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### (d) The Modigliani-Miller Hypothesis

The Modigliani-Miller (M-M) hypothesis is identical with the Net Operating Income (NOI) approach. It shows that in the absence of corporate taxes, the change in the capital structure or the degree of leverage of a firm will have no impact upon the firm's cost of capital and its market value.

#### Assumptions -

- i) The capital markets are perfect i.e. the investors are free to buy and sell securities and the transaction cost involved are absent (no brokerage costs, commission, etc.)
- ii) The investors are rational in their behaviour
- iii) Information is perfect i.e. each investor has the same information which is readily available to him without any cost.
- iv) The dividend payout is 100%.
- v) There is no corporate tax.

Under M-M Hypothesis we have to determine total value of the firm and overall cost of capital for both unlevered firm and levered firm. Here, the arbitrage process and arbitrage opportunity will be determined by transfer of shares <sup>and vice-versa</sup> from unlevered firm to levered firm. This arbitrage process will incorporate 'Personal leverage' as against the 'Corporate Leverage' and it will be explained with the help of the following example -

E.g. The following information are available for unlevered and levered firm —

<u>Particulars</u>	<u>Firm A</u> (Unlevered firm)	<u>Firm B</u> (Levered firm)
Equity Capital of ₹100 each	4,00,000	1,00,000
12% Debentures	—	3,00,000
Total Investment	<u>4,00,000</u>	<u>4,00,000</u>
Net Operating Income	1,00,000	1,00,000
Cost of equity	15%	16%

- i) Determine value of the firm and overall cost of capital of both unlevered and levered firm under M-M Hypothesis.
- ii) Suppose an investor holds 10% share in Firm B (levered firm). Discuss the arbitrage process under M-M Theory.

Soln: i) Determination of value of the firm and overall cost of capital under M-M Hypothesis.

<u>Particulars</u>	<u>Firm A</u>	<u>Firm B</u>
EBIT	1,00,000	1,00,000
<u>Less: Interest (I)</u>	—	36,000
EBT	<u>1,00,000</u>	<u>64,000</u>
Mkt. Value of Debt (D)	Nil	3,00,000
$\left[ \frac{\text{Interest}}{K_d} \right]$		

<u>Particulars</u>	<u>Firm A</u>	<u>Firm B</u>
Mkt. Value of Equity (E) $\left[ \frac{EBT}{K_e} \right]$	6,66,667	4,00,000
Total Value of Firm (V) $[D+E]$	<u>6,66,667</u>	<u>7,00,000</u>
Overall Cost of Capital ( $K_o$ ) $\left[ \frac{EBIT \times 100}{V} \right]$	15%	14.29%

ii) The following steps are to be considered under Arbitrage process —

Step 1: The investor will sell his 10% share in Firm B (levered firm) in the market for ₹ 40,000 [10% of ₹ 4,00,000]

Step 2: The investor will borrow from Firm B 10% of Debentures i.e. 10% of ₹ 3,00,000 i.e. ₹ 30,000.

∴ Total amount realised by investor = ₹ (40,000 + 30,000)  
= ₹ 70,000.

Step 3: Investor will buy 10% of shares in Firm A (unlevered firm) at a cost of 10% of ₹ 6,66,667 i.e. ₹ 66,667. Hence, surplus funds in the hands of the investor  
= ₹ (70,000 - 66,667)  
= ₹ 3,333.

Step 4: Determination of Net Income of investor from B Ltd. before transfer to A Ltd.

$$\begin{aligned} \text{EBIT} &= \text{₹ } 1,00,000 \\ \text{Less: Debenture Interest} &= \text{₹ } \underline{36,000} \\ & \quad [3,00,000 \times 12\%] \\ \text{EBT} &= \text{₹ } \underline{64,000} \end{aligned}$$

$$\begin{aligned} \text{Net income of investor} &= 10\% \text{ share of Net Income} \\ &= 10\% \times \text{₹ } 64,000 \\ &= \text{₹ } 6,400. \end{aligned}$$

Step 5: Determination of Net Income of investor from A Ltd. after transfer

$$\begin{aligned} \text{EBIT} &= \text{₹ } 1,00,000 \\ \text{Less: Debenture Interest} &= \underline{\text{NIL}} \\ \text{EBT} &= \text{₹ } \underline{1,00,000} \end{aligned}$$

$$\begin{aligned} 10\% \text{ share of the investor} &= \text{₹ } 10,000 \\ & \quad [10\% \times \text{₹ } 1,00,000] \end{aligned}$$

$$\begin{aligned} \text{Less: Interest on personal} & \\ \text{borrowings} &= \text{₹ } 3,600 \\ & \quad [12\% \times \text{₹ } 30,000] \end{aligned}$$

$$\text{Net income of investor} = \text{₹ } \underline{6,400}$$

Step 6: Although it is evident that the Net Income of investor is ₹ 6,400 in both Firm A and Firm B, the investor can increase the income by investing the surplus funds of ₹ 3,333 to elsewhere. Hence, arbitrage is profitable to the investor.

### Observation:

If the above arbitrage process is continued by other investors then value of Firm B will be reduced and value of Firm A will be increased. After a certain point, values of both the firms will be equal. Upto this level arbitrage process is recommended. But beyond this optimum level, if further shares are transferred from B to A then market value of Firm A will decrease and Firm B will increase. Hence, arbitrage is not to be recommended beyond the optimum level.

### Illustration 24.

Two companies, Unlevered Ltd. and Levered Ltd. belong to the equivalent risk group. The two companies are identical in every respect except that the Levered Ltd. has 6% Debentures of ₹ 5,00,000 in its capital structure. The other information for the two companies is as follows :

	Unlevered Ltd.	Levered Ltd.
Net Operating Income/EBIT	1,20,000	1,20,000
Less : Interest on Debentures	—	30,000
Equity Earnings ( $E_e$ )	1,20,000	90,000
Equity Capitalisation Rate ( $K_e$ )	10%	12%
Market Value of Equity ( $S$ ) $\left[ \frac{E_e}{K_e} \right]$	12,00,000	7,50,000
Market Value of Debt ( $D$ )	—	5,00,000
Total Value of the Firm ( $V$ ) [ $S + D$ ]	12,00,000	12,50,000
Overall Capitalisation Rate ( $K_o$ ) $\left[ \frac{EBIT}{V} \right]$	10%	9.6%
Debt/Equity Ratio	0	$66\frac{2}{3}\%$

An investor Mr. Z holds 5% equity shares of Levered Ltd. Is it possible for Mr. Z to reduce his outlay to earn same return through the use of arbitrage process ? Illustrate.

**Solution :**

Through arbitrage process it is possible for Mr. Z to reduce his outlay and earn the same return as follows :

1. Mr. Z would sell his 5% shares in Levered Ltd. for ₹ 37,500 (5% of ₹ 7,50,000)
2. He would create a personal leverage equal to his share of debt in the Levered Ltd. by borrowing ₹ 25,000 (5% of ₹ 5,00,000)
3. Total amount available with him is ₹ 62,500 (₹ 37,500 + ₹ 25,000).
4. He would buy 5% of shares in Unlevered Ltd. for ₹ 60,000 (5% of ₹ 12,00,000)
5. The income position of Mr. Z by switching his holding from Levered Ltd. to unlevered Ltd. as follows :

	₹
<b>Existing Income in Levered Ltd.</b>	
EBIT	1,20,000
Less : Interest on Debentures (6% of ₹ 5,00,000)	30,000
Earning available to equity shareholders for dividend	90,000
5% share of Mr. Z (5% of ₹ 90,000)	4,500
<b>Income in Unlevered Ltd. after switching his holding from Levered Ltd.</b>	
EBIT	1,20,000
Less : Interest on Debentures	NIL
Earnings available to equity shareholders for dividend	1,20,000
5% share of Mr. Z (5% of ₹ 1,20,000)	6,000
Less : Interest on Personal loan (6% of ₹ 25,000)	1,500
	4,500

His return from the Levered firm is ₹ 4,500 same as in the Unlevered firm. However, the funds involved in the Unlevered Ltd. are ₹ 60,000 only and thus, the investor can save an amount of ₹ 2,500. Therefore, it is possible for Mr. Z to reduce his outlay to earn the same return through the use of arbitrage process.

## Consideration of Corporate Tax factor in the M-M Hypothesis

Due to strong objections of some prominent financial theorists, M-M modified their earlier stand and admitted with the view that due to corporate tax factors, the overall cost of capital can be lowered as more leverage can be introduced in the capital structure of the firm. This is because dividends and retained earnings are not deductible for tax purposes. On the other hand, interest on debt is a tax-deductible expense. As a result, the value of levered firm (i.e. with debt) is higher than the value of unlevered firm (i.e. without debt).



According to the M-M Hypothesis, the value of an unlevered firm ( $V_u$ ) may be computed as follows:

$$V_u = \frac{\text{EBIT} (1-t)}{K_o}$$

where,  $V_u$  = Value of unlevered firm

EBIT = Earnings before interest and taxes.

$t$  = Corporate tax rate

$K_o$  = Overall cost of capital.

Here,  $K_o = K_e$  i.e. Overall cost of capital is equal to Cost of Equity.

The value of a levered firm ( $V_L$ ) can be computed as follows:-

$$V_L = V_u + tD$$

where,  $V_L$  = Value of levered firm

$V_u$  = Value of unlevered firm

$t$  = Corporate tax rate

$D$  = Amount of debt in levered firm.

### Illustration 6.

There are two firms P Ltd. and Q Ltd. which are exactly identical except that Q Ltd. has debts in its capital structure. P Ltd. is an unlevered firm having total assets of ₹ 10,00,000, all represented by share capital of ₹ 10,00,000 and equity capitalisation rate  $K_e$  of 10% (which is also overall cost of capital,  $K_o$ , for the unlevered firm). It has an EBIT of ₹ 2,00,000 subject to corporate tax @ 35%. Q Ltd. also having total assets of ₹ 10,00,000 and alike in all respects to P Ltd. except that Q Ltd. has 5% Debt of ₹ 4,00,000.

Using M-M Model with corporate taxes :

- Determine the total Market Value of both the firms.
- Determine the Cost of Equity ( $K_e$ ) for both the firms.
- Determine the Overall Cost of Capital ( $K_o$ ) for the firms.
- Make suitable comment on the above computations.

### Solution :

- Determination of total Market Value (V)

For unlevered firm P Ltd. ( $V_U$ )

$$\begin{aligned} V_U &= \frac{EBIT(1-t)}{K_o (=K_e)} \\ &= \frac{₹ 2,00,000 (1-0.35)}{0.10} \\ &= ₹ 13,00,000 \end{aligned}$$

For levered firm Q Ltd. ( $V_L$ )

$$\begin{aligned}V_L &= V_U + tD \\ &= ₹ 13,00,000 + (0.35 \times ₹ 4,00,000) \\ &= ₹ 14,40,000\end{aligned}$$

In this case, the market value of equity(s) is ₹ 10,40,000 (₹ 14,40,000 - ₹ 4,00,000)  
[∵  $V = S + D$  or,  $S = V - D$ ]

(b) Determination of Cost of Equity ( $K_e$ )

For unlevered firm P Ltd.

— 10%

For levered firm Q Ltd.

EBIT

Less : Interest (5% of ₹ 4,00,000)

EBT

Less : Tax @ 35%

EAT/Earnings available to equity share holders/Equity Earning ( $E_e$ )

₹
2,00,000
20,000
1,80,000
63,000
1,17,000

Now, We know that, Market Value of Equity ( $S$ ) =  $\frac{E_e}{K_e}$

$$\text{or, } K_e = \frac{E_e}{S}$$

$$\begin{aligned}&= \frac{₹ 1,17,000}{₹ 10,40,000} \\ &= 0.1125 \text{ or } 11.25\%\end{aligned}$$

(c) Determination of Overall Cost of Capital ( $K_o$ )

For Unlevered firm P Ltd.

Here,  $K_e = K_o = 10\%$  (∵ unlevered)

For levered firm Q Ltd.

$$K_o = \left(\frac{D}{V}\right)K_d(1-t) + \left(\frac{S}{V}\right)K_e$$

$$= \left[\frac{D}{D+S}\right]K_d(1-t) + \left[\frac{S}{D+S}\right]K_e$$

$$= \left[\frac{₹ 4,00,000}{₹ 4,00,000 + ₹ 10,40,000}\right] 0.05(1 - 0.35) +$$

$$\left[\frac{₹ 10,40,000}{₹ 4,00,000 + ₹ 10,40,000}\right] \times 0.1125$$

$$= [0.2778 \times 0.0325] + [0.7222 \times 0.1125]$$

$$= 0.0090285 + 0.0812475$$

$$= 0.090276 \text{ or, } 9.03\%$$

(d) The computation of different values for P Ltd. and Q Ltd. can be shown in a summarised form as follows :

Firm	EBIT (₹)	Corporate Tax Rate ( $t$ )	Market Value ( $V$ ) (₹)	Cost of Equity ( $K_e$ )	Overall Cost of Capital ( $K_o$ )
P Ltd. (Unlevered)	2,00,000	35%	13,00,000	10%	10%
Q Ltd. (Levered)	2,00,000	35%	14,40,000	11.25%	9.03%

► **Comment :**

It is evident that because of corporate income taxes, the levered firm (i.e., Q Ltd) can lower its cost of capital or increase its market value by continuously increasing leverage in its capitalisation. M-M hypothesis suggests that in order to achieve optimal capital structure the firm should strive for the maximum amount of leverage when *interest tax-shield* is taken into consideration.