OPTIMUM PORTFOLIO CONSTRUCTION USING SHARPE INDEX MODEL WITH REFERENCE TO PHARMACEUTICAL COMPANIES

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Abstract

The youth of India have started to find a source of Passive Income. Investing in the stock market has been one of those sources that has been taken seriously. Many of these investors invest individually and have little to no knowledge in this field. Portfolio investment may be an interesting solution for these individuals in order to reduce the risk and increase their returns earning capacity. The most common method to construct this portfolio is to use the Sharpe Model. With the recent fluctuations in the market, portfolio investment can be the best possible solution to minimize risk. This portfolio investment is made using historical data and calculations rather than skill, which can be used by those investors who are new to the field of investment. In this research, a study has been made with the 7 stocks of Pharmaceutical companies for a time period of 6 years.

Introduction

The interest in investing has been increased in the recent times. This interest can see to be increasing during the pandemic. The investors during this time would invest in those companies making profits. One such sector that had regular revenues and profits during the pandemic was Pharmaceutical industries. This has been in the growing phase ever since. This can be due to the fact that India has been exporting low-cost vaccines and drugs. It accounts to around 60% of the global demand and

also is a source to WHO for vaccines for around 70%. The industry has been currently valued at $50 billion and would reach $130 billion by 2030. It contributed to the total FDI inflow of 3.3% in the current financial year.

Investors normally choose to increase their returns while reducing the risk factor. Inexperienced investors would choose to make profits and that would motivate them. There is a need for diversifying the investment made in the stocks. This would result in increasing the returns of the total investment while reducing the risk. This research uses the idea of reducing the risk to construct an optimum portfolio in the Pharmaceutical sector. In this research, an attempt has been made to construct a portfolio of top 7 Indian Multinational Pharmaceutical Companies.

Literature Review

The importance of selecting an optimal portfolio is explained in (Sathyapriya, August, 2016), where the author says that the a through comparison between the assets that can be invested is to be made as the investor

doesn't suffer loss. The research paper deals with 20 different companies that are selected from the infrastructure and pharmaceutical structure. We can also find the ranks in which these companies are prioritized during investing, with Dr. Reddy being the highest at 56%.

The implications of the Stock market in the current economy of India is stated in the research paper (Agarwal, June 2014). The authors use the Sharpe Index Model and Regression analysis to develop an optimal portfolio. They use the stocks of pharmaceutical companies since they feel that the study on this sector would give us a summary of the health of the economy. The authors finally suggest the stocks that could be bought by different types of investors.

(Wallmeier, March 2008) speaks about how volatility plays an important role in the decision making of the portfolio investment. The author speaks about how the investors choose the portfolio that has higher Sharpe Ratio. The authors also speak about the diversification of the portfolios and how they impact the Sharpe Ratio.

With the uncertainty of the time of investment, the risk and returns of the portfolio varies. This is calculated using one-dimensional Brownian motion and Martingale approach in (Wallmeier, March 2008). The authors speak about how the decisions are affected based on different time horizons and there is an implication of independent time-horizon which is against the available literatures.

The application of technology in the field of finance can be studied in (Gupta, February 2022). The authors speak about how the Markowitz's portfolio theory can be used in fining the optimum portfolio. The authors use python programming to find the portfolios in different sectors and they also speak about the portfolio selection where the Sharpe Index should be high and the standard deviation and variance be low.

(Dowd, July 2000) speaks about the Sharpe ratio and its implications. The author says how the risk adjustments can be made and how this gives accurate assessment under normal circumstances. This ratio also speaks about the choice to be made and how the adjusted risk and returns can be used during portfolio investments.

Objective And Rationale

The objectives are:

- Studying the value of selected stocks that are listed under NSE from the Pharmaceutical Sector.
- To construct the Sharpe Index model for the selected Stocks.
- To find the investments to be made in each stock of the optimal portfolio.

The Indian population has shown interest in the investment of stocks during recent times. The number of investors has been increasing, and they may not have the right direction for this investment. Since the number of investors has increased in the COVID pandemic, an effort has been made to choose the sector that would essentially have done well in the pandemic. The optimal portfolio investment can be helpful for those investors who don't have enough knowledge of each stock and wish to reduce the risk during the investment.

Research Methodology

This research is conducted to calculate the optimal portfolio that can be constructed based on the adjusted closing price of the top 7 Indian pharmaceutical companies. This can be used by the investors during the portfolio investment. This can also show the market growth of each company, as the brand name, revenue, and market growth can usually be estimated by the demand of the shares and the returns that the companies provide on these shares.

The stocks chosen for this portfolio construction are CIPLA.NS, DRREDDY.NS, LUPIN.NS, SUNPHARMA.NS, AUROPHARMA.NS, ZYDUSLIFE.NS and GLENMARK.NS. These stocks are listed in NSE. The market that is been taken as the base for calculation is NSE. The selected data of the companies have been collected for a period of 6 years, from 01-05-2016 to 01-08-2023. This data has been collected on monthly basis. The data has been selected from the selected 7 companies.

The data collected is the secondary data. It is collected from Yahoo Finance (Yahoo Finance , n.d.). The rate of return for the risk-free security is taken as 7.214% as it is the rate od 10-year government bond issued in India (World Government Bonds, n.d.).

Hypothesis: It is better to invest in a group of stocks that can yield higher returns with lesser risk that invest in individual stocks.

Empirical Model: Sharpe Index Model

Sharpe Index Model is given by William F. Sharpe, as a continuation of Capital Asset Pricing Model. This model is used to compare the risk of a certain portfolio and return on investment over time, using historical data. This model uses the rate of return that is available for the risk-free asset in the market to calculate the optimum risk an investor can take-up while earning higher returns. It uses the market risk and returns as a base for calculations. This model depends on the risk and volatility factors that can affect the ROI over time. The investment is to

be made where the portfolio has higher Sharpe Ratio.

Data Presentation
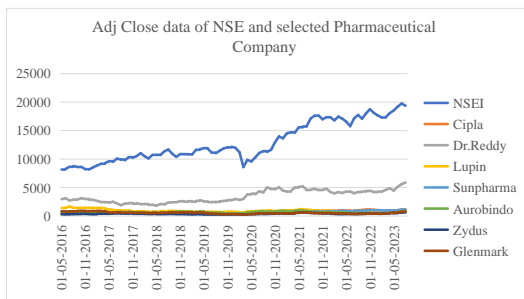
The above graph shows the adjusted closing price of each stock on monthly basis. The sources of these data are yahoo finance.

NSEI: (Nifty 50, n.d.)

Cipla: (Cipla.NS, n.d.)

Dr. Reddy: (DrReddy.NS, n.d.)

Lupin: (Lupin.NS, n.d.)

Sunpharma: (Sunpharma.NS, n.d.)

Aurobindo: (Auropharma.NS, n.d.)

Zydus: (Zyduslife.NS, n.d.)

Glenmark: (Glenmark.NS, n.d.)

This data is collected on the monthly frequency for a period of 6 years. The average annual returns of these data of the past 6 years can be seen to be

13.44%, 17.30%, 13.12%, 1.35%, 10.55%, 8.51%, 14.71%, 6.52% and 10.69% respectively (in the order mentioned above).

Data Analysis

Sharpe Index Model has been used to construct the optimum portfolio. The returns of the collected monthly stock price has been calculated using the following formula.

$$\text{Returns} = \frac{2nd\ Month\ price - 1st\ Month\ price}{1st\ Month\ price}$$

The returns of a particular stock should be higher than the market return for it to be considered invest-able individually. The average annual returns of the monthly returns is calculated using the average of the monthly returns and multiplying it with 12.

The standard deviation of each return is calculated using the NSE average annual return as base. This standard deviation can be used referred to as the risk factor. The risk rate of a particular stock should be lower than the market risk. The beta factor can also be used to calculate the risk factor. This is also calculated with the market returns using as the base. The

beta factor can be calculated using the statistical formula SLOPE.

The return value of the complete portfolio has been calculated by taking the average of the returns of the stock which ensures that each stock has been given equal weight-age

	Returns	Risk(SD)	Beta
R_NSEI	13.44%	0.048569975	1
R_Cipla	17.30%	0.076113601	0.449396438
R_Dr.Reddy	13.12%	0.078292915	0.174078033
R_Lupin	1.35%	0.091624048	0.697028661
R_Sunpharma	10.55%	0.083507889	0.707313464
R_Aurobindo	8.51%	0.107539382	0.820844023
R_Zydus	14.71%	0.08465161	0.529666192
R_Glenmark	6.52%	0.11532549	1.108301352
R_Portfolio	14.85%	0.064381675	0.68582852

Only Cipla and Zydus stocks can be invested individually has they have higher returns compared to the market. All the stock has higher risk than the market. The investor can make portfolio in this situation to increase the returns and reduce risk.

The Sharpe ratio is constructed using the return of the selected portfolio, rate of return of risk-free asset and standard deviation of the selected portfolio. The risk-free rate of return is taken as 7.214% following the interest rate of 10-Year Government Bond.

Sharpe Ratio =

$$\frac{Return\ of\ Portfolio - Risk\ Free\ Rate\ of\ Return}{Standard\ deviation\ of\ Portfolio}$$

The Sharpe Index should be comparably higher to construct the optimal portfolio. This index should be maximised with changing the weightage of each stock to obtain the ideal ratio which an investor can use to invest in the portfolio.

Results And Interpretation

After the optimization of the Sharpe Index, the weightage and the index can be found to be the following.

	Returns	Risk(SD)	Beta	Weights
R_NSEI	13.44%	0.048569975	1	
R_Cipla	17.30%	0.076113601	0.449396438	70.00%
R_Dr.Reddy	13.12%	0.078292915	0.174078033	5.00%
R_Lupin	1.35%	0.091624048	0.697028661	5.00%
R_Sunpharma	10.55%	0.083507889	0.707313464	5.00%
R_Aurobindo	8.51%	0.107539382	0.820844023	5.00%
R_Zydus	14.71%	0.08465161	0.529666192	5.00%
R_Glenmark	6.52%	0.11532549	1.108301352	5.00%
R_Portfolio	14.85%	0.064381675	0.68582852	100.00%
R_f	7.21%			
Sharpe Ratio	1.185818554			

The highest Sharpe Ratio is calculated to be 1.1858 during the optimization process keeping the minimum weightage of each stock to be at least 5%. We can see that Cipla has been allotted with 70%, which states that it is highly investable in the portfolio. This stock would earn higher returns with lesser risk.

Weights for Optimal Portfolio
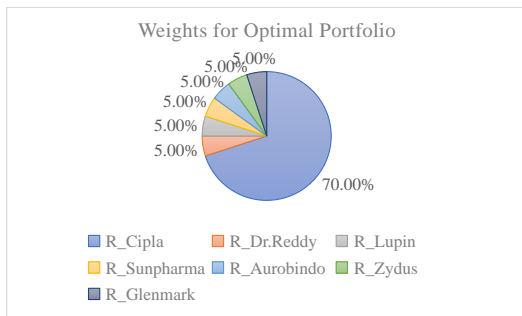
Findings And Discussion

With the above optimal portfolio, we can see that Cipla would be having higher weightage in the portfolio. It indicates that there is a consistent growth of this stock. We can also know about how the company is performing in recent times and their dividend distribution. With the constructed Sharpe Model, we can use this portfolio while buying the stocks in pharmaceutical sector. While we can see that there is only 1.4% increase in risk compared to the total market risk, we can choose to invest in the portfolio rather than individual stocks to reduce the probability of loss.

The choice of this portfolio is right as this has been one of those sectors that has seen growth even during the times when there was no growth in the economy. The Sharpe ratio of 1.18 shows that the portfolio model selected is good to be invested in. The investor should be aware that this ratio uses risk-free asset for comparison and not a risky asset. There would be major variations when there is a risky asset for comparison. This model compares the portfolio to a single market index, which would reduce the accuracy of this model.

Conclusion

From the above process of construction, we can see that the weights of the stocks that are to be invested varies based on the total return receivable from the portfolio and the risk that the total portfolio has to face. Any investor can use this portfolio to invest in the Pharmaceutical company. There are many other limitations that can be seen in this research as it has only considered top 7 companies and their stocks. There can be other companies that can have higher returns with lower risk. An advanced model can be used to construct a similar portfolio that can give better results. The uncertainties that can be posed in the future is not considered as this model is completely

based on the historical data and their calculations.

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