

Original Research Article

Dividend Policy, Personal Taxes and Optimal Capital Structure

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Abstract: This paper puts forward a capital structure model that incorporates the impacts of dividend policy and personal taxes that are commonly ignored by the existing capital structure models. The results show that paying dividends can reduce the tax benefits from issuing debts, which explains why existing capital structure models commonly overestimate leverage ratios. The results further show that as dividend payout increases, leverage ratios and credit spreads increase too. By incorporating the impacts of dividend policy and personal taxes, the capital structure model established in this paper can generate wide range of leverage ratios and credit spreads, which are consistent with what are observed in the real world.

Keywords: Capital Structure; Dividend Policy; Personal Taxes; Credit Spread

JEL Classification: G32, G3

1. Introduction

Tradeoff theory is a major class of theory to study firms' capital structure decisions. In the pioneering work of Modigliani and Miller (*M-M*)^[1,2], they show that the optimal amount of debt is determined by balancing the tax deductions for interest payments against the potential bankruptcy costs for given capital structure decision is independent of investment decision. However, Jensen and Meckling (*J-M*)^[3] point out that equityholders could extract value from debtholders by increasing risky investments. Hence, capital structure decision is not independent of investment decision and the agency costs should be considered in determining capital structures. Subsequently, more efforts have been made to incorporate various agency costs of debt and equity financing into capital structure models (e.g. Myers^[4] and Stulz^[5]). LeLand^[6] proposes a unified framework to encompass elements of both the *M-M* and *J-M* approaches to provide quantitative guidance on the amount and maturity of debt, financial restructuring, and the firm's optimal risk strategy. Nevertheless, he points out that the model is still restricted by assuming exogenous dividend policy. As a matter of fact, in the corporate finance literature, capital structure and dividend decisions are generally investigated separately. However, several empirical studies have shown that these two important corporate policies are linked. For example, Gaver and Gaver^[7] document that growth firms have significantly lower debt/equity ratios and lower dividend yields than no-growth firms. Gul^[8] finds that growth opportunities have significant negative relations with levels of both debt financing and dividend yields based on the observations of Japanese firms. Al-Najjar^[9] shows that capital structure and dividend policy are determined by such common factors as profitability, asset tangibility, market-to-book, and industry classification by examining Jordanian non-financial firms' data. Aggarwal and Kyaw^[10] show that consideration of the interdependence between capital structure and dividend policies could help explain the

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puzzling finding that multinational companies have significantly low debt ratios. More recently, Abbas, Hashmi, and Chishti^[11] explore the determinants of dividend policy and capital structure of manufacturing sector of Pakistan and conclude that dividend policy and capital structure are positively correlated each other.

In this paper, a capital structure model is developed based on the tradeoff theory by considering the relation between the capital structure and dividend decisions. The dividend decision is taken as the tradeoff between the tax consideration and the firm value added by distributing dividend. Thus, given a dividend payout, the tax losses to the firm can be determined. The tax losses represent the minimum value added at a given dividend payout. Allowing the dividend payout rate to vary, the capital structure model established in this paper can predict a reasonable range of leverage and credit spreads that are in line with those observed in practice.

Another problem in the existing capital structure models is incorporation of the effects of taxes. The major challenge is the complexity of the tax code, which could make capital structure models intractable. Hence, in the literature, most capital structure models over-simplify the tax structure, while some models consider the details of the tax code but over-simplify or assume away the stochastic nature of the firm value process, such as Graham^[12]. In the model of this paper, a balance is tried to be stricken between a reasonable tax structure and the tractability of the model. Conventionally, tax advantage of debt is captured by corporate tax rate and the amount of debts a firm borrows, $\tau_c D$, where τ_c is the corporate tax rate and D is the amount of debts. However, this practice completely ignores personal tax effects on capital structure. Miller^[13] argues that personal taxes can eliminate all corporate tax advantage of debts. Gordon and MacKie-Mason^[14] investigate Miller's prediction and estimate that the tax advantage of debts, net of personal tax penalty, increased following the Tax Reform Act of 1986 in which the top tax rate for personal ordinary income is significantly lowered. Givoly *et al.*^[15] find that both corporate and personal tax rates affect capital structure decisions. Graham^[16] reviews the impact of taxes on capital structure and points out the importance of building the impact of personal taxes into capital structure models. However, the major obstacle to incorporate personal taxes into capital structure models is their complexity. In the model of this paper, the authors try to capture the most important features of personal taxes and at the same time to keep model tractability.

First, the authors consider the tax rebates to both equity and debt. Most capital structure models assume that when default occurs, bondholders can recovery a portion of their investments but the shareholders lose everything. However, if shareholders well diversify their investments, they can receive tax deduction by using the capital losses to offset the gains of their other investments. Even though they do not have any gains, they can still receive tax deduction up to \$3,000 per year on their incomes and can carry the losses forward. Similar tax deduction is allowed for bonds too. In other words, when default occurs, there are cash flows (rebates) from government back to investors. Thus, the tax rebate implies that the risk associated with defaultable investments is overestimated if it is ignored. The default events are modeled as a jump process and the tax rebate essentially reduces the jump size. However, the impact of the tax rebates on bonds is not as great as that on equity because bondholders can recover a portion of the bond values after default. Therefore, ignoring the tax rebate results in underestimating the equity value more than the debt value. This is one of the reasons that most of the capital structure models overpredict the optimal leverage. For example, the empirical evidence documented by Hovakimian, Opler, and Titman^[17] suggests when firms either raise or retire significant amounts of new capital, their choices move them toward the target (optimal) capital structures suggested by the static tradeoff models. In general, the actual debt ratios are lower than the target debt ratios.

In the model of this paper, the authors capture the tax rebate and some complicated features related to tax rebate such as tax-losses carry-back or carry-forward without losing the tractability of the model. To do so, it is necessary to consider the difference between income and capital gains taxes. The difference is particularly important for the firms' decision on payout ratio because the dividend is taxed at the income tax rate, while the stock price appreciation that is held by the investors for more than a year is taxed at the capital gains tax. We define the capital gains tax rate as a proportion of the income tax rate $\alpha \tau_d$ where τ_d is the income tax rate and $0 \leq \alpha \leq 1$. The investors also have the choice when to realize their gains or losses. The choice includes delaying their gains and realizing their taxes in the favorable

circumstances. By assuming different values of $\alpha\tau_d$ it is able to simulate the impacts of the capital gains taxes related to tax rebate over different periods. Due to the asymmetry of income and capital gains taxes, it can be predicted that paying dividends affects equity value and, in turn, affects the optimal capital structure of firms.

The findings of Campello^[18] justify the above predictions and he documents that all else being equal, tax effects imply that firm value is negatively related to (1) the portion of payout dedicated to dividends, and (2) dividend taxation relative to capital gains taxation. Analogously, required pretax stock returns increase with dividend payout and with dividend tax rate relative to capital gains tax rate. Ince and Owers^[19] also lend the support to our tax treatment and show when the dividend tax rate exceeds the capital gains tax rate, dividend payout can partially offset value-enhancing effect of leverage. However, when the two rates are close, dividend payout loses its influence on the effect of leverage on firm value. Hence, it is important to incorporate both income and capital gain taxes to capital structure models.

In addition, income taxes consist of federal and state (including local taxes) taxes. Most models ignore the distinction between these different taxes. However, the distinction is important when computing the yield spread of a corporate bond. The yield spread is the difference between the yield of a corporate bond and that of a Treasury bond with the same maturity. Treasury bonds are liable for federal taxes, but not for state taxes, while corporate bonds are liable for both. Hence, neglecting the difference in tax liability between Treasury and state taxes leads to an underestimate of the yield spreads (see Elton, Gruber, and Agrawal^[20]; Liu *et al.*^[21]). The underestimate is especially severe for high quality bonds, of which the tax differential contributes to the most of the yield spreads.

To address the tax issues with the existing capital structure models, the authors model the dynamics of the claim to earnings before interest and taxes (EBIT) as log-normal and EBIT is invariant to changes in capital structure as in Goldstein, Ju, and LeLand^[22]. The major benefit of this kind of modeling is that all of the tax liabilities and tax deductions are naturally related to the components of earnings and all of the taxes can be treated cohesively in one model. Since both equations representing equity and debt values in the model of this paper are non-linear after incorporating our assumptions on the taxes, a simple closed-form expression cannot be obtained. The reason is that the scaling features that allow both equity and debt values to scale up and keep the leverage unchanged do not hold as that in LeLand^[6] and Goldstein, Ju, and LeLand^[22]. The simulation results show that our static model can predict wide ranges of leverage ratios and credit spreads, which are in line with what are observed in practice. By appropriately incorporating the impacts of dividend policy and personal taxes on capital structure decision, the model of this paper improves the predictions of leverage and yield spreads.

The remaining paper is organized as follows: Section 2 derives the capital structure model. Section 3 conducts the simulation based on the derived model. Finally, Section 4 concludes the paper.

2. Derivation of the capital structure model

In this section, the authors derive the capital structure model by incorporating the relation between the dividend and the capital structure policies and capturing the important features of personal taxes. First, as in Goldstein, Ju, and LeLand^[22], the authors specify the payout flow and firm value to follow the dynamic processes:

$$\begin{aligned}d\delta &= \mu\delta dt + \sigma\delta dZ \\dV &= \mu V dt + \sigma V dZ\end{aligned}\tag{1}$$

where δ is the payout flow and V is the firm value, the drift μ and the standard deviation σ are constants, and Z is the standard Brownian motion.

The market value of equity after taxes V_s is given by

$$\begin{aligned}E_s(V_o) &= E_o^Q \left\{ \int_0^{T(V_L)} (1 - \tau_d)(1 - \tau_c)(\delta - C)e^{-rs} ds \right. \\ &\quad \left. + \int_{T(V_L)}^{T(V_B)} (1 - \tau_d)(1 - \tau_c)(\delta - (1 + \tau_L)C)e^{-rs} ds + e^{-rT(V_B)} \alpha\tau_d E_s(V_o) \right\}\end{aligned}\tag{2}$$

where $T(V_L)$ is the stopping time of losing tax shield, where V_L is the firm value below which the firm losses tax shield. $T(V_B)$ is the stopping time of bankruptcy, τ_d is the income tax rate, τ_c is the corporate tax rate, τ_l is the tax rate on interest payment if the firm loses tax shield, $\alpha\tau_d$ is the capital gains tax rate, C is the interest payment, r is the after-tax interest rate, V_B is the firm value at which the firm claims bankruptcy, E_t^Q is the expectation at time t under the risk neutral probability measure Q .

The income tax rate consists of the federal and state components

$$\tau_d = \tau_f + (1 - \tau_f)\tau_s$$

where τ_f is the federal tax rate and τ_s is the state tax rate. The distinction between the federal and state taxes is necessary to determine the credit spread between the corporate bond yield and the Treasury yield. The corporate bond is taxable for both federal and state taxes, while the Treasury bond is only taxable for federal taxes.

The market value of the debt is defined as the sum of the present value of the after-tax interest payments and the present value of the residual value and the tax rebates if the debt defaults, as shown below:

$$D(V_o) = E_o^Q \left\{ \int_0^{T(V_B)} (1 - \tau_d) C e^{-rs} ds + e^{-rT(V_B)} [D_{rec} + \alpha\tau_d (D(V_o) - D_{rec})] \right\} \quad (3)$$

where D_{rec} is the residual value if the debt defaults. Denote ρ as the recovery rate, then

$$D_{rec} = \rho V_B \quad (4)$$

The model reflects the "absolute priority" of debt claims, *i.e.*, if default occurs, bondholders receive all asset value less default costs.

Next, solve the equity value of $E_s(V_o)$ in equation (2) to obtain

$$\begin{aligned} E_s(V_o) &= \frac{(1 - \alpha\tau_d)(1 - \tau_c) E_o^Q \left[\int_0^{T(V_L)} (\delta - C) e^{-rs} ds + \int_{T(V_L)}^{T(V_B)} (\delta - (1 + \tau_L)C) e^{-rs} ds \right]}{1 - E_o^Q (\alpha\tau_d e^{-rT(V_B)})} \\ &= \frac{(1 - \alpha\tau_d)(1 - \tau_c) E_o^Q \left[\int_0^{T(V_L)} \tau_L C e^{-rs} ds + \int_0^{T(V_B)} (\delta - (1 + \tau_L)C) e^{-rs} ds \right]}{1 - E_o^Q (\alpha\tau_d e^{-rT(V_B)})} \end{aligned} \quad (5)$$

Note that $\delta = (r - \mu)V$ and $f = E_t^Q \left[\int_0^{T(V_B)} \delta e^{-rs} ds \right]$ are the solutions of the differential equation

$$\mu V f_V + \frac{\sigma^2}{2} V^2 f_{VV} + p = r f \quad (6)$$

where p is the payout flow (Goldstein, Ju, and LeLand^[22]) and $p = (r - \mu)V$ in this particular case. The boundary conditions are

$$\begin{aligned} f &< \infty \text{ as } V \rightarrow \infty \\ f &= 0 \text{ as } V \rightarrow V_B \end{aligned}$$

The solution of equation (6) is given by

$$E_o^Q \left[\int_0^{T(V_B)} \delta e^{-rs} ds \right] = V + A_1 V^x + A_2 V^y$$

where

$$x = -\frac{1}{\sigma^2} \left[\sqrt{\left(\mu - \frac{\sigma^2}{2}\right)^2 + 2r\sigma^2} + \left(\mu - \frac{\sigma^2}{2}\right) \right]$$

$$y = \frac{1}{\sigma^2} \left[\sqrt{\left(\mu - \frac{\sigma^2}{2}\right)^2 + 2r\sigma^2} - \left(\mu - \frac{\sigma^2}{2}\right) \right]$$

Apply the boundary conditions to yield $A_2 = 0$ and $A_1 = -V_B^{-x+1}$. Then

$$E_o^Q \left[\int_0^{T(V_B)} \delta e^{-rs} ds \right] = V - V_B \left(\frac{V}{V_B} \right)^x$$

$g = E_t^Q \left\{ \int_0^{T(V_B)} C e^{-rs} ds \right\}$ satisfies equation (6) with $p = C$ and the boundary conditions

$$g = \frac{C}{r} \text{ as } V \rightarrow \infty$$

$$g = 0 \text{ as } V \rightarrow V_B$$

Apply the boundary conditions to yield $A_2 = 0$ and $A_1 = -\frac{C}{r} V_B^{-x}$. Then

$$E_o^Q \left[\int_0^{T(V_B)} C e^{-rs} ds \right] = \frac{C}{r} \left[1 - \left(\frac{V}{V_B} \right)^x \right]$$

$E_o^Q (e^{-rT(V_B)})$ satisfies equation (6) with $p = 0$ and the boundary conditions

$$f = 0 \text{ as } V \rightarrow \infty$$

$$f = 1 \text{ as } V \rightarrow V_B$$

Apply the boundary conditions to yield $A_2 = 0$ and $A_1 = V_B^{-x}$. Then

$$E_o^Q (e^{-rT(V_B)}) = \left(\frac{V}{V_B} \right)^x$$

$$E_s(V_o) = \frac{(1-\tau_d)(1-\tau_c) \left\{ \frac{\tau_L C}{r} \left[1 - \left(\frac{V}{V_L} \right)^x \right] + \left[V - V_B \left(\frac{V}{V_B} \right)^x \right] - \frac{(1+\tau_L)C}{r} \left[1 - \left(\frac{V}{V_B} \right)^x \right] \right\}}{1 - \alpha\tau_c \left(\frac{V}{V_B} \right)^x}$$

$$= \frac{(1-\tau_d)(1-\tau_c) \left[\left(V - \frac{C}{r} \right) - \frac{\tau_L C}{r} \left(\frac{V}{V_L} \right)^x + \left(\frac{(1+\tau_L)C}{r} - V_B \right) \left(\frac{V}{V_B} \right)^x \right]}{1 - \alpha\tau_c \left(\frac{V}{V_B} \right)^x}$$

(7)

Third, solve the debt value of $D(V_o)$ in equation (3) to obtain

$$D(V_o) = \frac{E_o^Q \left\{ \int_0^{T(V_B)} (1-\tau_d) C e^{-rs} ds + (1-\alpha\tau_d) e^{-rT(V_B)} \rho V_B \right\}}{1 - E_o^Q [\alpha\tau_d e^{-rT(V_B)}]}$$

and the boundary conditions for $D(V_o)$ are:

$$D(V_o) = (1-\tau_d) \frac{C}{r} \text{ as } V \rightarrow \infty$$

$$D(V_0) = \rho V_B \text{ as } V \rightarrow V_B$$

Using the boundary conditions we have $D(V_0)$ as

$$\begin{aligned} D(V_0) &= \frac{(1-\tau_d)\frac{C}{r}\left[1-\left(\frac{V}{V_B}\right)^x\right] + (1-\alpha\tau_d)\left(\frac{V}{V_B}\right)^x \rho V_B}{1-\alpha\tau_d\left(\frac{V}{V_B}\right)^x} \\ &= \frac{(1-\tau_d)\frac{C}{r} + \left[(1-\alpha\tau_d)\rho V_B - (1-\tau_d)\frac{C}{r}\right]\left(\frac{V}{V_B}\right)^x}{1-\alpha\tau_d\left(\frac{V}{V_B}\right)^x} \end{aligned} \quad (8)$$

Equation (8) shows that, as the firm value V becomes large, the value of debt approaches the value of risk-free debt. V_B is the level of asset value at which bankruptcy is declared. If bankruptcy occurs, a fraction of the bankruptcy value ρV_B , $0 \leq \rho \leq 1$, will be left to debtholders.

The optimal default boundary is determined as follows:

$$\begin{aligned} \frac{\partial V_s}{\partial V} \Big|_{V=V_B} &= 0 \\ V_B &= \frac{x}{x-1} \frac{C}{r} \end{aligned}$$

To determine the firm leverage, or equivalently the total coupon payments, the objective of management is to maximize the firm market-value after issuing debt, *i.e.*

$$\max_C E(V_0) + (1-q)D(V_0)$$

where q is the percentage of the expenses associated with issuing debt. The maximization is solved numerically and discussed in the following section.

3. Simulations of the capital structure model

In this section, simulation is performed based on the capital structure model to investigate how dividend payout and personal taxes affect a firm's capital structure policy and credit spread of bonds. First set the base case parameters as follows: corporate tax rate $\tau_c = 0.35$, federal tax rate $\tau_f = 0.30$, state tax rate $\tau_s = 0.07$, tax rate on interest payment $\tau_i = 0.35$, discount rate $r = 0.045$, volatility of the change of the firm value $\sigma = 0.25$, the proposition of the tax rate for the tax rebate relative to the income tax rate $\alpha = 0.4$, and the percentage of the expenses associated with issuing debt $q = 0.01$. Following Goldstein, Ju, and LeLand^[22], it is assumed that a firm will begin to lose tax benefit when firm value falls to seventeen times more than the interest payments, *i.e.* $V_L = 17C$.

Next, it is known that the investors pay income taxes on interest and dividend payments and capital gains taxes on price appreciations. The capital gains taxes are generally lower than the income taxes. In U.S. history, several tax laws specifically set the relationship between the capital gains taxes and income taxes. In the authors' simulation, they follow Green and Odegaard^[23] to set the capital gains tax rate as 40 percent of the income tax rate, *i.e.* $\alpha = 0.4$ ¹. Moreover, investors have the timing options to realize their capital gains taxes and they are more likely to exercise the timing option when the capital gains tax rates are low.

As shown in the model of this paper, paying dividends can reduce tax benefits gained from issuing debts, resulting in lower firm value. The decreased amount of firm value due to paying dividends is dividend cost, which mainly comes from the personal tax penalty. In turn, dividends and personal taxes have impacts on leverage ratios and credit spread.

¹ The relation reflects the percentage of the capital gains tax rate relative to the income tax rate for 1978-86.

Therefore, it is first simulated as dividend payout rate changes, how dividend cost and firm value changes. **Figure 1** demonstrates the simulation results. The dashed line represents the value of the firm that has no debt and pays no dividend, which is the baseline. The dashed-dotted line represents the value of the firm that pays no dividend but optimizes its capital structure. In this case, the firm value is higher than that of the baseline due to the tax benefits from issuing debts. Comparing the two lines, it can be seen that issuing debts increases firm value by about 4 percent. However, if the firm pays dividends, dividend cost will incur due to personal tax penalty. The solid line represents the value of the firm that pays dividend and optimizes its capital structure. As dividend payout rate increases, firm value decreases, which is consistent with the finding of Campello^[18]. This implies that dividend cost increases with dividend payout rate. The optimal choice to a firm to pay dividend is only if the tax benefit is greater than the dividend cost. As shown in the Figure, at 30 percent of the dividend payout rate, the tax benefit of issuing debts is almost offset by the dividend cost. If the firm further increases dividend payout rate, the firm value will fall below the value of an all equity firm (baseline) due to the dividend cost exceeds the tax benefits. The result shows that the dividend cost reduces the tax benefits gained from issuing debts and thereby reduce the value of the firm. Not surprisingly, the dash-double-dotted line shows that if an all equity firm pays out dividend at the same payout rate, the firm value would fall even further from the baseline.

The results in **Figure 1** suggest that if a capital structure model ignores the impact of dividend payout and personal taxes, the model will overpredict the tax benefits from issuing debts, and in turn, overpredict the optimal leverage ratio. This is one of the major problems with the existing capital structure models. Specifically speaking, the problem is overlooking the issues related to the capital gain taxes and the timing options that investors can decide when they will realize capital gains. Comparing an all equity firm that pays no dividend to its counterpart that pays no dividend but optimizes its capital structure, the gains in firm value is attributed to the difference between the taxes on equity $(1 - \alpha\tau_d)(1 - \tau_c)$ and the tax on debt $(1 - \tau_d)$ for the amount of equity replaced by debt. Comparing an all equity firm that pays out 100 percent of earnings as dividend to its counterpart that optimizes its capital structure and pays out 100 percent of earnings after interests as dividend, the gains in firm value are attributed to the difference between the taxes on equity $(1 - \tau_d)(1 - \tau_c)$ and the tax on debt $(1 - \tau_d)$ for the amount of equity replaced by debt. The comparison shows that the latter case has larger tax benefit of optimizing capital structure, and if dividend is ignored, the equity value and the leverage are overestimated. Put another way, assuming that earnings are taxed at income tax rate (equivalent to 100 percent dividend payout rate), the tax benefit of issuing debt is much larger than that of the earnings that are taxed at capital gain tax rate (equivalent to no dividend case). The capital structure models that ignore dividend and some other models that consider the personal taxes but do not differentiate the income taxes from the capital gains taxes can overestimate the tax benefits from issuing debts and thereby overestimate the optimal leverage ratios. The authors' results are supported by the empirical evidence documented by Ince and Owers^[19] that dividend payout can reduce the positive effect of leverage on firm value under the 1979-1981 and 1993-2002 tax regimes with income tax rate significantly different from the tax rate on capital gains.

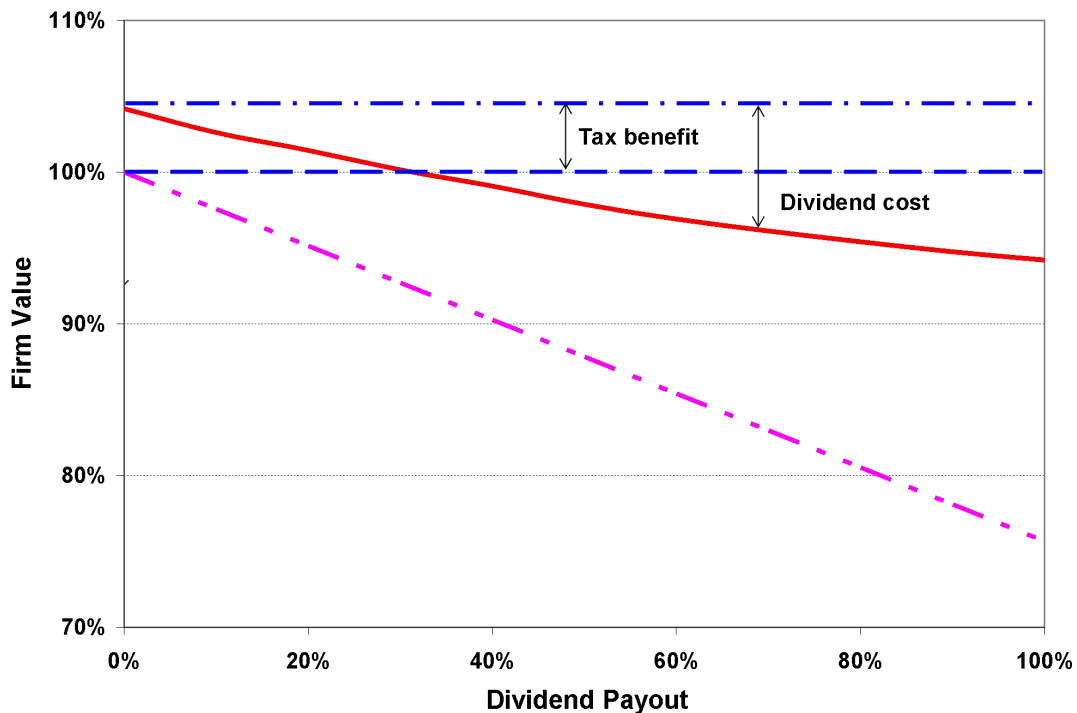


Figure 1. The relation between firm value and dividend payout rate.

This figure shows how firm value and dividend cost change as dividend payout rate changes. The dashed line represents the value of the firm that has no debt and pays no dividend. The dashed-dotted line represents the value of the firm that pays no dividend but optimizes its capital structure. The solid line represents the value of the firm that pays dividend and optimizes its capital structure. The dash-double-dotted line represents the value of the firm that has no debt but pays dividend.

To further investigate the effects of dividend payout rates on the optimal capital structure, the authors simulate how leverage ratios and credit spread change as dividend payout changes based on equations (7) and (8). The authors also examine as dividend payout changes, how default boundary, dividend cost, and tax benefit change. The results in **Table 1** show that dividend policy has significant impact on capital structure. As dividend payout increases from 0 to 100 percent of earnings, leverage ratio increases from 0.28 to 0.793. The finding is consistent with the empirical results reported by Ince and Owers^[19]. They computed the correlation between debt ratio and dividend payout ratio for the firms that make up the S&P 1500 Composite Index over 1979-2002. The correlation is strong at 81.9 percent under 1979-1987 and 1993-2002 tax regimes, but is weak under 1988-1992 tax regime. The former two tax regimes have substantially different income tax rate and tax rate on capital gains. However, the latter tax regime has similar income tax rate and tax rate on capital gains. Since the simulation assumes that the tax rate on capital gains is 40 percent of the income tax rate, it is not surprising that the results show the positive correlation between dividend payout and leverage ratio. In addition, the predicted capital structures of this paper comply with the actual capital structures documented in the empirical studies. For example, Bradley, Jarrell, and Kim^[24] document that the average debt to firm value varies from about 9 percent for drugs and cosmetics industry to 58 percent for airlines industry over the sample period of 1962-1981. Fama and French^[25] estimate that the target dividend payout ratio is 0.46 over the sample period of 1965-1999. The authors' results show that with the dividend payout ratio of 0.5, the predicted leverage ratio is 55.3 percent.

The results also show as leverage ratio increases, default boundary increases from 0.098 to 0.308 and the credit spread increases from 125 basis points to 289 basis points. As expected, as dividend payout ratio increases, dividend cost increases and thereby tax benefits from issuing debts decrease. If payout rate is greater than 30 percent, tax benefits

from issuing debts become negative. The simulation results suggest that the capital structure model of this paper that incorporates the impact of dividend policy and personal taxes can generate relatively wide range of leverage and corresponding credit spread. The pattern is consistent with what is observed in practice. For example, Elton *et al.*^[20] document that the average credit spreads for AA rated bonds to BBB rated bonds for financial sector range from 58.6 to 133.7 basis points for 2 to 10 year maturities and that for industrial sector bonds range from 41.4 to 118 basis points over the sample period of 1987-1996. Eom, Helwege, and Hung^[26] report that the average yield spread for different rating bonds has wide range based on the sample over the period of 1986 to 1997. The mean is 93.53 basis points, the standard deviation is 84.75 basis points, the minimum is 22.13 basis points, and the maximum is 555.6 basis points. The simulated credit spreads are within about two standard deviations of their reported mean credit spreads.

Dividend payout	Coupon	Default boundary	Leverage	Credit spread	Dividend cost	Tax benefit
0	0.013	0.098	0.280	125	0.000	0.042
0.1	0.015	0.108	0.332	135	0.016	0.026
0.2	0.018	0.136	0.387	153	0.027	0.014
0.3	0.020	0.157	0.441	168	0.040	0.002
0.4	0.228	0.176	0.496	183	0.051	-0.009
0.5	0.025	0.182	0.553	192	0.063	-0.021
0.6	0.028	0.228	0.597	219	0.070	-0.028
0.7	0.031	0.238	0.653	232	0.079	-0.037
0.8	0.034	0.246	0.710	243	0.088	-0.046
0.9	0.037	0.269	0.759	262	0.094	-0.053
1	0.039	0.308	0.793	289	0.010	-0.058

Table 1. The simulated results for the relation between dividend payout rate and leverage, credit spread and other variables

This table reports the simulation results that as dividend payout rate changes, how leverage, credit spread, coupon, default boundary, dividend cost and tax benefit change.

4. Conclusion

Ignoring the impacts of dividend policy and personal taxes on capital structure policy is one of the issues related to the existing capital structure models. The issue causes the existing capital structure models to overestimate optimal leverage ratios due to overestimate tax benefits from issuing debts. This paper proposes a capital structure model to incorporate the impacts of dividend payout ratio and personal taxes. The results show that dividend cost will incur if a firm pays dividends, which will reduce tax benefits from issuing debts. The estimated leverage ratios should be lower after taking into account the impacts of dividend policy and personal taxes. Thus, the model of this paper provides explanation to the overestimation of leverage ratios by the existing capital structure models.

In addition, the simulation results directly show how dividend payout ratio affects leverage and credit spreads. As dividend payout increases, leverage ratios and credit spreads increase too. The range of the leverage ratios and credit spreads is widened, which is consistent to what are observed in the real world. Therefore, this paper contributes to the extensive capital structure literature by fitting together two important problems related to the existing capital structure models.

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