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OPTIMAL PORTFOLIO CONSTRUCTION IN SELECTED MANUFACTURING SECTORS WITH REFERENCE TO NATIONAL STOCK EXCHANGE (NSE)

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ABSTRACT

The main focus of this research is to construct an optimal portfolio in Indian stock market with the help of the Sharpe single index model. Portfolio construction is an important process of the investors for investment in the equity market. A good combination of portfolio will give maximum return for a particular level of risk. In this research, Automobiles, Cements, Paints, Textiles and Oil & Refineries sectors have been taken into consideration for construction of portfolio. Companies were selected from five sectors and ranked them based on excess return to beta ratio. The cut-off point was calculated and highest value is to be taken as a base for calculation of money to be invested in each stocks. This research findings and suggestions would be helpful to investors.

KEYWORDS

sharpe, beta, market variance, residual variance.

INTRODUCTION

The security analysis and portfolio management has emerged as the most concerned aspect for rational investment and decision making. A portfolio is combination of securities held together as an investment. A portfolio tries to trade off the risk return preferences of an investor by not putting all eggs in single basket.

A portfolio allows for sufficient diversification. Traditionally diversification meant holding large number of securities scattered across different industries. Many would feel that holding fifty such scattered stocks is five times more diversified than holding ten scattered stocks. However modern portfolio doesn't believe in holding many stocks. It believes in having right kind of diversification", "the right timing" and "the right reason". Markowitz was the first who laid foundation of "Modern portfolio theory" to quantify risk. He provided analytical tools for analysis and selection of optimal portfolio. This portfolio approach won him Nobel Prize in 1990.

The work done by Markowitz was extended by William Sharpe. He simplified the amount and type of input data required to perform portfolio analysis. He made the numerous and complex computations easy which were essential to attain optimal portfolio. This simplification is achieved through single index model. This model proposed by Sharpe is the simplest and the most widely used one. The study focuses on finding out an optimal portfolio using single index model.

NEED FOR THE STUDY

Portfolio is constructed to diversify the risks and maintain perfect negative correlation between the securities held together. Framing portfolio by selecting securities based on brand identity and recent performance does not turn up anticipated return in long term. This paper is built around cooking up the portfolio by balancing the positive and negative correlation existing between the securities and in turn getting returns closer to the anticipated results.

OBJECTIVES

1. To study the relative market performance of fourteen companies belonging to Automobiles, Cements, Paints, Textiles and Oil & Refineries sectors, listed in National Stock Exchange, India.
2. To construct an optimal portfolio and analyze the risk and return, which notifies the company to meet the future needs of capital.
3. To identify stocks and proportion of stocks to be included in portfolio.
4. To guide investors to find out the company that gives the maximum return with minimum risk.
5. To study the volatility of companies in comparison with the market.

REVIEW OF LITERATURE

According to Campbell (2001) says about optimal portfolio selection is that a portfolio selections a model which allocates financial assets by maximizing expected return subject to the constraint that the expected maximum loss should meet the Value at Risk limits set by the risk manager. Similar to the mean-variance approach a performance index like the Sharpe index is constructed. Furthermore, when expected returns are assumed to be normally distributed, it is shown that the model provides almost identical results to the mean-variance approach.

Liow (2001) regarding the long term investment performance, examines the investment performance of Singapore real estate and property stocks over the past 25 years. Evaluations using coefficient of variation (CV), Sharpe Index (SI) suggest that real estate outperformed property stocks on a risk-adjusted basis. Results also indicate that risk adjusted investment performance for residential properties remained superior to performance for other real estate types and property stocks.

Haslem (2003), studied Data envelopment analysis (DEA) to identify the large-cap mutual funds in the 1999 Morningstar 500 for efficient or inefficient. An attempt is made to identify the financial variables that differ significantly between efficient and inefficient funds and to determine the nature of these relationships. According to study findings, there are identified input/output and profile variables that are significantly different between the 1999 morning star 500 large-cap mutual funds that are DEA performance-efficient and inefficient. The Sharpe index represents the DEA output variable. That is, the findings indicate the variables that are significantly different between performance efficient and inefficient funds and the nature of their relationships. The variable values associated with efficient funds are relatively conservative in nature, not aggressive. Andrea L. (July 2003), suggests empirical evidence on the efficiency and effectiveness of hedging U.S.-based international mutual funds with an ASIA-Pacific investment objective. The case for active currency risk management is examined for a passive and a selective hedge, which is constructed with currency futures in the major currencies. Both static and dynamic hedging models are used to estimate the risk-minimizing hedge ratio. The results show that currency hedging improves the performance in internationally diversified mutual funds. Such hedging is beneficial even when based on prior optimal hedge ratios and efficiency gains from hedging, as measured by the percent change in the Sharpe Index, are greatest under a selective portfolio strategy that is implemented with an optimal constant hedge ratio.

A study by Beneda (2004) explained a simplified model for quantifiably measuring and managing various types of risk, as a portfolio of risks. An asset management firm may face a variety of risks due to the broad nature of various investments. The technique utilizes computerized simulation and optimization modeling. The software used to administer the simulations is Crystal Ball. The use of simulation allows risk managers to combine the various categories of risk a firm face for constructing risk portfolio. These techniques will enable risks managers to have the information needed to achieve the desired level of overall firm risk and the expected cost of managing risk.

Moreno, Macro and Olmeda (2005) analyzed, from an investors perspective, the performance of several risk forecasting models in obtaining optimal portfolios. Specifically, it studies whether ARCH-type based models obtain portfolios whose risk-adjusted returns exceed those of the classical Markowitz model. The same

analysis is performed with models based on the Lower Partial Moment (LPM) which take into account the asymmetry in the distribution of returns. The results suggest that none of the models achieve a clearly superior average performance. It is also found that models based on semi variance perform as well as those based on the variance, but not better than, even if the evaluation criterion is based on the Reward-to-Semi variance ratio. Paudel and Koirala (2006), tried to find out whether or not Markowirz and Sharpe models of portfolio selection offer better investment alternatives to investors. They evaluated 30 stocks and took 5 stocks into optimal portfolio under the Sharpe model.

Another study by Abdullah, Hassan, and Mohamad (2007) said like one of the implications of Islamic investment principles is the availability of Islamic financial instruments in the financial market. The main aim of this research is to observe the difference in terms of performance between Islamic and conventional mutual fund in the context of Malaysian capital market. Sharpe index, Jensen Alpha, Timing and selectivity ability, basic finding of the paper is that Islamic funds performed well than the conventional funds during bearish economic trends while, conventional funds showed better performance than Islamic funds during bullish economic conditions. Yu, Yang, Wong (2007), the Sharpe rule in portfolio measurement and management proposes that a portion of the portfolio value should be invested in some other assets for portfolio improvement. With the help of Sharpe rule they determined that the new stocks are worthy and adding to the old portfolio if they satisfy the condition, in which the average rate of return of these stocks is greater than the rate of return of the old portfolio multiplied by the sum of the elasticity of the Value at Risk and 1. The main focus of this paper is Diversification of assets.

Ebner and Neumann (2008), explained the correlation instabilities in US stock returns and derive Variance-Covariance Matrices from time varying factor model estimates and used three different estimation approaches to overcome the problem: (1) moving window least squares, (2) flexible least squares and (3) the random walk model. The results suggest that a time-varying estimation of return correlations fits the data considerably better than time invariant estimation and thus, increases the efficiency of risk estimation and portfolio selection.

Kim, Zhong, Chen and Karadag on (9th March 2009) evaluated the risk-adjusted performance of three restaurant segments between 1 January 1998 and 31 December 2004. The Jensen, the Treynor and the Sharpe indexes were adopted as an analytical framework. The findings are not entirely consistent with those of Kim and GU (2003) because they show that the quick-service segment outperforms the other two segments. However, using NASDAQ, NYSE and S&P 500 as benchmarks, this study illustrates that the performance of the economy/buffet segment tops the quick-service and full-service segment tops the quick-service and full-service segments. It further indicates that the restaurant industry carries too much unsystematic risk, which it needs to reduce.

Nateson and Rajesh (2010) constructed portfolio using Sharpe's Single Index Model. They choose eight stocks for constructing an optimal portfolio from Nifty 50 and six stocks have been selected from Nifty Junior. The respective portfolio beta's were calculated and capital allocation for each stock was also determined. Thus, the analysis of the portfolio provides the rationale for forming an optimal portfolio of the securities instead of buying only a single security.

P. Varadharajan (2011), constructed an optimal equity portfolio with the help of Sharpe Index model. The study was conducted with the financial data from April 2006 to March 2011. The sample size was limited to 19. He took these companies from Banking and Information Technology. The portfolio was constructed with the top 5 stocks that meet the criteria to be included in the portfolio according to Sharpe Index Model. The portfolio predominantly consisted of stocks from the banking sector, and one stock from IT sector.

Study by A. Saravanan and P. Natarajan (2012) attempted to construct an optimal portfolio by using Sharpe's Single Index Model. For this purpose, NSE Nifty Index has been considered. The daily data for all the stocks and index for the period of April 2006 to December 2011 have been considered. They formulated the cut-off point and selected stocks having excess of their expected return over risk free rate of return surpassing this cut-off point. Percentage of investment in each of selected stocks is then decided on the basis of respective weights assigned to each stock depending on respective beta value, stock movement variance unsystematic risk, return on stock and risk free return vis-à-vis the cut off rate of return. From the empirical analysis, it was concluded that returns on either individual securities or on portfolio comprises of securities of different companies listed in Nifty 50 stocks under various sectors are asymmetrical and heterogeneous. The optimal portfolio consists of four stocks selected out of 50 short listed scrips, giving the return of 0.116. Significance of beta is not consistent with all security return, leading to the conclusion that every security depends to some extent on the overall performance of the market. From this empirical analysis, to some extent one can able to forecast individual security's return through the market movement and can make use of it. In the second phase, it is found that Indian Security market in information context Sharpe's single index market model will hold good. Further it helps to elicit that return on securities of different portfolio is independent of the systematic risk prevailing in the market.

METHODOLOGY

This is a descriptive study on the construction of portfolio of stocks. The data taken for the study is Secondary in nature. The data has been collected from various websites like National Stock Exchange (NSE), Reserve Bank of India (RBI), etc, and also from the databases of Ebsco and Proquest. The study is conducted with the financial data for the past ten years from January 2005 to November 2015. The sample size of the study is limited to 14. They are a combination of stocks from five different sectors namely Automobiles, Cements, Paints, Textiles and Oil & Refineries sectors. The sampling technique adopted is Random Sampling.

TOOLS USED FOR DATA ANALYSIS

BETA COEFFICIENT

Beta coefficient is the relative measure of non-diversifiable risk. It is an index of the degree of movement of an asset's return in response to a change in the market's return.

β = Correlation *$\sigma(Y)$ / $\sigma(X)$

Where

$\sigma(Y)$ = Standard Deviation of Individual Stock

$\sigma(X)$ = Standard Deviation of Market

RETURN

The total gain or loss experienced on an investment over a given period of time, calculated by dividing the asset's cash distributions during the period, plus change in value, by its beginning-of-period investment is termed as return.

Return = ((Today's market price- yesterday's market price)/ yesterday's market price)*100

EFFICIENT PORTFOLIO

A portfolio that maximizes return for a given level of risk or minimizes risk for a given level of return is termed as an efficient portfolio.

CORRELATION

A statistical measure of the relationship between any two series of numbers representing data of any kind is known as correlation.

RISK-FREE RATE OF RETURN (R_f)

Risk-free rate of return is the required rate of return on a risk free asset, typically a three month treasury bill.

EXCESS RETURN TO BETA RATIO

Excess Return to Beta Ratio = R_i-R_f/β_i

Where

Ri =The expected return on each individual stock

Rf = The risk-free or risk less rate of return

βi = The expected change in the rate of return on stock associated with one unit change in the market return

CUT-OFF POINT

$Ci = \sigma_m^{2*}\Sigma(R_i-R_f)*\beta/\ \sigma_{ei}^2\ /1+\{\ \sigma_m^{2*}\Sigma\ \beta^2/\ \sigma_{ei}^2\}$

Where, σ_m^2 = Variance of the market index

σ_{ei}^2 = Unsystematic Risk (Variance of a stock's movement which not associated with movement of market index)

INVESTMENT IN EACH SECURITY (Xi)

Percentage of each stock/security (Xi) = Z/ΣZ

Where

Xi = Proportion of investment in each stock; and

$Z=\beta/\sigma_{ei}^{2*}\{R_i-R_f/\beta)-C^*\}$

Where

C* = Cut-off point

ANALYSIS & INTERPRETATION

The best model to measure the risk is standard deviation and beta and using this stock return is calculated.

TABLE 1: RETURN (Ri), BETA (β) & EXCESS RETURN TO BETA RATIO (R_i-R_f/β_i)

Company scrip	Ri	β	R_i-R_f/β_i
Bajaj-Auto	0.0313374514	0.5624624482	-0.30574735
Hero Moto corporation	0.1924017916	0.60207557	0.539813834
M & M	0.1839819231	0.9207134551	0.049271702
TATA Motors	0.0304379191	1.070432621	2.958741142
Ashok Leyland	-0.1557852639	0.9011129499	-0.053176807
ACC	0.1969478714	0.7740009985	0.05698692
Ambuja Cement	0.0053677966	0.5264740524	-15.99937986
Asian Paints	0.244144506	0.288587717	0.429298488
Aditya Birla Textiles	0.2045115609	0.7706022437	0.20492864
Grasim	0.2246471622	0.7192604006	0.159139898
ONGC	-0.032714511	0.862642672	-0.13778678
BPCL	0.0415567849	0.5934291584	-0.118832097
Reliance Refineries	0.0986829178	0.999196035	-0.253985881
Hindustan Petroleum	-0.0067850568	0.5689281447	-0.520135698

Asian paints yielded the maximum return among the companies selected and Ashok Leyland yielded lower return. Banking sector have shown a higher return in all the companies chosen for the analysis. It shows that textile sector is the ever growing sector and it is most preferred investable securities in India. Beta is greater than 1 in TATA Motors, which shows more risk and at the same time the reward per unit of risk also more. But in case of other companies with regards to beta it is less than 1 which shows it is less risky when compared to market risk.

Sharpe has provided a model for the selection of appropriate securities in a portfolio. The excess return of any stock is directly related to its excess return to beta ratio. It measures the additional return on a security (excess of the risk less asset return) per unit of systematic risk. The ratio provides a relationship between potential risk and reward. Ranking of the stocks are done on the basis of their excess return to beta. Based on the excess return to beta ratio the scrip's are ranked from 1 to 14, with TATA Motors being in the first rank and Ambuja Cement being in the last. The excess return to beta ratio was calculated using 6.5% as risk free rate of return.

CUT-OFF POINT

The selection of the stocks depends on a unique cut-off rate such that all stocks with higher ratios of excess return to beta are included and stocks with lower ratio are left out. The cumulated values of Ci start declining after a particular Ci and that point is taken as the cut-off point and that stock ratio is the Cut-off ratio C.

TABLE 2: CUT-OFF POINT CALCULATION FOR 14 COMPANIES

COMPANY	R_i-R_f/β_i	$\beta^2/(\delta ei)^2$	$\{R_i-R_f/(\delta ei)^2\}/\beta_i$	$\sum\{R_i-R_f/(\delta ei)^2\}/\beta_i$	$\sum\beta^2/(\delta ei)^2$	Ci
TATA MOTORS	2.95874	101.99606	301.77996	301.77996	101.99606	0.342
HERO HONDA	0.53981	181.51973	97.98686	399.76682	283.51579	0.376
ASIAN PAINTS	0.42929	65.866336	28.27631	428.04314	349.38213	0.379
ADITYA BIRLA	0.20492	-2831.00484	-580.15397	-152.11082	-2481.62270	0.089
GRASIM	0.15913	-895.57535	-142.52176	-294.63259	-3377.19805	0.113
ACC	0.05698	322.25088	18.36408	-276.26851	-3054.94716	0.121
M & M	0.04927	297.91891	14.67897	-261.58953	-2757.02825	0.132
ASHOK LEYLAND	-0.05317	-309.04983	16.43428	-245.15525	-3066.07808	0.107
BPCL	-0.11883	-1402.15661	166.62121	-78.53404	-4468.23469	0.021
ONGC	-0.13778	-221.08579	30.46269	-48.07134	-4689.32048	0.0123
RELIANCE REFINIERIES	-0.25398	-2520.38987	640.14344	592.07209	-7209.71036	-0.0921
BAJAJ AUTO	-0.305745	-512.54292	156.708640	748.78073	-7722.25328	-0.108
HINDUSTAN PETROLEUM	-0.520135	127.69109	-66.41669	682.36403	-7594.56219	-0.1
AMBUJA CEMENT	-15.99937	522.37909	-8357.74152	-7675.37748	-7072.18309	1.22

The highest value of C_i is taken as the cut-off point that is C^*. Here Asian Paints has the highest the cut-off rate of C^*= 0.379. All the stocks having C_i greater than C^* can be included in the portfolio.

CONSTRUCTION OF OPTIMAL PORTFOLIO

After determining the securities to be selected, one should find out how much should be invested in each security. The percentage of funds to be invested in each security can be estimated. As already known all the stocks with C_i greater than cut off point can be included in the portfolio. Here the top three companies according to excess return to beta ratio is taken for calculating the proportion of investment.

TABLE 3: SELECTION OF STOCKS AMONG 14 COMPANIES

STOCKS	Cut-off point
Tata Motors	0.342
Hero Moto Corporation	0.376
Asian Paints	0.379

PORTFOLIO INVESTMENT

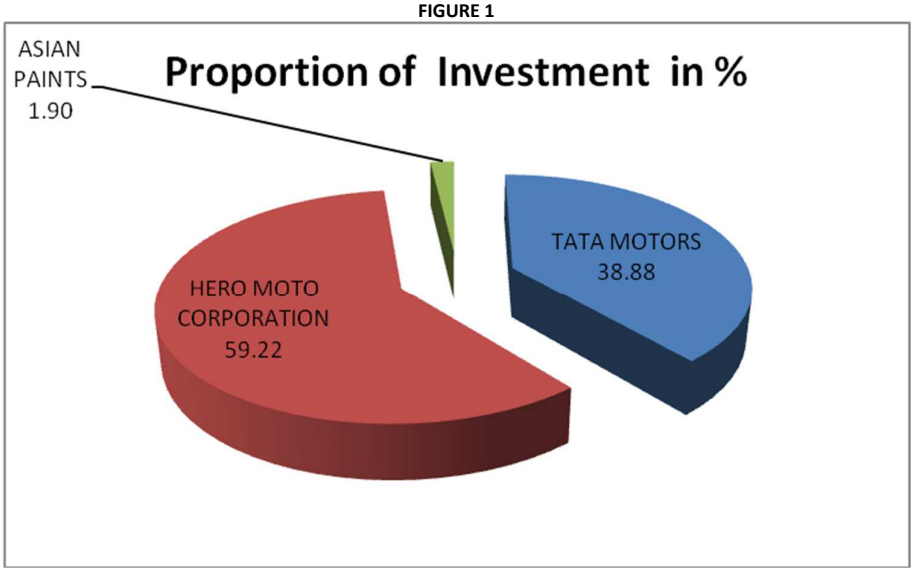
In the table, it shows the proportion of investment in each stock. And it indicates the weights on each security and they sum up to 100 percentage.

TABLE 4: PROPORTION OF INVESTMENT IN EACH STOCK

STOCKS	Proportion of Investment
TATA MOTORS	38.88%
HERO MOTO CORPORATION	59.22%
ASIAN PAINTS	1.90%

By using Sharpe index model, we are able to find out the proportion of investments to be made for an optimal portfolio. The maximum investment should be made in Hero Moto Corporation (previously Hero-Honda) with a proportion of 59.22%. Following that TATA Motors and Asian Paints are the next two companies where percentage of investment can be made. Among three securities selected for the investment two companies belongs to automobile sector and one company is from paints sector. Evidently, the companies chosen for the investments are growing at a steady rate in the recent years.

FIGURE 1



FINDINGS

The performance of Automobiles, Cements, Paints, Textiles and Oil & Refineries sectors, are calculated and in automobile sector more than 60%,all textiles companies & 50% cement companies are performing better than the market; individual return of each stocks is more than the market return in the entire portfolio; the performance of automobile sector is remarkable with higher return than the market in the last years compare to any other sectors; the stocks of higher risk yield higher return; TATA Motors has higher risk and yields higher return like the previous statement; the performance of other sector companies are not as good as to automobile sector companies; only one company that is, Asian paints is selected for the investment; with exception of the one stock (TATA Motors), all other stocks have beta less than one that is less than market beta. Even though the return of Asian paints is very high compare to other companies, the investment percentage is only 1.90 and got 3rd place in the portfolio.

CONCLUSION

Though there are 14 stocks that meet the criteria for being included in the Portfolio. The portfolio is constructed with the top 3 stocks that meet the criteria to be included in the portfolio according to the Sharpe Index Model. Those stocks are: TATA Motors, Hero Moto Corporation and Asian Paints. The portfolio predominantly consists of stocks from the automobile sector and one stock is from the paints sector. The share market is more challenging, fulfilling and rewarding to resourceful investors willing to learn the trade for having effective returns with minimum risk involved. The optimal portfolio analysis and risk- return trade off are determined by the challenging attitudes of investors towards a variety of fundamental, technical and psychological forces prevailing in the stocks market. Thus the portfolio construction table would help an investor in investment decisions. And the investors would select any company among the 14 companies from the above portfolio table and this paper will help the investors as a guiding record in future and help them to make appropriate investment decisions.

RECOMMENDATIONS

Hero Moto Corporation has high proportion of investment and it is the best option for investor to invest in this company giving a first priority. The proportion of about 59.22% and it has maximum return and minimum risk compare to the market and other companies in the portfolio and the lower proportion of investment is 1.90 % of Asian paints.

All companies have beta value less than one except for TATA Motors, which means risk, is comparatively low so diversification of portfolio helps the investor to eliminate the controllable risk associated with all these companies stocks.

LIMITATIONS

1. Portfolio is constructed based only on risk and return
2. Study is restricted to only 14 stocks from Automobiles, Cements, Paints, Textiles and Oil & Refineries sectors, which are constituents of market portfolio that is NSE NIFTY.
3. Stock prices considered are restricted to only the previous 10 years (2005-2015) closing prices.
4. All the calculations could not be brought into the report.

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