CHAPTER II
CAPITAL STRUCTURE AND COST OF CAPITAL - A THEORETICAL ANALYSIS

Various theories of capital structure and cost of capital which form the basis of study are explained in this chapter. Also, an attempt is made to explain the methods of computing the cost of various sources of funds. Finally, a brief review of literature available in this context are presented to prepare the groundwork for analysing the relationship between capital structure and cost of capital.

PART-I

II. 1 Theories of Capital Structure:

According to the traditional theory\(^1\), the cost of capital is affected by its capital structure, while Modigliani-Miller\(^2\) maintain that the cost of capital is independent of its capital structure. These theories are contrary to each other because of the difference in their approach. The proponents of the former adopted net income approach while the latter, the net operating income approach\(^3\).

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From the figure it is clear that as leverage \((B/S)\) increases, overall cost of capital \((K_0)\) decreases. This is because, the proportion of debt, the cheaper source of finance, increases in the capital structure.

II.1.2 Net operating income approach:

According to the net operating income approach, the market value of the firm is not affected by the capital structure changes. The market value of the firm is obtained by capitalising the net operating income at the overall average cost of capital, \(K_q\), which is constant. Therefore under this approach, the
In order to examine the relationship between capital structure and cost of capital, the following assumptions are made.

a. There is no income-tax, corporate or personal.
b. The firm pursues a policy of 100 percent dividend payout.  
c. Investors have identical subjective probability distributions of net income which is assumed to be constant for each company and  
d. A firm can change its capital structure almost instantaneously without incurring transaction costs.

(Based on the above assumptions, the following calculations are made.

\[ K_d = \frac{F}{B} = \frac{\text{Annual interest charges}}{\text{Market value of debt}} \]

Assuming that the debt capital is perpetual, \( K_d \) represents the cost of debt.

\[ K_e = \frac{E}{S} = \frac{\text{Equity earnings}}{\text{Market value of equity}} \]

When the dividend payout ratio is 100 percent and earnings constant, \( K_e \), as defined here represent the cost of equity capital.

Overall cost of capital is calculated as:

\[ K_o = \frac{0}{V} = \frac{\text{Net Operating income}}{\text{Market value of the firm}} \]
Where

\[ V = B + S \]

\( K_o \) = overall capitalisation rate for the firm.

\( B \) = Market Value of Debt.

\( S \) = Market Value of Equity.

II.1.1 Net Income Approach:

The essence of the net income approach is that the firm can increase its value or lower the overall cost of capital by increasing the proportion of debt in the capital structure. According to this approach the cost of debt capital, \( K_d \), and the cost of equity capital, \( K_e \), remain unchanged when \( B/S \), the proportion of debt in the capital structure varies. The constancy of \( K_d \) and \( K_e \) with respect to \( B/S \) means that \( K_o \), the average cost of capital is measured as

\[ K_o = K_d \left( \frac{B}{B+S} \right) + K_e \left( \frac{S}{B+S} \right) \]

declines as \( B/S \) increases. This happens because when \( B/S \) increases, \( K_d \), which is lower than \( K_e \), receives a higher weight in the calculation of \( K_o \).
overall capitalisation rate and the cost of debt remain constant for all degrees of leverage.

In the equation

\[ K_o = K_d \left( \frac{B}{B+S} \right) + K_e \left( \frac{S}{B+S} \right) \]

\( K_o \) and \( K_d \) are constant for all degrees of leverage. Hence, the cost of equity can be expressed as

\[ K_e = K_o + \left( K_o - K_d \right) \left( \frac{B}{S} \right) \]

The critical premise of this approach is that, the market capitalises the firm as a whole at a discount rate, which is
independent of the firm's degree of leverage. As a consequence, the division between debt and equity is irrelevant. An increase in the use of debt funds which are apparently cheaper is offset by an increase in the equity capitalisation rate. This happens because, equity investors seek higher compensation as they are exposed to greater risk arising from increase in the degree of leverage. They raise the capitalisation rate \( K_e \), as the degree of leverage increases.

David Durand\(^4\), in support of this approach argued that the market value of a firm depends on its net operating income and business risk. Hence the change in the degree of leverage employed by a firm cannot change underlying factors. Similar arguments were also made by Modigliani - Miller.

II.1.3 The Traditional View:

The traditional view, also known as an intermediate approach, is a compromise between the net income approach and the net operating income approach. The main propositions of the traditional approach are:

a. Up to a certain degree of leverage, the cost of debt capital \( K_d \), remains more or less constant but rises at an increasing rate thereafter.

b. The cost of equity capital \( K_e \), remains more or less constant or rises only gradually up to a certain degree of leverage and rises sharply thereafter.

\(^4\) Durand, D., op. cit PP. 91-116.
c. The average cost of capital, $K_o$, as a consequence of the above behaviour of $K_e$ and $K_d$,
(i) decreases up to a certain point.
(ii) remains more or less unchanged for moderate increases in leverage thereafter and
(iii) rises beyond a certain point.
Several shapes of $K_d$, $K_e$ and $K_o$ are consistent with this approach

**TRADITIONAL APPROACH**

Thus the traditional approach implies that the cost of capital is dependent on the capital structure and that there is an optimal capital structure which minimises the cost of capital.

**Criticism of the Traditional View:**

The validity of the traditional position is questioned on the ground that the market value of the firm depends upon its net
operating income and risk attached to it. This form of financing can neither change the net operating income nor the risk attached to it. It can simply change the way in which net operating income or the risk attached to it are distributed between equity and debtholder. Therefore, firms with identical net operating income and risk, but differing in their modes of financing should have the same total value. The traditional view is criticised because, it implies that totality of risk incurred by all security-holders of a firm can be altered by changing the way in which this totality of risk is distributed among the various classes of securities. However, the argument of the traditional theorists that an optimum capital structure exists can be supported on two counts: the tax deductibility of interest charges and market imperfections.

Modigliani and Miller do not agree with the traditional views. They criticise the assumption that the cost of equity remains unaffected by leverage up to some reasonable limit. They assert that sufficient justification do not exist for such an assumption. They do not accept the contention that moderate amount of debt in 'sound' firms do not add very much to the riskiness of the shares.

II. 1.4 The Modigliani-Miller Hypothesis:

Modigliani and Miller provided rigorous challenge to the traditional model. According to them, the cost of capital and the value of a firm remains unaffected by the leverage employed by the firm. In their opinion, any rational choice of debt and equity would result in the same cost of capital under their assumptions and there is no optimum mix of debt and equity financing. The independence of cost of capital argument is based on the hypothesis that, regardless of the effect of leverage on the interest rate, the equity capitalisation rate will rise by an amount sufficient to offset any possible saving from the use of low cost debt.

The Modigliani-Miller hypothesis is identical with the net operating income approach. Modigliani and Miller argue that in the absence of taxes, a firm's market value and the cost of capital remain unaltered to the capital structure changes. In their 1958 article\(^6\), they provide analytically sound and logically consistent behavioural justifications in favour of their hypothesis and reject the traditional view as incorrect based on the following assumptions.

1. The securities are traded in the perfect capital market situation. This specifically means that a) investors are free to buy or sell securities b) they can borrow without restriction as under the same terms as the firms do in the capital market and c)

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\(^6\) Modigliani F. and Miller, M.H., op. cit. pp 281-37.
they behave rationally. It is also implied that the transaction costs (the cost of buying and selling securities) do not exist.

2. Firms can be grouped into homogeneous risk classes. Firms are considered to belong to a homogeneous risk class if their expected earnings have identical risk characteristics. It is generally implied under the Modigliani - Miller hypothesis that firms within the same industry constitute the homogeneous class.

3. The expected net operating income is represented by a random variable and all the investors agree on the expected value of this probability distribution.

4. Firms distribute all net earnings to the shareholders, which means a 100 percent payout.

5. There is no corporate income tax. (However, in their later study the corporate income tax is considered).

The Modigliani - Miller argument is based on a simple switching over mechanism which is called as "arbitrage". They contend that market value of the two firms which are identical except for the difference in the pattern of financing will not vary because the arbitrage process will drive the total values of the two firms together. A rational investor, according to them, will employ arbitrage in the market to prevent the existence of the two assets in the same risk class and with the same expected returns from selling at different prices. For example, shares of
the two firms in the same risk class with equal expected returns cannot be sold at different prices in the market simply because one has applied larger doses of debt than the other while the investor can use personal leverage to achieve identical results.

The arbitrage process will continue until the difference in market values of the two firms are eliminated. At the equilibrium, the overall cost of capital ($k_o$) of the firms will be the same.

Theoretical validity of the Modigliani - Miller hypothesis is difficult to counter. Moreover, the approach has been criticised by a number of experts questioning the very assumptions on which the theory is framed.

Criticism of the Modigliani - Miller Hypothesis:

The arbitrage process is the behavioural foundation for the Modigliani - Miller hypothesis. The shortcoming of the Modigliani - Miller hypothesis lies in the assumption of perfect capital market in which arbitrage is expected to work. Due to the existence of imperfections in the capital market, arbitrage will fail to work and will give rise to discrepancy between the market values of levered and unlevered firms. The arbitrage process will fail to bring equilibrium in the capital market due to the following reasons.

1. The assumption that firms and individuals can borrow and lend at the same rate of interest does not hold good in practice.
2. It is incorrect to assume that "personal, homemade leverage" is a perfect substitute for "corporate leverage". The existence of limited liability of the firms in contrast with the unlimited liability of individuals clearly places the individuals and the firms on a different footing in the capital markets.

3. The existence of transaction costs also interferes with the working of arbitrage. Because of the costs involved in the buying and selling of security, it would become necessary to invest a greater amount in order to earn the same return. As a result, the levered firm will have a higher market value.

4. Institutional restrictions also impede the working of arbitrage.

5. The incorporation of the corporate income tax will also frustrate Modigliani - Miller's conclusions. Interest charges are tax deductible. This in fact means that, the cost of borrowing funds to a firm is less than the contractual rate of interest.

II.1.5 The Modigliani - Miller Hypothesis and the Corporate Taxes:

Following strong objections of Ezra Solomon and the prominent financial theorists, Modigliani and Miller modified their earlier stand and agreed with the view that favorable financial leverage can lower the overall cost of capital of a firm if corporate tax exists.7

Modigliani - Miller demonstrate that the value of a levered firm is higher than the value of an unlevered firm because of the fact that interest is tax deductible and as a result of this, more income flows to investors.

With taxes, the value of a firm according to Modigliani - Miller is

\[ V = \frac{\text{NOI} (1-t) + B(t)}{P_k} \]

Where \( t \) = corporate tax rate

\( P_k \) = After tax capitalisation rate applicable to the unlevered firm.

\( \text{NOI} \) = Expected net operating income.

\( B \) = Market value of debt.

Modigliani - Miller clearly recognise that, because of corporate income taxes, the firm can lower its cost of capital and raise value by continuously increasing the leverage. They suggest that in order to achieve optimum capital structure the firm should strive for the maximum amount of leverage. In contrast to this, traditional model pleads that cost of capital will tend to rise with the extreme leverage owing to increased financial risk. Therefore, the optimum capital structure according to the traditional model is not the one that calls for the maximum use of debt.
Part II

II.2 Computation of Cost of Capital:

The cost of each source of finance is computed as per the following method.

II.2.1 Preference share capital:

The cost of preference share capital is calculated on the basis of specified dividend rate.

\[ K_p = \frac{D}{P} \]

Where, 
- \( K_p \) = Cost of preference share capital
- \( D \) = Dividends stated
- \( P \) = Net proceeds of preference shares

The cost of preference share capital is not adjusted for income taxes, since, dividend is paid after taxes.

II.2.2 Equity share capital along with retained earnings:

The cost of equity is the discount rate \( K_e \), which equates the market value of equity with the present value of expected benefits. The expected future benefits can be expressed in terms of dividend or earnings. Accordingly, there are two approaches or models that may be employed to calculate the cost of equity.
There are,

1. Dividend model and
2. Earnings model.

Dividend model:

\[
K_e = \frac{D}{P}
\]

Where, \( K_e \) = Cost of equity

\( D \) = Expected dividend per share

\( P \) = Market price per share.

The basic assumptions of this model are:

i. the shareholders are concerned of dividend and

ii. the market value of the shares depend on the expected dividend stream.

If the dividends are expected to grow at a constant rate, \( g \), the cost of equity can be ascertained by the following equation.

\[
K_e = \frac{D_1}{P} + g
\]

Where \( D_1 \) = dividend per share after a year

\( P \) = current market price of equity per share.
The dividend model is not used in the present study since there can be no dividend when profits have been fully ploughed back. Also, when losses are incurred, the question of dividend does not arise. This is also considered by Modigliani-Miller and others.

Earnings model:

According to the earnings model, the cost of equity is measured as a ratio of expected earnings to price. That is

\[ K_e = \frac{E}{P} \]

Where

- \( E \) = Earnings per share
- \( P \) = Market price per share
- \( K_e \) = Cost of equity.

This model is based on the assumptions that the future earnings will grow at a constant rate and can be expressed as an average, and that the market price of shares is determined by the expected earnings stream.

Although the dividend model is more logical, yet it is the earnings model which is widely used in practice.\(^8\) It is preferred over the dividend model because, the cost of capital is

used primarily as an investment criterion and since earnings is the goal, the problem should be approached directly by using the earnings model.

II.2.3. Cost of debentures and long term loans:

The cost of debentures may be defined as the minimum rate of return that must be earned on debenture investment, if a company's total wealth is to remain intact. This rate will be contractual rate of interest on debentures. Computation of cost of debenture is relatively easy because, interest rate at which funds are borrowed is known. The explicit cost of debt is the discount rate $K_1$, which equates the net proceeds of the debt issue with the present value of interest plus principal payments and then adjusting the explicit cost obtained for the income tax effect. Since the interest charges are tax deductible, the after tax cost of debenture is calculated as follows.

$$K_d = K (1-t)$$

Where $K_d$ = after tax cost of debt  
$K$ = before tax cost of debt  
$t$ = tax rate

II.3. Weighted Average Cost of Capital (WACC):

Weighted average cost of capital is calculated in the following manner.
a. Cost of each source of funds namely, equity, preference share capital, retained earnings and debt is to be separately calculated.

b. Cost of each source is multiplied by the proportion of each source of capital.

c. In adding the weighted cost of all sources of funds, the weighted average cost of capital is obtained.

The weights used in calculating the weighted average cost of capital can be expressed in terms of book value or market value. Book value weights are determined by dividing the book value of each capital source by the sum of the book value of the total sources. Similarly, the market value weights are determined by dividing the market value of each capital source by the sum of the market values of all the sources.

The use of market value weights is theoretically more appropriate because, market values reflect current cost and the expectation of shareholders, while book values reflect historical costs. But the use of market value weight involves the danger of introducing a bias into the measurement of cost of capital. As market price is subject to constant fluctuation, its selection poses another difficulty.
The book value weights are used in this study. Book value weights are preferred because, these weights are easily ascertainable and controllable by the management. These weights are commonly used by the investors and policy makers.

PART III
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Review of Literature
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There are many studies supporting Modigliani - Miller\(^9\) and the traditional views. The Modigliani - Miller and Barges\(^10\) studies are based on simple regression technique, while Weston\(^11\).


pointing out specification bias in those studies used the multiple regression technique. Davenport used the British data of three unregulated industries to test the cost of capital proposition. Two stage least squares technique method is used by Modigliani – Miller to test the cost of capital hypothesis, also incorporating the tax effect of debt financing.

The others who tested the Modigliani – Miller hypothesis include Sarma and Rao, Rao.C. and R. Litzen Berger, Chakraborthy S.K. and Pandey I.M. Wippern used different leverage variable for conducting his study. The purpose of this chapter is to review some of the important empirical studies undertaken so far in India and abroad.


Modigliani and Miller's first study was based on the works of Allen and Smith. This theory is based on the following assumptions namely,

a. Capital markets are perfect and investors are assumed to be rationale.

b. The average expected future operating earnings of a firm are represented by a subjective random variable. The expected values of the probability distributions of expected operating earnings for all future periods are the same as the present operating earnings.

c. Firms can be categorised into equivalent risk classes. All firms within a class have the same degree of business risk, and

d. Corporate income tax is assumed to be absent.

Based on these assumptions, Modigliani and Miller first presented their independent hypothesis. The basic Modigliani - Miller hypothesis is that, the value of a firm and its cost of


capital are completely unaffected by its capital structure in the absence of corporate income tax. In other words, it implies that the inclusion of debt in the capital structure will not increase the value of the firm because, the benefit of cheaper debt will be exactly offset by the increase in cost of equity. Modigliani and Miller also offered behavioural support for the independence of the valuation and the cost of capital of a firm from its capital structure.

Modigliani and Miller have supported their claim with empirical evidence. Taking the figures of forty three electrical companies of the period 1947-48, they used the following linear regression model to test their hypothesis.

\[ X = a + bd \]

where,

\[ X = \frac{X_t}{V} \]

Sum of interest, preferred dividends and stockholders' after tax income

\[ V \]

Market value of all securities

\[ d = \frac{D}{V} \]

Market value of senior securities (debt + preferred stock)

Market value of all securities

Where,

\[ X = \text{Overall cost of capital} \]

\[ d = \text{Their measure of financial leverage} \]

They found that

\[ X = 5.3 + 0.006d (+/- 0.008) \]
The above regression shows that the overall cost of capital for electrical utilities during the 1947-48 period was 5.3 percent. The increase of 0.006 percent for each unit of additional financial leverage was so small as to be statistically insignificant, as indicated by the fact that its standard deviation was larger than the coefficient itself. Modigliani and Miller interpreted this to mean that the overall cost of capital was constant, because the slope of the line, as measured by the second term of equation, is insignificant. They found similar results for forty two oil companies during 1953, such that

\[ X = 8.5 + 0.006d \]

\[ V = (0.024) \]

Where again, the slope of the line was insignificant.

On the other hand, Modigliani and Miller found that the slope of the line for the cost of equity capital was significant, in contrast to and sufficient to exactly offset the injection of lower-cost debt and keep the overall cost of capital constant. They used the following model.

\[ Z = a + bh \]

where \( Z = \) Shareholders' net income after taxes

\[ \frac{\text{Market value of common shares}}{\text{Market value of senior securities}} \]

\( h = \) Market value of common shares
The following regression results were obtained.

Electrical Utilities $Z = 6.6 + 0.017 h (\pm 0.004)$
Oil companies $Z = 8.9 + 0.051 h (\pm 0.012)$

Modigliani and Miller concluded that the cost of capital rose at a sufficient rate as financial leverage increased to exactly offset the injection of lower-cost debt capital and keep the overall cost of capital constant.

Modigliani and Miller's results thus do not support the traditional position. But in view of their revised hypothesis\(^\text{20}\), that, the cost of capital declines with leverage due to the tax deductibility of interest charges, these findings needs a revision before outrightly rejecting the traditional view.

Modigliani - Miller hypothesis is criticised on the following grounds.

a. Sample firms in electric utilities and oil industry display diverse characteristics and do not correspond to the homogeneous risk class.

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b. Higher percentage of the sample observations are found with little or no debt.

c. The random variable v, used in the demonstration of the dependent and independent variables, tend to be highly correlated. This indicates a positive bias to the co-efficient of D/V, and hence, it is not a fair test of the traditional theory.

d. Omission of other variables (growth, payment size etc.) would significantly bias the co-efficient of the leverage variable.

e. Barges has criticised Modigliani and Miller for using market value measure of leverage variable. He contends that this will introduce bias against traditional theory.

However, it should be noted that Modigliani and Miller are aware of the limitations of their work and regard their findings as suggestive rather than conclusive.

II.5  Modigliani and Miller's second study

Following strong objections from Ezra Solomon and other prominent financial theorists, Modigliani and Miller modified their earlier stand and agreed with the view, that favourable financial leverage can lower the overall cost of a firm if corporation tax exists. According to him the value of levered firm is higher than the value of unlevered firm because of the

fact that interest is a tax deductible expense and due to which more income flows to investors.

Their sample consisted of sixty three electric utilities and the relationship studies were for three years namely, 1954, 1956 and 1957.

To study the effect of leverage and other variable on the cost of capital, they obtained the following equation.

\[(V-tD) = \frac{1}{A} + \frac{x}{A} \frac{(1-t)}{A} + \frac{\Delta A}{A} + U\]

Where,

- \(a_1\) = The marginal capitalisation rate for equity streams in the class.

- \(x\) = Expected total earnings.

- \(a_0\) = An intercept term whose size and sign measures any effects of scale on the firms valuation.

- \(a_2\) = The measures of the effects of growth potential on value

\[\Delta A = \frac{(1/5)}{(A_t - A_{t-5})/A_{t-5}}\]

- \(U\) = a random disturbance term

- \(A_t\) = a linear 5 years average of total assets times current total assets.
Regarding earnings variable, Modigliani and Miller pointed out that, theoretically one should use expected future earnings which are not directly measurable. If actually reported when earnings are substituted for expected earnings, certain biases arise which may distort the statistical results. To avoid such biases, Modigliani and Miller used two stage instrumental variable approach. First, regression of reported earnings on several selected instrumental variables, namely, size, growth, debt, preferred stock and dividends was obtained. Secondly, the earnings computed from this regression were substituted for the reported earnings.

In the two stage estimates, co-efficients of debt and preferred stock in the valuation model were so small in relation to their standard errors that, they could not be considered significant. Modigliani and Miller concluded that their findings were in agreement with their hypothesis that, leverage factor was significant only because of the tax advantage involved.

Modigliani and Miller also tested significance of dividends as a factor in the valuation of a firm. In their valuation model, the two stage estimates resulted in co-efficients of dividends variable, which lacked significance. Their findings tended to support their earlier theoretical finding that dividends were irrelevant to the value of common stock in perfect markets and support the independence hypothesis and weaken the
traditional view on the advantage of leverage financing.

The Modigliani - Miller's second study also suffers from a number of limitations.

i) Myran J. Gordon\textsuperscript{22} has questioned its applicability to regulated electricity utility companies. They did not provide perfect markets which had been crucial for Modigliani and Miller's model.

ii) Like the first Modigliani - Miller study, their second study also has the defect of having a large number of observations concentrated in the narrow range of 50 to 70 percent debt-equity ratios.

iii) The two stage least square method used by Modigliani and Miller to estimate the cost of capital was not an efficient estimation technique.

iv) Weston\textsuperscript{23} argued that their findings ran counter to the observed facts.

v) According to Wippern\textsuperscript{24} the theoretical underpinning of their empirical materials were misleading and inconsistent with the theory that Modigliani and Miller were attempting to verify.


\textsuperscript{24} Wippern, Ronald, op.cit., pp.615-633.
II.6 The Barges study\textsuperscript{25}:

Barges conducted the most comprehensive test of Modigliani - Miller hypothesis. Like Modigliani and Miller, he analysed the relationship between the average cost of capital and leverage, and between the stock yield and debt-equity ratio. For the purpose of his study, he utilised cross-section data from three different industries. Rail road, departmental stores and cement industries.

Special features of his study are

1. Unlike Modigliani - Miller's study, his observations have good distribution over the entire range of capital structure. Each sample has a significant number of observations with little or no debt.

2. He made special efforts to introduce homogeneity into the sample firms so that it might not distort the relationships.

3. Barges criticised Modigliani and Miller for using market value as it introduces bias in the estimate of leverage coefficient. He, therefore, used book value measure of leverage. He advanced three reasons to justify his choice of book value measures of leverage.

   i) Heterogeneity in data will not result in a systematic variation in the yield.

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\textsuperscript{25} Barges, A., op.cit., pp.26-33.
ii) Book value measures of leverages are controllable by management in the interest of the shareholders and

iii) Book value measures are the ones which are studied by investors in actual practice.

The use of book value measures of leverage is supported by Beranek\(^{26}\), Brigham and Gordon\(^{27}\) and Weston\(^{28}\).

iv) Barges employed two book value measures of leverage. The first measure considered preference share as part of debt, while the second included it under equity.

Barges supported the traditional concept of a saucer-shaped overall cost of capital curve which could be minimised. Using book values instead of market values for the weighing factors and ignoring any growth, he found that the average overall cost of capital in his regression, first rose and then declined as the ratio of long term debt to the total permanent capital increased for class I rail roads such that,


\[ Y = 12.39 - 0.244X + 0.00258X^2 \]

Where,

\[ Y = \text{the average cost of capital} \]
\[ X = \text{the ratio of long term debt to total permanent capital} \]

The result is significant at 1 percent and clearly suggests that the average cost of capital first tends to decline and then tends to rise as the proportion of debt capital increases in the capital structure.

Barges selected five sub samples in such a manner that one important variable was held constant. Barges used the following two models to test stock yield hypothesis.

\[ Y = a + bx_1 \]
\[ Y = a + bx_2 \]

Where,

\[ Y = \text{the stock yield} \]
\[ x_1 = \text{long term debt/preferred stock plus common equity} \]
\[ x_2 = \text{long term debt plus preferred stock/common equity} \]

The following results were obtained from rail road industry.

**MODEL I**
\[ Y = 11.36 + 0.0194x_1 \quad R = 0.173 \]

**MODEL II**
\[ Y = 10.80 + 0.2386x_2 \quad R = 0.293 \]
According to Barges, co-efficient of correlation is not significant at five percent level in case of Model I, while it is significant in case of Model II at that level. He also ran regression for those observations which had a moderate leverage ratio. The results were not significantly different from zero.

The regressions were run by including the squares of leverage term.

These results neither support nor contradict Modigliani – Miller hypothesis.

In his study of departmental stores, leverage ratios were computed in the same manner as in the rail road industry. The results obtained tend to support the traditional theory. Barges final test was in cement industry. The sample consisted of thirty four companies and was of special interest because, there was a large number of observations with little or no debt. The results obtained by him lend support to the traditional view.

Limitations of Barges study :

1. He has omitted significant explanatory variables like size, growth, payment, earnings variability, which influence leverage and the cost of capital without holding other variables constant, his results are of doubtful validity.
Secondly, the correctness of Barges\textsuperscript{29} results depend on the reasonableness of his use of book value measure of leverage. Theoretically, market value measure of leverage is more appropriate.

II.7 The WIPPERN\textsuperscript{30} Study:

Wippern tried to improve upon the Barges study by incorporating into his regression more variables which, since they were left out of the Barges regression, might have biased the results in favour of the traditional approach. He also concentrated on the cost of equity function instead of the overall cost of capital function. By doing this, Wippern could show that the cost of equity function was significantly linear, and increased at an appropriate rate to exactly off-set the injection of debt into the capital structure and keep the overall cost of capital constant. However, while Wippern did find some indication that the cost of equity capital was more linear and the overall cost of capital was a little less saucer-shaped than Barges had estimated, the cost of equity did not increase fast enough to keep the overall cost of capital constant.


\textsuperscript{30} Wippern, Ronald, op.cit., pp.615-633.
Wippern's specific regression model used the earnings yield as the imputed cost of equity capital, such that

\[ \frac{E}{P} = a + b_1 (FL) + b_2 (G) + b_3 (\text{divid}) + b_4 (S) + \ldots + b_{10} (Dt) \]

Where,

\[ \frac{E}{P} = \text{the earnings price ratio (earnings yield)} \]

\[ FL = \text{financial leverage as measured by i/c -2s where, it was the most recent years reported fixed charges, C was the 10 year trend line average of cash inflow and 2s was twice the standard deviation around that trend line.} \]

\[ g = \text{the growth} \]

\[ \text{Divid} = \text{the payout ratio for the firm.} \]

\[ S = \text{the logarithm of the firms size as measured by its assets} \]

\[ \text{Dt} = \text{dummy variables assigned to each industry to ensure that no bias because of business risk and operating environment distorts the relationship between financial leverage and the cost of equity.} \]

It is to be noted that wippern has taken great pains to ensure that his financial leverage measure is not distorted by the book value or the market value weighings and to include almost all the other variables to be sure that the results are not biased by the omission of an important factor.
II.8 Brigham and Gordon:
Brigham and Gordon\textsuperscript{31} used a slightly different model to test the behaviour of the cost of equity capital over the range of financial leverage. Their model being

\[ \frac{D_0}{P_0} = a + a_1 g + a_2 h + a_3 u \]

Where,

\[ \frac{D_0}{P_0} \] = the current dividend yield
\[ g \] = the growth rate of the firm
\[ h \] = the degree of the financial leverage
\[ u \] = an index of stability in the firm's earnings

Using sixty nine utility stock from 1958-1962, Brigham and Gordon found that the cost of equity as measured by the current dividend yield rose as the degree of financial leverage rose, but the implied slope was insufficient to maintain a constant overall cost of capital and that the traditional saucer-shaped \( K_0 \) function was supported.

II.9 The Weston Study:

Weston\textsuperscript{32} made one of the earlier attempts to refine the Modigliani and Miller empirical work by including the firm size and growth in order to determine the overall cost of capital.

\begin{itemize}
  \item 32. Weston J. Fred, op.cit., pp. 107-12.
\end{itemize}
Where,

\[ K_o = a + b_1(D/E) + b_2(A) + b_3(g) \]

Where,

\[ K_0 = \text{the overall cost of capital after tax} \]
\[ D/E = \text{the firms debt-equity ratio} \]
\[ A = \text{the firms asset value} \]
\[ g = \text{the firms growth rate} \]

Regressing the above equation on fifty-nine utilities for the year 1959, Weston found that the financial leverage variable (D/E) had a significant negative sign which to him supported the traditional concept of a saucer-shaped overall cost of capital function. He also found similar results when he used the pre-tax \( K_0 \) and when he excluded the preferred stock from the debt-equity ratio.

Weston's study also suffers from certain other important explanatory variables such as payout ratio and earnings variability.

II.10 Haim Ben-Shahar\(^3\):

In his article "The Capital Structure and the Cost of Capital: A suggested exposition", Haim Ben-Shahar has examined the firm's capital structure in terms of two parameters: the expected rate of return on the firm's stocks and its standard deviation. The relationship between the firm's capital structure

and the efficient opportunity curve of yield versus risk was presented, and the range of efficient capital structure of the firm was derived. The capital structure theorem was then formulated, stating that the firm's cost of capital is constant along the range of efficient structure and rises at the inefficient range. Since the range of efficient capital structure was shown to depend on the market structure of interest rates, it followed that the shape of the cost of capital curve is determined by the interest-rate structure.

It was therefore concluded that, in a perfect capital market where the interest rate is constant, any capital structure is efficient and that the cost of capital is therefore constant. When a firm's borrowing rate rises and the investors rate is constant, the range of efficient capital structure is limited. The highest efficient financial leverage is determined where the firm's marginal borrowing rate equals the investors rate. The cost of capital is therefore constant along the range of efficient capital structure and rises along the range of inefficient capital structure.

For other interest rate structures, different ranges of efficient capital structure are deduced, affecting the shape of the cost of capital curve. The analysis was carried out under the constraint that the investor has the opportunity to invest
In his article "The cost of Capital and the structure of the firm", Douglas Vickers has concentrated on the narrow but important set of issues namely, the nature and relevance to a firm at different optimisation points of the cost of money capital. But it has been inferred throughout and is implicit in the general optimisation planning model they have proposed that, the entire question of money capital costs is intimately bound up with the other aspects of the optimisation decisions of the firm, and in particular, with the optimum factor usage decision.

The purpose of the study was to employ the Modigliani and Miller's model under Indian conditions to a non-regulated industry and to test the influence of the debt on the value of the firm. They employed two stage least square method on the

data of thirty Indian engineering firms for three years namely, 1962, 1964 and 1965. In their estimate, the leverage variable has a co-efficient greater than the tax rate. Thus, agreeing with the traditional view, they concluded that the cost of capital is affected by debt apart from its tax advantage.

II.13 Pandey's Study:

Pandey describes the implications of financial leverage for the shareholders, the concept of cost of capital and capital structure theories using the data of four Indian industries namely, cotton, chemicals, engineering and electricity consisting of one hundred and thirty one companies for three cross-section years 1968, 1969 and 1970, as well as for the pooled data. A comprehensive regression was constructed to study the effect of capital structure on the cost of capital. The results of the study are in conformity with the traditional theoretical viewpoint. Cost of capital remains invariant to capital structure changes in the beginning, but rises slowly as compared to changes in capital structure. The main purpose of this study was either to approve or disapprove the Modigliani - Miller's independent hypothesis and not to measure the cost of capital.

II.14 Chakraborty's Study:

The main purpose of Chakraborty's study was to study


debt-equity financing pattern in private sector Indian industries and also to examine whether cost of capital, a resultant of capital structure, has any effect on debt-equity ratio or not. Though he has taken the data of seven hundred and seventy five public, as well as private companies, a sample of twenty two companies only (for the years 1963, 1966, 1968 and 1971) has been taken to compute the cost of capital. Book value weights had been used for computing the cost of capital. He also tried to test the linkages of company's cost of capital with its income distribution policy. He found negative correlation between these factors. The study has also proved that the cost of capital is an inverse function of share price.

He had taken Debt/Equity ratio as a dependent variable and sales growth, asset growth, retained earnings, operating profit (gross assets, gross fixed asset/sales, tax/profit and age of firms) as independent variables. He also found out the weighted average cost of capital for each company, for each of these years and then arrived at an average for all the four years for each company based on E/P ratio. The limitation of the study was that the size of the sample was too small to offer any generalised conclusion about inter-firm and inter-industry group variations.

II.15 V. Goyal's Study:

It is a unique study on the measurement of weighted average

cost of capital. The main purpose of his study was to measure the cost of capital using Indian data and to study its impact on decisions like budgeting and capital structure. The sample consists of one hundred and fifty six companies of seven industries which have different characteristics and are unregulated. The study covered a period of two years namely 1979 and 1985.

First of all, the cost of capital of each source of finance was calculated along with weighted average cost of capital for each company. This has been analysed on the basis of size and industry. The results proved that the cost of capital has declined in all the industries except cement industry between the years 1979 and 1985.

An examination of cost of capital on the basis of size showed that it has also declined in all the class intervals over this period of time. Further, it was found that, the cost of capital had declined because of increase in borrowed capital and decrease in earnings per share. Lastly, the relationship between the cost of capital and three independent variables namely, operating profit/capital employed, sales/assets and dividend payout ratio was tested through regression analysis. His results supported the traditional view on the relationships between leverage and cost of capital. His results are also in total agreement with Charaborthy’s study.
11.16 Conclusion:

In this chapter, a short description of some of the important empirical works have been made bringing out their scope and limitations. The Modigliani - Miller and Barges study provide a basic knowledge of the cost of capital and its relationship with capital structure. Weston also tried to prove its relationship and used two additional variables, growth and size, and concluded that his result are in conformity with the traditional view. In the studies conducted by Indian researchers, Chakraborty and Pandey, it is clear that they compute the cost of capital only to prove or disprove Modigliani and Miller's independent theory. V.K.Goyal's study is also limited to a period of 2 years. Hence in this study, an attempt is made to calculate the cost of capital by analysing the data over a period of 10 years. Thus a time series analysis using data of different firms belonging to different industries is made to determine the relationship between capital structure and cost of capital.