Managerial Entrenchment, Dividend Policy and Capital Structure*

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Abstract

This article develops a contingent-claims model to examine the impact of managerial entrenchment on corporate policies and security valuation. The model emphasizes the role that managerial agency issues play in determining both a firm's dividend payout and capital structure. I show quantitatively that self-interested managers' leverage choices deviate from those *ex ante* maximize firm values. Both the extent and the sensitivity of the deviations are affected by the relative bargaining power between debtor and creditors in bankruptcy negotiations. I find that dividend yields are negatively influenced by both leverage ratios and managerial entrenchment. Furthermore, shareholder-manager conflicts over risk choice and cash payout level change dynamically with a firm's financial health. The model provides a framework to measure managerial entrenchment and has implications for empirical research on the relationship between dividend yield and leverage ratio.

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1 Introduction

Contingent-claims models on the valuation of corporate securities have been used extensively to study capital structure choice. However, this literature has, by and large, ignored a central problem in corporate governance, which is the misalignment of the incentives of managers and shareholders[1]. The fact that shareholders rely on managers to implement financing decisions raises interesting questions: What influences self-interested managers' capital structure decisions? To what extent do their leverage choices deviate from those *ex ante* optimize firm values? What are the implications for security values? It is important for the contingent-claims literature to explore these questions in order to truly capture the mechanism underlying the valuation of securities. Little work has been done so far.

This article develops a contingent-claims model to investigate the impact of managerial entrenchment on corporate policies and security valuation. The model emphasizes the role that managerial agency issues play in determining both a firm's capital structure and dividend payout policies. Specifically, entrenched managers choose leverage not only to reduce the likelihood of bankruptcy but also to avoid a threat from shareholders to terminate their contract. Managers will assume the minimum amount of debt necessary and choose the minimum dividend payout rate to prevent the shareholders from exercising their threat to fire.

By comparing the optimal leverage ratios from managers' point of view to those from shareholders' point of view, I show quantitatively that self-interested managers' leverage choices deviate from those *ex ante* maximize firm values. With reasonable input values, the result shows that managers' leverage choices could be up to 55% lower than those optimal to shareholders. Managers choose lower leverage as they become more entrenched, consistent with empirical evidence that firms with stronger managerial control power tend to use less debt (Berger et al. (1997)). In addition, both the extent and the sensitivity of the deviations are affected by the relative bargaining strength between debtor and creditors in bankruptcy negotiations.

Little direct evidence exists on the dynamic relation between dividend payout and capital structure (Allen & Michaely (2002)). The role of managerial component in those policies

[1] See, for example, Grossman & Hart (1982), Jensen (1986), Novaes & Zingales (1995), Zwiebel (1996) and Fluck (1999) .

remains mostly unanswered (Welch (2004)). My finding suggests that, given managerial entrenchment power, dividend yield is negatively related to leverage ratio [2]. This supports the notion that dividend payout and debt financing are substitutable tools to restrict managerial self-interested activities by paying out earnings. Moreover, dividend yield is negatively affected by managerial entrenchment. When their entrenchment power reaches a certain level, managers are able to stop dividend payments altogether without provoking shareholders' firing action. My results have implications for empirical research attempting to relate dividend yield to capital structure. The evidence that leverage ratios matter more for firms with lower entrenchment suggests that empirical studies should control for entrenchment in the cross-section.

The results show that managerial agency conflicts vary with a firm's financial health. The interests of managers and shareholders become naturally aligned and shareholder-manager conflicts over risk choice and cash payout level disappear as a firm approaches bankruptcy. This evidence implies that managers' decisions on asset substitution/milking asset before default may be entirely driven by the selfish motive of increasing the value of their own rent, thus challenging the conventional explanation that managers attempt to shift wealth from debtholders to shareholders.

I gauge the impact of *ex post* debt renegotiation on corporate policies and security values in the presence of managerial self-interest. Entrenched managers benefit from strategic default as their human capital constitutes a part of the value to be negotiated in default. Managers' leverage choices are relatively higher in firms where *ex post* debt renegotiations are feasible. While the *ex ante* optimal leverage ratios are at the highest when debtholders possess all bargaining power in renegotiation, balanced bargaining strength between a firm and its creditors leads to maximal leverage ratios at managers' choice.

The contingent-claims literature starts with the seminal work of Black & Scholes (1973) and Merton (1974). Later, Black & Cox (1976) allow for default before debt maturity. Leland (1994) endogenizes default barrier and derives an analytical solution with perpetual debt. Leland & Toft (1996) extend the Leland model to allow for nonperpetual debt.

[2] Barclay et al. (1995) find that dividend yield and leverage ratio are positively correlated to firm growth opportunities (measured by market-to-book ratios), which suggests they could be positively correlated. Their finding does not contradict mine. Their study is cross-sectional and suggests a indirect relation due to a third variable. My results are for a single company for which the growth opportunities are taken as given.

Anderson & Sundaresan (1996), Mella-Barral & Perraudin (1997) and Fan & Sundaresan (2000) investigate the implications of strategic default. Leland (1998) and Ericsson (2000) study the effects of asset substitution and hedging policies. Francois & Morellec (2004) and Broadie et al. (2006) examine the impact of default procedures, and Morellec (2004) gauges the manager-shareholders conflicts through managers' incentives for over-investment. With the exception of Morellec (2004), the former models assume that the interests of managers and shareholders are always perfectly aligned.

My modeling of managers' leverage choice and payout policy is in the same spirit as Zwiebel (1996), and Myers (2000). Zwiebel shows that self-interested managers voluntarily take on debt as a self-commitment of restricting empire-building to prevent takeovers. Myers (2000) valuates outside equity by examining the strategic interactions between managers and shareholders over dividend payments in a model of an unlevered firm under certainty. This article generalizes their work by incorporating uncertainty, debt financing and bankruptcy in a dynamic framework with an emphasis on quantitative examination.

The methodology of this article is inspired by Anderson & Sundaresan (1996), who use a binomial model to study debt security design. Among contingent-claims models, Fan & Sundaresan (2000) point out the inadequacy of treating dividends passively as residual cash flows. They approximate dividends with total periodical payouts and investigate the implications on debt valuation when considering shareholder optimality. This article is closest to Morellec (2004) in terms of addressing the shareholder-manager conflicts, but from a very different angle. Morellec studies managers' incentives for over-investment to explain the low debt levels observed in practice. Shareholders' control challenge plays an important role in restricting managerial over-investment. This study focuses on examining the distortion that managers consume part of the free cash flow instead of fully paying it out. It emphasizes how dividend payout is determined in the presence of managerial agency problems. To the best of my knowledge, this is the first contingent-claims model to explicitly study dividend dynamics and its implications on security valuation. It allows for a direct comparison between shareholders' leverage choices and those of managers'. In addition, the model provides a framework to measure managerial entrenchment.

The remainder of the paper is organized as follows: Section 2 describes the model of nonstrategic default. Comparative static analyses are carried out in section 3. Section 4 extends the model to allow for strategic default. Section 5 discusses optimal capital structure.

Section 6 concludes.

2 The model

Consider a firm with three stakeholders: managers, shareholders and debtholders. Managers are self-interested and partially entrenched due to their contribution of firm-specific human capital to the value of the assets of the firm. The managers operate the firm and will not quit voluntarily as they derive a private rent besides salaries when being in control. B, S and M denote the values of debt, shareholders' equity and managers' rent respectively. In order to completely separate managers' interest from that of the shareholders, I assume the managers do not own any equity of the firm[3].

The debt is composed of coupon-bearing bonds of maturity T. The equity has no pre-specified maturity. The firm asset value v_t follows a binomial process that ends at the debt maturity[4]. Given the value v_t at each time t, nature decides whether the value of the asset moves up to uv_t or down to dv_t at $t+1$. This is illustrated in Figure 1. The risk-neutral probabilities of moving up and down are p and $1-p$, respectively, where p is firm-specific and invariant to time and node. At each t, the firm asset produces an observable but non-verifiable cash flow, βv_t. The amount of the cash flow is not subject to any default, firing or liquidation decisions made at t.

[insert Figure 1]

The shareholders can fire the managers and take over control at any time t. However, this will reduce asset value by $\phi(1-\beta)v_t$, which represents the loss of managerial human capital. ϕ reflects managerial entrenchment power. There is no information asymmetry on ϕ between managers and shareholders. The managers and shareholders agree implicitly on the value of ϕ. If debt contract is breached, the debtholders are entitled to take over the firm . They liquidate the firm immediately after the takeover. Upon liquidation, the firm asset suffers a liquidation loss of $\kappa(1-\beta)v_t$ besides losing the value of managerial human

[3]This provides an upper bound for the agency cost of equity, as shareholders' and managers' interest could be better aligned by changing the remuneration scheme of the managers, such as stock option plans.

[4]Firm continues its operation after the debt maturity, if the firm has not been liquidated. The binomial process ends at the debt maturity only for the sake of valuation.

capital if the managers are in control at the time. The liquidation recovery value of the firm can be expressed as $\beta v_t + (1-\kappa-\phi)(1-\beta)v_t$ - this comprises the current cash flow and the residual asset value.

Strategic default and debt renegotiation are ruled out in this model. So the model applies to firms that borrow public debts from diverse bondholders, with whom aggregate consents on debt relief are extremely costly to solicit. As illustrated in Figure 2, on each node, the following actions are observed as in the numerical sequence:

1. The managers decide whether to pay coupon (and principal) to the debtholders (at T).

2. The debtholders accept the payment if it satisfies the debt contract. Otherwise, the debtholders take over and liquidate the firm. The game is over.

3. If there is no liquidation, the managers make a dividend offer to the shareholders.

4. The shareholders decide whether to accept the offer or not. By accepting, they pocket the money and let the managers stay in control till next time. By rejecting, they claim control and fire the managers.

[insert Figure 2]

Equilibrium is obtained under the assumption that all stakeholders act rationally in their own best interests. The present values of the debt, equity and managers' rent are computed using backward induction. Thus, the valuation begins with the nodes on the debt maturity date T. On this date, the debtholders are entitled to receive the principal P and the last coupon cP, where c denotes coupon rate. The managers repay the debtholders the contracted amount if there is sufficient asset to fulfill the debt obligation. Otherwise, the firm defaults and is liquidated. Then the debtholders claim the liquidation recovery value. The value of the debt at T is

$$B(v_T) = \begin{cases} (1+c)P, \text{ if } v_T \geq (1+c)P \\ \\ \beta v_T + (1-\kappa-\phi)(1-\beta)v_T, \text{ if } v_T < (1+c)P. \end{cases} \tag{1}$$

I introduce $ER(v)$ as the sum of the values of the equity and the managers' rent. The value of $ER(v)$ at T is

$$ER(v_T) = \begin{cases} v_T - B(v_T) + \tau c P, \text{ if } v_T \geq (1+c)P \\ \\ 0, \text{ if } v_T < (1+c)P. \end{cases} \quad (2)$$

where τ is the corporate tax rate. The firm could refinance its debt at the maturity of its current debt. For the sake of simplicity, I assume that the firm remains unlevered after time T. Therefore, the value of the firm equals its asset value v_T.

The operation of the firm continues if there is no default at T. The managers' human capital remains valuable to the firm – firing the managers will incur a loss in asset of $\phi(1-\beta)v_T$[5]. The managers make a dividend offer that implies an equity value of $S(v_T)$. If the shareholders reject the offer, they fire the managers and end up with a takeover equity value of $ER(v_T)$ minus the firing cost $\phi(1-\beta)v_T$. In equilibrium, the managers match the offered equity value $S(v_T)$ with the takeover equity value $(ER(v_T) - \phi(1-\beta)v_T)^+$ to make the shareholders indifferent about accepting or rejecting the offer. The shareholders accept it in equilibrium[6]. The equity is worth nothing in default. Therefore, the value of the equity at T is

$$S(v_T) = \begin{cases} (ER(v_T) - \phi(1-\beta)v_T)^+, \text{ if } v_T \geq (1+c)P \\ \\ 0, \text{ if } v_T < (1+c)P. \end{cases} \quad (3)$$

The managers retain the rest of the firm asset for their own rent after repaying the debtholders and offering the shareholders an equity value. The managers receive nothing on default. The value of their rent at T is

$$M(v_T) = \begin{cases} ER(v_T) - S(v_T), \text{ if } v_T \geq (1+c)P \\ \\ 0, \text{ if } v_T < (1+c)P. \end{cases} \quad (4)$$

Interactions that take place at each time t prior to the debt maturity follow the same logic. One additional complication is that the valuation takes account of the expected continuation

[5] Myers (2000) valuates outside equity of an unlevered firm with constant asset. In this model, the value of equity at T can be estimated in the same spirit of Myers's with uncertain asset value.

[6] The managers can always slightly increase the offered equity value to make the shareholders totally favor accepting the offer. $(X)^+$ means $\max(0, X)$, reflecting limited liability.

values. I start by presenting the valuation if the firm does not default at t. Discussions on the default condition and the valuation in default follow. The nondefault value of the debt at t equals the current coupon plus the expected continuation value of the debt, which is computed by discounting the debt values on two adjacent nodes at $t+1$ under risk-neutral probability measure:

$$B(v_t) = cP + \frac{pB(uv_t) + (1-p)B(dv_t)}{1+r} \tag{5}$$

where

$$\begin{aligned} u &= \exp(\sigma) \\ d &= \frac{1}{u} = \exp(-\sigma) \\ p &= \frac{(1+r)(1-\beta) - d}{u-d}. \end{aligned}$$

See appendix for proof. The value of $ER(v_t)$ equals the ex-coupon cash flow $\beta v_t - (1-\tau)cP$ plus the expected continuation value of $ER(v_t)$, derived under the same risk-neutral probability measure:

$$ER(v_t) = \beta v_t - (1-\tau)cP + \frac{pER(uv_t) + (1-p)ER(dv_t)}{1+r}. \tag{6}$$

The ex-coupon cash flow may be negative as the firm becomes financially distressed due to its incapability to generate sufficient cash flow to pay the coupon. Fire sale of asset in this situation is disallowed by debt covenants, so the managers try to raise new capital from the shareholders to service debt[7]. The shareholders will contribute money to keep the firm alive only if they believe it is worthwhile. Otherwise, they refuse to inject money. Then, the firm is unable to fulfill its debt obligations and has to default. I will address the situation that provokes default in detail shortly.

To extract the maximum amount of cash flow, the managers try to pay out the minimum amount of dividend that does not trigger the termination of their contract at t. If the managers pay out the total ex-coupon cash flow, the shareholders do not dispute. Then the value of the equity equals the ex-coupon cash flow plus the expected continuation value of the equity. If the managers do not pay a satisfactory amount of dividend, the shareholders

[7]Lambrecht & Myers (2005) discuss managers' incentives to delay terminating the operation of a firm. Managers lose the value of their firm-specific human capital if the firm bankrupts.

will fire the managers and operate the firm themselves. Then the value of the equity equals $S\left(v_t^f\right)$, where v_t^f denotes the asset value after the managers have been fired. I will show how the value of $S\left(v_t^f\right)$ is computed in next subsection. It is easy to see that the value of $S\left(v_t^f\right)$ is always lower than the value of the equity associated with receiving the total ex-coupon cash flow as dividend. In equilibrium, the managers choose a dividend to signal that the value of the equity equals $S\left(v_t^f\right)$. The shareholders accept the dividend. The nondefault value of the equity at t is

$$S\left(v_t\right) = \min\left(S\left(v_t^f\right), \beta v_t - (1-\tau) cP + \frac{pS\left(uv_t\right) + (1-p) S\left(dv_t\right)}{1+r}\right) = S\left(v_t^f\right). \tag{7}$$

The unpaid cash flow is retained by the managers for their own rent. The nondefault value of their rent at t is

$$M\left(v_t\right) = ER\left(v_t\right) - S\left(v_t\right). \tag{8}$$

When the cash flow generated at t is insufficient to service debt ($\beta v_t < (1-\tau) cP$), the shareholders decide whether to default because they contribute new capital to service debt to keep the firm alive in financial distress. Default occurs when the shareholders are no longer interested in saving the financially troubled firm – when the value of the equity falls below the equity value in liquidation. When the firm is being liquidated, the debtholders claim the contracted amount if the liquidation recovery value is higher than that. Otherwise, they claim the liquidation recovery value. The shareholders receive the residual asset if there is any. The managers end up with nothing.

$$\begin{cases} B^l\left(v_t\right) = \min\left(\beta v_t + (1-\kappa-\phi)(1-\beta) v_t, P\right) \\[2ex] S^l\left(v_t\right) = \beta v_t + (1-\kappa-\phi)(1-\beta) v_t - B^l\left(v_t\right) \\[2ex] M^l\left(v_t\right) = 0. \end{cases}$$

Combining the formulas in both nondefault and default situations, the values of the debt, equity and managers' rent at t before the debt maturity are summarized in equation $(9), (10)$ and (11). The present values of the debt, equity and managers' rent are computed by repeating the valuation backward along the tree till $t = 0$.

$$B\left(v_t\right)=\begin{cases} cP+\frac{pB(uv_t)+(1-p)B(dv_t)}{1+r}, \text{ nondefault} \\ \\ \min\left(\beta v_t+(1-\kappa-\phi)(1-\beta)v_t, P\right), \text{ default}\end{cases} \tag{9}$$

$$S\left(v_t\right)=\begin{cases} S\left(v_t^f\right), \text{ nondefault} \\ \\ \beta v_t+(1-\kappa-\phi)(1-\beta)v_t-B\left(v_t\right), \text{ default}\end{cases} \tag{10}$$

$$M\left(v_t\right)=\begin{cases} ER\left(v_t\right)-S\left(v_t\right), \text{ nondefault} \\ \\ 0, \text{ default.}\end{cases} \tag{11}$$

$S\left(v_t^f\right)$ represents the value of the equity at t in case the shareholders fire the managers and operate the firm themselves later on. Suppose the shareholders take over control on a node at time t, asset value drops immediately from v_t to v_t^f, which equals $(1-\phi)(1-\beta)v_t$. This reflects the loss of managers' human capital. The firm asset without the human capital follows a new binomial tree that begins with v_t^f and ends at debt maturity. To avoid confusion, subscript h is used in this subsection to denote time along the new tree. u, d and p are firm-specific and remain the same. The firm asset generates a cash flow of βv_h^f at each time h except on the starting node because cash flow βv_t has already been realized before the shareholders take over control. Liquidation cost is κv_h^f without managers' human capital. The agency problems of equity no longer exist, so the value of the equity $S\left(v_h^f\right)$ at every h is computed in the same way as valuing $ER\left(v_t\right)$ before.

The same backward induction methodology is used to compute the values of $S\left(v_t^f\right)$ at the firing time. At the debt maturity T, the debtholders are repaid the contracted amount if the firm is financially able to honor the contract. Otherwise, they claim the liquidation recovery value as the firm defaults. The value of the debt at T is

$$B\left(v_T^f\right)=\begin{cases} (1+c)P, \text{ if } v_T^f\geq(1+c)P \\ \\ \beta v_T^f+(1-\kappa)(1-\beta)v_T^f, \text{ if } v_T^f<(1+c)P.\end{cases} \tag{12}$$

The value of the equity equals the asset value net of the value of the debt:

$$S\left(v_T^f\right) = \begin{cases} v_T^f - B\left(v_T^f\right) + \tau cP, \text{ if } v_T^f \geq (1+c)\,P \\ \\ 0, \text{ if } v_T^f < (1+c)\,P. \end{cases} \tag{13}$$

On each node at h prior to the debt maturity, the nondefault value of the debt equals the current coupon plus the expected continuation value of the debt. In default, the debtholders receive the contracted amount if the liquidation recovery value is higher than that. Otherwise, they recover the liquidation recovery value. The value of the debt at h is

$$B\left(v_h^f\right) = \begin{cases} cP + \frac{pB\left(uv_h^f\right)+(1-p)B\left(dv_h^f\right)}{1+r}, \text{ nondefault} \\ \\ \min\left(P, \beta v_h^f + (1-\kappa)\,(1-\beta)\,v_h^f\right), \text{ default.} \end{cases} \tag{14}$$

The nondefault value of the equity equals the ex-coupon cash flow plus the expected continuation value of the equity. The default value of the equity is the residual asset value after the debtholders' claim.

$$S\left(v_h^f\right) = \begin{cases} \beta v_h^f - (1-\tau)\,cP + \frac{pS\left(uv_h^f\right)+(1-p)S\left(dv_h^f\right)}{1+r}, \text{ nondefault} \\ \\ \beta v_h^f + (1-\kappa)\,(1-\beta)\,v_h^f - B\left(v_h^f\right), \text{ default.} \end{cases} \tag{15}$$

The default condition involves the continuing value of the equity $S\left(v_h^f\right)$ falling below the equity value in liquidation. The value of the equity on the managers being fired $S\left(v_t^f\right)$ is computed by repeating the valuation backward along the binomial tree till time t. However, firing the managers will never happen in equilibrium because the managers can always pay a dividend to make the value of the equity equal to or slightly higher than $S\left(v_t^f\right)$.

3 Comparative statics

I apply the model introduced in the previous section to investigate the impact of managerial entrenchment on firm policies and the values of the firm, debt and equity. ϕ, which characterizes the entrenchment power, is used as the changing parameter to carry out the analysis.

I fix the total liquidation cost $(\kappa + \phi)$ to 0.30. The purpose is to prevent the change in ϕ from affecting the total liquidation cost in order to make the comparative statics more meaningful. The initial asset value v_0 is normalized to 100. The time interval between t and $t+1$ is a week. The values of the other parameters are :

- Risk-free rate $r = 7.5\%$, about the average of 10-year Treasury rates, 7.45%, during 1982-2004.
- Payout rate $\beta = 6\%$, as assumed in Huang & Huang (2003).
- Asset return volatility $\sigma = 0.25$, about the same as in Leland (2004).
- Debt maturity $T = 10$. Barclay et al. (1995) report a median debt maturity of 5 years in their sample, which implies that the average maturity of newly issued debt is 10 years.
- Effective tax rate $\tau = 0.15$, as in Leland (2004), is lower than the corporate tax rate to reflect personal tax benefits to equity returns, thus reducing the tax advantage of debt.
- Debt principal $P = 30$.
- Coupon rate $c = 8.5\%$ in the base case[8].
- Total liquidation cost $\kappa + \phi = 0.30$, as in Leland (2004).

I define firm value as the sum of the values of debt and equity. Figure 3 $(A)\,(B)\,\&\,(C)$ show that managerial entrenchment reduces not only the values of debt and equity, but also overall efficiency (firm value plus managerial rent). $\phi = 0$ represents the benchmark in which the managers have no entrenchment power and act on the behalf of the shareholders. The values of the firm and equity are negatively correlated to entrenchment power – the firm value decreases monotonically from 102.30 to 87.40, and the value of equity decreases from

[8] According to Longstaff & Schwartz (1995), the average credit spreads on Moody's industrial bonds range from 48 bps for Aaa grade to 184 bps for Baa grade, with an average of 109 bps over the period 1977-1992. A coupon rate of the risk free rate plus 100 bps produces a yield spread of 110 bps, which roughly matches the observed average.

70.96 to 56.20 as ϕ increases from 0 to 0.15 in the base case. The negative relationships can be explained with two reasons: Higher entrenchment power enables managers to extract more value from the firm safely, which is reflected by the increase in the value of their rent from 0 to 14.71 with ϕ in Figure 3 (D). Secondly, managers' selfish actions reduce shareholders' willingness to bail the firm out of financial distress, leading to a higher likelihood of default which results in lower firm and equity values. Comparing two otherwise identical firms, the one with the higher degree of managerial entrenchment would have relatively lower firm and equity values.

[insert Figure 3]

As shown in Figure 3 (B), for $\beta = 6\%$, the value of debt decreases from 31.34 to 31.19 as ϕ increases. It seems that ϕ has only a small impact on debt value. This is largely due to the fixed total liquidation cost. In reality, the impact of ϕ on debt value could be more significant as liquidation cost increases with ϕ.

Figure 4 (A) tells that increasing firm risk (σ) reduces the value of firm except when a firm is close to bankruptcy. This is consistent to the results of previous studies (see, for example, Leland (1998)). Figures 4$(B), (C)$ and (E) show that the value of debt is always negatively correlated to firm risk, whereas the value of equity always responds positively. Interestingly, Figures 4 (D) and (F) show that when a firm is not imminent to default, say when debt/asset ratio $P/V = 45\%$, the value of managers' rent decreases from 9.97 to 9.18 as asset volatility σ increases from 0.1 to 0.5. An increase in firm risk level produces a higher likelihood of default, in which managers lose the value of their human capital. In contrast, the shareholders advocate higher risk levels because the value of equity increases from 45.83 to 56.57. The results highlight one of the conflicts between shareholders and managers over risk choice: for a financially healthy firm, shareholders would prefer to increase the risk level that produces a higher equity value. But managers would favor reducing the risk level to protect the value of their own rent. Challenging the conventional premise that managers always stay closer to shareholders than to debtholders, it is shown that managers' preference of risk choice is the same as that of debtholders in this situation.

Figures 4 (D) and (F) paint a different picture of the relationship between managers' rent and risk level when a firm is close to insolvency. The value of managers' rent tends to increase with risk. For instance, when $P/V = 95\%$, the value of debt decreases from

83.12 to 57.91 as σ increases, whereas the values of managers' rent and equity increase from 5.80 and 4.01 to 7.77 and 32.79 respectively. Managers' rent behaves like debt when a firm is financially healthy, and like equity when the firm is close to default. When a firm is close to bankruptcy, the asset substitution problem becomes economically significant, then shareholders' and managers' incentives for risk are aligned. This suggests that managerial entrenchment does not really mitigate the asset substitution problem of debt.

Conventionally, managers' decisions on asset substitution before default are explained as their attempt to transfer wealth from debtholders to shareholders. The results above suggest that asset substitution benefits not only shareholders but also managers themselves at the expense of debtholders. Managerial motives for performing asset substitution may be simply to pursue their own agenda. Overall, the preferences of shareholders and managers regarding risk choice become more aligned as a firm approaches bankruptcy.

[insert Figure 4]

Figure 5 (A) shows that the value of firm responds negatively to payout rate β except when a firm is close to default. Figures 5 (B), (C) and (E) plot that the value of debt decreases with payout rate and that the value of equity increases with it. The value of managers' rent is negatively correlated to payout rate when a firm is distant from financial distress. For example, when $P/V = 45\%$, the value of managers' rent decreases from 9.58 to 9.28 as β increases from 0.04 to 0.1. Managers favor lower payout rates that reduce the chance of losing their human capital in default. In contrast, the value of equity increases from 47.38 to 49.88 as payout rate increases. High cash payout policies are more attractive to shareholders than to managers. Managers' discretionary decision favors low cash payout policies in order to protect the value of their own claims.

Figure 5 (D) and (F) show that the value of managers' rent turns to increase with payout rate when a firm is on the edge of bankruptcy. For instance, when $P/V = 95\%$, the value of managers' rent increases from 6.62 to 7.04, while the equity value increases from 13.03 to 20.76, as payout rate rises from 0.04 to 0.1. The value of debt drops from 75.72 to 69.60. Presumably, both managers and shareholders would agree to increase payout in this situation - this benefits both of them at the expense of the bondholders. The evidence suggests that managers could have selfish incentives for milking asset prior to default for the sake of their own utility. The result challenges conventional reasoning that managers attempt to shift wealth from debtholders to shareholders, because managers' activities can be entirely driven by their own interest. Importantly, The result serves as a reminder to exercise caution when making assumptions on shareholder-manager conflicts because they change dynamically with a firm's financial health.

[insert Figure 5]

There has been little direct evidence on the dynamic relation between dividend payout and capital structure and on the influence of managerial entrenchment on dividend yield. This model sheds some light on those unanswered questions. I compute dividend yield as

$$\begin{aligned} DY(v_0) &= Dividend(v_0)/S(v_0) \\ &= (\beta v_0 - (1-\tau)cP - \Omega)^+ / S(v_0), \end{aligned}$$

where $\beta v_0 - (1-\tau)cP$ is the ex-coupon cash flow at $t = 0$. Ω represents managerial cash flow extraction at $t = 0$.

Figure 6 shows that dividend yields are negatively related to leverage ratios. When managers are not entrenched, dividend yield decreases from 5.93% to 1.75% as a firm increases its debt/asset ratio from 5% to 75%. The result suggests that firms with high leverages tend to have low dividend yields. Moreover, the result shows that dividend yield is negatively affected by managerial entrenchment. With $P/V = 35\%$, dividend yield decreases from 5.27% to 0.82% as entrenchment power ϕ increases from 0 to 0.03. As ϕ reaches and surpasses 0.04, managers are able to stop dividend payment without provoking shareholders' firing action. Given the observed average dividend yield of 1.5% and the average leverage ratio of S&P500 firms of 35%, the model predicts an average managerial entrenchment power, ϕ, of approximately 2.5%.

[insert Figure 6]

My results have implications for empirical research attempting to relate dividend yield to capital structure. With sufficient entrenchment, managers are able to stop dividend payments altogether without triggering shareholders' firing actions. The evidence that leverage ratios matter more for firms with lower entrenchment suggests that empirical studies should control for entrenchment in the cross-section. In addition, as a firm becomes more mature, it has more assets in place and less investment opportunities. Hence, managerial entrenchment is presumably lower for these firms because managing assets in place is less knowledge-specific. Firm age, board membership characters and industry could be used as proxies for entrenchment.

We observe that the value of managers' rent decreases as a firm takes on more debt, consistent with the well-documented role of debt as a discipline tool to restrict managerial value extraction. It attests that managers would like to issue zero debt to optimize their utility. We will discuss managers' leverage choice in more detail in the optimal capital structure section.

4 Strategic default

Strategic default has been disallowed in previous section to separate the impact of managerial agency issues on the valuation of securities from those of agency issues of debt. In this section, I relax that restriction to examine the managerial agency conflicts in the presence of *ex post* debt renegotiation. A firm may choose to serve its debt strategically, knowing that debtholders will bear a liquidation loss if they force the firm to bankrupt. Some contingent-claims models study strategic default and debt renegotiation without considering managerial agency issues[9]. Strategic default is more relevant to a firm which borrows from a few institutional creditors, with whom aggregate consents on debt relief can be obtained through renegotiation at small costs. For simplicity, I assume zero renegotiation cost in this model.

The game structure remains the same as in the base model, except that we observe the following changes: (i) payment to the debtholders may fall short of the contracted amount even if the firm is able to honor the contract; (ii) for their best interest, the debtholders may accept the below-contracted-amount payment and allow the game to continue. The game is illustrated in Figure 7[10].

[9] See, for example, Anderson & Sundaresan (1996), Mella-Barral & Perraudin (1997) and Fan & Sundaresan (2000).

[10] The realized asset value v_t has been observed before any default, coupon and dividend decisions are made. The expected equilibrium payoffs of three parties are known to all parties and taken into account to decide their interactive strategies. Therefore, The sequencing of the games does not have a significant impact on equilibrium strategies and payoffs. The sequential game that strategic default takes place before strategic dividend payout simplifies the model setup. However, it does not mean that debtholders have priority over

[insert Figure 7]

Backward induction begins at the debt maturity T. At the date, in case the firm defaults and is liquidated, the debtholders receive only the liquidation recovery value. Through renegotiation, the debtholders could receive the liquidation recovery value plus a saving from avoiding liquidation. According to the standard results of *Nash Equilibrium*, the saving that the debtholders receive equals a portion of $0 \leq \theta \leq 1$ of the saved liquidation loss, $(\kappa + \phi)(1-\beta) v_T$, due to their relative bargaining power θ to the firm. In equilibrium, the managers decide whether to honor the debt contract or to default strategically, depending on in which option they repay less to the debtholders. Strategic default occurs when the value of firm asset is low. The value of the debt at maturity equals either the contracted amount or the negotiated payoff in strategic default, whichever is lower.

$$B(v_T) = \min((1+c) P, v_T - (1-\theta)(\kappa+\phi)(1-\beta) v_T). \tag{16}$$

$ER(v_T)$ represents the sum of the values of the equity and managers' rent after the debt is repaid. It equals the asset value subtracting the value of the debt:

$$ER(v_T) = \begin{cases} v_T - B(v_T) + \tau c P, \text{nondefault} \\ \\ v_T - B(v_T), \text{ default.} \end{cases} \tag{17}$$

After repaying the debt, the managers offer the shareholders an equity value that renders the latter indifferent about accepting or rejecting the offer. The offered value of the equity is

$$S(v_T) = (ER(v_T) - \phi(1-\beta) v_T)^+. \tag{18}$$

In equilibrium, the shareholders accept the offer in equilibrium. The managers pocket the rest of $ER(v_T)$:

$$M(v_T) = ER(v_T) - S(v_T). \tag{19}$$

At each time t before T, the managers face two options in debt service. One option is to simply honor the debt contract so that the value of the debt equals the current coupon plus the expected continuation value of the debt. The other option involves renegotiating debt

shareholders in the non-bankruptcy states.

payment when the asset value is low. Upon renegotiation, the debtholders receive a portion θ of the value saved through renegotiation plus the liquidation recovery value. The value saved is the difference between the firm value $V(v_t)$ conditional on the firm surviving to $t+1$ and the liquidation recovery value, given that a firm has higher value as an ongoing entity than when being liquidated. The value of $V(v_t)$ is higher than the liquidation recovery value because it contains potential future tax benefits and avoids immediate liquidation cost. In equilibrium, the managers choose the option that yields a lower debt value. The value of the debt at t is:

$$B(v_t) = \min \begin{pmatrix} cP + \frac{pB(uv_t)+(1-p)B(dv_t)}{1+r}, \\ \theta V(v_t) + (1-\theta)(1-(\kappa+\phi)(1-\beta))\, v_t \end{pmatrix}, \tag{20}$$

where the value of the firm as an on-going entity, $V(v_t)$, equals the cash flow generated at t plus the expected continuation value of the firm:

$$V(v_t) = \beta v_t + \frac{p(B(uv_t) + ER(uv_t)) + (1-p)(B(dv_t) + ER(dv_t))}{1+r}.$$

Strategic default is reversible – the firm defaults when its asset value is low but has to resume "normal" debt service once its asset value recovers from the default barrier. There is no tax shield on the interest payments made during strategic default. If the firm does not default at t, the value of $ER(v_t)$ equals the ex-coupon cash flow plus the expected continuation value of $ER(v_t)$. If the firm defaults, the value of $ER(v_t)$ is the ongoing value of the firm value minus the value of the debt:

$$ER(v_t) = \begin{cases} \beta v_t - (1-\tau)\, cP + \frac{pER(uv_t)+(1-p)ER(dv_t)}{1+r}, & \text{nondefault} \\ V(v_t) - B(v_t), & \text{default.} \end{cases} \tag{21}$$

The managers pay out the minimum amount of dividend to the shareholders in order to maximize the value of their rent. In the case of no defaulted at t, the managers either payout all ex-coupon cash flow as dividend or make a dividend payment that equates the value of the equity to the reservation value $S\left(v_t^f\right)$. In default, the shareholders simply end up with the reservation value of equity $S\left(v_t^f\right)$. The value of the equity is:

$$S(v_t) = \begin{cases} \min\left(\beta v_t - (1-\tau)\, cP + \frac{pS(uv_t)+(1-p)S(dv_t)}{1+r}, S\left(v_t^f\right)\right), \text{nondefault} \\ S\left(v_t^f\right), \text{default,} \end{cases} \tag{22}$$

where the value of $S\left(v_t^f\right)$ is computed in the same logic as in the nonstrategic default case. See appendix for details. The value of managers' rent at t is:

$$M(v_t) = ER(v_t) - S(v_t). \tag{23}$$

5 Optimal capital structure

I apply the strategic default model to examine the optimal leverage from both shareholders' and managers' points of views. Debt amount is determined at financing decision time $t = 0$. The coupon rate, c, is no longer fixed and determined at debt insurance to equate debt value to its face value ($B = P$). Shareholders select the *ex ante* optimal leverage to maximize firm value. This is equivalent to maximizing equity value given that debt is issued at par. Managers choose leverage to optimize the value of their own utility. Then, the optimal amount of debt is determined numerically to maximize either the firm value or the value of managers' rent. Leverage is defined as the ratio of the value of debt to firm value:

$$L(v, P^*) = \frac{B(v, P^*)}{B(v, P^*) + S(v, P^*)}. \tag{24}$$

I examine three scenarios with $\theta = 0$, 0.5 and 1 respectively[11]. $\theta = 0.5$ is the benchmark as a firm and its creditors share equal bargaining power in debt renegotiations. $\theta = 1$ means that debtholders possess all bargaining power and therefore receive all liquidation avoidance savings in renegotiation. It closely resembles the nonstrategic default case in terms of discouraging the firm's strategic default activities. This represents that creditors, in practice, exercise strong power in the determination of restructure plans in bankruptcy courts. In the scenario of $\theta = 0$, the firm detains all bargaining power against its creditors in debt renegotiation. This is quite an extreme situation in which debtholders are not well protected and strategic defaults are maximally encouraged.

Table 1 reports *ex ante* optimal leverages and managers' leverage choices in the absence and in the presence of shareholders' threat to fire at different levels of debtholders' bargaining power.

[11] I assume that debtholders' bargaining power, θ, does not change regardless of whether the firm fires the incumbent managers.

[insert Table 1]

I start by discussing the benchmark scenario when debtholders and the firm share equal bargaining power ($\theta = 0.5$). With base case parameters, the *ex ante* firm value maximizing leverage ratio is 80% when managers are not entrenched, decreasing to 74% as managerial entrenchment power, ϕ, rises to 0.2. Managerial entrenchment could have two opposite effects on debt financing: first, it increases value extraction. Hence, shareholders would like to issue more debt to discipline managers by paying out free cash flows. On the other hand, higher entrenchment power implies greater liquidation costs that discourage debt financing as debtholders would *ex ante* demand higher premium for compensation. The second effect generally dominates the first one.

Column 12 in Table 1 reports managers' leverage choices in the absence of shareholders' threat to fire them. Consistent with my conjecture, managers issue zero debt to maximize the value of their rent. Although liquidation will not occur with debt renegotiation in equilibrium, managers have to share the value of their human capital with debtholders in negotiation. They would like to avoid losing any value of their human capital by issuing zero debt and eliminating completely the chance of debt renegotiation.

Given the fact that issuing debt is one of managers' standard responsibilities, some important questions arise: why do managers issue debt? why don't managers reduce existing debt to zero over time? The answer, again, lies in shareholders' threat to penalize managers. Consider if managers issue no debt at the financing decision time $t = 0$, firm (or equity) value will equal $(1 - \phi) V_0$. Shareholders could take over control and issue an optimal amount of debt to maximize the firm value, which is higher than $(1 - \phi) V_0$. Thus, managers have to issue some debt to avoid being fired at time $t = 0$. In the same vein, managers cannot reduce the existing debt below a certain amount ever after because this would invite takeover as well. For simplicity, I limit my experiment to the case that debt amount is chosen by managers at time $t = 0$ and cannot be changed later on.

Managers issue the minimum amount of debt to match the firm value to the one that shareholders may achieve by taking over control and applying optimal leverage. Column 6 in Table 1 reports managers' leverage choices that simultaneously maximize their own rent and prevent shareholders from exercising their threat to fire. The leverage ratios decrease monotonically from 68% to 50% as ϕ increases from 0.05 to 0.2. Managerial self-interest causes their selections of leverage ratios to deviate from those maximized firm values. The stronger their entrenchment power is, the less debt managers are able to issue without being fired because asset value decreases by their human capital if managers are fired at time $t = 0$. Firm values are lower at the leverage ratios chosen by the managers, compared to those at the optimal leverage ratios. The results are consistent with empirical finding that firms with stronger managerial control power tend to use less debt.

When $\theta = 0$, all liquidation avoidance savings go to shareholders and managers in negotiations. Strategic defaults are maximally encouraged and therefore occur at relatively high asset values. As a result, debtholders request higher premium *ex ante* to compensate for their higher expected loss in default, which in turn discourages the firm from borrowing debt. The optimal leverage ratios are lower and more sensitive to entrenchment, compared to their peers with stronger debtholder bargaining power. They decrease from 63% to 37% as ϕ increases from 0 to 0.2.

Managers do not deviate their leverage choices from the optimal ones in the presence of shareholders' control threat. As reported in Column 7, managers' leverage choices are the same as the firm value-maximizing ones. Shareholders are supposed to receive all value saved through debt renegotiation. But managers' human capital does not add any value to equity because managers retain it to themselves through dividend payments. Hence, shareholders will fire managers at the financing decision time if the latter do not lever up to the optimal level.

When $\theta = 1$, debtholders receive everything in debt renegotiation. As a result, strategic defaults are maximally discouraged and occur at relatively low asset levels. The recovery rates of debt in default are relatively high. These effects jointly make debt financing less expensive and more attractive. We observe that the firm value maximizing leverage ratios are higher than 90%. Managers' human capital constitutes a part of the renegotiation value that increases debt recovery in default and therefore reduces the cost of debt. Firm adopts high leverage ratios to take advantage of tax shield.

Managers' leverage choices deviate the most from the optimal ones in this scenario. It is shown that managers' selections of leverage ratios range from 54% to 41% as ϕ changes, up to 55% lower than the optimal ones. Shareholders have to be more tolerant to the deviation because if they fire the managers, the loss of human capital will reduce debt recovery in default and drive up the *ex ante* cost. Since managerial entrenchment is presumably lower for mature firms than growth firms because managing assets in place is less knowledge-specific. the result is consistent with the empirical evidence that mature firms have higher leverages than growth firms.

Firm values at the optimal leverages increase when debtholders possess stronger bargaining strength in debt renegotiation. Since debtholders' bargaining power in this model captures creditors' control in bankruptcy court in practice, the result echoes the finding in Broadie et al. (2006) that the first-best default outcome could be achieved if debtholders are given the control to decide when to liquidate the firm that has been taken to the Chapter 11 process by shareholders.

That, however, is not necessarily true when managerial agency issues are considered. At managers' choice, the leverage ratios and firm values are the highest when a firm and its debtholders have equal bargaining power. When the firm holds all the bargaining power ($\theta = 0$), it becomes too costly to issue a large amount of debt. At the other extreme ($\theta = 1$), shareholders' power to discipline the managers becomes limited. Thus, the leverage ratios and firm values are lower in both situations. The result suggests that balanced bargaining strength between a firm and its creditors could be the best solution in order to maximize firm efficiency in the presence of agency problems.

When it comes to restricting managerial value extraction, the results show that the value of managers' rent decreases with debtholders' bargaining power. They suggest that borrowing from the public is a more efficient approach to discipline managers, compared to borrowing privately. It is harder for a firm to renegotiate with diverse bondholders than to work together with private creditors.

The results provide implications on firm maturity and capital structure. Managerial entrenchment is presumably lower for mature firms than growth firms because managing assets in place is less knowledge-specific. Therefore, mature firms tend to have higher leverages than growth firms. This is consistent with empirical evidence.

6 Conclusions

I present a dynamic valuation model on corporate securities that characterizes firm dividend policies and capital structure through the agency issues between entrenched managers and shareholders who have limited power to fire the managers. Specifically, the entrenched managers make leverage choices and undertake dividend payout decisions to optimize their own utility and to prevent the shareholders from exercising their threat to fire simultaneously.

My findings show quantitatively the degree to which managerial entrenchment negatively influences the values of the firm, debt and equity. I demonstrate that leverage choices are subject to managerial entrenchment and to the relative bargaining power of creditors. The results suggest that balanced bargaining strength between a firm and its creditors could be optimal in order to maximize firm efficiency in the presence of agency problems.

Challenging the conventional thought that managers are always closer to shareholders than to debtholders, I show that managers' preference on risk choice/cash payout level tallies with that of debtholders when a firm is distant from financial distress. Shareholder-manager conflicts over risk choice and payout rate disappear and the interests of managers and shareholders become naturally aligned as a firm approaches bankruptcy. The evidence serves as a reminder to exercise caution when making assumptions on shareholder-manager conflicts because they change dynamically with a firm's financial health.

Dividend yields decrease with leverage ratios and managerial entrenchment. With sufficient entrenchment, managers are able to stop dividend payments altogether without triggering shareholders' firing actions. The evidence that leverage ratios matter more for firms with lower entrenchment suggests that empirical studies should control for entrenchment in the cross-section.

Some limitations remain. Managerial entrenchment is an exogenous factor, not linked to managerial competency or to shareholders' monitoring. Contractual provisions such as golden parachutes are not considered. Information asymmetries and growth opportunities are ignored. Nevertheless, all constitute interesting avenues by which to extend this model.

7 Appendix

7.1 Computing u, d and p

The values of u and d can be easily computed following standard binomial technics. For detailed treatment, see Hull (2004) chapter 16.

In the risk-neutral world, these are

$$\begin{aligned} v_t &= \frac{puv_t + (1-p)\,dv_t}{1+r} + \beta v_t \\ (1+r)(1-\beta) &= pu + (1-p)\,d \\ p &= \frac{(1+r)(1-\beta) - d}{u-d} \end{aligned}$$

and

$$\frac{\partial p}{\partial \beta} = -\frac{(1+r)}{u-d}.$$

7.2 Computing $S\left(v_t^f\right)$ in *strategic default*

I omit detailed introduction and simply provide the reader with the formula to compute $S\left(v_t^f\right)$. The logic is exactly the same as the one in computing $S\left(v_t^f\right)$ in the nonstrategic default case, while the equilibrium interactions are identical to valuating $ER(v_t)$ in the with-the managers strategic default case. At debt maturity T, debt and equity values are

$$\begin{cases} B\left(v_T^f\right) = \min\left((1+c)\,P, v_T^f - (1-\theta)\,\kappa\,(1-\beta)\,v_T^f\right) \\ \\ S\left(v_T^f\right) = \begin{cases} v_T^f - B\left(v_T^f\right) + \tau cP, & \text{nondefault} \\ \\ v_T^f - B\left(v_T^f\right), & \text{default.} \end{cases} \end{cases}$$

At h prior to maturity, debt value is

$$B\left(v_h^f\right) = \min\begin{pmatrix} cP + \frac{pB\left(uv_h^f\right) + (1-p)B\left(dv_h^f\right)}{1+r}, \\ \theta V\left(v_h^f\right) + (1-\theta)\,(1-\kappa\,(1-\beta))\,v_h^f \end{pmatrix}$$

where θ represents debtholders' bargaining power. Firm value contingent on survival is

$$V\left(v_h^f\right) = \beta v_h^f + \frac{p\left(B\left(uv_h^f\right) + S\left(uv_h^f\right)\right) + (1-p)\left(B\left(dv_h^f\right) + S\left(dv_h^f\right)\right)}{1+r}.$$

Shareholders' equity value is

$$S\left(v_h^f\right) = \begin{cases} \beta v_h^f - (1-\tau)\, cP + \frac{pS\left(uv_h^f\right)+(1-p)S\left(dv_h^f\right)}{1+r}, \text{nondefault} \\ \\ V\left(v_h^f\right) - B\left(v_h^f\right), \text{default.} \end{cases}$$

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Table 1: Optimal Leverages and Security Values (Strategic Default)

This table compares the *ex ante* optimal leverages and managers' leverage choices in the absence and in the presence of shareholders' threat to fire at three levels of relative bargaining strength of creditors in debt renegotiation. $\phi = 0$ represents that creditors have no bargaining power in debt renegotiation. $\phi = 1$ represents that creditors have full bargaining power. $\phi = 0.5$ represents balanced bargaining power between debtor and creditors. Columns $2 - 6$ report the *ex ante* optimal leverages and associated values. Columns $7 - 11$ report managers' leverage choices in the presence of shareholders' threat to fire them and associated values . Column 12 reports managers' leverage choices in the absence of shareholders' threat to fire.

	x ante Optimal Leverage L (%)	Firm Value V	Debt Value B	Equity Value S	Managers' Rent M	Managers' Leverage Choice with Threat L (%)	Firm Value V	Debt Value B	Equity Value S	Managers' Rent M	Managers' Leverage Choice without Threat L (%)
$\theta = 0$											
$\phi = 0.00$	63	105.52	66.55	38.97	0	n/a	n/a	n/a	n/a	n/a	n/a
$\phi = 0.05$	58	99.47	60.56	38.91	5.58	58	99.47	60.57	38.90	5.59	0
$\phi = 0.10$	51	93.62	52.87	40.75	10.88	51	93.62	52.86	40.76	10.88	0
$\phi = 0.15$	43	87.91	44.42	43.49	15.89	43	87.91	44.43	43.48	15.89	0
$\phi = 0.20$	37	82.33	38.39	43.93	20.98	37	82.33	38.40	43.93	20.98	0
$\theta = 0.5$											
$\phi = 0.00$	80	107.10	85.36	21.74	0	n/a	n/a	n/a	n/a	n/a	n/a
$\phi = 0.05$	81	103.01	85.74	17.27	3.43	68	101.75	71.87	29.88	4.50	0
$\phi = 0.10$	78	99.44	83.16	16.28	6.85	61	96.39	64.28	32.11	9.19	0
$\phi = 0.15$	76	95.89	80.57	15.32	10.20	55	91.04	58.05	32.99	14.00	0
$\phi = 0.20$	74	92.28	77.97	14.31	13.61	50	85.68	52.60	33.08	18.86	0
$\theta = 1$											
$\phi = 0.00$	91	108.63	99.14	9.49	0	n/a	n/a	n/a	n/a	n/a	n/a
$\phi = 0.05$	91	105.95	99.02	6.93	2.67	54	100.24	56.94	43.30	4.6	0
$\phi = 0.10$	92	103.87	100.00	3.87	4.75	49	94.96	51.28	43.68	9.34	0
$\phi = 0.15$	92	101.94	100.00	1.94	6.68	45	89.69	46.59	43.10	14.19	0
$\phi = 0.20$	92	100.22	100.00	0.22	8.41	41	84.41	42.43	41.98	19.09	0

Figure 1: Binomial Tree of Asset Value

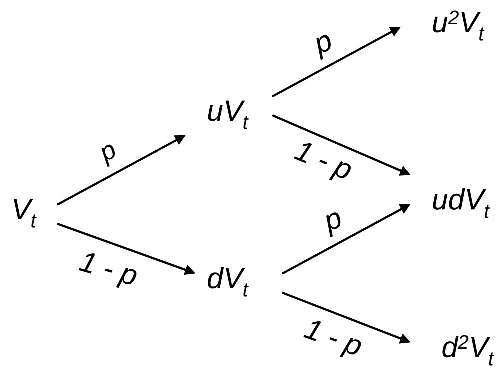


Figure 2: Illustration of the game at t in the model of nonstrategic default

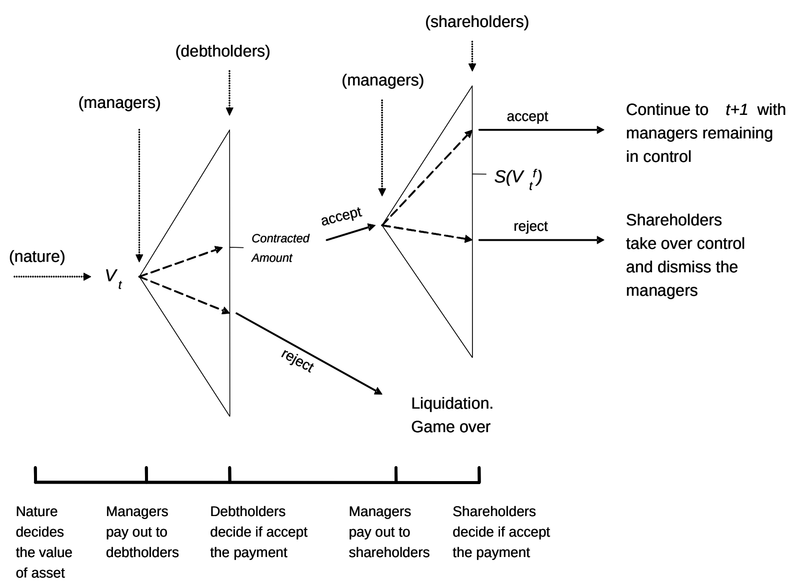
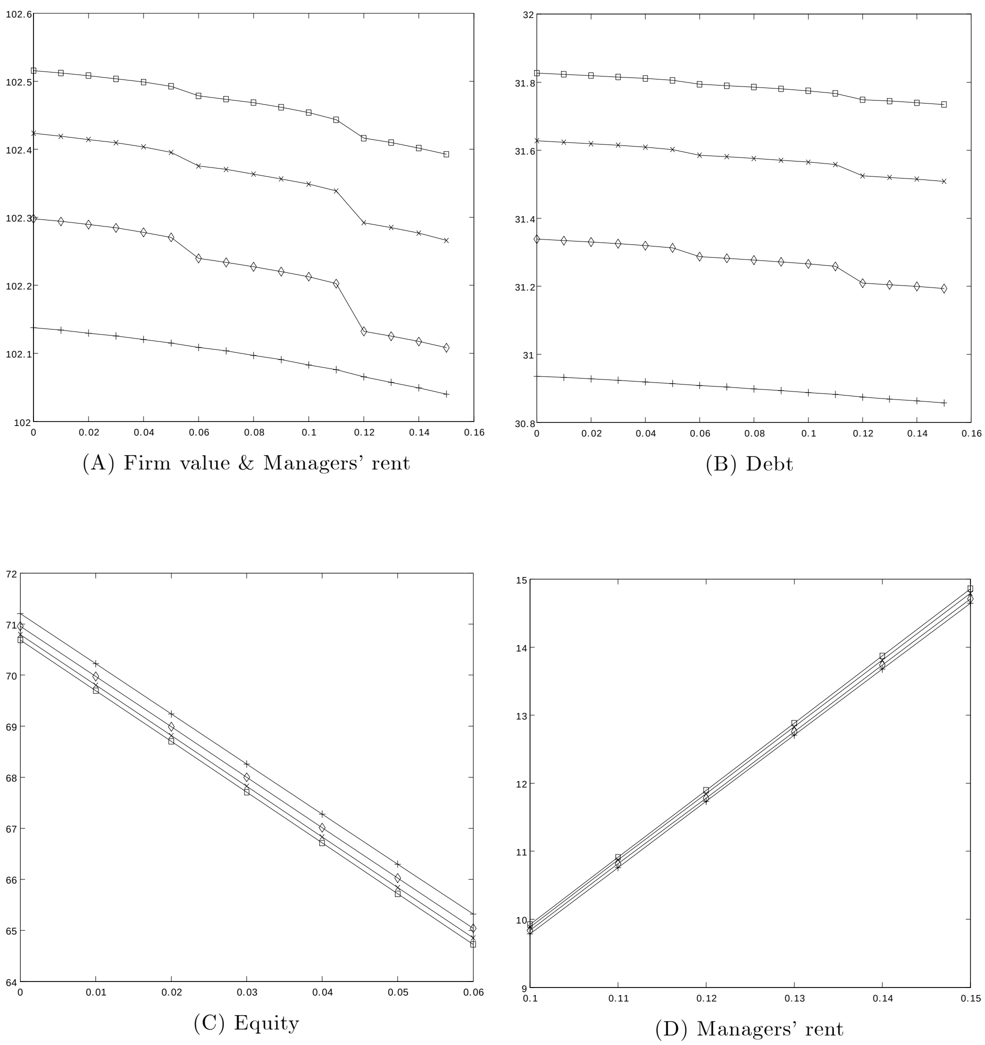


Figure 3: the values of the firm, debt, equity and managers rent as a function of managerial entrenchment power ϕ

With base case parameter values and $\beta = 2\%$ (square), $\beta = 4\%$ (x), $\beta = 6\%$ (diamond) and $\beta = 8\%$ (+). The x-axis represents the values of ϕ. Figure $3(A)$ shows that the overall efficiency (the value of the firm plus managerial rent) decreases as managers become more entrenched. Figure $3(B), (C)\&(D)$ plot that the values of debt and equity decrease with the degree of entrenchment, while the value of managerial rent increases.



(A) Firm value & Managers' rent

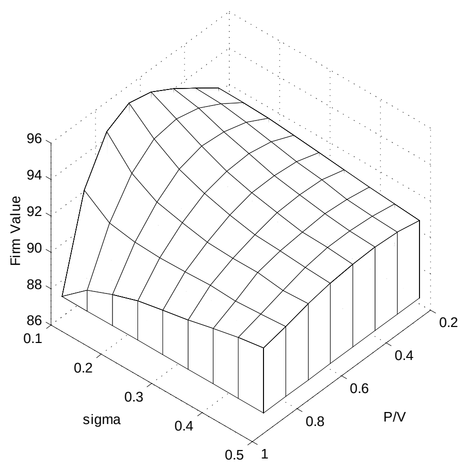
(B) Debt

(C) Equity

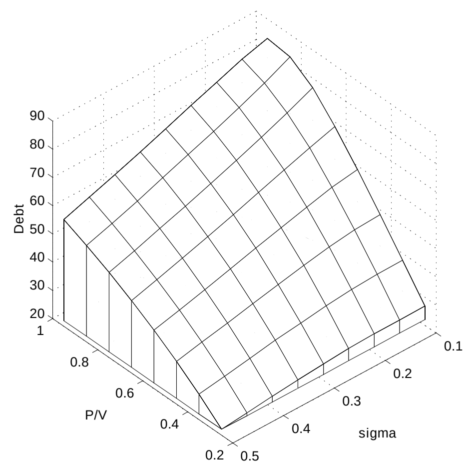
(D) Managers' rent

FIGURE 4: THE IMPACT OF σ ON THE VALUES OF THE FIRM, DEBT, EQUITY AND MANAGERIAL RENT (WITH $\phi = 0.1, \kappa = 0.2$)

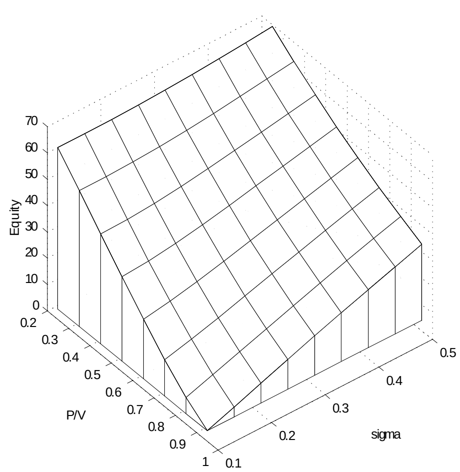
Figure 4 (A) illustrates that increasing firm risk (σ) reduces the value of the firm except when a firm is close to bankruptcy. Figures $4(B)\&\,(C)$ show that the value of debt is always negatively correlated to firm risk, whereas value of equity always responds positively. Figures $4(D)$ shows the relationship between the value of managers' rent and risk changes with debt/asset ratio.



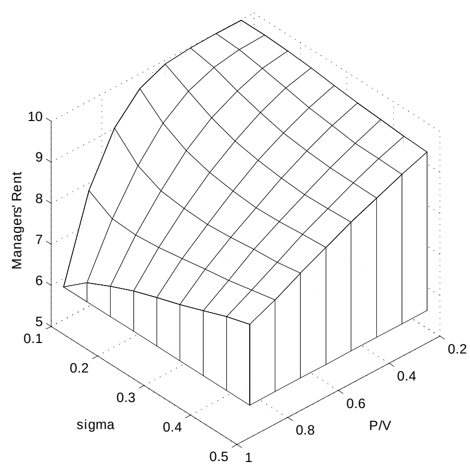
(A) Firm value



(B) Debt



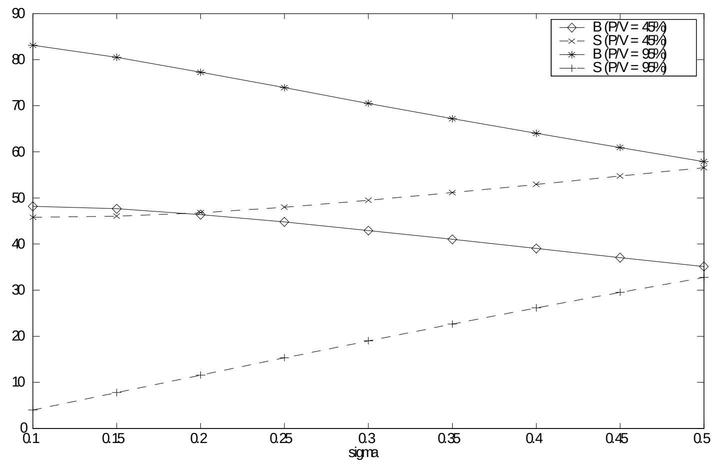
(C) Equity



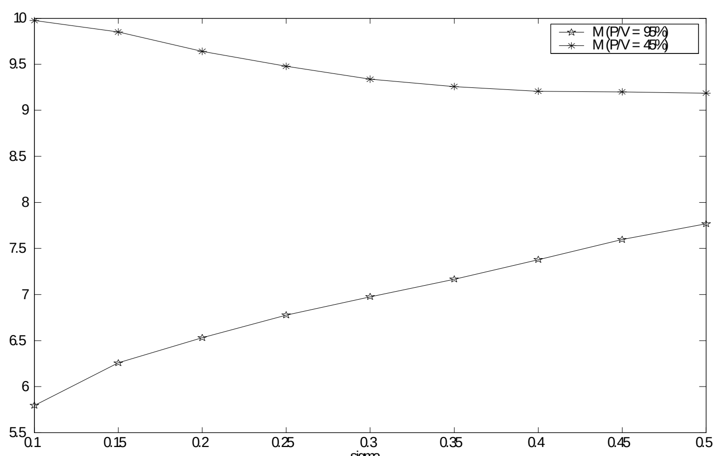
(D) Managers' rent

Figure 4 (continue) The values of debt, equity and managers rent at selected debt/Asset ratios (45% vs 95%)

Figure $4\,(E)$ shows that the value of debt, B, is always negatively correlated to firm risk, whereas value of equity, S, always responds positively regardless the debt/asset ratio. Figure $4\,(F)$ shows that when a firm is not imminent to default $(P/V = 45\%)$, the value of managers' rent decreases with asset volatility σ. When a firm is close to insolvency $(P/V = 95\%)$, the value of managers' rent tends to increase with risk.



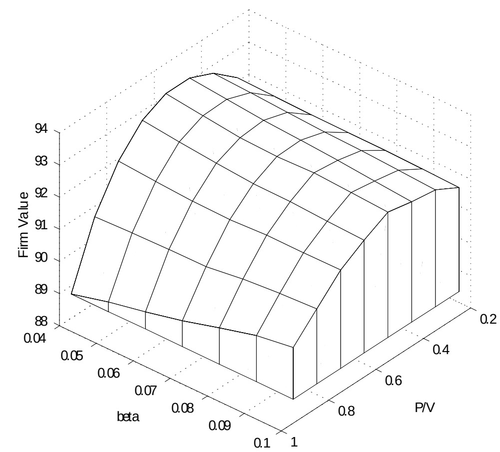
(E) Debt and equity at P/V=45% and P/V=95%



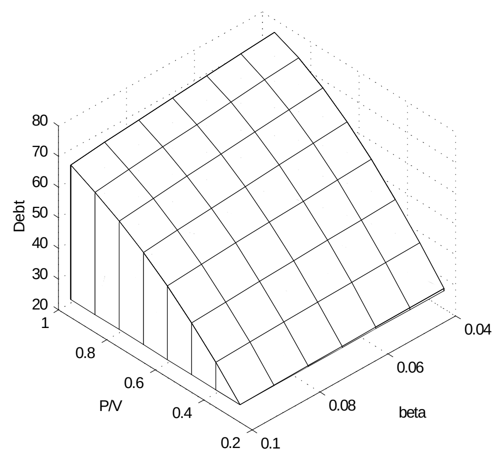
(F) Managers' rent at P/V=45% and P/V=95%

Figure 5: The impact of β on the values of the firm, debt, equity and managers rent (with $\phi = 0.1, \kappa = 0.2$)

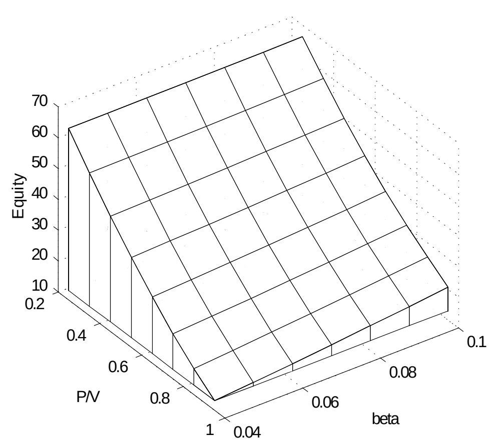
Figure $5\,(A)$ illustrates that increasing payout rate (β) reduces the value of the firm except when a firm is close to bankruptcy. Figures $5(B)\&\,(C)$ show that the value of debt is always negatively correlated to payout rate, whereas value of equity always responds positively. Figures $5(D)$ shows the relationship between the value of managers' rent and payout rate changes with debt/asset ratio.



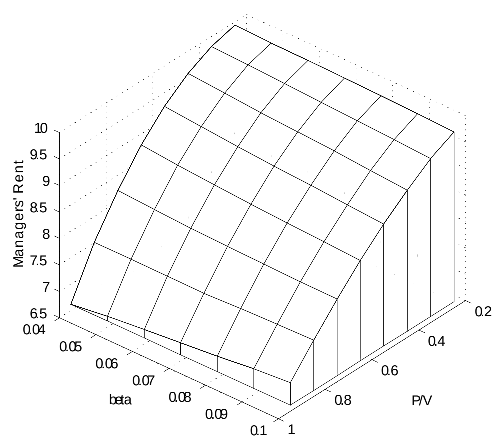
(A) Firm value



(B) Debt



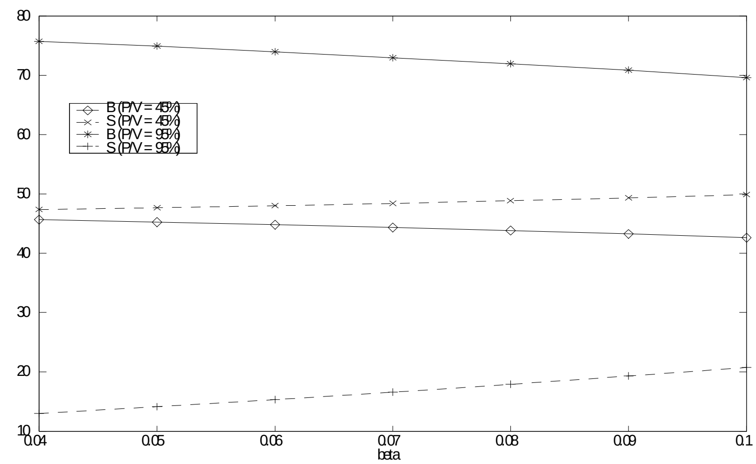
(C) Equity



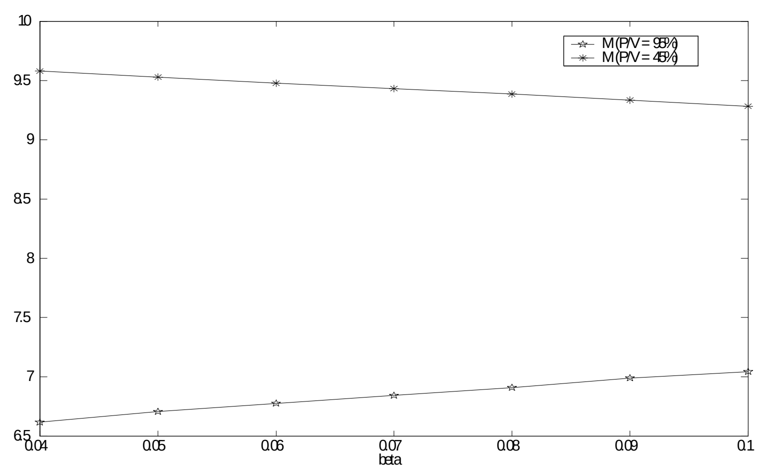
(D) Managers' rent

Figure 5 (continue) The values of debt, equity and managers rent at selected debt/asset ratios (45% vs 95%)

Figure 5 (E) shows that the value of debt, B, is always negatively correlated to payout rate, whereas value of equity, S, always responds positively regardless the debt/asset ratio. Figure 5 (F) shows that when a firm is not imminent to default $(P/V = 45\%)$, the value of managers' rent decreases with payout rate β. When a firm is close to insolvency $(P/V = 95\%)$, the value of managers' rent tends to increase with payout rate.



(E) Debt and equity at P/V=45% and P/V=95%



(F) Managers' rent at P/V= 45% and P/V=95%

Figure 6: Dividend yield with capital structure and managerial entrenchment power

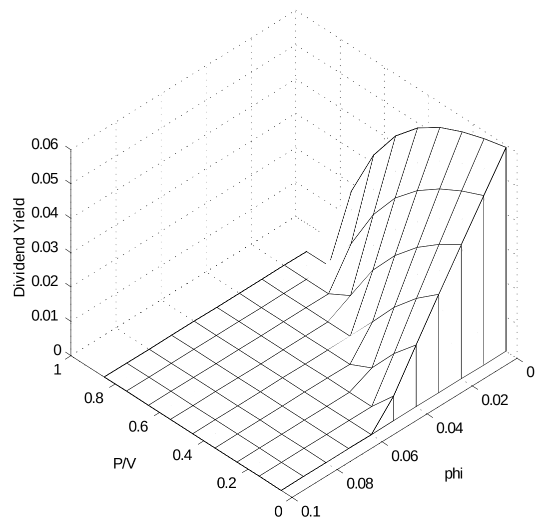


Figure 7: Illustration of the game at t for strategic default