The Modern Portfolio Theory and the Capital Asset Pricing Models have influenced the corporate financial theories to a great extent. As a result, it has been possible to establish a common link between the apparently separate issues relating to the corporation finance. A large number of studies have been directed toward the investigation into the theoretical as well as empirical relationships between the systematic risk (beta) and a set of potential risk-relevant accounting and financial variables which represent the firms' structural, operational and other characteristics.

The purpose of the present chapter is to analyse the relevant studies which establish the theoretical relationships between the systematic risk (beta) and the major financial management decisions such as capital budgeting decisions, capital structure decisions and the dividend policy decisions by the firm. An analysis relating to the predictive ability of the accounting income numbers will also be presented here in the light of the studies conducted by Ball
and Brown\textsuperscript{1}, Beaver and Manegold\textsuperscript{2} and Others\textsuperscript{3}.

The first section has been devoted to review the theoretical relationships between the risk and the major financial management decisions mainly on the basis of the contributions

\textsuperscript{1} Ray Ball and Philip Brown, "An Empirical Evaluation of Accounting Income Numbers", Journal of Accounting Research, 6 (Autumn, 1968); 159-78.


of Hamada, Rubinstein, Lev and Ball and Brown. The second section of this chapter deals with the review of some important empirical findings on the association between the market determined and the accounting determined risk measures. The concluding remarks have been presented in the third section.

SECTION - I

A. Implication of the Portfolio Theory on the Capital Budgeting

A firm can be defined as a legally wrapped bundle of a number


of investment projects. Hence, the firm's income can be viewed as the joint income stream from all such investments and for the purposes of evaluating the performance of a particular investment, one should consider the project in terms of its contribution (incremental or marginal) to the joint income stream of the firm and incremental or marginal opportunity cost associated with it. Thus, the task of evaluating any such investment project by the firm, requires the consideration of its contribution to the overall return and risk of the firm.

To put it in another way, any investment decision should be made such that it may contribute to the fulfilment of the corporate objective. As a value maximiser, the firm should select only those proposals whose future anticipated rate of return exceeds the required rate of return or the cost of capital.

Again, being a fictitious person, the firm should act in favour of its owners i.e., the investors. And, thus, it is required that the capital budgeting decisions by the firm are aimed at equating its own objective with the objectives of its owners. According to the portfolio theory, the investors are the single-period terminal wealth-utility maximizers. The CAPM defines the expected future return on a risky asset as:

$$E(R_i) = R_f + \beta_i \left[ E(R_m) - R_f \right]$$

...... 1.
It may be recalled that the return of a risky security \( i \) is equal to the risk-free interest plus the risk-premium proportional to its risk measured by beta (\( \beta_i \)). Thus, to serve the interests of the owners the firm is required to select only those proposals whose future anticipated returns are greater than the required return or the cost of capital given by \( E(\tilde{R}_i) \). Therefore, to this point, the implication of the portfolio theory on the capital budgeting is that the cost of capital is viewed as the return required by the investors which is given by \( E(\tilde{R}_i) \). Again the use of \( E(\tilde{R}_i) \) for project selection implies that the cost of capital is a function of both the systematic risk given by beta (\( \beta_i \)) and the risk premium required by the investors.

The portfolio theory and the capital asset pricing model imply that the capital market produces rapid adjustments to information and in equilibrium, the expected value of the future anticipated return is equal to the required rate of return (i.e., the cost of capital).

If the equivalence of the value of the firm and the value of the claims upon it is obvious, then the attitude of the prospective investors towards the securities of the firm will ultimately determine its value. The consequential effect of the importance being attached to the investors' attitude is that the pricing of claim upon the firm will undergo a rapid adjustment until an equilibrium solution is reached.
Further, the equivalence of the firm's objective with that of the investors is, by assumption, necessary and this condition is satisfied when the marginal opportunity cost is equal to the marginal contribution of an asset to the joint income stream of the firm. This equality of the marginal opportunity cost and the marginal contribution i.e., the equivalence of the cost of capital and the expected future anticipated return is attained under equilibrium conditions in the capital market.

**Weighted Average Cost of Capital as the Cut-off Rate**

The traditional finance theory argues for the use of the weighted average cost of capital as the cut-off rate. According to the portfolio theory, the rationale behind this is that the value of the firm, under the efficient market condition, is equal to the value of the claims upon it where these claims include all types of instruments either short-term or long-term along with the equity holders' claim upon the firm. In a portfolio sense, risk of the firm refers to the uncertainty attached to the joint earnings stream of all such claims. It is, therefore, evident that the cost of capital should not be viewed in terms of an individual claim upon the firm, rather, a weighted average form is more appropriate where the relative values of individual claims are used as weights.
Measurement of Risk

Another important implication of the portfolio theory and the CAPM is that the notion of risk developed by these two models can be equivalently applied in the context of any financial decision taken by the firm. The preceding discussion provides adequately the justification for the use of $E(R_i)$ as the required rate of return for any investment decision at the firm level. This, in turn, implies that it is not the variance, but the covariance of the future return (expected) of an investment with that of other assets available for investment in the economy is the appropriate measure of risk. In other words, the notion of risk, in a portfolio sense being the contribution of an asset to the overall uncertainty of the return of the investor's portfolio is also appropriate for the firm. And this remains unaltered even if the assumptions of the risk-free rate and the common market factor are relaxed. The only difference in such a case is that one is required to make a large number of parameter estimates which is obviously a difficult job. On the other hand, the assumptions underlying the Modern Portfolio Theory and the CAPM have greatly simplified the process of capital budgeting. Because, in the absence of the traditional theory's assumption of perfect certainty, the task of comparison between the two known rates of return is replaced by a somewhat difficult process. This requires comparisons between the probability distributions of the two rates of return - the
future anticipated return and the cost of capital, for each investment project and the covariability of these two.

More specifically, the apparently restrictive assumptions of the existence of a pure interest rate and the influence of a common market factor on the asset's return allow the investor to study the behaviour of $R_i$ and the covariability between $R_i$ and $R_M$ instead of comparing the distributions of each of the $R_i$ and $R_j$ values and the covariances.

Comparing the Two Projects and the M M Theory

Another difficulty associated with the traditional methods of capital budgeting decision is that a comparison between the two mutually exclusive projects of unequal lives is not possible. Moreover, the present practice of dividing the future into definite and separate periods has no sufficient theoretical base. The present theories dealing with uncertainty are silent in case of multi-period decisions also.

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8 According to Ball & Brown, "Reinvestment assumptions offer no solution. They merely reinstate the equal life assumption by allowing the ghost of the expired asset to continue until the demise of its competitor".


9 Though the multiperiod version of the CAPM has been developed, they are much more complex and their application for solving the practical capital budgeting problem is very difficult.
On the whole, the portfolio theory implies that for each capital budgeting decision one is required to make estimates of the parameters used in equation - (1). A more simplified solution to the capital budgeting decision can be obtained by the use of the Modigliani & Miller (M-M) approach.

According to M-M, (i) the probability distributions of the total returns of all the investment projects of the firm differ in respect of scale factor only (i.e., the assumption of homogeneous risk class) and (ii) the returns of all the investments of the same class are perfectly positively correlated. The assumption of a homogeneous risk class implies that all the investment projects within the same risk class are equally risky and thus, a uniform cut-off rate $\sqrt{E(R_i)}$ can be used to evaluate those projects.

The empirical evidence of the M-M study strongly supports the assumption of the homogeneous risk class. While some other studies conclude that such an assumption is an operational approximation of the Standard Industrial Classification. It can be argued that if a firm is considered to be

of such a risk class, then the diversity of investments within the firm is completely ignored. Hence, such an approximation may result in an adverse effect on the aggregate income of the firm. On the other hand, such diversity of investments can be considered as separate divisions and a firm can be viewed as a union of all such component parts. The notion of the equivalent risk class can now be applied in case of assets within a division.  

The foregoing discussion implies that the firm should accept all projects for which the expected values of the anticipated returns exceed the respective cost of capital commensurate with their risk. In other words, the cost of capital should be used as a sole criterion for project selection by the firm without any bias for making diversified investments and the consideration of the other criterion risk, may be dealt with approximately by incorporating proportionate value of the risk premium for each investment.

The problem has been discussed in a more comprehensive manner by M.E. Rubinstein. The author has derived the 'risk-
standardised cost of capital' using the risk-return equilibrium relationship of CAPM. According to him, this rate which he calls the 'Market Price of Risk' can be used as the sole criterion for project selection by all the firms in the economy.

According to the CAPM, the expected future return of an asset or security i can be written as:

$$E(R_i) = R_f + \sqrt{\frac{E(R_M) - R_f}{\sigma_M^2}}C_{iM} \quad ...... \quad (2).$$

Where \( R_i \) (random variable) is the rate of return on security i; \( R_M \) (random variable) is the rate of return on the market portfolio; \( R_f \) is the pure interest rate and \( C_{iM} \) represents the Covariance between security i and the market portfolio's return.

Alternatively, the above equation can be expressed in the following manner:

$$E(R_i) = R_f + \lambda C_{iM} \quad ...... \quad (3).$$

Where \( \lambda = E(R_M) - R_f / \sigma_M^2 \) and it represents a constant.

The author has described the risk-return relationship in terms of price relative as under:

$$E(\tilde{P}_i/P_i) = R_f + \lambda C_{iM} \quad ...... \quad (4).$$

Where \( P_i \) = the present price of security i; \( \tilde{P}_i \) = change in the price of security i (future price); and thus, \( E(\tilde{P}_i/P_i) = E(R_i) \)
The above expression can be used to describe the present price as:

\[ P_i = \frac{E(P_i)}{R_f + \lambda C_i M} \]

or \[ P_i = \frac{E(P_i) - \lambda C_i M}{R_f} \] (6).

Where \( R_f + \lambda C_i M \) is the risk adjusted discount rate and the present price of security \( i \) is equal to its future price discounted at this risk adjusted rate. The second equality, however, gives the certainty equivalent factor.

The author describes that all securities, in equilibrium, will lie along a straight line called the 'market line'. The relationship for the portfolio has been shown in the same manner as under:

\[ E(R_p) = R_f + \lambda C_p M \]

But the relationship for the market portfolio is, however, to some extent different:

\[ E(R_M) = R_f + \lambda C_M \]

or \[ E(R_M) = R_f + \lambda \sigma_M^2 \] (as \( C_M = r_M \sigma_M \sigma_M \)).

The author has used the above formulations to derive the appropriate criteria for the selection of investment projects by the firm. According to him, a firm should select only such investment projects whose expected internal rate of return
is greater than the appropriate risk adjusted discount rate given by \( R_f + \lambda C_{IM} \). Symbolically \( E(R^o_i) > R_f + \lambda C_{IM} \)

where \( R_i \) stands for the return from the new project and this has been defined as the ratio between the total return from the new investment and the cost associated with it.

The logic behind the requirement of the excess expected internal rate of return for the new project is that the individual investors require some additional premium for the new uncertain investment. This finding is similar to that of Ball and Brown.

Alternatively, the criteria for project selection can be rewritten as -

\[
\frac{E(R^o_i) - R_f}{C_{IM}} > \lambda \quad \text{(Lamda)}.
\]

This expression allows one to interpret the slope of the market line, \( \lambda \), as the 'risk-standardised cost of capital' that can be used for all projects as well as for all firms provided that \( C_{IM} \) is positive.

According to the author, the decision taken by the firm on the basis of this MPR criterion, remains unaffected in spite of any change in the firm's variance of the equity rate of return resulting from the contribution of the new project to the joint income stream. Thus, reduction of risk (i.e., reduction of the unsystematic risk) through diversification can
be ignored in case of capital budgeting decision by the firm. According to him, if the new project is assumed to be a separate firm, then the project can be evaluated separately without considering the firm's existing investments. But this simplification is not formally correct. Because, \( R_M \) includes all available securities in the market and, therefore, a reference of \( R_M \) automatically means for the reference of the existing investments of the firm. However, the author observes that in the U.S. Capital Market the \( R_M \) is hardly influenced by the single investment made by the firm. On the other hand, if the above simplification holds good, the firm is not required to make diversified investments in order to reduce the risk for the individual investors. On the contrary, the individual himself can diversify out the non-systematic risk.

The author has compared the newly derived economy-wide acceptable 'MPR' criterion for project selection with the traditional Weighted Average Cost of Capital (WACC) which is required to be computed separately for each firm. From his analysis, it appears that the two criteria lead to contradictory results relating to the profitability of the available investment proposals.

It is also revealed that the WACC method is unable to consider risk while evaluating investment projects. This method can produce accurate result if and only if the projects belong to the same risk class. As the method does not consider
risk for project evaluation, it can not be accepted as a marginal criterion. Because, the marginal cost of capital depends on the risk of a project and according to the MPR criterion, the same is given by the risk adjusted discount rate, $R_f + \lambda C_{1M}^O$ (where $C_{1M}^O$ stands for the covariance between the new project and the market).

Some other aspects of the capital budgeting decision have also been considered by the author on the basis of the aforementioned framework. According to him, the selection from among the mutually exclusive projects, should be made on the basis of the magnitude of the excess internal rate of return. And accordingly, the project having the highest excess value of the internal rate of return $\bar{\Delta}$ denoted as $E(R_{i1}^O)$ will be selected. This selection criterion is similar to that of the NPV method.

In case of capital rationing also, the selection procedure is the same. Only the projects lying above the 'market line' are taken to form different bundles of projects subject to the capital rationing constraint. Among the bundles so formed, the bundle having the highest excess expected rate of return weighted by its cost is to be selected.

For the mutually interdependent projects, the only task specific to it, in addition to the above, is that the decision maker has to consider the 'joint acceptance' of those projects as a single investment project along with separate
assessments for each of them.

On the whole, the mean-variance security valuation theorem has influenced the project appraisal techniques to a great extent. It offers more scientific basis for capital budgeting decisions -and the superiority of the new technique over the traditional methods is beyond doubt.

Financial Leverage and Risk

The issues relating to the financial management decisions by the firm which have drawn considerable attention of both the academicians and the practitioners include the financing problem of the firm. Several attempts have so far been made to specify the problem and work out an optimal solution. But, unfortunately, the discussion remains inconclusive.

Kraus and Litzenberger have offered an optimal solution to the problem using the state preference model. According to the authors, "The problem of capital structure is, therefore, formulated as the determination of that level of debt such that the resulting division of states (into those in which the firm is solvent and those in which it is insolvent) yields the maximum market value of the firm. It is shown that the total market value of the firm is not in general a concave function of financial leverage". But as the exact specification of the states of the world is almost impossible, it appears to be difficult to provide any empirical content on the model. - Alan Kraus and Robert H. Litzenberger, "A State Preference Model of Optimal Financial Leverage", Journal of Finance, pp. 911-922.
The development of the MPT and the CAPM has brought about considerable changes in the notion of risk and return of a particular investment. The CAPM's risk-return equilibrium relationship in particular, has influenced the finance literature to a great extent.

If the objective of the firm is to maximise its own market value, or in other words, to serve the interests of its owners, then the financing of a new investment either with equity capital or with the borrowed fund is of great importance. Because, the use of debt in the capital structure may increase the equity rate of return during period of prosperity. But conversely, it involves the firm with a fixed contractual burden which makes the equity rate of return uncertain at its hard times. Consequently, the degree of uncertainty to the future income stream available to the owners is remarkably increased which in turn affects the prices of the firm's securities in the capital market. Thus, a close relationship between the use of leverage in the firm's capital structure and the risk of its common stock is expected. Now, if, the CAPM's notion of risk (i.e., the systematic risk) can be appropriately used to measure the uncertainty attached with the future rate of return of the common stock, then the analysis can be approximated to an underlying relationship of the firm's capital structure (leverage) with the systematic risk of common stock.
The study by R.S. Hamoda provides an excellent theoretical construct as well as empirical evidence to this problem. The author has used the MM proposition from the outset to derive the relationship and has, subsequently, put them on some crucial tests to examine their validity.

The study rests on the simplifying assumption of equivalent risk class used by Modigliani and Miller in their magnificent work relating to the effect of corporate leverage on the market value of the firm. The authors in their study have replicated 'personal-leverage' for 'corporate-leverage' and have shown that the value of the firm remains indifferent even if the investments are financed out of borrowed capital in the absence of any tax liability on its future income stream. Hamada has, however, shown that the risk to the investor is increased by the use of leverage, irrespective of its source, in the capital structure, provided the amount of equity capital remains fixed. To put it in another way, the financing of a new investment project solely by the borrowed fund results in an increment of the debt-equity ratio which, in turn, increases risk. Thus, the two firms belonging to the same risk-class which have different debt-equity ratios will show different values of $\beta$ (the systematic risk proxy) - the firm with higher debt-equity ratio will

have higher $\beta$ value while the firm with lower debt equity ratio will have a lower value of beta ($\beta$).

The study has considered four different methods including that proposed by M-M, for measuring the effect of the firms' capital structure upon its risk complexion and has offered a technique which uses the M-M valuation model from the outset. According to M-M, for all firms in the same risk-class which are financed by equity only, the capitalisation rate ($\rho_r$) is the same. M-M valuation model assumes that two firms $i$ and $j$ are in the same risk-class if for all $t$,

$$R_i(t) = \lambda_i R_j(t)$$

where $R_i(t)$ and $R_j(t)$ denote the net cash earnings before interest of the two firms respectively at 't', while $\lambda_i$ is

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18 This definition of homogeneous risk class has been originally proposed by M-M in their initial paper cited earlier. This definition considers the average earnings of the firm only. According to Fama & Miller, the definition of the equivalent risk class should include the investment outlays so that the securities of the two firms belonging to the same risk-class can become perfect substitutes. They opine that the two securities can not become perfect substitutes if the earnings streams are obtained with non-proportional and uncertain investment outlays. They define the risk-class as under:

$$R_i(t) = \lambda_i R_j(t) \text{ and } I_i(t) = \lambda_i I_j(t)$$

where $R_i$ and $R_j$ are the net cash flows of the two firms at 't' and $I_i(t)$ and $I_j(t)$ represent the investment outlays of the two firms respectively. - E.F.Fama and M.H.Miller- The Theory of Finance, Halt Rinehart and Winston, Chapter 4, (1971).
a proportionality factor which remains the same for all periods and for earnings (and investment outlays) also. The M-M valuation model requires the specification of the risk-class in advance and the estimation of the expected earnings as well as the capitalised growth potentials implicit in the stock prices for both the levered and the unlevered firm. The specification of the exact magnitude of these two values involves considerable measurement error.

To avoid this problem, Prof. Hamada proposes to make an adjustment on the actual rate of return of the firm to work out the probable rate of return of the same firm if the firm had no debt and preferred stock in its capital structure.

This 'would have been return' of the firm, if it were not levered (i.e., unlevered) has been used by the author to workout its 'would have been systematic risk' for the same period. Hence, the difference (if any) between the $A\beta$ and the systematic risk calculated on the basis of the observed rate of return, $B\beta$ can be interpreted as the effect of leverage. As this model has explicitly used the M-M valuation theorem, any huristic interpretation of this worked out difference may lead to an inaccurate or even faulty description of the relationship between leverage and risk. The study, however, provides a proof of the validity of the M-M theory which advocates the superiority of this theory over the traditional one.
The Model

The returns available to the common stockholders for the period 't-1' to 't' can be written as:

\[(R-I)_{t} (1-r)_{t} - P_{t} + AG_{t} = d_{t} + c_{gt} \quad \ldots \ldots \quad (7)\]

Where \(R_{t}\) represents the total return before interest and taxes and preferred dividend; \(I_{t}\) stands for interest and other fixed charges for period 't'; 'r' is the tax rate; \(P_{t}\) and \(d_{t}\) are the preferred dividend and the equity dividend respectively; the growth potential has been denoted as \(AG_{t}\) and \(C_{gt}\) stands for the capital gains during the period.19

Now, the above equation can be used to derive the systematic risk of the levered firm as under:

\[\beta = \frac{\text{Cov} \{ (R-I)_{t} (1-r)_{t} - P_{t} + AG_{t} \} / S_{Bt-1}}{\sigma^{2}(R_{Mt})} \quad (8)\]

19 The left hand side of the equation (7) includes the growth potentiality factor, \(AG_{t}\), because each firm is assumed to possess a standard growth rate in its future earnings which is duly anticipated by the stockholders at the beginning of the period. This expectation, in turn, influences the stock prices which will be available to the stockholders. Thus, the total return available to them includes capital gains or the holding period gains along with the dividend for the current period and hence the equation includes the result of the growth opportunities, \(AG_{t}\) i.e., the capital gains, \(C_{gt}\) at the right hand side.
Where, \((R-I)_t (1-r)_t = P_t + 4G_t / S_{B t-1} = R_{Bt}\),

\(R_{Mt}\) = the return on the market portfolio; and

\(S_{Bt-1}\) = the market value of the common stock at the beginning of the period.

Equivalently, the systematic risk of the unlevered firm, \(A^\beta\) is:

\[
A^\beta = \frac{\text{Cov.} (R_{At}, R_{Mt})}{\sigma^2 (R_{Mt})} = \frac{\text{Cov.} \sqrt{R(1-r)_t + 4G_t / S_{At-1}}, R_{Mt}}{\sigma^2 (R_{Mt})} \ldots \ldots (9).
\]

where \(SA_{t-1}\) is used to denote the opening stock price for the unlevered firm.

By rearranging, the above equation can be shown as:

\[
A^\beta S_{At-1} = \frac{\text{Cov.} \sqrt{R(1-r)_t + 4G_t / S_{At-1}}, R_{Mt}}{\sigma^2 (R_{Mt})} \ldots \ldots (10).
\]

In a similar fashion, the equation (8) for the levered firm can be rearranged as under:

\[
B^\beta S_{Bt-1} = \frac{\text{Cov.} \sqrt{R(1-r)_t + 4G_t / S_{Bt-1}}, R_{Mt}}{\sigma^2 (R_{Mt})} \ldots \ldots (11).
\]

On the basis of an assumption that the covariance terms of the interest and the preferred stock divided by the variance of the market rate of return will become negligible, the above equation can be approximated to:

\[
B^\beta S_{Bt-1} = \frac{\text{Cov.} \sqrt{R(1-r)_t + 4G_t}, R_{Mt}}{\sigma^2 (R_{Mt})} \ldots \ldots (12).
\]
The above equation for the levered firm becomes similar to equation (10) for the unlevered firm and thus, mathematically it can be written as:

$$B^\beta S_{Bt-1} = A^\beta S_{At-1}$$

(13).

By rearranging:

$$A^\beta = \frac{B^\beta S_{Bt-1}}{S_{At-1}} = \frac{B^\beta S_{At-1}}{S_{Bt-1}}$$

(14).

From the above equation, it is evident that the systematic risk of the unlevered firm is the product of the observed systematic risk of the levered firm and the ratio of the prices of the common stocks of the two firms. Now, one would require to estimate the values for $A^\beta$ and $S_{At-1}$ which are not observable. For the sake of simplification the author has used the M-M valuation model.

According to Modigliani and Miller, the value of the securities of a levered firm is equal to that of an unlevered firm plus the tax subsidy enjoyed by the levered firm for inclusion of debt in its capital structure. Symbolically:

$$V_B (1) = V_A (1) + r_v d (2) (1)$$

(15).

where $V_B (1) = \text{value of the securities of the levered firm};$ $V_A (1) = \text{value of the securities of the unlevered firm};$ and

\[20\] A brief account of the M-M valuation model is presented in Appendix at the end of this chapter.
\( r_{v}d_{2}(1) \) = the period (1) market value of the tax saving on the interest payment by the firm on its debt at period (2). Equivalently, the above equation can be written as:

\[ V_A(1) = V_B(1) - r_{v}d_{2}(1) \] (16).

Thus, the value of the unlevered firm can be obtained by deducting the period (1) market value of the tax saving for debt financing at period (2). As the unlevered firm is entirely financed by the common stock only, its period (i) value \( \bar{V}_A(i) \) can be substituted by \( S_A(i) \). Hence, the 'would have been value' of the unlevered firm at t-1 can be written as:

\[ S_{At-1} = (V_B(t-1) - r_{v}d_{1}(t-1)) \] (17).

For simplicity, the above equation can be presented in the following manner:

\[ S_{At-1} = (V - r_D)_{t-1} \] (18).

It is now possible to estimate the systematic risk of the unlevered firm using the above equation for the 'would have been' opening price of its common stock.

For empirical purposes, the author has proposed to workout the leverage free return for all firms for a fairly long period. Then by applying the market model on this time series of the leverage free return, the beta (\( \alpha \beta \)) coefficients for all firms can be estimated. The leverage free return of the unlevered firm is:
\[ R_{At} = \frac{R_t (1-r)_t + \Delta G_t}{S_{At-1}} \]  

(19).

where,

\[ R_t (1-r)_t + \Delta G_t = (R-I)_t (1-r)_t - P_t + \frac{\Delta G_t}{t} + P_t + I_t (1-r)_t \]

Substituting the value of the equation (7) in the above expression -

\[ R_t (1-r)_t + \Delta G_t = \frac{d_t + C_{gt}}{t} + P_t + I_t (1-r)_t \]

Therefore, equation (10) can be expressed as under:

\[ R_{At} = \frac{d_t + C_{gt} + P_t + I_t (1-r)_t}{S_{At-1}} \]  

(20).

Now, using the value of \( S_{At-1} \) in equation (18) the above mentioned equation can be written as:

\[ R_{At} = \frac{d_t + C_{gt} + P_t + I_t (1-r)_t}{(v-D)^{t-1}} \]  

(21).

This gives the 'would have been return' of the unlevered firm. On the other hand, the observed rate of return for the levered firm is:

\[ R_{Bt} = \frac{(R-I)_t (1-r)_t - P_t + \Delta G_t}{S_{Bt-1}} \]

Equivalently,

\[ R_{Bt} = \frac{d_t + C_{gt}}{S_{Bt-1}} \]  

(22).

The foregoing discussion in connection with the estimation
of the systematic risk of the unlevered firm is based on the M-M valuation theory. Thus, the model developed by the author to examine the effect of leverage on the systematic risk of common stock, may be acceptable provided the M-M valuation model is correct.

The Empirical Test

In order to prove the empirical validity of the model discussed in the preceding lines, the following four regression equations have been used:

\[ R_{	ext{Ait}} = A \alpha_i + A \beta_i R_{	ext{Mt}} + A \varepsilon_{\text{it}} \]  \\
\[ R_{	ext{Bit}} = B \alpha_i + B \beta_i R_{	ext{Mt}} + B \varepsilon_{\text{it}} \]  \\
\[ \ln(1 + R_{\text{Ait}}) = A_c \alpha_i + A_c \beta_i \ln(1+R_{	ext{Mt}}) + A_c \varepsilon_{\text{it}} \]  \\
\[ \ln(1 + R_{\text{Bit}}) = B_c \alpha_i + B_c \beta_i \ln(1+R_{	ext{Mt}}) + B_c \varepsilon_{\text{it}} \]

Where \( i \) is used to denote the firms and \( t \) stands for the period. \( \alpha_i \) and \( \beta_i \) are constants for each regression while \( \varepsilon_{\text{it}} \) is the normal disturbance term. The last two equations, however, provide the continually compounded rate of return for the two firms unlevered and levered respectively.

It may be recalled that the model requires the estimation of the systematic risk of the unlevered firm on the basis of the observed rate of return on the securities of the levered firm. The model also requires the market value ratio of the
prices of the stocks of the two firms.

According to the CAPM, it is obvious that the systematic risk of the levered firm is greater than that of the unlevered firm - because the expected rate of return on the stock of the levered firm is higher than that of the unlevered firm. Following this hypothetical point of view, the model has been tested in two ways. For the model to be correct - (i) the observed beta values for the levered firm $B\beta$ should be greater than the estimated systematic risk of the unlevered firm $A\beta$; and (ii) the observed rate of return for the common stocks of the levered firm $ER_B$ should be higher than the 'would have been return' of the unlevered firm $ER_A$. The empirical findings are in conformity with the hypothetical relationship i.e., $B\beta > A\beta$ and $ER_B > ER_A$, and, therefore, the model appears to provide adequate description of the relationship between the systematic risk of common stock and leverage.

Another cross-sectional test has been suggested relating to the market price ratios of $S_{At-1}$ and $S_{Bt-1}$ which is required for the equation (13) of the model.

The test has been designed as under:

$$(B\beta)_i = a_1 + b_1 \left( \frac{S_A}{S_B} A\beta \right) + u_{1i}$$  \hspace{1cm} 24(a).

$$(Bc\beta)_i = a_2 + b_2 \left( \frac{S_A}{S_B} Ac\beta \right) + u_{2i}$$  \hspace{1cm} 24(b).
\[(A\beta)_i = a_3 + b_3 \left( \frac{S_B}{S_A} B\beta \right) + u_{3i} \quad \ldots \quad 24(c).\]

\[(Ac\beta)_i = a_4 + b_4 \left( \frac{S_B}{S_A} B\beta \right) + u_{4i} \quad \ldots \quad 24(d).\]

For the model, as specified in equation (13), to be valid, the above tests require that - (i) the intercept, \(a\), should be equal to zero, and (ii) the slope \(b\), should be equal to unity and (iii) \(R^2\) should have a high value.

In so far as the market price ratios are concerned, the study reveals that the long-run average market price ratios can be used satisfactorily, in order to adjust the systematic risk of the unlevered firm, in equation (13). The same for the equation (21) and (23) can be done satisfactorily by using one year's market price ratio.

The empirical tests mentioned above conducted by Prof. Hamada satisfy all the aforesaid conditions and therefore, it can be concluded that the alternative approach suggested by him for measuring the effect of leverage on the systematic risk of common stock is adequate. But the acceptability of this theoretical construct ultimately rests on the validity of the M-M model. The study includes another set of tests on this issue, and provides a comparative analysis between the M-M valuation model and the traditional theory.

According to the M-M theory, the \(E(R_A)\) (which is the capitalisation rate for an all equity financed firm) would be the
same for all firms if they were financed by the common equity only provided they belong to the same risk class. And, consequently, the $A_{\beta}$ for all those firms would also be the same. On the other hand, if the firms are financed by different combinations of debt and equity the value of $B_{\beta}$ for each of the firms will be different. This means that the use of leverage in the firm's capital structure determines the corporate risk complexion. This proposition of the M-M valuation model, however, does not support the traditional view in this regard.

According to the traditional theory, the capitalisation rate for the common equity $E(R)$ remains constant up to a certain point of leverage. This means that until the said critical point is reached, $B_{\beta}$ for all are the same irrespective of their differences in leverage (debt-equity ratio) provided they belong to the same risk class. Thus, the two theories are in clear contrast with each other.

Prof. Hamada has conducted three tests to arrive at a conclusion as to which of these two theories provides better and acceptable description of the effect of corporate leverage on risk. The first test involves a comparison of the

standard deviations of the unbiased estimates of the beta values for all firms in the same risk-class. The second phase of the testing procedure involves a chi-square test of the distribution of the beta values for all the firms of the entire sample. Lastly, the author has performed the ANOVA test on the estimated variance of the inter-industry beta values.

The first test shows that almost in all cases, the $A_c \beta$ is less than the $B_c \beta$. This implies that the systematic risks of all-equity-financed firms (i.e., unlevered firms) are less than the observed stock's systematic risks of the same firms belonging to the same risk class. These results are, in clear agreement with the M-M valuation theorem and thus, advocate its superiority over the traditional view. The other two tests have endorsed the conclusion of the first test.

Thus, the proof on the validity of the M-M valuation theorem ultimately establishes Prof. Hamada model on a sound base.

Following the works of Modigliani and Miller, and R.S. Hamada, the problem relating to the effect of the corporate capital structure on the equity holders earnings and the value of the firm has been investigated by M.E. Rubinstein\textsuperscript{22}. The author has shown that under certain assumptions, - such as when the firm's operating profit does not depend on the composition of its capital structure and in the absence of

corporate taxes, the value of the levered firm is equal to that of the unlevered firm. Symbolically - 
\[ V_j^* = V_j \]; where \( V_j \) and \( V_j^* \) represent the values of the levered and the unlevered firms respectively. This finding is similar to that presented by Modigliani & Miller. Both of these studies derive that if the earnings of the firms are subject to corporate taxes, the value of the levered firm is equal to that of the unlevered firm plus the tax subsidy enjoyed by the levered firm for the amount of debt in its capital structure. And, therefore, on the basis of the above two assumptions, the value of the firm remains indifferent to its capital structure. As a result, according to the author, the share price remains unaffected by the use of the borrowed fund by the firm to finance the new investments. Symbolically, 
\[ P_j^* = P_j \]; where \( P_j^* \) and \( P_j \) represent the security prices of the unlevered and the levered firm respectively. Moreover, if the net operating income remains unaltered, the equity holder's return \( R_j^* \) remain the same and consequently, 

23 The mathematical manipulation to derive the above relationship has been presented in Appendix at the end of this chapter.

24 One important difference between these two studies is that Rubinstein has used risky debt in order to provide the theoretical relationship between the corporate leverage and the value of the firm, while Modigliani & Miller's study uses the personal leverage in place of corporate borrowing.
the weighted average cost of capital (WACC) is also independent of the composition of the capital structure.

By definition, the rate of return to the equity holders for the levered firm, denoted as \( R_j \), is

\[
R_j = \frac{X_j - R_f B_j}{S_j}
\]  

(25).

And for the unlevered firm, it is simply the ratio between the net operating income \( (X_j) \) and the value of the firm \( (V_j) \) i.e.,

\[
R_j^* = \frac{X_j}{V_j}
\]

Where \( R_j^* \) represents the income available to the equity holders of the unlevered firm.

Now, on the basis of the above assumptions, the correlations between the equity rates of return and the market return for both the levered and the unlevered firms are equal. Symbolically,

\[
r(R_j, R_M) = r(R_j^*, R_M).
\]

But the variance terms for the two rates of return are not equivalent. Because, \( R_j^* \) is independent of the capital structure while the levered firm has to deduct the fixed interest payment from the net operating income to arrive at the equity holders claim \( (R_j) \). According to the author
If \( E(R_j) = R_f + \lambda^* r(R_j, R_M) \) then it can be shown that:

\[
E(R_j) = R_f + \lambda^* r(R_j, R_M) \sqrt{\text{Var} R_j} \left(1 + \frac{B_j}{S_j} \right)
\]

(26).

It is therefore, obvious that if the correlation terms, i.e., \( r(R_j, R_M) \) and \( r(R_j^*, R_M) \) are equivalent the effect of financial leverage is fully absorbed by \( \sqrt{\text{Var} R_j} \). Again, as \( \lambda^* \) and \( \sqrt{\text{Var} R_j} \) are positive, the expected return on security \( j \) depends on \( r(R_j, R_M) \) and the degree of financial leverage.

From the above discussion it is evident that \( E(R_j) \) depends on three factors. They are - (a) \( R_f \), the risk free rate, (b) \( \lambda^* r(R_j^*, R_M) \sqrt{\text{Var} R_j^*} \), the operating leverage and (c) \( \lambda^* r(R_j, R_M) \sqrt{\text{Var} R_j} \left(1 + \frac{B_j}{S_j} \right) \), the financial risk. Thus, the equity rate of return \( \sqrt{E(R_j)} \) will be changed due to any change in the above three factors.

The study also offers an excellent analysis of the sources of operating risk given by \( \lambda^* r(R_j^*, R_M) \sqrt{\text{Var} R_j^*} \). Suppose, for

\[\beta_L = (1 + \frac{D}{S}) \beta_U \]

firm \( j \), \( Q_m \) is the units of output produced by the firm, \( P_m \) stands for the price per unit, \( F_m \) is the fixed cost, \( V_m \) represents the variable cost per unit and \( \kappa_m \) is the proportion of the assets (\( V_j \)) employed for the production of \( Q_m \), then, on the assumption that the fixed costs can be fully allocated to the production units, the operating risk can be decomposed as under:

\[
\kappa^* r(R^*_j, R^*_m) \sqrt{\text{Var} R^*_j} = \kappa_m (P_m - V_m) r(Q_m, R_m) \sqrt{\text{Var} (Q_m / \kappa_m V_j)} \ldots \tag{27}
\]

Where \( P_m - V_m \) is the operating leverage, \( r(Q_m, R_m) \) stands for the correlation between the output produced by the firm and the market index and \( \sqrt{\text{Var} (Q_m / \kappa_m V_j)} \) measures the uncertainty attached with the operating efficiency.

Therefore, by increasing the operating efficiency and maintaining the appropriate and necessary level of the operating leverage, the firm can minimise the operating risk.

Hence, on the basis of the preceding discussion it is clear that the financial management decisions relating to the investment by the firm in the physical (or financial) assets and its financing policy do have considerable influence on both the equity earnings and the corporate risk complexion. The managerial skill on the operational front also determines these two important aspects (return and risk) of the firm.
On the whole, the corporate leverage is positively correlated with the shareholders return and risk. The study by M.E. Rubinstein reveals that the return to the equity holders depends on its correlation with the market rate of return and the financial risk appears to be an important factor to determine its future expected value along with other two factors - the risk free rate and the operating risk. The last two factors are, however, common to all firms. Prof. Hamada provides similar observations in this regard. According to him, both the risk and the expected return to the equity holders of the levered firm are greater than those of the unlevered firm.

Another important aspect of the study presented by Rubinstein is the analysis of the operating risk and its relationship with the equity rate of return. Following his study, Prof. Baruch Lev has examined the relationship between the operating leverage and risk both theoretically and empirically. The study will be discussed in the following paragraphs.

Operating Leverage and Risk

The study of Prof. M.E. Rubinstein reveals that the corporate risk complexion is a function of the operating risk which on the other hand, depends on (i) the operating leverage; (ii) the economy or market factor and (iii) the uncertainty attached with the operating efficiency of the firm of them,
probably the most important determinant of the operating risk is the operating leverage\textsuperscript{26}. According to Brigham, "\ldots\ldots\ldots\ldots conceptually the firm has a certain amount of risk inherent in its operations - this is its business risk\textsuperscript{27}. Thus, the business risk can be defined as the uncertainty inherent in the projections of the future operating income of the firm and it depends, inter-alia, on the extent to which the fixed costs are used in the operations i.e., the operating leverage. Other factors include the demand situation, variance in sales prices, variability in input prices and the ability of the firm to adjust the output prices with the changes in the input prices etc. All of these factors including the operating leverage partly depend on the individual characteristic of the firm and are also to some extent controllable. Thus, the task of managerial decision making relating to the use of higher operating leverage

\textsuperscript{26} Other two factors are also identified as important sources of the operating risk. Of them, the economy and market factor is beyond the control of the firm and thus is not taken up for discussion. Again the operating efficiency is not directly related with the financial management decision and thus has been kept outside the purview of this study.

in the firm's operations has considerable bearing upon its future earnings and consequently, on risk.

Prof. B. Lev, has investigated into the relationship between the operating leverage and risk. According to him, "The firm's operating leverage is defined as the ratio of the fixed to variable operating costs; a high operating leverage refers to a high share of fixed costs relative to variable costs." According to the author, therefore, it is the ratio between the fixed and variable components of the total cost, not the amount of fixed cost alone, which represents the degree of operating leverage used in the production process adopted by the firm. Because, the amount of fixed cost depends on a number of different aspects such as the volume of operation and the type of the product that may require huge amount of investment in both the fixed and variable components of the total cost. And, therefore, the consideration of the fixed cost alone is not sufficient to determine the degree of operating leverage. Instead, a relative measure of the same (operating leverage) which is the ratio between the fixed and the variable costs is necessary. And, if the alternative methods of production are available then it lies on the managerial decisions with regard to the use of higher degree

of operating leverage by the firm and hence, it can be regarded as a determinant of the corporate risk profile, provided there is a positive relationship between the two variables - operating leverage and risk.

In order to show this relationship, the CAPM's notion of risk i.e., the systematic risk of an asset or a security has been used. And, hence, the assumptions underlying the portfolio theory of Markowitz and the CAPM by Sharpe, Lintner, Fama, Mossin and Others are also operative here. The continuous growth possibility in the future earnings of the firm has also been duly considered by him following the views of R.S. Hamada and Fama and Miller\(^29\). He has also taken the help of the assumptions necessary for the M-M's view that a considerable number of firms may be seen the returns of which vary at a fixed proportion i.e., the assumption of homogeneous risk class.

The relationship between the operating leverage and risk has been logically derived by B. Lev and his study provides empirical evidence on it. According to the author, the operating leverage is positively related with risk. This means that an

increase in the operating leverage will be accompanied by proportionate increase in the risk associated with the shareholder's earnings where the term risk refers to both the overall and the systematic portion of it. If the firm acts in favour of its owners, the effect of the operating decisions on the prices of its shares is of great importance. On the other hand, the individual investors should take such relationships into consideration before arriving at a decision relating to the composition of their portfolios.

In order to examine the association between the operating leverage and risk (both overall risk measured by the standard deviation of return and the systematic risk measured by beta), the author has first considered the relationship between the post-tax net earnings of the firm and the return on its common stock. Then, on the basis of different contribution margins of the two firms, he has shown that the earnings of a firm which has used relatively higher degree of operating leverage in its production process is more volatile as compared to the other firm with respect to the demand fluctuations.

The post-tax earnings, $X_{jt}$, of the jth firm at time 't' is given by:

$$X_{jt} \cdot (1-r) = (R_{jt} - V_{jt} - F_{jt}) \cdot (1-r) \quad (28).$$

Where $R_{jt}$, $V_{jt}$ and $F_{jt}$ represent the total revenue (Sales), total variable cost and the fixed cost for the firm j, at
period 't' and 'r' stands for the average (and marginal) corporate tax rate. This post-tax earnings given by equation (28), is now available for distribution among the equity holders of the firm as dividend (djt).

If, now, the return per share of the jth firm at period 't' (rjt) can be expressed as:

\[ r_{jt} = d_{jt} + c_{jt} \]

where cjt represents the capital gain during the period 't', then the equation (28) can be used to express 'rjt' as:

\[ r_{jt} = d_{jt} + c_{jt} = \frac{x_{jt} (1-r) + q_{jt}}{S_{jt-1}} \quad (29) \]

Where \( \Delta g_{jt} \) is the change in the capitalised growth rate and \( S_{jt-1} \) represents the stock price at period 't-1'.

According to the author, the market holding period return per share, rjt, will be different for the two firms using different degree of operating leverage in their production process, even if, they have identical pattern of sales\(^{30}\).

Now, if \( R_{jt} = P \cdot Q_{jt} \), then the equation (28) can be rewritten as:

\[ X_{jt} = (P \cdot Q)_{jt} - (V \cdot Q)_{jt} - P_{jt} \quad (30) \]

\(^{30}\) For the homogeneous firms, the average price of the products will be the same subject to the assumption that the products of both the firms are traded in a perfectly competitive market.
Where 'P' and 'Q' stand for the unit price and the output sold in the market by the jth firm at period 't' respectively and 'v' represents the unit variable cost for the firm.

As the future demand is uncertain, the total revenue and the total variable cost are also uncertain. But the fixed cost remains unchanged at least up to a specified limit. Thus, any change in the amount of sales is reflected in the net earnings of the firm. This difference in the Xjt due to only one unit of change in the sales actually represents the contribution per unit which is simply the difference between the price per unit (p) and the per unit variable cost (v). Symbolically, the contribution per unit denoted by Xjt can be written as:

\[ X_{jt} = p - v \]

Thus, the total contribution Cjt can be shown as:

\[ C_{jt} = (X'_{jt}) \cdot (Q_{jt}) = (p - v) \cdot Q_{jt} \]

This total contribution is used by the firm to meet the fixed cost first and the balancing figure represents the profit. As soon as the fixed cost is met, any increase in the sales or equivalently, in the unit contribution, results in an equivalent amount of increment in the earnings of the firm. Thus, for the firm with lower amount of unit variable cost or conversely, higher amount of unit contribution, the profit grows at a faster rate than the others, beyond the required amount of sales to meet the fixed contractual obligations. Alternatively, for
each unit of decline in sales the profit figure for the firm with lower variable cost (or using higher operating leverage) decreases at a faster rate than the other firms. Thus, the relationship between the variable cost and the contribution margin can be summarised as under:

When the variable cost is higher the contribution margin (per unit) becomes lower. Symbolically, when \( V_{jt} > V_{it} \), \( X_{jt} < X_{it} \); where 'i' and 'j' represents the two firms. Alternatively, the variable cost and the contribution margin per unit are negatively correlated.

Another conclusion which follows is that the earning of the firm is more volatile if it earns contribution margin at a comparatively high rate than the other firm. Symbolically - if \( X'_{it} > X'_{jt} \), then \( \frac{\partial X_{it}}{\partial \Omega_{it}} > \frac{\partial X_{jt}}{\partial \Omega_{jt}} \). This means that the two variables are positively associated with each other.

From equation (29) it is evident that the earnings per share is a function of the post-tax earnings and the growth rate of the firm. Hence, if, the changes in the growth rate and the stock prices at the beginning of the period for both the firms 'i' and 'j' are equal, then it is obvious that the earnings per share of the firm (in this example, \( r_{it} \)) which uses higher operating leverage is relatively more volatile than that of the other firm (\( r_{jt} \)). Therefore, it can be concluded that if \( V_{jt} > V_{it} \), then \( \frac{\partial r_{jt}}{\partial \Omega_{jt}} < \frac{\partial r_{it}}{\partial \Omega_{it}} \). This means that
the variable cost and the earnings volatility is negatively correlated. Alternatively, the operating leverage is positively associated with the volatility in earnings per share. If, now, the volatility of return indicates the overall riskiness of a firm's stock, then it is evident that the overall riskness of the i th stock is higher than that of the j th firm and hence, it is concluded that the operating leverage and the overall riskness of the firm's stock are positively correlated.

The author has also shown the effect of operating leverage on the systematic risk of common stock. According to the CAPM only a portion of the total risk (earnings variability) which is relevant for an efficient portfolio is called the non-diversifiable or the systematic risk ($\beta$). Symbolically it can be given as under:

$$\beta_j = \frac{\text{Cov.} (r_{jt}, r_{Mt})}{\sigma^2 (r_{Mt})} \quad \ldots \quad (31).$$

With the help of the equation (29) the same can be shown as:

$$\beta_j = \frac{\text{Cov.} \sqrt{s_{jt}} (1-r) + 4g_{jt} \cdot r_{Mt-1}}{s_{jt-1}} \quad \frac{1}{\sigma^2 (r_{Mt})} \quad \ldots \quad (32).$$

Similarly, using equation (28) the above equation can be expressed in the following manner:

$$\beta_j = \frac{\text{Cov.} \left( R_{jt} - V_{jt} - F_{jt} \right) (1-r) + 4g_{jt}}{s_{jt-1}} \cdot r_{Mt} \quad \ldots \quad (33).$$
The covariance between the fixed cost and the market rate of return is zero because the fixed cost remains fixed overtime irrespective of the volume of production up to a specified limit. And, hence, the term can be excluded. Similarly, the covariance between the sales and the market index becomes irrelevant here. Because, it is assumed that both the firms are identical with respect to their production and sales. Thus, this term is not expected to contribute significantly to the differences in the beta values of the two firms. As regards the third term of the equation (35), similar conclusion holds. In this regard, the author opines that if the states of nature of both the firms are similar\textsuperscript{31}, the growth rates for both of them are also expected to be the same\textsuperscript{32}. And, hence, this term also becomes irrelevant in so far as the measurement of its effect on the systematic risk of the firm's equity is concerned. However, the relevant portion of equation (35) in this context is the covariance between the

\textsuperscript{31} The author specifies the equivalence of the states of nature as $R_{jt} (Q) = R_{it} (Q)$.

\textsuperscript{32} In this context the author assumes that the differences in the product mix are not sufficient to affect the growth rate.
variable cost and the market rate of return. As the variable costs associated with the productions by the two firms 'i' and 'j' are different their (variable cost) covariances with the market rate of return for both firms are also different. For instance, the covariance between the two variables for the ith firm will be low, as it uses a lower amount of variable cost in its production process. On the other hand, as a higher amount of variable cost is involved in case of the jth firm's operation, the same for this firm will be high.

Symbolically,

\[
\frac{\text{Cov.} \sqrt{V_{it}} (1-r), r_{Mt}}{\sigma^2 (r_{Mt})} < \frac{\text{Cov.} \sqrt{V_{jt}} (1-r), r_{Mt}}{\sigma^2 (r_{Mt})}
\] ...

(36).

Thus, for the ith firm, the equation (34) will come down to:

\[
S_{it-1} \beta_i = \frac{\text{Cov.} \sqrt{V_{it}} (1-r), r_{Mt}}{\sigma^2 (r_{Mt})}
\]

Similarly, for the jth firm the same can be expressed as under:

\[
S_{jt-1} \beta_j = \frac{\text{Cov.} \sqrt{V_{jt}} (1-r), r_{Mt}}{\sigma^2 (r_{Mt})}
\]

Now, on the basis of equation (36) it is evident that:

\[
S_{it-1} \beta_i > S_{jt-1} \beta_j
\] ...

(37).

It means that the product of the opening stock price of the firm 'i' multiplied by its systematic risk is greater than that of the jth firm. This difference arises from the underlying differences in the variable cost associated with the two separate production methods adopted by the two firms. Now, on the basis of an assumption that the share prices of the
two firms are equal, the above equation comes down to:

$$\beta_i > \beta_j$$

The equivalence of the share price of the two firms is consistent with the M-M proposition that the value of the firm is independent of the ratio of debt to equity. Another theoretical support in favour of this equality is the work of P.A. Diamond\textsuperscript{33} While considering the equilibrium solution to the stock market under the uncertain technological situation the author is of the view that the present value of stock should be equal for all firms having same output stream. Hence, for differences in the operating leverage, the present value of future factor payments is not affected i.e., they are the same for both the firms 'i' and 'j'. Equivalently, the stock prices will also be the same for both the firms as the states of nature are equal.

From the above analysis, it appears that the risk associated with the equity earnings is higher for the \textit{ith} firm which uses higher degree of operating leverage or lower amount of variable cost (per unit) in its operations as compared to the \textit{jth} firm. And, therefore, it can be concluded that the operating leverage and the systematic risk of the common stock are positively correlated or in other words, the variable

cost is negatively associated with the systematic risk of the common stock of the firm.

The author himself has investigated into the empirical content of the aforesaid theoretically derived relationship between the operating leverage and risk (both overall and systematic) and the evidences presented by him are sufficient to validate the said proposition. In order to meet the 'cross-sectional equality of sales pattern across states of nature' three homogeneous industries namely, electric utility, steel and oil have been chosen. Another argument in favour of selecting homogeneous industries is that a greater degree of comparability between the financial data is ensured as they are expected to adopt a relatively identical pattern of accounting practices.

It may be recalled that the study involves the use of cost data like fixed and variable costs which are not directly available from the financial accounting reports of the firms. To solve the problem, a time series regression has been used in order to decompose the operating costs into two separate components - fixed and variable as under:

\[ T_{cit} = a_i + v_i Q_{it} + u_{it} \quad \ldots \ldots \quad (38) \]

Where 't' refers to the time and \( T_{cit} \) and \( Q_{it} \) are the total operating costs and the physical output for the \( i^{th} \) firm at period 't' respectively. The above equation has been used by
the author to workout the unit variable cost for each firm at a particular period or periods. Hence, on the basis of an assumption that the fixed cost and the unit variable cost remain fixed overtime, it can be shown that the operating cost \( T_{cit} \) in equation (38) is a function of \( Q_{it} \) only i.e., the output produced and sold in the market by the \( ith \) firm at period 't'.

The study also rests on a restrictive assumption that whatever is produced is sold in the market by the firm and there is no substantial change in its periodic inventory value. Such an assumption is required to ensure the accuracy of the estimated fixed and variable costs of the firm\(^{34}\).

On the basis of the estimated unit variable cost of the firms (using equation (38)) the two risk measures (i.e., the overall risk measure in terms of the standard deviation of monthly return over 10 year period and the systematic risk using the 'market model' of Sharpe for the same period) have been cross sectionally regressed as under:

\[
\xi(r_i) = a_1 + b_1 \hat{v}_i + \xi_{1i}
\]

and

\[
\beta_i = a_2 + b_2 \hat{v}_i + \xi_{2i}
\]

\(^{34}\) The author has, however, rightly opine that complete separation of the fixed and the variable cost is impossible without the help of the internal data of the firm which are not available for public use.
The results of the aforesaid tests almost in all cases, are consistent with the theoretically derived relationship i.e., the average variable cost is negatively associated with both of the two risk measures. The study also reveals that the unit variable cost is able to explain the larger portion of the cross sectional variability of the overall risk as compared to the systematic risk measure. Prof. Lev observes that the operating leverage may not be the only and the major variable to contribute significantly to the cross sectional risk differentials.

The results of the empirical tests show the validity of the theoretically derived relationship. In short, it is evident that higher the operating leverage, greater the overall and the systematic risk. Alternatively, risk of the common stock's return is lower if the firm uses higher amount of variable cost per unit in its production process.

On the basis of the above findings, some implications of the said relationship may be drawn in respect of the investment decisions both at the firm and the individual investor's level. The firm should adjust its current cut-off rate such that the increased risk to the common stock's earnings resulting from the use of higher degree of operating leverage by the firm is incorporated in it (the cost of capital) before making any investment decision at the firm level. Because, the use of the unadjusted current cut off rate for project selection will ultimately result in an unfavourable revision of
stock prices.

Thus, the individual investors should consider the changes in the riskness of the common stock's return in order to have an accurate description of the corporate risk complexion. In case of substantial changes in the degree of operating leverage, it is suggested that the historical data should not be solely used to measure the riskness of the common stock.

On the whole, Prof. Lev's study is very simple and provides an excellent description of the effect of operating decision by the firm on its stock price. But in practice, it will be very difficult to have an accurate estimate of the fixed and unit variable costs involved in the firm's production process. If the value of the unsold stock changes significantly, the model may provide faulty description of the relationship and thus, may give rise to misleading conclusions.

Corporate Dividend Policy and Risk

The formulation of the dividend policy is considered to be one of the major financial management decisions of the firm. In the context of the assumption that the investors are terminal wealth-utility maximisers, the issue should be considered in terms of the fulfilment of the investor's objective

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35 According to the author, if the firm uses absorption costing system, the value of unsold stock may create trouble to estimate the average variable cost, $\hat{v}_i$. 
if the firm is assumed to act in favour of its owners. Because, an investor evaluates the attractiveness of an investment proposal in terms of his portfolio risk and return and hence, the payment (or non-payment) of dividend by a firm during a particular period may have considerable bearing on the prices of its securities.

Several authors have tried to analyse the impact of dividend policy decisions by the firm on its share prices, but no such theoretical construct has so far been developed to consider the effect of such decisions on the corporate risk complexion. Most of these studies identify the dividend pay-out ratio as a factor affecting shareholder's wealth. Other aspects like the stability of dividend payments, stock dividends and stock splits etc. may also be able to influence the prices of common stocks. As the dividend pay-out ratio represents the amount of the firm's earnings paid to the stockholders by way of dividend out of total distributable profits, it ultimately reduces the amount of retained earnings of the firm - that might be used to finance the available investment projects. Thus, the dividend decision is also directly related with the financing decision by the firm.

According to Walter, the optimal dividend pay-out is determined by the profitability of the available investment opportunities before the firm. He opines that, in order to

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maximise the prices of common stocks, the firm should not pay dividend so long as the available investment projects remain profitable i.e., the returns from those projects exceed the required rate of return. Alternatively, if the investment opportunities are not expected to generate excess return over the required rate, it will be wise to payout the entire amount of the firm's earnings as dividend. Hence, the dividend pay-out plays a passive role to determine the stock prices. On the other hand, if the available investment projects are no longer profitable, the stock prices and the dividend pay-out ratio show a positive correlation between them.

Under the assumption of perfect certainty and in the absence of flotation or transaction costs and taxes, Modigliani and Miller assert that the dividend pay-out ratio does not affect the shareholder's wealth.37

According to them, the said proposition is equally valid even with uncertainty. They opine that the investors will be able to manufacture 'homemade' dividends in the similar fashion they were shown to manufacture 'homemade' leverage in the capital structure decision by the firm.

However, by relaxing the assumption of perfect capital market, the dividend may appear to be relevant. The empirical findings of Elton and Gruber show that the dividend pay-out is inversely related with the implied tax bracket of the marginal investors. According to them, the dividend declaration, in turn, leads to the reduction of the stock prices of the firm. On the other hand, Black and Scholes opine that the value of the firm remains unaffected by the payment of dividend.

In an earlier study, Friend and Puckett, observe that for the non-growth industries, it is possible to increase the stock prices by raising dividends, while the growth industries are required to retain their earnings for this purpose. This finding, however, conforms to the analysis by Walter.


The empirical findings of some other studies provide evidences that the expected before tax returns are positively related with dividend yield\(^41\).

Some authors opine that the payment of cash dividend acts as a signal to the investors about the future profitability of the firm\(^42\).

The study by Beaver, Kettler & Scholes reveals that the dividend pay-out is negatively correlated with the systematic risk\(^43\). While Bowman opines that there is no theoretical basis for the relationship between dividend pay-out and the beta\(^44\). According to him, 'dividend beta' can be the only


\(^{42}\) Sudipta Bhattacharya, "Imperfect Information, Dividend Policy and the 'Bird-in-the-han' Fallacy", Bell Journal of Economies, 10, (Spring 1974); pp.259-70.


appropriate form to provide the effect of dividend policy on risk associated with the investments in common stocks of the firm.

The empirical studies in the context of the Indian stock market conditions are, however, too few to be mentioned here. The study of Sankar De concludes, "... it is an empirical finding that in the valuation of shares, the importance of certain constant factors is much more marked than that of dividend yield or retained earnings effect.\textsuperscript{45} The author opines that these constant factors represent the nominal value of shares and the reputation and standing of the firm which have much more potent to influence the stock prices.

In a recent study, Prof. S.K. Chaudhuri finds that the dividend pay-out and the systematic risk show consistently significant relationship between them.\textsuperscript{46} The author also observes that the degree of association is stronger at the portfolio level.

\textsuperscript{45} Sankar De, "Dividend and Stock Prices - The Indian Experience", Economic and Political Weekly, Review of Management, (September 1975); pp. M 62 - M 72.

\textsuperscript{46} Swapan Kanti Chaudhuri, "Empirical Determinants of Systematic Equity Risk (Beta)", Indian Journal of Accounting, 19, (June 1989), Part I; pp.67-75.
SECTION - II

Accounting Income Numbers & Risk

The corporate earnings and the risk associated with the same occupy the central position in almost all valuation models. It may be recalled that risk of an asset, according to the portfolio theory, is measured in terms of covariability of the asset's return with that of other assets. If the informations conveyed by the financial reports of the firm can be useful for measuring such covariability of returns, then the accounting income numbers can provide adequate description of the corporate risk complexion. Several attempts have been made to examine the extent to which the informations conveyed by the financial reports regarding the state of affairs

of the firm can affect the systematic risk and to examine if the accounting risk measures are good proxies for the market determined measures of risk\textsuperscript{48}.

Under the assumption of perfect capital market, the expectations or belief about the future value of the firm in the minds of the investors determine the stock prices. And such investor's belief on the other hand, depends on the informations relating to the firm and the economy as a whole gathered by the investors from different sources. According to the efficient market hypothesis, all informations are translated into the investor's belief which ultimately results in the revision of the security prices. Likewise, the new accounting informations play a vital role to determine the prices of securities in the market and thus, the possibility of exploding price variance in the absence of such information is reduced or even eliminated.

According to Ball and Brown, the security price uncertainty and the uncertainty relating to the predictive ability of the information sources are equivalent\textsuperscript{49}. They have argued

\textsuperscript{48} Reference of a large number of studies can be given in this context. Of them, however, some important works will be reviewed in the present study.

that if no informations were available, the market could have experienced exploding price variance (i.e., security price uncertainty). Hence, the existence of the information sources clearly reduces the uncertainty relating to the security price (variance). And consequently, the variance in the returns and the same in the value of an asset are reduced. As a result, the portfolio risk is also reduced provided the informations are reliable. Thus, the logical conclusion which follows is that the information sources can reduce the absolute risk subject to the errors if any, in the information content. However, this information-induced errors can be avoided. According to Ball and Brown, these errors can be eliminated by firstly, making diversified investments and secondly, by the use of other information sources, if available, in order to have a prior knowledge about the measurement errors in the information content induced by the accountants of the firm. On the other hand, if the investors are not aware of these information errors, the predictive ability of the information sources will not be sufficient to reduce the risk. Therefore, it is not merely the information but its predictive ability which reduces the price variance. Alternatively, greater the uncertainty attached with the predictive ability of the information sources, higher the security price variance and thus, a higher degree of risk.

The authors have conducted an empirical test with an eye to examine whether and to what extent the accounting income
numbers are able to predict the degree of association between the ex-post returns and the systematic risk of a firm's security. They have computed the accounting betas in two ways. Firstly, they have used the original accounting return series and then in the second phase, they have worked out the accounting betas on the basis of the first differences of the return (accounting) series. Their study reveals that the accounting betas calculated on the basis of the first differences produce higher association with the market determined risk measures than the other method.

In an earlier study, Beaver, Kettler and Scholes argued that the price volatility is significantly influenced by the earnings volatility\(^{50}\). According to them, the systematic volatility in earnings is an important determinant of the systematic volatility in the market prices of securities. The study uses the accounting beta to measure systematic volatility in earnings while the market price volatility (systematic) has been increased in terms of market beta. Their study also reveals that different aspects of the corporate risk are reflected by several accounting measures and, hence, they can be viewed as surrogates for those different aspects of the risk. These accounting risk measures can also be used as the

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instrumental variables in order to avoid the estimation errors from the market betas. Though the accounting beta, according to them, is not the most important predictor of the market determined risk measure.

This observation is similar to that of another study by Rosenberg and McKibben\textsuperscript{51}. However, a more rigorous proof of the relationship between the two risk measures has been presented by Pettit and Westerfield\textsuperscript{52}.

The study of Ball and Brown provides evidence that at least 35 to 40 per cent of the differences in betas among the firms are explained by the accounting beta. Another study by Gonedes advocates for the computation of the accounting betas with earnings deflated by the book value of total assets\textsuperscript{53}, while the earlier studies use the market value of common


equity to deflate the earnings series. The empirical evidence of the study by Beaver and Manegold strongly supports the relationship between the two measures of risk. In other words, there exists a statistically significant relationship between the risk reflected in the security prices and the risk reflected in the accounting earnings data.

This study (Beaver & Manegold) produces evidence that the adjusted betas — (following the Bayesian adjustment technique) provide better result than the unadjusted betas. The authors are also of the opinion that instead of a pure accounting beta the net income to market value beta appears to provide better explanatory power. Though their study does not provide any explanation for the superiority of the net income to market value beta over the pure accounting betas. However, the pure accounting betas also exhibit substantial correlation with the market determined risk measure (beta)\(^\text{54}\).

Another important empirical work in this direction has been conducted by A.R. Offer\(^\text{55}\). The author has developed a method

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of measuring the effect of change in the firm's earnings-growth rate on the investors' belief. His study concludes that there is a strong relationship between the beta and the dividend pay-out ratio, past growth and earnings variability. In case of earnings variability, however, the relationship appears to be stronger than other variables chosen for this study.

The impact of corporate growth rate on the systematic risk of the firm has been investigated by Fewings. The author has examined if the stochastic nature of the capitalisation risk and the corporate growth plays an important role to determine the magnitude of that risk. The author shows that the rate of growth of the expected total corporate earnings has considerable bearing on the systematic capitalisation risk of common stock.

Ben-Zion and Shalit have investigated into the empirical determinants of equity risk through the analysis of the firm's underlying characteristics, namely, the firm's size, its financial structure and the dividend record. For this

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57 Uri Ben-Zion and Sol S. Shalit, "Size, Leverage And Dividend Record As Determinants of Equity Risk", The Journal of Finance, Vol.30, No.4, (September 1975); pp.1015-1026.
purpose the authors have used three alternative measures of risk e.g., the earnings-dividend risk, beta and the stock turnover ratio. They have shown that the above three measures of risk are the functions of the firm's financial leverage, its size in terms of sales and the dividend record. This study reveals that the firm's risk as captured by three alternative risk measures, is positively related to its financial leverage and negatively related to its size and the dividend record. The authors conclude that the firm's size, leverage and dividend records are determinants of its risk. According to Ben-Zion and Shalit, the firm's dividend record provides a measure of the firm's success in maintaining a target dividend policy, its underlying earnings stability and to some extent, its age.

Under the assumption of an efficient capital market, Griffin has assessed the joint and the individual effects of the published earning per share numbers, dividend per share numbers and the analyst's forecasts of earnings per share on the security return. The author observes that the joint effect of earnings per share, dividends per share and the analyst's forecasts of earnings per share on the expected equity return is significant. It is also evident from this

study that the capital market responds significantly to the sign and magnitude of the forecast errors associated with the variables used by the author.

While Logue and Merville have used nine variables to examine the relationship between the two measures (market and accounting) of risk. Of them, only three variables namely, return on asset, asset size, and the financial leverage show significant relationship with beta.

Another important study has been presented by Donald J. Thompson II. According to him, the importance of studying the relationship between the market-determined and the accounting determined risk measures are manyfold. Firstly, it can help the corporate management personnel to realize the effect of the decisions which they take from time to time or the effect of the strategies which they adopt, on the systematic risk of their firms. Secondly, this will help the prospective investors to predict the future risk (systematic) of their investments in a better way. And lastly, the accountants


can develop more useful risk measures if they know the importance of accounting informations which determine the systematic risk of common stocks.

The author in his study, has used a special grouping technique in order to avoid biasness in the parameter estimates. According to him, such biasness in parameter estimates arises due to the measurement errors that actually stem from different sources such as differences in accounting methods used by the firms (e.g., the use of LIFO or FIFO methods to evaluate inventories) to measure the same phenomena, the use of ex-post data in place of ex-ante expectations and the estimation of variables from small samples.

He has, however, formulated 43 variables to explain the systematic risk of common stock. In order to describe them, he has grouped all these explanatory variables in four categories, namely, means, trends, variances and covariant forms. The study offers a model which directly relates the common stock's beta to three covariant risk measures such as, dividend beta, earnings beta and earnings multiple beta. It reveals that these three risk factors are inherent in stock beta. According to the author, "these risks stem from the co-movements between fluctuations in the earnings, dividends and earnings multiple of the individual firm with microeconomic fluctuation in these factors".

61 Donald J. Thompson II, See footnote 60, pp.187 of the article.
The relationship between the beta and the 43 explanatory variables have been studied by using correlation and regression analysis and many of these explanatory variables appear to be significantly related with beta. The study also observes that the covariant forms of certain firm-related risk measures provide better explanation of the differences in the systematic risk than the explanations provided by the analogous mean and variance forms.

Rosenberg and McKibben's study has examined altogether 32 variables. Of them, 20 variables have been chosen from accounting data. Seven variables of the remaining twelve represent the market-based descriptors and the balance five are the market valuation descriptors. Their study produces evidences that only 13 variables are significant although the relationship that they exhibit are not in agreement with the theoretically derived (i.e., expected) directions.

The study by Eskew is concerned with the examination of the forecasting ability of the accounting risk measures. The


author has examined the behaviour of the systematic risk over time and has used three prediction models namely, order bias adjustment, mean reversion adjustment and the Bayesian adjustment which use past estimates of beta in order to predict its future levels. Another beta-based risk prediction model has been considered following the work of Beaver, Kettler and Scholes. A second risk predictor has been formed by the author using the accounting data. The result of the study clearly speaks for the superiority of the accounting based risk predictors over the others.

Evidences presented by Elgers are in sharp contrast with the findings of Eskew. His study concludes that the accounting variables do not provide superior risk-predictions than the market-based measures. Instead, the use of the accounting variables introduces random error in beta predictions. He has also found that the association of the accounting variables and the beta differs by risk level.

The works of Bowman provides a theoretical basis for the empirical research into the relationship between systematic risk and financial or accounting variables. More

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specifically, the study offers an excellent analysis which reveals that there is theoretical relationship between the systematic risk of the firm and the leverage used by it (firm) in its capital structure and the accounting beta.

The author has shown that the firm's size growth, earnings variability and the dividends do not have direct relationship with the systematic risk. On the basis of an assumption that the firm can borrow or lend at the same risk-free rate as the individual investors, the author has derived a theoretical relationship between the systematic risk and leverage. According to him, the systematic risk of a levered firm is equal to that of an unlevered firm multiplied by one plus the debt equity ratio\textsuperscript{66}.

By incorporating corporate tax-rate, the author derives the leverage effect on the beta values which is analogous to the M-M model. According to the author, the relationship can be expressed as under:

\[ BL = (1-r) \frac{DL}{SL} BU; \]

where 'r' refers to the corporate tax rate.

\textsuperscript{66} Symbolically, the relationship is given by \( B_L = (1+\frac{DL}{SL}) BU \) where \( BL \) and \( BU \) stand for the systematic risks of the levered and the unlevered firm respectively. While \( DL \) is the debt and \( SL \) is the equity of the levered firm.
Another important contribution on the determinants of the firm's systematic risk and its relationship with leverage, growth earnings variability, accounting beta or cyclical beta etc. has been presented by Turnbull. According to him, "To describe the determinants of systematic risk, it is necessary to consider the general question of describing the determinants of market value".

He opines that it depends on a number of economic variables, namely, the level of GNP, Plant capacity and the inventory levels. Alternatively, it can be said that the value of the firm is a function of a number of firm-specific as well as a set of general economic variables. He has also derived a general partial differential equation for describing the market value of the firm. According to him, if the firm specific characteristics are independent across firms and independent of the economic indices, then it is possible to avoid their effect on the portfolio risk through proper diversification. And thus, the consumption-investment decisions are independent of the effects of such firm specific characteristics.

The author has logically derived that the systematic risk of

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equity will be changed as a result of changes in the systematic risk of the firm and the degree of leverage used by it in its capital structure. He has also analysed the relationship between the growth and the systematic risk. It has also been examined in the study whether the duration of the project can affect the systematic risk of the firm.

He, however, finds a negative association between the duration of the project and the systematic risk. In so far as the relationship between the earning's growth and the systematic risk is concerned the study offers a negative association between them which is contrary to the argument offered by Beaver, Kettler and Scholes.

H.L. Dhingra has examined the specific and distinctive characteristics of firms in order to predict the risk potential of equities. More specifically, he has developed a set of a priori hypothesis on the relationship between the risk of a firm and the structural, operational and financial variables such as size, profit, growth, stability, capital intensity, liquidity, financial leverage, dividend policy and retained earnings, production technology, security trading, volume and price etc.

According to the author, the beta should be positively related with the variables like profit, growth, stability in terms of sales, earnings and dividend pay-out, capital intensity, financial leverage, security trading, volume etc.

On the other hand, size, liquidity, dividend policy, retained earnings, production technology and security price will be negatively associated with the systematic risk of the firm.

The financial policy variables used by the author do not indicate any clear and systematic relationship with the risk variables. In case of growth and stability, the study does not arrive at any conclusive result while the capital intensity ratio appears to have negative association with beta which is contrary to the hypothesized relationship.

The author has also examined the multiple effect of different variables on the corporate risk profile. The empirical evidences, however, remain inconclusive (but indicative).

The empirical research in this direction on the Indian Stock Market condition is still at a primitive level. Reference can be made of only one study conducted by Prof. S.K. Chaudhuri. Prof. Chaudhuri has presented empirical evidences on the association between the systematic risk and some accounting

69 Equity Risk (Beta), Indian Journal & Accounting, 14, (June 1989), pp.67-75.
variables selected mainly on the basis of the work of Beaver, Kettler and Scholes.

The study reveals that the dividend pay-out and leverage produce significant relationship with beta. Other variables, however, do not appear to have significant relationship with the systematic risk.

SECTION - III

In the preceding two section an attempt has been made to provide a brief outline of the modern financial management theories, relating to the major financial management decisions, developed by several authors on the basis of the capital market equilibrium theories of which CAPM is a sub-set.

To be more specific, the risk-return equilibrium relationship given by CAPM, has greatly influenced the traditional finance literature and provides more scientific and accurate solution to different issues relating to it.

The traditional view of evaluating investment proposals singly and in isolation with others is found to be inefficient in the sense that it fails to consider all investment projects simultaneously which the investors, in practice, hold at a particular point of time. The use of weighted average cost of capital for project selection proves to be un-scientific by the reason of the fact that this method does not consider one most important aspect of an investment -
risk, at all and thus, fails to identify the profitable or acceptable projects accurately. A more scientific method which is able to consider both the two aspects—risk and return, is the 'Market Price of Risk' suggested by Rubinstein. The preceding analysis also provides that the traditional methods of capital budgeting decision fail to consider the two mutually exclusive projects of unequal lives.

The modern view is, however, to use the CAPM's definition of risk and return and it offers more scientific basis for project selection. The capital budgeting decisions under the condition of capital rationing by the firm and the selections from among the mutually interdependent projects are considered more appropriately by the new method.

This modern view of finance, advocates the need of equating the firm's objective with the interests of its owners. It has been able to establish theoretical relationship between the different aspects of financial management which appeared to be apparently separate in the traditional finance literature.

The effect of firm's financing decision on the equity risk and return has been considered by several authors. These study conclude that the leverage is positively related with the common stock's earnings and risk, measured by beta.

The operating decision by the firm has also considerable bearing on the degree of uncertainty attached with the firm's
earnings. The study of Baruch Lev provides theoretical basis as well as empirical evidence on this issue. According to him, both the overall and the systematic risk of the firm are significantly related with the operating leverage and show a positive correlation between them.

Unfortunately, no such theoretical relationship between the firm's dividend policy and risk has been developed. But the seminal work of Beaver, Kettler and Scholes argues that the dividend pay-out is negatively related with the risk given by beta. However, there are considerable number of empirical studies which do not support this view.

According to Walter, the dividend-payout plays a passive role to determine the prices of the common stock. According to this view, the firm's dividend decision is directly related with its financing decision. According to Friend and Puckett, the effect of dividend decisions by all the firms on the prices of their common stocks are not necessarily the same. For the growth firms the relationship is negative while a positive association is expected in case of non-growth firms.

The importance of the firm's financial accounting report for the investor's risk perception has been duly identified by the modern literature and is not considerable only as a mere detail of the state of affairs of the firm as per the traditional view. Several attempts have been made to examine how far the accounting income numbers can be used for the
prediction of the corporate risk complexion and conclude that the covariant form is more efficient than the other forms for this purpose.

In sum, the modern finance literature originated from the Modern Portfolio Theory and the Capital Asset Pricing Model has undoubtedly established its superiority over the traditional theories. Still it is not free from criticism. The main limitation of these theories is that they are unable to provide solution to the multi-period decision problems. Though the multi-period version of CAPM has been developed, its application to solve the practical capital budgeting problems is very difficult.
M-M VALUATION MODEL:

In order to show the effect of the tax deductibility of corporate interest payments on the value of the firm, the authors assume that the two firms - levered and unlevered, are identical in all respects except in the composition of their capital structure and that their earnings for period 2 are equal.

Symbolically - $R_B(2) = R_A(2) = R(2)$.

Where A and B represent the levered and the unlevered firm respectively. Inspite of the same earnings by the two firms they can not distribute similar rate of return to their security holders. Because, the levered firm has to pay interest for having debt in its capital structure, which for the unlevered firm is irrelevent. This fixed amount of interest, payment by the levered firm acts as an aid to increase the value of the levered firm. Because, irrespective of their capital structure, the income of all firms are subject to corporate tax deduction. The difference with regard to tax payments between the two firms is that the unlevered firm has to pay tax on its total earnings during a period while the levered firm pay tax on the balance amount of the total return after meeting fixed contractual payments. On other words, the levered firm has got an opportunity of tax savings.
on the interest paid by it during the period which, in turn, increases the rate of return available to its securing holders as compared to that of the unlevered firm.

Symbolically, the post-tax return available to the security holders of the unlevered firm is:

\[ R(2) - r R(2) = R(2) (1-r) \]  
(1)

The same for the levered firm is:

\[ R(2) - r (\sqrt{R(2)} - d(2)) = R(2) (1-r) + rd(2) \]  
(2)

Where \( d(2) \) stands for the interest on the debt capital at 2; and \( r \) represents the corporate tax rate.

Thus, for the levered firms it is the tax-saving on the fixed interest payment \( \sqrt{R(2)} - \sqrt{d(2)} \) by which the return available to the security holders becomes greater than that of the unlevered firm.

Likewise, it can be shown that the value of the levered firm \( (V_B) \) at period (1) is greater than that of the unlevered firm \( (V_A) \) for the same period by the amount of tax saving \( rd(1) \).

For an investor who holds \( \alpha \) of the common stock of the levered firm (firm-B), the return for his holdings at period 2, can be written as:

\[ \alpha [R(2) - r (\sqrt{R(2)} - d(2)) - \sqrt{d(2)} + D(2)] \]  
(3)

Where \( D(2) \) stands for the debt fund at period 2.

By rearranging -,
Therefore, the return available to the common stock holders calculated by deducting the amount of tax to the time of recoveries, and the payment of interest and principal to the bond-holders from the total return of the firm.

The investor can earn an identical return as shown in equation (4) above if he invests in the unlevered firm and finances the investment, in part, by issuing personal debt. For the personal debt, the investor commits to pay \( \alpha (1-r) d(2) \) and \( \alpha D(2) \) for period (2) to the supplier of the borrowed fund.

Now his total investment cost at period (1) is:

\[ \alpha V_A(1) - \alpha \sqrt{D(1)} - r_v d(2)(1) \]  

... (5).

When \( r_v d(2)(1) \) represents the period (1) market value of the tax-saving at period 2.

Similarly, the period (1) investment cost to hold the proportion \( \alpha \) of the shares of a levered firm can be written as:

\[ \alpha S_A(1) = \sqrt{V_B(1) - D(1)} \]  

... (6).

Now, as the earnings from both of the firms are equal, the investment cost should also be equal. Mathematically, it can be written as:

\[ \alpha \sqrt{V_B(1) - D(1)} = \alpha V_A(1) - \alpha \sqrt{D(1)} - r_v d(2)(1) \]  
or, \( V_B(1) = V_A(1) + r_v d(2)(1) \)  

... (7).
Now it is evident that the value of the levered firm is
greater than that of the unlevered firm by an amount equiva-
lent to the period (1) market value of the period (2) tax-
saving on the interest payment.
If the net operating income of the two firms - levered and unlevered are equal (i.e., $X_j = X_j^*$) and are denoted as $X_j$ and $X_j^*$ respectively and $t_j$ represents the corporate tax rate then the return on the equity shares can be written as (for the levered firm):

$$R_j = (X_j - R_{Fj} \cdot B_j) (1 - t_j)$$

Where $R_{Fj}$ stands for the rate of return on the risky debt.

According to the Mean Variance Security Valuation Theorem, the expected return on the shares of the jth firm can be written as -

$$E(R_j) = R_f + \lambda \text{Cov} (R_j, R_M)$$

Using equation (11) the same can be written as -

$$E(R_j) = \frac{E(X_j)(1-t_j) - E(R_{Fj})B_j(1-t_j)}{S_j} = R_f + \lambda \text{Cov}(R_j, R_M)$$

Putting the value of $R_j$ in the covariance term of equation (3), we get -

$$E(R_j) = E(X_j)(1-t_j) - E(R_{Fj})B_j(1-t_j)$$

$$= R_f S_j + (1-t_j) \text{Cov}(X_j, R_M) + \lambda (1-t_j)B_j \text{Cov}(R_{Fj}, R_M)$$

Now, for the unlevered firm, the return on the equity capital can be written as -
\[ R_j = \frac{x_j (1-t_j)}{V_j^*} \] where, \( V_j^* \) is the value of the unlevered firm.

Thus, \( E(R_j^*) = \frac{E(X_j)(1-t_j)}{V_j^*} = R_f + \gamma (1-t_j), \text{ Cov.} (X_j, \hat{R}_M) \).

or, \( E(X_j)(1-t_j) = R_f V_j^* + \gamma (1-t_j) \) \( \text{Cov.} (X_j, \hat{R}_M) \) \( \gamma B_j (1-t_j) \)

Now, putting the value of \( R_{Fj} = R_f + \gamma \text{Cov.} (R_{Fj}, R_M) \) into the equation (4), the value of \( E(R_j) \) can be expressed as -

\[ E(X_j)(1-t_j) = \sqrt{R_f} + \gamma \text{Cov.} (R_{Fj}, R_M) \gamma B_j (1-t_j) \]

Replacing the equation (5) for \( E(X_j)(1-t_j) \), the above equation can be written as -

\[ R_f V_j^* + \gamma (1-t_j) \text{Cov.} (X_j, \hat{R}_M) - R_f B_j (1-t_j) \]

Therefore, in the absence of corporate taxes the value of the levered firm \( V_j = V_j^* \). Because, it is seen that the value of the levered firm is greater than that of the unlevered firm by an amount equivalent to the tax subsidy enjoyed by the levered firm on the amount of debt used by it. This finding is similar to that of Modigliani and Miller proposition I and II.