondholders and the inclusion of a collateral provision. This is done via a proposition. (All proofs are in the Appendix). To simplify the problem, I assume that the model parameters satisfy the restriction $W/\xi < (1-p)/(1-q)$.

Proposition 1.

(i) If $\alpha < \alpha_{NC}^*$ the backwards-induction outcome is (S, r_{NC}^S) and the manager's profit is

$E_{NC}^M(S, r_{NC}^S) = W - (1-q)\xi + \alpha[qH + E + (1-q)\xi - W - I] > 0$. α_{NC}^* *and* r_{NC}^S *are*

$$\alpha_{NC}^* = \frac{q(q-p)\xi}{p[qZ + E + (1-q)\xi - W - I] - q[qH + E + (1-q)\xi - W - I]}$$

$$r_{NC}^S = \frac{I - (1-q)(E + \xi - W)}{qI} - 1$$

(ii) If $\alpha_{NC}^* < \alpha < \alpha_C^*$ the backwards-induction outcome is (S, r_C^S) and the manager's profit is

$E_C^M(S, r_C^S) = qW + \alpha[qH + E - qW - I] > 0$. α_C^* *and* r_C^S *are*

$$\alpha_C^* = \frac{q(q-p)W}{p[qZ + E - qW - I] - q[qH + E - qW - I]}$$

$$r_C^S = \frac{I - (1-q)E}{qI} - 1$$

(iii) Finally, if $\alpha > \alpha_C^*$ *the backwards-induction outcome is* (R, r_{NC}^R) *and the manager's profit is* $E_{NC}^M(R, r_{NC}^R) = W - (1-p)\xi + \alpha[pZ + E + (1-p)\xi - W - I] > 0$. r_{NC}^R *is*

$$r_{NC}^R = \frac{I - (1-p)(E + \xi - W)}{pI} - 1$$

Proposition 1 shows that, for small alphas, the manager invests in the safe project *S*, even without a collateral provision. When $\alpha < \alpha_{NC}^*$ only a small fraction of the manager's compensation is linked to firm value: thus, the manager maximizes the probability of receiving the fixed salary *W* by investing in the project with the highest probability of success. When $\alpha_{NC}^* < \alpha < \alpha_C^*$, and a more consistent fraction of the manager's compensation is tied to firm value, bondholders must impose a collateral provision in the contract to provide the manager with the incentive to invest in the safe project. The collateral provision affects the manager's incentives by putting his fixed compensation at risk. Once again, the manager maximizes his utility by investing in the project with the highest probability of success, *S*. Finally, for $\alpha > \alpha_C^*$, the manager's compensation depends relatively more on the incentive component: thus, the manager has the incentive to invest in the project with the highest outcome, even tough the expected outcome is small. In this case, not even a collateral provision affects the manager's incentives for asset substitution: collateral affects only the fixed component of the compensation, and for high α the fixed component is relatively not important.

Simple manipulations of the equations for the threshold α^*'s show that the numerator is the difference in the expected fixed compensation obtained by choosing *S* over *R*, while the denominator is the difference in the expected incentive compensation obtained by choosing *R* over *S* (for a specific interest rate). Consider the case of r_C^S as an example. $E_C^M(R, r_C^S) = pW + \alpha(p/q)[qZ + E - qW - I]$ is the manager's expected profit when the interest rate is r_C^S and he invests in project *R*. On the other hand, $E_C^M(S, r_C^S) = qW + \alpha[qH + E - qW - I]$ is the manager's profit when the interest rate is r_C^S and

he invests in project *S*. The difference in expected fixed compensation obtained by choosing *S* over *R* is $(q-p)W$, while the difference in expected incentive compensation obtained by choosing *R* over *S* is $(p/q)[qZ+E-qW-I]-[qH+E-qW-I]$. The two expressions represent the numerator and the denominator of α_C^* respectively. If α_C^* is high, the expected advantage of choosing *S* over *R* on the fixed part of the compensation is relatively higher than then expected advantage of choosing *R* over *S* on the incentive component of the compensation. Therefore, it is optimal to invest in the safe project *S*.

To summarize, Proposition 1 states that as the manager's incentive compensation α increases, bondholders first include a collateral provision in the contract, then increase the interest rate.

3.3 Bank debt

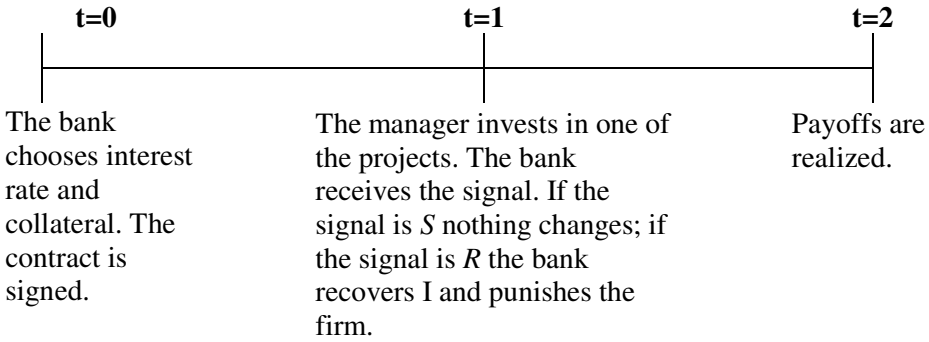
3.3.1 Timing and Monitoring technology

Assume now that firms can only raise *I* from banks. Banks are assumed to be able to monitor the manager's project choice.[5] The timing of the game is as follows: in t=0 the bank decides what interest rate to charge the firm, and if a collateral provision should be included in the contract. The contract is signed. In t=1 the manager invests in one of the projects. The bank receives a signal that can be either *S* for the safe project or *R* for the risky project. Assume that if the signal is *R*, the bank stops the project, recovers *I*, and punishes the firm by liquidating $E-(W-\xi)$ (*E* if the loan is collateralized); if the signal is *S* nothing changes. Finally, in t=2, all payoffs are realized. Figure *2* describes the timing of the game.

The bank pays a fixed cost *c* for the signal. Assume that $P(sig=S \mid proj=S)=1$ and $P(sig=S \mid proj=R)=\phi$. If the manager invests in the safe project, the signal has a precision of 1 and is always *S*. If, on the other hand, the manager invests in the risky project, the signal is wrong with probability ϕ. The monitoring technology is common knowledge. Figure 2 describes the timing of the game.

[5] Altman, Gande, and Saunders (2006) argue that banks' incentives to monitor are likely to be preserved even in the presence of loan syndication and a secondary loan market.

Figure 2: timing of the game



3.3.2 Bank debt - The manager's project choice

As before, this game can be solved by backwards induction. In the second stage (t=1) the manager invests in either *S* or *R* depending on the interest rate offered by the bank and the precision of the signal. Thus, the manager maximizes his expected profit $\overline{E}_j^M\left(P_i, \overline{r}_j, \phi(P_i)\right)$ with respect to project P_i, (with $i = \{S, R\}$) so that $\overline{E}_j^M\left(P_i, \overline{r}_j, \phi(P_i)\right) \geq 0$, where $\overline{r}_j$, with $j = \{NC, C\}$, indicates the interest rate offered by the bank and the inclusion of a collateral provision. Given this payoff structure, the manager's choice depends on the interest rate offered by the bank, the precision of the signal, and the punishment the firm has to suffer if he is caught investing in the risky project. The manager's reaction function is described in Lemma 2 (all proofs are in the Appendix):

Lemma 2

(i) If the bank does not require collateral, the manager's reaction function is

$$g_M(\overline{r}_{NC}) = \begin{cases} R \text{ if } & r > \overline{r}_{NC}^* \\ S \text{ if } & r < \overline{r}_{NC}^* \end{cases} \qquad \text{where } \overline{r}_{NC}^* = \frac{(qH - \phi pZ)}{(q - \phi p)I} + \frac{E - W}{I} + \frac{\xi}{\alpha I} - 1$$

(ii) If the bank does require collateral, the manager's reaction function is

$$g_M(\bar{r}_C) = \begin{cases} R \; if \;\; r > \bar{r}_C^* \\ S \; if \;\; r < \bar{r}_C^* \end{cases} \qquad where \;\; \bar{r}_C^* = \frac{(qH - \phi pZ)}{(q - \phi p)I} + \frac{E - W}{I} + \frac{W}{\alpha I} - 1$$

Lemma 2 states that if the interest rate charged by the bank is above the threshold $\bar{r}_{NC}^*$ ($\bar{r}_C^*$), the manager invests in the risky project *R*; otherwise he invests in the safe project *S*. A comparison with the threshold interest rates of the public debt case (Lemma1) shows that, for $\phi < 1$, $\bar{r}_{NC}^* > r_{NC}^*$ and $\bar{r}_C^* > r_C^*$: with bank debt the condition to invest in the safe project is easier to satisfy. The intuition is that if the signal is to some extent informative (the probability ϕ of receiving the wrong signal is less than 1), the manager investing in the risky project *R* could be detected and lose the incentive component of the compensation as well as part of his fixed salary (all of it if the loan is collateralized). Thus, monitoring can reduce the manager's incentives to invest in the risky project. Notice that as the precision of the signal increases (ϕ diminishes) $\bar{r}_{NC}^*$ and $\bar{r}_C^*$ increase, because the probability of being detected increases, and reduces the manager's incentives to invest in the risky project.[6] [7]

3.3.3 Bank debt - The bank's interest rate

Since the bank can solve the manager's optimization problem as well as the manager, it can anticipate the manager's reaction to each interest rate, and the related signal precision. The competitive bank charges an interest rate that, given the manager's reaction function, guarantees a non-negative expected profit. Thus, the bank charges the interest rate $\bar{r}_j$ that solves $\bar{E}^L(\bar{r}_j, g_M(\bar{r}_j), \phi(g_M(\bar{r}_j))) = 0$,

[6] If $\phi = 1$, then $\bar{r}_{NC}^* = r_{NC}^*$ and $\bar{r}_C^* = r_C^*$: the signal is always wrong, thus there is no monitoring.

[7] As in the case of public debt, if managerial incentives are more aligned with the shareholders' (α increases), the condition that makes the safe project the best choice is stronger (the threshold rates become smaller); when the initial investment I increases, the manager has more incentive to invest in the risky project to try to recover the higher project cost; if the probability of success of the safe (risky) project increases, the safe (risky) project becomes more attractive; if the successful outcome of the safe (risky) project H (Z) increases, the manager has more incentives to invest in the safe (risky) project.

where $\bar{r}_j$, with $j = \{NC, C\}$, indicates the interest rate offered by lenders and the inclusion of a collateral provision.

3.3.4 Bank debt - The equilibrium project choice and interest rate

To focus on non-trivial results, I assume that the model parameters satisfy the restriction $q/\phi p < [qZ + E + (1-q)\xi - W - I]/[qH + E + (1-q)\xi - W - I]$. This assumption guarantees that the outcome $(S, \bar{r}_{NC}^S)$ is not always feasible. In other words, I assume that there for some α the manager, offered the interest rate $\bar{r}_{NC}^S$, invests in the risky project *R*. In what follows I describe the backwards-induction outcomes $(P_i, \bar{r}_j^i)$, where P_i, with $i = \{S, R\}$, indicates the manager's project choice, and $\bar{r}_j$, with $j = \{NC, C\}$, indicates the interest rate offered by the bank and the inclusion of a collateral provision. This is done via a proposition. (All proofs are in the Appendix).

Proposition 2.

(i) If $\alpha < \bar{\alpha}_{NC}^*$ the backwards-induction outcome is $(S, \bar{r}_{NC}^S)$ and the manager's profit is

$\bar{E}_{NC}^M(S, \bar{r}_{NC}^S) = W - (1-q)\xi + \alpha[qH + E + (1-q)\xi - W - I - c] > 0$. *$\bar{\alpha}_{NC}^*$ and $\bar{r}_{NC}^S$ are*

$$\bar{\alpha}_{NC}^* = \frac{q(q-\phi p)\xi}{\phi p[qZ + E + (1-q)\xi - W - I - c] - q[qH + E + (1-q)\xi - W - I - c]}$$

$$\bar{r}_{NC}^S = \frac{I + c - (1-q)(E + \xi - W)}{qI} - 1$$

(ii) If $\bar{\alpha}_{NC}^* < \alpha < \bar{\alpha}_C^*$ the backwards-induction outcome is $(S, \bar{r}_C^S)$ and the manager's profit is

$\bar{E}_C^M(S, \bar{r}_C^S) = qW + \alpha[qH + E - qW - I - c] > 0$. *$\bar{\alpha}_C^*$ and $\bar{r}_C^S$ are*

$$\bar{\alpha}_C^* = \frac{q(q-\phi p)W}{\phi p[qZ + E - qW - I - c] - q[qH + E - qW - I - c]}$$

$$\bar{r}_C^S = \frac{I + c - (1-q)E}{qI} - 1$$

(iii) Finally, if $\alpha > \bar{\alpha}_C^*$ *the backwards-induction outcome is* $(R, \bar{r}_{NC}^R)$ *and the manager's profit is*

$\bar{E}_{NC}^M(R, \bar{r}_{NC}^R) = W - (1-\phi p)\xi + \alpha[\phi p Z + E + (1-\phi p)\xi - W - \phi I - c] > 0$ *if and only if*

$q/\phi p < (qZ + E - qW - I - c)/(qH + E - qW - I - c)$*; otherwise, if* $\alpha > \bar{\alpha}_{NC}^*$ *and* $q/\phi p$ *is above the threshold, the backwards-induction outcome is* $(S, \bar{r}_C^S)$ *and the manager's payoff is*

$\bar{E}_C^M(S, \bar{r}_C^S) = qW + \alpha[qH + E - qW - I - c] > 0$. $\bar{r}_{NC}^R$ *is given by*

$$\bar{r}_{NC}^R = \frac{\phi I + c - (1-\phi p)(E + \xi - W)}{\phi p I} - 1$$

Proposition 2 is qualitatively similar to Proposition 1. It states that if alpha is low ($\alpha < \bar{\alpha}_{NC}^*$) the manager maximizes the probability of receiving the fixed compensation by choosing the project with the highest probability of success (project *S*). For higher alphas ($\bar{\alpha}_{NC}^* < \alpha < \bar{\alpha}_C^*$), the bank has to put the fixed compensation at risk by including a collateral provision to force the manager to invest in the safe project. Finally, for $\alpha > \bar{\alpha}_C^*$, two outcomes are possible: if the precision of the signal $(1-\phi)$ is low enough that $q/\phi p$ is below the threshold, it is not possible to induce the manager to invest in the safe project: thus the bank does not require collateral, but charges the firm a higher interest rate, and the backwards-induction outcome is $(R, \bar{r}_{NC}^R)$. On the other hand, if the precision of the signal is high enough that $q/\phi p$ is above the threshold, the manager invests in the safe project *S* if a collateral provision is included in the contract, and the backwards-induction outcome is still $(S, \bar{r}_C^S)$.

It turns out that $\bar{\alpha}_{NC}^* > \alpha_{NC}^*$ and $\bar{\alpha}_C^* > \alpha_C^*$ if the monitoring cost *c* is small and $\phi < 1$. The intuition is that monitoring, and the related risk of being caught investing in the risky project, affects the manager's incentives for asset substitution: the manager chooses to invest in the safe project more often if

monitored by the bank, because he wants to avoid the punishment the firm would incur if the choice of the risky project was detected. [8]

3.4 The choice between public and bank debt

In what follows I describe the backwards-induction outcomes of the game when the manager can choose the financing source. This is done via a proposition. (All proofs are in the Appendix).

Proposition 3.

(i) If $\alpha < \alpha^*_{NC}$ *the backwards-induction outcome is* (S, r^S_{NC}) *and the manager's expected payoff is*

$$E^M_{NC}(S, r^S_{NC}) = W - (1-q)\xi + \alpha[qH + E + (1-q)\xi - W - I] > 0 \ .$$

(ii) If $\alpha^*_{NC} < \alpha < \overline{\alpha}^*_{NC}$ *the backwards-induction outcome is* $(S, \overline{r}^S_{NC})$ *and the manager's expected payoff is* $\overline{E}^M_{NC}(S, \overline{r}^S_{NC}) = W - (1-q)\xi + \alpha[qH + E + (1-q)\xi - W - I - c] > 0$.

(iii) If $\overline{\alpha}^*_{NC} < \alpha < \overline{\alpha}^*_C$ *the backwards-induction outcome is* $(S, \overline{r}^S_C)$ *and the manager's expected payoff is*

$$\overline{E}^M_C(S, \overline{r}^S_C) = qW + \alpha[qH + E - qW - I - c] > 0.$$

(iv) If $\alpha > \overline{\alpha}^*_C$ *and* $q/\phi p < (qZ + E - qW - I - c)/(qH + E - qW - I - c)$, *the backwards-induction outcome is* (R, r^R_{NC}) *and* $E^M_{NC}(R, r^R_{NC}) = W - (1-p)\xi + \alpha[pZ + E + (1-p)\xi - W - I] > 0$ *is the manager's payoff. Otherwise, if* $\alpha > \overline{\alpha}^*_{NC}$ *and* $q/\phi p$ *is greater than the threshold, the backwards induction outcome is* $(S, \overline{r}^S_C)$ *and the manager's expected payoff is*

$$\overline{E}^M_C(S, \overline{r}^S_C) = qW + \alpha[qH + E - qW - I - c] > 0.$$

[8] Notice that the threat of punishment must be credible to affect the manager's incentives. The threat is credible only if a bank that receives the signal *R* has the incentive to punish the firm instead of just hoping for a successful outcome of the risky project. It is straightforward to show that the punishment maximizes the bank expected payoff when the signal is *R*.

Proposition 3 illustrates the main result of the model. For low levels of alpha the manager invests in the safe project *S* without monitoring or the inclusion of a collateral provision in the contract. This result is driven by the relative importance the manager places on the fixed component of his compensation: for low α the manager maximizes the probability of receiving the fixed compensation in full by choosing the project with the highest probability of success (*S*). Because the manager does not need to be monitored to avoid risk-shifting activities, there is no need to pay the monitoring cost *c* associated with bank debt: the manager chooses to issue public bonds. For $\alpha_{NC}^{*} < \alpha < \overline{\alpha}_{NC}^{*}$ two outcomes are feasible: (S, r_C^S) and $(S, \overline{r}_{NC}^S)$. Without bank monitoring the manager invests in the safe project only if a collateral provision is included in the contract, while with bank monitoring the collateral provision is not necessary, because the expected cost of being caught investing in project *R* is too high. It can be shown that the manager's expected payoff is higher with bank monitoring: the backwards-induction outcome is $(S, \overline{r}_{NC}^S)$.[9] If $\overline{\alpha}_{NC}^{*} < \alpha < \overline{\alpha}_C^{*}$ the two feasible outcomes are (R, r_{NC}^R) and $(S, \overline{r}_C^S)$. Without bank monitoring not even a collateral provision can induce the manager to invest in the safe project. On the other hand, with bank monitoring and a collateral provision the risk of being caught investing in the risky project and the risk of losing the fixed compensation in case of default induce the manager to invest in the efficient project *S*. It can be shown that, for these levels of α, the manager's expected payoff is higher with bank monitoring. Thus, the backwards-induction outcome is $(S, \overline{r}_C^S)$.

Finally, I investigate the case $\alpha > \overline{\alpha}_C^{*}$. Suppose first that the probability ϕ that the signal is wrong is high enough that $q/\phi p$ is below the threshold. If that is the case, not even bank monitoring can change the manager's incentives to invest in the risky project, because the probability that the manager is caught violating the covenant that prohibits the firm to invest in the risky project is too low. Thus, two outcomes are feasible: (R, r_{NC}^R) and $(R, \overline{r}_{NC}^R)$. If monitoring cannot affect the manager's asset

[9] Notice that $r_C^S < \overline{r}_{NC}^S$: the interest rate charged to the firm is lower with public debt; however, the manager prefers to submit to bank monitoring and avoid the collateral provision in order to protect his fixed compensation.

substitution incentives, there is no need to pay the monitoring cost *c*: thus, the backwards-induction outcome is (R, r_{NC}^{R}) and the manager chooses public debt. On the other hand, if the probability ϕ that the signal is wrong is low enough that $q/\phi p$ is greater than the threshold, bank monitoring can affect the manager's incentives: because the probability of being caught and punished is now high enough, the manager has the incentive to invest in the safe project and avoid the potential punishment. The two feasible outcomes are (R, r_{NC}^{R}) and $(S, \bar{r}_{C}^{S})$: it can be shown that the manager's expected payoff is higher with bank monitoring, so that $(S, \bar{r}_{C}^{S})$ is the backwards-induction outcome.

To summarize, Proposition 3 shows that the relation between α (the interest alignment between manager and shareholders) and the manager preference toward bank debt is positive. Managers whose compensation depends mainly on the fixed component prefer to invest in the project with the highest expected payoff, and need no monitoring; on the other hand, managers with relatively high incentive compensation have the incentive to invest in the project with the highest outcome, but submit to bank monitoring to reduce borrowing costs. Banks can force the manager to invest in the efficient project by monitoring his project choice and punishing the firm if risk-shifting is detected. If the bank is not able to monitor the manager's choices closely (ϕ is high), the relation between α and the preference towards bank debt is concave: when monitoring and the inclusion of a collateral provision are not enough to deter the manager from risk-shifting activities, bank debt loses its advantage over public debt. Thus, the manager prefers to save the monitoring cost *c* by choosing public debt.

According to Proposition 3, if $\alpha_{NC}^{*} < \alpha < \bar{\alpha}_{C}^{*}$ the manager has the opportunity to invest in the efficient project only if bank loans are available. In terms of social welfare, the total NPV for manager, shareholders and lenders improves by $qH - pZ - c$ because the manager is now forced to invest in project with higher NPV and lower volatility. The cost to society is only the monitoring cost c; however, if banks are competitive, c is very low.

Proposition 3 provides an alternative explanation of the relation between incentive compensation and the preference towards bank debt. In Hoshi, Kashyap, and Scharfstein (1993) and Almazan and Suarez (2003) the relation between incentive compensation and financing decisions is driven by the manager's incentives to extract private benefits at the expense of the shareholders; the role of bank monitoring and incentive compensation is to protect shareholders' interest by forcing the manager to avoid pet projects, and to invest efficiently. In my model, on the other hand, incentive compensation provides the manager with the incentive to engage in asset substitution activities at the expense of the lenders, and bank monitoring is a commitment mechanism to limit the manager incentives for risk-shifting activities and reduce the firm borrowing costs. This intuition has testable implications on the links between incentive compensation, borrowing costs, and collateralization decision that distinguish it from Hoshi, Kashyap, and Scharfstein (1993) and Almazan and Suarez (2003) models.

I make some simplifying assumptions to develop the model: I consider only a non-repeated game with no renegotiation, I model incentive compensation as exogenous, and I analyze firms with no existing debt. In my model the game ends at period 2 when the payoffs are realized. It is possible, though, to develop a scenario in which the game is repeated multiple times and firms that invested in the inefficient project in the first stage are refused additional financing. In this scenario, there would be no asset substitution, because the cost of losing all future financing opportunity would be too high. The problem with such a model is that the coordination between banks would be difficult to achieve. Additionally, empirical evidence suggests that managers do engage in asset substitution activities (Parrino and Weisbach, 1999), even more when their compensation is tied to firm performance (Datta, Iskandar-Datta, and Raman, 2001; Ryan and Wiggins, 2001). Renegotiation does not change the result of my model. Depending on the parameters, lenders may provide new financing hoping to recover the money already spent on the firm. However, this new loan/bond must have a higher interest rate, thus exacerbating the manager's incentive to engage in asset substitution activities. Thus, although renegotiation might be possible, it does not affect the relation between incentive compensation and spreads.

In my model firm owners want the manager to protect their interests and maximize shareholders' value. They achieve this objective by granting the manager incentive compensation. There is no need for them to make the compensation scheme contingent on the manager's financing choices. From an empirical standpoint, it is unusual to observe managerial contracts with rewards that depend directly on the CEO's financing choices. Additionally, I find that my empirical results are robust to endogeneity concerns on the incentive variables.

Existing firm debt does not change the results of the model. Additional claims on the firm profit give the manager even more incentives to invest in the project with the highest outcome (the risky project *R*). Myers and Majluf (1984), however, show that if the firm uses up the ability to issue low risk debt, it eventually incurs in the underinvestment problem. In this paper I do not study the agency problem of underinvestment: my model is focused on managers that have already decided to invest and must choose between public and bank financing. In this framework, the assumption of no initial leverage is not restrictive.

3.5 Testable hypotheses

My model has empirical implications on the cross-sectional relation between managerial incentive compensation and the probability that a bank loan is preferred to public bonds as the firm financing source. The model predicts that when the manager's compensation is tied to firm performance, the manager prefers bank to public debt. The model also predicts that, if the costly signal received by the bank is not very precise, the bank cannot limit the risk-shifting incentives of a manager with high incentive compensation. The manager, in that case, prefers public debt. In empirical terms, the model predicts a positive and concave relation between the manager's incentive compensation, and the preference toward bank debt. In my model the incentive alignment between manager and shareholders is captured by the fraction of the firm value granted to the manager as incentive compensation (α). Thus, α represents the manager's stock holdings. In real contracts, however, incentive compensation does not consist of stock holdings only: managers are usually awarded stock options with different vesting periods,

maturities, and strike prices. The logic of the argument does not change: incentive alignment, however achieved, increases the manager's incentives to asset substitution. From an empirical standpoint, incentive alignment between manager and shareholders can be captured by Core and Guay (2002) Pay-Performance-Sensitivity to account for stock options as well as stock holdings. As alternative measure I use DELTA, the sensitivity of option value to changes in the underlying stock price.

The choice of incentive compensation variables needs some additional discussion. What drives investment and financing choices in my model is the conflict of interest between shareholders and lenders. If the firm is in some level of financial distress, shareholders have the incentive to forgo safe, profitable project if most of the profit must be paid back to lenders. On the other hand, they do have the incentive to invest in projects that, although with a lower expected value, have a higher outcome in case of project success. Managers are usually the decision-takers in the firm, and their risk preferences and incentives may be different. Tying compensation to stock performance aligns managers' and shareholders' preferences: thus, managers that hold firm stocks and options share owners' incentive to invest in the risky project and expropriate lenders. In my model, the incentive alignment between manager and shareholders is the trigger of the asset substitution activities. In the empirical tests I measure incentive alignment with Pay-Performance-Sensitivity and Delta.

Vega, the sensitivity of option value to changes in the volatility, is a direct measure of the effect of stock options on manager's preferences toward risk. Stock option value increases with the volatility of the underlying asset: thus, stock options give managers incentives to increase the volatility of the firm equity. This is not, however, the incentive I try to measure: my focus is on the manager's incentive to forgo safe projects for less efficient ones to expropriate bondholders. The incentive for such asset substitution activities depends on the interest alignment between manager and shareholders, which is best measured by Pay-Performance-Sensitivity and Delta. Those will be the main incentive compensation variables in the regressions.

My model predicts that bondholders anticipate asset substitution activities and price the manager's incentive compensation. The model also predicts that banks reduce the manager's asset

substitution incentives ex-ante, and do not need to increase the borrowing costs. Empirically, the model predicts a positive relation between manager's incentive Pay-Performance-Sensitivity and bond spreads, and no relation between Pay-Performance-Sensitivity and loan spreads.

My model also has a novel empirical implication on the cross-sectional relation between manager's incentive compensation and the inclusion of a collateral provision in the loan contract. The model predicts that banks collateralize the loan more often if the manager's compensation is tied to firm's performance. The intuition is that a collateral provision can, as a risk-reducing feature of the loan, limit the manager's incentives to asset substitution. Empirically, the model predicts that the probability of including a collateral provision in the debt contract is positively related to the CEO's Pay-Performance-Sensitivity.

4. Data and variable definition

4.1 Data

To test my hypotheses I use data on bank loans, bond issues, firm characteristics, and executive compensation. I obtain the sample of private corporate debt from Dealscan, a database created by Loan Pricing Corporation (LPC). I extract loan information for the period 1992-2005. The sample consists of loans made by US banks to US companies. I exclude utilities and financial firms from the sample of borrowers, and I only keep in the sample loans that are not refinancing agreements. Dealscan provides information on loans at facility level: a deal is a package of multiple facilities or tranches, each usually different in terms of pricing, maturity, and amount. For the main tests I aggregate the information from facilities that belong to the same loan in a single observation. Specifically, I compute dollar amount, spread, and maturity of the loan as weighted averages of dollar amounts, spreads, and maturities of the loan tranches. I compute the weights as the ratio of tranche amount to deal amount. I refer to the Dealscan sample as the private sample.

I obtain data on straight bond issues from Fixed Investment Securities Database (FISD), a database created by Mergent. I extract bond information for the period 1992-2005. The sample consists of

straight corporate bonds issued by US firms in US markets. I eliminate utilities and financial firms from the sample of issuers. I refer to this sample as the public sample. I obtain information on executive compensation from ExecuComp for the period 1992-2005. Finally, I obtain data on firm characteristics from Compustat North America over the same time period. I am interested in the information that is available to the lenders at the time of the loan: thus, I extract information from ExecuComp and Compustat from the last available financial statement at the time of the loan/bond issue.

4.2 Variable Description

4.2.1 Managerial Incentive Alignment

I use Pay-Performance-Sensitivity to measure the incentive alignment between manager and shareholders. Following Core and Guay (2002), I define Pay-Performance-Sensitivity (PPS) as the sensitivity of the CEO's portfolio to firm value, and compute it as the dollar increase in the manager's portfolio for $1,000 increase in firm value. My alternative measure for incentive alignment is DELTA, measured as the dollar increase in the value of the manager's stock options for a $1 increase in stock price.

4.2.2 Choice between Public and Private Debt

I use the ratio new bank debt to total new debt in a year to measure the manager's preference toward bank debt. I call this variable %NEW BANK.

4.2.3 Cost of Debt

I use Dealscan's overall cost variable as a measure of the cost of bank loans, and label this variable SPREAD. Dealscan provides the overall cost of the loan, including annual and upfront fees, as a spread over the London interbank offering rate (LIBOR). If the base rate is not the LIBOR, Dealscan converts the spread over the base rate to spread over LIBOR by adding or subtracting a constant differential that reflects historical differences between the relevant rates. For the public sample, I define

SPREAD as the spread over a Treasury bond of comparable maturity. The variable SPREAD is not directly comparable across the two groups because bank loan rates are floating, while public bond rates are fixed. I use Cook and Spellman (2006) method to create the fixed equivalent of a floating rate. I call this variable RATE PAID. For bank loans, I compute RATE PAID by adding the then one-month LIBOR and the then prevailing rate for the Treasury bond with the same maturity to SPREAD, and subtracting the then three-month Treasury rate. For public bonds, I define RATE PAID as the offering yield in basis points. I delete from the sample all observations for which the variables SPREAD is missing.

4.2.4 Collateral

I define a dummy variable COLLATERAL that takes a value of 1 if the bond /loan is collateralized, 0 otherwise. There are 380 missing values for the variable COLLATERAL in the private sample and 91 in the public sample. I exclude the missing observations only where the variable COLLATERAL is included in the tests.

4.2.5 Control Variables

I use dummy variables for the second and third terciles of firm total assets (SIZE2 and SIZE3) to capture size effects and non linearities in the relation between size and the dependent variables of my study. I include the ratio of operating income before depreciation and total assets (PROFITABILITY) and a dummy variable equal to 1 if the firm reported a loss (LOSS) to measure firm profitability. I use two measures of growth opportunities: the ratio of R&D expense and total assets (R&D), and the book value of debt plus market value of common and preferred stock divided by total assets (and MARKET-TO-BOOK). I include the age of the firm (AGE) to capture reputation effects.

My proxies for potential financial distress are the ratio of liabilities to total debt (BOOK LEVERAGE), the ratio of operating income before depreciation to interest expense (INTEREST COVERAGE), and Altman (1981) Z-SCORE, computed as

$$1.2*\frac{Working\ Capital}{Total\ Assets}+1.4*\frac{Retained\ Earnings}{Total\ Assets}+3.3*\frac{EBIT}{Sales}+0.999*\frac{Sales}{Total\ Assets}+\quad+0.6*\frac{Market\ Value\ of\ Equity}{Market\ Value\ of\ Liabilities}.$$ To account for overall firm risk I also include in the analysis the moving standard deviation of daily returns on a window of 30 days (RETURNS VOLATILITY), and the ratio of net plant and equipment to total assets (TANGIBILITY)[10]. I include in the analysis the dummy variable BLOCK to account for the presence of block holders.

I include in all regressions the variable MATURITY, calculated as the maturity of the loan/bond in years, and DEAL AMOUNT, computed as total amount of the loan/bond issue. Finally, I include the variable INTEREST VOLATILITY, measured as the monthly average of the 12-month moving standard deviation of daily yields on 10-years U.S. T-bonds. All continuous variables are winsorized at 1%. Regressions include industry dummies based on the first 2 digits of the NAICS code, and year dummies. The private and public samples have 631 and 1567 observations respectively. A list of all variables and their definition is provided in Table I.

5. Univariate Analysis

Table II presents a description of the private sample. Panel A shows that the vast majority (97.65%) of bank loans are syndicated deals. Panel B shows that the most common facility type is the revolver line with a maturity of more than one year (53.95%) followed by the 364-day facility (33.46%). Finally Panel C reports that general corporate purposes (37%), CP backup and takeover (19% each) are the most common facility purposes[11]. Panel A of Table III reports the percentage of repeated borrowers in the public and private sample. Approximately 20% of the firms in the private sample have multiple bank loans in the sample period. On the other hand, 64% of the firms in the public sample issued multiple bonds. Panel B of Table III reports the number of deals for each company. On average, firms in the private sample have 1.58 new bank loans during the sample period. Firms on the public sample, on the

[10] Investments in fixed capital are easily monitored by lenders, and can be used as collateral. Therefore, a firm with tangible assets is perceived as less risky.

[11] According to SDC, the purpose of almost all bond issues in the sample period is General Corporate Purposes.

other hand, issued on average 3.63 new bonds. In the multivariate analysis the standard errors are adjusted for the clustering of observations in firms that have multiple loans or issue multiple bonds.

Panel A of Table IV presents the comparison of some debt contract features across the two types of financing, bank loans and public bonds, while panels B, C, and D report the main descriptive statistics for the whole, public and private sample respectively. The main sample consists of 631 bank loans aggregated at deal level, and 1567 public bonds. The first row of Panel D presents the total debt issued by firms in the sample: the total volume of bank loans is $441,953 million, while the total volume of public bonds is $578,840 million. These numbers show that, in terms of volume, banks can compete with public bonds as a source of external financing. The mean deal amount of a bank loan is $700 million, compared with $369 million of a bond issue, and the difference is significant. The smallest deal in the sample is a bank loan of $10 million, while the biggest one is a bank loan of $7,000. New loans represent on average 19.9% of firm assets and 43.4% of firm debt. Those percentages are significantly lower for issues of public bonds (6.2% and 11.1% respectively), likely because private borrowers are on average smaller than public borrowers. These percentages show that loans are important financing events for firms. RATE PAID is significantly lower in the sample of bank loans: the average RATE PAID for a bank loan is 600 bps, against 678 bps for a bond. The average loan SPREAD is 81 bps (against 161). Loans have a shorter maturity with respect to bonds, 2.9 years against 13.5 on average. The shortest maturity for a bank loan is one year, while for a bond is two years. The longest maturities are 6.7 years for a bank loan and 100 years for a public bond. Finally, 38.6% of bank loans are collateralized, while the percentage for public bonds is only 1%: this is consistent with my model's prediction that only banks include a collateral provision in the contract.

Panel A of Table V reports the comparison of firm characteristics across private and public borrowers, while panels B, C, and D report the main descriptive statistics for the whole, public and private sample respectively. Consistent with my hypothesis that aligned managers have a preference for bank debt, Table V shows that private borrowers have a significantly higher PPS than public borrowers: an increase of $1,000 in firm value increases the value of the manager's portfolio by $20.05. For a public

borrower, that number is reduced to $15.04. This result could be driven by self selection on firm size. The Spearman correlation coefficient between PPS and size is negative and significant (the coefficient is -0.614 and the p-value is 0.000); additionally, Table V shows that the average size of a private borrower is approximately 45% of the average size of a public borrower. These two facts together may point to a selection problem: if small firms do not have access to bond markets, the relation between PPS and %NEW BANK could be positive because small firms are characterized by high PPS. In the multivariate regressions I will try to control for this potential selection problem and isolate the non-spurious relation between PPS and the choice of bank debt. DELTA, my alternative measure of incentive alignment, is also higher for bank borrowers, but the difference is not significant.

Consistent with the intuition that firms that face potentially high asset substitution costs prefer to commit to bank monitoring, I find that private borrowers have a significantly higher MARKET-TO-BOOK (2.018 against 1.781) and R&D (0.007 for private borrowers and 0.004 for public borrowers). As for overall firm risk, bank borrowers exhibit higher RETURNS VOLATILITY (2.363% against 2.103%) and lower TANGIBILITY (0.334 vs. 0.385) than their public counterparts. Private borrowers seem to have a better credit quality than public borrowers: they have lower BOOK LEVERAGE (0.161 for private borrowers and 0.208 for public borrowers)[12], higher INTEREST COVERAGE (22.818 against 10.683), and higher Z-SCORE (4.191 vs. 3.151). There are no differences in profitability between the two groups. This finding is not consistent with Denis and Mihov (2003) result that private borrowers have a lower credit quality. Finally, private borrowers are younger than public borrowers (37.6 vs. 41.5 years). This finding is consistent with Diamond (1991) prediction that young firms choose bank debt to build reputation.

[12] Private borrowers also have lower book leverage (24.4% vs. 31%).

6. Multivariate Analysis

6.1.1 The choice between public and private debt

To gather insights on the relation between managerial incentive compensation and the choice between public and bank debt, I now turn to multivariate regression analysis. In the main tests I assume that managerial compensation is optimally set before the firm financing decision, and use pooled OLS as my primary estimation method. In Section 6.1.2 I test the assumption, and show that my results are robust to endogeneity concerns. I also show that my results do not depend on self selection on firm size or existing bank debt in the firm balance sheet.

Table VI, Column (1), reports the results of a pooled OLS regression of the percentage of new bank debt (%NEW BANK) on incentive and control variables. The most important result is that the coefficient on PPS is positive and significant (the coefficient is 0.041 and the p-value is 0.034), while the coefficient on PPS^2 is negative and significant (the coefficient is -0.009 and the p-value is 0.029). This evidence supports my prediction that the relation between the manager's incentive alignment and the preference toward bank debt is positive and concave. In terms of economic significance, the coefficients on PPS and PPS^2 from column (1) imply that a firm with Pay-Performance-Sensitivity in the 50th percentile issues almost 8.5% more new bank debt than a firm with Pay-Performance-Sensitivity in the 1st percentile. Even smaller increments of PPS from the 1st to the 10th percentile, or from the 5th to the 25th percentile, increase the percentage of new issues of bank debt by approximately 4%. The coefficients from Table VI indicate that the relation between PPS and %NEW BANK is concave: accordingly, for higher percentiles of PPS the impact of an increase in managerial incentive compensation is lower of even negative. For example, an increase in PPS from the 50th to the 75th percentile implies an increase in %NEW BANK of only 0.5%, while an increase from the 75th to the 90th percentile implies a decrease in %NEW BANK of 1.6%. This is consistent with my model: if incentive compensation is very high, not even the probability of being caught and punished can deter the manager from engaging in asset substitution activities. If the bank cannot change the manager's incentives ex-ante, there is no reason for the firm to pay the monitoring cost: under these circumstances, the manager issues public bonds.

Firm size strongly affects the choice between public and bank debt: the coefficients on the two size terciles are both negative (-0.236 and -0.306 respectively) and highly significant. This result could be explained by the negative correlation between firm size and PPS: I address the issue in the next section. The coefficient on the third tercile is 30% larger than the coefficient on the second tercile in absolute terms: this shows clearly that the effect of size on the choice of debt is not linear. The coefficient on PROFITABILITY is negative and significant (the coefficient is -1.285 and the p-value is 0.008): profitable firms have a lower probability of default, thus making bank monitoring less necessary. The age of the firm does not seem to have an impact on debt choice: this is not consistent with Diamond's prediction that new firms rely on bank debt to build a reputation (Diamond, 1991). The effect of the presence of a block holder is not significant.[13]

The coefficient on BOOK LEVERAGE is negative and significant (the coefficient is -0.509 and the p-value is 0.000), while the coefficient on Z-SCORE is positive and significant (the coefficient is 0.064 and the p-value is 0.046): these results confirm the finding from Table V that borrowers with better credit quality prefer bank debt. The coefficients on RETURNS VOLATILITY, MARKET-TO-BOOK and R&D are not significantly different from zero. The coefficient on DEAL AMOUNT is positive and highly significant (the coefficient is 0.091 and the p-value is 0.000): this result shows that companies in need of a substantial loan turn to banks. Finally, the coefficient on MATURITY is negative and significant (the coefficient is -0.010 and the p-value is 0.000), indicating that firms that need a short term loan choose a bank loan over a bond.

To have a better insight on the relation between incentive compensation and debt choice, I consider an alternative measure on incentive alignment between manager and shareholders: Column (2) of Table VI reports the results of a pooled OLS regression of %NEW BANK on DELTA, defined as the sensitivity of CEO's stock options to changes in the stock price. The coefficient on DELTA is positive and significant (the coefficient is 0.762 and the p-value is 0.028). The coefficient on DELTA^2 is also

[13] A block holder could force the manager to invest in risky projects with the threat of termination, even when the manager's interests are not aligned with the shareholders' through incentive compensation. In unreported tests I check for this effect by including the interaction term PPS*BLOCK: it is not significant.

positive and significant (the coefficient is 0.925 and the p-value is 0.008). Thus, the preference toward bank debt seems to increase as delta increases. The coefficients on the control variables are comparable to the coefficients from the first regression.

6.1.2 The choice between public and private debt: robustness checks

Denis and Mihov (2003) suggest that the choice of the firm financing source could be affected by the existing debt structure. New bank debt loses its advantage on public bonds if lenders can free ride on pre-existing bank monitoring: if that is the case, there should be no relation between PPS (DELTA) and %NEW BANK. I hand collect information on existing bank debt from Moody's Industrial Manuals for the period 1995-2001. I only include in the analysis debt that is explicitly labeled as bank debt. Columns (3) and (4) from Table VI report the coefficients of the regression of %NEW BANK on PPS and DELTA with the new variable %EXISTING BANK DEBT included as a control variable. The coefficient on PPS is still positive and significant (the coefficient is 0.064 and the p-value is 0.013), while the coefficient on PPS^2 is now not significantly different from 0. The coefficient on DELTA is positive and significant (the coefficient is 1.428 and the p-value is 0.018), as the coefficient on DELTA^2 (the coefficient is 1.289 and the p-value is 0.027). The results indicate that the relation between preference toward bank debt and managerial incentive compensation is still positive, but not concave. The coefficient on %EXISTING BANK DEBT is positive and significant in both regressions, indicating that public lenders do not free ride on pre-existing bank monitoring.

I next consider a scenario, depicted in theoretical papers like John and John (1993) and Almazan and Suarez (2003), where the relation between managerial incentive compensation and firm debt choices is endogenous. To address the issue, I re-estimate the model with a two-stage least square regression of %NEW BANK, treating PPS and DELTA as endogenous variables. I use three instruments: compensation on the year before the relevant year, CEO tenure, and sales growth. According to Murphy (1999) incentive compensation depends on firm industry and size: thus, it is likely that a firm past incentive compensation is a determinant of incentive compensation on the relevant year. Additionally,

compensation from the previous year should not be related with debt choice or with the financing cost, because lenders are only interested in the managerial incentives in place at the time of the loan. Palia (2001) and Murphy (1986) argue that the manager's ability is unknown in the beginning of his term and that performance is used to infer information on managerial ability. Thus, in early years, performance has a larger impact on the manager's pay-performance sensitivity. Finally Conyon and Nicolitsas (1998) and Kedia and Mozumdar (2002) find evidence of a positive relation between sales growth and incentive compensation. Following Baum, Schaffer, and Stillman (2003), I check the relevance of the instruments (correlation with the suspected endogenous variable) with partial R^2 and F-test on the joint significance of the instruments in the first stage regression. I also check the validity of the instruments (orthogonality to the error process) with the Hansen J statistic. Table VII presents the results of the tests. The partial R^2 ranges from 0.305 to 0.532, while the F statistics are all above 56: the instruments seem to be relevant. The p-values on the Hansen J statistic fail to reject the null hypothesis that the instruments are not correlated to the error process. Thus, the instruments are valid. Finally, I rest the endogeneity of PPS and DELTA: the Sargan C statistic fails to reject the null that PPS (DELTA) and PPS^2 (DELTA^2) are exogenous. Thus, my primary estimation method is pooled OLS.

A concern in the tests presented so far is a potential sample self-selection on firm size: small firms, usually characterized by higher Pay-Performance-Sensitivity, may not have access to bond markets. That could explain the positive relation between %NEW BANK and PPS. A similar concern is that large firms, characterized by low PPS, may have to issue public bonds to raise sizable sums. This selection could also explain the positive relation between PPS and %NEW BANK. However, loan syndication enables banks to offer loans that are comparable in size with bond issues. In this sample the mean deal amount is actually greater for bank loans than public bonds. Thus, this second type of selection is less of a concern. To reduce the bias from both sources, I truncate the main sample at 10% on both

sides on firm size.[14] Columns (1) and (2) from Table VIII present the results of the regression on this sub sample. The coefficient on PPS and PPS^2 are now not significantly different from 0. However, the coefficients on DELTA (the coefficient is 1.015 and the p-value is 0.016) and DELTA^2 (the coefficient is 1.142 and the p-value is 0.008) are still positive and highly significant.

Myers (1977) and Barnea, Haugen, and Senbet (1980) suggest that debt maturity can be used to alleviate the agency problems of underinvestment and asset substitution. In my framework, short term debt could be used to mitigate the asset substitution cost imposed by a manager whose interests are aligned with the shareholders' through incentive compensation. Long term debt is mainly available in the form of public bonds: a manager who has low incentive compensation, and thus prefers long tem debt to avoid costly liquidation, has no choice but to issue corporate bonds. On the other hand, short term debt is mainly available through bank loans: a manager with high incentive compensation, who thus prefers short term debt to alleviate the agency problem of asset substitution, may be forced to choose bank debt. If that is the case, the positive relation between incentive compensation and preference toward bank debt could be due to the relation between incentive compensation and maturity. To address this issue, I estimate the model on a sub sample truncated on maturity at 10% on both sides. Columns (3) and (4) of Table VIII present the regression coefficients. The coefficients on PPS and DELTA (0.039 and 0.74) are positive and significant. The coefficient on PPS^2 is negative and significant (the coefficient is -0.009 and the p-value is 0.025), while the coefficient on DELTA^2 is positive and significant (the coefficient is 0.933 and the p-value is 0.005).[15]

Finally, columns (5) and (6) of Table VIII report the coefficients of the regression from a sub sample truncated at 10 % on both size and maturity. The coefficients on PPS and PPS^2 are now not

[14] In unreported tests, I eliminate from the main sample bank borrowers that are smaller than the smallest public borrower, and public borrowers that are bigger than the biggest bank borrower. The results do not change significantly.

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[15] I also estimate the model on a sub sample created by eliminating from the original sample bank loans with a maturity shorter than the shortest maturity of a public bond, and public bonds with a maturity longer than the longest maturity of a bank loan. Coefficients do not change significantly.

significantly different from 0, but the coefficients on DELTA and DELTA^2 are both positive and highly significant. These results indicate that selection on maturity and size does not fully explain the positive relation between incentive compensation and preference toward bank debt.

In Table IX I include SPREAD as a determinant of the firm financing source. Panel B of Table IX shows statistic and p-values of the endogeneity test, as well as the test on the relevance and validity of the instruments. I use a dummy variable identifying dividend payers and INTEREST VOLATILITY as instruments for SPREAD. Partial R^2, F-statistic, and Hansen J statistic show that the instruments are correlated with SPREAD and orthogonal to the error process. The C-statistic confirms the endogeneity of SPREAD. Panel A reports the coefficients of a 2SLS regression of %NEW BANK. The coefficient on PPS is still positive and significant (the coefficient is 0.038 and the p-value is 0.075), while the coefficient on PPS^2 is still negative and significant (the coefficient is -0.010 and the p-value is 0.029). From column (2), the coefficient on DELTA is positive and significant (the coefficient is 0.694 and the p-value is 0.074), while the coefficient on DELTA^2 is still positive and significant (the coefficient is 0.874 and the p-value is 0.022). The coefficient on SPREAD is never significant. Notice that all coefficients are similar to the coefficients from the main regression: adding SPREAD did not change the results. In unreported regressions I also test the endogeneity of the maturity of the loan. Following Dennis, Nandy, and Sharpe (2000) I use the ratio of taxes and total assets, and asset maturity as instruments for maturity. The C-statistic fails to reject the null hypothesis that debt maturity is exogenous.

To summarize, the coefficient on the main incentive alignment variable, Pay-Performance-Sensitivity, is positive and significant even after existing debt structure is included in the model, and self selection induced by size and maturity is reduced. The evidence presented in tables VI, VIII, and IX supports my hypothesis that a manager whose interests are aligned with the shareholders' through incentive compensation shows a preference for bank debt over public bonds as the firm's financing source.

6.2.1 Incentive alignment and spread

I now turn to examine the relation between managerial incentive compensation and cost of public and bank debt. I use a multivariate regression of the spread over the relevant benchmark (SPREAD) on Pay-Performance-Sensitivity (PPS), DELTA, and the control variables. In the main test I assume that incentive compensation is exogenous and use pooled OLS. In section 6.2.2 I test the assumption and show that my results are robust to endogeneity concerns.

I first focus on public borrowers. Column (1) of Table X shows the coefficients of a pooled OLS regression of SPREAD on PPS and the control variables on the sample of public borrowers. The main finding is the positive and significant coefficient on PPS (the coefficient is 6.991 and the p-value 0.025). The coefficient is consistent with the intuition that public lenders account for the risk-shifting incentives of a manager with high Pay-Performance-Sensitivity, and charge the firm a higher spread. In economic terms, the coefficients from column (1) in Table X imply that, holding everything else constant, borrowing costs of a firm with PPS in the 75th percentile are approximately 12 bps higher than borrowing costs of a firm with PPS in the 25th percentile. This number is consistent with Ortiz-Molina (2005) finding that a comparable increase in the number of stock and stock options increases the borrowing costs by 8 bps.

The two size variables are negatively related to SPREAD (the coefficients are -28.496 and -65.5587 respectively). Large firms are more scrutinized by analysts, thus the information asymmetry, and the related risk, is reduced. The coefficient on the second size tercile is 43% smaller than the coefficient on the third size tercile in absolute terms: this suggests that the effect of information asymmetry reduction on the bond spread is not linear. AGE is negatively related to SPREAD (the coefficient is -0.556 and the p-value is 0.062), indicating that firm reputation can reduce the cost of debt. The coefficient on PROFITABILITY is also negative and significant (the coefficient is -538.902 and the p-value is 0.002): a profitable firm most likely will be able to pay back the lenders, and is thus perceived as less risky. Consistent with the intuition that a firm with opportunities for asset substitution activities has a higher cost of debt, the coefficient on R&D is positive and significant (the coefficient is 582.195 and the p-value

0.0028). However, the coefficient on MARKET-TO-BOOK is negative and significant (the coefficient is -7.248 and the p-value 0.093): the negative value seems to indicate that MARKET-TO-BOOK is measuring profitability more than growth opportunities.

The coefficients on BOOK LEVERAGE (the coefficient is 105.107 and the p-value is 0.002) and Z-SCORE (the coefficient is -64.507 and the p-value is 0.000) confirm the intuition that firms in financial distress face a high cost of debt. This result is consistent with Merton (1974) model for pricing default risk on corporate debt, which suggests that cost of debt is positively related to firm leverage and to the variance of the underlying assets of the borrower (here measured by the Z-SCORE). Finally, the coefficients on MATURITY (the coefficient is 0.454 and the p-value is 0.000) and COLLATERAL (the coefficient is 304.892 and the p-value is 0.000) are positive and significant. The coefficient on COLLATERAL is consistent with Berger and Udell (1990), and indicates that risky borrowers are required to pledge collateral and pay higher spreads.

Column (2) of Table X shows the coefficients of the regression of SPREAD on DELTA. The coefficient on DELTA is positive and significant (the coefficient is 50.225 and the p-value is 0.059). The coefficients on the control variables are qualitatively and quantitatively similar to the coefficients in column (1). In economic terms, the coefficients from column (2) in Table IX implies that, holding everything else constant, borrowing costs of a firm with DELTA in the 75th percentile are only 10.7 bps higher than the borrowing costs of a firm with DELTA in the 25th percentile.

Columns (2) and (3) of Table X present the result of the regression of SPREAD on the managerial incentive compensation variables on the sample of bank borrowers. As predicted by the model, there is no relation between incentive compensation and the cost of bank loans. [16] This finding suggests that banks are not worried about the asset substitution behavior induced by incentive

[16] For this test I delete all the observation where the variable COLLATERAL is missing. In unreported tests, I set COLLATERAL to 0 whenever the variable is missing. That allows me to increase the sample size to 631 observations. The coefficients do not change significantly. Most importantly, the coefficients on the incentive compensation variables are still not significant.

compensation, possibly because they can reduce the manager incentives to asset substitution through monitoring.

6.2.2 Incentive alignment and spread: robustness checks

I next consider a scenario where CEO's incentive compensation is endogenous. As Ortiz-Molina (2005) points out, there could be a risk factor correlated with incentive compensation and cost of debt. Alternatively, firm risk may affect the structure of the CEO compensation package. To address the issue, I estimate the model with a two-stage least square regression of SPREAD, treating the incentive variables as endogenous. I use incentive compensation on the year before the financing event and CEO tenure as instruments PPS and DELTA. The economic rationale of using past PPS and DELTA as instruments for current incentive compensation is that past incentive compensation should not be related to SPREAD, because lenders are only interested in the CEO's incentive structure at the time the loan is negotiated. Palia (2001) suggests CEO experience as instrument for pay-performance-sensitivity.[17] As before, I test the relevance and validity of the instruments: Table XI reports the results of the tests for both the public and private sample. The partial R^2 always falls within 0.226 and 0.658, while the F statistics are all above 14. Additionally, the Hansen J statistic fails to reject the null that the instruments are orthogonal to the error process. I can conclude that the instruments are relevant and valid. Finally, the C statistic fails to reject the null that PPS and DELTA are exogenous in all cases. Thus, I use pooled OLS as primary estimation method.

The results for private borrowers may be affected by the choice to aggregate tranches that belong to the same deal, and to calculate weighted spreads and maturities. In unreported tests, I re-estimate the coefficients of the regressions using sub samples with revolvers only, largest tranches and whole deals only, whole deals only. I have only 59 observations of term loans, thus I cannot perform any test on that

[17] See Section 6.1.2.

sub sample. The results of the regressions on these private loans sub samples do not change: PPS and DELTA are not related to SPREAD. [18]

In summary, the results from Table X support the model prediction that the relation between cost of debt and incentive compensation is positive in the public sample, and non significant in the bank sample. This finding is consistent with the intuition that public lenders account for the manager's incentives to invest in risky assets by looking at his compensation package, and charge a higher spread to be compensated for the expected asset substitution. The results are also consistent with my model' prediction that banks can limit the manager's incentives to asset substitution trough monitoring, thus eliminating the need to charge the firm a higher interest rate.

6.3.1 Incentive alignment and collateral

I now turn to examine the relation between managerial incentive compensation and the inclusion of a collateral provision in the debt contract. The model predicts a positive relation between incentive compensation and the probability that a collateral provision is included in the debt contract. I test these predictions with a logistic regression of the dummy variable COLLATERAL on incentive and control variables. I test the hypothesis on the private sample only because the model predicts that collateral is only used by banks. Additionally, only 1% of public borrowers collateralized their bond issue in my sample.

Table XII shows the coefficients of a logistic regression of COLLATERAL on PPS and DELTA. The main result in Column (1) is that PPS is positively related to the probability that a collateral provision is included in the debt contract (the coefficient is 0.283 and the p-value 0.077). This finding supports the hypothesis that lenders use the collateral provision to limit manager's incentives for asset substitution.

[18] Another possible source of bias in the regression is the selection of the variable *Collateral*: because selection is unobserved, the effect of *Collateral* on Spread could be confounded by the unknown factors affecting the collateralization decision. I use a treatment effect model à la Heckmann to correct for the selection bias. In the public sample, the coefficient on the Inverse Mills Ratio (IMR) is significant, indicating that the treatment effect model should be used. However, the coefficients are qualitatively and quantitatively similar to the OLS coefficients. For the private sample, the coefficient on the IML is not significant – OLS can be safely used.

The coefficients on the size terciles are negative and significant (the coefficients are -1.038 and -1.600): large firms are less risky for lenders because there is less information asymmetry. The coefficients on BOOK LEVERAGE and RETURNS VOLATILITY (4.362 and 0.612 respectively) and tangibility (the coefficient is -.2635 and the p-value is 0.060) indicate that firms with lower credit quality or high overall risk have to pledge collateral. Finally, loans with longer maturity require the collateral provision (the coefficient on MATURITY is 0.347 and the p-value 0.041). In economic term the coefficients from column (1) imply that a firm with PPS in the 75th percentile is 2.3 times more likely to collateralize the loan than a firm with PPS in the 25th percentile.

Column (2) reports the coefficient of the logistic regression of COLLATERAL on DELTA. The coefficient on DELTA is positive and significant (the coefficient is 3.862 and the p-value 0.044). The effect of DELTA on the collateralization decision is quite significant: the coefficient implies that a firm with DELTA in the 75th percentile is 10 times more likely to include a collateral provision in the loan contract than a firm with DELTA in the 25th percentile. In column (3) I set the variable COLLATERAL to 0 whenever the observation is missing. This allows me to increase the sample size to 631. The results are similar, although now the coefficient on PPS is not significant.

These findings are consistent with the intuition that banks can include a collateral provision in the contract to reduce the incentives to asset substitution of an aligned manager. My results seem to indicate that public lenders price the manager's incentives to asset substitution, while banks limit those incentives by monitoring the firm and sometimes also by including a collateral provision. These findings are consistent with monitoring and collateral being complementary mechanisms to limit managerial incentives for asset substitution activities. [19]

[19] Anecdotal evidence shows that firms sometime pledge their receivables as collateral. Because the value of receivables depends directly on the firm operations, lenders will have even more incentive to monitor the firm and the value of the collateral.

7. Conclusion

I develop a model to explain the relation between managerial incentive compensation and the choice between public and private debt. Stock holdings and stock options align managers' and owners' incentives, and induce managers to take risk to maximize shareholder value. Public lenders anticipate the risk-shifting incentives embedded in managers' compensation, and include the information in the pricing of new bond issues. Banks, on the other hand, reduce managers' asset substitution incentives ex-ante, by monitoring the project choices and punishing the firm that deviates from the efficient investment decisions. Thus, banks do not price risk-shifting incentives. Banks can also limit managers' risk-shifting incentives by collateralizing the loan. The model predicts that managers whose compensation is tied to firm performance choose bank loans and submit to bank monitoring as a commitment mechanism to reduce the cost of debt.

I empirically investigate the role of managerial incentive compensation as a determinant of the choice between bank debt and public bonds for a sample of 2198 new debt financings over the period 1992-2005. I also investigate the impact of managerial incentive compensation on lenders' pricing and collateralization decisions, distinguishing between public lenders and banks. I find that the choice of debt instrument is strongly related to the incentive alignment between manager and shareholders. Managers with a strong incentive component in the compensation package seem to prefer bank debt as source of new financing. I also find that the offering yield of public bonds is strongly related to the manager's incentive compensation, while the overall cost of bank loans is not. Consistent with a risk-reducing role of collateral, I find that bank loans are collateralized more often if managerial incentive compensation is high. These findings support the hypothesis that aligned managers choose bank debt and submit to bank monitoring as a commitment mechanism to limit the asset substitution incentives and reduce the cost of debt. Monitoring and collateralization seem to be complementary mechanisms to limit asset substitution.

My results raise interesting questions for future research. There are mechanisms other than bank monitoring to limit the asset substitution incentives, and the related cost of debt, of an aligned manager. Debt covenants can play an important role in limiting the manager's flexibility, while convertible debt can

directly change the manager's incentives by giving lenders the opportunity to share the potential profits of asset substitution activities. Investigation of these alternatives could improve our understanding of the firm financing choices.

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Table I

Variable Definitions

DEPENDENT VARIABLES

%NEW BANK: private loans as a percentage of total new debt (public and private) for a given year.

RATE PAID: fixed equivalent of a floating rate. For private loans, it is computed as SPREAD plus the then one-month LIBOR and the then prevailing rate for the Treasury bond with the same maturity of the loan, minus the then three-month Treasury rate; for public bonds, RATE PAID is the bond offering yield. It is measured in basis points.

SPREAD: for private loans, it is the cost for the borrower of each dollar withdrawn as a spread on the libor/prime base rate; for public bonds, it is the spread on the comparable Treasury bond. The spread is measured in basis points. In the case of private loans with multiple facilities, SPREAD is calculated as a weighted average of the SPREAD of each facility. The weights are given by the ratio of each facility dollar amount and the total deal dollar amount.

COLLATERAL: dummy variable equal to 1 if the bond/loan is collateralized, 0 otherwise.

MANAGERIAL INCENTIVES

PPS: Pay-Performance-Sensitivity. PPS is the sensitivity of the CEO's portfolio to firm value, and is computed as the dollar increase in the value of the manager's equity portfolio for a $1,000 increase in firm value. It is calculated as:

$$PPS = \left(\frac{\#\ of\ shares\ sheld}{\#\ of\ outstanding\ shares} + \frac{\#\ of\ options\ on\ firm\ common\ stock\ held}{\#\ of\ outstanding\ shares} * delta \right) * 1{,}000$$

DELTA: dollar change in option value for a $1 increase in stock price. Following Core and Guay (2002) it is computed as:

$$DELTA = e^{-dT} N[Z]$$

$$Z = \left[\ln(S / X) + T\left(r - d + \sigma^2 / 2\right)\right] / \sigma T^{(1/2)}$$

where N is the cumulative probability function for the normal distribution, S is the stock price, X is the exercise price, σ is the expected stock-return volatility over the life of the option, r is the natural

logarithm of the risk-free interest rate, T is the time to maturity of the option in years, and d is the natural logarithm of expected dividend yield over the life of the option.

LOAN AND BOND CHARACTERISTICS

DEAL: deal dollar amount.

MATURITY: maturity of the bond/loan in years. In the case of private loans with multiple facilities, the maturity is calculated as a weighted average of the maturities of each facility. The weights are given by the ratio of each facility dollar amount and the total deal dollar amount.

FIRM CHARACTERISTICS

AGE: number of years since inclusion in Compustat North America.

BLOCK: dummy variable equal to 1 if at least one shareholder holds 5% or more of the shares outstanding, 0 otherwise.

INTEREST COVERAGE: operating income before depreciation to interest expense.

LOSS: dummy variable equal to 1 if the operating income before depreciation is negative, 0 otherwise.

BOOK LEVERAGE: total liabilities divided by total assets.

MARKET-TO-BOOK: book value of debt plus market value of common and preferred stock divided by total assets.

PROFITABILITY: operating income before depreciation to total assets.

RETURNS VOLATILITY: moving standard deviation of daily returns on a window of 30 days.

R&D: R&D expense to total assets.

TANGIBILITY: net property, plant and equipment to total assets.

SIZE: firm total assets in $ million.

Z-SCORE: Defined as in Altman (1981) as: $1.2 * \frac{Working\ Capital}{Total\ Assets} + 1.4 * \frac{Retained\ Earnings}{Total\ Assets} +$

$$+ 3.3 * \frac{EBIT}{Sales} + 0.999 * \frac{Sales}{Total\ Assets} + 0.6 * \frac{Market\ Value\ of\ Equity}{Market\ Value\ of\ Liabilities}.$$

%EXISTING PRIVATE DEBT: existing bank debt to total assets.

MACRO VARIABLES

INTEREST VOLATILITY: Monthly average of the 12-month moving standard deviation of daily yields on 10-years U.S. T-bonds.

Table II

Characteristics of loan facilities

The private sample consists of 631 U.S. dollar-denominated bank loans to U.S. non financial corporations between 1992 and 2005.Panel A presents the different type of deals; Panel B shows the different type of facilities (tranche-level analysis); Panel C shows the facility purpose (tranche-level analysis).

Panel A - Deal Type			Panel B - Facility Type			Panel C - Facility Purpose		
Deal Type	**Frequency**	**Percentage**	**Facility type**	**Frequency**	**Percentage**	**Facility Purpose**	**Frequency**	**Percentage**
Bilateral	1	0.12	364-Day Facility	271	33.46	Acquisition line	33	4.07
N/A	2	0.25	Bridge Loan	3	0.37	CP backup	160	19.75
Sole Lender	16	1.98	Demand Loan	1	0.12	Capital expenditure	1	0.12
Syndication	789	97.65	Other Loan	1	0.12	Corporate purposes	298	36.79
			Revolver/Line < 1 Yr.	22	2.72	Debt Repayment	13	1.60
			Revolver/Line >= 1 Yr.	437	53.95	Debtor-in-possession	5	0.62
			Revolver/Term Loan	2	0.25	Equipment Purchase	1	0.12
			Synthetic Lease	2	0.25	LBO/MBO	13	1.60
			Term Loan	45	5.56	Lease finance	3	0.37
			Term Loan A	10	1.23	Other	7	0.86
			Term Loan B	13	1.60	Project finance	1	0.12
			Term Loan C	1	0.12	Real estate	2	0.25
			Term Loan D	1	0.12	Recapitalization	3	0.37
			Term Loan E	1	0.12	Spinoff	1	0.12
						Stock buyback	12	1.48
						Takeover	158	19.51
						Trade finance	1	0.12
						Working capital	98	12.10

Table III

Number of facilities

The private sample consists of 631 U.S. dollar-denominated bank loans to U.S. non financial corporations between 1992 and 2005.Panel A presents the percentage of repeated borrowers in the whole, private and public sample respectively; Panel B shows the average, median, min and max number of deals per company in the sample period.

Panel A - % repeated borrowers				Panel B - # number of deals			
# of loans/bond issues	**Whole**	**Private**	**Public**	**# of loans/bond issues per company**	**Whole**	**Private**	**Public**
1	0.442	0.656	0.358	**Mean**	3.204	1.585	3.363
2	0.192	0.191	0.232	**Median**	2	1	2
3	0.087	0.090	0.112	**Min**	1	1	1
>3	0.278	0.063	0.298	**Max**	30	6	30

Table IV

Univariate analysis of debt characteristics

The private sample consists of 631 U.S. dollar-denominated bank loans to U.S. non financial corporations between 1992 and 2005; the public sample consists of 1567 public bonds issued in the U.S. by U.S. non financial corporations between 1992 and 2005. *Deal Amount* is total amount of the loan/bond in $ million; *Deal/TA* is deal amount to total assets; *Deal/TD* is deal amount divided by the sum of the firm current liabilities and long term debt. For firms in the private sample *Spread,* computed in basis points (bps), is the sum of spread over the LIBOR and any other annual fee; for firms in the public sample *Spread* is the spread over a Treasury bond of comparable maturity. For firms in the private sample *Rate Paid,* computed in basis points (bps), is the sum of spread over LIBOR (or Prime) and any other annual fee, plus then prevailing one-month LIBOR and rate for the Treasury bond with the same maturity of the loan, minus then prevailing three-month Treasury rate; for firms in the public sample *Rate Paid* is the bond offering yield. *Maturity* is maturity of the loan/bond in years. All continuous variables are winsorized at 1%. Panel A presents the sample means (medians in parentheses); p-values are from a Kruskal-Wallis test of equality across categories. Panel B, C, and D report mean, standard deviation, min, max, 25th, 50th, and 75th percentile of debt characteristics for the whole sample, the private sample, and the public sample respectively.

PANEL A - Test of sample differences

New debt issues characteristics	**Full sample N=2198**	**Bank Debt N=631**	**Public Debt N=1567**	**p-values for equality across categories**
Total Issue Volume (in $ million)	1,020,794	441,953	578,840	
Deal Amount (in $ million)	464.419	700.401	369.394	0.049
	(300.000)	(300.000)	(275.000)	
Deal/TA	0.101	0.199	0.062	0.000
	(0.050)	(0.131)	(0.036)	
Deal/TD	0.204	0.434	0.111	0.000
	(0.083)	(0.234)	(0.056)	
Spread (in bps)	138.119	81.050	161.100	0.000
	(98.000)	(55.000)	(112.500)	
Rate Paid (in bps)	655.555	599.550	678.107	0.000
	(670.747)	(640.114)	(686.000)	
Maturity (in years)	10.465	2.920	13.504	0.000
	(7.008)	(3.000)	(10.001)	
Fraction with Collateral	0.065	0.386	0.010	0.000

Table IV (continued)

PANEL B – Whole Sample (N=2198)

New debt issues characteristics	Mean	Std	Min	Max	25th	50th	75th
Deal (in $ million)	464.419	652.469	10	7,000	175	300	500
Deal/TA	0.101	0.141	0.003	1.168	0.024	0.050	0.120
Deal/TD	0.204	0.400	0.015	150.000	0.067	0.170	0.457
Spread (in bps)	138.119	120.487	15	640	60	98	175
Rate Paid (in bps)	655.555	160.033	206.652	1,125.00	568.587	670.747	747.694
Maturity (in years)	10.465	11.775	1	99.999	4.996	7.008	10.008

PANEL C - Private Sample (N=631)

New debt issues characteristics	Mean	Std	Min	Max	25th	50th	75th
Deal (in $ million)	700.401	1079.036	10	7000	128	300	800
Deal/TA	0.199	0.211	0.008	1.168	0.062	0.131	0.253
Deal/TD	0.434	0.612	0.022	150.000	0.200	0.519	1.246
Spread (in bps)	81.050	69.616	15	325	30	55	110
Rate Paid (in bps)	599.550	155.336	206.652	901.760	485.164	640.114	705.243
Maturity (in years)	2.920	1.758	1	6.679	1.000	3.000	5.000

PANEL D - Public Sample (N=1567)

New debt issues characteristics	Mean	Std	Min	Max	25th	50th	75th
Deal (in $ million)	369.394	312.047	75	2000	200	275	500
Deal/TA	0.062	0.069	0.003	0.373	0.019	0.036	0.075
Deal/TD	0.111	0.210	0.015	6.048	0.055	0.121	0.269
Spread (in bps)	161.100	128.749	30	640	73	113	205
Rate Paid (in bps)	678.107	156.365	269.000	1125.000	600.000	686.000	763.000
Maturity (in years)	13.504	12.693	2.008	99.999	7.000	10.001	12.007

Table V

Univariate statistics of firm characteristics

The private sample consists of 631 U.S. dollar-denominated bank loans to U.S. non financial corporations between 1992 and 2005; the public sample consists of 1567 public bonds issued in the U.S. by U.S. non financial corporations between 1992 and 2005. *PPS* (Pay Performance Sensitivity) is the dollar increase in the value of the manager's portfolio for a $1,000 increase in firm value; *Delta* is the dollar increase in the value of the manager's stock options for a $1 increase in the stock price; *Size* is total assets of the firm in $ million; *Age* is number of years since first record in Compustat; *Profitability* is operating income before depreciation to total assets; *Market-to-Book* ratio is book value of debt plus market value of common and preferred stock divided by total assets; *R&D* is R&D expenditures to total assets; *Book Leverage* is liabilities divided by total assets; *Interest Coverage* is operating income before depreciation to interest expense; Z-*Score* is defined as in Altman (1981): (3.3*EBIT/Sales + 0.999*Sales/Total Assets + 1.4*Retained Earnings/Total Assets + 1.2*Working Capital/Total Assets + 0.6*Market Value of Equity/ Market Value of Liabilities); *Returns Volatility* is the moving standard deviation of daily returns on a window of 30 days (in percentage); *Tangibility* is property, plant and equipment to total assets. All continuous variables are winsorized at 1%. Panel A presents the sample means (medians in parentheses); p-values are from a Kruskal-Wallis test of equality across categories. Panel B, C, and D report mean, standard deviation, min, max, 25th, 50th, and 75th percentile of firm characteristics for the whole sample, the private sample, and the public sample respectively.

PANEL A - Test of sample differences

Sample firms characteristics	**Full sample N=2198**	**Private Debt N=631**	**Public Debt N=1567**	**p-values for equality across categories**
PPS	16.481	20.050	15.043	0.000
	(5.681)	(7.317)	(5.001)	
Delta	0.647	0.650	0.646	0.233
	(0.642)	(0.647)	(0.640)	
Size (in $ million)	13,756	7,338	16,340	0.000
	(6051)	(2459)	(7908)	
Age	40.383	37.602	41.503	0.000
	(47.000)	(45.000)	(48.000)	
Profitability	0.039	0.040	0.039	0.202
	(0.037)	(0.038)	(0.036)	
Market-to-Book	1.849	2.018	1.781	0.000
	(1.493)	(1.582)	(1.454)	
R&D	0.005	0.007	0.004	0.000
	(0.000)	(0.000)	(0.000)	
Book Leverage	0.195	0.161	0.208	0.000
	(0.178)	(0.149)	(0.192)	
Interest Coverage	14.167	22.818	10.683	0.027
	(6.757)	(7.492)	(6.586)	
Z-Score	3.449	4.191	3.151	0.000
	(2.967)	(3.384)	(2.764)	

Table V (continued)

PANEL A - Test of sample differences				
Sample firms characteristics	**Full sample N=2198**	**Private Debt N=631**	**Public Debt N=1567**	**p-values for equality across categories**
Returns Volatility	2.178	2.363	2.103	0.000
	(1.923)	(2.033)	(1.886)	
Tangibility	0.370	0.334	0.385	0.000
	(0.319)	(0.265)	(0.347)	
Fraction with Op. Profit <0	0.087	0.101	0.081	0.125
Fraction with block holder	0.733	0.731	0.735	0.850

PANEL B - Whole Sample (N=2198)							
Sample firms characteristics	**Mean**	**Std**	**Min**	**Max**	**25th**	**50th**	**75th**
PPS	16.481	31.439	0.377	211.912	2.463	5.681	13.886
Delta	0.647	0.093	0.414	0.840	0.580	0.642	0.718
Size (in $ million)	13,755.98	25,220.000	114.16	216,548.70	2,100.90	6,051.28	15,616.00
Age	40.383	13.900	8.000	56.000	31.000	47.000	51.000
Profitability	0.039	0.022	-0.046	0.126	0.026	0.037	0.051
Market-to-Book	1.849	1.092	0.818	8.340	1.196	1.493	2.081
R&D	0.005	0.011	0.000	0.072	0.000	0.000	0.005
Book Leverage	0.195	0.121	0.000	0.551	0.103	0.178	0.272
Interest Coverage	14.167	38.027	-2.431	536.500	3.832	6.757	12.615
Z-Score	3.449	2.375	-0.225	19.389	1.906	2.967	4.320
Returns Volatility	2.178	1.020	0.751	6.721	1.468	1.923	2.621
Tangibility	0.370	0.225	0.012	0.913	0.012	0.319	0.529

Table V (continued)

PANEL C - Private Sample (N=631)

Sample firms characteristics	Mean	Std	Min	Max	25th	50th	75th
PPS	20.050	35.366	0.455	211.912	3.504	7.317	19.881
Delta	0.650	0.101	0.414	0.840	0.572	0.647	0.729
Size (in $ million)	7,338.48	12,711.000	114.16	79,467.00	800.20	2,459.03	8,193.00
Age	37.602	14.744	8.000	56.000	28.000	45.000	50.000
Profitability	0.040	0.026	-0.046	0.126	0.025	0.038	0.053
Market-to-Book	2.018	1.346	0.825	8.340	1.254	1.582	2.246
R&D	0.007	0.014	0.000	0.072	0.000	0.000	0.008
Book Leverage	0.161	0.119	0.000	0.511	0.067	0.149	0.229
Interest Coverage	22.818	66.773	-2.431	536.500	3.750	7.492	14.760
Z-Score	4.191	3.013	0.332	19.389	2.223	3.384	4.895
Returns Volatility	2.363	1.181	0.751	6.721	1.528	2.033	2.916
Tangibility	0.334	0.221	0.021	0.901	0.021	0.265	0.471

PANEL D - Public Sample (N=1567)

Sample firms characteristics	Mean	Std	Min	Max	25th	50th	75th
PPS	15.043	29.602	0.377	183.204	2.295	5.001	11.931
Delta	0.646	0.089	0.447	0.838	0.582	0.640	0.713
Size (in $ million)	16,340.19	28,356	479	216,548	3,295	7,907	17,912
Age	41.503	13.388	10.000	56.000	34.000	48.000	52.000
Profitability	0.039	0.020	-0.027	0.104	0.026	0.036	0.050
Market-to-Book	1.781	0.964	0.818	5.801	1.181	1.454	2.020
R&D	0.004	0.010	0.000	0.048	0.000	0.000	0.004
Book Leverage	0.208	0.119	0.006	0.551	0.118	0.192	0.283
Interest Coverage	10.683	13.881	0.000	88.316	3.847	6.586	11.888
Z-Score	3.151	1.988	-0.225	11.388	1.773	2.764	4.110
Returns Volatility	2.103	0.938	0.783	5.930	1.446	1.886	2.482
Tangibility	0.385	0.225	0.012	0.913	0.012	0.347	0.539

Table VI

OLS Regression of %New Bank

The sample consists of 631 U.S. dollar-denominated bank loans to U.S. non financial corporations and 1567 public bonds issued in the U.S. by U.S. non financial corporations between 1992 and 2005. *%New Bank* is new bank debt to total new debt. *PPS* (Pay Performance Sensitivity) is the natural logarithm of the dollar increase in the value of the manager's portfolio for a $1,000 increase in firm value; *Delta* is the natural logarithm of the dollar increase in the value of the manager's stock options for a $1 increase in the stock price; *% Existing Bank Debt* is existing bank debt to total assets; *Size 2* and *Size 3* are dummy variables for the second and third tercile of the firm size, where *Size* is total assets $ million; *Age* is number of years since first record in Compustat; *Block* is a dummy variable equal to 1 if at least one shareholder holds 5% or more of the shares outstanding, 0 otherwise; *Profitability* is operating income to total assets; *Market-to-Book* ratio is book value of debt plus market value of common and preferred stock divided by total assets; *R&D* is R&D expenditures to total assets; *Book Leverage* is liabilities divided by total assets; *Interest Coverage* is operating income to interest expense; *Z-Score* is defined the natural logarithm of (3.3*EBIT/Sales+0.999*Sales/Total Assets+1.4*Retained Earnings/Total Assets+1.2*Working Capital/Total Assets+0.6*Market Value of Equity/ Market Value of Liabilities); *Returns Volatility* is the moving standard deviation of daily returns on a window of 30 days; *Maturity* is maturity of the loan/bond in years; *Deal Amount* is the natural logarithm of the total amount of the loan/bond in $ million. Industry dummies are based on the first two digits of the NAICS code. All continuous variables are winsorized at 1%.Columns (1) to (4) present estimated coefficients (p-values) from OLS regressions of *%New Bank*. Standard errors are robust and clustered by firm.

Independent Variables	**(1) N=2198**	**(2) N=2198**	**(3) N=713**	**(4) N=713**
Intercept	-0.242**	-0.064	-0.589***	0.097
	(0.045)	(0.617)	(0.002)	(0.696)
PPS	0.041**		0.064**	
	(0.034)		(0.013)	
PPS^2	-0.009**		-0.008	
	(0.029)		(0.246)	
Delta		0.762**		1.428**
		(0.028)		(0.018)
Delta^2		0.925***		1.289**
		(0.008)		(0.027)
% Existing Bank Debt			0.259**	0.267***
			(0.012)	(0.008)
Size 2	-0.236***	-0.230***	-0.132***	-0.147***
	(0.000)	(0.000)	(0.000)	(0.000)
Size 3	-0.306***	-0.315***	-0.175***	-0.207***
	(0.000)	(0.000)	(0.000)	(0.000)
Age	0.000	0.000	-0.001	0.000
	(0.804)	(0.992)	(0.238)	(0.797)

Table VI (continued)

Independent Variables	(1) N=2198	(2) N=2198	(3) N=713	(4) N=713
Block	-0.028	-0.018	-0.016	0.007
	(0.190)	(0.372)	(0.529)	(0.783)
Profitability	-1.285***	-1.227**	0.318	0.184
	(0.008)	(0.012)	(0.652)	(0.792)
Market-to-Book	0.007	0.007	-0.032**	-0.042**
	(0.541)	(0.574)	(0.050)	(0.012)
R&D	1.288	1.163	0.241	0.029
	(0.195)	(0.251)	(0.855)	(0.982)
Book Leverage	-0.509***	-0.532***	-0.307**	-0.341***
	(0.000)	(0.000)	(0.011)	(0.005)
Z-Score	0.064**	0.066**	0.068	0.071
	(0.046)	(0.034)	(0.212)	(0.184)
Returns Volatility	0.016	0.015	0.003	0.001
	(0.130)	(0.142)	(0.844)	(0.935)
Maturity	-0.010***	-0.010***	-0.004***	-0.004***
	(0.000)	(0.000)	(0.000)	(0.000)
Deal Amount	0.091***	0.088***	0.101***	0.095***
	(0.000)	(0.000)	(0.000)	(0.000)
Industry Dummies	*Yes*	*Yes*	*Yes*	*Yes*
Year Dummies	*Yes*	*Yes*	*Yes*	*Yes*
R^2	*0.365*	*0.367*	*0.274*	*0.276*

Significant at 1 percent (***), 5 percent (**), and 10 percent (*) levels.

Table VII

Test for endogeneity of PPS, Delta, and %New Bank

The sample consists of 631 U.S. dollar-denominated bank loans to U.S. non financial corporations and 1567 public bonds issued in the U.S. by U.S. non financial corporations between 1992 and 2005. The table reports statistics from tests for relevance and validity of instruments. Shea partial R^2, partial R^2, and F-statistics of joint significance of the instruments in the first stage test provide tests of instrument relevance. The Hansen J statistic tests the exogeneity of instruments for validity. Difference in Sargan C statistic tests the exogeneity of the endogenous variables.

	PPS	**PPS^2**	**Delta**	**Delta^2**
	N=1427		**N=1464**	
Instruments: CEO tenure, PPS (Delta) on the previous year, sales growth.				
Shea Partial R^2	0.014	0.011	0.002	0.002
Partial R^2	0.532	0.414	0.333	0.305
F	140.960***	56.120***	91.370***	77.700***
	(0.000)	(0.000)	(0.000)	(0.000)
Hansen J	0.215	1.111	0.322	0.327
	(0.898)	(0.574)	(0.851)	(0.849)
C statistic	1.273	0.377	0.008	0.002
	(0.259)	(0.539)	(0.930)	(0.965)

Significant at 1 percent (***), 5 percent (**), and 10 percent (*) levels.

Table VIII

OLS Regression of %NEW BANK – Truncation on Size and Maturity

The sample consists of 631 U.S. dollar-denominated bank loans to U.S. non financial corporations and 1567 public bonds issued in the U.S. by U.S. non financial corporations between 1992 and 2005. *%New Bank* is new bank debt to total new debt. *PPS* (Pay Performance Sensitivity) is the natural logarithm of the dollar increase in the value of the manager's portfolio for a $1,000 increase in firm value; *Delta* is the natural logarithm of the dollar increase in the value of the manager's stock options for a $1 increase in the stock price; *% Existing Bank Debt* is existing bank debt to total assets; *Size 2* and *Size 3* are dummy variables for the second and third tercile of the firm size, where *Size* is total assets $ million; *Age* is number of years since first record in Compustat; *Block* is a dummy variable equal to 1 if at least one shareholder holds 5% or more of the shares outstanding, 0 otherwise; *Profitability* is operating income to total assets; *Market-to-Book* ratio is book value of debt plus market value of common and preferred stock divided by total assets; *R&D* is R&D expenditures to total assets; *Book Leverage* is liabilities divided by total assets; *Interest Coverage* is operating income to interest expense; *Z-Score* is defined the natural logarithm of (3.3*EBIT/Sales+0.999*Sales/Total Assets+1.4*Retained Earnings/Total Assets+1.2*Working Capital/Total Assets+0.6*Market Value of Equity/ Market Value of Liabilities); *Returns Volatility* is the moving standard deviation of daily returns on a window of 30 days; *Maturity* is maturity of the loan/bond in years; *Deal Amount* is the natural logarithm of the total amount of the loan/bond in $ million. Industry dummies are based on the first two digits of the NAICS code. All continuous variables are winsorized at 1%. Columns (1) and (2), (3) and (4) , and (5) and (6) present estimated coefficients (p-values) from OLS regressions of *%New Bank* on the main sample truncated at 10% on firm size, maturity, and both firm size and maturity respectively. Standard errors are robust and clustered by firm.

Independent Variables	**(1) N=1759**	**(2) N=1759**	**(3) N=1770**	**(4) N=1770**	**(5) N=1407**	**(6) N=1407**
Intercept	-0.521***	-0.332**	-0.182	-0.006	-0.558***	-0.373**
	(0.000)	(0.034)	(0.152)	(0.964)	(0.000)	(0.017)
PPS	0.025		0.039**		0.014	
	(0.307)		(0.039)		(0.565)	
PPS^2	-0.008		-0.009**		-0.006	
	(0.105)		(0.025)		(0.200)	
Delta		1.015**		0.774**		1.058***
		(0.016)		(0.019)		(0.004)
Delta^2		1.142***		0.933***		1.199***
		(0.008)		(0.005)		(0.002)
Size 2	-0.164***	-0.156***	-0.255***	-0.247***	-0.182***	-0.172***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Size 3	-0.270***	-0.262***	-0.313***	-0.319***	-0.270***	-0.257***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Age	0.000	0.001	0.000	0.000	0.001	0.001
	(0.510)	(0.237)	(0.701)	(0.908)	(0.371)	(0.153)
Block	-0.029	-0.027	-0.021	-0.012	-0.029	-0.026
	(0.205)	(0.225)	(0.319)	(0.566)	(0.196)	(0.222)

Table VIII (continued)

Independent Variables	(1) N=1759	(2) N=1759	(3) N=1770	(4) N=1770	(5) N=1407	(6) N=1407
Profitability	-0.928	-0.818	-0.948*	-0.912	-0.059	0.012
	(0.116)	(0.164)	(0.087)	(0.103)	(0.926)	(0.985)
Market-to-Book	0.014	0.014	0.009	0.008	0.010	0.011
	(0.321)	(0.337)	(0.502)	(0.531)	(0.529)	(0.477)
R&D	0.346	0.231	0.824	0.658	-0.869	-0.946
	(0.775)	(0.849)	(0.409)	(0.518)	(0.440)	(0.390)
Book Leverage	-0.451***	-0.474***	-0.466***	-0.488***	-0.388***	-0.406***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Z-Score	0.037	0.040	0.044	0.045	0.009	0.011
	(0.283)	(0.242)	(0.149)	(0.139)	(0.783)	(0.728)
Returns Volatility	0.002	0.000	0.015	0.015	0.001	0.000
	(0.892)	(0.990)	(0.135)	(0.138)	(0.907)	(0.976)
Maturity	-0.009***	-0.009***	-0.021***	-0.021***	-0.018***	-0.017***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Deal Amount	0.158***	0.157***	0.098***	0.096***	0.180***	0.179***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Industry Dummies	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Year Dummies	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
R^2	*0.349*	*0.352*	*0.423*	*0.425*	*0.425*	*0.430*

Significant at 1 percent (***), 5 percent (**), and 10 percent (*) levels.

Table IX

2SLS Regression of %NEW BANK – Endogeneity of Spread

The sample consists of 631 U.S. dollar-denominated bank loans to U.S. non financial corporations and 1567 public bonds issued in the U.S. by U.S. non financial corporations between 1992 and 2005. *%New Bank* is new bank debt to total new debt. For firms in the private sample *Spread,* computed in basis points (bps), is the sum of spread over the LIBOR and any other annual fee; for firms in the public sample *Spread* is the spread over a Treasury bond of comparable maturity. *PPS* (Pay Performance Sensitivity) is the natural logarithm of the dollar increase in the value of the manager's portfolio for a $1,000 increase in firm value; *Delta* is the natural logarithm of the dollar increase in the value of the manager's stock options for a $1 increase in the stock price; *% Existing Bank Debt* is existing bank debt to total assets; *Size 2* and *Size 3* are dummy variables for the second and third tercile of the firm size, where *Size* is total assets $ million; *Age* is number of years since first record in Compustat; *Block* is a dummy variable equal to 1 if at least one shareholder holds 5% or more of the shares outstanding, 0 otherwise; *Profitability* is operating income to total assets; *Market-to-Book* ratio is book value of debt plus market value of common and preferred stock divided by total assets; *R&D* is R&D expenditures to total assets; *Book Leverage* is liabilities divided by total assets; *Interest Coverage* is operating income to interest expense; Z-*Score* is defined the natural logarithm of (3.3*EBIT/Sales+0.999*Sales/Total Assets+1.4*Retained Earnings/Total Assets+1.2*Working Capital/Total Assets+0.6*Market Value of Equity/ Market Value of Liabilities); *Returns Volatility* is the moving standard deviation of daily returns on a window of 30 days; *Maturity* is maturity of the loan/bond in years; *Deal Amount* is the natural logarithm of the total amount of the loan/bond in $ million. *Dividend* is a dummy variable equal to 1 if the company pays dividend, 0 otherwise; *Interest Volatility* is the monthly average of the 12-month moving standard deviation of daily yields on 10-years U.S. T-bonds. Industry dummies are based on the first two digits of the NAICS code. All continuous variables are winsorized at 1%. Columns (1) and (2) present estimated coefficients (p-values) from 2SLS regressions of *%New Bank*. Instruments for the endogenous variable *Spread* are *Dividend* and *Interest Volatility*. Standard errors are robust and clustered by firm.

Panel A: 2SLS regression			**Panel B: tests for endogeneity**		
Independent Variables	**(1) N=2185**	**(2) N=2185**	**Statistics**	**(1) N=2185**	**(2) N=2185**
Intercept	-0.121	0.061	Partial R^2	0.022	0.021
	(0.562)	(0.808)			
Spread	0.001	0.000	F	10.010	11.250
	(0.479)	(0.579)			
PPS	0.038*		Hansen J	1.447	1.537
	(0.075)			(0.229)	(0.215)
PPS^2	-0.010**		C statistic	7.057***	5.973**
	(0.029)			(0.008)	(0.015)
Delta		0.694*			
		(0.074)			
Delta^2		0.874**	Instruments for Spread: Dividend and Interest		
		(0.022)	Volatility		
Size 2	-0.227***	-0.221***			
	(0.000)	(0.000)			
Size 3	-0.282***	-0.292***			
	(0.000)	(0.000)			

Table IX (continued)

Panel A: 2SLS regression			Panel B: tests for endogeneity		
Independent Variables	**(1) N=2185**	**(2) N=2185**	**Statistics**	**(1) N=2185**	**(2) N=2185**
Age	0.000	0.000			
	(0.805)	(0.750)			
Block	-0.027	-0.019			
	(0.216)	(0.357)			
Profitability	-1.142**	-1.101**			
	(0.034)	(0.042)			
Market-to-Book	0.009	0.009			
	(0.457)	(0.499)			
R&D	1.131	1.065			
	(0.281)	(0.309)			
Book Leverage	-0.582***	-0.591***			
	(0.000)	(0.000)			
Z-Score	0.098*	0.092			
	(0.099)	(0.106)			
Returns Volatility	0.002	0.005			
	(0.927)	(0.837)			
Maturity	-0.011***	-0.011***			
	(0.000)	(0.000)			
Deal Amount	0.094***	0.090***			
	(0.000)	(0.000)			
Industry Dummies	*Yes*	*Yes*			
Year Dummies	*Yes*	*Yes*			
R^2	*0.310*	*0.493*			

Significant at 1 percent (***), 5 percent (**), and 10 percent (*) levels.

Table X

OLS Regression of Spread

The private sample consists of 251 U.S. dollar-denominated bank loans to U.S. non financial corporations; the public sample consists of and 1476 public bonds issued in the U.S. by U.S. non financial corporations between 1992 and 2005. For firms in the private sample *Spread,* computed in basis points (bps), is the sum of spread over the LIBOR and any other annual fee; for firms in the public sample *Spread* is the spread over a Treasury bond of comparable maturity. *PPS* (Pay Performance Sensitivity) is the natural logarithm of the dollar increase in the value of the manager's portfolio for a $1,000 increase in firm value; *Delta* is the natural logarithm of the dollar increase in the value of the manager's stock options for a $1 increase in the stock price; *Size 2* and *Size 3* are dummy variables for the second and third tercile of the firm size, where *Size* is total assets $ million; *Age* is number of years since first record in Compustat; *Profitability* is operating income to total assets; *Loss* is a dummy variable equal to 1 if the operating income before depreciation is negative, 0 otherwise; *Market-to-Book* ratio is book value of debt plus market value of common and preferred stock divided by total assets; *R&D* is R&D expenditures to total assets; *Book Leverage* is liabilities divided by total assets; *Interest Coverage* is operating income to interest expense; Z-*Score* is defined the natural logarithm of (3.3*EBIT/Sales+0.999*Sales/Total Assets+1.4*Retained Earnings/Total Assets+1.2*Working Capital/Total Assets+0.6*Market Value of Equity/ Market Value of Liabilities); *Collateral* is a dummy variable equal to 1 if the bond/loan is collateralized, 0 otherwise; *Returns Volatility* is the moving standard deviation of daily returns on a window of 30 days; *Maturity* is maturity of the loan/bond in years; *Deal Amount* is the natural logarithm of the total amount of the loan/bond in $ million. Industry dummies are based on the first two digits of the NAICS code. All continuous variables are winsorized at 1%. Columns (1) and (2) show the coefficients (p-values) of OLS regressions of *Spread* for the public sample; columns (3) and (4) show the coefficients (p-values) of OLS regressions of *Spread* for the private sample. Standard errors are robust and clustered by firm.

	Public Bonds		**Bank Loans**	
Independent Variables	**(1) N=1476**	**(2) N=1476**	**(3) N=251**	**(4) N=251**
Intercept	211.038***	264.610***	183.066***	197.092***
	(0.000)	(0.000)	(0.000)	(0.000)
PPS	6.991**		2.295	
	(0.025)		(0.487)	
Delta		50.225*		12.546
		(0.059)		(0.606)
Size 2	-28.496***	-32.202***	-26.924**	-27.454**
	(0.001)	(0.000)	(0.018)	(0.015)
Size 3	-65.587***	-73.469***	-37.960**	-39.448***
	(0.000)	(0.000)	(0.014)	(0.010)
Age	-0.566*	-0.460	-0.137	-0.138
	(0.062)	(0.143)	(0.632)	(0.639)
Profitability	-538.902***	-571.633***	247.605	230.005
	(0.002)	(0.001)	(0.251)	(0.287)
Loss	5.490	4.949	-1.080	-1.227
	(0.536)	(0.583)	(0.934)	(0.926)

Table X (continued)

	Public Bonds		Bank Loans	
Independent Variables	**(1) N=1476**	**(2) N=1476**	**(3) N=251**	**(4) N=251**
Market-to-Book	-7.248*	-8.632*	2.225	2.210
	(0.093)	(0.051)	(0.645)	(0.648)
R&D	582.195**	516.343**	-238.236	-252.941
	(0.028)	(0.049)	(0.368)	(0.333)
Book Leverage	105.107***	107.618***	-3.717	-2.518
	(0.002)	(0.001)	(0.906)	(0.936)
Interest Coverage	0.146	0.158	-0.031	-0.030
	(0.576)	(0.539)	(0.549)	(0.559)
Z-Score	-64.507***	-65.227***	-53.228***	-53.266***
	(0.000)	(0.000)	(0.000)	(0.000)
Returns Volatility	36.950***	36.725***	7.089	7.172*
	(0.000)	(0.000)	(0.105)	(0.098)
Deal Amount	3.362	1.854	-9.383**	-9.824**
	(0.518)	(0.718)	(0.040)	(0.031)
Maturity	0.454***	0.421***	1.919	2.073
	(0.000)	(0.001)	(0.417)	(0.378)
Collateral	204.892***	209.450***	72.842***	72.786***
	(0.000)	(0.000)	(0.000)	(0.000)
Interest Rate Volatility	42.762	43.831	48.446	48.692
	(0.138)	(0.127)	(0.232)	(0.231)
Industry Dummies	*Yes*	*Yes*	*Yes*	*Yes*
Year Dummies	*Yes*	*Yes*	*Yes*	*Yes*
R^2	*0.607*	*0.606*	*0.650*	*0.649*

Significant at 1 percent (***), 5 percent (**), and 10 percent (*) levels.

Table XI

Test for endogeneity of PPS, Delta, and Spread

The sample consists of 187 U.S. dollar-denominated bank loans to U.S. non financial corporations and 1427 public bonds issued in the U.S. by U.S. non financial corporations between 1992 and 2005. The table reports statistics from tests for relevance and validity of instruments. Shea partial R^2, partial R^2, and F-statistics of joint significance of the instruments in the first stage test provide tests of instrument relevance. The Hansen J statistic tests the exogeneity of instruments for validity. Difference in Sargan C statistic tests the exogeneity of the endogenous variables.

	Public Sample		**Private Sample**	
	PPS	**Delta**	**PPS**	**Delta**
	N=1427		**N=187**	
Instruments: CEO tenure, PPS (Delta) on the previous year.				
Partial R^2	0.658	0.382	0.226	0.298
F	336.450***	139.850***	14.930***	44.380***
	(0.000)	(0.000)	(0.000)	(0.000)
Hansen J	2.115	0.652	1.099	0.490
	(0.146)	(0.419)	(0.295)	(0.484)
C statistic	0.207	0.737	1.211	0.693
	(0.649)	(0.391)	(0.271)	(0.405)

Table XII

Logistic Regression of Collateral

The private sample consists of 251 U.S. dollar-denominated bank loans to U.S. non financial corporations between 1992 and 2005. *Collateral* is a dummy variable equal to 1 if the bond/loan is collateralized, 0 otherwise; *PPS* (Pay Performance Sensitivity) is the natural logarithm of the dollar increase in the value of the manager's portfolio for a $1,000 increase in firm value; *Delta* is the natural logarithm of the dollar increase in the value of the manager's stock options for a $1 increase in the stock price; *Size 2* and *Size 3* are dummy variables for the second and third tercile of the firm size, where *Size* is total assets $ million; *Age* is number of years since first record in Compustat; *Profitability* is operating income to total assets; *Loss* is a dummy variable equal to 1 if the operating income before depreciation is negative, 0 otherwise; *Tangibility* is net property, plant and equipment to total asset; *Market-to-Book* ratio is book value of debt plus market value of common and preferred stock divided by total assets; *R&D* is R&D expenditures to total assets; *Book Leverage* is liabilities divided by total assets; *Interest Coverage* is operating income to interest expense; Z-*Score* is defined the natural logarithm of (3.3*EBIT/Sales+0.999*Sales/Total Assets+1.4*Retained Earnings/Total Assets+1.2*Working Capital/Total Assets+0.6*Market Value of Equity/ Market Value of Liabilities); *Returns Volatility* is the moving standard deviation of daily returns on a window of 30 days; *Deal Amount* is the natural logarithm of the total amount of the loan/bond in $ million; *Maturity* is maturity of the loan/bond in years. Industry dummies are based on the first two digits of the NAICS code. All continuous variables are winsorized at 1%. Columns (1) and (2) show the coefficients (p-values) of a logistic regression of *Collateral* for the private sample; columns (3) and (4) show the coefficients (p-values) of a logistic regression of *Collateral* for the private sample: here the dummy variable Collateral is set to 0 when the observation is missing. Standard errors are robust and clustered by firm.

Independent Variables	**(1) N=242**	**(2) N=242**	**(3) N=611**	**(4) N=611**
Intercept	4.043	6.683**	-1.493	-0.104
	(0.109)	(0.015)	(0.515)	(0.965)
PPS	0.283*		0.099	
	(0.077)		(0.522)	
Delta		3.862**		3.047***
		(0.044)		(0.009)
Size 2	-1.038**	-1.008**	-1.595***	-1.588***
	(0.024)	(0.029)	(0.000)	(0.000)
Size 3	-1.600**	-1.847***	-1.970***	-1.985***
	(0.032)	(0.005)	(0.001)	(0.000)
Age	-0.015	-0.011	-0.022*	-0.017
	(0.400)	(0.498)	(0.066)	(0.127)
Profitability	-4.923	-3.333	-8.653	-9.304
	(0.664)	(0.765)	(0.258)	(0.221)
Tangibility	-2.635*	-2.615*	-0.385	-0.312
	(0.060)	(0.056)	(0.687)	(0.750)
Loss	0.594	0.787	0.490	0.572
	(0.407)	(0.277)	(0.295)	(0.232)

Table XII (continued)

Independent Variables	**(1) N=242**	**(2) N=242**	**(3) N=611**	**(4) N=611**
Market-to-Book	-0.306	-0.345	-0.063	-0.071
	(0.280)	(0.205)	(0.803)	(0.762)
R&D	-23.301	-26.446	-7.646	-11.494
	(0.319)	(0.288)	(0.597)	(0.452)
Book Leverage	4.362*	4.823**	2.321*	2.807*
	(0.064)	(0.044)	(0.097)	(0.060)
Interest Coverage	0.001	0.001	0.004**	0.004**
	(0.621)	(0.663)	(0.040)	(0.025)
Z-Score	-0.400	-0.528	-0.346	-0.455
	(0.593)	(0.486)	(0.547)	(0.409)
Returns Volatility	0.612***	0.629***	0.437***	0.420***
	(0.002)	(0.003)	(0.002)	(0.003)
Deal Amount	-0.447*	-0.525**	-0.110	-0.143
	(0.056)	(0.038)	(0.497)	(0.392)
Maturity	0.347**	0.384**	0.334***	0.359***
	(0.041)	(0.022)	(0.002)	(0.001)
Interest Rate Volatility	1.292	1.224	2.021	1.701
	(0.556)	(0.587)	(0.253)	(0.340)
Industry Dummies	*Yes*	*Yes*	*Yes*	*Yes*
Year Dummies	*Yes*	*Yes*	*Yes*	*Yes*
Pseudo R^2	*0.403*	*0.415*	*0.331*	*0.345*

Significant at 1 percent (***), 5 percent (**), and 10 percent (*) levels.

APPENDIX

Proof of Lemma 1. The manager invests in the safe project only if investing in S maximizes his expected profit. Thus, the manager solves the inequality $E_{NC}^{M}(S,r) > E_{NC}^{M}(R,r)$ ($E_{C}^{M}(S,r) > E_{C}^{M}(R,r)$) for the interest rate *r*. Without collateral, that is equivalent to solving

$$W-(1-q)\xi+\alpha q[E+H-W-I(1+r)]>W-(1-p)\xi+\alpha p[E+Z-W-I(1+r)]$$

On the other hand, if the bond is collateralized the inequality becomes

$$qW+\alpha q[E+H-W-I(1+r)]>pW+\alpha p[E+Z-W-I(1+r)]$$

Solving the inequalities for *r* leads to *Lemma 1*. Q.E.D.

Proof of Proposition 1. This proof has two parts: first I analyze all the feasible outcomes given the manager's reaction function; then I study which outcome prevails for different levels of incentive compensation *α*.

Part 1: Feasible Outcomes

a) $r_{NC} < r_{NC}^{*}$

Bondholders know that if $r_{NC} < r_{NC}^{*}$ the manager invests in project *S*. Thus, they charge the interest rate that solves equation $E^{L}(S,r_{NC}) = qI(1+r_{NC}) + (1-q)(E+\xi-W) - I = 0$. The solution is $r_{NC}^{S} = [I-(1-q)(E+\xi-W)]/qI-1$. To be feasible, the interest rate must be incentive compatible and must guarantee a non-negative profit to the manager. r_{NC}^{S} is incentive compatible only if $r_{NC}^{S} < r_{NC}^{*}$. Solving the inequality for the level of incentive compensation *α* gives the condition for r_{NC}^{S} to be incentive compatible: there is a threshold $\alpha_{NC}^{*} > 0$ such that if $\alpha < \alpha_{NC}^{*}$, $r_{NC}^{S} < r_{NC}^{*}$, with

$$\alpha_{NC}^{*} = \frac{q(q-p)\xi}{p[qZ+E+(1-q)\xi-W-I]-q[qH+E+(1-q)\xi-W-I]}$$

Only when *α* is below the threshold α_{NC}^{*} the manager, offered the interest rate r_{NC}^{S}, invests in the safe project, and has an expected payoff of $E_{NC}^{M}(S,r_{NC}^{S}) = W-(1-q)\xi+\alpha[qH+E+(1-q)\xi-W-I] > 0$. If *α* is greater than the threshold α_{NC}^{*}, r_{NC}^{S} is not feasible: the manager facing the rate r_{NC}^{S} invests in the risky project, and bondholders' expected profit is negative. Thus, for *α* greater than the threshold, no lender offers r_{NC}^{S}.

b) $r_{NC} > r_{NC}^{*}$

Lenders know that if $r_{NC} > r_{NC}^{*}$ the manager invests in project *R*. Thus, they find r_{NC} that solves $E^{L}(R,r_{NC}) = pI(1+r_{NC}) + (1-p)(E+\xi-W) - I = 0$. The rate $r_{NC}^{R} = [I-(1-p)(E+\xi-W)]/pI-1$ solves the equation. As before, to be feasible the interest rate must be incentive compatible and guarantee a non-negative profit to the manager. r_{NC}^{R} is incentive compatible only if $r_{NC}^{R} > r_{NC}^{*}$. Solving the

inequality for the level of incentive compensation α gives the condition for r_{NC}^{R} to be incentive compatible: there is a threshold $\alpha_{NC}^{**} > 0$ such that if $\alpha > \alpha_{NC}^{**}$, $r_{NC}^{R} > r_{NC}^{*}$, where α_{NC}^{**} is

$$\alpha_{NC}^{**} = \frac{p(q-p)\xi}{p[pZ + E + (1-p)\xi - W - I] - q[pH + E + (1-p)\xi - W - I]}$$

Only when α is above the threshold α_{NC}^{**} the manager, offered the interest rate r_{NC}^{R}, invests in the risky project, and has an expected payoff of $E_{NC}^{M}(R, r_{NC}^{R}) = W - (1-p)\xi + \alpha[pZ + E + (1-p)\xi - W - I] > 0$. If α is below the threshold, r_{NC}^{R} is not incentive compatible: the manager, offered r_{NC}^{R}, invests in the safe project, and bondholders have a positive expected profit. However, because public lenders are competitive, another group of investors offers the lower rate r_{NC}^{S}, and the manager accepts the offer and invests in project *S* because $E_{NC}^{M}(S, r_{NC}^{S}) > E_{NC}^{M}(R, r_{NC}^{R})$ Thus, if α is lower than the threshold, no lender offers r_{NC}^{R}.

c) $r_C < r_C^*$

Lenders know that if $r_C < r_C^*$ the manager invests in project *S*. Thus, they charge r_C that solves equation $E^L(S, r_C) = qI(1 + r_C) + (1-q)E - I = 0$. The solution is $r_C^S = [I - (1-q)E]/qI - 1$. The interest rate must be incentive compatible and must guarantee a non-negative profit to the manager to be feasible. Solving the inequality $r_C^S < r_C^*$ for the level of incentive compensation α gives the condition for r_C^S to be incentive compatible: there is a threshold $\alpha_C^* > 0$ such that if $\alpha < \alpha_C^*$, $r_C^S < r_C^*$, where α_C^* is

$$\alpha_C^* = \frac{q(q-p)W}{p[qZ + E - qW - I] - q[qH + E - qW - I]}$$

Only when α is below the threshold α_C^* the manager, offered the interest rate r_C^S, invests in the safe project, and has an expected payoff of $E_{NC}^{M}(S, r_{NC}^{S}) = qW + \alpha[qH + E - qW - I] > 0$. If α is greater than the threshold α_C^*, r_C^S is not feasible: the manager facing a rate of r_C^S invests in the risky project and bondholders' expected profit is negative. Thus, for α greater than the threshold, no lender offers r_C^S.

d) $r_C > r_C^*$

Lenders know that if $r_C > r_C^*$ the manager invests in project *R*. Thus, they charge r_C that solves equation $E^L(R, r_C) = pI(1 + r_C) + (1-p)E - I = 0$. The solution is $r_C^R = [I - (1-p)E]/pI - 1$. The interest rate must be incentive compatible and must guarantee a non-negative profit to the manager to be feasible. Solving the inequality $r_C > r_C^*$ for the level of incentive compensation α gives the condition for r_C^R to be incentive compatible: there is a threshold $\alpha_C^{**} > 0$ such that if $\alpha > \alpha_C^{**}$, $r_C > r_C^*$, where α_C^{**} is

$$\alpha_C^{**} = \frac{p(q-p)W}{p[pZ + E - pW - I] - q[pH + E - pW - I]}$$

Only when α is above the threshold α_C^{**} the manager, offered the interest rate r_C^R, invests in the risky project, and has an expected payoff of $E_C^M(R, r_C^R) = pW + \alpha[pZ + E - pW - I] > 0$. If α is lower than the threshold, r_C^R is not feasible: the manager, offered r_C^R, invests in the safe project, and bondholders have a positive expected profit. However, because public lenders are competitive, another group of investors offers the lower rate r_C^S, and the manager accepts the offer and invests in project S because $E_C^M(S, r_C^S) > E_C^M(R, r_C^R)$ Thus, if α is lower than the threshold, no lender offers r_C^R.

Part 2: Final Outcomes

It can be readily shown that $\alpha_{NC}^{**} < \alpha_{NC}^{*} < \alpha_C^{*}$. For simplicity I assume that $\alpha_{NC}^{**} < \alpha_C^{**} < \alpha_{NC}^{*}$. If $\alpha_{NC}^{**} < \alpha_{NC}^{*} < \alpha_C^{**} < \alpha_C^{*}$ the final result does not change. If $\alpha < \alpha_{NC}^{**}$ only two interest rates are feasible, r_{NC}^S and r_C^S. Simple calculations show that $E_{NC}^M(S, r_{NC}^S) > E_C^M(S, r_C^S)$: thus, for $\alpha < \alpha_{NC}^{**}$, the backwards-induction outcome is (S, r_{NC}^S). For $\alpha_{NC}^{**} < \alpha < \alpha_C^{**}$ the feasible interest rates are r_{NC}^S, r_C^S and r_{NC}^R. Because $E_{NC}^M(S, r_{NC}^S) > E_C^M(S, r_C^S)$, the relevant comparison is between $E_{NC}^M(S, r_{NC}^S)$ and $E_{NC}^M(R, r_{NC}^R)$. It can be shown that $E_{NC}^M(S, r_{NC}^S) > E_{NC}^M(R, r_{NC}^R)$: thus, for $\alpha_{NC}^{**} < \alpha < \alpha_C^{**}$, the backwards-induction outcome is (S, r_{NC}^S). For $\alpha_C^{**} < \alpha < \alpha_{NC}^{*}$ the feasible interest rates are r_{NC}^S, r_C^S, r_{NC}^R, and r_C^R. Because $E_{NC}^M(S, r_{NC}^S) > E_C^M(S, r_C^S)$ and $E_{NC}^M(R, r_{NC}^R) > E_C^M(R, r_C^R)$, the relevant comparison is again between $E_{NC}^M(S, r_{NC}^S)$ and $E_{NC}^M(R, r_{NC}^R)$: thus, for $\alpha_C^{**} < \alpha < \alpha_{NC}^{*}$, the backwards-induction outcome is (S, r_{NC}^S). If $\alpha_{NC}^{*} < \alpha < \alpha_C^{*}$ the feasible interest rates are r_C^S, r_C^R and r_{NC}^R. Because $E_{NC}^M(R, r_{NC}^R) > E_C^M(R, r_C^R)$, the relevant comparison is between $E_C^M(S, r_C^S)$ and $E_{NC}^M(R, r_{NC}^R)$. Given the model parametric assumptions, it can be shown that $E_C^M(S, r_C^S) > E_{NC}^M(R, r_{NC}^R)$: thus, for $\alpha_{NC}^{*} < \alpha < \alpha_C^{*}$ the backwards-induction outcome is (S, r_C^S). Finally, for $\alpha > \alpha_C^{*}$, the only feasible interest rates are r_{NC}^R and r_C^R. Because $E_{NC}^M(R, r_{NC}^R) > E_C^M(R, r_C^R)$, the relevant comparison is between $E_C^M(S, r_C^S)$ and $E_{NC}^M(R, r_{NC}^R)$. Q.E.D.

Proof of Lemma 2. The manager invests in the safe project only if investing in S maximizes his expected profit. Thus, the manager solves the inequalities $\overline{E}_{NC}^M(S, \bar{r}) > \overline{E}_{NC}^M(R, \bar{r})$ ($\overline{E}_C^M(S, \bar{r}) > \overline{E}_C^M(R, \bar{r})$) for the interest rate r. Without collateral, that is equivalent to solving

$$W - (1-q)\xi + \alpha q[E + H - W - I(1+r)] > W - (1-\phi p)\xi + \alpha\phi p[E + Z - W - I(1+r)]$$

If the bond is collateralized the inequality becomes

$$qW + \alpha q[E + H - W - I(1+r)] > \phi p\, W + \alpha\phi p[E + Z - W - I(1+r)]$$

Solving the inequalities for *r* leads to *Lemma 2*. Q.E.D.

Proof of Proposition 2. This proof has two parts: first I analyze all the feasible outcomes given the manager's reaction function; then I study which outcome prevails for different levels of incentive compensation α.

Part 1: Feasible Outcomes

a) $\bar{r}_{NC} < \bar{r}^*_{NC}$

The bank knows that, if $\bar{r}_{NC} < \bar{r}^*_{NC}$, the manager invests in project *S*, and the signal is *S* with probability 1. Thus, the bank solves $E^L(S, \bar{r}_{NC}) = qI(1+\bar{r}_{NC}) + (1-q)(E+\xi-W) - I - c = 0$ for $\bar{r}_{NC}$. The solution is $\bar{r}^S_{NC} = [I + c - (1-q)(E+\xi-W)]/qI - 1$. To be feasible, the interest rate must be incentive compatible and must guarantee a non-negative profit to the manager. $\bar{r}^S_{NC}$ is incentive compatible only if $\bar{r}_{NC} < \bar{r}^*_{NC}$. Solving the inequality for the level of incentive compensation α gives the condition for $\bar{r}^S_{NC}$ to be incentive compatible: there is a threshold $\bar{\alpha}^*_{NC}$ such that if $\alpha < \bar{\alpha}^*_{NC}$, $\bar{r}_{NC} < \bar{r}^*_{NC}$ with

$$\bar{\alpha}^*_{NC} = \frac{q(q-\phi p)\xi}{\phi p[qZ + E + (1-q)\xi - W - I - c] - q[qH + E + (1-q)\xi - W - I - c]}$$

Only when α is below the threshold $\bar{\alpha}^*_{NC}$ the manager, offered the interest rate $\bar{r}^S_{NC}$, invests in the safe project. His expected payoff is $E^M_{NC}(S, r^S_{NC}) = W - (1-q)\xi + \alpha[qH + E + (1-q)\xi - W - I - c] > 0$. If α is above the threshold $\bar{\alpha}^*_{NC}$, $\bar{r}^S_{NC}$ is not feasible: the manager facing a rate of $\bar{r}^S_{NC}$ invests in the risky project and the bank expected profit is negative. Thus, for α greater than the threshold, no bank offers $\bar{r}^S_{NC}$.

b) $\bar{r}_{NC} > \bar{r}^*_{NC}$

The bank knows that, if $\bar{r}_{NC} > \bar{r}^*_{NC}$, the manager invests in project *R*, and the signal is *S* with probability ϕ and *R* with probability $1-\phi$. Thus, the bank charges the interest rate $\bar{r}_{NC}$ that solves the following equation:

$$E^L(R, \bar{r}_{NC}) = \phi[pI(1+\bar{r}_{NC}) + (1-p)(E+\xi-W) - I - c] + (1-\phi)(E - W + \xi - c) = 0$$

The solution is $\bar{r}^R_{NC} = [\phi I + c - (1-\phi p)(E+\xi-W)]/\phi pI - 1$. As before, to be feasible the interest rate must be incentive compatible and guarantee a non-negative profit to the manager. $\bar{r}^R_{NC}$ is incentive compatible only if $\bar{r}_{NC} > \bar{r}^*_{NC}$. Solving the inequality for the level of incentive compensation α gives the condition for $\bar{r}^R_{NC}$ to be incentive compatible: there is a threshold $\bar{\alpha}^{**}_{NC}$ such that if $\alpha > \bar{\alpha}^{**}_{NC}$, $\bar{r}_{NC} > \bar{r}^*_{NC}$ where $\bar{\alpha}^{**}_{NC}$ is

$$\bar{\alpha}^{**}_{NC} = \frac{\phi p(q-\phi p)\xi}{\phi p[\phi pZ + E + (1-\phi p)\xi - W - \phi I - c] - q[\phi pH + E + (1-\phi p)\xi - W - \phi I - c]}$$

Only when α is above the threshold $\bar{\alpha}^{**}_{NC}$ the manager, offered the interest rate $\bar{r}^R_{NC}$, invests in the risky project. $\bar{E}^M_{NC}(R, \bar{r}^R_{NC}) = W - (1-\phi p)\xi + \alpha[\phi pZ + E + (1-\phi p)\xi - W - \phi I - c] > 0$ is the manager's expected payoff. If α is below the threshold, $\bar{r}^R_{NC}$ is not feasible. The manager invests in the safe project and the bank has a positive expected profit. However, because banks are competitive, another group of investors offers the lower rate $\bar{r}^S_{NC}$, and the manager accepts the offer and invests in project *S* because $E^M_{NC}(S, r^S_{NC}) > E^M_{NC}(R, r^R_{NC})$ Thus, if α is below the threshold, no bank offers $\bar{r}^R_{NC}$.

c) $\bar{r}_C < \bar{r}_C^*$

The bank knows that if $\bar{r}_C < \bar{r}_C^*$ the manager invests in project *S* and that the signal is *S* with probability 1. Thus, the bank solves $\bar{E}^L(S,\bar{r}_C) = qI(1+\bar{r}_C) + (1-q)E - I - c = 0$ for the interest rate $\bar{r}_C$. The solution is $\bar{r}_C^S = [I + c - (1-q)E]/qI - 1$. To be feasible, the interest rate must be incentive compatible and must guarantee a non-negative profit to the manager. Solving the inequality $\bar{r}_C < \bar{r}_C^*$ for the level of incentive compensation α gives the condition for $\bar{r}_C^S$ to be incentive compatible: there is a threshold $\bar{\alpha}_C^*$ such that if $\alpha < \bar{\alpha}_C^*$, $\bar{r}_C < \bar{r}_C^*$ where $\bar{\alpha}_C^*$ is

$$\bar{\alpha}_C^* = \frac{q(q-\phi p)W}{\phi p[qZ + E - qW - I - c] - q[qH + E - qW - I - c]}$$

Only when α is below the threshold $\bar{\alpha}_C^*$ the manager, offered the interest rate $\bar{r}_C^S$, invests in the safe project, and has an expected payoff of $E_C^M(S, r_C^S) = qW + \alpha[qH + E - qW - I - c] > 0$. If α is greater than the threshold $\bar{\alpha}_C^*$, $\bar{r}_C^S$ is not feasible: the manager facing a rate of $\bar{r}_C^S$ invests in the risky project and the bank expected profit is negative. Thus, for α greater than the threshold, no bank offers $\bar{r}_C^S$.

d) $\bar{r}_C > \bar{r}_C^*$

The bank knows that if $\bar{r}_C > \bar{r}_C^*$ the manager chooses to invest in project *R*. In that case they know the signal is S with probability ϕ and R with probability $1-\phi$. Thus, they need to find the interest rate $\bar{r}_{NC}$ that solves the following equation:

$$E^L(R,\bar{r}_C) = \phi[pI(1+\bar{r}_C) + (1-p)E - I - c] + (1-\phi)(E-c) = 0$$

The solution is $\bar{r}_C^R = [\phi I + c - (1-\phi p)E]/\phi pI - 1$. The interest rate must be incentive compatible and must guarantee a non-negative profit to the manager to be feasible. Solving the inequality $\bar{r}_C > \bar{r}_C^*$ for the level of incentive compensation α gives the condition for $\bar{r}_C^R$ to be incentive compatible: there is a threshold $\bar{\alpha}_C^{**}$ such that if $\alpha > \bar{\alpha}_C^{**}$, $\bar{r}_C > \bar{r}_C^*$ where $\bar{\alpha}_C^{**}$ is

$$\bar{\alpha}_C^{**} = \frac{\phi p(q-\phi p)W}{\phi p[\phi pZ + E - \phi pW - \phi I - c] - q[\phi pH + E - \phi pW - \phi I - c]}$$

Only when α is above the threshold $\bar{\alpha}_C^{**}$ the manager, offered the interest rate $\bar{r}_C^R$, invests in the risky project, and has an expected payoff of $\bar{E}_C^M(R,\bar{r}_C^R) = \varphi pW + \alpha[\phi pZ + E - \varphi pW - \phi I - c] > 0$. If α is below the threshold, $\bar{r}_C^R$ is not feasible. The manager invests in the safe project and the bank has a positive expected profit. However, because banks are competitive, another bank offers the lower rate $\bar{r}_C^S$ and the manager accepts the offer and invests in project *S* because $\bar{E}_C^M(S,\bar{r}_C^S) > \bar{E}_C^M(R,\bar{r}_C^R)$ Thus, if α is below the threshold, no bank offers $\bar{r}_C^R$.

Part 2: Final Outcomes

It can be readily shown that $\overline{\alpha}_{NC}^{**} < \overline{\alpha}_{NC}^{*} < \overline{\alpha}_{C}^{*}$. For simplicity I assume that $\overline{\alpha}_{NC}^{**} < \overline{\alpha}_{C}^{**} < \overline{\alpha}_{NC}^{*}$. If $\overline{\alpha}_{NC}^{**} < \overline{\alpha}_{NC}^{*} < \overline{\alpha}_{C}^{**} < \overline{\alpha}_{C}^{*}$ the final result does not change. If $\alpha < \overline{\alpha}_{NC}^{**}$ only two interest rates are feasible, $\overline{r}_{NC}^{S}$ and $\overline{r}_{C}^{S}$. Simple calculations show that $\overline{E}_{NC}^{M}(S,\overline{r}_{NC}^{S}) > \overline{E}_{C}^{M}(S,\overline{r}_{C}^{S})$: thus, for $\alpha < \overline{\alpha}_{NC}^{**}$, the backwards-induction outcome is $\left(S,\overline{r}_{NC}^{S}\right)$. For $\overline{\alpha}_{NC}^{**} < \alpha < \overline{\alpha}_{C}^{**}$ the feasible interest rates are $\overline{r}_{NC}^{S}$, $\overline{r}_{C}^{S}$ and $\overline{r}_{NC}^{R}$. Because $\overline{E}_{NC}^{M}(S,\overline{r}_{NC}^{S}) > \overline{E}_{C}^{M}(S,\overline{r}_{C}^{S})$, the relevant comparison is between $\overline{E}_{NC}^{M}(S,\overline{r}_{NC}^{S})$ and $\overline{E}_{NC}^{M}(R,\overline{r}_{NC}^{R})$. It can be shown that $\overline{E}_{NC}^{M}(S,\overline{r}_{NC}^{S}) > \overline{E}_{C}^{M}(R,\overline{r}_{NC}^{R})$: thus, for $\overline{\alpha}_{NC}^{**} < \alpha < \overline{\alpha}_{C}^{**}$, the backwards-induction outcome is $\left(S,\overline{r}_{NC}^{S}\right)$. For $\overline{\alpha}_{C}^{**} < \alpha < \overline{\alpha}_{NC}^{*}$ the feasible interest rates are $\overline{r}_{NC}^{S}$, $\overline{r}_{C}^{S}$, $\overline{r}_{NC}^{R}$, and $\overline{r}_{C}^{R}$. Because $\overline{E}_{NC}^{M}(S,\overline{r}_{NC}^{S}) > \overline{E}_{C}^{M}(S,\overline{r}_{C}^{S})$ and $\overline{E}_{NC}^{M}(R,\overline{r}_{NC}^{R}) > \overline{E}_{C}^{M}(R,\overline{r}_{C}^{R})$, the relevant comparison is again between $\overline{E}_{NC}^{M}(S,\overline{r}_{NC}^{S})$ and $\overline{E}_{NC}^{M}(R,\overline{r}_{NC}^{R})$: thus, for $\overline{\alpha}_{C}^{**} < \alpha < \overline{\alpha}_{NC}^{*}$, the backwards-induction outcome is $\left(S,\overline{r}_{NC}^{S}\right)$. If $\overline{\alpha}_{NC}^{*} < \alpha < \overline{\alpha}_{C}^{*}$ the feasible interest rates are $\overline{r}_{C}^{S}, \overline{r}_{C}^{R}$ and $\overline{r}_{NC}^{R}$. Because $\overline{E}_{NC}^{M}(R,\overline{r}_{NC}^{R}) > \overline{E}_{C}^{M}(R,\overline{r}_{C}^{R})$, the relevant comparison is between $\overline{E}_{C}^{M}(S,\overline{r}_{C}^{S})$ and $\overline{E}_{NC}^{M}(R,\overline{r}_{NC}^{R})$. Given the parametric assumptions, it can be shown that $\overline{E}_{C}^{M}(S,\overline{r}_{C}^{S}) > \overline{E}_{NC}^{M}(R,\overline{r}_{NC}^{R})$: for $\overline{\alpha}_{NC}^{*} < \alpha < \overline{\alpha}_{C}^{*}$ the backwards-induction outcome is $\left(S,\overline{r}_{C}^{S}\right)$. Finally, for $\alpha > \overline{\alpha}_{C}^{*}$, the only feasible interest rates are $\overline{r}_{NC}^{R}$ and $\overline{r}_{C}^{R}$. Because $\overline{E}_{NC}^{M}(R,\overline{r}_{NC}^{R}) > \overline{E}_{C}^{M}(R,\overline{r}_{C}^{R})$, the backwards induction outcome for this case is $\left(R,\overline{r}_{NC}^{R}\right)$. Q.E.D.

Proof of Proposition 3. It can be easily shown that, for a small monitoring cost *c*, $\alpha_{NC}^{*} < \alpha_{C}^{*} < \overline{\alpha}_{NC}^{*} < \overline{\alpha}_{C}^{*}$ if $\overline{\alpha}_{C}^{*} > 0$. This is equivalent to the condition:

$$\frac{q}{\phi p} < \frac{qZ + E - qW - I - c}{qH + E - qW - I - c}$$

To prove Proposition 3, I compare the manager's payoffs for each backwards-induction outcome. If $\alpha < \alpha_{NC}^{*}$, the feasible outcomes are (S, r_{NC}^{S}) with public debt and $(S,\overline{r}_{NC}^{S})$ with bank debt. Thus I compare the manager's expected payoffs:

$$W - (1-q)\xi + \alpha\left[qH + E + (1-q)\xi - W - I\right] > W - (1-q)\xi + \alpha\left[qH + E + (1-q)\xi - W - I - c\right]$$

Then, for $\alpha < \alpha_{NC}^{*}$, $E_{NC}^{M}(S,r_{NC}^{S}) > \overline{E}_{NC}^{M}(S,\overline{r}_{NC}^{S})$ and the final outcome is (S, r_{NC}^{S}). If $\alpha_{NC}^{*} < \alpha < \alpha_{C}^{*}$ the feasible outcomes are (S, r_{C}^{S}) with public debt and $(S,\overline{r}_{NC}^{S})$ with bank debt. Thus I compare the manager's expected payoffs:

$$qW + \alpha\left[qH + E - qW - I\right] < W - (1-q)\xi + \alpha\left[qH + E + (1-q)\xi - W - I - c\right]$$

The inequality is true for small *c*. Thus, for $\alpha_{NC}^{*} < \alpha < \alpha_{C}^{*}$, $E_{NC}^{M}(S,r_{C}^{S}) < \overline{E}_{NC}^{M}(S,\overline{r}_{NC}^{S})$, and the final outcome is $(S,\overline{r}_{NC}^{S})$. If $\alpha_{C}^{*} < \alpha < \overline{\alpha}_{NC}^{*}$ the feasible outcomes are (R, r_{NC}^{R}) with public debt and $(S,\overline{r}_{NC}^{S})$ with bank debt. I compare the manager's expected payoffs:

$$W - (1-p)\xi + \alpha\left[pZ + E + (1-p)\xi - W - I\right] < W - (1-q)\xi + \alpha\left[qH + E + (1-q)\xi - W - I - c\right]$$

The inequality is true for small c. Thus, for $\alpha_C^* < \alpha < \overline{\alpha}_{NC}^*$, $E_{NC}^M(R, r_{NC}^R) < \overline{E}_{NC}^M(S, \overline{r}_{NC}^S)$, and the final outcome is again $(S, \overline{r}_{NC}^S)$. If $\overline{\alpha}_{NC}^* < \alpha < \overline{\alpha}_C^*$ the feasible outcomes are (R, r_{NC}^R) with public debt and $(S, \overline{r}_C^S)$ with bank debt. I compare the manager's expected payoffs:

$$W - (1-p)\xi + \alpha\left[pZ + E + (1-p)\xi - W - I\right] < qW + \alpha\left[qH + E - qW - I - c\right]$$

The inequality is true for small c. Thus, for $\overline{\alpha}_{NC}^* < \alpha < \overline{\alpha}_C^*$, $E_{NC}^M(R, r_{NC}^R) < \overline{E}_C^M(S, \overline{r}_C^S)$, and the final outcome is $(S, \overline{r}_C^S)$. Finally, for $\alpha > \overline{\alpha}_C^*$ the feasible outcomes are (R, r_{NC}^R) with public debt and $(R, \overline{r}_{NC}^R)$ with bank debt. I compare the manager's expected payoffs:

$$W - (1-p)\xi + \alpha\left[pZ + E + (1-p)\xi - W - I\right] > W - (1-\phi p)\xi + \alpha\left[\phi pZ + E + (1-\phi p)\xi - W - \phi I - c\right]$$

The inequality is always true. Thus, for $\alpha > \overline{\alpha}_C^*$, $E_{NC}^M(R, r_{NC}^R) > \overline{E}_C^M(R, \overline{r}_{NC}^R)$ and (R, r_{NC}^R) is the final outcome. Outcome (R, r_{NC}^R) is feasible only if the probability of detecting a violation of the loan covenant is low, and the condition on $q/\phi p$ is satisfied. If the signal is very precise ($q/\phi p$ is above the threshold), then $\overline{\alpha}_C^* < \alpha_{NC}^* < \alpha_C^* < \overline{\alpha}_{NC}^*$, the outcome $(S, \overline{r}_C^S)$ is always feasible, and the comparison is again between $(S, \overline{r}_C^S)$ and (R, r_{NC}^R). If that is the case, the final outcome for $\alpha > \overline{\alpha}_{NC}^*$ is $(S, \overline{r}_C^S)$. Q.E.D.