

THE U.S. TAX CUTS AND JOBS ACT IN AN M&M CONTEXT: AN EXAMPLE

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ABSTRACT

The work of Franco Modigliani and Merton Miller revolutionized the way in which both academics and practitioners think about capital structure and firm value. In providing a framework for analysis of key corporate financial policies, these researchers laid the foundation for much of modern corporate finance theory in three seminal papers. Miller (1977), the final installment of the series, incorporates multiple tax rates and provides a platform from which to examine the impact on firm value of changes in the relationship between the various rates of taxation embedded in the U.S. tax code.

This paper examines, through a numerical exercise, the implications for firm value arising from the passage of the Tax Cuts and Jobs Act and changes in both corporate and personal income tax rates. First, the M&M framework for corporate valuation is revisited with a special focus on the later models which incorporate income tax rates. Next, the implications for firm value of the changes are discussed, and numerical examples of valuation impacts are provided. The paper concludes with a discussion of likely impacts over time in the real-world capital markets and outlines future research to examine the behavior of firms after the changes to the code have been in effect long enough to induce changes to corporate policy.

INTRODUCTION

Franco Modigliani and Merton Miller are credited with establishing the predominant framework for analyzing the impact of capital structure policy on the value of the firm. Their 1958 thesis (hereafter, M&M '58) is well known and concludes that the value of a firm is independent of its capital structure. The 1963 paper (hereafter, M&M '63) introduced corporate income taxes and the resultant gain from the use of leverage implied that the value of a firm is influenced by its choice of capital structure. In 1977, Miller included personal income taxes with the corporate income tax and concluded again that capital structure does matter to firm value.

Proposition I from Miller (1977) (hereafter, Miller '77) is the primary focus of this paper. Miller '77 tackles the tax rates on corporate income, personal income from equity sources, and personal income from debt sources, and determines that the gain in corporate value from the use of debt (G_L) in the funding mix is as follows:

$$G_L = \left[1 - \frac{(1 - T_C)(1 - T_{PS})}{(1 - T_{PB})} \right] B_L$$

Here T_C is the corporate tax rate on a firm's income, T_{PS} is the personal tax rate on income from an equity investment in the firm, and T_{PB} is the personal tax rate on income from an investment in the firm's debt. Finally, B_L is the market value of the firm's debt.

The gain from leverage relationship and its effect on firm value is typically presented assuming two otherwise identical firms where one is financially leveraged (V_L) and the other is not (V_U).

$$V_L = V_U + \left[1 - \frac{(1 - T_C)(1 - T_{PS})}{(1 - T_{PB})} \right] B_L$$

If T_{PS} and T_{PB} are set to zero, the result is equivalent to Proposition I with corporate taxes from M&M '63:

$$V_L = V_U + T_C B_L$$

And if all tax rates are set to zero, the solution is Proposition I from M&M '58.

$$V_L = V_U$$

THE 2017 CHANGES TO THE U.S. TAX CODE

On December 22, 2017 extensive changes were made to the U.S. tax code as part of the Tax Cuts and Jobs Act (hereafter, TCJA). The changes became effective with fiscal tax year 2018. From a corporate perspective, the most reported and relevant change to the U.S. tax code was the reduction of the maximum corporate income tax rate to 21 percent from 35 percent. All else equal, this change will reduce the incentive that interest expense provides and make debt a less attractive source of long-term capital funds as it becomes more costly on an after-tax basis. In other words, M&M's '63 gain from leverage became less valuable as a result of the TCJA.

There is a less-reported and less well-known provision that limits most large corporations' deduction of interest expense for tax purposes according to Elliot (2018). The Internal Revenue Service (2018) details the change to section 163(j) of the U.S. tax code that limits business interest expense to any business interest income plus 30 percent of earnings before interest, taxes, depreciation, and amortization (hereafter, EBITDA). Essentially, this would limit a firm's ability to take full advantage of any tax incentive that debt might provide in any particular year. Although a carryforward provision may provide some future benefit, a company that relies on large amounts of debt as a source of capital is likely to find their interest expense deduction capped indefinitely.

Additionally, during tax year 2022, the definition of earnings on which the 30% interest expense deduction cap is applied changes to *include* depreciation and amortization. This forthcoming change will decrease the earnings threshold used to determine the 30% cap and create an additional incentive to rely less on debt as a long-term source of funds.

There were also many changes to personal income tax rates, income thresholds, the elimination of exemptions, limits placed on deductible expenses and an expansion of the standard deduction, among other revisions as part of the TCJA.

For the purposes of this paper, the more extensive changes are left to a later date. It is the changes to personal income tax rates and, more importantly, the corporate income tax rate that are the center of the examples and discussion that follow.

NUMERICAL EXAMPLE

Modigliani and Miller set their theories of corporate financial structure in a world without any of the encumbrances and limitations that actually exist. A set of assumptions is made in order to reach, through an arbitrage proof, the initial 1958 conclusion that the use of leverage does not increase the value of the firm and thus capital structure does not matter. This is known as Proposition I.

Proposition II submits that the return shareholders demand will increase with the use of financial leverage. Initially, shareholders are compensated based on the risk of the firm's assets. Substituting debt for equity in the capital structure introduces financial risk, and shareholders will require a risk premium that is proportional to the level of debt.

Finally, Proposition III proposes that the value of the firm depends on the present value of its operating income with the weighted average cost of capital (hereafter, WACC) as the discount rate. They argue that the WACC is constant since shareholders will require higher returns to compensate for the increased risk associated with substitution of lower-cost debt for equity in the capital structure. Therefore, the value of the firm is unchanged when it is derived from operating income.

For consistent application of this example, a simple set of assumptions is made:

- (1) the corporation has operating income (EBIT) of \$25,000,000,
- (2) the corporation is capitalized with equity and \$50,000,000 book value debt,
- (3) debt has a yield-to-maturity of 8.0 percent, and the market value is equal to the book value,
- (4) equity investors require an unlevered 11.0 percent rate of return when no debt is used for capital funds.

Further assumptions will be employed or relaxed when appropriate as each of the three M&M papers are evaluated in order. The definitions of the variables used throughout this example are listed below and note that any superscript on a variable indicates a fiscal tax year.

V_U	=	Value of an unlevered firm
V_L	=	Value of a levered firm
r_{SU}	=	Required return on unlevered equity
r_{SL}	=	Required return on levered equity
B_L	=	Market value of debt
S_L	=	Market value of equity

- r_B = Return to debtholders
 T_C = Corporate income tax rate
 T_{PS} = Personal income tax rate on returns from equity
 T_{PB} = Personal income tax rate on returns from debt
 $WACC_U$ = Weighted average cost of capital of an unlevered firm
 $WACC_L$ = Weighted average cost of capital of a levered firm

Modigliani and Miller 1958

In addition to the numerical assumptions, the original 1958 M&M thesis assumed the following (in no particular order):

- Perfect capital markets, and equality of information between corporations and individuals.
- Investors are rational and risk neutral.
- There are no transaction costs.
- Securities are infinitely divisible.
- No investor is large enough to influence the market price of securities.
- There are no floatation costs when raising funds.
- Equal borrowing costs for corporations and individuals.
- There is no corporate income tax nor personal income taxes.
- There are no costs associated with bankruptcy.

Exhibit I: The three propositions of M&M '58	
Proposition I	$V_L = V_U$
Proposition II	$r_{SL} = r_{SU} + (r_{SU} - r_B) \left(\frac{B_L}{S_L} \right)$
Proposition III	$WACC_U = WACC_L = r_{SU}$

Applying the simple numerical assumptions of the example provides the following results:

Proposition I: Value of the firm

$$V_U = \frac{EBIT}{r_{SU}} = \frac{\$25,000,000}{0.11} = \$227,272,727$$

Proposition II: Return on levered equity

$$r_{SL} = r_{SU} + (r_{SU} - r_B) \left(\frac{B_L}{S_L} \right) = 0.11 + (0.11 - 0.08) \left(\frac{\$50,000,000}{\$177,272,727} \right) = 0.11 + 0.03(0.282) = \mathbf{0.1185}$$

Proposition III: Weighted-average cost of capital

$$WACC_U = WACC_L = \left(\frac{B_L}{V_L}\right) \times r_{BL} + \left(\frac{S_L}{V_L}\right) \times r_{SL} = \left(\frac{\$50,000,000}{\$227,272,727}\right) 0.08 + \left(\frac{\$177,272,727}{\$227,272,727}\right) 0.1185$$

$$= (0.22)0.08 + (0.78)0.1185 = 0.0176 + 0.09243 = \mathbf{0.1100}$$

Proposition I determines that the total value of the unlevered firm is \$227,272,727, consisting of \$50,000,000 in debt and \$177,272,727 in equity. Given that debt will increase the riskiness of the firm, the required return for the remaining, now levered, shareholders increases from 11.0 percent to 11.86 percent in accordance with Proposition II. Proposition III evaluates the substitution of low-cost debt for equity. The WACC remains unchanged and equal to the return on unlevered equity because the lower cost of debt is entirely offset by the increase in the return demanded by levered shareholders. Proposition I is confirmed as the discount rate (WACC) for operating earnings that determines firm value is unaffected by the level of leverage employed.

Modigliani and Miller 1963

To continue with the example, it is necessary to relax the assumptions of no corporate income tax and no bankruptcy costs. Other assumptions remain intact for this 1963 extension. Exhibit II summarizes the three propositions under the new set of assumptions.

Exhibit II The three propositions of M&M '63)	
Proposition I	$V_L = V_U + T_C B_L$
Proposition II	$r_{SL} = r_{SU} + (r_{SU} - r_B)(1 - T_C) \left(\frac{B}{S_L}\right)$
Proposition III	(a) $WACC_L = \left(\frac{B_L}{V_L}\right) \times r_B(1 - T_C) + \left(\frac{S_L}{V_L}\right) \times r_{SL}$ (b) $WACC_L = r_{SU} \left[1 - T_C \left(\frac{B_L}{V_L}\right)\right]$

With the inclusion of corporate income tax, the changes to the U.S. tax code through the TCJA become relevant as the corporate income tax rate fell from 35 percent in 2017 to 21 percent in 2018. Assuming the market value of debt remains constant, the numerical assumptions provide the following results.

Preliminary: Value of the unlevered firm

For proper perspective in relation to M&M '58, the value of an unlevered firm is first found by discounting the after-tax operating earnings using the return required by unlevered shareholders for both years in question:

$$V_U^{2017} = \frac{EBIT(1 - T_C^{2017})}{r_{SU}} = \frac{\$25,000,000(1 - 0.35)}{0.11} = \left(\frac{\$16,250,000}{0.11} \right) = \$147,727,273$$

$$V_U^{2018} = \frac{EBIT(1 - T_C^{2018})}{r_{SU}} = \frac{\$25,000,000(1 - 0.21)}{0.11} = \left(\frac{\$19,750,000}{0.11} \right) = \$179,545,455$$

The value of the unlevered firm increases significantly after the enactment of the TCJA. The corporate income tax rate declined which allowed more operating earnings to pass through to shareholders.

Proposition I: Value of the firm

$$V_L^{20xx} = V_U^{20xx} + T_C B_L$$

$$V_L^{2017} = \$147,727,273 + (0.35 \times \$50,000,000) = \$147,727,273 + \$17,500,000 = \$165,227,273$$

$$V_L^{2018} = \$179,545,455 + (0.21 \times \$50,000,000) = \$179,545,455 + \$10,500,000 = \$190,045,455$$

Establishing the value of the unlevered firm in the preliminary step, turns the focus of Proposition I to the increase in firm value that is derived from the substitution of debt for equity in the capital structure.

The TCJA focal point of Proposition I is the decrease in the gain from leverage (2017: \$17,500,000 to 2018: \$10,500,000) resulting from a decrease of the corporate income tax rate from 35 percent to 21 percent. Note that the 14-point decline from 35 percent represents a 40 percent decrease in the corporate income tax rate. The dollar gain from leverage ($T_C B_L$) decreases proportionately by 40 percent.

Proposition II: Return on levered equity

$$r_{SL}^{2017} = r_{SU} + (r_{SU} - r_B)(1 - T_C^{2017}) \left(\frac{B}{S_L} \right) = 0.11 + (0.11 - 0.08)(1 - 0.35) \left(\frac{\$50,000,000}{\$115,227,273} \right) = 0.1185$$

$$r_{SL}^{2018} = r_{SU} + (r_{SU} - r_B)(1 - T_C^{2018}) \left(\frac{B}{S_L} \right) = 0.11 + (0.11 - 0.08)(1 - 0.21) \left(\frac{\$50,000,000}{\$140,045,455} \right) = 0.1185$$

As with the M&M '58 result, the substitution of debt for equity increases the return required by levered equity holders. In this M&M '63 case, the decrease in the corporate tax rate

has no effect, as it is offset by the higher market value of equity after the substitution of debt in the capital structure. The numerical result is equivalent to that of M&M '58 Proposition II.

Proposition III: Weighted-average cost of capital

$$WACC_L^{20xx} = \left(\frac{B_L}{V_L}\right) \times r_{BL}(1 - T_C^{20xx}) + \left(\frac{S_L}{V_L}\right) \times r_{SL}$$

$$WACC_L^{2017} = \left(\frac{\$50,000,000}{\$165,227,273}\right) 0.08(1 - 0.35) + \left(\frac{\$115,227,273}{\$165,227,273}\right) 0.1185$$

$$= (0.3026) \times 0.052 + (0.6974) \times 0.1185 = \mathbf{0.0984}$$

$$WACC_L^{2018} = \left(\frac{\$50,000,000}{\$190,045,455}\right) 0.08(1 - 0.21) + \left(\frac{\$140,045,455}{\$190,045,455}\right) 0.1185$$

$$= (0.2631) \times 0.0632 + (0.7369) \times 0.1185 = \mathbf{0.1040}$$

As low-cost debt is substituted in the capital structure for equity, there is a noticeable decrease to 9.84 percent in the after-tax WACC from the 11.0 percent of an unlevered firm. As expected, after the TCJA changed the corporate income tax to 21 percent, the WACC increases from the 2017 level due to the higher after-tax cost of debt.

Miller 1977

The Miller '77 introduces personal income tax rates on returns from both debt and equity in addition to corporate income taxes. This necessitates assumptions regarding the different types of taxes that may be applied to personal income and investment returns.

Assumptions: Taxpayer

It is assumed that the taxpayer is single, had an adjusted gross income in 2017 of \$134,767, chose one exemption and used the standard deduction. In 2017, the standard deduction of \$6,350 and \$4,050 for one exemption reduces the taxable income to \$124,367, which falls into the 28% marginal income tax rate for that year.

For 2018 it is assumed that adjusted gross income increases by 2.83 percent to \$138,583. The TCJA eliminated the deduction for exemptions, however the single taxpayer standard deduction increased to \$12,000. Therefore, this taxpayer's \$126,583 taxable income points to a marginal income tax rate of 24 percent.

Justification for arriving at these income levels are detailed in Appendix 1 at the end of the paper.

Assumptions: Taxes on Returns from Equity and from Debt

Shareholders of a corporation receive their returns through dividends and capital gains, both of which are subject to income taxes, but at different rates. The tax rate on capital gains

remained a constant 15 percent during the 2017 to 2018 period. It is traditionally assumed that shareholders will not be subject to this tax due to their ability to postpone it indefinitely by never selling the stock or selling stock with capital losses to offset those sold with capital gains. It is assumed in this example that a true capital gains tax lies somewhere between zero and 15 percent and 7.50 percent is chosen for expediency. It is noted that there have recently been historic levels of stock buybacks by corporations which would contribute toward capital gains of shareholders.

Cash dividends are considered current income and are taxed at the shareholder's marginal personal income tax rate. According to Ironman (2014), approximately 82 percent of companies included in the S&P 500 index paid dividends to their stockholders. The average dividend payout ratio from earnings was approximately 40 percent according to Birstingl (2016). Following these companies' preference, it is concluded for this example that the total return to shareholders will be composed of 40 percent dividend income and 60 percent capital gain income.

$$T_{PS}^{20xx} = (0.40 \times \text{marginal tax rate}^{20xx}) + (0.60 \times \text{capital gains tax rate})$$

$$T_{PS}^{2017} = (0.40 \times 28 \text{ percent}) + (0.60 \times 7.5 \text{ percent}) = 15.7 \text{ percent}$$

$$T_{PS}^{2018} = (0.40 \times 24 \text{ percent}) + (0.60 \times 7.5 \text{ percent}) = 14.1 \text{ percent}$$

A weighted average tax rate of dividend income and capital gains is computed. This results in a blended personal income tax rate on equity (T_{PS}) of 15.7 percent in 2017 and 14.1 percent in 2018. The two tax rates on equity returns are similar but represent a modest 10 percent decrease due to the TCJA mandates.

The personal income tax rate on debt (T_{PB}) is assumed to be equal to the marginal tax rate of the example taxpayer, or 28 percent in 2017 and 24 percent in 2018. Interest income is taxed as current income and subject to the marginal income tax rate of the individual. It is further assumed the taxpayer is astute enough to amortize any discount or premium paid for the debt on an annual basis.

In order to focus attention on the change in corporate income tax rates resulting from the TCJA legislation, two scenarios are presented as personal income taxes are introduced. In the first scenario, it is assumed that the personal income tax rate on debt as well as the blended tax rate on equity returns remain at the 2017 level. The second scenario then allows personal income tax rates to adjust to the 2018 level following the TCJA and provides an opportunity to observe how personal taxes affect the firm while holding corporate income tax rates constant.

All prior assumptions continue to hold from M&M '58 and M&M '63 aside from relaxing those related to personal and corporate income taxes. Exhibit III summarizes the three propositions under the new set of assumptions of Miller '77.

Exhibit III The three propositions of Miller '77	
Proposition I	$V_L = V_U + \left\{ 1 - \left[\frac{(1 - T_C)(1 - T_{PS})}{(1 - T_{PB})} \right] \right\} B_L$
Proposition II	$r_{SL} = r_{SU} + [r_{SU} - r_B \times (1 - T_{PB})] \times \left[\frac{(1 - T_C)(1 - T_{PS})}{(1 - T_{PB})} \right] \left(\frac{B_L}{S_L} \right)$
Proposition III	<p>(a) $WACC_L = \left(\frac{B_L}{V_L} \right) \times r_B (1 - T_C)(1 - T_{PS}) + \left(\frac{S_L}{V_L} \right) \times r_{SL}$</p> <p>(b) $WACC_L = r_{SU} \left(1 - \left\{ 1 - \left[\frac{(1 - T_C)(1 - T_{PS})}{(1 - T_{PB})} \right] \right\} \frac{B_L}{V_L} \right)$</p>

Preliminary: Value of the unlevered firm

To begin the Miller '77 exercise, the operating earnings of a firm funded with all equity passes through two income tax thresholds. Routinely identified as the double taxation of dividends, operating earnings are taxed first at the corporate level, and returns to the shareholders are then taxed as personal income. Therefore, the value of an unlevered firm will depend on the after-tax earnings distributed to shareholders discounted by the required rate of return of unlevered shareholders:

$$V_U^{20xx} = \frac{EBIT(1 - T_C)(1 - T_{PS})}{r_{SU}}$$

$$V_U^{2017} = \frac{\$25,000,000(1 - 0.35)(1 - 0.157)}{0.11} = \left(\frac{13,698,750}{0.11} \right) = \$124,534,091$$

Scenario 1: Personal rates constant at 2017 level, corporate rate falls to 21%:

$$V_U^{2018} = \frac{\$25,000,000(1 - 0.21)(1 - 0.157)}{0.11} = \left(\frac{16,649,250}{0.11} \right) = \$151,356,818$$

Scenario 2: All tax rates at 2018 level:

$$V_U^{2018} = \frac{\$25,000,000(1 - 0.21)(1 - 0.141)}{0.11} = \left(\frac{16,965,250}{0.11} \right) = \$154,229,545$$

The added burden of income tax on equity returns reduces the value of the unlevered firm to \$124,534,091 from \$147,727,273 obtained with M&M '63 which incorporated the first level of taxation on firm income.

In Scenario 1, the value of the unlevered firm does increase when the corporate income tax rate is decreased while holding personal income tax rates on equity constant at the 2017 level. More earnings are available to the shareholders when the corporate income tax burden is reduced.

With the addition of the decrease in personal income tax rates in 2018, scenario 2 details a slight increase in the value of the firm to \$154,356,818 as shareholders retain a higher level of after-tax returns. Any decrease in either level of the double taxation of equity returns (capital gains or marginal income) is positive for the unlevered firm's value.

Proposition I: Value of the firm

$$V_L^{20xx} = V_U + \left\{ 1 - \left[\frac{(1 - T_C)(1 - T_{PS})}{(1 - T_{PB})} \right] \right\} B_L$$

$$V_L^{2017} = \$124,534,091 + \left\{ 1 - \left[\frac{(1 - 0.35)(1 - 0.157)}{(1 - 0.28)} \right] \right\} \times \$50,000,000$$

$$V_L^{2017} = \$124,534,091 + \$11,947,917 = \$136,482,008$$

Scenario 1: Personal rates constant at 2017 level, corporate rate falls to 21%:

$$V_L^{2018} = \$151,356,818 + \left\{ 1 - \left[\frac{(1 - 0.21)(1 - 0.157)}{(1 - 0.28)} \right] \right\} \times \$50,000,000$$

$$V_L^{2018} = \$151,356,818 + \$3,752,083 = \$155,108,901$$

Scenario 2: All tax rates at 2018 level:

$$V_L^{2018} = \$154,229,545 + \left\{ 1 - \left[\frac{(1 - 0.21)(1 - 0.141)}{(1 - 0.24)} \right] \right\} \times \$50,000,000$$

$$V_L^{2018} = \$154,229,545 + \$5,354,605 = \$159,584,150$$

As with M&M '63, the focus is the gain in firm value as debt is substituted for equity in the funding mix of the firm. Prior to the TCJA, the dollar gain from leverage in this example adds \$11,947,917 to the value of an unlevered firm as a result of the combination of taxes.

Scenario 1 shows that holding personal income tax rates constant at the 2017 level and decreasing the corporate income tax rate to 21 percent from 35 percent results in a much smaller increase in firm value of \$3,752,083. The \$8,195,834 decline represents a 68.6 percent loss in the gain from leverage when the corporate tax rate is reduced. Recall that M&M '63 resulted in a smaller percentage decline (-40 percent) in the same measure.

When the personal income tax rates are adjusted to their 2018 levels, holders of equity and debt retain more of their returns from funding the firm and combine to recover some of the loss that the reduced corporate income tax rate imposed. With all income tax rates set to their

2018 level, the value of the gain from leverage decreases 55.2 percent over the value prior to the TCJA of 2017 (\$5,354,605 from \$11,947,917).

Proposition II: Return on levered equity

$$r_{SL} = r_{SU} + [r_{SU} - r_B \times (1 - T_{PB})] \times \left[\frac{(1 - T_C)(1 - T_{PS})}{(1 - T_{PB})} \right] \left(\frac{B_L}{S_L} \right)$$

$$r_{SL}^{2017} = 0.11 + [0.11 - 0.08(1 - 0.28)] \times \left[\frac{(1 - 0.35)(1 - 0.157)}{(1 - 0.28)} \right] \left(\frac{\$50,000,000}{\$86,482,008} \right) = \mathbf{0.1331}$$

Scenario 1: Personal rates constant at 2017 level, corporate rate falls to 21%:

$$r_{SL}^{2018} = 0.11 + [0.11 - 0.08(1 - 0.28)] \times \left[\frac{(1 - 0.21)(1 - 0.157)}{(1 - 0.28)} \right] \left(\frac{\$50,000,000}{\$105,108,902} \right) = \mathbf{0.1331}$$

Scenario 2: All tax rates at 2018 level:

$$r_{SL}^{2018} = 0.11 + [0.11 - 0.08(1 - 0.24)] \times \left[\frac{(1 - 0.21)(1 - 0.141)}{(1 - 0.24)} \right] \left(\frac{\$50,000,000}{\$109,584,150} \right) = \mathbf{0.1300}$$

When personal tax rates enter the example, the return on levered equity increases significantly to 13.31 percent from 11.85 percent obtained with M&M '63. Since Miller '77 introduces double taxation of equity returns, the desire to obtain a particular after-tax return leads the shareholders to seek higher pre-tax returns.

Otherwise, the return to levered shareholders is not affected if their personal tax rates remain constant at the pre-TCJA level and only the corporate income tax rate is varied. As the corporate tax rate falls, the levered firm value increases through the gain from leverage and shareholders secure these gains. The proportion of debt in the capital structure (B_L/S_L) decreases as the value of the firm increases offsetting the effect that the corporate income tax may have on levered-equity returns.

After passage of the TCJA, levered shareholders' return decreases to 13.0 percent due to lower personal income tax levels. Ultimately, the change in personal income tax rates makes the shareholders' view their investment in the firm as less risky.

Proposition III: Weighted-average cost of capital

$$WACC_L = \left(\frac{B_L}{V_L} \right) \times r_{BL}(1 - T_C)(1 - T_{PS}) + \left(\frac{S_L}{V_L} \right) \times r_{SL}$$

$$WACC_L^{2017} = \left(\frac{\$50,000,000}{\$136,482,008} \right) \times 0.08(1 - 0.35)(1 - 0.157) + \left(\frac{\$86,482,008}{\$136,482,008} \right) \times 0.133056$$

$$WACC_L^{2017} = (0.36635) \times 0.043836 + (0.63365) \times 0.133056 = \mathbf{0.1004}$$

Scenario 1: Personal rates constant at 2017 level, corporate rate falls to 21%:

$$WACC_L^{2018} = \left(\frac{50,000,000}{155,108,902} \right) \times 0.08(1 - 0.21)(1 - 0.157) + \left(\frac{105,108,902}{155,108,902} \right) \times 0.133056$$

$$WACC_L^{2018} = (0.32235) \times 0.053278 + (0.67765) \times 0.133056 = \mathbf{0.1073}$$

Scenario 2: All tax rates at 2018 level:

$$WACC_L^{2018} = \left(\frac{50,000,000}{159,584,150} \right) \times 0.08(1 - 0.21)(1 - 0.141) + \left(\frac{109,584,150}{159,584,150} \right) \times 0.130044$$

$$WACC_L^{2018} = (0.31331) \times 0.05429 + (0.68669) \times 0.130044 = \mathbf{0.1063}$$

With personal income tax rates included, the WACC numerical result (10.04 percent) is higher than the result under M&M '63 (9.84 percent). This reflects higher before-personal-tax returns desired by suppliers of equity to the firm (13.31 percent vs. 11.85 percent under M&M '63)

After passage of the TCJA and holding personal tax rates at the 2017 level, the lower corporate income tax increases the after-tax cost of debt to the firm from 4.38 percent to 5.33 percent, and thus increases the WACC.

The 2018 reduction in personal tax rates causes the after-tax cost of debt to increase further to 5.43 percent, however this is offset by a small decrease in the proportion of debt in the capital structure. It is the decrease in the cost of equity and the slightly higher reliance on equity that reduces the firm's WACC a small amount under this scenario.

SUMMARY OF RESULTS

This exercise is in chronological order of the Modigliani and Miller series of papers. The exhibits featured here depict the featured results in a more concise form. Exhibit IV summarizes the value of the firm from stockholders' perspective. The value is derived from the firm's operating earnings passed to the stockholders. As income taxes are incorporated, the value of the unlevered firm decreases as a portion of the earnings are diverted elsewhere.

Exhibit IV				
Value of the Unlevered Firm				
Operating Earnings passed through to Shareholders				
	V_U^{2017}	V_U^{2018}	\$ Change	% Change
M&M 1958	\$ 227,272,727	\$ 227,272,727	\$ 0	
M&M 1963	\$ 147,727,273	\$ 179,545,455	\$ 31,818,182	21.54 %
Miller 1977				
With 2017 Personal tax rates	\$ 124,534,091	\$ 151,356,818	\$ 26,822,727	21.54 %
With 2018 Personal tax rates	\$ 124,534,091	\$ 154,229,545	\$ 29,695,454	23.85 %

It is the purpose of Exhibit V to summarize the increase in firm value that results from the use of debt. M&M '63 incorporates the corporate income tax alone and Miller '77 extends by including personal income taxes on both debt and equity returns. Panel A serves as the base case of the exercise by determining the gain from leverage as it appeared prior to the TCJA. By incorporating personal income taxes, the gain in levered firm value decreases in percentage terms.

Exhibit V				
Gain from Leverage				
Substituting Low-Cost Debt for Equity in the Capital Structure				
Panel A				
Gain from Leverage 2017				
Prior to the Tax Cuts and Jobs Act				
	V_U^{2017}	V_L^{2017}	Gain from leverage $T_C^{2017} = 35\%$	% increase in firm value
M&M 1958	\$ 227,272,727			
M&M 1963	\$ 147,727,273	\$ 165,227,273	\$ 17,500,000	11.85
Miller 1977	\$ 124,534,091	\$ 136,482,008	\$ 11,947,917	9.59
Panel B				
Gain from Leverage 2018				
	V_U^{2018}	V_L^{2018}	Gain from leverage $T_C^{2018} = 21\%$	% increase in firm value
M&M 1958	\$ 227,272,727			
M&M 1963	\$ 179,545,455	\$ 190,045,455	\$ 10,500,000	5.85 %
Miller 1977				
With 2017 Personal tax rates	\$151,356,818	\$ 155,108,902	\$ 3,752,083	2.48 %
With 2018 Personal tax rates	\$ 154,229,545	\$159,584,151	\$ 5,354,605	3.47 %

Panel B of Exhibit V displays the results of the exercise while transitioning to the post TCJA U.S. tax code. As expected, the lower corporate income tax reduces the gain from leverage substantially to 5.85 percent of levered firm value. Introducing personal income taxes at 2017 levels serves to decrease levered firm value further as the gain from leverage only adds 2.48 percent to firm value. The gain from leverage recovers somewhat (to 3.47 percent) when personal income taxes are lowered to post-TCJA levels.

Finally, the return on levered equity and the weighted average cost of capital results of the exercise are arranged in Exhibit VI. The substance of the results of Panel A is that the use of debt in the capital structure introduces a financial risk component and leads stockholders to require higher rates of return commensurate with that risk. The inclusion of personal income taxes further increases the risk of after-tax returns expected on equity.

The combination of returns on debt and equity, as well as their respective proportions within the firm comprise the weighted average cost of capital. Panel B of Exhibit VI summarizes the WACC findings of the exercise. Allowing debt to enter the capital structure secures a low, after-tax cost of funds for the firm while simultaneously decreasing the proportion of high-cost levered equity as a source of funds. In all cases involving debt, the WACC is reduced from that of an unlevered firm, attesting to the influence that debt and taxes play in the cost of funds. Miller's 1977 inclusion of personal income taxes increases the WACC slightly as both suppliers of capital seek increased returns to counterbalance the income taxes that are assessed.

Exhibit VI				
Propositions II and III Summary				
Panel A			Panel B	
Proposition II			Proposition III	
Return on Levered Equity			Weighted Average Cost of Capital	
	r_{SL}^{2017}	r_{SL}^{2018}	$WACC_L^{2017}$	$WACC_L^{2018}$
M&M 1958	11.85 %	11.85 %	11.00 %	11.00 %
M&M 1963	11.85 %	11.85 %	9.84 %	10.39 %
Miller 1977				
With 2017 Personal tax rates	13.31 %	13.31 %	10.04 %	10.73 %
With 2018 Personal tax rates		13.00 %		10.63 %

CONCLUSION

The ground-breaking capital structure theories of Modigliani and Miller have been the basis for multitudes of financial literature over the past 50 years. This exercise uses the foundation of Modigliani and Miller theories to present an interpretation of changes in a firm's

desire for debt or equity as a source of capital funds when corporate income tax rates change. Specifically, an example is pursued using the abrupt change in the corporate income tax rate instituted by the 2017 U.S. Tax Cuts and Jobs Act.

The examples and assessments provided in this paper demonstrate that changes in the corporate income tax may be directly related to a firm's use of debt as a funding source. If corporate income tax rates decline, the after-tax cost of debt increases, and firms will reduce the level of debt in favor of equity as a long-term source of funds. Investors in the firm subject to personal income taxes will make similar accommodations when the corporate income tax rate declines. The firm cannot offer debtholders high enough returns (when personal income taxes are considered) therefore, some investors will migrate away from debt toward the higher after-tax return that the firm's equity provides.

As a practical matter, the outcome of a reduction in the gain from leverage as corporate income tax rates decline was expected. However, it implies that empirical evidence may be available to determine if U.S. firms are currently undergoing capital structure change that includes less debt. Not only did the corporate income tax rate decline but, as mentioned previously, a cap on interest expense tax-deductions based on a firm's EBITDA was instituted. It is not often that changes in the U.S. tax code are so abrupt and substantial that it provides many unique opportunities for additional study. Further, investor behavior and preferences during this time of changing income tax rates may also provide insight on the availability and source of capital funds.

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APPENDIX 1***Derivation of the Adjusted Gross Income for Tax Application***

Data is available from The Tax Foundation (2018) and its *Summary of the Latest Income Tax Data 2017 Update*. Available from: <https://taxfoundation.org/summary-federal-income-tax-data-2017/>

Table 3 of the Update contains aggregate Adjusted Gross Income (\$ billions) for the years 1980 to 2015 for a variety of income groups. Table 2 of the 2017 Update contains the aggregate number of tax returns (thousands) filed in each of the income groups for the years 1980 to 2015.

The relevant number, Adjusted Gross Income (AGI), of an individual tax return is found by dividing the Table 3 value by the Table 2 value for the same year and income group. This is indicated in the Excel displays in Graphic 1 that follows the text of this appendix.

It is assumed that only the top 50 percent of taxpayers will have investments in either corporate equity or debt. Although arguments can be made to use the AGI for other income groups available (e.g. top 25% or top 10%) the income levels observed appeared unreasonably high for the purposes of this paper.

For 2015, the latest year available, average adjusted gross income is found to be \$127,448 for the top 50 percent of taxpayers. This 2015 AGI must be adjusted to 2017 and 2018 levels so that appropriate personal income tax rates may be determined.

The annual growth rate of AGI for the top 50 percent of taxpayers was determined for each of the prior 14 years (2001 – 2015). The average of these growth rates is 2.8314 percent. This simple process is displayed in Graphic 2 that follows.

The average annual growth rate is applied to the 2015 AGI of \$127,448 to arrive at the 2017 AGI value of \$134,767 and 2018 of 138,583 used in the Miller 1977 section of the paper.

Graphic 1:
Determination of Adjusted Gross Income for an Example Taxpayer that is
Likely to Invest in Corporate Securities

Table 3. Adjusted Gross Income of Taxpayers in Various Income Brackets, 1980–2015 (\$Billions)									
Year	Top 1%	Top 5%	5% - 10%	Top 10%	10% - 25%	Top 25%	25% - 50%	Top 50%	Bottom 50%
2012	\$1,977	\$3,331	\$997	\$4,328	\$1,934	\$6,262	\$1,776	\$8,038	\$1,004
2013	\$1,720	\$3,109	\$1,034	\$4,143	\$2,008	\$6,152	\$1,844	\$7,996	\$1,038
2014	\$1,998	\$3,491	\$1,093	\$4,583	\$2,107	\$6,690	\$1,924	\$8,615	\$1,094
2015	\$2,095	\$3,659	\$1,145	\$4,803	\$2,194	\$6,998	\$2,000	\$8,998	\$1,145

Table 2. Number of Federal Individual Income Tax Returns Filed 1980–2015 (Thousands)									
Year	Top 1%	Top 5%	5% - 10%	Top 10%	10% - 25%	Top 25%	25% - 50%	Top 50%	Bottom 50%
2012	1,361	6,804	6,804	13,608	20,412	34,020	34,020	68,040	68,040
2013	1,383	6,916	6,916	13,831	20,747	34,578	34,578	69,157	69,157
2014	1,396	6,978	6,978	13,956	20,934	34,891	34,891	69,781	69,781
2015	1,412	7,060	7,060	14,120	21,181	35,301	35,301	70,602	70,602

Adjusted Gross Income per Tax Return: Table 3 divided by Table 2 adjusted by \$1,000,000									
Year	Top 1%	Top 5%	5% - 10%	Top 10%	10% - 25%	Top 25%	25% - 50%	Top 50%	Bottom 50%
2012	\$1,452,608	\$489,565	\$146,531	\$318,048	\$94,748	\$184,068	\$52,205	\$118,136	\$14,756
2013	\$1,243,673	\$449,537	\$149,508	\$299,545	\$96,785	\$177,917	\$53,329	\$115,621	\$15,009
2014	\$1,431,232	\$500,287	\$156,635	\$328,389	\$100,650	\$191,740	\$55,143	\$123,458	\$15,678
2015	\$1,483,644	\$518,209	\$162,149	\$340,179	\$103,603	\$198,231	\$56,665	\$127,448	\$16,211

Graphic 2:
Determining the average annual growth rate in Adjusted Gross Income for the Example Taxpayer

Year	Top 50%	Annual growth rate
2001	\$87,710	
2002	\$85,357	-2.68%
2003	\$87,564	2.59%
2004	\$95,111	8.62%
2005	\$102,876	8.16%
2006	\$108,687	5.65%
2007	\$114,147	5.02%
2008	\$108,780	-4.70%
2009	\$100,709	-7.42%
2010	\$105,099	4.36%
2011	\$107,727	2.50%
2012	\$118,136	9.66%
2013	\$115,621	-2.13%
2014	\$123,458	6.78%
2015	\$127,448	3.23%
Average Annual Growth		2.8314%