Subject	COMMERCE
Paper No and Title	14. SECURITY ANALYSIS AND PORTFOLIO MANAGEMENT
Module No and Title	3. RISK AND RETURN
Module Tag	COM_P14_M3

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1. LEARNING OUTCOMES

After the study of this lesson, the reader should be able to
- ➤ Understand the meaning of returns and risk involved in securities investment decision.
- ➤ Analyse the impact of different types of risk on investment decisions.
- ➤ Learn the different techniques available for measuring risk and returns.
- ➤ Apply the CAPM model to calculate the relationship between expected returns and systematic risk with the help of beta coefficient.

2. INTRODUCTION

Every financial decision has two aspects these are risk and return as these are the two main determinants of security prices. They have their impact on the share prices as well as the valuation of firm. Every decision involves some degree of risk, so an investor has to take his financial decision rationally to optimize his returns through the calculations of risk and return.

3. Return

Return is associated with gain or loss on money invested in the market. The rate of return on a security is the annual income received plus any change in the market price of an asset. Return is required to maximize the market price of the share but return is associated with risk because the greater the return, higher the expectation of risk. An investor has to consider the risk of different financing patterns to balance his decision between risk and return. Like the return is expected to be high for investing in purchase of an equity share in the market, but such a return is associated with high risk. Govt securities have a low risk as they provide stable return but at very low rate. Thus the investor has to pay the price in term of loss of return in order to invest in safe securities having minimum risk.

4. Risk

Since investment decision is based on future estimated returns which are exposed to different kinds of risk, so forecasts cannot be made with certainty. Thus Risk and returns are closely related. A profitable investment may also be very risky. So an investor has to manage a trade off between risk and return.

The variability of the actual return from the expected returns associated with the given asset is defined as a risk. The greater variability is associated with the risky securities like equity shares and the more certainty of return is associated with the government securities like Treasury-Bills have lesser variability and thus are less risky. Risks on investment like bank deposit are considered to be quite safe, but rate of interest can change depending on the policy of RBI. Investments in equity securities of a firm possess higher degree of risk as compared to govt securities and bank deposits as they are surrounded by market risk, which is quite uncontrollable because they are broad spectrum depending on market forces.

An investor has to take a decision in investing the firm's funds in such a way to optimize return along with minimization of risk. This combination is called the risk return trade-off. This is the level where the market price of the share is maximized. The balance brought about by matching risk and return help in achieving the objectives of wealth maximization.

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5. Types of Risk

The investor tries to reduce risk by understanding the risk environment. Risk consists of two types of exposures i.e. systematic and unsystematic exposures.

   a. Systematic risk- Systematic risk is due to the broad spectrum of uncontrollable risk associated with the business activities within a country. It generates out of macroeconomic environmental factors such as demand, supply, inflation, change in interest rates, and change in government policies backed by sociological and political factors in a country. It is an uncontrollable risk as these forces are beyond the control of any individual and thus cannot be minimized by a single firm. They have their strong influence on the market conditions. Such risks are called market risk and interest risk and purchasing power risk. These risks affect the cash inflows of a project. The changes in cash inflows will also bring about change in the profitability of an investment proposal.

   b. **Unsystematic risk**- Unsystematic risk is a unique risk related to the company pertaining to the behaviour pattern or internal influence of a firm like the problems relating to management, staff, expenses, losses, strikes and other issues directly affect the company's own operations. These are controllable risks and thus can be minimized by diversification of investment portfolio.

Thus an investor must analyse the existence of the degree of above mentioned two risks to balance his decision of risk and return to get potential gains at minimum risk.

6. Measurement of risk and return

Return measurement- Securities provide returns in the form of dividends or interests and it also provides a return at the time of sale in the form of capital gain. These securities have to be valued at different points of time. The returns at a particular point of time are required to be calculated by discounting the returns at an appropriate discount rate, which depends upon the individual's own perception of risk. The discount rate which is also called the required rate of return show the risk of the cash flows. It would also help to determine the value of the asset. The higher the discount rate greater will be the risk level. Thus the value of an asset therefore varies according to the risk perception and estimation of each individual. The required rate of return can be calculated with the help of the following formula-

$K = I_f + R_p$

Where

K= required rate of return

I_f= risk free rate

R_p= Risk premium

The risk free rate remains the same irrespective of any increase or decrease of risk level. The risk premium which indicates the compensation for taking the risk increases with increase in risk and decreases with decreasing risk. Thus the required rate of return comprises of the risk free rate, the risk perception and risk premium.

Figure1: The Required Rate of Return
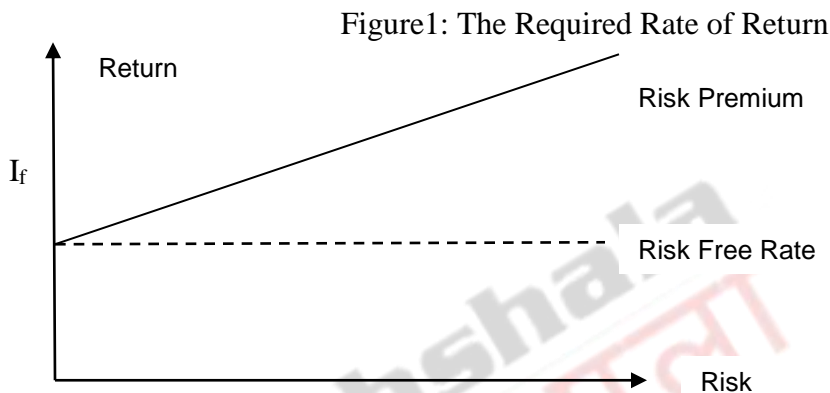
In the above figure the X-axis shows level of risk and Y-axis depicts the rate of return. From the point of origin and up to I_f is the risk free zone. The slope after the risk free rate slopes upward as this is the risk premium for compensating high risk with higher return.

Risk Measurement- The risk associated with a security from both a behavioural and a quantitative/statistical point of view. Different techniques are available to measure these different risks. The behavioural view of risk can be measured by using sensitivity analysis and probability distribution. The statistical measures of risk of a security are standard deviation and coefficient of risk.

   a. Sensitivity Analysis- It is a behaviorioul approach to assess risk by taking into account a number of possible return estimates so that a sense of variability among outcomes can be measured. In order to have a sense of variability among return estimates, a possible approach is to estimate the worst (pessimistic), the expected (most likely) and the best (optimistic) return associated with the asset. The difference between the optimistic and pessimistic outcomes is the range which according to sensitivity analysis is the basic measure of risk. The greater range indicates the more variability of the asset.

   b. **Probability distribution**- The risk associated with an asset can be assessed more accurately by the use of probability distribution than sensitivity analysis. It is a model that relates probabilities to the associated outcomes. The probability of an outcome represents the likelihood/percentage chance of its occurrence. For example if the expectation is that a given outcome will occur eight out of ten

times, it can be said to have eighty percent chance of occurrence. If it is certain to happen, the probability of happening is 100 percent. An outcome which has a probability of zero indicates that this outcome will never occur. Based on the probabilities assigned to the rate of return, the expected value of the return can be computed which is the weighted average of all possible returns multiplied by their respective probabilities. Thus, probabilities of the various outcomes are used as weights. The expected return,

Re=∑sum of $R_i * Pr_i$
Where
R_e= Expected Return
R_i= Return for the ith possible outcome
Pr_i=probability associated with its return
N=number of outcomes considered.

c. **Standard deviation of return**- Risk refers to the dispersion of returns around an expected value. The most common statistical measure of risk of an asset is the standard deviation from the mean /expected value of return. It represents the square root of the average squared deviations of the individual returns from the expected returns, symbolically the standard deviation

$$\sigma = \sqrt{\sum_{i=1}^{n}(Ri - Re)^2 * Pr_i}$$
where

σ = Standard Deviation of Returns
R_e= Expected Return
R_i= Return for the ith possible outcome
Pr_i=probability associated with its return
N=number of outcomes considered.

The greater standard deviation of returns indicates the greater variability/dispersion of returns and the greater risk of the investment. It is the absolute measure of dispersion and does not consider the variability of return in relation to the expected value.

d. **Coefficient of variation**- It is a measure of relative dispersion used in comparing the risk of assets with differing expected returns. It is a measure of risk per unit of expected return. It converts standard deviation of expected values into relative values to enable comparison of risks associated with assets having different expected values. The coefficient of variation is computed by dividing the standard deviation for an asset by its expected value.

CV= σ_r/Re
Where
CV= Coefficient of variation
σ_r= Standard deviation of return

Re = Expected Return
The larger CV is associated with the larger
relative risk of the asset. The use of coefficient of variation for comparing asset risk is the best since it considers the relative size (expected value) of assets.

7. Measurement of security risk and return through Capital Asset Pricing Model (CAPM)

The capital asset pricing model is an equilibrium model of the trade off between expected security return and systematic risk which is unavoidable. It is the basic theory that links together risk and return of all assets and also explains how the security prices are calculated in the market place.

It provides the framework for determining the equilibrium expected return for risky securities by deriving the relationship between expected return and systematic risk of individual securities and portfolios. Thus the CAPM has implications for:

- Risk returns relationship for an efficient portfolio as well as for an individual security.
- Identification of under and over-valued assets traded in the market.
- Pricing of asset not yet traded in the market.
- Effect of leverage on cost of equity (rate of return required by equity shareholders)
- Capital budgeting decisions and cost of capital.
- Risk of firm through diversification of project portfolio.

Assumptions
The CAPM makes certain simplifying assumptions to remove the complexities of the model. Some of them may be relaxed later:

- All investors are price takers. They are large in number so that no single investor can affect prices.
- All investors use the mean- variance portfolio selection model of Markowitz's asset pricing model.
- Assets/securities are perfectly divisible.
- All investors plan for one identical holding period.
- Investors can lend or borrow at an identical risk-free rate.
- There are no transaction costs and income taxes.

The market price of share is influenced by systematic and unsystematic risk. The CAPM approach measures the systematic risk of the security. Such a risk is measured by beta which measures change in market value of equity shares relative to change in market index. If beta is high the company's share will have high risk. The CAPM model calculates cost of equity through the following equation:

$K_e = K_f + \beta(K_m - K_f)$

K_e = cost of equity capital
K_f = cost of risk free asset
β = coefficient of systematic risk
K_m = cost of market portfolio.

The CAPM consists of two elements: The Capital Market Line (CML) and the Security Market Line (SML).

The Capital Market Line (CML)- It represents the risk return relationships for efficient portfolios. It represents the efficient frontier formed by combining one month T-bills with a broad index of common stocks. It depicts the risk return relationships for efficient portfolio available to investors. It also shows that the appropriate measure of risk for an efficient portfolio is the standard deviation of return on the portfolio.

The Security Market Line (SML)- It is a graphic depiction of CAPM and describes the relationship between expected return and systematic risk in capital markets. The risk averse investors seek risk premium to assume the risk embedded in risky assets. Systematic risk which is unavoidable is the contribution of an individual asset to the risk of market portfolio. According to the capital market theory, the market compensates or rewards for systematic risk only as unsystematic risk can be eliminated by diversification. The level of systematic risk in an asset is measured by the beta coefficient β. The CAPM links beta to the level of required return. SML is the linear relationship defined by the equation:

Expected return= risk free return+ (Beta*Risk premium of market)

$E(r_i) = r_f + \beta(E(r_m) - r_f)$

Where
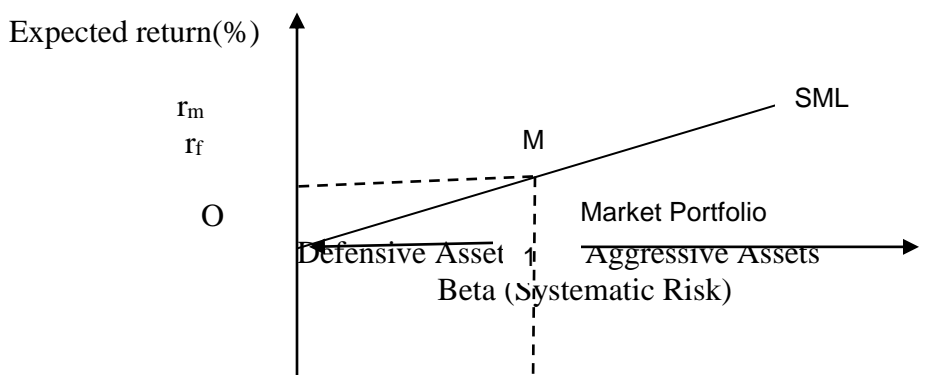
$E(ri)$= expected or required rate of return on asset i

r_f= risk free rate of return, vertical axis intercept

β= Systematic risk of the asset, beta

$E(r_m)$= expected return on market portfolio.

$E(r_m) - r_f$= Risk premium of market

Figure 2 Security Market Line

I= Intercept+ (Beta*slope of SML)

The more familiar form of the SML:

$E(r_i)-r_f= \beta (E(r_m)-r_f)$

Risk premium on security i= Beta* Risk premium of market

9. Risk-Return relationship

In the CAPM, the expected return on an asset varies directly with its systematic risk and the risk premium of market portfolio which is a reward depending on the level of risk free return and return on the market portfolio. In other words, the risk premium for an asset or portfolio is a function of its beta i.e. the risk premium added to the risk free rate is directly proportion to beta.

Thus the three basic elements required to apply CAPM model are: risk free rate, risk premium on market portfolio and beta.

Risk free rate- The rate of return available on an assets like T- bills, money market funds or bank deposits is taken as the proxy for risk free rate as such assets have very low or virtually negligible default risk and interest rate risk. However under inflationary conditions, they are risk less in nominal terms only. In fact, real return (nominal return-inflation rate) may become zero, even negative when inflation wakes up.

Risk premium on market portfolio- The risk premium on market portfolio is the difference between the expected return on the market portfolio and the risk free rate of the return. The CAPM holds that in equilibrium the market portfolio is the unanimously desirable risky portfolio. It contains all securities in proportion to their market value. In the efficient portfolio, which enables neither lending and borrowing, the risk premium on the market portfolio is proportional to its risk and the degree of risk aversion of the average investor.

Beta- Beta measures the risk (Volatility) of an individual security relative to market portfolio. Accordingly, beta is the co variance of the security's return with the market portfolio's return, divided by the variance of market portfolio. The co-variance of two securities is the product of their correlation coefficient and respected standard deviation. The covariance of the market portfolio with itself is the variance of the portfolio. Thus the beta of the market portfolio is one. This classifies all other market portfolios and securities in the two risky classes. Securities with beta less than one are called defensive security. Security with beta greater than one is called aggressive security. Risk free security has a beta equal to zero.

10. Validity of CAPM

The CAPM is a rigorously derived equilibrium model. It has been widely used on the basis of four factors. First, the risk return trade off- the direct proportional relationship between the two- has a distinct intuitive appeal. Second the transition from the capital market line to the security market line shows that the undiversifiable nature of the systematic risk makes it the relevant risk for pricing of securities and portfolios. Third the beta- the measures of systematic risk is easy to compute and use. Finally the model shows that investors are content to put their money in a limited number of portfolios, namely, a risk free asset like Treasury bills and a risky asset like a market index fund.

However, the CAPM is essentially a single factor model in that the security's expected return depends on a single factor namely beta. But there may be other factors, apart from beta which may affect required returns. Therefore, the inclusion factors like taxes, inflation ,liquidity, market capitalization size and price earnings in the CAPM equation would provide better explanation of variables impacting security returns which have been used in the extended CAPM model to overcome the shortcomings of CAPM model.

11. SUMMARY

Return is associated with gain or loss on money invested in the market. The rate of return on a security is the annual income received plus any change in the market price of an asset.

Thus Risk and returns are closely related. A profitable investment may also be very risky. So an investor has to manage a trade off between risk and return.The variability of the actual return from the expected returns associated with the given asset is defined as a risk. Systematic risk is due to the broad spectrum of uncontrollable risk associated with the business activities within a country. It generates out of macroeconomic environmental factors such as demand, supply, inflation, change in interest rates, and change in government policies backed by sociological and political factors in a country.

Unsystematic risk is a unique risk related to the company pertaining to the behaviour pattern or internal influence of a firm like the problems relating to management, staff, expenses, losses, strikes and other issues directly affect the company's own operations.

The risk associated with a security from both a behavioural and a quantitative/statistical point of view. Different techniques are available to measure these different risks. The behavioural view of risk can be measured by using sensitivity analysis and probability distribution

In the CAPM, the expected return on an asset varies directly with its systematic risk and the risk premium of market portfolio which is a reward depending on the level of risk free return and return on the market portfolio.