Chapter III

Theoretical Framework

3.1 Definition of Risk

“Risk refers to the likelihood that in life’s games of chance that one will receive outcome that he/she will not like”. Thus the risk is perceived almost entirely in negative terms. In finance, risk is viewed in broader sense that the return to be received by the investor on his/her investment may fetch the positive outcome or negative outcome. The positive outcome refers that the actual return is more than the expected return whereas the negative outcome refers that the actual return is less than the expected return. The chance of occurring outcome would be different from what one expects but the outcome can not only be bad but it can also be a good one. The above fact differentiates financial risk from the normal risk. When the actual return is less than the expected one then it is called as downside risk whereas the actual return is more than the expected return then it is called upside risk.

In Chinese language the risk has a symbol with a mix of danger and opportunity witnessing clearly that there is a tradeoff between the higher rewards that come with the opportunity and the higher risk that has to be borne as a consequence of the danger. The effort taken by the investor with the best model to convert the danger into opportunity may bring higher return on his investment. In finance, the danger is referred to risk and opportunity is referred to expected return. The question is how the risk to be perceived. There is argument that the risk to be perceived from the eyes of the firm or shareholders. If the risk to be perceived from the point of view of the firm, the perception will be different because of dealing with bulk of capital, human and financial invested in the firm. If the risk is viewed from the firm’s stockholders, the perception of those would be different since they hold stock as one investment in a larger portfolio.
Hence the risk has to be perceived through the eyes of the investors. Since the firm has large number of investors, with different perspective, is quite difficult to take into account of the perception of all investors and therefore it is asserted that the risk has to be measured from the perspective of “marginal investor” defined to be the investor most likely to be trading on the stock at any given point of time.

3.2 Equity Risk and Expected Return

Risk analysis can be taken in the form of following steps. The steps consist of three important items as follows.

1. The risk may be defined in terms of the distribution of actual returns around an expected return.

2. The risk may be segregated into two components such as specific risk and market risk. When the risk is associated with the firm alone, it can be regarded as specific risk whereas the risk that affects much wider cross section of investment can be termed as market risk.

3. A model may be developed to measure the market risk.

When an investor who buys an asset and holds it for some time, he or she may expect to earn returns over the time horizon. The probability of getting expected return may vary from the actual return and the difference between the actual and expected returns act as the source of the risk. As and when an investor who invests in the riskless assets such as Treasury bill or Government bonds the expected rate of return will synchronize with the actual return in that sense, there will be no deviation around expected return. Hence the investment in this asset category is called riskless investment. To provide a contrast to the riskless investment, the investment made by the investor in equity may be termed as risky investment. By investing in equity, the investor may get higher or lower return in comparing with the expected rate of return. In this case the actual return is different from expected return. The spread of the actual returns around the expected return is measured by the variance or standard deviation of the distribution. The greater the deviations of the actual return from the expected return, the greater the variance. Next the bias towards positive or negative returns is represented by the Skewness of distribution.
When there is higher probability of getting longer positive returns than negative returns then the distribution is positively skewed. The shape of the tails of the distribution is measured by Kurtosis of the distribution. The Kurtosis helps to find the ups and downs of the equities. In riskless investment the actual return lies on the expected return as vertical line to the axis of expected return whereas the investment is risky the actual return would be curve shaped stretching the tail at right end. In rare case, the distribution would be normal distribution where the bell shaped curve with right hand and left hand tail without touching the axis. In normal distribution there is no Skewness and to have a Kurtosis of zero.

When return distribution takes normal form, the characteristics of any investment can be measured with two variables – the expected return, which represents the opportunity in the investment and the standard deviation or variance which represents the danger. A rational investor is one who is about to choose between two investments with same standard deviation but different expected returns, will always pick up the higher expected return with same standard deviation. In general, when the distribution is neither symmetric nor normal, the investor will choose the investment by expected return and the variance, according to the utility function of the individual. The choice of the investments normally is based on the degree of Skewness and Kurtosis. Positively skewed distribution and distribution with a lower likelihood of jumps (lower Kurtosis) will be preferred than negatively skewed distribution with higher likelihood of jumps (higher Kurtosis). The selection process of choice of investment is made on the basis of expected return and variance which in turn are estimated on the ground of historical data. As the past returns are the good indicators for future return, the historical estimates can be regarded to be good measures of risk.

3.3 Diversifiable and Non-Diversifiable Risk

The reason for actual return differs from expected return may be attributed to firm specific risk and market wide risk. The firm specific risk affects one or few investments whereas market wide risk affects many or all investments. When the investor makes an investment in equity he/she is encountered with many risks. The firm specific risk is
further divided into project risk, competitive risk and sector risk. The project risk arises when the company misjudges demand in its future operation and as the result of misjudgment, the bottom line of the company is affected then the market price of the company may come down. The risk is called project risk. Sometimes the risk may arise from competition in which the competitor may take a competitive advantage which in turn makes the company weaker in the market witnessing the ebb in demand of the product of the company as well as its suppliers. Hence the competitive risk may affect few firms. The sector risk refers to the announcement of Government in terms of lesser allocation of fund to the particular sector may have negative impact on the companies which belong to the sector. Normally the sector risk affects only subset of firms. The another category of risk is called as market risk where almost all the instruments are affected to certain extent. When the general rate of interest is increased, the procurement of capital will become costlier for all the companies irrespective of the sector they belong to. Similarly when the economy weakens, all firms feel the effects. When most of the companies are operated under international market in a country’s economy and in case the currency of the country gains the strength against the currency of the other countries currency, the impact will be negative in terms of earnings and value of the firms with international operation whereas few companies with international operation in a country faces the above similar situation the impact will be pertaining to small set of companies. The former is known as market wide risk and the latter is closer to the spectrum of firm specific risk. When an investor invests his entire portfolio in one asset, he or she is exposed both firm specific and market risk. Rather expanding the portfolio to include other assets or stocks may help the investor to eliminate or reduce the exposure of firm specific risk. The concept of reducing firm specific risk by including more assets in one portfolio is known as diversification. There are two reasons why diversification reduces or eliminates firm specific risk. The first is that each investment in diversified portfolio is a smaller portion of that portfolio so that any action that increases or decreases the value of only that investment may have a small impact on overall portfolio whereas undiversified investors are much more exposed to changes. The second reason is that the effects of firm specific action on the prices of individual
assets can be either positive or negative for each asset so that in a larger portfolio the effect will be nullified.

3.4 Statistical analysis of diversifiable risk

The variance in a portfolio is partially determined by the variances of individual assets in the portfolio and partially determined by how they move together; the latter is measured statistically with correlation or covariance. In well diversified portfolio the weights of individual would be very small and therefore the variances of individual securities would be insignificant. But the covariance between the securities would be significant. As and when the securities are negatively correlated, the covariance will be negative. But in practice securities may have some correlation. The above fact is the base for diversifiable risk and non diversifiable risk. The unique risk of security can be reduced by the formation of portfolio whereas the market risk cannot be avoided since the securities in the diversified portfolio moves with the market.

3.5 Measuring the market risk of an individual asset

The risk of any asset is calculated by adding the asset to the investor’s portfolio. Since the theory of Capital Asset Pricing Model has an assumption of market portfolio concept, the risk of the individual asset is derived by how much the risk is added to the market portfolio by the individual asset. The individual security may move independently of the market portfolio so that it may not add much risk to the market portfolio. But when the individual security moves up and down with market portfolio then there is a chance that the risk may be added to market portfolio. This type of asset will have more market risk and less firm specific risk. Normally the added risk is measured with the help of covariance.

3.6 Measuring the non diversifiable risk

Suppose an investor holds two assets in such a way that riskless security and the market portfolio and if the risk of any asset to be measured with respect to the market portfolio then the risk of the particular asset can be measured with the help of the variance of the portfolio. Prior to the addition of the security the portfolio may have particular risk and after adding the security into the portfolio the risk may differ. Hence the variance of the portfolio undergoes changes in terms of risk prior to the addition of the asset and after
addition of the asset. Since the portion of individual asset and its weight on market portfolio would be small there could be negligible effect of individual asset leaving the third term of the following equation as the measure of the risk added by the asset.

$$\sigma_{m}^2 = \omega_1^2 \sigma_1^2 + (1 - \omega_1)^2 \sigma_m^2 + 2 \omega_1 (1 - \omega_1) \sigma_{im}$$

The third part of the above equation refers the covariance of asset and market. Since the covariance is percentage value, it is difficult to measure in terms of relative risk. Therefore it is necessary to standardize the risk measure by dividing the covariance of each asset with the market portfolio by the variances of the market portfolio.

3.7 Concepts related to capital market line and capital asset pricing model

Capital Market Line refers to the reward that an investor expects for taking risk. Suppose the risk free investment is 5%. This means that anybody can earn this return of 5% by simply investing in risk free investments. When the investor invests in the stock market on certain rate of return say 15%, anyone who invests in the stock will be able to earn 15%. The excess return earned over and above the risk free return is called as risk premium. In the above case, the risk premium of stock market investment is (15-5) 10%. If an investment is found to be as much as risk of the stock market, then the risk premium will be equivalent to 10%. At the same time, the investment is riskier than the stock market; the investment should fetch more than 10%. The extent of additional risk in an investment with respect to the market can be computed by comparing the standard deviation of the investment and that of the market. If the standard deviation of the investment is 0.75 while that of the market is 0.5 then it can be said that the former is 50% riskier. It should earn a risk premium of 50% more than the risk premium of the stock market. The total return from the investment is the risk free investment plus the risk premium.
Three things have to be borne in the mind while investing in the stock market.

1. The stock market is not concerned with diversifiable risk.
2. The stock market is not concerned with whether you as an investor have a diversified portfolio.
3. The compensation that market pays you will be limited to only non-diversifiable risk.

By taking into account of three important aspects, it becomes clear that an investor has to strike a balance between on the one side of non-diversifiable portion of risk and on the other side returns that he or she seeks. Capital Asset Pricing Model provides the link between return and non-diversifiable risk. An investor can use CAPM to assess the extent of additional return over risk free return, for a given level of systematic risk of a risky investment. The above concept can be explained as follows. When the risk free return is 10% and the risk class associated with the industry is about 20% then the risk premium for the risk taken to buy the equity of the company X is 10% . But company Y in the same industry has a risk class three times more than the company X, then the company has 30% more than the risk premium of the company X. The risk premium for the company X is 10% whereas the risk premium of the company Y 13% in comparing with risk free return and 3% in comparing with the company X which means the company Y is 1.3 times riskier than company X. How much more risky is an investment with reference to the market is, identified by beta.

The message conveyed by CAPM is stunning and lucid. The risk premium on a stock varies in direct proportion to its beta. If the market risk premium is 7% and the beta of the stock is 1.3 then the risk premium for that stock is 8.1%, when the beta is 0.8 then the corresponding risk premium for that stock is 5.6%
3.8 Undervalued stocks and overvalued stocks

If the required rate of return (as computed by CAPM) is less than the expected return (calculated using any other factor) then the stock is undervalued. This is because the stock gives more return than what it should give. Such stocks should be bought.

If the required rate of return (as computed by CAPM) is higher than the expected return (calculated using any other factor) then the stock is overvalued. This is because the stock gives less return than what it should give. Such stocks should be sold.

If the required rate of return (as computed by CAPM) is equal to the expected return (calculated using any other factor) then the stock is rightly valued. This is because the stock gives same return as what it should give. Such stocks should be held.

The difference among security market line, capital asset pricing model and capital market line are as follows. Security market line is a graphical version of CAPM. It depicts the relationship between expected rate of return of a scrip and beta. Having known the expected rate of return of scrip, this market line helps to calculate the required return of stock for various levels of beta including for a beta of zero. CAPM applies to one security and to a portfolio of securities. Capital Market Line represents the efficient set of portfolio formed from both risky and riskless assets.

The notion of alpha is understood as a measure of a share’s abnormal return and represents the percentage by which the share’s returns are currently above or below the required return given its systematic risk. Alpha is an indicator of the extent to which the actual return of a stock deviates from those predicted by its beta value.

**Alpha = Return mandated by CAPM – Actual Return earned**

If the CAPM holds well, the value of alpha should be zero. Over the long run, the alpha value of any individual share should be zero. Similarly the alpha of a well diversified portfolio should be zero. Alpha values assume significance in the investment market. They help an investor to decide whether stocks are undervalued, overvalued or rightly valued. The following rules would help make the choice. A positive alpha value indicates that the expected return from the stock could be higher than the value mandated by CAPM. Hence stocks with positive alpha should be considered as undervalued stocks. Such stocks should be bought. A negative alpha value indicates that
expected return from the stock will be less than that mandated by CAPM to the extent of the alpha value. Hence stocks with negative alpha should be considered as overvalued stocks. Such stocks should be sold. Sale of overvalued stocks and purchase of undervalued stocks would mean that over time, the value of the stocks will touch the values suggested by CAPM and hence the alpha values will become zero in the long run.

3.9 Factor Model – Arbitrage Pricing Theory Model (APTM)

The concept of APTM has been extended from CAPM. The CAPM provides a link between expected returns on a share and expected returns on a market index. The risk arising from the firm specific factors is diversifiable. The risk arising from the market related factors cannot be diversified. The essence of CAPM is that the investor will be rewarded for only non-diversifiable risk. In CAPM, market risk primarily arises from the sensitivity of an asset’s return to the market return and this is reflected by beta. Just one factor – the market returns – affects the firm’s return. Hence CAPM is one factor model.

The beta of the firm would differ depending on their individual sensitivity to market. The concept of beta measures the non-diversifiable risk by taking market index as a proxy. But these non-diversifiable risks can be traced to macro economic factors. The hidden macro economic factors such as interest rate, Gross National Product, Balance of Payment, Foreign Exchange Reserves etc. could affect the firms differently and those factors are addressed in APTM. The responsiveness of the business entity to each of these factors will be different. Hence a business entity can have a Beta for a change in foreign exchange reserves, another Beta for a change in GNP, and a third Beta for a change in inflation rates etc. Using the sensitivity of the firm to two or more such factors that are relevant, the expected return on a given stock can be estimated.

**Market Model**

The Market model is a takeoff from CAPM and recognizes the existence of Alpha. It suggests that it would be more appropriate to arrive at expected return of a stock by including the alpha which is represented by

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\text{Market model} = \text{CAPM} + \text{Alpha}
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The risk premium for a security computed under both need not be identical. Alpha value can be taken as expected excess return for the stock, only where the excess return for the market index were expected to be zero.

3.10 Flow of the study

Calculation of Scrips Returns and Market Return

Estimation of Beta Values

Time Interval

Individual Securities

Portfolio Level

Measuring Beta Stability

Estimation of scrip’s return with the test of Heteroscedasticity

Absence of Heteroscedasticity

Reliable on OLS Beta Values

Presence of Heteroscedasticity

Application of GARCH Model to Predict the Volatility of the Scrip Return