Managerial Incentives in Highly Levered Firms*

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Abstract

Compensating managers with debt as well as equity stakes in their firm is a seemingly natural solution to the agency costs of debt. However, it is absent from both current practice and the academic literature. I consider several possible rationalizations, none of which are wholly satisfactory. Covenants are incomplete and managers may risk-shift to avoid breaching covenant triggers. Private benefits and bonuses give the manager incentives to achieve solvency; however, he remains insensitive to liquidation value given bankruptcy and may gamble for resurrection. Risk aversion may mean that a fall in the manager's equity stake must accompany the assumption of debt. However, effort incentives are not reduced if effort is productive in improving liquidation value, or if bankruptcy is likely. Managerial debt stakes may thus be particularly effective in LBOs and CDOs, and to "insure" large, liquid firms against a collapse.

KEYWORDS: Agency costs of debt, corporate governance, executive compensation, time inconsistency, optimal liquidation
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1 Introduction

This paper analyzes whether managerial debt stakes have a role in executive compensation for firms in which agency costs of debt are significant. Such costs arise when equity-aligned managers take actions that benefit shareholders to the detriment of both creditors and overall firm value. I particularly focus on asset substitution, but other relevant actions include underinvestment, inefficient continuation, concealment of information and raising additional debt to pay dividends. The natural solution is to grant the manager debt stakes to complement his equity, so that his total pay is tied to overall firm value. Ex ante, such a scheme benefits the shareholders who determine his compensation scheme by lessening the cost of debt. Moreover, it is simple to implement as it automatically adjusts to reflect market-induced changes in the firm's debt and equity values.

However, this solution is almost never employed in practice and seems to have been ignored by the academic literature. I attempt to rationalize these absences in four ways, none of which are wholly satisfactory. First, agency costs of debt may simply be an unimportant issue in practice as covenants give creditors control rights even before bankruptcy is reached. However, covenants may simply shift the region in which asset substitution occurs and lead to managers taking gambles to avoid breaching the covenant. Moreover, contracts are inherently incomplete and cannot safeguard creditors in all possible contingencies, as shown by the numerous bankruptcies of 2001-3 - including large multinationals with supposedly strong corporate governance structures. In addition, covenants are not a costless solution as they may suboptimally restrict managerial flexibility.

Second, managers often derive private benefits from running their firm, which may be enhanced by cash bonuses for achieving solvency. This can lead to a partial alignment with creditors as the manager has strong incentives to avoid bankruptcy. However, the alignment is far from complete: if the manager is made redundant upon bankruptcy, his private benefits are zero regardless of the liquidation value recovered by creditors. Thus a manager in difficulties may "gamble for resurrection", taking great risks to try to preserve his private benefits and bonus, rather than maximizing liquidation value.

Third, risk-averse managers will be unwilling to hold risky debt in their firm unless part of their equity stake is exchanged for cash. This has potential adverse effort implications, and thus the compensation scheme must trade off eliciting maximum effort with optimal project selection. For the vast majority of firms, which are far from bankruptcy, the effort issue is first-order, justifying why their managers do not hold debt. However, managerial debt stakes may be beneficial for highly levered firms where risk shifting concerns are important. Moreover, if effort has a high expected payoff in bankruptcy (either because bankruptcy is likely, or because effort involves actions that pay off primarily in liquidation states), switching equity for debt may *increase* effort as well as improving project selection. In contrast to the "agency costs of equity" nomenclature, suboptimal effort may not purely result from an insufficient managerial

equity stake, particularly if the firm is likely to go bankrupt and so effort primarily benefits creditors.

Fourth, managerial debt stakes may be time inconsistent. Once debt has been raised, shareholders can grant the manager additional equity, reigniting his incentives to risk shift. In addition to the standard defenses of coordination problems among dispersed shareholders and reputational issues for concentrated shareholders, in this paper renegotiation may be prohibitively costly. If the debt is subject to a lock-up and cannot be sold, and either limited liability or risk aversion prevents him from borrowing to buy additional shares, he will only accept extra equity if it is given for free. Since it is the *ratio* of the manager's equity to debt share that determines his risk-shifting incentives, once he is given a sizable debt stake, shareholders may need to make such a large extra grant of shares to restore asset substitution incentives that the cost is prohibitive.

Therefore, while there is merit in the above arguments, they cannot rationalize the absence of managerial debt stakes in every firm. I identify three specific cases where managerial debt stakes may be particularly valuable. Two are leveraged buyouts and collateralized debt obligations, which are highly levered from origination and thus frequently bear double-digit costs of debt. Debt stakes may serve to reduce yields, lighten covenants and potentially open up the leveraged buyout channel to a new class of firms for which high agency costs of debt had previously made it unviable. The third, somewhat paradoxically, is large, liquid, companies. Even though debt for such firms is close to risk-free and asset substitution is initially an unimportant issue, this also means that the CEO may be willing to hold debt without a significant reduction in his equity stake. The incentive value of the debt stake can be seen if the firm falls on difficult times and its equity value declines sharply. The manager's debt is then a substantial proportion of his investment in the company, and so he becomes closely aligned with creditors precisely at the point when this is desirable. This solution may have deterred the debtholder expropriation that occurred in the many "fallen angels" of 2001-3, such as Enron and WorldCom. The alternative of waiting until a firm encounters trouble before granting the manager debt is unviable as shareholders remain in control, and they have little incentive to align the manager more closely with creditors.

In the final theoretical part of the paper, I depart from the main model to analyze the liquidation decision of Rajan (1992). Similar to Aghion and Bolton (1992) and Dewatripont and Tirole (1994), Rajan argues that optimal decisions can be ensured by relying on an external investor, with the correct incentives, to step in and seize control just before the decision is to be taken. This may not always be effective if investors are dispersed or uninformed, or if projects arrive frequently and stochastically: then it is difficult to time the maturity of debt so that control shifts at exactly the correct moment. It is more effective to give the *manager* the appropriate incentives, which involves granting him debt as well as equity.

My conclusions stand in sharp contrast to existing practice, even bearing in mind that they apply only in limited cases. However, current reality may result from CEOs' influence over

their own compensation package rather than optimizing behavior. I present a multitude of evidence that firms do take action to reduce the risk of asset substitution and thus consider it an important issue. Awarding debt stakes may have the same beneficial impacts on project selection as the measures currently practised, with fewer side-effects on effort.

Many existing papers recognize the role of managerial compensation structures in reducing the agency costs of debt. John and John (1993) and Brander and Poitevin (1992) both argue pay-performance sensitivity should decline, and fixed cash bonuses rise, as leverage increases. Duru, Mansi, and Reeb (2003) extend the John and John model and predict that cash bonuses for avoiding bankruptcy should be higher as managers' equity claims rise.

In this context, this paper makes three principal contributions. First, it is the first to propose the award of managerial debt stakes, rather than fixed cash bonuses, by illustrating that the latter may fail in certain circumstances. Second, previous papers produce skewed results as they only consider the agency costs of debt (project selection) and ignore the agency costs of equity (effort). In their framework, it is unclear why managers hold any equity at all given it only has negative effects by encouraging asset substitution. I incorporate the effort decision and illustrate the trade-off between providing optimal effort and project selection incentives. Moreover, I show that there may not be a trade-off if effort has a particularly high expected payoff in bankruptcy. Third, I extend the concept of debt stakes to inducing optimal liquidation, and argue that reliance on external intervention may be less effective.

This paper is organized as follows. Section 2 presents the basic model, which proposes that the manager holds a capital structure mimicking investment in his firm. Section 3 examines whether private benefits, effort considerations or renegotiation concerns justify the near absence of managerial debt stakes in practice. Section 4 identifies specific cases where managerial debt may be particularly valuable and considers the additional benefit of inducing optimal liquidation. Section 5 considers the apparent inconsistency of empirical evidence with the recommendations of this paper, and Section 6 concludes.

2 Alleviating the Agency Costs of Debt

This section is divided into two parts. Section 2.1 discusses whether agency costs of debt are an important issue in practice that requires a solution at all. Section 2.2 introduces the model illustrating that managerial debt stakes can alleviate asset substitution.

2.1 Are The Agency Costs of Debt Real?

CEOs are appointed by equityholders and incentivized to act in their interest, through shares, options and bonuses contingent on equity value. Even if total firm value is unchanged, shareholders gain when the value of existing debt falls since equity is a residual claim. Following Black and Scholes (1973), risky debt equals risk-free debt minus a default put, P, on total firm

value V. Since the value of the put is an increasing function of asset risk (σ), time to maturity (t) and the face value of debt (F), and decreasing in V, managers can erode the value of debt through manipulating these parameters as summarized by Myers (2003).

For brevity, the core model and much of the text focuses on one agency cost of debt: the asset substitution effect of Jensen and Meckling (1976). This occurs when managers increase P by raising the firm's asset risk ($dP/d\sigma > 0$). Equity-aligned managers have incentives to select even negative-NPV risky projects since the gains from success accrue principally to shareholders, but losses from failure are borne by creditors owing to the limited liability of equity.

Although the paper uses risk shifting as the working example, its conclusions also apply to other actions that managers can take to benefit shareholders at the expense of creditors. First, Johnson (2004) shows that the asset substitution effect need not be confined to project selection: managers can increase idiosyncratic risk by augmenting the opacity of the firm. Concealing information prevents creditors from acting immediately to force bankruptcy and lengthens the effective maturity of debt. This benefits shareholders, since $dP/dt > 0$. Second, Section 4.2 analyzes managers suboptimally failing to liquidate the firm: this can be seen either as choosing risky continuation over safe liquidation ($dP/d\sigma > 0$) or lengthening debt maturity ($dP/dt > 0$). Third, Appendix A considers the debt overhang effect of Myers (1977), whereby managers underinvest as part of the gains from investment accrue to debtholders, since $dP/dV < 0$. Fourth, managers may borrow additional debt and pay out the entire proceeds as cash to shareholders. This is a zero-NPV transaction but benefits shareholders as $dP/dF > 0$. (New creditors are willing to lend as debt is issued at market value).

All of the above actions will be anticipated by rational creditors in advance, increasing the cost of debt ex ante. The most natural solution is to tie manager's pay to the value of debt. Given we almost never observe managerial debt stakes, it could be that such actions are very rare in practice, but merely confined to the textbooks. Indeed, they are a minor issue for firms far from bankruptcy: if debt is close to risk-free, $P \approx 0$ and equity maximization closely approximates firm value maximization. Moreover, even in the highly levered firms that are the focus of this paper, covenants may limit bondholder expropriation.

However, covenants are an imperfect solution. Investment is non-contractible (Myers, 1977) – even if outsiders can observe the outcome of investments, it is the ex ante probability distribution of payoffs that is key and these are unlikely to be verifiable to a court. Bankruptcy may arise from the manager taking the optimal decision but being unlucky. Even assuming the terms of any contract written are fully enforceable, contracts are inherently incomplete (e.g. Aghion and Bolton, 1992). It is impossible to describe every feasible contingency; even in the states of nature that the contract does specify, the actions prescribed ex ante may turn out to be ex post suboptimal and constrain managerial flexibility. The imposition of rules rather than discretion constrains the use of managerial flexibility to improve firm value. Covenants that allow creditors to take control some way above bankruptcy (e.g. when a trigger credit rating is breached) may simply lead to a vertical translation of the region in which asset substitution oc-

curs. Managers now risk shift when the firm approaches the trigger, rather than when the firm approaches bankruptcy, as they do not wish to lose control rights. Possibly for these reasons, McDaniel's (1986) study of large US corporations finds almost no restrictions on the ability of firms to increase their risk.

Two prominent and recent cases illustrate the substantial debtholder losses that can occur when managers take excessive risk - even in large multinationals with supposedly strong governance structures.

The first is the English engineering company Invensys. It had failed to achieve planned synergies from its formation in 1999 by the merger of BTR and Siebe. Coupled with declining conditions in the process automation market, this led to severe financial difficulties. The CEO responded by paying $725m in June 2000 for the Dutch software firm Baan - a takeover viewed as highly risky at the time, but a "punt" that could have saved Invensys had it been successful. However, the acquisition was a failure, bond prices fell sharply and Invensys was broken up.

The second example is Enron, a firm that was suffering substantial losses from risky new ventures and needed cash to service its debt. As these losses mounted, Enron took increasingly greater risks (in particular in derivatives trading) to attempt to stay solvent (increasing σ) and concealed its problems (increasing t). Not only did Enron eventually go bankrupt, but the severity of bankruptcy was unprecedented, with creditors losing billions of dollars. As with Invensys, managerial debt may have helped by aligning the manager with liquidation value.

More generally, several studies demonstrate that executive compensation has a significant effect on risk across a wide range of firms, despite private benefits and covenants. Guay (1999) shows that the volatility of firms' stock returns increases with the convexity of managers' payoffs. Datta, Iskandar-Datta and Raman (2001) find that managers with higher equity-based pay engage in risk-increasing acquisitions. Rajgopal and Shevlin (2002) conclude that stock options motivate oil and gas executives to undertake exploration risk. Saunders, Strock and Travlos (1990) document a positive association between equity-based pay and risk-taking in banks; Agrawal and Mandelker (1987) draw similar conclusions for industrial firms.

The importance of the agency costs of debt cannot simply be ascertained solely by looking at actual instances of risk shifting, underinvestment, concealment of information and dividend escalation. As discussed in Section 5, many firms may view these costs as important and actively address them by moderating leverage (losing some of the benefits of debt), or by reducing the manager's equity stake (with adverse effort implications). Alleviating the costs directly via managerial debt stakes may allow them to set a higher debt level or managerial equity stake rather than employing the second-best solutions currently used[1].

2.2 The Model

[1] While Andrade and Kaplan (1998) conclude that costs of financial distress are low in their sample of highly leveraged transactions, they acknowledge that their results may be driven by sample selection - only firms with low costs of distress choose to become levered in the first place. Other firms with high costs of distress may set a suboptimally low level of leverage.

This section illustrates the role of managerial debt stakes in inducing optimal project selection. Consider a firm with a single manager in a three-period setting, with the risk-free rate normalized to 0. (I refer to the manager as "he" and the creditor, introduced later, as "she"). The firm has zero-coupon risky debt with face value F outstanding. It matures at time 1, and its time 0 value is $D_0 < F$. Current total firm value is $V_0 = E_0 + D_0$.

At $t = 0$, the manager can invest in one of two mutually exclusive projects: R (risky) or S (safe, but not risk-free). R has probability p_R of "success", in which case the firm is worth V_{GR} at $t = 1$. In "failure" (which occurs with probability $(1 - p_R)$), firm value is V_{BR}, net of any bankruptcy costs. S pays V_{GS} with probability p_S, and V_{BS} otherwise. In this section, these values are exogenous of managerial effort and known at $t = -1$. I assume $V_{GR} > V_{GS} > F$, $V_{BR} < V_{BS} < F$ and $p_R \leq p_S$.

The manager's compensation, set at $t = -1$, consists of a riskless wage plus an incentive component, $f(V)$. Aside from the limited liability restriction of $f(V) \geq 0 \; \forall \; V$, I make no further assumptions on $f(.)$ at this stage: I do not yet restrict it to comprising the standard instruments of debt and equity but seek to derive the globally optimal incentive schedule. Owing to risk aversion, the manager is willing to bear no more than $\overline{\sigma}^2$ in total dollar value of the risk of his compensation package. Hence, if the manager is compensated by securities $i = 1, ..., n$, his risk constraint (RC) is given by

$$\sum_{i=1}^{n} \lambda_i^2 \sigma_i^2 + \sum_{i=1}^{n} \sum_{j=1, j \neq i}^{n} \lambda_i \lambda_j \sigma_{ij} \leq \overline{\sigma}^2 \tag{1}$$

where σ_i is the standard deviation of \$1 invested in security i and λ_i is the number of dollars the manager holds in that security. As long as RC is not violated, the manager and all creditors are assumed risk neutral. In this simplified setting, the compensation scheme has a single objective: to induce optimal project selection. Hence, if and only if the risky project has a lower NPV, i.e. inequality (2) is satisfied, we wish the manager's incentives to lead him to reject it, i.e. inequality (3) to be satisfied. I refer to (3) as the manager's incentive compatibility (IC) constraint.

$$p_R V_{GR} + (1 - p_R) V_{BR} \leq p_S V_{GS} + (1 - p_S) V_{BS} \tag{2}$$

$$p_R f(V_{GR}) + (1 - p_R) f(V_{BR}) \leq p_S f(V_{GS}) + (1 - p_S) f(V_{BS}) \tag{3}$$

This double implication requires $f(.)$ to be an affine function of V, i.e. $f(V) = xV + y$ for any $x \geq 0$. Jensen and Meckling (1976) show that x should be maximized if managerial effort improves firm value: this is considered in more detail in Section 3.2. Maximizing x subject to the limited liability restriction $xV + y \geq 0 \; \forall \; V$ and the risk constraint yields:

$$y = -xV_{BR}, \; x = \frac{\overline{\sigma}}{V \sigma_V} \tag{4}$$

Hence the manager has a "firm value option": his incentive compensation is linear in V, but unlike a pure equity claim, the option is struck at V_{BR}, the lowest possible firm value, rather than F. Thus it is sensitive to firm value in bankruptcy, which a pure equity claim is not.

The firm value option can be replicated using standard securities. If the manager holds a fraction α of the firm's equity and β of its debt (and thus αE_0 and βD_0 dollars respectively), $\beta = \alpha$ achieves the desired linearity. (RC) is $\alpha^2 E_0^2 \sigma_E^2 + \beta^2 D_0^2 \sigma_D^2 + 2\alpha\beta E_0 D_0 \sigma_{ED} \leq \overline{\sigma}^2$ yielding $\beta = \alpha = \frac{\overline{\sigma}}{V \sigma_V}$ as before, since $\sigma_V^2 = \sigma_E^2 + \sigma_D^2 + 2\sigma_{ED}$. Hence, for the remainder of the paper, I can assume the manager's incentive pay comprises equity and debt stakes.

$\beta = \alpha$ implies that the manager is compensated with a "capital structure mimicking investment". Such a scheme does not need to be actively rebalanced for market-induced changes in debt and equity value as such rebalancing occurs automatically. Intuitively, $\beta < \alpha$ will encourage asset substitution as the manager overweights equityholders' interests; $\beta > \alpha$ will lead to excessive conservatism as S may be suboptimally chosen.

In practice, $\beta = 0$ and $\alpha > 0$ are observed. The manager chooses R if:

$$p_R \alpha (V_{GR} - F) \geq p_S \alpha (V_{GS} - F) \tag{5}$$

This is suboptimal if (2) is also satisfied, i.e. S has a higher NPV. The asset substitution issue is increasing in F, as debt creates a wedge between firm and equity value. The "trade-off" theory of capital structure therefore advocates lowering leverage to a second-best level $F^{SB} < V_{BR}$, as the firm is never bankrupt and incentives are perfectly aligned. F^{SB} minimizes *total* agency costs, plus other factors such as taxes and bankruptcy costs. This is a second-best solution as it loses some of the many benefits of debt, such as tax shields and reducing free cash flow. Alternatively, the firm can keep debt at the first best level $F^{FB} > F^{SB}$ which is optimal in the absence of agency costs of debt, but bears an additional discount as rational creditors foresee the risk of expropriation. Either way, shareholders suffer and thus have full incentives to commit to optimal project choice ex ante, even though ex post they would like the manager to risk shift. (The second manifestation will be used as it is more workable within the model: hence F is exogenously set equal to F^{FB}.) Thus $\beta = \alpha$ increases *shareholder* value[2]. Appendix A illustrates that the Myers (1977) "debt overhang" issue can be examined in the same light.

The "leverage" which drives the need for $\beta > 0$ need not be purely financial. Fama (1990) argues that other stakeholders with fixed claims, such as workers, suppliers and customers, will also price their claims in consideration of the manager's likely investment decisions. Hence $\beta > 0$ may reduce the demands of these constituents.

[2]Let the manager raise F at time $t = -1$, and D_{-1}^* and E_{-1}^* be the debt and equity values under $\beta = \alpha$. If $\beta = 0$, equity is worth $E_{-1} > E_{-1}^*$ as shareholders benefit from R being chosen in states of nature where S is optimal. However, they suffer an additional discount of $D_{-1}^* - D_{-1}$ at $t = -1$ and thus borne in all states because debt is worth less. Since $V_{-1}^* > V_{-1}$, as the former is firm value under optimal decisions, $D_{-1}^* - D_{-1} > E_{-1} - E_{-1}^*$ and so shareholders benefit from $\beta = \alpha$.

Finally, as discussed in Section 2.1, covenants may mean that creditors can take control before bankruptcy, e.g. when firm value falls to $G > F$. This merely moves the risk-shifting region upwards: if creditors will liquidate the firm once they have control[3], G effectively becomes F in the above analysis. Hence, covenants may paradoxically make the asset substitution worse: the manager risk-shifts even when the firm is some distance from bankruptcy.

3 Rationalizing the Absence of Managerial Debt Stakes

If covenants indeed cannot eliminate asset substitution, the predictions of Section 2.2 are in stark contrast to the near absence of managerial debt stakes in practice. This section attempts to rationalize current executive compensation policies in three additional ways. First, Section 3.1 considers the fact that the manager's payoff function may already include "debt-like" elements such as private benefits and bonuses. Second, Section 3.2 analyzes the negative effect of debt grants on the manager's equity stake (if there is an upper bound to the value of risky securities he is willing to hold), with potential adverse effort consequences. Third, Section 3.3 discusses whether a compensation contract involving debt is time inconsistent, as shareholders are in control during solvency and may be able to renegotiate the contract back to pure equity. I show that, in certain circumstances, managerial debt stakes remain an optimal feature of compensation policy even in the presence of private benefits and effort considerations.

3.1 Private Benefits and Bonuses

Existing features of a manager's payoff function may already give him a sufficient incentive to avoid bankruptcy, rendering managerial debt stakes unnecessary. For example, the manager may derive non-pecuniary private benefits from incumbency (firm-specific human capital, reputation, prestige and perquisites)[4] or can be incentivized to prevent bankruptcy via a cash bonus. I now introduce private benefits of B if the firm is solvent: this may include a cash bonus paid if and only if bankruptcy is avoided. (IC) is now:

$$p_R[\alpha(V_{GR} - F) + \beta F + B] + (1 - p_R)\beta V_{BR} \leq p_S[\alpha(V_{GS} - F) + \beta F + B] + (1 - p_S)\beta V_{BS} \quad (6)$$

which we wish to hold if and only if (2) holds. Manipulating these equations gives the optimal level of β below:

$$\beta = \alpha - \frac{B(p_S - p_R)}{F(p_S - p_R) + (1 - p_S)V_{BS} - (1 - p_R)V_{BR}} = \alpha - BY \quad (7)$$

[3]Dewatripont and Tirole (1994) show that creditors may liquidate the firm even if this is suboptimal for overall firm value, since they are excessively conservative.

[4]We assume for simplicity that bankruptcy leads to termination. Private benefits are even less effective at deterring risk shifting if the manager is not made redundant upon default. I also ignore severance pay as it would work to weaken the effects of private benefits and bring us closer to the model of Section 2.2.

Private benefits do not affect the earlier $\beta = \alpha$ result if $p_S = p_R$, as S is no more likely to succeed than R. Its only benefit is its higher liquidation payoff, but private benefits are insensitive to this. If $p_S > p_R$, $Y > 0$. Private benefits provide the manager with a natural inclination to choose S and the required β falls. However, the desired β is still strictly positive, as long as inequality (8) is satisfied:

$$B \geq \alpha\{F + [(1 - p_S)V_{BS} - (1 - p_R)V_{BR}]/(p_S - p_R)\} \tag{8}$$

Private benefits do not render managerial debt stakes redundant as they only lead to a partial alignment with creditors. Although they provide managers with a strong interest in solvency, they are insensitive to creditors' payoffs if bankruptcy occurs. For instance, if the manager is fired upon bankruptcy, his firm-specific human capital is worth zero regardless of liquidation value. Hirshleifer and Thakor (1992) argue that the managerial labor market only distinguishes between success and failure, and not the severity of failure.

Moreover, in some cases private benefits can *exacerbate* asset substitution. If S instead represented "safe liquidation" (considered in more detail in Section 4.3) and gave $V_L < F$ but $V_L >> V_{BR}$ for certain, we require (9) to hold if and only if (10) holds:

$$p_R V_{GR} + (1 - p_R)V_{BR} \leq V_L \tag{9}$$

$$p_R[\alpha(V_{GR} - F) + \beta F + B] + (1 - p_R)\beta V_{GR} \leq \beta V_L \tag{10}$$

Incentive compatibility requires $\beta = \alpha + \frac{B}{V_{GR} - F}$ which is *increasing* in B. Rather than preserving liquidation value, private benefits give the manager with a natural inclination to "gamble for resurrection" by choosing R, attracted by the possibility of solvency and not deterred by the severe creditor value destruction upon failure. Reputational concerns only work in Hirshleifer and Thakor (1992) as they assume that liquidation value is always zero under failure: hence there is no disadvantage of a mechanism with a binary payoff.

The same argument explains why the fixed cash bonuses for achieving solvency, proposed by John and John (1993) and Brander and Poitevin (1992), fail to prevent asset substitution. Duru, Mansi and Reeb's (2003) interpretation of John and John's model, that "cash bonus compensation represents pay-for-performance from a bondholder perspective", is incorrect as the bonuses suggested are insensitive to bondholder payoffs in liquidation. The bonus only works in John and John as $p_S = 1$: solvency can be guaranteed. In reality, many distressed companies cannot avoid bankruptcy with certainty even via the safest course of action. Invensys and Enron needed to take large risks to escape from their troubles. If instead $p_S \approx p_R$ (or $V_{BS} >> V_{BR}$), then (8) shows that the required bonus may be so high that it is impractical to offer it. Section 3.2 illustrates that a bonus also provides weaker effort incentives than debt.

In practice, bonuses very rarely have the binary form assumed above. Instead, they are

positively related to shareholder value, thus effectively increasing α further, but are hardly ever sensitive to the payoff in bankruptcy. Murphy's (1999) survey concludes: "under the typical plan, no bonus is paid until a threshold performance"[5]. Hence they exacerbate risk-shifting incentives. Duru, Mansi and Reeb's (2003) empirical finding that cash bonuses are positively correlated with pay-performance sensitivity fails to support their model as it requires a *fixed* cash bonus – indeed, variable cash bonuses could the very reason for the sensitivity of pay to performance that they find. In addition, bonuses are typically contingent upon accounting profit rather than security values, and the former is dependent upon accounting policy. By contrast, debt values depend on cash flows, which are independent of accounting.

Redesigning the bonus to pay off exactly like a debt security may still be inferior to the security itself. First, debt is a cleaner solution, as it avoids writing a complex contract – just as companies in practice find it easier to award shares and options directly rather than incorporating their upside potential into a CEO's contract[6]. Second, management pay is widely considered junior to debt claims (e.g. Dewatripont and Tirole, 1994) and so the manager may receive nothing in bankruptcy, especially if a court decides that he should not be rewarded for failure. Third, bonuses lapse if the manager leaves the firm, but a debt stake is retained. If investments are irreversible, debt may induce the manager to choose S even if he fears redundancy, whereas a bonus may not. In addition, shareholders may threaten to fire the manager if he does not engage in asset substitution – in which case the bonus has no effect, as the manager will not choose S as he fears being fired and not receiving it at all.

3.2 Managerial Effort

In the model of Section 2.2, the manager's incentive scheme had a single objective: to induce optimal project selection. In reality, compensation schemes are also required to elicit effort. Models such as John and John (1993) and Brander and Poitevin (1992) which incorporate only the agency costs of debt (project selection) but ignore the agency costs of equity (effort) have skewed conclusions, as increasing α only has negative effects. It is unclear why managers hold any equity at all in these models: $\beta = \alpha$ could be achieved simply by setting $\alpha = \beta = 0$.

I therefore add effort to the model. In my framework, the role of $\beta > 0$ is to mitigate the investment distortions arising from setting $\alpha > 0$ to encourage effort. This echoes Tinbergen's (1952) "two targets, two instruments" approach to achieving both internal and external balance via macroeconomic policy.

[5] The only example I have found is the unsecured creditors committee of Pan Am proposing paying the top 3 managers a $1.5 million bonus based on their success at narrowing the company's losses, documented in Gilson and Vetsuypens (1994a).

[6] Similarly, in theory the board could replicate the payoff of a debt security through a portfolio of equity and a binary option. However, such a portfolio will have to be dynamically re-hedged as the probability of bankruptcy changes. Not only is this costly (and may lead to confusing incentives for the manager) but also such re-hedging is non-contractible, as the probability of bankruptcy is unlikely to be verifiable. There is a classic time inconsistency problem: the board, appointed by shareholders, has no incentive to effect any rehedging that would reduce the manager's alignment with shareholder payoffs.

The manager chooses effort level $e \geq 0$, with unit cost of 1. Effort improves V_G by $g(e)$ regardless of project selection, and V_B by $b(e)$ (for simplicity I assume $V_B + b(e)$ remains below F). Intangible investment, such as staff training and building customer relationships, will have a high g and low b; the converse is true for exerting effort to scrap investment projects or liquidate assets[7]. Additionally, I assume $g'(.) > 0$, $g''(.) < 0$ and similarly for $b(.)$, so there are diminishing returns to effort. With a binding risk constraint of $\alpha^2 E_0^2 \sigma_E^2 + \beta^2 D_0^2 \sigma_D^2 + 2\alpha\beta E_0 D_0 \sigma_{ED} = \overline{\sigma}^2$ and risky debt, increasing β lowers α with potential adverse effort consequences, and thus may rationalize the $\beta = 0$ observed in practice. The simplistic form of (RC) implies infinite risk aversion once $\overline{\sigma}^2$ is exceeded, and so the manager will only accept additional risky securities if they are given for free. While not entirely realistic, the assumption is made for tractability as modeling risk aversion in a standard manner would substantially increase complexity without affecting the intuition. Relaxing it would strengthen our results, by making the manager more willing to accept debt without a reduction in his equity stake.

I also allow the parameters to be stochastic and realized at $t = 0$, after the compensation schedule is set but just before the manager chooses the project[8]. All the comparative statics results can be generated by allowing variation in a single parameter: I assume $V_{GR} \sim U[V_{GS}, V_{GRH}]$ and keep the others fixed. The analysis is substantially simplified by assuming $p_R = p_S = p$. Probabilities are thus exogenous of effort; hence "success" and "failure" can be thought of two states of nature, θ_G (good) and θ_B (bad). This is realistic if they are exogenously determined, for example by regulatory action or economic conditions. If effort increases the probability of solvency, it is not the case that debt stakes discourage effort by making θ_B less painful to the manager. The debt stake is worth F in θ_G and only V_{BR} or V_{BS} in θ_B, and so its value is maximized in solvency. These payoffs are in contrast to other compensation instruments such as severance pay, which only pay off in θ_B and so may indeed have a disincentive effect if probabilities are endogenous. Note that the assumption that $p_R = p_S = p$ also renders private benefits irrelevant, allowing a focus on the effort - project selection trade-off. The effect of private benefits has already studied in Section 3.1.

Consider first the manager's effort decision. If R is eventually chosen, firm value is $p(V_{GR} + g(e)) + (1-p)(V_{BR} + b(e)) - e$; if S is eventually chosen, firm value is $p(V_{GS} + g(e)) + (1-p)(V_{BS} + b(e)) - e$. Regardless of which project is selected, the first-order condition for firm value maximization implicitly defines the first best effort level e^{**}:

$$pg'(e^{**}) + (1-p)b'(e^{**}) = 1 \tag{11}$$

[7]Non-core asset sales increase liquidation value. Even though the receivers are able to sell assets in bankruptcy, a manager is likely to obtain a significantly higher value than in a "fire sale" when it is known that the firm is a forced seller. In addition, the manager is likely to have greater expertise over the true value of the assets. Similarly, curbing investment projects with intangible or long-term payoffs increases liquidation value more than solvency value.

[8]Stochastic parameters are introduced so that the asset substitution effect increases the further we depart from $\beta = \alpha$. With fixed parameters, both (2) and (3) would be known and the board could simply maximize effort subject to both constraints being satisfied.

However, the manager will not select e^{**} as he bears the full cost of effort yet only shares in some of the gains. His chosen level of effort, e^*, is determined by equation (12) below:

$$p\alpha g'(e^*) + (1-p)\beta b'(e^*) = 1 \tag{12}$$

Thus $e^* < e^{**}\ \forall\ (\alpha, \beta)$: firm value is always increased by eliciting more effort from the manager. (12) shows that the effort level chosen depends on the probabilities of the two states and the relative productivity of effort in each state. If effort is more productive in augmenting solvency value (i.e. $g'(e) > b'(e)$), or if θ_G is more likely, the optimal α rises. However, $\beta > 0$ may be justified on effort grounds alone if $p << 1$ and effort has strong effects on liquidation value ($b(e) >> 0$ for some e).

Effort is thus a function of α and β. Since $\frac{\delta e^*}{\delta \alpha} > 0$ and $\frac{\delta e^*}{\delta \beta} > 0$, (RC) binds in equilibrium and the choice of α automatically determines β. Thus effort can be considered a function of $\gamma = \frac{\alpha}{\beta}$: I write $e^*(\gamma)$. Since $\frac{\delta e}{\delta \alpha} = \frac{\delta e}{\delta \gamma}\frac{1}{\beta}$, if e is monotonically increasing (decreasing) in α, it is monotonically increasing (decreasing) in γ.

Now consider project selection. Firm value is maximized if the manager chooses R if and only if V_{GR} turns out higher than V_{GR}^{**}, where V_{GR}^{**} is defined by equation (13) below:

$$V_{GR}^{**} = V_{GS} + \frac{(1-p)}{p}(V_{BS} - V_{BR}) \tag{13}$$

However, the manager will choose R if and only if $V_{GR} > V_{GR}^{*}$, where:

$$V_{GR}^{*} = V_{GS} + \frac{(1-p)}{\gamma p}(V_{BS} - V_{BR}) \tag{14}$$

Asset substitution occurs if $V_{GR}^{*} < V_{GR}^{**}$. If γ rises, V_{GR}^{*} falls and the manager suboptimally chooses R for a greater range of V_{GR} out-turns. I thus write $V_{GR}^{*}(\gamma)$. Hence, if $\frac{\delta e}{\delta \gamma} > 0$, there is a trade-off between project selection and effort inducement, as in Rajan (1992) and Dewatripont and Tirole (1994). For a given γ, firm value is given by equation (15) below:

$$\begin{aligned} &p(E[V_{GR}|V_{GR} > V_{GR}^{*}(\gamma)]) + (1-p)V_{BR}] * Pr(V_{GR} > V_{GR}^{*}(\gamma)) \\ &+ [pV_{GS} + (1-p)V_{BS}] * Pr(V_{GR} < V_{GR}^{*}(\gamma)) \\ &+ pg(e^*(\gamma)) + (1-p)b(e^*(\gamma)) - e \end{aligned} \tag{15}$$

Noting that $\Pr(V_{GR} > V_{GR}^{*}(\gamma)) = \frac{V_{GRH} - V_{GR}^{*}(\gamma)}{V_{GRH} - V_{GS}}$ and $\Pr(V_{GR} < V_{GR}^{*}(\gamma)) = \frac{V_{GR}^{*}(\gamma) - V_{GS}}{V_{GRH} - V_{GS}}$, the marginal change in firm value from increasing γ is given by (16) below:

$$
\begin{aligned}
&[p(\frac{V_{GRH}+V^*_{GR}(\gamma)}{2})+(1-p)V_{BR}]*\frac{(1-p)}{p\gamma^2}(\frac{V_{BS}-V_{BR}}{V_{GRH}-V_{GS}})\\
&-[pV_{GS}+(1-p)V_{BS}]*\frac{(1-p)}{p\gamma^2}(\frac{V_{BS}-V_{BR}}{V_{GRH}-V_{GS}})\\
&-\frac{(1-p)}{2\gamma^2}(V_{BS}-V_{BR})(\frac{V_{GRH}+V^*_{GR}(\gamma)}{V_{GRH}-V_{GS}})\\
&+[pg'(e^*(\gamma))+(1-p)b'(e^*(\gamma))-1]\frac{\delta e^*}{\delta\gamma} \qquad (16)
\end{aligned}
$$

The fourth line in (16) represents the effect of increasing γ on firm value via the effect on effort. If $\frac{\delta e^*}{\delta\gamma}>0$, this effect is positive. The other lines illustrate the effect on project selection. The first two lines show the value change from the manager choosing R over S for an additional set of V_{GR} out-turns. The third line captures the fact that, since the "threshold" V^*_{GR} for the acceptance of R has decreased, the average V_{GR} given that R is chosen is lower.

(16) simplifies to (17) below:

$$
\begin{aligned}
V'(\gamma) \;=\; & \frac{(1-p)^2(1-\gamma)}{p\gamma^3}\frac{(V_{BS}-V_{BR})^2}{V_{GRH}-V_{GS}}\\
&+[pg'(e^*(\gamma))+(1-p)b'(e^*(\gamma))]\frac{\delta e^*}{\delta\gamma} \qquad (17)
\end{aligned}
$$

In the most common case, where $\frac{\delta e^*}{\delta\gamma}|_{\gamma=1}>0$ and so $\gamma>1$, the first line is negative and the second is positive, illustrating the trade-off. Since effort is only implicitly defined by (12), I cannot derive the optimal γ in closed form. However, it can be seen that managerial debt stakes have a role in executive compensation if (17) is negative for some γ. Hence they are more appropriate if, ceteris paribus:

1. $V_{BS} >> V_{BR}$. This makes the first term of (17) more negative: it is even more important to for the manager to be sensitive to the liquidation payoff. This occurs if R involves intangible investment with little payoff in bankruptcy (such as advertising) or the firm has limited traditional debt capacity in the form of tangible assets in place, as these form a lower bound to V_{BR}. Raising β could increase the firm's "effective debt capacity", allowing the issuance of more debt without a deterioration in terms. V_{GS} does not appear in (17) as incentives are aligned with respect to this parameter.

2. $b'(e)$ rises relative to $g'(e)$. This occurs if effort is relatively productive in improving liquidation value. Then the payoffs to effort are more concentrated in θ_B, and so giving the manager a share of the payoff in θ_B is appropriate. In the extreme, there is no trade-off between effort and project selection, as increasing β improves both ($\frac{\delta e^*}{\delta\gamma}<0$).

3. p falls. This occurs if the firm is close to bankruptcy; again the benefits from effort are more concentrated in θ_B, and so increasing β is appropriate if $\frac{\delta e^*}{\delta \gamma} < 0$. In addition, the asset substitution issue is greater.

The literature refers to suboptimal effort as the "agency costs of equity" (e.g. Jensen and Meckling, 1976), and advocates maximizing α as a solution. However, the above analysis illustrates that increasing β may be effective if effort has greater expected productivity in bad states - either because the bad state is more likely (p is low) or because it has greater productivity in a bad state ($b'(e) > g'(e)$). A fixed cash bonus has no incentive effects as the manager remains indifferent between all outcomes in bankruptcy: as Murphy (1999) writes, "if expected performance is far *below* the incentive zone, managers will ... discount the bonus opportunity". Hence, inconsistent with the "agency costs of equity" nomenclature, insufficient effort need not be a consequence of the manager having an suboptimal *equity* stake.

4. The asset substitution effect becomes more certain. We have already seen that decreasing p raises asset substitution costs. In addition, if V_{GRH} - V_{GS} falls, the first term in (17) becomes more negative. Increasing γ creates an extra range of possible V_{GR} out-turns where R is suboptimally chosen; reducing $V_{GRH} - V_{GS}$ increases the probability of V_{GR} falling into this extra range. By contrast, if the debt is risk free, the asset substitution effect disappears. If $V_{BR} > F$, the manager chooses R if:

$$p[\alpha(V_{GR} - F) + \beta F] + (1-p)[\alpha(V_{BR} - F) + \beta F] > p[\alpha(V_{GS} - F) + \beta F] + (1-p)\beta V_{BS} \quad (18)$$

This reduces to:

$$pV_{GR} + (1-p)V_{BS} > pV_{GS} + (1-p)V_{BS} \quad (19)$$

which is the condition for optimal selection of R. In this case, α and β should be chosen to elicit maximum effort.

5. The manager is willing to hold debt without requiring a reduction in his equity stake. This occurs either if the debt is close to risk-free (i.e. the firm is highly solvent, so $\sigma_D \approx 0$ and $\sigma_{ED} \approx 0$), or if (RC) does not bind initially, which may be the case in practice. Jensen and Murphy (1990) find that the amount of a CEO's income at risk for poor performance is tiny. While Hall and Liebman's (1998) more recent study finds that the rise of stock-based compensation has sharply increased the "wealth at risk" of some CEOs, their study is focused on the "largest, publicly traded US firms". Hence some firms may be able to raise β without decreasing α.

A numerical example illustrates the benefits of managerial debt stakes on firm value. Assume $p = 0.5, F = 50, V_{GS} = 90, V_{BR} = 0, V_{BS} = 40, V_{GRH} = 150$, $\overline{\sigma}^2 = 4$, $\sigma_E = 0.3$, $\sigma_D = 0.1$ and $\sigma_{ED} = 0.3$ so there is no diversification benefit. If the market expects asset substitution, $E_0 = 0.5 * ((90 + 150)/2 - 50) = 35$ and $D_0 = 0.5 * 50 = 25$ [9]. Let $g(e) = 20\sqrt{e}$ and $b(e) = 2\sqrt{e}$: since $g'(e) > b'(e)$, there is a trade-off.

If the manager has a pure equity claim, $\alpha = 0.1905$ and $e^* = 0.9073$. Hence $g(e^*) = 19.05$ and $b(e^*) = 1.905$. $V^*_{GR} = 90$ so the manager always chooses R, leading to a total firm value of $35 + 25 + 0.5 * (19.05 + 1.905) - 0.9073 = 69.5692$. However, the optimal level of α is 0.1557 with $\beta = 0.1416$. While e^* falls to 0.7250 (with $g(e^*) = 17.0295$ and $b(e^*) = 1.7030$), this is outweighed by the effect of raising V^*_{GR} to 127.5496, closer to $V^{**}_{GR} = 140$. Overall firm value rises to 75.2828. The alternative solution of $\alpha = \beta = 0$ would generate a firm value of 66.6667.

3.3 Renegotiation Proofness

Myers and Majluf's (1984) asymmetric information model illustrates that, if the manager is compensated according to *current* shareholder value, he will bypass positive NPV investment projects if this requires raising equity when it is undervalued, but issue overvalued equity even in the absence of profitable investment opportunities. Dybvig and Zender (1991) claim that this could be solved by paying the manager on the basis of profit, rather than stock price (a solution similar in spirit to this model) so that he is unconcerned by market valuations. However, Persons (1994) argues that this solution is not renegotiation proof. Current shareholders may privately renegotiate the CEO's contract to align it with the current share price, re-igniting incentives to issue overvalued equity. Potential new investors will not be fooled by a public disclosure of a managerial contract tying his pay to profit, as they will rationally expect that it has since been privately renegotiated. New equity issues will indeed be greeted with a discount, and the underinvestment result is resurrected.

A similar critique may apply to models such as this paper's, where shareholders make a "commitment" to bondholders via a managerial compensation contract. They may have incentives to renegotiate the contract opportunistically once the debt has been raised, for example by awarding the CEO extra shares for free[10]. Brander and Poitevin (1992) and John and John (1993) are silent on the renegotiation issue, which may be justifiable as there are a number of barriers to renegotiation. First, Hart (2001) questions whether the board has sufficient power to revise the managerial incentive scheme; even if it does, it is unclear why the board will revise it to benefit current shareholders owing to principal-agent problems between shareholders

[9] For simplicity, we assume that the managerial wealth constraint is defined with respect to equity and debt values calculated expecting R is chosen and no effort. This removes the need to account for feedback effects and does not qualitatively affect the results.

[10] Even if it is possible to contractually prevent the CEO from being awarded extra shares (as his shareholding is verifiable), shareholders may circumvent this and effectively increase his α through variable cash bonuses or perquisites. However, this may be an inefficient form of compensation (with the marginal cost to shareholders exceeding the marginal benefit to the manager for perquisites), which strengthens the argument that renegotation may not be worthwhile.

and the board (Mace, 1971) and/or collective choice problems if shareholders are dispersed (Persons, 1994). Even substantial shareholders may be unable to influence the board owing to regulatory constraints (Grundfest, 1990). In many US states, the board's fiduciary duty is to *all* stakeholders (including creditors), rather than shareholders alone (Persons, 1994). Second, Ortiz-Molina (2005) argues that, if firms expect to re-enter the debt markets frequently, reputational concerns will discourage opportunism. Supporting both hypotheses, Zhou (2001) finds that managerial ownership evolves very slowly over time, which is inconsistent with opportunistic resetting. The empirical studies in Section 6.2 that find α falls with leverage also suggest that α is not increased after debt is raised.

Such defenses may not be wholly satisfactory as they are inconsistent with the assumptions required for the board to be motivated to design the initial value-maximizing contract in the first place. If reputational concerns are sufficiently strong to deter contract renegotiation, they should deter asset substitution without the need for managerial debt (Diamond, 1989). Similarly, if principal-agent problems are sufficiently severe that the board does not maximize shareholder value ex post via renegotiation, they may not maximize it ex ante by designing a contract to mitigate asset substitution. Moreover, such problems are unlikely to be strong where there is a concentrated private equity investor.

There are three counter-arguments to the above. First, although collective choice problems may be insignificant in private equity, reputational concerns are unlikely to be. The key is the distinction between the reputations of the manager and the investor. A verbal commitment by the manager not to risk shift may not be credible, particularly if the manager is near the end of his career. However, a commitment by the private equity investor through compensating the manager with debt is much stronger: if she reneges by renegotiating, the debt markets will punish her when this firm *and all other firms owned by her* attempt to raise debt again. As in Edwards's (1955) study of the effect of multi-market contact on cartel sustainability, it is the investor's involvement in multiple firms which makes her commitment credible.

Second, the cost of the new contract may outweigh the benefits. If the debt can be locked up (as occurs with managerial equity in practice), debt-equity swaps are prevented. If (RC) initially binds, the manager will only accept additional α if it is given for free, which is costly to shareholders. Even if we relax the assumption of infinite risk aversion after $\overline{\sigma}^2$, limited liability constrains the manager's ability to pay for extra equity. Moreover, the gains are limited: it is $\gamma = \alpha/\beta$ that determines shareholder alignment, and once $\beta > 0$ has been awarded, increases in α have a muted effect on γ: indeed, full congruence with shareholders only be achieved by increasing α to ∞. Cash bonuses, by contrast, do not achieve the same level of precommitment that John and John (1993) claim as they are easier to renegotiate privately through a bonus-equity swap. Unlike debt, a bonus is not a security that can be locked up; moreover, bonuses are a feature of a contract between the manager and shareholders alone and thus could be renegotiated bilaterally. Even if shareholders do choose to renegotiate, it is not obvious that debtholders lose. Increasing α helps bondholders by raising effort; given that the

rise in γ is small (since $\beta > 0$), this may attenuate or even outweigh the effect of increased asset substitution.

Extending the earlier numerical example illustrates this. Once β is fixed at 0.1416, I now give shareholders the option of changing α to maximize $(1-\alpha)E_0$. The optimal α is now 0.2410, with e^* increasing to 1.6333 and $(1-\alpha)E_0$ rising from 31.1679 to 33.1651 (E_0 is 43.6949). V^*_{GR} falls to 114.2576, outweighing the effect of α on effort to creditors, so D_0 declines from 38.3680 to 34.3639 but still exceeds the 26.7143 under $\beta = 0$. Hence, even assuming that creditors rationally foresaw such renegotiation when pricing their debt claims, the value of the firm rises to $43.6949 + 34.3639 = 78.0588$, which exceeds the 69.5692 under $\beta = 0$.

Third, adding creditors to the board or compensating board members with equity may credibly commit not to renegotiate. While non-executive directors may be unable to prevent risky projects given much of the day-to-day operation is delegated to the CEO, executive compensation decisions are nearly always approved by the board before implementation.

4 A Role for Managerial Debt Stakes?

The analysis of Section 3.2 indeed rationalized the absence of managerial debt stakes for firms where asset substitution is likely and effort considerations are first-order, such as start-ups with high growth opportunities that require intangible investment[11]. However, it also suggests a role for managerial debt stakes in specific circumstances, to improve project selection and potentially also effort. Section 4.1 discusses the circumstances in which managerial debt stakes may be valuable. Section 4.2 analyzes an additional advantage: inducing optimal liquidation.

4.1 Where Might Managerial Debt Stakes Be Valuable?

The comparative statics analysis of Section 3.2 suggests that managerial debt stakes may be a feature of optimal compensation packages where bankruptcy risk is particularly high, and effort is productive in improving liquidation value - or where debt is sufficiently safe that the manager is willing to hold it without a significant reduction in his equity stake. In this section I discuss three broad categories of firms that satisfy these criteria.

First, leveraged buyouts (LBOs) of mature "cash cows" give the manager a pure equity claim so that he can only earn a return through avoiding bankruptcy by exerting effort to reduce costs and liquidate non-core assets. The level of debt is chosen so that the manager has a good chance of avoiding bankruptcy if he expends sufficient effort. However, things may not go to plan. A downturn in economic conditions may significantly reduce the chance of solvency[12].

[11] Note these are firms where *effort* does not pay off in liquidation – if *risky project choice* reduces liquidation value, granting debt stakes may be appropriate.

[12] Alternatively, the LBO could have been poorly structured in the first place. Kaplan and Stein (1993) contend that many LBOs originated in the late 1980s were doomed to fail from the start owing to over-aggressive

This aggravates asset substitution concerns, as the manager needs to take increasing risk for his equity stake to have value - but there are few NPV-positive projects, as the firm is in a mature industry. Buffett (1990) described the typical manager of an LBO as: "behaving much as a heroin user might, he devoted his energies not to finding a cure for his debt-ridden condition, but rather to finding another fix". In addition, effort incentives fall – a manager who holds only equity may simply "give up" as he has no financial inducement to maximize liquidation value. The double-digit returns frequently demanded by creditors reflects their ex ante fears of such scenarios. Granting such managers debt stakes may alleviate their concerns and reduce the cost of debt.

An example of the above is the $1.8 billion management buyout (MBO) of Regal Cinemas, funded by KKR and Hicks Muse in May 1998. The CEO was given an equity stake that exceeded $15 million. The company underwent an aggressive expansion campaign over the next 18 months, but it backfired and Regal soon went bankrupt, with significant creditor losses. More generally, Citron et al (2003) find recovery rates from UK MBOs in distress for *secured* creditors average 62%. This is significantly lower than the range of 80.1-100% found for non-MBOs in the US (Weiss, 1990; Franks and Torous, 1994; Tashjian, Lease, McConnell, 1996), suggesting that MBOs that fail exhibit particularly high creditor value destruction.

Managerial debt stakes may also open up the LBO channel to a new class of firms. Jensen's (1989) prediction that the LBO would become the dominant organizational form has not been borne out. LBOs are particularly rare for growth firms with few intangible assets, potentially owing to significant agency costs of debt which managerial debt stakes may attenuate.

Second, collateralized debt obligations (CDOs) involve a portfolio of risky debt claims being placed into a special purpose vehicle and tranches of securities (from AAA debt, through non-investment grade debt, to equity) issued against these assets. The debt portfolio is run by a manager, often with a pure equity stake. However, investors frequently fear that the manager is "managing only for the equityholders", by taking excessive risk when churning the portfolio. Garrison (2005) presents a number of pieces of evidence that such fears are justified: for example, Moody's finds that collateral held by corporate CDOs has performed worse than the overall corporate market, at each broad rating level. Giving the manager a stake in junior debt tranches will reduce the likelihood of such exploitation and elicit effort even if bankruptcy is likely.

One example is the Corvus CDO launched by the British bank Barclays in December 2000, which came to hold unexpectedly risky assets such as airline leases, loans for pre-fabricated-housing, and other Barclays CDO debt. By September 2003, even the top three tranches of the CDO had fallen to non-investment grade status. Barclays subsequently settled with a major creditor HSH Nordbank, who had sued the bank over mismanagement of the portfolio[13]. Similarly, American Express managed a number of CDOs from the late 1990s, holding only an

structuring.

[13]Barclays had adhered to the strict terms of the contract; hence the risk-shifting was contractually possible despite the covenants in place. The lawsuit was launched as HSH Nordbank claimed that Barclays had not acted in good faith.

equity stake. These suffered substantial losses around the turn of the millennium.

Third, and somewhat paradoxically, large, liquid companies may benefit from managerial debt stakes. Since the debt is close to risk-free, the manager may require only a marginal decline in α to be willing to hold it. While such a grant may initially seem unnecessary given the very low probability of default, the main benefit arises if the firm's fortunes unexpectedly plummet. In such an event, the value of the manager's equity will sharply decline so his debt stake comprises a substantial part of his portfolio. Hence he becomes more closely aligned with creditors precisely when this is desirable, which would potentially deter the risk-shifting that occurred in "fallen angels" such as Enron, WorldCom and Global Crossing. This state-contingent alignment is consistent with Gilson and Vetsuypens's (1994b) statement that "efficient resource allocation requires that managers and directors act as agents for the firm's residual claimholders". Managers are initially aligned with shareholders, the residual claimants in solvency, but increasingly weight creditors' interests as bankruptcy looms large. It is necessary to give the CEO debt when he joins the firm, even if the company is healthy at the time, rather than wait until the firm runs into difficulties as the shareholders will still be in control and have no incentive to align the manager with creditors.

If managers are given debt stakes, they should be subject to similar restrictions to those currently applied to their equity holdings to prevent managers from undoing their incentive effects. As with equity, debt stakes should be "locked up" so that managers cannot freely sell them. Just as CEOs are forbidden from purchasing put options on their stock, they must be prevented from purchasing credit protection on their debt. From an implementation standpoint, one key attraction of a compensation package containing both debt and equity is that it is not necessary to rebalance passive, market-induced changes in leverage as such rebalancing occurs automatically. Contracts could specify that the manager's stake is rebalanced for *active* leverage changes (e.g. debt-equity recapitalizations); in any cases, substantial active changes are rare compared to stock-market induced changes (Welch, 2004).

4.2 An Additional Role: Liquidation

This section extends the principles of Sections 2 and 3 to the liquidation decision. Rajan (1992) tackles the issue of inefficient continuation: managers having insufficient incentives to terminate unprofitable projects, either owing to the limited liability of equity or private benefits from running projects. Both issues may be overcome by giving the manager debt.

In Rajan's model, the firm borrows debt of I, which it invests in a project at time $t = 0$. Simultaneously, the manager exerts effort e (at unit cost 1) which affects the time 1 probability of a good investment opportunity arising, $q(e)$. At $t = 1$, he discovers the project's quality, and can choose to terminate, returning the liquidation value L. At $t = 2$, a good investment pays X with certainty; a bad investment pays X with probability p_B and 0 otherwise. I refer to an outcome where cash of X is earned as "success", and the other outcome as "failure".

In a successful outcome, the firm repays the face value, F where $X > F > I$. We have $X > I > L > p_B X$, so liquidation is optimal if the project is bad.

Under optimal liquidation, the lender's expected payoff is $qF + (1-q)L$ (suppressing the dependence of q on e). Assuming a competitive supply of creditors, her individual rationality (IR) constraint binds with equality so $F^*_{FB} = \frac{I-(1-q)L}{q}$ is promised. Total surplus is given by:

$$-I + q(e)X + (1-q(e))L - e \tag{20}$$

and so the first-best effort level e_{FB} is determined implicitly by

$$q'(e_{FB}) = \frac{1}{X-L} \tag{21}$$

However, the manager has no incentive to liquidate a bad project if he has a pure equity claim and limited liability. Liquidation yields zero payoff to the manager, but continuation gives him a p_B chance of earning $\alpha(X-F)$. Again, shareholders bear this agency cost, as a rational lender demands a higher F to compensate for inefficient continuation. Knowing that she will only earn $p_B F$ (rather than L) in the bad state, her expected payoff is $qF + (1-q)p_B F$. To satisfy (IR), $F^*_{SB} = \frac{1}{q+(1-q)p_B}$ under the second-best. The manager's objective function is:

$$\alpha[q(e)(X - F^*_{SB}) + (1-q(e))p_B(X - F^*_{SB})] - e \tag{22}$$

and the effort level e_{SB} is defined by

$$q'(e_{SB}) = \frac{1}{\alpha(1-p_B)(X - F^*_{SB})} \tag{23}$$

We can see that $e_{SB} < e_{FB}$: this is intuitive as the manager gets a lower payoff from a good project given the higher repayment to the lender.

The solution Rajan considers is for the creditor to lend short-term (i.e. one period at a time). He assumes that an "inside" bank also learns project quality at $t = 1$, and can force liquidation in the bad state by refusing to roll over the loan. However, the bank can also threaten to withdraw funding in the good state, and demand a share $(1-\mu)$ of the surplus $(X - L)$ generated from continuation, where μ denotes the owner's bargaining power. This reduces the manager's effort choice below both e_{FB} and e_{SB} - effort is less worthwhile for the manager given the bank cannot credibly commit not to extracting part of the surplus from a good project. Hence the ex post operating efficiency of short-term inside bank finance comes at the expense of reduced ex ante effort incentives. This is a similar trade-off to Section 3.

In addition to decreasing effort, the use of inside bank debt may not work as it rests on several assumptions. One is that the inside bank also learns project quality at $t = 1$. However, the manager may be able to selectively reveal information; even if not, key data may be tacit or

require expertise to be interpreted. A second is that there is only one creditor. For many large firms, there are multiple lenders who may suffer from collective action problems preventing them from stepping in and taking the optimal decision.

Most importantly, it requires that the debt comes up for refinancing (i.e. the bank has control rights) at the same time as project quality is learned. This requires the bank to know at $t = 0$ exactly when the information becomes known, and to time the maturity of the short-term debt to coincide with this date. In reality, investment opportunities arise stochastically. If a risky project becomes available in the interim, the bank has no control rights and cannot force the manager to liquidate[14]. Similar concerns apply to other papers that consider optimal liquidation, summarized in Appendix B, as well as the seminal models of Aghion and Bolton (1992) and Dewatripont and Tirole (1994). All of these models rely on a single external investor with the correct incentives to obtain control just before the key project selection decision. More generally, this argument highlights a weakness of covenants, which may not come into effect until *after* the key investment decision has been made. A debt covenant may be breached because R was chosen (while the manager had control) and it has since failed. If the investment is irreversible, creditors obtain control too late. For the "fallen angels" of 2001-3, their decline was so rapid that investor intervention were unable to halt it.

Since the manager has both full information on project quality, and effective control, optimal liquidation may be better achieved by giving him appropriate incentives (via a debt stake) than granting control rights at discrete times only to a creditor who is not only partially uninformed, but also may not be in control when the decision arises. Levitt and Snyder (1997) argue that "to elicit early warning, contracts must reward agents for coming forward with bad news" – i.e. to provide the *manager* with the optimal incentives.

Let the manager have a share β of the firm's debt. Thus his payoff is βL if a bad project is liquidated, and $p_B[\alpha(X-F)+\beta F]$ otherwise. For liquidation of a bad project and continuation of a good project, we require:

$$\frac{\alpha p_B(X-F)}{L-p_B F} < \beta < \frac{\alpha(X-F)}{L} \tag{24}$$

(24) is more easily satisfied with a low p_B or a high L – this increases the wedge between L and $p_B X$ and thus the inefficiency of continuation. If (24) is satisfied, there is perfect incentive compatibility and so the promised payment can be reduced to $F^*_{FB} = \frac{I-(1-q)L}{q}$.

If α is unchanged, effort rises. The manager's objective function is now

[14] Given the costs of renegotiating financing, even short-term debt is unlikely to have a maturity of less than several months. In addition, Rajan considers the possibility of the bank renegotiating the debt contract if the maturity of the debt extends past the date project quality becomes known. However, this may not be a viable solution as it can give managers incentives to "blackmail" the creditor by threatening to invest in risky projects – particularly as the manager can control his investment opportunity set to some extent, and thus create risky investment opportunities for the sole purpose of triggering a renegotiation.

$$q(e)[\alpha(X - F^*_{FB}) + \beta F^*_{FB}] + (1 - q(e))\beta L - e \tag{25}$$

Comparing this to the objective function under the second best, both the first and second terms are higher (the latter follows from (22) and $F^*_{SB} > F^*_{FB}$) and so the "optimal incentives" level of effort, e_{OI} (defined by $q'(e_{OI}) = \frac{1}{\alpha(X-F^*_{FB})+\beta(F^*_{FB}-L)}$) is greater than e_{SB} as the manager has the extra "carrot" of $F^*_{FB} - L$ in the good state. Hence debt stakes achieve both ex post operating efficiency and an ex ante improvement in incentives.

If (RC) binds and α must decline, the effect on effort is ambiguous and depends on the parameters. Since Rajan only considers effort affecting q rather than L, the odds are already stacked against effort rising. Via concavity of $q(e)$, effort increases if

$$\alpha_{OI}(X - F^*_{FB}) + \beta_{OI}(F^*_{FB} - L) > \alpha_{SB}(1 - p_B)(X - F^*_{SB}) \tag{26}$$

where $\alpha_{SB} = \frac{\overline{\sigma}}{\sigma_E}$, β_{OI} is defined by the left-hand-side of (24) holding with equality and α_{OI} comes from (RC). If the parameters are such that this inequality does not hold, the firm could give the extra debt required to the manager for free. As long as the total promised debt (to both the manager and the lender) still is less than F^*_{SB}, we have both cheaper debt and increased effort.

5 Empirical Studies

This paper has argued that managerial debt stakes may be a component of an optimal compensation package in certain situations, even when private benefits, bonuses and effort are taken into consideration. Even though the proposal only applies to limited cases, it remains highly surprising that managers virtually never hold debt in practice[15].

One explanation is that pure equity-based pay has become institutionalized into being "the norm" in compensation contracts. The use of compensation consultants and benchmarking may have contributed to plans being relatively standard. This is an example of hysteresis – packages may have become "stuck" in a standard that may have been previously optimal, but inappropriate in recently introduced forms of organization, such as the LBO or CDO.

This argument alone is inconsistent with the multitude of recent innovations to compensation policy, such as managerial options. However, even though Hall and Liebman (1998) find that this innovation has increased manager-investor alignment, they "do not argue that current CEO contracts are efficient ... there are some potentially serious flaws in the contracts of CEOs".

[15] An extensive search has only uncovered one paper reporting such a compensation package: Gilson and Vetsuypens (1993) found eight companies that tied the CEO's compensation to the value of creditors' claims. For example, in its 1990 bankruptcy reorganization plan, Southmark proposed paying the CEO a bonus equal to a specified percentage of annual cash payments on the company's new notes and preferred stock.

One potential reason for the suboptimality of contracts is CEOs' influence on the negotiation of their own compensation package. As Bolton and Dewatripont (2005) write: "[i]n practice ... it is the manager (or a compensation committee, often appointed by the manager) who draws the compensation package and gets it approved by the directors (who are, for all practical purposes, on the manager's payroll). ... [M]any commentators have argued that managerial compensation has more to do with rent extraction than with providing incentives to CEOs". CEOs are willing to accept greater alignment with investors' objectives if it offers them upside potential; indeed, Bebchuk, Fried and Walker (2002) argue that CEOs use investor alignment as a justification for option grants that substantially increase their wealth. Managers would be much less likely to introduce debt stakes to the bargaining table as the upside is capped. Hence the lack of managerial debt stakes in practice does not necessarily mean that $\beta = 0$ is never a feature of an efficient compensation agreement.

Although I cannot test the model directly, I can examine whether existing studies yield results consistent with the model's predictions. In particular, I can look for a systematic relationship between α and firm value or α and leverage. There is indeed much evidence that firms take action to reduce the agency costs of debt, suggesting they are a significant issue in practice despite covenants and private benefits.

5.1 Relationship Between α and Firm Value

The model predicts an ambiguous relationship between α and firm value – with β fixed at 0, a side effect of increasing α is that it moves α further from β and so accentuates asset substitution. If agency costs of debt were negligible, there would be a clear positive relationship owing to the effort gains of α.

While Morck, Shleifer and Vishny (1988) and McConnell and Servaes (1990) find a positive relationship between α and firm performance (measured by Tobin's Q) for low levels of α, they do not address the issue that α may be endogenous and itself affected by Q (Demsetz and Lehn, 1985). The endogeneity issue is critical, as α may be chosen to maximize firm value given its circumstances (such as the severity of agency costs of debt), rather than "given". Several studies have tackled endogeneity via instrumental variables, and indeed find no systematic relationship between α and performance. Examples include Himmelberg, Hubbard and Palia (1999), Palia (2001), Demsetz and Villalonga (2003) and Loderer and Martin (1997).

5.2 Relationship Between α and Leverage

If β is fixed at zero, we expect a negative relationship between α and leverage, to reduce the incentives for creditor expropriation. Again, the lack of actual realizations of risk shifting does not mean that the issue is immaterial - the firm may have recognized the risks and addressed it via the second-best solutions of reducing α (increasing the agency costs of equity) or decreasing leverage (losing some of the benefits of debt).

Indeed, Agrawal and Nagarajan (1990) note that the mean (median) of shareholdings of top management is 33% (32%) for all-equity firms, but only 20% (16%) for levered firms. Demsetz and Villalonga (2003) and Friend and Lang (1988) both document a negative relationship between leverage and management shareholdings. Ortiz-Molina (2004) finds that both overall pay-performance sensitivity and the proportion of annual pay corresponding to stock options are decreasing in leverage. These findings are inconsistent with the Persons (1994) view of opportunistic shareholder renegotiation to re-align managerial incentives with equity value.

Gilson and Vetsuypens (1993) discover that, when firms become financially distressed, pay-performance sensitivity sharply declines and becomes statistically indistinguishable from zero, potentially as risk shifting concerns become most pronounced. However, financial distress is precisely the time when managerial effort is key, and so the effort implications of reducing α may be severe. Increasing β may serve to avoid asset substitution and encourage effort.

5.3 Other Empirical Findings

Section 4.3 argues that, if β is constrained to equal zero, efficient liquidation should be more common for firms with low levels of debt, as this reduces the wedge between shareholder value maximization and firm value maximization. Indeed, Fleming and Moon's (1995) study of voluntarily liquidation confirms this.

The model also predicts a negative impact of awarding options on debt prices, given that options provide even greater risk-taking incentives than shares (Guay, 1999) and thus accentuate the asset substitution effect. DeFusco, Johnson and Zorn (1990) discover that stock price volatility increases, and traded bond prices decrease, after the approval of executive stock option plans. Ortiz-Molina (2005) finds a positive relationship between option ownership and yield spreads to Treasuries of newly-issued bonds, confirming that creditors do foresee the increased risk incentives when purchasing debt. In addition, options have even more adverse effects on yield spreads than stocks.

Finally, LBOs often feature "strip financing" whereby investors hold both debt and equity in the firm to mitigate creditor-shareholder conflict, which is further evidence that such conflicts are important. However, this solution loses the benefits of separating cash flow streams into equity and debt (Dewatripont and Tirole, 1994); moreover, particular investors may only wish to hold one type of security.

6 Conclusion

In 1976, Jensen and Meckling demonstrated that managerial equity stakes improve equity value by aligning shareholder-manager interests. They also recognized that shareholders have an incentive to protect creditors, to lessen the cost of debt ex ante. Therefore, it is surprising that the symmetrical solution of using managerial debt stakes to align creditor-manager interests is

almost never used in practice nor advocated in the academic literature. Currently employed measures of addressing the agency costs of debt are not costless. Covenants restrict managerial flexibility, may be incomplete and difficult to enforce, or may encourage risk-shifting to avoid a trigger being breached. Private benefits and fixed cash bonuses give the manager strong incentives to avoid liquidation, but are insensitive to the firm's liquidation value and may encourage gambling for resurrection. Moderating leverage loses some of the benefits of debt, such as tax shields and managerial discipline; reducing the manager's equity stakes decreases effort.

This paper has proposed granting the manager debt stakes, to align his interests with bondholders as well as shareholders. Such a stake constitutes a credible commitment not to expropriate debtholders, as well as providing incentives to take personally costly actions that increase the liquidation payoff. As with the measures currently practised, this solution is also not without its costs. If risk aversion means that the manager will only accept debt stakes if part of his equity is exchanged for cash, there may be adverse effort implications. Therefore, debt clearly should not be a component of all executive compensation packages. However, in highly levered firms where effort has primarily tangible benefits, the improved project selection that results from an equity-debt swap may come at little or no cost in terms of effort. In addition, managerial debt stakes may paradoxically also be desirable in large, liquid companies as insurance against a rapid downturn in fortunes: if equity value suddenly falls, the manager becomes more closely aligned with creditors precisely when this is desirable. Incentivizing the manager to take optimal decisions, such as the choice between two projects or whether to liquidate or continue, is more effective than relying on the intervention of an outside investor to obtain control (as well as the necessary information) at precisely the right time.

While there are very few cases of managers holding debt in practice, this may reflect managers' influence on the pay setting process rather than the observed schemes being efficient. Indeed, a plethora of studies suggest that levered firms are attempting to achieve the $\beta = \alpha$ suggested by the model – under the constraint that $\beta = 0$, this involves reducing α. Similarly, that there is no systematic relationship between α and firm value, once endogeneity is addressed, suggests that certain firms optimally choose to lower α to avoid asset substitution.

One true test of a normative theory is whether it is eventually adopted in practice (absent power imbalances). It would be interesting to learn the views of practitioners, such as managers, creditors, compensation committees and credit rating agencies on the solutions proposed in this paper. Either managerial debt stakes are a solution that is worth consideration, or their absence is a puzzle that requires further explanation.

A Debt Overhang

While Section 2.2 considers inefficient investment, Myers (1977) showed that agency costs of debt could manifest in managers failing to invest in positive NPV projects, if part of the benefits flow to creditors. Let the firm have probability p_N of having value V_{GN} at time 1, and V_{BN} otherwise, where $V_{GN} > F > V_{BN}$. If the manager invests in a project at time $t = 0$ at cost K to existing shareholders[16], the firm instead has probability $p_I \geq p_R$ of having value V_{GI} and V_{BI} otherwise, where $F > V_{BI} \geq V_{BN}$. The investment is efficient if:

$$p_I V_{GI} + (1 - p_I)V_{BI} \geq p_N V_{GN} + (1 - p_N)V_{BN} + K \tag{27}$$

However, if $\beta = 0$, the manager invests only if $p_I(V_{GI} - F) \geq p_N(V_{GN} - F) + K$. As with the choice of S in Section 2.1, he ignores the beneficial effects on the debtholders: both the decreased probability of bankruptcy (as $p_I \geq p_N$) and the increased liquidation value if bankruptcy occurs (as $V_{BI} > V_{BN}$). The manager's IC constraint is given below:

$$p_I[\alpha(V_{GI} - F) + \beta F] + (1 - p_I)\beta V_{BI} \geq p_N[\alpha(V_{GN} - F) + \beta F] + (1 - p_N)\beta V_{BN} + \alpha K \tag{28}$$

Setting $\beta = \alpha$ reduces (27) to (28), and thus achieves incentive compatibility.

B Other Papers on Insufficient Incentives to Liquidate

Eisfeldt and Rampini (2004) consider managers who privately observe the productivity of capital at their disposal, but those with low productivity do not alert the investor to allow reallocation owing to the private benefits of holding capital. Eisfeldt and Rampini's solution is to bribe managers by an amount equal to the private benefits lost from having capital reallocated away from them. However, the bribe required may be so large that the investor decides against reallocation, which is inefficient. This occurs in particular when managers are abundant, as wages are normally low and so a high incremental bribe is needed.

In Galindo and Micco's (2004) model, the manager learns whether the project will succeed or fail. He then can liquidate a project doomed to fail (before the payoffs are actually received) but chooses not to owing to private benefits. The model is thus similar to Rajan (1992), except that the manager's distorted incentives stem from private benefits, not an equity stake. The proposed solution of short-term debt again may fail as it relies on a partially uninformed lender to have control rights exactly when the liquidation decision is to be taken.

Wang and Zhu (2004) consider a choice between three operating decisions at time 1: continuation (C), reorganization (R) and liquidation (L). Managerial effort affects project quality;

[16] For instance, K could instead be returned to shareholders via dividends or a share buyback. If K has to be raised from new equity, new shareholders will be unwilling to invest even if the manager is.

this in turn affects both time 1 cash flows and the cash flows received at time 2 depending on the time 1 operating decision. Given the differing level of private benefits, the manager prefers C to R to L regardless of project quality. C is indeed optimal for a good project (maximizing time 2 cash flows), but R is efficient for a bad project. However, implementing R requires the manager's firm-specific human capital - as this is inalienable, the manager can remove R from the investors' option set by threatening to walk away if C is not chosen. Since an investor prefers C to L, the manager can effectively force the investor into allowing a bad project to continue. Not only does this generate ex post inefficiency, but it reduces ex ante managerial effort incentives to ensure a good project as even a bad project is continued.

Wang and Zhu's solution is to split the capital structure into debt and equity as in Dewatripont and Tirole (1994). If the firm is in default at time 1, the debtholder has control. Since her payoff depends principally on the lower tail of the distribution, she prefers a safe L to risky C and thus will prefer to liquidate a bad project. However, again this rests on the creditor having both information and control at the appropriate time. In addition, even though a bad project reduces expected time 1 cash flows and thus the probability that the debtholder has control in the appropriate state of nature, it is possible for the bad project to be "lucky" at time 1 and so the firm is not in default.

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