



# Optimal Portfolio Selection Using Sharpe's Single Index Model

## KEYWORDS

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**ABSTRACT** The present study aims to test whether single index model offers an appropriate explanation of stock returns on IT stocks. The sample in the present study consists of 13 actively traded scrips listed in the National Stock Exchange Limited, Bombay (NSE). The scrips in the sample are selected from NSE IT index. Having tested using regression on the excess return of S&P CNX Nifty and IT Index it is found that there is a significant relationship and a good explanation of IT index over S&P CNX Nifty. In addition to that the study investigated that there are four aggressive stocks having beta co-efficient of more than 1 such as Moser Baer India Ltd, Oracle Financial Services Software Ltd, Polaris Software Lab Ltd, Rolta India Ltd. Ultimately it is recommended that among the sample companies all the stocks are undervalued except one stock (G T L Ltd.) thus the investors can pick these stocks to revise their portfolio.

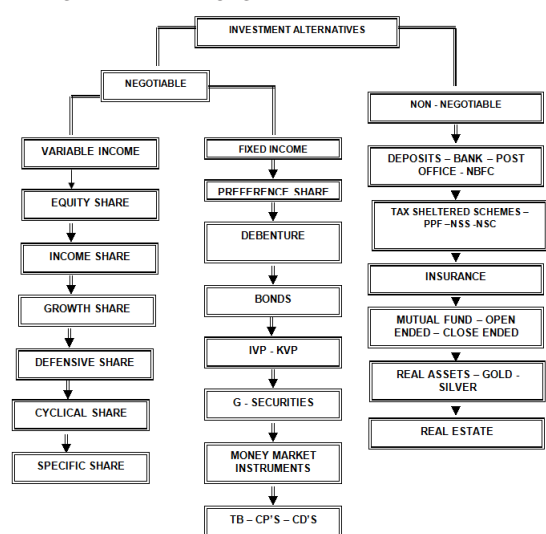
## INTRODUCTION:

Investment in equity and equity linked schemes is a milky way of ensuring expected return rather opting investment vehicles that render risk free return. Apart from fixed income bearing securities there are umpteen numbers of financial products are seen in the modern financial supermarkets to create extraordinary return which has been integrated with uncertainty to the investors. So the rational investors could never ever ignore the risk factor which is fabricated in risk premium. All of us take risk in some form when we invest. But some investment avenues involve huge risk and some less risk. Risk can also be defined as the risk arising from the market forces which is known as systematic risk and measured in terms of beta and the unique risk known as unsystematic risk. The investors go for a collection of investment, which is known as a portfolio in order to diversify the unsystematic risk a great extent. Considering the level of systematic risk ( - Beta Co- efficient or slope of straight line) the assets are priced in order to derive the expected return by means of Sharpe - Lintner-Mossin form of capital asset pricing model -CAPM.

## MEANING OF INVESTMENT

Investment, in its broadest sense, means the sacrifice of current dollars for future dollars. Two different attributes are generally involved, time and risk. The sacrifice takes place in the present and it is certain. The reward comes later, if at all, and the reward is generally uncertain. In some cases the element of time predominates in terms of government bonds. In other case risk is the dominant factor with reference to common stock. Postponement of present consumption is certain but the benefit of future is uncertain, and that uncertainty is known as risk. Risk is the chances of loosing or not getting the expected return.

## INVESTMENT AVENUES



## TRADITIONAL PORTFOLIO THEORY (TPT)

Traditional portfolio theory deals with the evaluation of return and risk conditions of each security. It reveals the subjective nature. The value of particular scrip depends upon the quantum of amounts of dividends declared by the company, the price earning ratio and the EPS of the holding period. It recognizes specific type of risk and non risk factors. The risk of each individual security is measured by calculating the standard deviation. The traditional approach recognizes several basic tenets for building a best portfolio. First, the investors prefer large to smaller returns from securities. Second, the way to achieve the goal is to make more risk. Third the ability to achieve higher return depends upon investors judgment of risk and his ability to assume specific risk. And it considers factors such as interest rate risk, purchasing power risk, financial risk, taxation and marketability. There are certain assumptions in traditional theory as listed hereunder.

- The Market is inefficient
- Fundamentalists take advantage on market inefficiency
- Fundamentalists earn quick profits
- Fundamentalists will expect the potential growth of a particular company for predicting the future trend of the share price.

### MODERN PORTFOLIO THEORY (MPT)

According to research work done by Hary M Markowitz and William Sharpe the modern portfolio theory indicates the maximization of returns through a combination of different securities. This theory tells us that risk can be reduced by combining low risk securities with high risk. This theory depends upon the concept of diversification. Like traditional theory here also a set of assumptions available which are cited below.

- Free and perfect flow of information.
- Market is perfect and absorbs quick information
- The riskness of a financial asset in portfolio is to be seen in the context of market related risk or portfolio risk, but not in isolation.

### MARKOWITZ THEORY OF PORTFOLIO MANAGEMENT (MTPM)

The modern portfolio theory was developed by Dr Hary M. Markowitz in 1952. It is a model based on a theoretical frame work for analysis of risk and return. He used the standard deviation for measurement of risk .He also utilized the relationship between securities for selection of better asset mix in a portfolio. His entire work led to the concept of efficient portfolio. An efficient portfolio is expected to yield the highest return for low level of risk. **According to Markowitz "A portfolio is said to be efficient, if it is expected to yield the highest possible return for the lowest risk or a given level of risk"** He further emphasized that the quality of a portfolio will depend upon the quality of individual assets in the portfolio .Therefore the combined risk of two different financial assets is not the same like the separate risk of two assets. Risk is measured by the dispersion of the distribution away from the mean return, which are called as standard deviation. As per the modern portfolio theory the expected return, the variance of these returns and co-variance of these returns of these securities with in the portfolio are to be considered for the choice of the portfolio.

#### Assumptions:

- Investors behave rationally.
- Investors know all the information about the market.
- Investors choose higher returns to lower level of risk.
- The markets are efficient and they absorb information quickly and perfectly.

### CONCEPTUAL FRAME WORK OF SINGLE INDEX MODEL:

The observation of the stock prices over a period of time reveals that most of the stock prices move with the market index. When the senser increases, stock price also tend to increase and vice-versa. This indicates that some underlying factors affect the market index as well as stock prices .Stock prices are related to the market index and this relationship could be used to estimate the return on stock<sup>1</sup>. Towards this purpose the following equation can be used.

$$R_i = \alpha_i + \beta_i (R_m - R_f) + E_i$$

$$R_i = \text{Expected return}$$

$$\alpha_i = \text{Intercept of the straight line or alpha co-efficient}$$

$$\beta_i = \text{Slope of straight line or beta co-efficient}$$

$$R_m = \text{Market return}$$

$$E_i = \text{Error Term}$$

$$R_f = \text{Risk free rate of return}$$

According to equation, the return of a stock can be divided in to two components, the return due to the market and the return independent of the market.  $\beta_i$  indicates the sensitiveness of the stock return to the changes in the market

return. For example  $\beta_i$  of 1.5 means that the stock return is expected to increase by 1.5% when the market index return increase by 1% vice-versa. Likewise  $\beta_i$  of .5 expresses that the individual stock return would change by .5% when there is a change of 1% in the market return.  $\beta_i$  of 1 indicates that the market return and security return are moving in tandem. The estimates of  $\beta_i$  and  $\alpha_i$  are obtained from regression analysis. The single index model is based on the assumption that stocks vary together because of the common movement in the stock market and there are no effects beyond the market(i.e any fundamental factor effects)that account the stocks co-movement. The expected return, standard deviation and co-variance of the single index model represent the joint movement of securities. The mean return is

$$\text{The variance of security's return, } \sigma^2 = \beta_i^2 \sigma_m^2 + \sigma_{ei}^2$$

$$\text{The covariance of returns between securities I and j is } \sigma = \beta_i \beta_j \sigma_m^2$$

The variance of the security of the security has two components namely; systematic risk and unsystematic risk or unique risk. The variance explained by the index is referred to systematic risk. The unexplained variance is called residual variance or unsystematic risk.

$$\text{Systematic risk} = \beta_i^2 \sigma_m^2$$

$$= \beta_i^2 \sigma_m^2$$

$$\text{Unsystematic risk} = \text{Total variance} - \text{systematic risk}$$

$$E^2(\text{unsystematic risk}) = \sigma_{ei}^2 - \text{systematic risk}$$

$$\text{Thus the total risk} = \text{Systematic risk} + \text{Unsystematic risk}$$

$$\beta_i^2 \sigma_m^2 + E_i^2$$

From this, the portfolio variance can be derived

### REVIEW OF LITERATURE

It was with the development of the Markowitz' portfolio theory in the 1950s that the modern theory of investment commenced. The capital market theory is an extension of the portfolio theory of Markowitz (1952, 1959). Portfolio theory is a description of how rational investors should build efficient portfolios and the capital market theory indicates how assets should be priced in the efficient capital market. In security analysis we are concerned only with those assets whose prices can be estimated. The usual notion in economics is that the price of an asset is determined based on the demand for and supply of the asset. The same notion is used to describe a theory that explains how assets are priced in the securities market. Sharpe (1964), Lintner (1965) and Mossin (1968) have independently developed a standard form of general equilibrium model for asset returns in the securities market. This model has come to be known as Sharpe-Lintner-Mossin form of Capital Asset Pricing Model (CAPM) or standard form of CAPM. This model is based on many assumptions about capital market. However, it has been useful to understand the complex relationship between securities returns and risks. The studies conducted by the Brennan (1971), Black, Jensen and Scholes (1972), Black (1972), Fama and MacBeth (1973), Blume and Friend (1973), Brito (1977), Ross (1978), Gibbons and Ferson (1985), Handa et al (1993), Terregrossa (2001), Feldman and Riesman (2003), Koedijk and Vandijk (2004) are largely supportive of Standard form of CAPM. Research findings of these studies have been debated again and again.

### DATA AND ANALYSIS

The modus operandi adopted in the study consists of the following steps.

- Collecting the monthly returns of the IT stocks, constitu-

ent of IT index, for the time period of 2004-2008.

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- Calculating monthly excess return over risk free rate of return (T-Bill) for stocks, senssex and IT index returns.
- Applying regression on the market return and excess security return.

The regression methodology is a convenient way of compressing large amounts of data in to an equation that captures the relationship between excess market return and excess security returns. The basic regression assumes linear relationship between excess market return and excess security returns. Regression technique has been used to test the efficiency of the model. The R value is analyzed whether it is good fit model or not. If the value of R is very high which means that the excess market return is explaining the high proportion of variability in stock return? .The entire data for the calculation has been collected from proweess.

### S&P CNX Nifty Vs IT Stocks

Stock	Stdev	Variance	Beta (Market)	Unsystematic Risk	Systematic Risk
Patni	0.059695386	0.003563539	0.689270996	0.002901794	0.000661745
C M C Ltd.	0.068771307	0.004729493	0.857468911	0.00370538	0.001024112
G T L Ltd.	0.061460738	0.003777422	0.754740319	0.002983997	0.000793425
H C L	0.11654303	0.013582278	0.63503041	0.013020584	0.000561694
H C L	0.073528796	0.005406484	0.983118936	0.004060242	0.001346241
Hexaware	0.119898403	0.014375627	0.828457603	0.013419641	0.000955986
Infosys	0.100726391	0.010145806	0.408530665	0.009913339	0.000232466
Moser	0.074721441	0.005583294	1.085747602	0.003941311	0.001641983
Mphasis	0.085148843	0.007250325	0.587181421	0.006770089	0.000480237
Oracle	0.068882004	0.00474473	1.051244056	0.003205449	0.001539281
Polaris	0.079528916	0.006324849	1.246249462	0.004161528	0.00216332
Rolta	0.090959235	0.008273582	1.168957743	0.006370277	0.001903305
Wipro	0.091521641	0.008376211	0.88931709	0.00727461	0.001101601
S&P CNX Nifty	0.037321185	0.001392871	1		

So far as the above shown empirical results are concerned, there are four aggressive stocks having beta co-efficient of more than 1 such as Moser Baer India Ltd, Oracle Financial Services Software Ltd, Polaris Software Lab Ltd, Rolta India Ltd. Of the 13 companies which have been taken in to consideration for the present study Infosys, HCL Tech, Wipro, are the nifty companies contributing much on nifty variation.

### FINDINGS AND CONCLUSION

IT industry is the most important and prominent industry for the Indian economy in bringing enormous foreign exchange.

### EMPIRICAL RESULTS S&P CNX Nifty Vs IT Index

Year	Explanation of CNX IT over S&P CNX Nifty
2008	0.059164478
2009	0.020264578
2010	0.780336948
2011	0.825854094
2012	0.641506208
2013	0.566581545

The regression result ,between excess return of IT index and S&P CNX Nifty ,reveals that the IT index return explains 6%,2%,78%,82%,64%,and 56.6% variation over the S&P CNX Nifty during the year 2004,2005,2006,2007,and 2008 respectively. It means except the year 2004 the entire study period has witnessed that the IT index has a phenomenal amount of sensitiveness over S&P CNX Nifty.

Thus it is important to know the status and contribution of the IT stocks in the S&P CNX Nifty. Another aspect is to verify which It stock is currently overvalued and undervalued with respect to the current Nifty index levels. It hopes that this paper will give some useful insight to the investors who are interested in investing IT stocks. Moreover the study reveals that all the IT stocks are undervalued except GTL limited with respect to the current market levels. Investors can thus, still pick these stocks for their portfolio.

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