

# The Corporate Effects of Personal Taxation

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## Abstract

*Under fairly general conditions it is shown that changes in personal tax rates on dividend and capital gains income will change a firm's share price, cost of equity capital and the shape of its cost of equity capital function. A personal tax rate change will also affect a firm's optimal capital structure and its WACC. In 2003, the personal tax rates of dividend and capital gains income were lowered for many tax payers. The model presented here predicts that the effects of the 2003 tax cuts should include a rise share prices, an increase in the amount of equity capital in firm's capital structures and a significant increase in the number of firms increasing or initiating dividend payments. Various empirical analyses cited in this study show that all of these things did occur.*

**Keywords:** Tax, Dividend, equity capital, weighted average cost of capital (WACC)

Since at least Modigliani and Miller (1958, 1963) it has been recognized that the corporate tax deductibility of interest payments can affect firm value and capital structure. First, M&M showed that in an environment of perfect and frictionless markets, risk-free debt and no personal or corporate income taxes firm value would be unaffected by the amount of debt in its capital structure and, therefore, capital structure would be irrelevant. If corporate income taxes were allowed then firm value would be directly related to the amount of debt in the firm's capital structure and the firm's optimal capital structure would be 100% debt (or as close to it as lenders would allow). In an extension of his original work, Miller (1977) allowed for the existence of personal income taxes on interest and shareholder income as well for taxes on corporate income. Initially, Miller showed that depending on the tax rates on each of the three types of income, firm value could increase, decrease or remain unchanged as the amount of debt in the firm's capital structure increased. Therefore, a firm's optimal capital structure could be 100% debt, 0% debt or there would be no optimal capital structure. Miller went on to show when the debt markets were in equilibrium there would be no relationship between debt capital financing and firm value. That is, firms had no optimal capital structure. Although of great value, the above theories did not satisfactorily explain the distribution of actual capital structures observed in the market. For example, many firms have debt in their capital structures but few firms have debt ratios that approach 100% nor are capital structures evenly distributed between 0% and 100% as implied by capital structure irrelevance. Another short coming of Miller's model was that it did not allow different tax rates on dividend and capital gains income even though that is the usual circumstance.

Nevertheless, personal income tax rates do seem to affect security prices and firm behavior. For example, Elton and Gruber (1970) showed that the ex-dividend day price adjustment of a firm's common shares is related to the implied marginal dividend and capital gains income tax rates of the firm's shareholders. Additionally, a number of studies have found that the 2003 cut in tax rates on dividend and capital gains income affected firm capital structures, stock prices and dividend payments. Fosberg (2010) found that firms increased the amount of equity in their capital structures by approximately 6% by the end of 2004 and maintained those capital structures through at least the end of 2006. The major events in the passage of the 2003 tax cuts were found to generate higher abnormal returns for firms with higher dividend payouts while firms that did not pay dividends had higher abnormal returns than dividend payers (Auerbach and Hassett (2005,2006) and Gadarowski, Meric, Welsh and Meric (2007)). Additionally, the number of firms initiating and raising dividends increased significantly following the passage of the tax cuts (Brown, Liang and Weisbrenner (2007), Chetty and Saez (2005) and Julio and Ikenberry (2004)). Chetty and Saez found that the percentage of firms paying dividends increased from 20% to 25% with total dividend payments increasing by \$5 billion (20%). Share ownership by various groups was shown to be a significant determinant of which firms raised or initiated firms. Share ownership by executives, individuals and taxable institutional shareholders were shown to be positively correlated with the probability that a firm would increase or initiate dividends. Contradictory results were obtained for the effect of share ownership by tax-exempt institutions on the probability of a dividend increase or initiation (Brown, Liang and Weisbrenner (2007) and Chetty and Saez (2005)). Firms with a large independent shareholder on the board were also more likely to initiate dividends while having a large outside shareholder not on the board of directors had no effect on firm dividend payments (Chetty and Saez (2005)). Additionally, the probability of a dividend increase or initiation was shown to be inversely related to executive stock option ownership (Brown, Liang and Weisbrenner (2007), Chetty and Saez (2005)).

In this study, I seek to extend the work of Modigliani and Miller by developing a model of firm capital structure that allows for risky debt and different personal income tax rates on dividend and capital gains income. The model predicts that decreases in the personal income tax rates on dividend and/or capital gains income will raise share prices, lower the firm's cost of equity capital and increase (reduce) the amount of equity (debt) in the firm's capital structure. Personal income tax rate increases on dividend and/or capital gains income will have the opposite effects. The predictions of this model are consistent with the findings of Fosberg (2010) that the 2003 cuts in the personal tax rates on dividend and capital gains income resulted in an increase in the amount of equity capital in firm's capital structures.

### **Share Prices and the Cost of Equity Capital**

The basic assumptions of the model are as follows. Except as noted below, capital markets are assumed to be perfect and frictionless. Prior to period 0 a company makes its capital investment, financing and dividend decisions and these plans will not be affected by any tax rate changes on personal or corporate income between periods 0 and 1. The current market price of the firm's shares is  $P_0$  and the expected price at period 1 is  $P_1$ . The firm finances its investments in accordance with its optimal capital structure. The optimal capital structure is assumed to be the capital structure that minimizes the firm's weighted average cost of capital (WACC). At period 1 the company will pay a dividend. The expected dividend payment is  $D$  and will be paid out of cash-on-hand. Investors in the firm's shares will pay a constant marginal tax rate of  $t_d$  on dividend income and a constant marginal tax rate of  $t_c$  on capital gains income. The corporate tax rate and the personal tax rate on interest income are assumed to remain unchanged between 0 and 1. Assuming the marginal investor is not tax-exempt, the shares will be priced so that shareholders' actual after-tax return,  $[D(1 - t_d) + C(1 - t_c)]/P_0$ , generates for them their required after-tax return ( $r$ ). The variable  $C$  is the expected capital gains income ( $P_1 - P_0$ ) accruing to each share. It is assumed that both the expected dividend and capital gain are positive, that is, part of an investor's return comes from dividend income and part

comes from capital gains income. In equation form, the shares will be priced so that the following equation holds.

$$r = \frac{D(1-t_d)+C(1-t_c)}{P_0} \quad (1)$$

The firm's cost of equity capital ( $r_e$ ), also investors' before-tax return, is then

$$r_e = \frac{D+C}{P_0} \quad (2)$$

Solving equation 1 for  $P_0$  and then substituting for  $P_0$  into 2 yields an alternate formulation of  $r_e$ ,

$$r_e = \frac{(D+C)}{C(1-t_c)+D(1-t_d)} \cdot r \quad (3)$$

Equation 3 shows that the firm's cost of equity capital depends on investors' after-tax required return, the tax rates on dividend and capital gains income, and the amount of the dividend and capital gains income the shares will generate. Equivalently, equation 3 indicates how much the firm's cost of equity capital (investors' before-tax return) will be "grossed up" in response to the personal tax rates on dividend and capital gains income.

Now assume that immediately after period 0 the government changes the personal tax rates on dividend and capital gains income. The new tax rates will be denoted  $t_{dn}$  and  $t_{cn}$ , respectively. The  $n$  subscript will be used to indicate the new value of a variable, i.e., the value of the variable after the tax rate change occurs. Since a change in tax rates will change the expected after-tax cash flow received by shareholders, the price of the firm's shares must adjust to the tax rate changes in order to deliver to shareholders their required after-tax return. The new share price will be denoted  $P_n$ . Adjusting equation 1 for the tax rate and share price changes (and ignoring the effect of the tax rate changes on  $P_1$ ) yields a new (after the tax rate change) equation for shareholders' required return,

$$r = \frac{D(1-t_{dn})+C(1-t_{cn})}{P_n} \quad (4)$$

However, changing the personal tax rates of dividend and capital gains income does not change either the operating or financial risk of the firm, therefore, shareholders' after-tax required return ( $r$ ) is unchanged. This implies that the right-hand side of equations 1 and 4 must be equal. Setting the right-hand side of 1 equal to the right-hand side of 4 and solving for  $P_n$  yields

$$P_n = \frac{D(1-t_{dn})+C(1-t_{cn})}{D(1-t_d)+C(1-t_c)} \cdot P_0 = \lambda P_0 \quad (5)$$

The ratio on the right-hand side of equation 5 measures the expected after-tax cash flow to shareholders with the new tax rates divided by the expected after-tax cash flow to shareholders under the initial tax rates. This ratio, represented by  $\lambda$ , is the cash flow multiplier associated with the tax change. That is, it measures the change in the after-tax cash flows to shareholders caused by a change in personal income tax rates. For example, a decrease in either the tax rate on dividend or capital gains income (assuming the other remains constant) will result in a  $\lambda > 1$  and cause an increase in the after-tax cash flows to shareholders. Conversely, an increase in either personal tax rate will cause  $\lambda < 1$  and make the after-tax cash flows to shareholders smaller. Lambda is also the share price multiplier associated with a tax change. That is, if tax rates change, the new price of a firm's shares ( $P_n$ ) will be  $\lambda$  times the old price ( $P_0$ ) of a share. Although  $\lambda$  can range between zero and  $\infty$ , it will generally not be a great distance from one.

The proportional change in the price of a firm's shares ( $\Delta P$ ) caused by the tax rate change is

$$\Delta P = \frac{P_n - P_0}{P_0}.$$

After substituting  $\lambda P_0$  for  $P_n$  the formula for  $\Delta P$  becomes

$$\Delta P = \frac{\lambda P_0 - P_0}{P_0} = \lambda - 1.$$

That is, any personal tax rate change on dividend and/or capital gains income will generate a change in share price of  $\lambda - 1$  percent (in decimal form). After the tax rate change the firm's stock price adjusts to  $P_n$  and the firm's new cost of equity capital ( $r_{en}$ ) becomes

$$r_{en} = \frac{D + C}{P_n} = \lambda^{-1} r_e. \tag{6}$$

Substituting  $\lambda P_0$  for  $P_n$  and  $r_e$  for  $(D + C) / P_0$  on the right-hand side of equation 6 yields a new right-hand side of  $\lambda^{-1} r_e$ . Thus, the new cost of equity capital for the firm is proportional to the reciprocal of  $\lambda$ . Consequently, if the government lowers one or both of the personal tax rates,  $\lambda^{-1}$  will be less than one. Thus, a tax decrease will lower the firm's cost of equity capital, i.e., shift the cost of equity capital function down. Conversely, a personal tax increase will raise the firm's cost of equity capital. In sum, a decrease (increase) in the personal tax rate on dividend and/or capital gains income will cause firm share prices to rise (fall) and the cost of equity capital to fall (rise). Further, a change in tax rates will also affect the shape of the cost of equity capital function. Remembering that the new cost of equity capital function is  $r_{en} = \lambda^{-1} r_e$ , its first derivative is then  $r'_{en} = \lambda^{-1} r'_e$ . Since  $\lambda^{-1}$  is less than one for a tax cut,  $r'_{en}$  is less than  $r'_e$  if there is a tax cut. The opposite occurs when tax rates are raised. Consequently, a tax cut flattens out the cost of equity capital function while a tax increase steepens it. In sum, a tax change will shift both the position and shape of the cost of equity capital function.

To ascertain the relationship between the size of a firm's dividend payment and the firm's share price reaction to a tax rate change you must differentiate  $\lambda$  with respect to  $D$ . It is assumed that the derivative of  $C$  with respect to  $D$  is negative one. That is, dividends are paid out of cash-on-hand and, therefore, every dollar of dividends paid out reduces the expected sale price of a share ( $P_1$ ) and the expected capital gain ( $C$ ) by one dollar. This derivative ( $\lambda'$ ) is

$$\lambda' = \frac{[t_{cn} - t_{dn}][C(1 - t_c) + D(1 - t_d)] + [t_d - t_c][C(1 - t_{cn}) + D(1 - t_{dn})]}{[C(1 - t_c) + D(1 - t_d)]^2}.$$

Since the denominator will always be positive the sign of the derivative will be determined by the sign of the numerator. Under previous assumptions, the two terms in brackets in the numerator that contain  $C$  and  $D$  will always be positive and, therefore, the sign of the numerator will be determined by the signs of the two bracketed terms involving tax rate differences and the magnitudes of the other terms in the numerator. Since the terms with the tax rate differences can be either positive or negative, the sign of  $\lambda'$  is generally indeterminate. As a specific case, let's investigate the effect of the 2003 tax cuts on the sign of  $\lambda'$ . Prior to the tax cuts,  $t_d$  was greater than  $t_c$  for individuals in the top four tax brackets. After the tax cuts, the capital gains tax rate was made equal to the dividend income tax rate for individuals in the top four brackets (and the bottom two brackets as well). Consequently,  $t_{cn} - t_{dn}$  is zero and  $t_d - t_c$  is positive. This makes the sign of the numerator of  $\lambda'$  and of  $\lambda'$  itself both positive. This indicates that if the marginal investor is in one of the top four personal tax brackets, the higher the dividend payment that a firm made the greater the share price appreciation the firm should have experienced with the passage of the 2003 tax cuts. Consistent with this prediction, studies of share price performance around the adoption of the 2003 tax cuts by Auerbach and Hassett (2005, 2006) and Gadarowski, Meric, Welsh and Meric (2007) found that the higher a firm's dividend payment the greater the abnormal returns the firm's shares experienced. Another implication of a positive  $\lambda'$  is that a firm can lower its cost of equity capital even more following a tax cut by increasing its dividend payment. This provides a possible explanation for the significant increase in the number

of firms increasing or initiating dividend payments following the 2003 tax cuts noted by Brown, Liang and Weisbrenner (2007), Chetty and Saez (2005) and Julio and Ikenberry (2004).

### Optimal Capital Structure

Next, the effect of a personal tax rate change on a firm's WACC and capital structure are investigated. Let  $W_d$  represent the proportion of the firm's investments that will be financed with debt capital (where  $0 \leq W_d < 1$ ) and  $W_e$  be the proportion that will be financed with equity capital (where  $0 < W_e \leq 1$ ). The firm's after-tax cost of debt capital ( $r_i$ ) is equal to the firm's before-tax cost of debt capital ( $r_d$ ) multiplied by one minus the firm's marginal corporate income tax rate. The firm's cost of debt and equity capital are both functions of  $W_d$ , that is  $r_i = f(W_d)$  and  $r_e = g(W_d)$ . It is assumed that both cost of capital functions are twice continuously differentiable. Additionally, since increasing the amount of debt in the firm's capital structure increases the risk of both the firm's debt and equity, the first derivatives of both cost of capital functions are assumed to be positive ( $r_i' > 0$  and  $r_e' > 0$ ). It is also assumed that the second derivatives of  $r_i$  and  $r_e$  are also positive ( $r_i'' > 0$  and  $r_e'' > 0$ ). The assumptions about the first and second derivatives imply that both cost of capital functions are upward sloping, convex functions similar to those depicted on page 631 of Brigham and Ehrhardt (2008). The firm's WACC is calculated as  $W_d r_i + W_e r_e$  subject to the constraint that  $W_d + W_e = 1$ . The constraint can be incorporated into the WACC equation by rearranging the constraint to yield  $W_e = 1 - W_d$  and substituting for  $W_e$  in the WACC thus yielding

$$WACC = W_d r_i + (1 - W_d) r_e .$$

Before the tax rate change, the firm begins the process of finding its optimal capital structure by differentiating the WACC equation with respect to  $W_d$  and setting the derivative (WACC') equal to zero. Doing so yields the following first order condition

$$WACC' = r_i + W_d r_i' + r_e' - r_e - W_d r_e' = 0 \tag{7}$$

or rearranging terms the first order condition becomes

$$r_e - r_i = W_d r_i' + (1 - W_d) r_e' . \tag{8}$$

Since equity has a lower priority claim on the assets of the firm than debt, the equity of the firm is inherently more risky than the firm's debt and, therefore, the firm's cost of equity capital must be greater than its before and after-tax cost of debt capital ( $r_e > r_d > r_i$ ) for any level of debt. Therefore, when a firm increases the amount of debt in its capital structure it is substituting cheap debt capital financing for more expensive equity capital financing. The cost of the equity capital being replaced less the cost of the debt financing being added ( $r_e - r_i$ ) represents the savings to the firm of substituting one dollar of debt capital financing for an equal amount of equity capital financing. This will be termed the substitution effect of adding additional debt to the firm's capital structure. There is also another effect associated with increasing the amount of debt in the firm's capital structure; it also increases the risk of both the firm's debt and equity securities. The cost of both the firm's debt and equity capital will consequently increase. The change in the cost of the firm's debt capital financing caused by employing one additional dollar of debt capital financing is equal to the marginal cost of debt capital ( $r_i'$ ) multiplied by the amount of debt in the firm's capital structure ( $W_d$ ). This is the first term on the right-hand side of equation 8. The change in the cost of the firm's equity capital financing caused by employing an additional dollar of debt in the firm's capital structure is the marginal cost of equity capital ( $r_e'$ ) multiplied by the amount of equity in the firm's capital structure ( $1 - W_d$ ). This is the second term on the right-hand side of equation 8. The sum of the two terms on the right-hand side of equation 8, thus represents the increase in the firm's WACC associated with the increase in risk caused by adding more debt to the firm's capital structure. This will be termed the risk effect of adding additional debt to the firm's capital structure. Equation 8 indicates that a firm

reaches its optimal capital structure when the marginal benefit of adding more debt to the firm's capital structure (the substitution effect) equals the marginal cost (the risk effect). Assuming the second order conditions for a minimum are satisfied, solving the first order condition for W yields the firm's optimal capital structure. As previously noted, the firm's current WACC (before any tax change) is

$$WACC = W_d r_i + (1 - W_d) r_e . \quad (9)$$

After a tax change, assuming no change in capital structure, the firm's new WACC ( $WACC_n$ ) becomes

$$WACC_n = W_d r_i + (1 - W_d) r_{en} . \quad (10)$$

Since the personal tax rate on interest income has not changed, the after-tax cost of debt capital ( $r_i$ ) is unchanged. Substituting  $\lambda^{-1} r_e$  for  $r_{en}$  yields

$$WACC_n = W_d r_i + (1 - W_d) \lambda^{-1} r_e . \quad (11)$$

Subtracting equation 9 from 11 yields the change in WACC ( $\Delta WACC$ ) caused by a personal tax rate change if the firm maintains its current optimal capital structure.

$$\Delta WACC = -(1 - W_d) r_e (1 - \lambda^{-1}) . \quad (12)$$

Since the first two terms on the right-hand side of equation 12 ( $1 - W$  and  $r_e$ ) are positive, the sign of 12 is determined by  $(1 - \lambda^{-1})$ . If there is a tax cut then  $\lambda^{-1}$  will be less than one and the sign of equation 12 will be negative. That is, a tax cut will lower a firm's WACC, even if it maintains its current capital structure. Conversely, a tax increase will cause  $\lambda^{-1}$  to be greater than one, resulting in an increase in the firm's WACC. The above conclusions remain valid even if the firm is not at its optimal capital structure. If a change in tax rates causes a firm to shift its capital structure, the change in the firm's WACC will be different from that shown in equation 12.

The new first order condition (based on equation 10) is then

$$WACC_n' = r_i + W_d r_i' + r_{en}' - r_{en} - W_d r_{en}' = 0$$

Substituting  $\lambda^{-1} r_e$  for  $r_{en}$  and  $\lambda^{-1} r_e'$  for  $r_{en}'$  and factoring out  $\lambda^{-1}$  the new first order condition becomes

$$WACC_n' = r_i + W_d r_i' + \lambda^{-1} (r_e' - r_e - W_d r_e') = 0 . \quad (13)$$

To ascertain the effect of a change in personal tax rates on the firm's optimal capital structure you need to look at the individual terms in the first order conditions. Looking at the first order condition before the tax change (equation 7), the components of the first two terms ( $r_i$ ,  $W_d$  and  $r_i'$ ) are all positive (assuming  $W_d \neq 0$ ). Therefore, the sum of the first two terms must be positive, and consequently, the sum of the last three terms must be negative. Moving to the post tax change first order condition (equation 13), the only difference between the before and after tax first order conditions is that the last three terms in the latter case are multiplied by  $\lambda^{-1}$ . If there is a tax cut then  $\lambda^{-1} < 1$  and the product of  $\lambda^{-1}$  times  $(r_e' - r_e - W_d r_e')$  will be smaller (in absolute value) than it was before the tax cut. Therefore, for the after-tax first order condition to hold, the sum of the first two terms must get smaller as well. This will only happen when  $W_d$  declines, because as  $W_d$  declines the values of the other two variables will decline as well. Specifically, as the amount of debt in a firm's capital structure declines the risk of the firm's debt will fall and, therefore, so must  $r_i$ . Additionally, because it has been assumed that  $r_i'' > 0$ ,  $r_i'$  must fall as  $W_d$  declines. Therefore, the sum of the first two terms must also decline. Consequently, a reduction (increase) in personal income taxes on dividend and/or capital gains income will result in a reduction (increase) in the amount of debt (equity) in the firm's optimal capital structure. Conversely, an increase in personal income tax rates on dividend and/or capital

gains income will result in an increase (reduction) in the amount of debt (equity) in the firm's optimal capital structure.

### Conclusion

Under fairly general conditions it is shown that changes in personal tax rates on dividend and capital gains income will change a firm's share price, cost of equity capital and the shape of its cost of equity capital function. A personal tax rate change will also affect a firm's optimal capital structure and its WACC. In 2003, the personal tax rates of dividend and capital gains income were lowered for many tax payers. The model presented here predicts that the effects of the 2003 tax cuts should include a rise share prices, an increase in the amount of equity capital in firm's capital structures and a significant increase in the number of firms increasing or initiating dividend payments. Various empirical analyses cited in this study show that all of these things did occur.

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