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1. Learning Outcomes

After studying this module, you shall be able to:

- Understand the irrelevance of capital structure
- Know capital structure is irrelevant for firm's valuation
- See how capital structure affects investors' returns
- Recognize the importance of arbitrage process and how this process is being used for making the value of levered and unlevered firms equal
- Analyze the various criticisms of this approach

2. Introduction

As we know, the capital structure of a firm defines the combination of debt and equity in the total capital. In the process of deciding about this combination, one of the important considerations is value of the firm. Traditional theories believe that the capital structure has an impact on the value of the firm (as discussed earlier). In contrast to this, Modigliani and Millar argue that capital structure does not affect value of the firm in the absence of taxes and transaction cost. However, if taxes are considered capital structure becomes relevant. This approach to capital structure is explained in the following sections.

3. MM Hypothesis with No Taxes: Irrelevance of Capital Structure

Modigliani and Millar hypothesize that capital structure is irrelevant for firm valuation. That is by changing the proportion of debt and equity, a firm cannot change its value. Firm's value depends on earnings and risk of its assets rather than leverage (debt-equity ratio). However, it has also been argued that capital structure affects shareholders' or investors' returns. These hypotheses form the two propositions as explained below:

3.1 Proposition 1: Capital structure is irrelevant for firm's valuation.

First proposition of MM hypothesis states that capital structure does not affect the value of a firm.

3.1.1 Assumptions

This proposition is based on certain assumptions. These assumptions mainly relate to the behavioral pattern of investors, capital markets, firms and tax environment.

- 1) *Perfect Capital Markets*: Capital markets are perfect when (a) investors can freely buy or sell securities; (b) they behave rationally; (c) they can borrow without any restriction as firms; (d) transaction cost doesn't exist.
The third assumption is very important because if firms can borrow at a cheaper rate than investors, then they can increase firm value by borrowing (debt).
- 2) *Homogeneous Risk*: Operating risk is the variability of net operating income of the firm. It is assumed that firms from same industry also have homogeneous risk classes.
- 3) *No Taxes*: There are no corporate taxes. Thus, there is no tax saving for firms on interest payment of debt.

- 4) *Full Payout*: Firms distribute all their earnings after interest as dividends. Thus, the dividend payout is 100%.

3.1.2 How proposition 1 works?

Proposition 1 given by Modigliani and Millar holds true on the basis of various assumptions discussed. Let's say there are two firms A & B. Both the firms belong to the same industry and same market share. Thus, the operating income and operating risk faced by the two firms is exactly same. Because of same risk and return, investors expect same rate of return or cost of capital on assets. Suppose both the firms are totally equity financed, net operating income before and after interest will be same, as no interest is paid. Moreover, income before and after taxes will also be same, as taxes are absent. We know that,

$$\text{Value of the firm} = \frac{\text{Net Operating Income}}{\text{Opportunity Cost of Capital}}$$

Thus, value of both the firms will be same.

Now, let's assume that the capital structure of firms A & B are different. Firm A is 100% equity financed and Firm B is 50% equity and 50% debt financed. On the basis of our assumptions, we can state that the earning potential will still be the same for both the firms as it depends on investment in assets. Risk will also be the same as it depends on business conditions not debt. As risk and return are same, expected rate of return (cost of capital) will also be same. Thus, as the net operating income and cost of capital remain intact, the value of both the firms will be same i.e. no effect of leverage.

$$\text{Value of Firm A} = \text{Value of Firm B}$$

i.e. Value of Unlevered Firm = Value of Levered Firm

$$\text{Symbolically, } V_U = V_L \quad (1)$$

Thus, it can be said that,

$$V = V_U = V_L = \frac{\text{NOI}}{K_a} \quad (2)$$

Where, V is the value of firm which is the sum of value of equity and value of debt. NOI is the net operating income i.e. earnings before interest and tax (EBIT), and K_d is the firm's opportunity cost of capital.

In case of levered firm, its net operating income will be income of debt holders and shareholders i.e. interest and dividends which is EBIT. The expected rate of return will include expected return of debt holders and & shareholders. Thus, cost of capital becomes weighted average cost of capital i.e. $WACC = K_L = K_a$. Thus,

$$V_L = \frac{\text{NOI}}{K_a}$$

So,
 í (3)

$$K_a = \frac{NOI}{V_L}$$

In case of an unlevered firm, its net operating income will be the income of its shareholders i.e. dividends. The expected rate of return will be the cost of capital (equity only) i.e. $K_U = K_a$. Thus,

$$V_U = \frac{NOI}{K_U = K_a}$$

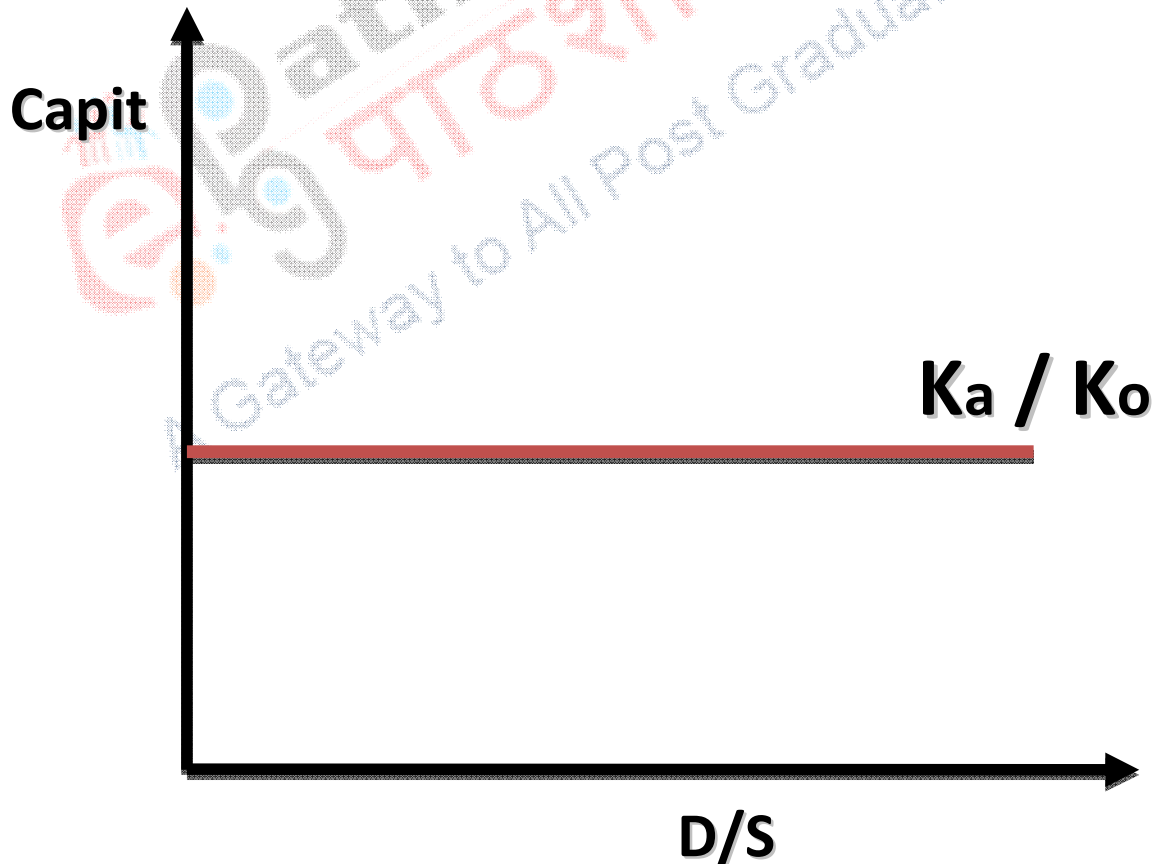
So,

$$K_U = K_a = \frac{NOI}{V_U} \quad (4)$$

From equation (1), it is very clear that value of levered and unlevered firm is same. Moreover, it has also been discussed that due to same industry and equal market share and assets, net operating income will be same. Thus, cost of capital of two firms will also be the same i.e. from (3) and (4).

$$K_U = K_L = K_o = K_a \quad (5)$$

Thus, cost of capital of levered and unlevered firms will be equal.



3.1.3 Arbitrage Process under Proposition 1: Why Proposition 1 works?

So far we have discussed that proposition 1 works on the basis of various assumptions of same return, same assets, same risks, etc. Suppose now the two firms are identical with different capital structures and different market values. In such a case, arbitrage or switching process will start and restore the firms at same level of value. Thus, the investors will engage in arbitrage for their home made leverage as against corporate leverage and the values of two firms will come at same level. We can understand this process through following example.

Illustration:

Case 1: Suppose two firms are there. Firm U is an unlevered firm with equity of Rs 1,00,000 and Firm L is a levered firm with equity of Rs 50,000 and debt of Rs 50,000. The net operating income for both is Rs 10,000. Firm L has to pay interest on debt at the rate of 6% p.a. The cost of equity for Firm U is 10% and it is 11.7% for Firm L. The value of Firm U will be value of equity and the value of Firm L will be value of equity plus debt.

Value of Levered and Unlevered Firms

	Firm U (Unlevered)	Firm L (Levered)
Net Operating Income	10,000	10,000
Less: Interest on Debt		3,000
Net Income of Shareholders (A)	10,000	7,000
Cost of Equity (B)	10%	11.7%
Value of Equity (C = A ÷ B)	1,00,000	60,000
Value of Debt (D)	0	50,000
Total Value of Firm (C+D)	1,00,000	1,10,000
WACC (NOI ÷ Value of Firm)	0.10	0.091

Thus, we see that both the firms are identical, but due to cheaper debt the value of the Firm L increase by Rs 10,000. But MM argue that rational investors will start arbitrage and the value of both the firms will come at same level.

Let's say an investor holds 10% stake in Firm L i.e. he holds 10% debentures (10% of Rs 50,000) of Rs 5,000 and 10% equity at a value (10% of Rs 60,000) of Rs 6,000. His dividend income will be 10% of total dividends i.e. Rs 700 (10% of Rs 7,000). Now, the investor will try to take advantage of this extra value of levered firm for his own benefits. He will convert the corporate leverage of Firm L to his home made leverage. He will follow the following strategy:

- 1) He will first sell all his shares of Firm L for Rs 6,000.
- 2) Now, he will borrow Rs 5,000 (equal to his holdings of debt in Firm L) at 6% rate of interest. Thus, he uses homemade leverage.
- 3) Now, he has Rs 11,000 (Rs 6,000 + Rs 5,000). He will buy 10% shares of unlevered firm (i.e. equal to equity holding in Firm L) and pay Rs 10,000 (10% of Rs 1,00,000).

Thus, now we see that the investor is left with a cash surplus of Rs 1,000 (Rs 11,000 - Rs 10,000). If we calculate his net return from his strategy, he will get dividend from Firm U @10%.

Dividend Income = 10% of Rs 10,000 = Rs 1,000

But, he has to pay interest on his personal borrowings @ 6% p.a. i.e. of Rs 300 (6% of Rs 5,000).

$$\begin{aligned} \text{So, Net Return} &= \text{Dividend Income} - \text{Interest Payment} \\ &= \text{Rs 1,000} - \text{Rs 300} \\ &= \text{Rs 700} \end{aligned}$$

Thus, we see that the investor still gets the same return plus extra cash of Rs 1,000 by converting corporate leverage to homemade leverage. Likewise, all the rational investors will follow the same strategy. They will keep selling shares of Firm L which will decrease its market price and keep buying shares in Firm U which will increase its market price. Therefore, value of an unlevered firm will rise and value of levered firm will go down and they will be equal through this process of arbitrage.

Case 2: Now let's assume that the cost of capital of levered firm is 17.5%, other things remain same. The value of levered firm will be different.

$$\begin{aligned} \text{Value of Firm L} &= \text{Value of Equity} + \text{Value of Debt} \\ &= \frac{\text{Rs 7000}}{0.175} + \text{Rs 50000} \\ &= \text{Rs 40,000} + \text{Rs 50,000} \\ &= \text{Rs 90,000} \end{aligned}$$

Thus, we see that now the value of levered firm is less than unlevered firm. The arbitrage process in this case would be reversed as explained below. Investor holds 10% shares in Firm U.

- 1) He will first sell all his shares in Firm U for Rs 10,000 (10% of Rs 1,00,000).
- 2) Using this Rs 10,000, he will buy 10% stake of Firm L in debts and equity.

$$\begin{aligned} \text{Total Investment in Firm L} &= 10\% \text{ Debt} + 10\% \text{ Equity} \\ &= 10\% \text{ of Rs 50,000} + 10\% \text{ of Rs 40,000} \\ &= \text{Rs 9,000} \end{aligned}$$

Thus, he will invest Rs 9,000 in Firm L and will be left with an extra cash of Rs 1,000. His returns from Firm L will include dividend and interest.

$$\begin{aligned} \text{Total Return} &= \text{Dividend} + \text{Interest} \\ &= 10\% \text{ of Rs 7,000} + 6\% \text{ of Rs 5,000} \\ &= \text{Rs 1,000} \end{aligned}$$

Earlier his return in Firm U was also Rs 1,000 (10% of Rs 10,000). Thus, through arbitrage he will earn same return with a surplus cash of Rs 1,000.

Similarly, every rational investor will follow the same arbitrage strategy. Investors will keep selling shares of Firm U which will reduce its prices and will keep buying shares of Firm L which will increase its price. Thus, the value of Firm U will go down and value of Firm L will go up and through arbitrage both will get at the same level.

Conclusion: Thus, it can be concluded that capital structure remains irrelevant for valuation of a firm. Even if there are differences in the values, arbitrage process brings both the firms at equilibrium. Hence, leverage is irrelevant.

3.2 Proposition 2: Capital structure affects investors' returns.

So far we have discussed that capital structure does not affect the value of a firm. But second proposition of MM says that it affects returns of investors (shareholders) i.e. return on equity (ROE) and earnings per share (EPS). It says that as the leverage increases, variability of dividends to shareholders also increases. Thus, the risk for shareholders increases. Now, to compensate for this increasing risk, they expect higher return. Thus, it can be said that with increasing leverage, the risk and return of shareholders increase.

3.2.1 How proposition 2 works?

Suppose there are two firms U & L. Firm U is an unlevered firm and Firm L is the levered firm. In case of an unlevered firm, the weighted average cost of capital (WACC) will be same as cost of equity because of absence of debt i.e. $K_a = K_e$. However, in case of a levered firm WACC will include cost of equity and cost of debt. MM proposition 1 states that WACC (K_a) will be same for a levered and unlevered firm. As we know that debt is a cheaper source of finance, the cost of equity has to be higher to compensate it. Thus, in case of a levered firm $K_e > K_a$. This extra value of cost of equity is called financial risk premium as it arises due to financial risk of levered firm. Let's discuss it through equations. We know that,

$$\text{WACC } (K_a) = K_e \times \frac{E}{E+D} + K_d \times \frac{D}{E+D} \quad \text{..... (6)}$$

$$K_a(E+D) = k_e \times E + k_d \times D$$

$$K_e E = K_a E + K_a D - K_d D$$

Dividing both sides by E,

$$K_e = K_a + K_a \frac{D}{E} - K_d \frac{D}{E}$$

$$K_e = k_a + (k_a - k_d) \frac{D}{E} \quad \text{.....(7)}$$

Thus, if the firm is unlevered (i.e. $D = 0$) then $K_e = K_a$ i.e. cost of capital will be equal to cost of equity. But, if the firm is levered D/E will be positive and $(k_a - k_d)$ is also positive. Thus, $k_e > k_a$ i.e. cost of capital will be less than the cost of equity. And the extra financial risk premium will be equal to ratio of debt & equity multiplied by the difference of k_a and k_d .

$$\text{Financial risk premium} = \frac{(K_a - K_d) D}{E}$$

3.2.2 Illustration: Proposition 2

Suppose there are two firms, U and L. Firm U is the Unlevered Firm and Firm L is the Levered Firm. Firm U has 10000 shares @ Rs 12 per share. Firm L has 5000 shares @ Rs 12 per share and 6% debentures worth Rs 60,000. Operating income of both the firms is Rs 18,000. Now we will compare the cost of equity of these two firms.

1) Cost of equity of Firm U:-

$$K_e = \frac{\text{Net Operating Income}}{\text{Market value of equity}} = \frac{18000}{120000} = 0.15 \text{ or } 15\%$$

In case of Firm U, the cost of equity will be same as cost of capital because of zero debts.

$$\text{Earnings Per Share (EPS)} = \frac{\text{Dividend Income}}{\text{Number of shares}} = \frac{18000}{10000} = \text{Rs } 1.80 \text{ per share}$$

2) *Cost of equity of Firm L:-*

Based on proposition 1, the average cost of capital does not depend on capital structure.

Thus, WACC will be 15%. We know that,

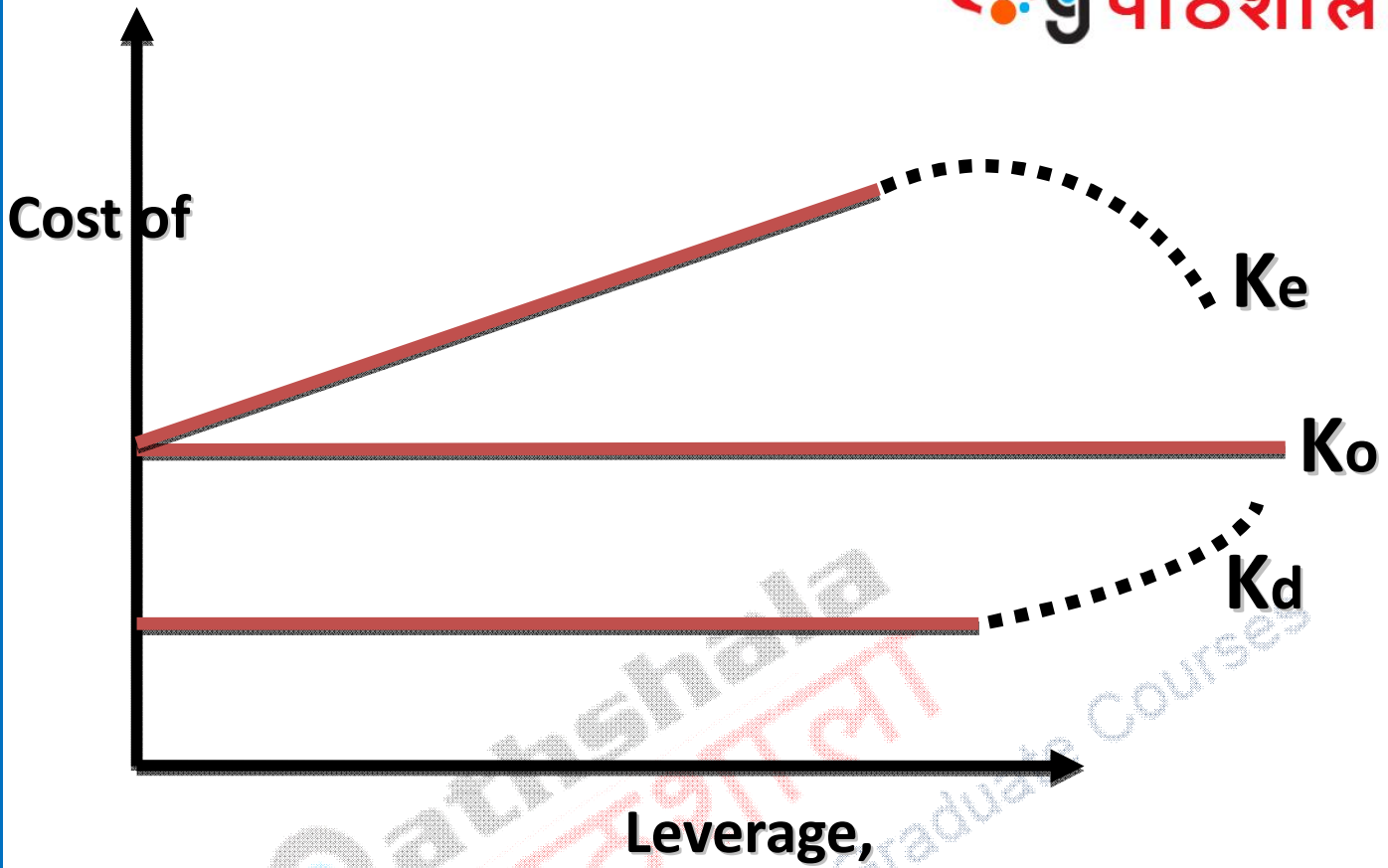
$$K_e = K_a + (K_a - K_d) \frac{D}{E} = 0.15 + (0.15 - 0.06) \frac{60000}{60000} = 0.24 \text{ or } 24\%$$

Thus, cost of equity will be higher than WACC i.e. 15%. The extra 9% becomes the financial risk premium.

$$\begin{aligned} \text{Earnings Per Share (EPS)} &= \frac{\text{Net Operating Income} - \text{Interest}}{\text{Number of shares}} \\ &= \frac{18000 - 3600}{5000} = \text{Rs } 2.88 \text{ per share} \end{aligned}$$

Conclusion: Thus, it can be concluded that the return for shareholders in the form of EPS and ROE (K_e) increase with increase in leverage.

As we know that, WACC remains same on changing leverage under proposition 1, it is also important to note that as leverage increases, the cost of debt also increases because of higher risk of default. Thus, the increase required in cost of equity slightly slows down i.e. K_e increases at a decreasing rate. Eventually, with very high leverage, debt holders get a claim on firms' assets. Thus, the business risk of shareholders is transferred to debt holders. Thus, K_e starts decreasing beyond a limit as shown below.



3.3 Criticism of MM Approach

The propositions given by MM mainly holds true because of the arbitrage process of investors. But this arbitrage process may take place only when the underlying assumptions hold true. But if we look at the capital markets, these assumptions don't hold true, because of which arbitrage can't take place and there exists a difference between the value of levered and unlevered firm. Following are the criticisms of MM hypothesis:-

1. **Discrepancy in Lending and Borrowing Rates:** The rates at which investors and firms can borrow and lend are different. Firms generally have higher credit ratings than individual investors, thus can borrow at lower rates. Thus, the assumption on which homemade leverage takes place does not hold true.
2. **No Substitution of Personal and Homemade Leverage:** Although the net return is same in case of personal or corporate leverage, but the risk or liability of investor is different in the two cases. In case of corporate leverage, if firm goes bankrupt the investor will lose only the amount of his equity shares. But if he has personal leverage and firm goes bankrupt, he will lose his shares and will have to repay a loan also. Thus, his risk is higher in case of personal leverage. Thus, homemade and corporate leverages are not same for investors.
3. **Transaction Costs:** There exist transaction costs also. Thus, in the process of buying and selling and converting the leverage from corporate to personal, some costs have to be

incurred. Thus, the extra return in case of personal leverage vanishes due to transaction costs. Thus arbitrage cannot take place.

4. **Institutional Restrictions:** Institutional restriction means restrictions on institutional investors on creating personal leverage. As some of the investors in the firms would be institutional investors also, they cannot get indulge in arbitrage due to restrictions.
5. **Existence of Corporate Taxes:** Due to existence of corporate taxes, levered firms get an advantage. The interest payment is tax deductible. Thus, the net operating income is higher and so is the firm value. Therefore, propositions will not hold true.

4. Summary

- Modigliani and Millar argue that capital structure does not affect value of the firm in the absence of taxes and transaction cost.
- First proposition of MM hypothesis states that capital structure does not affect the value of a firm.
- Even if there are differences in value, arbitrage process brings both the firms (levered and unlevered) at equilibrium i.e. at equal value.
- Second proposition of MM says that it affects returns of investors (shareholders) i.e. return on equity (ROE) and earnings per share (EPS). With increasing leverage, the risk and return of shareholders increase.
- The propositions given by MM mainly holds true because of the arbitrage process of investors.
- Propositions of MM does not hold true in capital markets due to discrepancy in lending and borrowing rates, existence of transaction costs and corporate taxes, no substitution of personal and homemade leverage, etc.