Capital Structure and the Control of Managerial Incentives

by

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Abstract

We present a theory of capital structure based on the power of shareholders, bondholders and managers to control the incentive conflicts in large corporations. The manager-owner conflict produces a trade-off between inefficiency in the low state and rents in the high state, and the shareholder-bondholder conflict produces under-investment as in Myers (1977). Since managers and bondholders both prefer more efficient actions in the low state, the two conflicts are interdependent. With risk less levels of debt, there are no shareholder-bondholder agency costs but managerial control over the incentive-setting process produces excessive rents. With risky debt, shareholders focus more on returns in the high state so that shareholder-bondholder agency costs increase but managerial rents decrease. Efficient levels of debt holder protection facilitate a reduction in manager-owner agency costs that outweighs shareholder-bondholder agency costs, and are decreasing in firm performance. The results are consistent with the separate empirical results relating control to both compensation and leverage, and suggest how future studies can be integrated.

Capital Structure and the Control of Managerial Incentives

The theory of corporate capital structure has advanced significantly following Modigliani and Miller (1958). The effects of taxes and (direct) bankruptcy costs, though well developed theoretically, appear to play a minor role empirically. The major empirical determinants of capital structure appear to information and agency problems (Titman and Wessels (1988), Barclay and Smith 1998)). The pioneering theoretical studies of these problems include Jensen and Meckling (1976), Myers (1977), Ross (1977) and Myers and Majluf (1984). Jensen and Meckling (1976) show that an entrepreneurial firm can designed capital structure to minimize the cost of perquisite incentives under equity financing and risk-taking (asset substitution) incentives under debt financing. Myers (1977) shows that debt provides shareholders with an incentive to under-invest when some of the value accrues to bondholders. Ross (1977) shows that a manager's personal loss in bankruptcy enables debt levels to convey inside information, and Myers and Majluf (1984) show that shareholders have an incentive to under-invest when signaling is difficult so that securities are mis-priced.

The importance of incentives in each of these theories encouraged other researchers to further distinguish between the managers and owners of large corporations, and to focus on the firm's ability to design managerial incentives that mitigate the agency and information problems associated with different capital structures. For example, Dybvig and Zender (1990) employ a principle-agent setting and show that capital structure is again irrelevant if the owners can provide incentives (compensation) that are independent of capital structure. Although the premise that managerial actions reflect endogenous incentive contracts is highly realistic, there are many reasons why Dybvig and Zender's results may not hold.[1] One reason, as advanced by Persons (1994), is that the managerial incentives underlying the irrelevance results may not be dynamically consistent. The effective incentives faced by the manager reflect the shareholders' ability to alter the manager's incentives ex-post (at the beginning of a subsequent period), so that agency costs depend on the dynamically consistent influence over the manager's incentives. Another reason is that a basic tenet of the principal-agent setting, that the owners maintain full power over the manager's incentives (so that incentives are designed to maximize the owners' wealth), may be unrealistic. This tenet requires the board of directors to act as a perfect fiduciary for shareholders, yet there is considerable research questioning whether this is so (see Jensen (1993), Shliefer and Vishny (1997)). Indeed, many analyses argue the other extreme, presuming that managers have full control over the board so that capital structure and incentives are in fact chosen to maximize the manager's utility (Grossman and Hart (1982), Novaes and Zingales (1995), Zwiebel (1996)). The reality is likely between the two extremes, such that the incentives implemented reflect both manager and owner objectives.

In this paper we study capital structure under the premise that managerial actions reflect endogenous incentives, and explicitly incorporate the dynamically consistent control over the incentive-setting process. Consistent with the empirical evidence in Bertrand and Mullainathan (2000), Core, Holthausen, and Larcker (1999), Newman and Moses (1999), Murphy (1998), Berger, Ofek and Yermack (1997), Berokohvitch, Brunarski and Parrino (1997) and Yermack (1997), we allow for the possibility that managers, at least partially, control the incentive-setting process.[2] We also allow the incentives implemented to reflect the influence of shareholders and debt holders. Capital structure is relevant because the dynamically consistent influence of debt holders depends on the firm's ex-ante debt contracts. The analysis illustrates how capital structure can optimally control deviations from value maximization that arise from managerial control over the incentive setting process and the ex-post wealth expropriation incentives of shareholders. The optimal capital structure is determined by the interactions between the different agency conflicts stemming from the 'primitive' objectives of shareholders, bondholders and managers.

Capital structure is defined to include both the level of debt and the level of protection against bondholder wealth expropriation. This protection provides the bondholders with the power to ensure that managerial incentives are not designed to induce wealth-expropriating actions. The level of bondholder power can be chosen via the composition of debt (e.g. private versus diffusely held market debt) and specific debt covenants (e.g. investment restrictions, accounting requirements, board representation). The importance of this dimension of capital structure is illustrated by recent studies concluding that the debt level alone is an incomplete specification of capital structure choices. For example, Gilson and Warner (1998) find that firms adjust the composition of their debt due to debt holder influence, Beneish and Press (1995) find that debt holder influence depends on specific accounting covenants, and Booth and Deli (1999) illustrate the effects of creditor representation on the board.

The optimal capital structure depends not only on the conflict of interest between debt holders and shareholders, but also on the conflict of interest between the manager and owners. In particular, the manager's information advantages (hidden actions and hidden knowledge) imply that optimal incentive contracts provide the manager with rents (utility in excess of his reservation level). These rents reflect a trade-off between investor returns in high and low states. Specifically, the optimal contract trades off high managerial payoffs (rents) for good outcomes with inefficient actions for bad outcomes. Greater managerial control over the compensation-setting process leads to an incentive contract that reduces the inefficiency in the low state in order to increase the manager's rents in the high state. This increases the

costs of the owner-manager agency conflict, since higher managerial rents reduce the shareholders' expected return. However, the positive relationship between managerial rents and the focus on investor returns in the low state aligns the ex-post preferences of manager's and debt holders over the incentive contract. This alignment implies that the shareholder's ex-post incentive to under-invest when the gains accrue to bondholders as in Myers (1977) also serves as an incentive to reduce the level of managerial rents. Thus, when managerial rents are inefficiently high, risky debt levels that create shareholder incentives to expropriate from bondholders can actually increase the value of the firm. To do so, the firm's debt contracts provide the debt holders with an ex-post level of influence (protection) that, when combined with the manager's influence, lead to more efficient managerial incentives.

The result that firms can increase value by exploiting the interactions between shareholder-bondholder and owner-manager agency conflicts is similar to Hirshleifer and Thakor (1992) and John and John (1993). Hirshleifer and Thakor illustrate an alignment between managers and debt holders when outcomes are not contractible, so that the manager's payoffs are determined solely by his perceived ability in the labor market. This alignment reduces the manager's incentive to benefit shareholders by taking risky investments (asset substitution). This reduces the agency costs of debt, enabling the firm to increase the tax benefit of debt. Similarly, John and John show that managerial penalties in bankruptcy can align the preferences of managers and debt holders, again reducing the manager's incentive to benefit shareholders through asset substitution and reducing the agency costs of debt. Although both of these papers recognize the importance of ex-post influence over managerial incentives, their analyses abstract from the issue. John and John consider ex-ante incentive contracts as in Dybvig and Zender (1990), suggesting that ex-ante debt contracts should provide debt holders with representation on the board or the ability to sue if incentive contracts are changed. Hirshleifer and Thakor abstract from the issue by assuming that the only dynamically consistent managerial incentive is to enhance his perceived ability in the labor market. In their analysis, however, the manager's incentive to benefit shareholders implicitly assumes incentives that differ from enhancing his perceived ability (since the shareholder-bondholder conflict has no direct effect on the labor market's perceptions). The analysis implicitly assumes an incentive contract that aligns the preferences of managers and shareholders (e.g. share compensation), so that the agency costs again depend on the dynamically consistent managerial incentive contract. In each case, firm value depends critically on the strength of the ex-post alignments between the parties. In our paper the ex-post influence and preferences of each party are explicitly incorporated.[3]

Our analysis is related to a large empirical literature investigating incentive problems and corporate governance. The effects of managerial influence on compensation contracts are consistent with

the findings of Core, Holthausen, and Larcker (1999) and Bertrand and Mullainathan (2000), who proxy managerial influence with board and ownership variables (board size and composition, presence of large shareholders, CEO ownership and tenure). The relationship between managerial influence and compensation is also consistent with the positive association between anti-takeover amendments and expected compensation found by Berokohvitch, Brunarski and Parrino (1997).

We also consider the difference in the capital structure preferences of managers and shareholders. In particular, the manager prefers either lower debt levels or similar debt levels accompanied by higher levels of bondholder protection. The manager's preference for lower debt levels reflects the higher rents discussed above, and is consistent with the negative correlation between leverage and managerial entrenchment found by Berger, Ofek and Yermack (1997), and between leverage and the strength of antitakeover laws found by Garvey and Hanka (1999). The manager's preference for debt contracts that protect against under-investment (at the higher debt levels discussed above) is tempered by the potential loss of control in the event of default (similar to Zwiebel 1996)). Ceteris paribus, however, greater managerial control should be associated with stronger covenants restricting under-investment and asset maintenance choices (Smith and Warner (1979), Chen and Wei (1993), Beneish and Press (1993)), or restricting external threats (e.g. poison put covenants studied by Crabbe (1991), Perumpral Davidson Sen (1999)).

The interactions between the different incentive conflicts also allow the analysis to illustrate how different results in the empirical literature can be reconciled or extended. For example, the aligned under-investment incentives of managers and bondholders can reconcile the negative association between leverage and entrenchment with the aligned voting of managers and bondholders on antitakeover amendments (Brickley, Smith and Lease (1988)). Further, the analysis illustrates how the findings of studies that relate compensation to control (e.g. Berokohvitch, Brunarski and Parrino (1997), Core, Holthausen, and Larcker (1999), Bertrand and Mullainathan (2000), which omit capital structure effects) integrate with studies that relate leverage to control (Berger, Ofek and Yermack (1997), Garvey and Hanka (1999), which omit compensation effects). For example, controlling for information problems, lower debt levels or higher debt levels accompanied by higher protection against under-investment and takeovers, should be associated with higher managerial compensation.

Finally, the analysis implies that optimal capital structure must account for the effects of performance on the influence of each party. When managerial influence is positively related to performance (because poor performance heightens the directors' concern with shareholder lawsuits

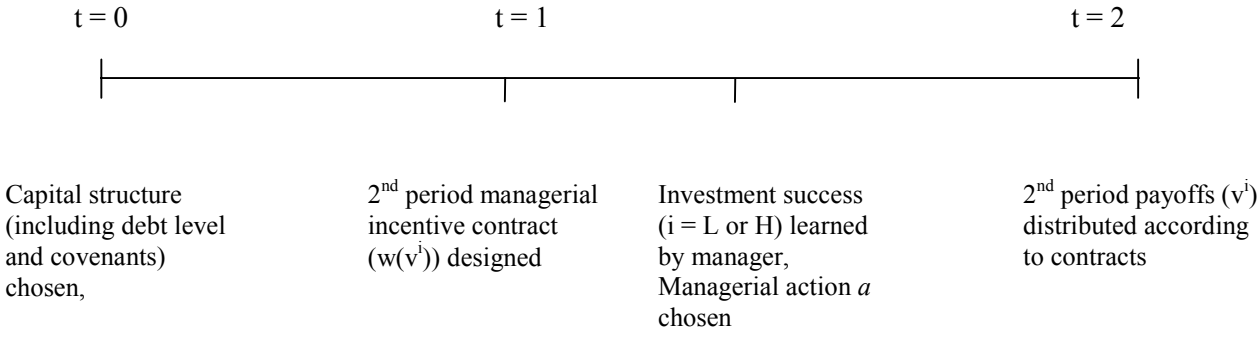
(Kesner and Johnson (1990)), decreases capital requirements for a takeover (Grossman and Hart 1982)), or decreases manager-specific value), the optimal level of debt holder influence is negatively related to performance. This is a common feature of capital structure that has received considerable attention (see Harris and Raviv (1991), Allen and Winton (1995), Rajan and Winton (1995), Shleifer and Vishny (1997)). The analysis here illustrates that this feature can result endogenously from the interactions between incentive conflicts and a positive relation between managerial influence and performance.

The remainder of the paper is organized as follows. The basic manager-owner agency conflicts, and the effects of control over the incentive-setting process are developed in section I. Risky debt levels and the interactions between shareholder-bondholder and manager-owner incentive conflicts are incorporated in section II. Extensions and empirical implications are presented in section III, and section IV concludes.

I. Model.

This section develops an agency model of large corporations, in which the management and ownership of the firm's capital are separated. The manager's actions are determined by his incentive contract, which is designed to induce optimal actions while controlling for information asymmetries between the manager and the owners (which include both debt holders and equity holders). The incentive contract implemented (and therefore the manager's actions) can be influenced by each of the parties we consider, i.e. shareholders, debt holders, and managers.

Figure 1: Time Line and Sequence of Events.



As illustrated in figure 1, the incentive contract to manage the firm's investment during the second period is implemented at t = 1, and payoffs are realized at t = 2. The gross value of the firm at t = 2 depends on the both the realized value of the firm's investments, x^i, and the manager's action, a^i, during the second period (i.e. between t = 1 and t = 2),

$$v^i(x^i, a^i) = x^i + a^i.$$

The realization of x^i can be high or low (i = H or L) and is asymmetrically observed by the manager just prior to his action choice a^i. The manager's action choice is non-contractible, and a^i denotes the incentive compatible choice of a corresponding to the realization of i (this simplifies notation, as discussed below).

Gross value at t = 2 is divided between the shareholders, debt holders and manager. The investors receive gross value less any payments to the manager (the debt holders receive the first F dollars and shareholders receive the residual). The investors care only about their expected returns. However, the manager's utility is given by

$$u(w, a) = w - A(a)$$

where w is monetary compensation and A(a) is the disutility of the action a (e.g. the disutility of effort or of forgoing perquisites). The manager's action is chosen from the set $a \in [\underline{a}, \overline{a}]$, and for simplicity we let

$$A(a) = j + ka^2 / 2.$$

The manager's t = 1 reservation utility is u.

To illustrate the effects of capital structure and managerial influence, we begin with the simplest case where debt is risk free and shareholders have full influence over managerial compensation. In this case, the debt holders receive payment independent of the actions taken within the firm and optimally have no influence over incentives. The incentives implemented are designed to maximize shareholder wealth at t = 1, which depends on the information asymmetry during the second period, as follows.

I.1 Shareholder Control over Compensation

When the shareholders have full control over the incentive contract at t = 1, the compensation contract is designed to induce wealth-maximizing actions while accounting for the manager's information advantages during the second period (specifically, hidden knowledge of x^i and his hidden action a^i). To illustrate the optimal incentive contract, we begin with the case where the shareholders perfectly observe the realisation of x^i (so that only the manager's action a^i is hidden). In this case, the shareholders offer a

compensation contract, contingent on the realisation of x^i, that induces the desired action by the manager[4]. Denoting the incentive compatible action for each realisation of x^i by a^i, the optimal contract maximises

$$x^i + a^i - w^i - F$$

subject to the manager's reservation utility constraint

$$w^i - A(a^i) \geq u$$

and the incentive compatibility constraint for a^i (the desired value of a given x^i),

$$w(v(x^i, a^i)) - A(a^i) \geq w(v(x^i, a)) - A(a), \ \forall a \neq a^i.$$

In this setting, the optimal contract induces the first best by specifying the payment

$$w(v^i) = \begin{cases} w^i > 0 \text{ if } v^i = x^i + a^i \\ 0 \quad \text{otherwise,} \end{cases}$$

where w^i satisfies the reservation utility constraint given the first best action, $a^i = a^{FB}$ where $A'(a^{FB}) = 1$, for i = L, H.[5] Note that this solution provides the first best, or maximum value of the owners' claims.

Now consider the more realistic case where the manager asymmetrically observes x^i (Ross (1977), Myers and Majluf (1984), Dybvig and Zender (1990)). When the realization of x^i is asymmetrically observed, the shareholders' objective is to maximize their expected wealth, which depends on the probability of the high value of x^i. This probability depends on the shareholders' information at t = 1, which is represented by a commonly observed signal of success, denoted s, so that the probability of realizing x^i is denoted by $\sigma(s)$. Given risk free debt and the probability σ of the high realization of x^i, the shareholders' expected return is

$$S(\cdot) = (1-\sigma)(x^L + a^L - w^L) + \sigma(x^H + a^H - w^H) - F.$$

As above, the incentive contract must ensure the manager his reservation utility level u for each realization of x^i, i.e. it must satisfy the reservation utility (RU) constraints for i = L or H

$$w^L - A(a^L) \geq u \qquad (RU^L)$$

$$w^H - A(a^H) \geq u. \qquad (RU^H)$$

Since the manager asymmetrically observes both x^i and a, however, the incentive compatibility constraints ensure that it is in the manager's interest to choose the level of a^i intended for each realisation of x^i, given his ability to manipulate his action and obtain the payment intended for the other realisation. This is ensured by including the incentive compatibility (IC) constraints for i = L or H,

$$w^L - A(a^L) \geq w^H - A(a^H + \Delta x) \qquad (IC^L)$$

$$w^H - A(a^H) \geq w^L - A(a^L - \Delta x) \qquad (IC^H)$$

where $\Delta x \equiv x^H - x^L$. Note that, although the (RU) and (IC) constraints are contingent on x^i, the contract is designed before x^i is realised (as in figure 1). The contract design problem therefore accounts for the fact that x^i will be asymmetrically observed by the manager (i.e. for simultaneous hidden actions and hidden knowledge). The contract is dynamically consistent (renegotiation-proof) because the shareholders receive no new information when x^i is realised (so that an improved contract cannot be negotiated).

Since the right hand side of (IC^H) strictly exceeds the left-hand side of (RU^L), the optimal contract must provide the manager with strictly more than u when i = H. Thus, the model implies that (RU^H) is not binding and produces an endogenous managerial "information rent" when i = H. In addition, only one of the incentive compatibility constraints, (IC^H) and (IC^L) can bind. To see this, rewrite the incentive compatibility constraints as

$$w^H - w^L \leq A(a^H + \Delta x) - A(a^L)$$

and

$$w^H - w^L \geq A(a^H) - A(a^L - \Delta x).$$

Since $A' > 0$ and $A'' > 0$,

$$A(a^H + \Delta x) - A(a^L) > A(a^H) - A(a^L - \Delta x)$$

only one constraint can bind, and the shareholders concern with limiting payments to the manager implies that (IC^H) binds (otherwise the firm would pay the manager more than necessary to control the information asymmetries). Similarly, (RU^L) binds since it is costly to pay the manager more than his reservation utility u when i = L, and reducing the utility level for i = L also reduces the information rent required by (IC^H) for i = H.

When the shareholders have full control over the incentive setting process, therefore, the compensation contract is designed to maximize their expected return subject to the minimum utility constraint for i = L (RU^L) and the incentive compatibility constraint for i = H (IC^H). Specifically, the shareholders problem (SP) is given by

$$\max_{<w^i, a^i>} L^S = (1-\sigma)(x^L + a^L - w^L) + \sigma(x^H + a^H - w^H) - F$$
$$+\theta^L_{RU}(w^L - A(a^L) - u) + \theta^H_{IC}(w^H - A(a^H) - w^L + A(a^L - \Delta x)). \qquad (SP)$$

The first order conditions for w^L and w^H yield $\theta^L_{RU} = 1$ and $\theta^H_{IC} = \sigma,$ and the first order conditions for a^H and a^L yield

$$\partial L^S / \partial a^H = \sigma - \sigma A'(a^H) = 0 \Rightarrow A'(a^H) = 1,$$

$$\partial L^S / \partial a^L = (1-\sigma) - A'(a^L) + \sigma A'(a^L - \Delta x) = 0.$$

The optimal contract induces the first best action if i = H, $a^H = a^{FB}$, but less than first best if i = L:

$$(1-\sigma)(1 - A'(a^L)) = \sigma(A'(a^L) - A'(a^L - \Delta x)). \qquad (1)$$

Since the right hand side of (1) is strictly positive, the solution implies $A'(a^L) < 1$ so that $a^L < a^{FB}$. Reducing a^L from the first best level reduces the information rent required to satisfy (IC^H). This can be seen from the manager's utility in the high state,

$$w^H - A(a^H) = w^L - A(a^L - \Delta x) = u + A(a^L) - A(a^L - \Delta x),$$

so that his information rent,

$$\rho(a^L) \equiv A(a^L) - A(a^L - \Delta x),$$

decreases when a^L is reduced because $A'' > 0$.

The contracting (or agency) costs in the solution to (SP) consist of two components: (i) the reduction in managerial actions from the first best level when i = L, which has an inefficiency cost of

$$\alpha(a^L) \equiv (a^{FB} - A(a^{FB})) - (a^L - A(a^L)),$$

and (ii) the rents obtained by the manager when i = H, denoted by

$$\rho(a^L) \equiv A(a^L) - A(a^L - \Delta x).$$

The expected contracting costs are therefore

$$c(a^L) \equiv \sigma\rho(a^L) + (1-\sigma)\alpha(a^L).$$

Intuitively, managerial incentive contracts are designed to induce efficient actions while limiting the proportion of value gains accruing to the manager. The manager obtains a portion of value gains, however, because he is able to choose his action after observing hidden knowledge concerning the value of the firm's investments.

The optimal contract here differs from that in the standard principal-agent model, where efficient actions are induced while limiting the amount of risk imposed on the agent (i.e. efficient actions are traded off with proportional ownership rather than with efficient risk-sharing). Similar to the standard model, however, any payment in excess of that required to ensure the manager's opportunity cost is a contracting cost, defined as the difference between the optimised objective function and what that objective function would be if information were symmetric and *a* were contractible. With symmetric information, the first best action would be induced when i = L, and the manager would receive his reservation utility when i = H (as in the case where x^i is symmetrically observed above). The information asymmetry reduces shareholder (and firm) value equal by $c(a^L)$. In the analysis below, the level of a^L and the associated level of shareholder wealth that are obtained when shareholders have full control over compensation are denoted a^{L*} and S^*, respectively.

I.2 Managerial Control over Compensation

Under the opposing view that management effectively controls the board (including the compensation committee), the compensation setting process is controlled by itself (Crystal (1991), Jensen (1986), Zwiebel (1996), Yermack (1997)). The compensation contract is constrained only by an unwillingness to draw the attention of active shareholders or become the target of a takeover, and managers pay themselves as much as possible subject to these constraints (Bertrand and Mullainathan (2000) label this the 'skimming model' of managerial compensation).

Under this view, compensation is designed to maximize the manager's welfare (expected utility) at the time the contract is offered, i.e.

$$(1-\sigma)(w^L - A(a^L)) + \sigma(w^H - A(a^H))$$

and is constrained only by the manager's concern with active investors, which we incorporate by assuming that the manager will attract a raider if the compensation scheme produces shareholder wealth that deviates sufficiently from that with shareholder control (i.e. destroys sufficient shareholder value). Specifically, to avoid a takeover the compensation contract must produces a share value of at least $\underline{S} \equiv S^* - E$, where S^* is the share value produced when incentives are designed to maximize shareholder wealth (as above), and E represents the level of managerial entrenchment (similar to Zweibel (1996)).

Since share value (in the absence of a takeover) is based on expectations of the manager's actions and compensation in the second period as above, the manager is concerned with credibly convincing

shareholders (more precisely the raider) that his actions and compensation levels will not warrant a takeover. To convince the shareholders, the compensation scheme must again satisfy the incentive compatibility and reservation utility constraints above. When managers control the incentive setting process, therefore, the compensation contract is designed to maximize their expected utility subject to lower bound on share value, $\underline{S}$, the minimum utility constraint for i = L (RU^L) and the incentive compatibility constraint for i = H (IC^H). Specifically, the manager's problem (MP) is given by

$$\max_{<w^i, a^i>} L^M = (1-\sigma)(w^L - A(a^L)) + \sigma(w^H - A(a^H))$$

$$+\lambda[(1-\sigma)(x^L + a^L - w^L) + \sigma(x^H + a^H - w^H) - F - \underline{S}] \qquad \text{(MP)}$$

$$+\theta^L_{RU}(w^L - A(a^L) - u) + \theta^H_{IC}(w^H - A(a^H) - w^L + A(a^L - \Delta x)).$$

The first order conditions for w^L and w^H yield $\theta^L_{RU} = \lambda - 1$ and $\theta^H_{IC} = \sigma(\lambda - 1)$, and the first order conditions for a^H and a^L yield

$$\partial L^M / \partial a^H = \sigma(\lambda - A'(a^H)) - \sigma(\lambda - 1)A'(a^H) = 0 \Rightarrow A'(a^H) = 1,$$

$$\partial L^M / \partial a^L = (1-\sigma)(\lambda - A'(a^L)) - (\lambda - 1)A'(a^L) + \sigma(\lambda - 1)A'(a^L - \Delta x)$$

$$= (1-\sigma)(\lambda)(1 - A'(a^L)) - \sigma(\lambda - 1)(A'(a^L) - A'(a^L - \Delta x)) = 0$$

$$\Rightarrow (1-\sigma)(1 - A'(a^L)) = (\frac{\lambda - 1}{\lambda})\sigma(A'(a^L) - A'(a^L - \Delta x)). \qquad (2)$$

Comparing (MP) with (SP) above, it is apparent that the manager's compensation design problem constitutes a 'dual' to the shareholders' problem above. That is, the information asymmetry (that exists in either case) implies that the optimal compensation contract must satisfy the same individual rationality and incentive compatibility constraints, and therefore has a similar form in each case. The two solutions differ, however, with respect to the welfare levels obtained by each party. When the manager controls the incentive setting process his compensation payments are increased at the expense of shareholder wealth, and the resulting welfare levels depend on the manager's insulation (entrenchment) against external discipline.[6] If the manager enjoys no insulation, E = 0 so that $\underline{S} = S^*$ and the solution to the manager's problem is identical to the shareholders' (i.e. the solution sets $\lambda = 2$ in (2)). With positive levels of E, λ decreases so that the incentive compatible action in (2) increases, i.e. $a^L > a^{L*}$. The increase in a^L reflects

the improved incentives associated with higher (optimal) compensation levels. Specifically, the compensation payment in the low state, w^L, is increased to induce a higher value of a^L (and satisfy the reservation utility constraint), and w^H is increased to provide the manager with a higher level of rents,

$$\rho(a^L) \equiv A(a^L) - A(a^L - \Delta x).$$

Although more efficient actions are induced, the effects of the higher compensation payments dominate so that shareholder wealth decreases to $\underline{S} < S^*$. In fact, extremely high levels of managerial entrenchment E lead to the first best level of a^L and a^H, but are particularly detrimental (to shareholders) because the manager appropriates funds (as compensation) without providing any offsetting efficiency improvements. In this section, we focus on the lower (but still positive) levels of E. That is, we focus on entrenchment levels satisfying $0 < E < \overline{E}$ where $\overline{E}$ represents the entrenchment level that just produces first best actions (i.e. the level producing $\lambda = 1$ so that $a^L = a^{FB}$ in (2)). The solution with full managerial control therefore produces $a^{L*} < a^L < a^{FB}$ (since $1 < \lambda < 2$ in (2)), yielding higher managerial rents ($\rho(a^L)$) and lower shareholder wealth ($\underline{S}$) than the solution with full shareholder control. We extend the analysis to allow for cases where each party has partial control in the next subsection.

I.3 Shareholder and Manager Control over Compensation

The analysis above characterizes optimal compensation contracts when either the manager or shareholders fully control the compensation setting process. In reality, neither party is likely to have full control, so that observed compensation contracts are likely to reflect the objectives of both parties (Murphy (1998), Core, Holthausen, and Larcker (1999), Bertrand and Mullainathan (2000), Talmor and Wallace (2000)). It is relatively straightforward to extend our analysis to allow for this because the information asymmetries have similar effects on the optimal contract in each case, so that the differing concern over each party's welfare has highly tractable implications.

We incorporate the possibility that both managers and shareholders have some control over compensation by formulating the compensation design problem to maximize a combination of the objective functions of each party. Specifically, the manager's welfare is given the weight *m* (and the shareholders' 1-*m*), such that compensation is designed to maximize

$$(1-m)[(1-\sigma)(x^L + a^L - w^L) + \sigma(x^H + a^H - w^H) - F] + m[(1-\sigma)(w^L - A(a^L)) + \sigma(w^H - A(a^H))].$$

The weight *m* represents the manager's influence during the compensation setting process. This influence reflects the level of managerial control over the board (or the bargaining power of those board members loyal to the manager).[7] Its support is restricted to $m \in [0, \overline{m}]$, where $m = \overline{m}$ corresponds to the case of full

managerial control above (i.e. the case where shareholder wealth equals $\underline{S} = S^* - E \geq S^* - \overline{E}$). The weighted average formulation therefore nests the (SP) and (MP) problems above, and allows for cases where each party has partial control (i.e. cases where $0 < m < \overline{m} < 1/2$).[8]

Formally, the compensation design problem when both managers and shareholders influence the compensation process becomes

$$\max_{<w^i, a^i>} L = (1-m)[(1-\sigma)(x^L + a^L - w^L) + \sigma(x^H + a^H - w^H) - F]$$
$$+m[(1-\sigma)(w^L - A(a^L)) + \sigma(w^H - A(a^H))]$$
$$+\theta^L_{RU}(w^L - A(a^L) - u) + \theta^H_{IC}(w^H - A(a^H) - w^L + A(a^L - \Delta x)).$$

The first order conditions for w^L and w^H now yield $\theta^L_{RU} = 1 - 2m$ and $\theta^H_{IC} = \sigma(1-2m),$ and the first order conditions for a^H and a^L yield

$$\partial L / \partial a^H = \sigma(1-m) - \sigma(1-m)A'(a^H) = 0 \Rightarrow A'(a^H) = 1$$

$$\partial L / \partial a^L = (1-m)(1-\sigma) - m(1-\sigma)A'(a^L) - (1-2m)A'(a^L) + \sigma(1-2m)A'(a^L - \Delta x) = 0$$
$$\Rightarrow (1-\sigma)(1 - A'(a^L)) = (\frac{1-2m}{1-m})\sigma(A'(a^L) - A'(a^L - \Delta x)). \quad (3)$$

Comparing (3) with (1), this formulation of the compensation design problem produces the solution to the shareholders' problem ($a^L = a^{L*}$) when $m = 0$. Similarly, the formulation produces the solution to the manager's problem ($a^{L*} < a^L < a^{FB}$) when $m = \frac{1}{1+\lambda} \equiv \overline{m}$ (comparing (3) with (2)). Moreover, for values of m satisfying $0 < m < \overline{m}$, equation (3) implies $a^{L*} < a^L < a^{FB}$. Similar to above, the solution produces contracting costs equal to $c(a^L) \equiv \sigma\rho(a^L) + (1-\sigma)\alpha(a^L)$, where $\rho(a^L)$ represent the manager's rents and $\alpha(a^L)$ represents the inefficiency cost of $a^L < a^{FB}$.

The contracting costs implied by (3) reflect both the manager's information advantages and the manager's influence over the firm. As the manager's influence m increases, a^L increases so that $\alpha(a^L)$ decreases and $\rho(a^L)$ increases. The increase in rents more than offsets the decrease in inefficiency costs, so that total contracting costs increase.[9] Moreover, the increase in managerial rents is obtained via an increase in compensation w^H (since $a^H = a^{FB}$) that reduces the value of equity. These effects of

managerial influence on compensation and equity value are consistent with the empirical investigations of Core, Holthausen, and Larcker (1999) and Bertrand and Mullainathan (2000)), who employ board and ownership structure variables to proxy for managerial control. These investigations, however, do not allow for any effects of capital structure on managerial incentives, such as those advocated by Jensen (1986) and Zwiebel (1996). In the next section, we illustrate that capital structure also has significant effects on managerial incentive contracts, suggesting that empirical investigations may benefit by including capital structure variables.

II. Risky Debt and the shareholder-bondholder conflict

In this section, we illustrate how higher leverage in the firm's capital structure can improve managerial incentives and lead to higher firm value. In particular, we illustrate that increasing the firm's debt level so that debt becomes risky can increase firm value due to the interactions between the shareholder-bondholder conflict and the manager-owner conflict.

The debt level F becomes risky when the firm has insufficient funds to cover both the manager's payment w^i and the face value of the debt F for some realizations.[10] For brevity, we focus attention to the case where the firm has sufficient funds when x^H is realized but insufficient funds when x^L is realized (i.e. where $v^H > F + w^H$ but $v^L < F + w^L$). In this case, shareholders receive $x^H + a^H - w^H - F$ if i = H and nothing if i = L, and bondholders receive F if i = H and $x^L + a^L - w^L$ if i = L. Thus, shareholders are concerned with changes in value for the high outcome while debt holders are concerned with the low outcome, and the familiar shareholder-bondholder conflicts arise (Myers (1977), Jensen and Meckling (1976)).

Given the conflicting primary objectives of managers, shareholders and debt holders, the incentives implemented by the firm will again depend on the relative influence of each party. Similar to above, we incorporate the creditors' influence by giving their objective function a weight in the firm's incentive design problem. This weight reflects the factors that determine the concern with debt holder wealth, including the proportion of capital owned by debt holders, debt composition and the monopolistic power of banks, specific debt covenants, reputation concerns, and board representation, as discussed below.

Thus, the objective function in the compensation design problem now becomes a weighted average of the expected returns to creditors and shareholders and the manager's expected utility. Specifically, the manager's influence provides the weight *m*, the bondholders' influence provides the weight (1-*m)*β and the shareholders' influence provides the weight (1-*m*)(1-β). The Lagrangian becomes

$$\max_{<w^i,a^i>} L = (1-m)[(1-\beta)\sigma(x^H + a^H - w^H - F) + \beta((1-\sigma)(x^L + a^L - w^L) + \sigma F)]$$

$$+m[(1-\sigma)(w^L - A(a^L)) + \sigma(w^H - A(a^H))]$$

$$+\theta^L_{RU}(w^L - A(a^L) - u) + \theta^H_{IC}(w^H - A(a^H) - w^L + A(a^L - \Delta x).$$

The first order conditions now yield (calculations shown in the appendix)

$$(1-\sigma)(1-A'(a^L)) = \delta\sigma(A'(a^L) - A'(a^L - \Delta x)) \tag{4}$$

where

$$\delta = \frac{(1-\beta) - m/(1-m)}{\beta}.$$

To illustrate the effects of the shareholder-bondholder conflict, consider the case where the bondholders have no protection against expropriating decisions at t = 1, so that there is no concern with their wealth at t = 1, i.e. the case where β = 0. The compensation design problem then focuses relatively strongly on the shareholders' expected return, so that the incentive contract induces less efficient actions when value is low (increasing α and decreasing ρ). Indeed, if β = 0 case the minimum a^L is induced in order to maximize the t = 2 return if high value is realized. This under-investment in a^L expropriates wealth from bondholders similar to the under-investment in Myers (1977) where shareholders forego profitable projects because part of the return would accrue to debt holders. Here, the shareholders forego a profitable ex-post "investment" of w^L since the benefit, an increase in a^L, accrues to the bondholders.

Although the creditors bear the cost of this ex-post (at t ≥ 1), they anticipate the expropriation ex-ante (at t = 0 when the debt is issued), so that the original owners ultimately bear any residual loss as in Jensen and Meckling (1976). The initial owners therefore design t = 0 debt contracts to minimize the residual loss (similar to Jensen and Meckling (1976) and Myers (1977)). For example, debt contracts commonly include covenants designed to provide creditors with some power to deter opportunistic actions at t = 1 (Smith and Warner (1979), Beneish and Press (1993. 1995), Chen and Wei (1993), Gilson and Warner (1998)).[11] In our model, this power is represented by β > 0 so that there is some deterrence to

inducing actions that expropriate bondholder wealth during the compensation setting process. In our model, however, optimal capital structure must reflect the interactions between the shareholder-bondholder and manager-owner agency conflicts at t = 1.

Debt contracts that provide debt holders with more power at t = 1 (e.g. more stringent covenants or board representation) lead to t = 1 compensation contracts that induce more efficient actions (higher values of a^L) following low realizations. This implies that capital structure affects firm value at t = 1 (and therefore t = 0). The optimal capital structure limits the focus on bondholder wealth at t = 1 (limits β) for two reasons. First, the creditors are not concerned with the increase in information rents as a^L increases (as this is absorbed by shareholders), and will pursue excessively high values of a^L (i.e. $a^L > a^{L*}$) if they receive too much power. Second, the manager's influence also leads to higher values of a^L (due to the positive effect on his information rents), so that a^L also increases with the manager's control over incentives. The optimal capital structure provides creditors with a level of influence that, combined with the manager's level of influence, produces a t = 1 incentive contract that induces a^{L*} in the low state, as above. Comparing (4) with (1), the ex-ante value of the firm is maximized with an ex-ante capital structure that provides a level of debt holder influence equal to

$$\beta = \frac{1 - m/(1-m)}{2}, \tag{5}$$

so that $\delta = 1$. The value maximizing level of debt holder influence decreases with the manager's influence m because, at t = 1, both prefer incentive contracts that induce higher levels of a^L. In contrast, the shareholders prefer contracts that induce lower values of a^L that decrease the manager's rents $\rho(a^L)$, because managerial rents are obtained at the expense of shareholders.

The higher debt level in this section produces higher firm value because the shareholders' lack of concern for bondholder payoffs increases their focus on high outcomes when there is risky debt, increasing their incentive to pursue contracts that induce lower levels of a^L. Provided that this incentive to under-invest in a^L is appropriately mitigated by the dynamically consistent influence of the manager and debt holders, risky debt levels can actually increase ex-ante value. This is because the manager's influence ($m > 0$) leads to an inefficiently high level of managerial rents in equation (3). Without the additional incentive to expropriate from bondholders, the shareholders are insufficiently motivated to reduce a^L, as they also incur the inefficiency cost when i = L. The Myers-type under-investment incentive increases the shareholders' incentive to induce lower levels of a^L because they no longer bear

the inefficiency cost when i = L. The two agency conflicts therefore interact such that risky debt reduces the agency costs associated with the separation of ownership and management of the firm's resources.

The effect of the shareholder-bondholder conflict on managerial incentive contracts is related to the work of Dybvig and Zender (1991) and Persons (1994). Dybvig and Zender (1991) illustrate that capital structure becomes irrelevant if an ironclad incentive contract can be implemented at t = 0 (so that the differing t = 1 objectives of each party become irrelevant). Persons, however, shows that such an incentive contract is dynamically inconsistent. Specifically, if shareholders retain full power over the incentive setting process, they will change the contract at t = 1 in a manner that is Pareto improving for the contracting parties (the manager and shareholders). While Persons focuses on the dynamically inconsistency of the contract resulting in Dybvig and Zender (and the implications for optimal investment), the analysis here focuses on dynamically consistent contracts that do result. Capital structure is relevant because these contracts depend on the creditors' dynamically consistent influence at t = 1, which in turn depends on the terms of the initial debt contracts.

The idea that firms can design debt contracts to mitigate shareholder-manager agency conflicts has also been advanced by other papers in the literature (see Harris and Raviv (1991), Allen and Winton (1995), Shleifer and Vishny (1997)). For example, in Grossman and Hart (1982), Jensen (1986), Zwiebel (1996), and Berger, Ofek and Yermack (1997) debt reduces managerial entrenchment and therefore deviations from value maximization. Here, debt alters the shareholders' incentive to take actions that offset the effects of managerial influence *m*, rather than reducing the level of entrenchment E. That is, the effects of risky debt operate even while E (the cost of ousting an entrenched manager) and *m* (the manager's ability to take advantage of these costs) remain constant.

Our analysis is also related to the work that focuses more heavily on the interactions between the shareholder-bondholder and manager-owner conflicts. As such it is similar to Hirshleifer and Thakor (1992) and John and John (1993). In John and John (1993) the shareholders' asset substitution (risk-shifting) incentives are offset by providing the manager with an appropriate mix of share compensation (which aligns his risk preferences with shareholders) and salary loss in bankruptcy (which aligns his risk preferences with debt holders'). Their analysis focuses more heavily on the shareholder-bondholder conflict in that the manager-owner conflict is easily controlled (because the manager has no direct utility for his actions). In Hirshleifer and Thakor, the aligned preferences of managers and debt holders reflect managerial reputation concerns (which create a preference for excessive conservatism). The shareholders

counteract the incentive for conservatism by issuing risky debt that creates the asset substitution (risk-shifting) conflict between shareholders and bondholders. This leads to higher firm value because the influence of share value on the manager's incentives offsets the influence of his reputation concern. Our analysis differs in that the interactions between manager-owner and shareholder-bondholder agency conflicts depend explicitly on the dynamically consistent influence of each party. The importance of this can be seen from a closer examination of their model, which abstracts from this influence by assuming that outcomes are not contractible so that the only dynamically consistent managerial incentive is to enhance his perceived ability in the labor market. However, the market's knowledge of managerial ability is independent of capital structure. For their results to hold, therefore, the manager's asset substitution incentives (and therefore firm value) must ultimately reflect shareholder influence over managerial incentives, as do the managerial incentives in the analysis above.

III. Extensions and empirical implications

In this section we consider extensions of the analysis above as well as empirical implications. The analysis in section I implies that, ceteris paribus, greater managerial control over the incentive setting process (higher values of m) leads to greater compensation at the expense of value-maximization. This is consistent with the empirical findings of Core, Holthausen, and Larcker (1999) and Bertrand and Mullainathan (2000), who proxy managerial influence with board and ownership variables (board size and composition, presence of large shareholders (on the board and overall), CEO ownership, and tenure). Section II implies that managerial compensation is also related to capital structure, including both debt levels and the protection against shareholder-bondholder expropriation. Ceteris paribus, lower debt levels, or stronger covenants restricting investment or asset maintenance decisions, should be associated higher managerial compensation. This suggests that investigations of compensation and control (such as those above) may benefit from incorporating the effects of capital structure variables.

The analysis above is also consistent with the relationship between expected compensation and anti-takeover amendments (ATAs) found by Berokohvitch, Brunarski and Parrino (1997). Anti-takeover amendments that increase managerial entrenchment (E) produce higher expected compensation when the manager has control (section I.2). When shareholders have control, ATAs have no effect (section I.1), and when with partial control (section I.3), the effects of ATAs depend on the relationship between the level of entrenchment E and the manager's control over the incentive setting process, m. While closely

related, changes in *m* represent an increase in the manager's *relative* power, holding the level of entrenchment constant (i.e. an increase in *m* reflects a greater portion of E accruing to the manager, rather than an increase in E itself). This implies that the relationship between compensation and ATAs should also depend on the manager's relative power. Berokohvitch, Brunarski and Parrino (1997), however, find only weak interaction effects between the effects of ATAs on compensation contracts and proxies for managerial power (percent of outsiders on board, fractional CEO ownership, and blockholder ownership). This is somewhat puzzling, given their conclusion that the effects of ATAs appear to reflect entrenchment. Again, our analysis suggests that these results may be reconciled by incorporating the effects of capital structure. In particular, when the firm has risky debt, the interaction effects should depend on both the manager's and debt holders' influence over the compensation setting process (i.e. on both *m* and β as in section II).

The relationship between managerial control and compensation can also be reconciled with that between managerial control and capital structure studied by Jensen (1986), Zwiebel (1996), Berger, Ofek and Yermack (1997), and Garvey and Hanka (1999). These studies focus on the case where managers have full control over capital structure.[12] The contrasts with section II (where the initial owners design capital structure to improve managerial incentives similar to Harris and Raviv (1990), John and John (1993) and Hirsheifer and Thakor (1992)). An extension to incorporate managerial control over capital structure (both debt levels and β) does not alter the analysis with risk-less debt in section I.2 (where $t = 1$ compensation provides maximal rents while protecting against a takeover as in the manager's problem (MP)). With higher (risky) debt levels, however, the manager prefers higher levels of debt holder influence, due to the alignment in under-investment preferences. The effects of β on entrenchment, however, temper this preference. In particular, when increasing β reduces entrenchment as in Zwiebel (1996) (e.g. because it increases the probability of covenant violation), the manager trades off the effects on entrenchment with the effects on a^L developed in section II.[13] Managerial control produces a higher β (and higher rents) than the solution in section I.3 with shareholder control. Since the manager's utility in section I.3 is less than that with risk-less debt (section I.2), however, the manager's preferred capital structure is ambiguous. In contrast to shareholders, who prefer the risky debt levels in section I.3, the manager prefers either low (risk-less) debt levels or risky debt levels combined with a higher value of β.

The relationship between debt levels and managerial control (or entrenchment) is consistent with the negative correlation between leverage and entrenchment found by Berger, Ofek and Yermack (1997), and between leverage and the strength of antitakeover laws found by Garvey and Hanka (1999). Moreover, the interactions behind this relationship suggest directions for future empirical work. In

particular, the analysis illustrates how the relationship between leverage and entrenchment should be related to debt holder power β. Ceteris paribus, greater managerial entrenchment (or power) should also be associated with stronger covenants addressing under-investment (e.g. covenants restricting under-investment or asset maintenance choices) or providing direct protection against external discipline (e.g. poison put covenants). Poison put covenants increase the cost of a takeover directly (Crabbe (1991), Perumpral Davidson Sen (1999)), supporting a higher equilibrium value of a^L, and therefore higher managerial and bondholder wealth. This alignment between managers and bondholders can reconcile the negative leverage-entrenchment relationship with the aligned voting of managers and bondholders found by Brickley, Smith and Lease (1988). The interactions between incentive contracts and leverage also illustrate how empirical analyses of control and compensation (such as those above, which neglect capital structure effects) relate to investigations of control and leverage (such as those above, which neglect compensation effects). For example, low debt levels, or higher debt levels with stronger covenants protecting against under-investment and takeovers, should be associated with higher compensation.

Finally, the analysis can be extended to consider the interactions between capital structure, compensation, and differing levels of t = 1 performance. In our model, t = 1 performance is given by the realization of the signal s, which determines the probability of success, σ(s)) at t = 1. Consider again the case where the firm's t = 0 debt contracts (debt level and covenants) to provide the value-maximizing level of debt holder influence at t = 1, i.e. such that δ = 1 as in section II. The analysis in section II is presented for a particular realization of the signal s, and therefore σ(s)), at t = 1. More generally, t = 0 debt contracts should provide the efficient level of debt holder influence β(σ(s)) for all possible realizations of s. An extension to incorporate different realizations of s, however, is straightforward. For each realization of s, the dynamically consistent t = 1 incentive contract is given by (4), i.e.

$$(1-\sigma(s))(1-A'(a^L)) = \delta(\sigma(s))\sigma(s)(A'(a^L) - A'(a^L-\Delta x)) \qquad (4')$$

where

$$\delta(\sigma(s)) = \frac{(1-\beta(\sigma(s))) - m(\sigma(s))/(1-m(\sigma(s)))}{\beta(\sigma(s))}.$$

and the value maximizing incentives are again given by

$$(1-\sigma(s))(1-A'(a^L)) = \sigma(s)(A'(a^L) - A'(a^L-\Delta x)). \qquad (1')$$

Thus, the value maximizing δ remains equal to one for all s, and risky debt is again required to implement the value maximizing incentives. However, the t = 1 influence provided by the firm's debt contracts must

take into account any effects of t = 1 performance (the realization of s) on the level of managerial influence, $m(\sigma(s))$.

As discussed above, the manager's influence reflects his control over the board, the cost of takeovers, and the value of manager-specific knowledge, each of which is likely to decrease following poor performance, so that managerial influence is likely to decrease following poor performance, consistent with the empirical evidence.[14] In the case where m increases with t = 1 performance, i.e. $m'(\sigma(s)) > 0$, the firm's optimal capital structure must be designed such that $\beta(\sigma(s))$ decreases with s, i.e. such that $\beta' < 0$. In particular, the efficient level of debt holder influence is such that $\delta(\sigma(s)) = 1$ or

$$\beta(\sigma(s)) = \frac{1 - m(\sigma(s)) / (1 - m(\sigma(s)))}{2}$$

for each realization of s. This implies

$$\beta' = -\frac{m'}{2(1-m)^2} < 0$$

so that it is optimal for the debt holders' objectives to have higher priority following lower realizations of the signal s. This is a common feature of capital structure, and has been explained by improved investigation or liquidation decisions, or improved control of different agency conflicts in isolation (see Harris and Raviv (1991), Allen and Winton (1995), Rajan and Winton (1995), Shleifer and Vishny (1997)). The reason here is new, however, in that it derives from the interactions between different agency conflicts coupled with the positive relation between managerial influence and performance.[15]

IV. Conclusions

The capital structure literature has produced a rich set of theories based on the nexus of contracts view of the firm (Harris and Raviv (1991), Allen and Winton (1995)). Many of these theories are based on particular corporate objectives and focus on specific conflicts of interest between managers, shareholders and bondholders. Early theories consider the capital structure that maximizes the objectives of an owner-manager, focusing on the agency conflicts between the owner-manager and outside investors (Jensen and Meckling (1976), Myers (1977), Myers and Majluf (1984)). Others consider the capital structure that maximizes the manager's objective, focusing on the agency conflict between owners and managers (Grossman and Hart (1982), Zwiebel (1996)). Still others consider the capital structure that

maximizes the objectives of owners (as distinct from managers), focusing on the ability of managerial incentive contracts to mitigate the agency conflict between shareholders and bondholders (John and John (1993)) or between shareholders and new investors (Dybvig and Zender (1990, Persons (1994)). In each case, the effects of debt on corporate efficiency depends crucially on the agency conflict and objectives considered. For example, in Myers (1977) debt increases agency costs due to the shareholder-bondholder conflict, in Zwiebel (1996) debt decreases the agency cost of the owner-manager conflict, and in Dybvig and Zender (1990) debt has no effect on agency costs. As Allen and Winton (1995) summarize, the focus on particular aspects of agency conflicts in isolation leaves open the important question of how the different conflicts interact, especially in large corporations.

This paper contributes by presenting a theory of capital structure that incorporates the interactions between manager-owner and shareholder-bondholder agency conflicts. The analysis is particularly rich in that it incorporates the 'primitive' objectives of each party in a setting that combines the agency and information problems inherent to large corporations. Although managerial incentives are endogenous (Dybvig and Zender (1990)), capital structure is relevant since it affects dynamically consistent influence (Persons (1994)). The conflicting manager-owner objectives produce a trade-off between the inefficiency in the low state and rents in the high state, and the conflicting shareholder-bondholder objectives produce the Myers (1977) under-investment incentives. This produces an alignment between managers and debt holders, since both prefer to invest more to maintain operations in the bad state. This alignment implies that the agency costs of the shareholder-bondholder and manager-owner conflicts are interdependent. When the capital structure includes low (risk less) levels of debt, there are no shareholder-bondholder agency costs and therefore no debt holder influence prior to maturity. However, the manager's influence provides him with excessive rents and inefficiently high agency costs (similar to Grossman and Hart (1982), Zwiebel (1996)). With higher (risky) levels of debt, shareholder-bondholder agency costs are introduced and the shareholders' increased focus on returns in the high state leads to a reduction in managerial rents. This reduces cost of the manager-owner conflict but increases the cost of the shareholder-bondholder conflict. When debt contracts provide the debt holders with an efficient level of ex-post influence, the reduction in the manager-owner agency cost outweighs the shareholder-bondholder agency cost so that total value increases.

Empirically, the analysis implies that the interactions between agency conflicts should affect both capital structure (including both the debt level and the level of protection against expropriating actions) and compensation choices. The predicted relationship between compensation contracts and managerial influence is consistent with the findings of Berokohvitch, Brunarski and Parrino (1997), Core,

Holthausen, and Larcker (1999) and Bertrand and Mullainathan (2000), and suggests how these analyses can be extended to incorporate the effects of capital structure on incentives. In particular, the alignment between managers and bondholders implies a positive relationship between compensation and the strength of covenants restricting under-investment and asset maintenance choices. If managers control capital structure, these covenants are predicted to be stronger, as are covenants that restrict external threats (e.g. poison put covenants that increase the cost of a takeover (Crabbe (1991), Perumpral Davidson Sen (1999)), leading to higher compensation. Alternatively, the manager may prefer low debt levels, producing a negative correlation between manager control (entrenchment) and leverage consistent with Berger, Ofek and Yermack (1997) (who use board composition and manager tenure as proxies for entrenchment) and Garvey and Hanka (1999) (who use the strength of takeover statutes). The alignment between managers and bondholders during the incentive-setting process can reconcile this negative relationship between debt and managerial control with the aligned voting on antitakeover amendments in Brickley, Smith and Lease (1988).

Finally, the model also implies that the value-maximizing capital structure should provide greater debt holder protection (influence) when low realizations occur. This capital structure can be implemented with commonly observed debt covenants (including accounting covenants) that relate debt holder influence to signals of firm performance. Such a capital structure is consistent with the empirical relationship between debt covenants and bondholder protection found by Smith and Warner (1979), Chen and Wei (1993), and Beneish and Press (1993).

Appendix

Solution to the problem in section II: The Lagrangian is

$$\max_{<w^i, a^i>} L = (1-m)[(1-\beta)\sigma(x^H + a^H - w^H - F) + \beta((1-\sigma)(x^L + a^L - w^L) + \sigma F)]$$

$$+m[(1-\sigma)(w^L - A(a^L)) + \sigma(w^H - A(a^H))]$$

$$+\theta^L_{RU}(w^L - A(a^L) - u) + \theta^H_{IC}(w^H - A(a^H) - w^L + A(a^L - \Delta x)$$

The first order conditions are:

$$\partial L / \partial w^H = -\sigma((1-m)(1-\beta) - m) + \theta^H_{IC} = 0 \Rightarrow \theta^H_{IC} = \sigma((1-m)(1-\beta) - m)$$

$$\partial L / \partial w^L = -(1-\sigma)((1-m)\beta - m) + \theta^L_{RU} - \theta^H_{IC} = 0$$

$$\Rightarrow \theta^L_{RU} = (1-\sigma)((1-m)\beta - m) + \theta^H_{IC}$$

$$= (1-\sigma)((1-m)\beta - m) + \sigma((1-m)(1-\beta) - m)$$

$$= 1 - 2m - (1-m)((1-\sigma)(1-\beta) + \sigma\beta),$$

$$\partial L / \partial a^H = \sigma((1-m)(1-\beta) - mA'(a^H)) - \theta^H_{IC}A'(a^H) = 0$$

$$\Rightarrow \sigma((1-m)(1-\beta) - mA'(a^H)) = \sigma((1-m)(1-\beta) - m)A'(a^H) \Rightarrow A'(a^H) = 1,$$

$$\partial L / \partial a^L = (1-\sigma)((1-m)\beta - mA'(a^L)) - \theta^L_{RU}A'(a^L) + \theta^H_{IC}A'(a^L - \Delta x)$$

$$= (1-\sigma)((1-m)\beta - mA'(a^L)) - [(1-\sigma)((1-m)\beta - m) + \theta^H_{IC}]A'(a^L) + \theta^H_{IC}A'(a^L - \Delta x)$$

$$= (1-\sigma)(1-m)\beta(1 - A'(a^L)) - \theta^H_{IC}A'(a^L) + \theta^H_{IC}A'(a^L - \Delta x) = 0$$

$$\Rightarrow (1-\sigma)(1-m)\beta[1 - A'(a^L)] = \sigma((1-m)(1-\beta) - m)[A'(a^L) - A'(a^L - \Delta x)]$$

$$\Rightarrow (1-\sigma)\frac{\partial \alpha}{\partial a^L} + \sigma\delta\frac{\partial \rho}{\partial a^L} = 0$$

where

$$\delta = \frac{1 - \beta - m/(1-m)}{\beta}.$$

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Notes:

[1] This is not to say that the analysis in Dybvig and Zender (1990) is not useful. Rather, it can be seen as further illustrating where not to look (similar to the seminal papers of Modigliani and Miller).

[2] Murphy (1998) provides a comprehensive survey CEO compensation practices. He concludes "There no doubt, however, that CEOs and other top managers exert at least some influence on both the level and structure of their pay" (p. 2517).

[3] In addition, the preference alignments in our paper are stronger than in John and John (1993) and Hirshleifer and Thakor (1992) in that the manager always gets his reservation utility in their analyses. In contrast, Berkovitch and Israel (1996) present a case where the manager obtains an exogenous level of rents in all states, so that he is aligned with whichever party prefers to retain him.

[4] Note that, although the contract offered to the manager is contingent on x^i in this case, it can still be designed before x^i is realized (as in figure 1) since it is dynamically consistent (or renegotiation proof). That is, it is designed such that the shareholders can do no better by offering a new contract after x^i is observed. In the case where x^i is asymmetrically observed (below) the contracts offered are again dynamically consistent since the shareholder receives no new information when x^i is realized (and therefore cannot renegotiate an improved contract).

[5] Technically, we assume $u \geq A(\underline{a})$ so that $w^i = A(a^{FB}) + u \geq A(a^{FB}) + A(\underline{a})$ ensures the incentive compatibility constraint. Note that only one non-zero wage is required since the value of v^i is deterministic when x^i is observed.

[6] The level of entrenchment reflects the cost of mounting a hostile takeover, which could include lost synergies from entrenching investments as in Shliefer and Vishny (1989).

[7] In a more complex setting, the value of *m* could be derived as the solution to a Rubinstein bargaining game, in which case the value of *m* would reflect the manager's bargaining power (or that of the board members loyal to the manager). The compensation contracts would be qualitatively unchanged, again reflecting the relative power of the manager.

[8] Values of $E > \overline{E}$ (such that $\lambda = 1$ and $a^L = a^{FB}$ in the solution with full managerial control) correspond to value of $m \geq ½$. In this case, the manager's influence is so strong that he can dictate a contract that simply pays out the firm's resources as wage compensation (in which case, the $S \geq \underline{S}$ constraint would again be required). This situation would be difficult to maintain in equilibrium, and we restrict attention to values of $m \leq ½$.

[9] To see this formally, note that the contracting costs depend on *m* only via the effect on a^L in (3). Thus, the contracting costs can be written as

$$c(a^L(m)) \equiv \sigma\rho(a^L(m)) + (1-\sigma)\alpha(a^L(m)).$$

The value of *m* that minimizes these costs is therefore given by

$$(\sigma\frac{\partial\rho}{\partial a^L} - (1-\sigma)\frac{\partial\alpha}{\partial a^L})\frac{\partial a^L}{\partial m} = 0$$

where

$$\frac{\partial a^L}{\partial m} = \frac{\sigma\Delta x}{(1-\sigma)(1-m)^2}) > 0$$

(obtained by differentiating (3) with $A'' = k$). Comparing with (1), contracting costs are minimized when $m = 0$.

[10] For simplicity, we assume that debt payments are made after payments to the manager since, by law, employee salaries have priority over debt holders (this assumption could be reversed if the manager's payment is considered a bonus, but the results would not be affected).

[11] There is voluminous literature illustrating how a firm's capital structure can affect the level of debt holder influence (and therefore the residual loss) at t = 1. Debt composition (e.g. bank versus market, straight versus convertible) can affect the creditors' incentives to monitor the firm (Rajan and Winton (1995)), the creditors' bargaining power once projects have begun (Rajan (1992)), and the creditors' influence over future investment

decisions (Berlin and Mester (1992), Perry and Taggart (1998)). Gilson and Warner (1998) illustrate that firms adjust debt composition (substitute public for bank debt without changing total debt) when they get close to contractual restrictions. Debt maturity can affect the frequency of negotiations and the influence provided by reputation concerns or monopolistic power of banks (Myers (1977), Barclay and Smith (1995), Houston and James (1996)); and provisions for senior debt can reduce the shareholders' under-investment incentives (Stulz and Johnson (1985)). Additional covenants, such as interest, collateral, net worth, and working capital restrictions can affect the influence provided by the threat of legal actions by debt holders (e.g. bankruptcy). Accounting covenants appear to be particularly useful in this role, as they are the most common cause of default and their violation often leads to (out of court) negotiations that protect the debt holders' position (Asquith, Gertner and Scharfstein (1994), Beneish and Press (1993, 1995)). Debt contracts can also stipulate creditor representation on the board (Booth and Deli (1999), Krosner and Strahan (1999))

[12] These studies do not explicitly consider compensation contracts. The assumption of full managerial control over the decisions taken within the firm, however, implicitly assumes full managerial control over the incentive setting process.

[13] The manager can increase β by designing debt contracts that include stronger investment or asset maintenance restrictions, tighter accounting covenants, stronger liquidation rights, etc., which increase the probability of default. Asquith, Gertner and Scharfstein (1994) and Beneish and Press (1995) find that accounting covenants are the most frequent source of default. Beneish and Press (1993) and Chen and Wei (1993) find that accounting violations are usually waived following out of bankruptcy negotiations that increase the debt holders' protection against expropriating actions that could benefit shareholders (e.g. new covenants to prevent the further dissipation of assets). The analysis also suggests further extensions to focus on the manager's choice of β, including the effects on ex-ante investment decisions (which determine Δx) and the effects on renegotiation incentives (which affect takeover incentives).

[14] Although the level of m is difficult to observe in practice (since, by definition, it conflicts with the manager's fiduciary duty), existing empirical evidence suggests that $m'(\sigma(s)) > 0$. For example, Warner Watts and Wruck (1988), Weisbach (1988), Dennis and Dennis (1995) document that the probability of dismissal increases with poor performance. Gilson (1989) finds that this relationship is stronger for firms with more independent outside directors, and Hermalin and Weisbach (1988) find that firms add more outside directors when performance is poor. The incentive for board vigilance is heightened following poor performance, in part because the threat of a shareholder lawsuit against the board increases (Kesner and Johnson (1990)). Similarly, Murphy (1998) finds that the negative correlation between dismissal and performance increases when the threat of a takeover increases, and Mitchell and Lehn (1990) show that managers who make value-reducing acquisitions (poor bidding performance) face a higher threat of takeover (become good targets). Finally, Weisbach (1993) and Dennis and Dennis (1995) show that the previous manager's investments face a higher probability of divestiture after they are replaced.

[15] This result can be strengthened further if $m(s)$ is endogenized (e.g. if m also depends on the ability to meet debt obligations similar to Grossman and Hart (1982) and Zweibel (1996)).