Managerial entrenchment, equity payout and capital structure

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ABSTRACT

I develop a contingent claims model to examine the impacts of managerial entrenchment on capital structure and security valuation. The analysis shows that managers’ self-interested leverage choices deviate significantly from the optimal leverages that maximize firm values, partially explaining the suboptimal leverage ratios observed empirically (Graham, 2000). Both the extent and sensitivity of the deviations are affected by firm characteristics, debt features and default solutions. The shareholder-manager conflicts over risk level and cash payout vary dynamically with a firm’s financial health. Managerial entrenchment does not mitigate the agency problems of debt since managers’ discretionary decisions on milking properties or asset substitution could be driven by incentives to increase their own utility.

1. Introduction

Since the seminal work of Black and Scholes (1973) and Merton (1974), contingent claims models on the valuation of corporate securities have been used extensively to examine capital structure choice quantitatively. 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 (see Jensen and Meckling (1976), Grossman and Hart (1982) and Jensen (1986), among others). In this paper, I develop a contingent claims model to bridge the two lines of literature to examine in what sense and to what extent managerial entrenchment influence firm policies and security valuation.

I consider that partially entrenched managers pursue maximal rent extraction rather than optimal firm value. Shareholders’ limited capability to discipline managers both incentivizes and restricts on managerial value expropriation. The model emphasizes the role managerial agency issues play in determining capital structure and equity payout. In particular, entrenched managers choose leverage not only to minimize bankruptcy risk but also to avoid being removed. As a result, managers assume a minimal amount of debt to deter shareholders from dismissing them.

The model allows for quantitative comparisons between managerial leverages and optimal leverages. I show that managers’ self-interested leverage choices deviate significantly from those maximizing firm values. Consistent with the empirical findings in Berger et al. (1997), the stronger the entrenchment of managers, the lower the leverages that they tend to choose. The evidence also supports the notion that entrenchment motives could encourage managers to increase leverage beyond the optimal level to inflate their power against takeover (Harris and Raviv, 1989; Stulz, 1988). The analysis highlights the important role that corporate governance plays on capital structure, suggesting that firms with low leverages but high levels of managerial entrenchment may lift their values by restricting managerial entrenchment power by improving board control (Rosenstein and Wyatt, 1990; Yermack, 1996; Faleye, 2009) and shareholder monitoring (Gillan and Starks, 2000).

The deviations of managerial leverages from optimal leverages are significantly affected by firm characteristics, debt features and default solutions. In particular, managerial leverage deviations increase with a firm’s cash payout and risk level. This suggests that in cross-section, small firms are more prone to the negative influence of managerial entrenchment. Issuing debts of long maturities with high coupon rates generates relatively high managerial leverages. I present important evidence that when a firm and its creditors have equal bargaining strength in default negotiations, the managerial leverages and firm values are optimized.² Shared

² Fan and Sundaresan (2000) and Broadie et al. (2007) find that the ex ante firm value is maximized when a firm’s creditors possess the strongest ex post bargaining strength against the firm in default renegotiations when managerial agency issues are ignored.
bargaining power optimally trades off reducing debt costs and lifting shareholders’ capability to discipline managers. Those results yield applicable implications for corporate governance and bankruptcy process design.

I find that self-interested managers’ preferences regarding operating cash flow and risk level that influence equity payout and financing policies change dynamically with a firm’s financial health. When a firm is financially healthy, self-interested managers’ preferences for low cash payout and low risk tally with those of debtholders, rather than those of shareholders. However, the interests of managers and shareholders naturally align as a firm approaches distress. Both managers and shareholders prefer high risk and high cash payout to increase their own wealth at the expense of debtholders. Managerial entrenchment does not mitigate the agency problems of debt, since managerial decisions on milking properties and asset substitution could be driven by managers’ incentives to increase their own utility as well as by attempting to shift wealth from debtholders to shareholders.

From the modeling perspective, this paper stems from the contingent claims literature that starts with Black and Scholes (1973) and Merton (1974). With a few recent exceptions, those models assume that managers make decisions in the best interest of shareholders. My modeling of the interacted managerial agency and shareholder control dynamics is in the same spirit as that of Zwiebel (1996) and Myers (2000). Zwiebel designs a dynamic model in which self-interested managers voluntarily take on debt to restrict empire-building and thereby prevent takeovers. Myers (2000) values outside equity by examining the strategic interactions between managers and shareholders over dividend payments. This paper extends their work by considering asset value uncertainties, tax benefits, financial distress and default solutions in a valuation framework.

Anderson and Sundaresan (1996) develop a binomial model to study debt security design and capital structure design in the presence of the debtholder–shareholder conflicts. My model moves one step further to incorporate managerial agency problems and examine jointly the two types of agency issues. In such a setting, shareholders, managers and debtholders all make rational decisions in Nash equilibrium to maximize their own interests. Among the contingent claims models, Fan and Sundaresan (2000) point out the inadequacy of treating equity payouts as passive residual cash flows. They proxy dividends with periodical asset payouts to investigate the impacts of dividend policy on security valuation. Morellec (2004) examines the manager-shareholder conflicts on leverage focusing on managerial incentives for over-investment. Lambrecht and Myers (2007) develop a real-option model to examine the influence of managerial agency issues on investment and disinvestment with an emphasis on the influence of managerial personal wealth restriction combined with external takeover threat. Recently, Morellec and Smith (2007) and Morellec et al. (2008) study managerial agency conflicts with respect to risk management and capital structure.

To the best of my knowledge, this is the first paper studying managerial agency issues and security valuation with finite debt maturity, endogenous payout policy, and endogenous financing policy. It facilitates the generation of numerous new results regarding corporate policies and managerial entrenchment. The binomial lattice model developed combines intuitive simplicity with powerful flexibility to examine complex and interacted corporate issues in an equilibrium setting. It allows security valuation to take into account the time-varying and economic state dependent interactions of debt and equity agency issues without imposing restrictive assumptions. I emphasize analysing the extent to which the deviations between managerial leverages and optimal leverages are influenced by firm and debt characteristics to provide applicable implications for corporate governance and bankruptcy process design.

The rest of the paper is organized as follows: Section 2 describes the base case model without strategic default. Comparative static analyses are carried out in Section 3. Section 4 examines managerial leverages and optimal leverages. Section 5 concludes.

2. The base case model

I introduce the base case model in which strategic default and debt renegotiations are ruled out. The purpose is to simplify the model setup and to separate the impacts of managerial agency issues on corporate policies and security valuation from those of debt agency problems. Table 1 summarizes the notations used in this paper.

2.1. Model setup

Consider a firm of three parties: managers, shareholders and debtholders. Self-interested and partially entrenched managers operate the firm and derive private rents as they are in control. To completely separate managers’ interest from that of shareholders, I assume managers hold zero equity of the firm. Under the risk-neutral measure Q, the unlevered firm asset value process is expressed as

\[ dV_t = (r - \beta)dt + \sigma dW_t, \]

where \( r \) denotes the risk-free rate, \( \beta \) denotes the operating cash payout rate, and \( \sigma \) denotes the asset return volatility.

There is no information asymmetry in the model, i.e., all three parties are able to observe the evolution of the firm asset value continuously. The firm raises capital by issuing a coupon-bearing bond that matures at time \( T \). The bond principal and coupon rate are denoted by \( P \) and \( c \), respectively. Equity has no prespecified maturity. In valuation, the firm asset value \( V_t \) follows a discrete binomial process that ends at debt maturity.4 In the lattice, the asset set value \( V_t \) moves either up to \( uV_t \) with a risk-neutral probability of \( 1 - p \) or down to \( dV_t \) with a risk-neutral probability of \( p \) at time \( t + 1 \). The up-move multiple \( u = e^\delta \), the down-move multiple \( d = 1/u = e^{-\delta} \), and the probability of up-move \( p = (e^{\delta T} - d)/(u - d) \). On each node, the firm asset generates an operating cash flow of \( \beta V_t \) to pay interest and dividend at \( t \).

The shareholders are able to dismiss the managers and take control at any time. However the takeover will result in an asset loss of \( \phi V_t \) as the firm loses its managerial human capital. The value of \( \phi \) represents managerial entrenchment power that is primarily determined by the managers’ competency and is influenced by corporate governance. The debtholders are entitled to take over and liquidate the firm if the firm defaults. Upon liquidation, the firm suffers an unrecoverable asset loss of \( \kappa V_t \) on top of losing

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3 This assumption creates an upper boundary for the agency cost of equity. The interests of shareholders and managers could be better aligned by changing managers’ remuneration scheme, such as stock option plans (King and Santor, 2008; Margaritis and Pislaki, 2009). That constitutes an interesting avenue in which to extend this model in future research, but will not change the basic conclusions in this paper.

4 Upon no liquidation, the firm continues its operation after retiring debt at its maturity. The binomial process ends there for valuation purpose only.
2.2. Valuation

At debt maturity $T$, the debtholders are entitled to receive the last coupon $cP$ plus debt principal $P$. If there is no strategic default, the managers will repay the debtholders the contracted amount if assets are sufficient to fulfill the debt obligation $(V_T \geq (1 + c)P)$. Otherwise, the firm defaults and is liquidated. Upon liquidation, the debtholders receive the recovered asset value, $(1 - \kappa - \phi)V_T$.

The value of debt at time $T$ is

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

The sum of equity value and managerial rent, denoted by $SM$, at time $T$ is

$$SM(V_T) = \begin{cases} V_T - B(V_T) + \tau cP, & \text{if } V_T \geq (1 + c)P, \\ 0, & \text{if } V_T < (1 + c)P. \end{cases}$$

where $\tau$ denotes the corporate tax rate and $\tau cP$ represents the tax shield on interest.

Following Myers (2000), I assume that the firm continues its operation after time $T$ if there is no default. Then managerial human capital remains valuable to the firm, and dismissing the managers will incur an asset loss of $\phi V_T$. The managers therefore match their offered equity value $S(V_T)$ with what the shareholders are able to obtain if they take over, $\max(SM(V_T) - \phi V_T, 0)$. In equilibrium, the shareholders accept the proposed offer.\(^6\) The value of equity at time $T$ is expressed as

$$S(V_T) = \begin{cases} \max (SM(V_T) - \phi V_T, 0), & \text{if } V_T \geq (1 + c)P, \\ 0, & \text{if } V_T < (1 + c)P. \end{cases}$$

Upon no default, the managers retain the rest of the firm’s assets as their private rent. Upon default, the managers receive nothing. The value of managerial rent at time $T$ is

$$M(V_T) = \begin{cases} SM(V_T) - S(V_T), & \text{if } V_T \geq (1 + c)P, \\ 0, & \text{if } V_T < (1 + c)P. \end{cases}$$

2.2.2. At time $t$ prior to debt maturity

The valuation at each time $t$ prior to debt maturity is analogous to the valuation at debt maturity, except that it takes into account the expected continuation values of securities. To streamline the presentation, I first discuss how to value $B(V_t), S(V_t)$ and $M(V_t)$ if default does not occur at time $t$. The introduction of default conditions and valuation in default states will follow.

2.2.2.1. Valuation in non-default states. The non-default value of debt at time $t$ equals the coupon plus the expected continuation value of debt, which is computed by discounting the debt values on two adjacent nodes at time $t + 1$ under the risk-neutral probability measure $Q$. The value of debt is expressed as

$$B(V_t) = cP + e^{-\tau t}(pB(uV_t) + (1 - p)B(dV_t)).$$

The non-default value of $SM(V_t)$ equals the ex-coupon cash flow $\beta V_t - (1 - \tau)cP$ plus the expected continuation value of $SM(V_t)$ derived under the risk-neutral probability measure $Q$. It is expressed as

$$SM(V_t) = \beta V_t - (1 - \tau)cP + e^{-\tau t}(pSM(uV_t) + (1 - p)SM(dV_t)).$$

The managers are supposed to pay out all ex-coupon cash flow to the shareholders as dividends. If so the equity value will equal the ex-coupon cash flow plus the expected continuation value of equity. The shareholders will take over if the managers fail to

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\(^6\) The managers can always sweeten the dividend offer to increase $S(V_t)$ slightly above $SM(V_t) - \phi V_t$ to ensure that the shareholders will favor accepting the dividend offer.
pay out a satisfactory amount of dividend. Then the shareholders end up with the reservation equity value \( S(V^t_f) \), where \( V^t_f \) denotes the asset value after the managers are removed. To maximize their rent value, the managers attempt to pay out the minimal amount of dividend without triggering the termination of their contract. The non-default value of equity at time \( t \) equals the lower of the reservation equity value or the ex-coupon cash flow plus the expected continuation equity value. And \( S(V^t_f) \) is lower than the latter since the firm asset value decreases after the managers are dismissed. We take \( S(V^t_f) \) as given for the time being. I will describe how to compute \( S(V^t_f) \) in the next subsection. In equilibrium, the managers make a dividend offer that equates the equity value to the reservation equity value. The value of equity is expressed as

\[
S(V_t) = \min \left( \beta V_t - (1 - \tau) e^p + e^{-rt}(e^{V_t}(1 - \phi)), S(V_f^t) \right) = S(V^t_f).
\]

The amount of equity payout varies with asset value \( V_t \). In practice, firms tend to smooth out their cash dividends and to repurchase their own shares when they perform well. We could regard the equity payments in this model as a combination of share repurchases and cash dividends. So they change with a firm’s performance over time.

The managers retain the rest of the cash flow for their private rent. The non-default value of managerial rent is expressed as

\[
M(V_t) = SM(V_t) - S(V_t).
\]

### 2.2.2. Default conditions and valuation in default states

The firm becomes financially distressed when the ex-coupon cash flow at time \( t \) is negative \((\beta V_t - (1 - \tau) e^p < 0)\), i.e., the firm’s asset value falls too low to generate sufficient operating cash flow to pay interest. The managers have an incentive to delay the termination of the firm’s operation since they will lose their firm-specific human capital in liquidation (Lambrecht and Myers, 2007). The shareholders will raise new capital to pay interest to keep the firm alive as long as they believe saving the firm is worthwhile. The firm defaults when the value of equity drops to or below zero \((S(V_t) \leq 0)\), where the shareholders are no longer interested in keeping the financially troubled firm alive. The endogenous default conditions are in fact the same as in Leland (1994), ignoring more realistic but complex default and liquidation solutions presented in Broadie et al. (2007). However, this simplification will not change the main implications delivered by the model.

Upon liquidation, the debtholders claim the lower one of the principal or the recovered asset value, \( B(V_t) = \min (P, (1 - \kappa - \phi) V_t) \) where the superscript \( l \) denotes liquidation. Given that the firm will only default when the equity value falls to or below zero, the values of equity and managerial rent are 0. Combining the formulas in both non-default and default states, the valuations of debt, equity and managerial rent at time \( t \) are summarized as below

\[
B(V_t) = \begin{cases} e^p + e^{-rt}(e^{V_t}(1 - \phi) V_t) & \text{if } S(V_t) > 0, \\ \min ((1 - \kappa - \phi) V_t, P) & \text{if } S(V_t) \leq 0; \end{cases}
\]

\[
S(V_t) = \begin{cases} S(V^t_f) & \text{if } S(V_t) > 0, \\ 0 & \text{if } S(V_t) \leq 0; \end{cases}
\]

\[
M(V_t) = \begin{cases} SM(V_t) - S(V_t) & \text{if } S(V_t) > 0, \\ 0 & \text{if } S(V_t) \leq 0. \end{cases}
\]
Following the standard valuation method of binomial lattice (Cox et al., 1979), the present values of debt, equity and managerial rent are computed by repeating the valuation at each time t backward along the binomial lattice to its starting node at time 0.

### 2.2.3. Computing reservation equity value \( S(V^f_t) \)

The reservation equity value \( S(V^f_t) \) represents the hypothetical equity value if the shareholders dismiss the managers at time \( t \). For valuation, I assume the shareholders will operate the firm after the takeover until debt maturity or default. An alternative way to interpret this assumption is that the best available managers in the takeover are the current managers. An alternative way to interpret this assumption is that the best available managers in the employment market possess zero entrenchment power. Suppose the shareholders take over at time \( t \), and the asset value drops from \( V_t \) to \( (1 - \phi)V_t \), reflecting the loss of managerial human capital. Under the risk-neutral measure \( \mathbb{Q} \), the unlevered firm asset value process is expressed as

\[
\frac{dV^f_t}{V^f_t} = (r - \delta)dt + \sigma dW_t,
\]

where \( V^f_t \) denotes the unlevered firm asset value after dismissing the managers. In discrete time, \( V^f_t \) follows a “new” subgame binomial lattice starting on the node of \( V_t \) and ending at debt maturity time \( T \).

To avoid confusion, I use another subscript \( h \) to denote time for this subgame lattice. The firm-specific up-move multiple \( u \), down-move multiple \( d \), and the risk-neutral probability of up-move \( p \) remain unchanged. Firm asset generates a cash flow of \( \beta V^f_{h+1} \) at each time \( h \) except on the starting node \( V_t^f \) because cash flow \( \beta V^f_{h+1} \) has already realized before the takeover. The valuation of equity in the subgame lattice is analogous to that of \( SM(V^f_t) \) in the original lattice.

At debt maturity time \( T \), the debtholders are repaid with the contracted amount \( (1 + c)P \) if the firm is able to honor its debt contract. Otherwise, the debtholders claim the recovered asset value \( (1 - \kappa)V^f_T \) after liquidation. The value of debt at time \( T \) is expressed as

\[
B(\mathcal{V}_T^f) = \begin{cases} (1 + c)P, & \text{if } V^f_T \geq (1 + c)P, \\ (1 - \kappa)\mathcal{V}_T^f, & \text{if } V^f_T < (1 + c)P. \end{cases}
\]

The value of equity equals the asset value minus the value of debt upon default and zero upon default:

\[
S(\mathcal{V}_h^f) = \begin{cases} V^f_h - B(\mathcal{V}_h^f) + \tau cP, & \text{if } V^f_h \geq (1 + c)P, \\ 0, & \text{if } V^f_h < (1 + c)P. \end{cases}
\]

The default conditions are the same as those in the original model, i.e., when the value of equity falls to/below zero \( S(V^f_h) \leq 0 \), the shareholders are no longer interested in contributing new capital to bail out the financially troubled firm. On each node at time \( h \) prior to debt maturity, the value of debt in non-default states equals the coupon received at time \( h \) plus the expected continuation value of debt. Upon default, the debtholders receive the lower one of the principal or the recovery value. The value of debt at time \( h \) is expressed as

\[
B(\mathcal{V}_h^f) = \begin{cases} cP + e^{-\tau} \left( pB(\mathcal{V}_{h+1}^f) + (1 - p)B(\mathcal{V}_{h+1}^f) \right), & \text{if } S(\mathcal{V}_h^f) > 0, \\ \min \left( (1 - \kappa)V^f_h, P \right), & \text{if } S(\mathcal{V}_h^f) \leq 0. \end{cases}
\]

The value of equity equals the ex-coupon cash flow at time \( h \) plus the expected continuation value of equity in non-default states. The default value of equity is 0 in default states. Then we have

\[
S(\mathcal{V}_h^f) = \begin{cases} \beta V^f_h - (1 - \tau)cP + e^{-\tau} \left( pS(\mathcal{V}_{h+1}^f) + (1 - p)S(\mathcal{V}_{h+1}^f) \right), & \text{if } S(\mathcal{V}_h^f) > 0, \\ 0, & \text{if } S(\mathcal{V}_h^f) \leq 0. \end{cases}
\]

The reservation equity value, \( S(V_t) \), is computed by repeating the valuation at each time \( h \) backward along the subgame lattice till time \( t \). Note that, in equilibrium, the managers will never be removed at time \( t \) because they can always offer a dividend that makes the equity value equal to or slightly higher than the reservation equity value.

### 3. Comparitive statics

I apply the model introduced in the previous section to examine the impacts of managerial entrenchment on corporate policies and security valuation. The benchmark parameter values are introduced in Table 1. I define firm value as the sum of the values of debt and equity. Managers possess no entrenchment power when \( \phi = 0 \).

Table 2 shows that the firm and equity values decrease monotonically from 100.93 and 53.55 to 90.20 and 44.28, respectively, as \( \phi \) increases from 0% to 10%. Higher entrenchment power allows managers to extract more value from a firm, i.e., the value of managerial rent increases from 0 to 9.20 as managers become more entrenched. Their selfish actions increase the likelihood of default and in turn reduce firm values. This is evidenced by the fact that debt current yield spread increases from 133.25 bps to 153.35 bps as \( \phi \) increases. Default barrier, \( V_B \), increases from 25.92 to 28.37, confirming that the manager-shareholder conflicts increase default probability. The results suggest that credit risk models should take managerial agency issues into consideration (Liao et al., 2009).

Managerial entrenchment reduces not only firm value, but also overall economic efficiency. The sum of firm value and managerial rent decreases from 100.93 to 99.40 as managers become more entrenched. The results suggest that firms with better corporate governance enjoy relatively higher firm and security values because corporate governance helps to restrict managerial entrenchment. This benefits overall social welfare as well.

### 3.1. Impacts of firm characteristics

Table 3 reports the influence of firm risk level, proxied by asset return volatility \( \sigma \), on the relationship between managerial entrenchment and security valuation. Consistent with the findings in previous research, firm/debt values decrease with business risk level, whereas equity value increases. Equity value decreases less with managerial entrenchment as a firm business risk level increases. The equity value decreases by 9.99 as \( \phi \) increases from 0% to 10% when \( \sigma \) equals 0.1, but decreases by 9.29 when \( \sigma \) equals 0.9. The negative influence of entrenchment on equity value is mitigated by the increase in equity value thanks to increased risk level. As \( \phi \) increases from 0% to 10%, debt yield spread increases by 0.34 bps and 58.85 bps when \( \sigma \) equals 0.1 and 0.9, respectively. The influence of managerial entrenchment on default risk is magnified by firm underlying risk level. In cross-section, young and small firms tend to have higher risk than mature and large firms, so the security valuations of young and small firms are more

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7 Default barrier changes dynamically in binomial lattice model with debt of finite maturity (Broadie et al., 2007). I choose to report the default barrier as the first time default occurs in the lattice. The default barrier provides us with at least some idea of the impacts of entrenchment on firm default probability.
The influence of firm risk on the impacts of managerial entrenchment. This table reports the influence of firm risk, on the relationships between managerial entrenchment and the values of firm, equity and managerial rent, debt credit spread, and default barrier. The debt credit spread is defined as current yield minus risk-free rate (cP/B – r). The default barrier is the asset value at which first time default occurs in the lattice.

Table 3

<table>
<thead>
<tr>
<th>Entrenchment</th>
<th>Firm value</th>
<th>Debt spread</th>
<th>Equity</th>
<th>Managerial rent</th>
<th>Economic efficiency</th>
<th>Default barrier</th>
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...well-documented role of debt as a disciplinary tool to restrict managerial value expropriation. It further predicts that selfish managers would like to issue zero debt to optimize their own interest in the absence of internal/external takeover threats (Zwiebel, 1996). I will examine managerial financing choices in the absence/presence of a shareholder takeover threat in the managerial capital structure in the next section below.

3.2. Impacts of debt features

Table 5 shows that high coupon rates increase firm value but reduce managerial rent value. When \( \phi = 10\% \), managerial rent value drops from 9.25 to 9.03 as the coupon rate increases from 5% to 9%. The evidence supports the notion that debt could be used to reduce managerial value expropriation by paying out free cash flows. A higher coupon rate implies a greater likelihood of default and a higher bond yield spread. Managerial entrenchment magnifies the positive relationship between debt yield spread and coupon rate. The debt yield spread difference between \( c = 5\% \) and 9% is 257 bps for \( \phi = 0 \), and increases to 268 bps for \( \phi = 10\% \).

As illustrated in Table 6, the relationship between managerial rent value and debt maturity is subject to leverage ratio. For a low leverage ratio (\( P/V_0 = 20\% \)), the managerial rent value...
Table 4
The influence of leverage on the impacts of managerial entrenchment. This table reports the influence of leverage, proxied by the ratio of debt principal over the initial asset value ($P/V_0$), on the relationships between managerial entrenchment and the values of firm, equity and managerial rent, debt credit spread, and default barrier. The debt credit spread is defined as current yield minus risk-free rate ($cP/B_0/C_0r$). The default barrier is the asset value at which first time default occurs in the lattice.

<table>
<thead>
<tr>
<th>Leverage $P/V_0$ (%)</th>
<th>$\phi$</th>
<th>Firm value</th>
<th>Debt spread</th>
<th>Equity</th>
<th>Managerial rent</th>
<th>Default barrier</th>
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Table 5
The influence of coupon rate on the impacts of managerial entrenchment. This table reports the influence of debt coupon rate on the relationships between managerial entrenchment and the values of firm, equity and managerial rent, debt credit spread, and default barrier. The debt credit spread is defined as current yield minus risk-free rate ($cP/B_0/C_0r$). The default barrier is the asset value at which first time default occurs in the lattice.

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Table 6
The influence of debt maturity on the impacts of managerial entrenchment. This table reports the influence of debt maturity on the relationships between managerial entrenchment and the values of firm, equity and managerial rent, debt credit spread, and default barrier. The debt credit spread is defined as current yield minus risk-free rate ($cP/B_0/C_0r$). The default barrier is the asset value at which first time default occurs in the lattice.

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decreases from 9.98 to 9.87 as debt maturity increases from 5 to 20 years for $\phi = 10\%$. This could be explained by the model assumption that managers have full bargaining strength against shareholders at debt maturity. The more frequently that managers could exploit shareholders for a rent value that matches their human capital, the higher their rent values. However, for a high leverage ratio ($P/V_0 = 80\%$), the managerial rent value increases from 5 to 20 years for $\phi = 10\%$. The evidence indicates that, when managers’ exploitation at debt maturity is less of an issue, debt of short maturity is more effective in terms of restricting managerial entrenchment. In this model, debt maturity could be viewed alternatively as the tenure of managers as well. The longer the debt maturity, the longer managers could stay in control. And the results suggest that to restrict managerial entrenchment, a firm should avoid keeping the same management team in control for too long.

### 3.3. Shareholder-manager conflicts over risk and payout

Next I examine the manager-shareholder conflicts over risk choice and payout level with a firm’s financial health. Fig. 2 illustrates the impacts of risk level proxied by asset return volatility $\sigma$ on the values of firm, debt, equity and managerial rent in the presence of managerial entrenchment. Fig. 2(A) shows that firm value decreases with risk level except for extremely high debt/asset ratios. The result echoes those of previous studies (Merton, 1974; Leland, 1998). Fig. 2(B) and (C) shows that debt values are negatively correlated to firm risk, whereas equity values respond positively.

Fig. 2(D) indicates that when a firm is financially healthy with a low debt/asset ratio, the value of managerial rent decreases with risk level. An increase in risk level leads to a higher likelihood of default upon which managers lose their firm-specific human capi-

![Fig. 2. Firm, debt, equity and managerial rent values and firm risk. This figure plots the impacts of firm risk, $\sigma$, on firm, debt, equity and managerial rent values. Leverage is proxied by the ratio of debt principal over the initial asset value ($P/V_0$).](image-url)
The results highlight the shareholder-manager conflict over risk choice. For a financially healthy firm, shareholders would prefer investing in risky projects to boost equity value, but managers favor safe projects for their own sake. This evidence contradicts the notion that managers are more aligned to shareholders than to debtholders, i.e., managers’ preference on firm risk level tallies with that of debtholders when a firm is financially healthy.

The value of managerial rent switches to increase with risk level as the firm approaches bankruptcy. When the debt/asset ratio is high, say $P/V = 95\%$, both the values of managerial rent and equity increase with $\sigma$, whereas the debt value decreases. This suggests that the relationship between managerial rent and risk level changes with a firm’s financial health. Managerial rent behaves like debt when a firm is financially healthy but resembles equity when the firm is close to default where the asset substitution problem becomes economically significant. The preferences of shareholders and managers over risk choice naturally align, suggesting that managerial entrenchment does not mitigate the asset substitution problem of debt. Asset substitution is conventionally explained as an attempt by managers to transfer wealth from debtholders to shareholders prior to default. My analysis, however, implies that asset substitution benefits not only shareholders but also managers at the expense of debtholders. Thus, managerial decision about asset substitution could be driven by self-interest as well.

Fig. 3 illustrates the impacts of operating cash payout on firm, debt, equity and managerial rent values in the presence of managerial entrenchment. Fig. 3(A) shows that the firm value responds negatively to cash payout rate $b$ except when the debt/asset ratio is high. Fig. 3(B) and (C) plots that the value of debt (equity) decreases (increases) with payout rate, respectively. Fig. 3(D) shows that when a firm is in good financial health with a low debt/asset ratio, the value of managerial rent is negatively correlated with payout rate. Managers prefer retaining more money in the firm to reduce the probability of default and to avoid losing.

Fig. 3. Firm, debt, equity and managerial rent values and cash payout rate. This figure plots the impacts of operating cash payout rate, $b$, on firm, debt, equity and managerial rent values. Leverage is proxied by the ratio of debt principal over the initial asset value ($P/V_0$).
their human capital. Thus, “cash cow” projects appear attractive to shareholders but not to managers, who favor a low cash payout policy to increase the expected value of their rent.

The value of managerial rent turns to increase with cash payout when a firm is close to bankruptcy. When $P/V_0 = 95\%$, the value of managerial rent increases as the payout rate rises, whereas the value of debt decreases. Managers and shareholders are likely to agree to increase cash payout since doing so benefits both of them at the expense of bondholders. Then managerial decisions on milking properties could be driven by their incentives to increase their own utility. This constitutes an alternative to the explanation of the milking of properties as an attempt by managers to shift wealth from debtholders to shareholders. Overall, the evidence presented in this subsection serves as a reminder for caution for making assumptions on the shareholder-manager conflicts that may vary dynamically with a firm’s financial health.

4. Managerial capital structure

The lattice model allows for a direct comparison of managerial discretionary leverage choices versus the optimal leverages that maximize firm values. I focus on addressing the following questions: (1) What are managers’ leverage choices in the absence/presence of a takeover threat by shareholders? (2) How much do managerial leverage choices deviate from the optimal leverage ratios? (3) To what extent are the deviations affected by firm characteristics, debt features and default solutions? To address the latter question, I present in the appendix an extension of the basic model that considers alternative default rules.

A firm’s leverage ratio is determined at $t=0$, the financing decision time. Shareholders would select ex ante an optimal leverage ratio to maximize firm value. That equates to maximizing equity value given that debt is fairly priced. Managers choose ex ante a debt amount to maximize their private rent value. The notional amount of debt is solved numerically to maximize either firm value or managerial rent value. Leverage is defined as the ratio of debt value over firm value, $\text{Leverage} = B/(B+S)$.

In the benchmark, I assume that a firm and its creditors share equal bargaining strength, i.e., debtholders’ bargaining power $\theta = 0.5$. Fig. 4(A) reports managerial leverage choices in the absence and presence of shareholders’ takeover threat and optimal leverages. The solid line represents the optimal leverage ratios that increase with managerial entrenchment power. Managerial entrenchment may have two opposite effects on optimal leverage ratios. On one hand, it encourages shareholders to issue more debt to discipline entrenched managers by paying out free cash flows. On the other hand, higher entrenchment power results in higher debt costs due to increased expected default loss, which in turn discourages debt financing. The first effect appears to be dominant. The positive relationship between managerial entrenchment and optimal leverage, however, contradicts the empirical evidence that firms with stronger managerial control issue less debt (Berger et al., 1997).

Since financing decisions are a standard responsibility of managers, managerial leverage choices provide an explanation of the abnormality. The longdash–shortdash line in Fig. 4(A) shows that managers tend to issue zero debt without shareholders’ takeover threat. Issuing zero debt enables them to maximize the value of their private rent by avoiding completely losing any value of their human capital in default. This evidence is consistent with the negative relationship between managerial rent and debt amount identified in the comparative statics.

This leads to the following questions: Why do managers issue debt? Why do not managers reduce existing debt to zero over time? The answers lie in shareholders’ takeover threat. Consider that if managers issue zero debt at the financing decision time,

---

**Fig. 4.** Interactions on a node at time $t$ in the strategic default model. This figure illustrates the interactions among managers, debtholders and shareholders on a node at time $t$. After firm asset value $V_t$ is realized, the managers make a debt payment to the debtholders. The payment may fall short of the contracted amount even if the firm is able to honor the debt contract. The debtholders will accept the payment with no dispute when it satisfies the debt contract. But when the payment falls short of the contracted amount, the debtholders weigh their options. They will accept the below-contracted-amount payment to avoid liquidation if it is in their best interest to do so. Upon no liquidation, the managers make a dividend offer to the shareholders. The shareholders decide whether to accept the dividend offer. By accepting, they pocket the money and keep the managers in control till next time $t+1$. By rejecting, they dismiss the managers and operate the firm themselves.
shareholders could take control immediately and issue an optimal amount of debt to maximize firm value. Thus, managers have to issue some debt to avoid being removed. In the same vein, managers cannot reduce the existing debt below a certain level because that would invite takeover as well. For simplicity, I assume that the notional amount of debt is chosen by managers at time \( t = 0 \) and does not change before maturity.

To avoid being dismissed, managers issue a minimal amount of debt to match the firm value to what shareholders are able to achieve by taking control and applying optimal leverage. The long-dash line in Fig. 4(A) represents managerial leverage choices that simultaneously maximize their own rent and prevent shareholders from exercising their threat to take over. Their leverage choices decrease monotonically as entrenchment power increases. Managers’ incentives to maximize the value of their private rent make their leverage choices deviate substantially from the optimal leverages. This is consistent with the empirical findings that firms with stronger managerial control tend to use less debt (Berger et al., 1997).

The stronger their entrenchment power is, the less debt managers are able to issue without triggering dismissal. As a result, the firm values associated with managers’ leverage selections (long-dash line in Fig. 4(B)) are increasingly lower than the optimal firm values as managers become more entrenched. Since managerial entrenchment power could be restricted through corporate governance, the analysis suggests that firms with better corporate governance should have relatively higher leverage ratios. Capital structure constitutes an important channel for improving firm value through effective board control and stringent shareholder monitoring.

Little direct evidence exists on the dynamic relationship between payout policy and capital structure (Allen and Michaely, 2002). The question of the role of the managerial component in those policies remains mostly unanswered (Welch, 2004). I apply the model to shed some light on those unanswered questions. The dividend is defined as

\[
\text{Dividend}(V_0) = S(V_0) - e^{-rt}(pS(uV_0) + (1 - p)S(dV_0)).
\]

Fig. 4(C) shows that dividends decrease (increase) with managerial entrenchment power at the optimal leverages (managerial leverage choices). Combining the results with those reported in Fig. 4(A), I find that dividend yields are negatively correlated to leverage ratios. This is intuitive since issuing more debt reduces net incomes and hence dividends. But their individual relationships with managerial entrenchment are completely switched at the optimal leverages compared to at managerial leverage choices. The evidence highlights the importance of controlling for managerial entrenchment in cross-sectional empirical investigations on the interactions between equity payout and financing policies. Fig. 4(D) shows that, for entrenched managers, zero leverages produce the highest rent values, followed by their own leverage choices. The optimal leverages generate the lowest rent values.

To answer questions (2) and (3), I estimate the optimal leverages and managers’ leverage choices in the presence of a shareholders takeover threat for different firm characteristics and debt features. Fig. 5 shows that managerial leverages further deviate from the optimal leverages as managers become more entrenched. Fig. 5(A) plots the interactions of managerial leverage deviations with different operating cash payout levels. The result indicates that firms with high cash payout rates tend to experience greater

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**Fig. 5.** Leverages, firm, equity and managerial rent values for different leverage choices. This figure plots leverage ratios, firm and managerial rent values, and dividends for different leverage choices. The solid lines represent the variable values at the optimal leverages that maximize firm values. The long-dash–short-dash lines represent the variable values at the managerial leverage selections in the absence of a takeover threat from the shareholders. The long-dash lines represent the variable values at the managerial leverage selections in the presence of a takeover threat from the shareholders.
deviations from optimal leverages. Fig. 5(B) shows that the deviations increase substantially as firm risk level $r$ increases. As part of the value to be renegotiated in defaults that are more likely to take place with volatile asset returns, managerial human capital is of greater importance to shareholders. In turn, shareholders would be more tolerant of managerial leverage deviations. The results explain why small firms tend to have relatively lower leverage ratios from the entrenchment angle.

The features of debt play a remarkable role in restricting managerial deviations from the optimal leverage choices. Fig. 5(C) shows that managerial leverage deviation decreases with debt coupon rate. By paying out free cash flows, shareholders discourage managerial rent-seeking and make managers issue debt closer to the optimal amount. Fig. 5(D) indicates that managerial leverage choices are decreasingly lower than the optimal leverages as debt maturity increases. With longer debt maturity, managers are forced to issue more debt to avoid being dismissed as the firm could enjoy more tax savings with debt of longer maturity. Together with the fact that short maturity debt better restricts managerial entrenchment, this result suggests that issuing debts of different maturities trades off tax savings versus not only bankruptcy loss, but also versus managerial value extraction. Overall, the analysis shows that debt features significantly influence firm leverage ratios when the agency issues between shareholders and managers are taken into account.

I gauge the impacts of default rules on managerial leverage deviation by examining three different levels of debtholders’ negotiation power: $h = 0, 0.5$ and 1. I assume that dismissing managers does not change a firm’s relative bargaining strength against its debtholders. $h = 0.5$ is the benchmark as the firm and debtholders share equal bargaining strength in debt renegotiations. $h = 1$ implies that debtholders possess all bargaining strength and obtain entire liquidation avoidance savings in negotiations. This is technically equivalent to liquidation default since shareholders cannot exploit debtholders in strategic defaults. In practice, it represents the case that creditors exercise strong power in a workout or negotiating restructure plans in bankruptcy court. When $h = 0$, the firm possesses all bargaining strength in negotiations. That represents an extreme situation in which debtholders are not well protected and strategic defaults are maximally encouraged.

Fan and Sundaresan (2000) and Broadie et al. (2007) find that, in the absence of managerial agency issues, optimal leverages and firm values increase when debtholders possess more bargaining strength in debt renegotiations. However, Fig. 6(A) and (B) shows that, at managers’ discretion, leverage ratios and firm values are optimized when a firm and its debtholders share equal bargaining strength. When a firm holds all bargaining power, it becomes too costly to issue a large amount of debt because all liquidation avoidance savings go to shareholders and managers in debt renegotiations. Strategic defaults are maximally encouraged and occur more frequently. As a result, debtholders require high premium ex ante to compensate their high expected losses in defaults (Fig. 6(C)). But when debtholders possess full bargaining strength, shareholders’ power to discipline managerial underleverage is limited. In this case, strategic defaults are maximally discouraged and occur less frequently. In addition, debt default recovery is relatively high. Those two effects jointly make debt financing more attractive. However, shareholders are forced to be more tolerant of leverage deviations since losing managerial human capital will reduce debt recoveries in defaults and drive up the cost of debt.

![Graphs of leverage and entrenchment](image-url)
The leverage ratios and firm values are lower in both situations. Shared bargaining strength best trades off the needs to reduce debt costs and to lift shareholders’ ability to discipline managers. As a result, managerial rents are at the lowest level with $\theta = 0.5$ (Fig. 6(D)).

5. Conclusions

I develop a dynamic valuation model that characterizes equity payout and capital structure through the agency issues between entrenched managers and shareholders who have limited power to discipline managers. In particular, the entrenched managers undertake financing and payout decisions to maximize their private rents and simultaneously to prevent shareholders from removing them. The model allows for quantitative examinations on the impacts of the agency problems of debt and equity on security valuation in one setting.

Evidence shows that managers’ preferences on risk choice and cash payout level change according to a firm’s financial health. Their decisions on milking properties/asset substitution could be explained by managers’ incentives to increase their own utility as opposed to the conventional explanation that they attempt to shift wealth from debtholders to shareholders. The evidence serves as an important reminder for caution because the shareholder-manager conflicts may vary with a firm’s financial health.

Entrenched managers select leverages that are substantially lower than the optimal leverages. That helps to explain the suboptimal leverage ratios observed empirically (Graham, 2000). The deviations of managerial leverage choices from the optimal leverages are significantly affected by firm characteristics and debt features. In particular, the deviations increase with operating cash payout and risk level. Debts of long maturities with high coupons help to alleviate the inefficiency due to the managerial agency issues. Managerial leverage deviations decrease as a firm and its creditors share equal bargaining strength in debt renegotiations. Those findings provide applicable implications for corporate governance and bankruptcy process design.

Some limitations remain for the model. Managerial entrenchment is exogenous and is not linked to managers’ competency, board quality or shareholder monitoring. Contractual provisions such as executive stock options and golden parachutes are not considered. Information asymmetry is ignored as well. Nonetheless, all constitute interesting avenues by which to extend this model.

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![Managerial Leverage](A) Managerial Leverage

![Firm Value](B) Firm Value

![Debt Credit Spread](C) Debt Credit Spread

![Managerial Rent](D) Managerial Rent

Fig. 7. Impacts of debtholders’ bargaining power. This figure plots the impacts of debtholders’ bargaining power on leverage ratios, firm and managerial rent values, and debt credit spreads at the managerial leverage choices. Different debtholders’ bargaining power values: $\theta = 0$, 0.5 and 1, represent that the debtholders possess zero, equal and all bargaining power against the firm in debt renegotiations, respectively.
Appendix A. Extended model of strategic default

Strategic default has been deliberately shut off in the base case model to eliminate the impacts of the agency issues of debt. In this section, I relax the restriction to examine simultaneously the managerial agency conflicts and ex post debt renegotiations with respect to capital structure and security valuation. Liquidation is more costly than restructuring due to unrecoverable losses (Altman, 1984). A firm may have incentives to default strategically knowing that its creditors will bear the losses in liquidation. Among others, Anderson and Sundaresan (1996) and Fan and Sundaresan (2000) study security valuation with strategic defaults and debt renegotiations but without considering managerial agency issues.

The interactions in the strategic default model are analogous to those in the base case model, except that negotiations between the managers and the debtholders take place in strategic defaults. I follow Anderson and Sundaresan (1996) to assume zero renegotiation costs. As illustrated in Fig. 7, on each node of time $t$, we observe the following actions:

1. The managers make a debt payment to the debtholders. The payment may fall short of the contracted amount even if the firm is able to honor the debt contract.
2. The debtholders will accept the payment with no dispute when it satisfies the debt contract. But when the payment falls short of the contracted amount, the debtholders weigh their options. They will accept the below-contracted-amount payment to avoid liquidation if it is in their best interest to do so.
3. Upon no liquidation, the managers make a dividend offer to the shareholders. By accepting, they pocket the money and keep the managers in control till next time $t + 1$. By rejecting, they dismiss the managers and operate the firm themselves.

Appendix B. Valuation in the model of strategic default

The valuation is carried out using backward induction and starts with the nodes at debt maturity $T$.

B.1. At debt maturity

Supposing that the firm is liquidated upon default at debt maturity $T$, the debtholders bear an unrecoverable loss of $(\kappa + \phi)VT$. Through renegotiation, the debtholders could save part of the liquidation loss, depending on their relative bargaining strength, $0 < \theta < 1$, against the firm. According to the standard results of Nash Equilibrium, the debtholders receive $\theta$ of the savings from liquidation avoidance. To repay the minimal amount to the debtholders, the managers choose between honoring the debt contract or defaulting strategically. Strategic defaults occur when the asset value is sufficiently low to secure the firm a gain in debt renegotiation. In equilibrium, the value of debt at time $T$ equals the lower one of the contracted amount or the negotiated payoff in strategic default, which equals the liquidation recovery $(1 - \kappa - \phi)VT$ plus the debtholders' share of the saved liquidation loss, $\theta(\kappa + \phi)VT$. The value of debt can be expressed as

$$B(V_T) = \min \left( (1 + c)P, (1 - \theta)(\kappa + \phi)VT \right).$$  

(18)

The sum of equity value and managerial rent $SM(V_T)$ is expressed as

$$SM(V_T) = \begin{cases} V_T - B(V_T) + \tau cP, & \text{if } B(V_T) = (1 + c)P, \\ V_T - B(V_T), & \text{if } B(V_T) = (1 - (1 - \theta)(\kappa + \phi))VT. \end{cases}$$  

(19)

The value of equity at time $T$ is expressed as

$$S(V_T) = \max \left( SM(V_T) - \phi VT, 0 \right).$$  

(20)

Upon no default, the managers retain the rest of the firm’s asset value as their private rents. The value of managerial rent at time $T$ is

$$M(V_T) = SM(V_T) - S(V_T).$$  

(21)

B.2. At time $t$ before debt maturity

At every time $t$, the managers may honor the debt contract. The value of debt then equals the coupon received at time $t$ plus the expected continuation value of debt. The managers may default strategically. Then the debtholders receive $\theta$ of the value saved by avoiding liquidation on top of the recovery asset value $(1 - \kappa - \phi)VT$. The value saved by avoiding liquidation equals the difference between the ongoing firm value $V^o_t(V_t)$ and the liquidation recovery value. Since $V^o_t(V_t)$ avoids immediate liquidation costs and contains future tax benefits, its value is certainly higher than the recovery asset value. The managers will pay the minimal amount to the debtholders. The latter will accept in equilibrium. The value of debt at time $t$ is:

$$B(V_t) = \min \left( cP + e^{-rt}(pB(uV_t) + (1 - p)(B(dV_t))), \theta V^o_t(V_t) + (1 - \theta)(1 - \kappa - \phi)VT \right).$$  

(22)

where the ongoing firm value equals the cash flow generated at time $t$ plus the expected continuation value of the firm:

$$V^o_t(V_t) = \beta V_t + e^{-rt}[p(B(uV_t) + SM(uV_t)) + (1 - p)(B(dV_t) + SM(dV_t))].$$

Unlike liquidation, strategic defaults are reversible. The firm defaults strategically when its asset value is sufficiently low, but has to resume the normal debt service once its asset value rises above the default barrier. Upon no default, the value of $SM(V_t)$ equals the ex-coupon cash flow plus the expected continuation value of $SM(V_t)$. Upon default, the value of $SM(V_t)$ equals the ongoing firm value minus the debt value:

$$SM(V_t) = \begin{cases} \beta V_t - (1 - \tau cP + e^{-rt}(pSM(uV_t) + (1 - p)SM(dV_t))), & \text{no default,} \\ V^o_t(V_t) - B(V_t), & \text{default}. \end{cases}$$  

(23)

Upon no default, the value of equity at time $t$ equals the lower one of the reservation equity value or the ex-coupon cash flow plus the expected continuation value of equity, $\min(\beta V_t - (1 - \tau cP + e^{-rt}(pSM(uV_t) + (1 - p)SM(dV_t)), S(V_t))$. The reservation equity value is lower for certain because the firm asset value decreases after the managers are removed. In equilibrium, the managers make shareholders' equity value equal to the reservation equity value $S(V_t)$:

$$S(V_t) = S(V_t') .$$  

(24)

The managers retain the rest for their private rent. The value of managerial rent is expressed as

$$M(V_t) = SM(V_t) - S(V_t).$$  

(25)

B.2.1. Computing reservation equity value $S(V_t')$

Computing the reservation equity value is analogous to that in the base case model. For simplicity, I omit a detailed introduction and provide the reader with the equations and brief descriptions. At debt maturity time $T$, the values of debt and equity are expressed as

$$S(V_T) = \max \left( SM(V_T) - \phi VT, 0 \right).$$  

(20)
\[ B(V_h) = \min \left\{ (1 + c)P, 1 - (1 - \delta)\kappa V_h \right\} \]
\[ S(V_h) = \begin{cases} V_h - B(V_h) + \alpha P, & \text{if } B(V_h) = (1 + c)P, \\ V_h - B(V_h), & \text{if } B(V_h) = (1 - \delta)\kappa V_h. \end{cases} \]

The up-move multiple u, down-move multiple d, and the risk-neutral probability of \( p \) remain unchanged. At every time \( h \) before debt maturity, the value of debt is expressed as

\[ B(V_h) = \min \left\{ cP + e^{-\delta} \left( pB(uV_h) + (1 - p)B(dV_h) \right), \right\} \]

where the ongoing firm value is expressed as

\[ V^m(V_h) = \beta V_h + e^{-\delta} \left( pB(uV_h) + S(uV_h) \right) + (1 - p) \left( B(dV_h) + S(dV_h) \right). \]

The value of shareholders’ equity is expressed as

\[ S(V_h) = \begin{cases} V_h = (1 - \tau)cP + e^{-\delta} \left( pS(uV_h) \right), & \text{no default,} \\ V^m(V_h), & \text{default.} \end{cases} \]

References


