INTRODUCTION TO THE MARKOWITZ MODEL IN THE INDIAN STOCK MARKET

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ABSTRACT

The aim of this paper is to build a portfolio for large cap companies that are both effective and successful. This research allows for a better understanding of the results of some Nifty Fifty companies with a greater market capitalization. This paper's analysis is focused on risk and return, as well as the Markowitz modern portfolio model. This paper is a condensed version of Markowitz's contributions to Modern Portfolio Theory. The study concludes that applying these basic models, which were created many years ago, still provides better options for making decisions in the selection of optimal portfolios in the Indian stock market.

Keywords: Indian Stock Market, Markowitz Modern Portfolio Theory,

1. INTRODUCTION

The principle of maximising return and mitigating risk on an investment is still on the mind of a rational investor. Investing in several securities is a strategy for achieving this often-conflicting goal, suggesting that a model may be used to prove the old axiom – "don't put all your eggs in one basket." (1952, Markowitz). The portfolio model of Markowitz is concerned with risk averse investors selecting the best portfolio. To create a set of efficient portfolios for risk averse investors, according to Markowitz's model, the portfolio must maximise return at a given level of risk or reduce risk at a given level of return, (Fabozzi, Gupta, & Markowitz, 2002), which is characterised as a portfolio of securities with a trend of less-than-perfect positive correlations in their return patterns. (1973,Merton). In the literature, three themes of portfolio theory have been identified. The first is the fundamental concept that investors expect a reward for risky investments in order to escape risk. The second theme is focused on quantifying investors' personal trade-offs between the portfolio's expected return and risk.

Finally, the third fundamental concept is to distinguish an asset's risk from the risk of the portfolio of which it is a member, which cannot be assessed; that is, the proper way to calculate an individual asset's risk is to evaluate its effect on the volatility of the entire portfolio of assets, as well as to analyse the positive risk return relationship using regular data analysis. [French et al. (1987), Campbell (1987), Chou (1988), Chan et al. (1992), Chou et al. (1992), Glosten et al. (1993), Harvey (1989, 2001), Bollerslev and Zhou (2005), Ludvigson and Ng (2007)]. Though US equities account for roughly half of all global equities, Indian equities account for less than 1% of total global market capitalization. The Indian stock market is very competitive, and all types of investors can benefit from a detailed understanding of portfolio analysis, which can help them diversify their investment risk. The systematic review of available portfolios and, as a result, the selection of the best portfolio helps to diversify risk without losing return. It also makes it easier to mobilise capital in all sectors of the economy by enticing investors to invest in stocks of various industries, thus fostering the country's economic development. In this context, the current research was conducted with the aim of applying Markowitz's portfolio models to the Indian stock market and thus assisting in the selection of optimal investments. Clearly, this research has presented a range of options for choosing an appropriate portfolio based on the needs and desires of investors.

2. LITERATURE REVIEW

Markowitz's Modern Portfolio Theory [Markowitz, 1952] is widely credited with being a watershed moment in the field of advantage assignment and portfolio advancement. Markowitz's selection model is one of the basic theories that laid the groundwork for today's asset allocation theory. By focusing on minimising the variance of a portfolio with a fixed average return for the entire portfolio, the literature considers rational investors and models. Tobin James' work [Hester and James, 1967] integrates risk-free assets into the standard Markowitz detailing by strengthening the Separation hypothesis, which states that in the presence of a risk-free asset, the ideal risky portfolio can be formulated without taking into account the investor's preferences, Sharpe's Capital Asset Pricing Model (CAPM) [Sharpe, 1964] takes into account an asset's exposure to non-diversifiable risk when it is applied to an officially existing all-encompassing extended portfolio. It takes into account the portfolio's volatility, the covariance structure of the returns, and the market premium, which is measured as the difference between the expected return and the risk-free rate of return on the asset. Furthermore, Ross' Arbitrage Pricing Theory (APT) [Ross, 1976] models an asset's expected return as a linear function of various macroeconomic variables. Numerically/statistically, various schools of thinking had different perspectives on the topic of portfolio enhancement.

Massive advancements in writing [SCI, 2009], [Balbs, 2007], [Sereda et al., 2010], and [Ortobelli et al., 2005] have been made over the years in terms of investigating return and risk measures for evaluating the parameters of the portfolio enhancement problem. Michaud's resampled efficiency approach [Michaud and Michaud, 2008] emphasises consistent re-inspecting from exact data to represent the flaws in parameter evaluations.

The Random Matrix Theory, as cited in [Shari et al., 2004], [Daly et al., 2008], and [Conlon et al., 2007], is related to covariance structures of asset returns to provide stability to the problem and provides a new approach for risk assessment. The aim of this research is to investigate quadratic constraints in order to optimise a portfolio based on Markowitz's asset allocation theory.

3. RESEARCH METHODOLOGY

The current study looks at NSE Nifty stock results, focusing on 42 companies that have a higher trading volume and market capitalization. The Nifty of the National Stock Exchange (NSE) is used as a benchmark index. From April 2005 to March 2016, the study period was taken into account. The study data consisted of the closing prices of the related firms' stocks as well as indices. The stock price data collected on a regular basis is used to measure portfolio returns. Using the covariance function in Excel's data analysis section, a portfolio's covariance matrix is developed. The lingo software is used to measure the best portfolio weights.

To use the Markowitz portfolio optimization model, we must first reduce the portfolio's variance. After that, we must decide the best weights for the portfolio in order to obtain a return that is equal to or greater than the anticipated return. The variance is used as a risk factor in this situation. As a result, for n properties, the mathematical model is as follows: Reduce to a bare minimum-

$$\sum_{i=1}^{n}\sum_{j=1}^{n} w_i\, w_j Cov_{ij}$$

$$\sum_{i=1}^{n} R_i W_i \geq \rho$$

$$\sum_{i=1}^{n} W_i = 1$$

$$0 \leq W_i \leq 1$$

$i = 1 \ldots\ldots\ldots\ldots\ldots\ldots n$

Where,

Wi = the percent of the portfolio in asset i

E(Ri) = the expected rate of return for asset i

σ_p= the standard deviation of the portfolio

σ = the variance of rates of return for assets i

Cov $_{ij}$ = the covariance between the rates of return for assets i and j

ρ= a parameter representing the minimal rate of return required by an investor

4. RESULTS OF EMPIRICAL RESEARCH

A) For the 42 stocks listed, the individual mean return is first calculated on a regular basis, and then the annual mean return is calculated. The standard deviation and variance are determined in the same way, and the results are shown in Table 1.

Table 1: Return, Variance and Standard Deviation of Individual Stock

COMPANY NAME	MEAN	MEAN (ANNUAL)	VAR	S.D .
ACC	0.000488717	0.178381804	0.1593213	7.62576362
AMBUJA CEM	0.000526593	0.192206456	0.1854102	8.2264638
ASIAN PAINTS	0.001133391	0.413687586	0.1162177	6.51302245
AUROPHARMA	0.001190513	0.434537269	0.2887281	10.2657569
AXIS BANK	0.000817839	0.298511109	0.2773047	10.0606264
BANK OF BARODA	0.00043878	0.160154649	0.2524898	9.59993547
BHARTI AIRTEL	0.000430585	0.157163357	0.1928047	8.38890417
BOSCH	0.000841759	0.307241871	0.11393	6.4485998
BPCL	0.000583173	0.212858156	0.2082804	8.71907919
CIPLA	0.000585164	0.213584711	0.1304981	6.90157868
DR REDDYSLAB	0.000769162	0.280743963	0.1327536	6.96096786
EICHER MOTORS	0.001501629	0.548094432	0.2626837	9.79180964
GAIL INDIA	0.000326728	0.11925576	0.1753323	7.99976855
GRASIM INDIA	0.000417535	0.152400349	0.1526261	7.4638147
HCL TECH	0.000783473	0.285967674	0.2348195	9.25792224
HDFC BANK	0.000832672	0.303925143	0.1482514	7.35607067
HDFC	0.000748349	0.273147521	0.2034657	8.61771327
HEROMOTOCOR P	0.000618401	0.225716243	0.1455854	7.28962839
HINDALCO	-0.0000999	-0.03646815	0.3151318	10.7248818
HINDUNILVR	0.000689964	0.251836952	0.1267311	6.80124014
ICICIBANK	0.000391774	0.142997623	0.2679605	9.88967132

INDUSINDBANK	0.001067053	0.38947421	0.3458732	11.2358233
INFY	0.000539297	0.196843429	0.147951	7.34861254
IOC LTD	0.0002055	0.075007383	0.1871311	8.26455418
ITC	0.000727148	0.265409151	0.1261312	6.78512366
LT LTD	0.000720528	0.262992642	0.207029	8.69284728
LUPIN LTD	0.001195018	0.436181484	0.1527014	7.46565453
MAHINDRA & MAHINDRA	0.000827541	0.302052354	0.2089499	8.73308093
MARUTI SUZUKI	0.000789574	0.288194441	0.1679532	7.82961802
NTPC	0.000141344	0.051590402	0.145096	7.27736616
ONGC LTD	0.000138157	0.050427189	0.1743458	7.9772313
RELIANCE IND	0.000555318	0.202690909	0.1743025	7.97623952
SBIN	0.000411181	0.150081219	0.2039334	8.6276126
SUN PHARMA	0.00105107	0.383640672	0.1477408	7.34339011
TATAMOTORS	0.000563527	0.205687459	0.2780952	10.0749562
TATAPOWER	0.0002253	0.082234585	0.2182914	8.92616184
TATASTEEL	-0.00004527	-0.016525	0.3097854	10.6335161
TCS	0.000710054	0.25916964	0.1593342	7.62607234
ULTRATECH CEMENT	0.000809985	0.295644638	0.1734386	7.95644919
WIPRO	0.000376637	0.137472679	0.1713487	7.90836767
YES BANK LTD	0.000998636	0.364502277	0.340668	11.1509567
ZEEL	0.000631943	0.230659141	0.2679502	9.88948051

B. The variance-covariance matrix is computed in step B. However, due to a lack of space, the results are not released.

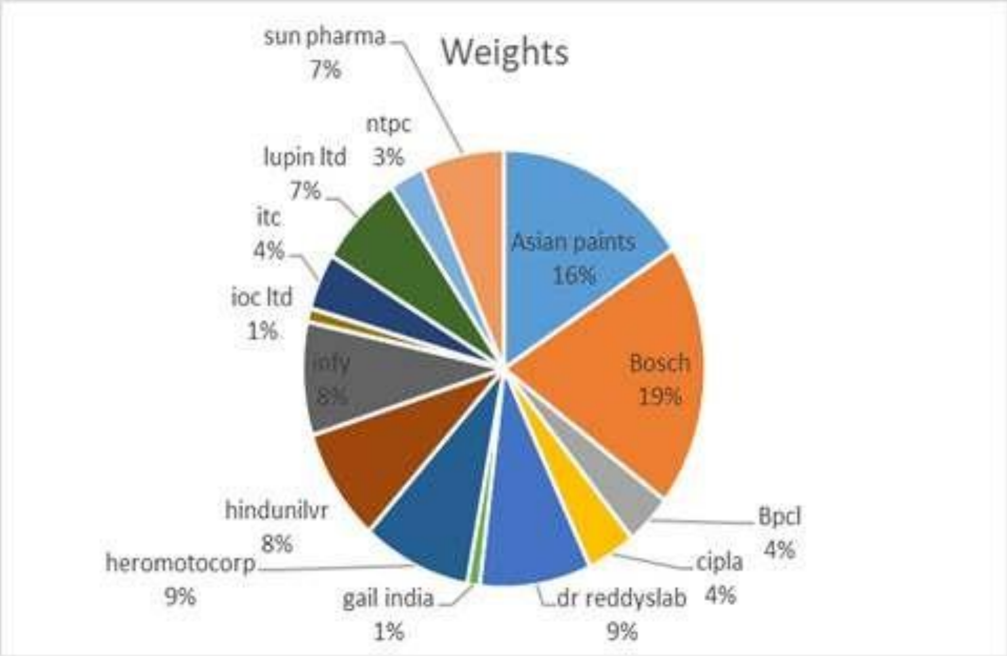
C) We solve the quadratic equation by minimising the variance using the lingo command while keeping the Markowitz constraint in mind, as shown in Table 2. The results show that fourteen stocks were chosen from a pool of forty-two, and the remaining twenty-eight stocks were not chosen because their weights were zero.

Table 2: Optimal portfolio weights and estimated returns

Company Name	Weight	Expected Return
Asian paint	15.81%	41.37 %
Bosch	19.47%	30.72 %
Bpcl	3.79%	21.29 %
Cipla	3.91%	21.36 %
Dr reddysla	8.96%	28.07 %
Gail india	1 %	11.93 %
Heromotoco	8.75%	22.57 %
Hindunilvr	8.39%	25.18 %
InFY	8.38%	19.68 %
IoCLTD	1 %	7.50 %
ItC	4.18%	26.54 %
Lupin ltd	6.89%	43.62 %
Ntpc	2.84%	5.16 %
Sun pharma	6.63%	38.36 %

The following pie chart depicts the portfolio's optimum weights (Figure 1)

Figure 1: Optimal portfolio representation weights



On the basis of the optimal weights of the portfolio the portfolio return and portfolio risk have been estimated as follows:

Return of the portfolio E(Rp) = 29.41 percent Variance of the portfolio (σ 2 = 3.65 percent

The return of the benchmark portfolio nifty fifty is estimated as 17.65 percent and the variance is computed as 5.58 percent.

5. CONCLUSION

The portfolio is built with the top 14 stocks that meet the criteria to be included in the portfolio according to the Markowitz Portfolio Model, despite the fact that there are 42 stocks that meet the criteria to be included in the portfolio. Asian Paints, Bosch, BPCL, Cipla, Dr Reddys Lab, GAIL India, Hero Moto Corp, Hindustan Liver, Infosys, IOC Ltd, ITC, Lupin Ltd, NTPC, and Sun Pharma are among the stocks listed. The portfolio is mostly made up of stocks from the pharmaceutical and energy industries. The return on the portfolio of 14 stocks is 29.41 percent, which is significantly higher than the return on the benchmark portfolio of the Nifty Fifty, which is 17.65 percent. In contrast to the benchmark portfolio Nifty fifty, which has a risk of 5.58 percent, 14 stock has a risk of just 3.65 percent. The Markowitz quadratic programming model was used with real data from a developing business sector, and the results showed that Markowitz portfolios consistently outperformed the Nifty benchmark portfolio. The analysis is done on the Nifty as one of the major market indices, and the results show where investors can make the most money and where they should invest. As a result, building an ideal portfolio will assist an investor in making sound investment decisions.

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