



Portfolio Construction Using Sharpe Index Model

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Abstract

Since 2018 small cap securities in the Indian Stock Exchanges are giving sluggish return and it is expected that small cap market will grow in the year 2023 and thereafter, therefore, present paper has been undertaken to analyse the securities which are constituents of NIFTY Small Cap 250 listed in the National Stock Exchange using William Sharpe Single Index Model and further to suggest an optimal portfolio that can beat the return given by model index during the study period. To undertake this study monthly closing prices of the securities for the last 5 years have been taken into account and the average return has been compared with that of return given by the NIFTY Small Cap 250 index.

Key Words: Sharpe Index, Stock Market, National Stock Exchange, Portfolio, NIFTY Small Cap, Economy, Emerging Market, liquidity, bullish, bearish, industry.

Overview of Indian Economy

World Bank reported that due to the outbreak of COVID-19, 10 million people had infected and 2 million lost their life, as a consequence of which, global stock market showed a robust decline of 30 percent the other sector which affected the most is real estate. Increasing COVID-19 cases created liquidity crunch in the emerging markets, therefore, the period between March 2020 and April 2021 saw a flush of liquidity, as most of the Central Bank across the world lowered the interest rate to record the low and introduced various other measures to help economies to wriggle out of the pandemic. But now the pandemic is over and Indian stock market is going bullish, but the trend showing that market is gaining in terms of volume but losing in terms of average returns, this implies that risk perception of the investors had decreased, which encouraged them to enter the market at low prices, thus improving market volume, but due to the continuing recession return in the financial sector have been declined dramatically. There are reasons behind this anomaly, namely investors who wish to enter in the market when stock prices were low in order to earn profits in the near future, when the economic crisis faced by India ends; another reason may be the investor confidence could be the diversion of funds from debt based instruments to equity market in response to RBI's measures to boost demand. Therefore, Indian economy showed GDP annual growth rate at an average rate of 5.87 percent from 1951 to until 2022 reaching all time high of 20.10% in the second quarter of 2021 and a record low of -23.8 percent in the second quarter of 2020. In the year 2022, it has been identified that India is a world's fastest growing economy having 5.5 percent average growth over the past decade. This has been witnessed by the data revealed by Ministry of Statistics and Programme Implementation that Indian economy expanded 13.5 percent year on year basis in the second quarter of 2022, the most in a year but less than market forecasts of 15.2 percent. The sectors which have contributed 13.7 percent of average increase in the second quarter of 2022 over 6.13 percent during the similar quarter of 2021 are agriculture, forestry, fishing, electricity, gas, water supply, utility services, financial, real estate, professional services, public administration, defence and other services sector. On the other hand a slowdown was also observed in mining, manufacturing, trade, transport, communication and hotel industries etc. Meanwhile, gross fixed capital formation slowed 20.1percent to 62.5 percent and net foreign demand contributed negatively to growth, as exports rose 14.7 percent while imports advanced at a faster rate of 37.2 percent. In the past decade India had already remained as the fastest growing economy is the world with the 5.5 percent average gross domestic product, the mega trends that had emerged as the reason were global offshoring, digitalization and energy transition. Global Offshoring has created a workforce for rest of the world and this has facilitated the tighter global labour market, emergence of distributed work model and bringing to the new idea of back office. Therefore, companies around the world have been started outsourcing of services for software development, customer service and business process outsourcing from India. Secondly, low cost and safest digitalisation are the other variables for the rest of the world to move to India and thirdly, overall consumption could be more than double as income distribution in the country shifts. Ridham Desai of Morgan Stanley's Chief Strategist for India says, "We believe India is set to surpass Japan and Germany to become the world's third largest economy by 2027 and will have the third largest stock market by the end of this decade." Consequently, India is gaining power in the world order and it is estimated that idiosyncratic changes imply a once in a generation shift and an opportunity for investor and companies. It is estimated that India's GDP will be double from present 286.5 lakh crore to 573 lakh crore rupee by 2031, while Bombay Stock Exchange could deliver 11% annual growth and reach at 818.16 lakh crore in the coming decade. It will not be denied that while the world that is currently starved of growth, the opportunity

set in India and is on the global investor radar, because India will be the only third country after Russia and China to generate more than 3.27 lakh crore annual economic output growth from 2023 onwards, and this will give rise to 4.08 lakh crore after 2028.

Stock Market

In spite of International disturbances like outbreak of dengue, covid-19, Russia-Ukraine war, terrorism threats and other natural calamities, Indian stock market has witnessed a robust return in the year 2022, the reasons behind this are increased demand for Asian equities, liquidity condition and macro environment factors, these factors have accelerated the growth of Asian Market and as a result Indian Sensex rose from 26000 points of March, 2020 to 61638 point on 18th August, 2022, outperforming all the major indices as compared to the declining European markets. One of the major reasons behind this is the cross border flow of capital largely through Foreign Institutional Investors in the developing economies. Secondly, the Government of India keeping in view to improve the efficiency, enhance transparency, check unfair trade practices, protect the interests of investors and bringing the Indian Capital Market up to a certain international standard framed Securities and Exchange Board of India as the apex regulator in India. This has led the economists to predict that the largest economies in 2050 would be China, India, Russia and Japan. Presently market capitalisation of BSE is measured as world's 11th largest stock exchange with 276.713 lakh crore rupee as on January, 2022 with 5293 listed companies and NSE has a total market capitalisation of 3.4 trillion US dollar making it with the 9th world's largest stock exchange.

Present Scenario of the small cap equities in the Indian Stock Market

Government of India has accelerated structural reforms like licencing requirement, reduction in tariff, easing of import licencing, relaxation of control on foreign direct and portfolio investment, reduction of red tapism in the approval process for foreign direct investment, liberalisation of interest rate etc after the balance of payment crisis in 1991, further to boost the domestic manufacturing with an aim to bring import substitution and increased global market share, amendment in insolvency and bankruptcy code 2016 has been considered one of the biggest reform in India that enable resolution in a time bound manner; Taxation reforms like reduction in the corporate tax from 25 percent to 15 percent for new manufacturing firms in line with Asian countries under the make in India policy; and thereafter, continuously making efforts for development friendly environment in India. It has also been observed that small caps have been observed as sharply underperformed since 2018; therefore, small cap shares have become a right case of adding in a staggered manner to the portfolio.

Portfolio

The word 'Portfolio' comes from the Latin folium, which mean "carry leaves", this terminology was used when stock and bond certificates were issued in paper form. It can also be described as pie that's been divided into pieces of varying wedge-shaped sizes, each piece representing a different asset class and type of investment. Portfolio here means financial portfolio, which is a collection of investments like stocks, bonds, commodities, real estates, gold, paintings, art collectibles, cash and cash equivalents, including closed end funds and exchange traded funds. The objective of portfolio construction is to support the theory that investor is risk averse and therefore, want to construct well diversified portfolio to achieve a risk return allocation which is appropriate for their level of risk tolerance. Portfolio construction is a combination of investing in a wide range of investments held at a point of time that work together to create an investment solution for addressing personal investment objective and other components such as risk, return and expected life of investment of the investor. In a diversified portfolio some securities may not perform as expected, but other may exceed the expectation and making the actual return of the portfolio close of the anticipated return. For the purpose of this paper portfolio means investment in securities, which are constituent of NIFTY Small Cap 250.

Review of Literature

A study conducted by Andrew C Worthington and Helen Higgs in (2004) on "Art as an Investment: Risk, Return and Portfolio Diversification in Major Painting Markets" during 1976-2001 on portfolio diversification among major painting and financial markets found that returns on paintings are much lower and the risk much higher than conventional investment markets.

There are contributor of literature in European Market and a very few in Indian context. In the European Countries Stephen A Ross (1976), Chamberlain and Rothschild (1983), Cho (1984), Roll and Ross (1986), Cho and Taylor (1987), Morelli (1999), Reisman (2002), Aquunio (2005) have studied on Arbitrage Pricing Theory. Whereas in the Indian context studies have been conducted on Comparison of Capital Assets Pricing Model and Arbitrage Pricing Theory, which reveal that return generating process of the Indian Capital Market is characterized by a multi factor structure and the risk return relationship is consistent with the APT hypothesis, the contributors of this view are Sood (1995), Gian Chandani (1997), Rajeswari (2000), Dhankar (2005), Singh (2008),

A study on "Portfolio Construction and the Performance of Individual Investors" by Zoran Ivkovic, Clemens Sialm and Scott Weisbenner (2008) tested why some individual investors concentrate their stock portfolio in a few stocks and consequently it was concluded that individual investors make poor investment decision, however, this study also reveals that some households with portfolios large enough to diversify among many stocks.

Further a research study on "Risk, Return and Portfolio Theory conducted by SamithambySenthilnathan (2013) concluded that illustrations of tables and figures can significantly contribute to the understanding of a reader in relation to portfolio management of risk and return.

Significance of the Study

Small caps shares are those which are neither large cap nor mid-cap. Presently small-cap is having a market capitalisation of rupee 5000 crore approximately. It has been observed from the available data in the stock market that a retail investor always lost in periodic bearish trends. This has hesitate the retail investors to enter in the stock market and since the household sector's share is much larger in the country's savings, therefore, it becomes the duty of the government, researchers and financial consultants to guide deployment of their savings in the right direction so that they may be able to earn better returns on their investment. Thus with a plethora of small cap shares available in the capital market and their potential for growth in terms of share price, there is a need for the

present study to find out a better portfolio, which is able to earn better return with a certain level of risk, further it could guide the retail as well as small investor and fund managers to make appropriate decision while construction of their own portfolio in small cap shares.

Problem Statement:

The theory of modern portfolio suggests not to putting all the eggs in a single basket, it suggests, investment in multiple assets. Therefore, Construction of Portfolio is a very important variable in determining success of investment but the retail investors have no simple or clear way to construct it. So the present paper will help household investors in constructing portfolio containing stocks of Small Cap to earn adequate profit on their small investment. Therefore, the statement of question in the present paper is as follows:-

Whether an equity portfolio can be constructed which can produce more return that produced by NIFTY-Small Cap-250 of NSE index?

Objectives of the Study

- i. To analyse the performance of selected small cap shares and to assess their potential to be included in the portfolio.
- ii. To study the risk and return associated with the portfolio so constructed with small cap shares.
- iii. To make a comparison of return produced by between the NIFTY small cap 250index and the selected shares.

Research Methodology

The present study is based on the monthly movement of share prices of small cap equity shares in National Stock Exchange from January, 2018 to December, 2022 i.e. during study period of 5 years. For this purpose monthly closing price and consequent return therefrom of selected companies equity shares have been taken into consideration. The major objective of the study is to construct optimal portfolio using Sharpe's Single Index Model, Universe of the study is the Nifty Small Cap 250 Index companies and for the purpose of this study 40 small cap companies listed in the National Stock Exchange and representative of the NIFTY Small Cap 250 Index have been selected, keeping in view their share in terms of market capitalisation with the ratio of total capitalisation of NIFTY Small Cap 250 index and in such a way that to cover from major sector of the economy such as Construction and Construction Material, Financial Services, Transport, Healthcare, Chemicals, Pharma, Consumer Durables, Digital Services and Information Technology, Media and Communication, Fast Moving Consumer Goods, Automobile and Auto Components, Transport and other diversified sectors of the economy. Statistical tools like Mean, Standard Deviation, Covariance, Variance, Alpha, Beta, coefficient of correlation have been used to drive desired data from the raw data available at the sources of data collection. Further to make a comparison between the expected return of the security, Risk free rate of return has been taken as 4.75% offered on State Bank of India on fixed deposit of 90 days as against Standard Deviation Square of Return on the market portfolio is of 20.63% of NIFTY Small Cap 250 during the study period. Further Microsoft Excel software has been used to calculate components of Sharpe's Index Model and to analyse the data.

William Sharpe's Single Index Model

This model is based on the assumption that stocks vary together because of common movement in stock market, because stock prices move with the movement of market index, this implies that when Sensex increases, stock prices tend to increase and vice-versa. Sharpe's Index is based on 3N+2 concept, means to construct a portfolio of 40 securities 132 securities need to be analyse. Since the Sharpe's index is the study of relationship of market index and the stock price, the following equation is used for the purpose:

$$R_i = \alpha + \beta I + e_i$$

α = Intercept of the straight line or alpha coefficient.

β = Slope of the straight line or beta coefficient

I = Level of market

E_i = Error

According to this equation return of the stock can be divided into two components, the return due to the market, and the return independent of the market. Relationship of individual security with the index is represented with the help of β and depending upon the beta value of the securities, these can be classified into three types:

Defence Stocks $\beta < 1$

Neutral Stock $\beta = 1$

Aggressive Stock $\beta > 1$

Calculation of Sharpe's Ratio = $R_p - R_f / \sigma_p$ ----- (i) Equation

Whereas R_p = Return of Portfolio

R_f = Risk Free Rate

σ_p = Standard Deviation of Portfolio

Expected Return of the Portfolio

$R_a = R_{rf} + \beta (R_m - R_{rf})$ ----- (ii) Equation

Whereas R_a is the expected return of the Security, R_{rf} is the Risk free Rate, β is the beta of security, R_m is the expected return of the market and $R_m - R_{rf}$ is equity market premium.

Construction of Return and Risk Portfolio under Sharpe’s Mode

$\bar{R}_i - R_{rf}$ = Mean Excess Return of the Security e_i

R_{rf} = Risk Free Return

α = Intercept of straight line or Alpha coefficient in such amount of excess return when excess return on the market is zero.

\bar{R}_m = Expected mean return on market

e_i = Random error or error with mean of zero and standard deviation, which are constant. The mean value of e_i is zero and hence the equation becomes as under:-

$$\bar{R}_i - R_{rf} = \alpha_i + \beta_i (\bar{R}_m - R_{rf}) \text{-----(iii) Equation}$$

In the above equation the alpha value is the value of excess return in the equation when the value of excess return on market portfolio is zero, this is non-market or unsystematic component of security return. On the other hand beta coefficient is the slope of the regression line and as such it is a measure of the sensitivity of the stock’s excess return to the movement in the market’s excess return. The collective term $\beta_i \times ((\bar{R}_m - R_{rf}))$ is the representative of the excess return due to the market movement. This implies that systematic component of the security’s excess return.

To calculate the Returns of Portfolio weighted average of the estimated return each security in the portfolio is required and the weight will be the representative of the proportion of the portfolio. The following equation will be used:

$$\bar{R}_p - R_{rf} = \sum_{i=1}^N (W_i \alpha_i) + \beta_p \times (\bar{R}_m - R_{rf}) \text{-----(iv) Equation}$$

Where

\bar{R}_p = Expected portfolio return

R_{rf} = Risk free return

W_i = The proportion of the portfolio devoted to stock i

$$\beta_p = \sum_{i=1}^N (W_i \beta_i) \text{----- (v) Equation}$$

β_p = Beta of the portfolio is the weighted beta of the individual securities comprised in the portfolio.

$$\alpha_p = \sum_{i=1}^N (W_i \alpha_i) \text{----- (vi) Equation}$$

α_p = Portfolio’s alpha value is the weighted average of the alpha values of the component securities, using relative market value as weight.

There are two types of risk in the security portfolio one is systematic risk and the other is unsystematic risk. The risk can be calculated by using the following equation:

$$\text{Variance } (\bar{R}_i - R_{rf}) = \alpha_i + \beta_i^2 \text{Variance}(\bar{R}_m - R_{rf}) \text{----- (vii) Equation}$$

Variance \bar{R}_i = Variance of the Security excess return

σ_{ei}^2 = Unsystematic risk of security i

$$\text{Systematic Risk} = \alpha_i + \beta_i^2 \text{Variance} (\bar{R}_m - R_{rf}) \text{----- (viii) Equation}$$

Unsystematic Risk = Total Variance of Security – Systematic Risk

$$\text{Non Systematic Risk of Portfolio} = \sum_{i=1}^n W_i^2 \times \sigma_{ei}^2 \text{----- (ix) Equation}$$

$$\Sigma_p^2 \text{Standard Deviation square of Portfolio} = \beta_p^2 \times \sigma_m^2 + \sum_{i=1}^n W_i^2 \times \sigma_{ei}^2 \text{----- (x) Equation}$$

Data Analysis and Interpretation

Table 1: showing Company Name, Stock Code, Security as percentage ratio of market capitalisation of NIFTY 250 Small Cap Index value and Average of the Absolute Return arise from variation in share prices traded in NSE.

Security Name	Stock Code	Percentage of NIFTY 250 Small Cap in NSE	Average of Absolute Return in percentage
BRIGHTCOM GROUP LIMITED	BCG	0.5011	115
SHREE RENUKA SUGARS LIMITED	RENUKA	0.336582	74.14
LAXMI ORGANIC INDUSTRIES LTD	LXCHEM	0.084023	61
JB CHEMICALS & PHARMACEUTICALS LTD	JBCHEPHARM	0.202859	50.6
HOUSING AND URBAN DEVELOPMENT LTD	HUDCO	1.564254	38.06
JK PAPER LIMITED	JKPAPER	1.46994	33.92

WELSPUN CORP LTD	WELCORP	0.125372	31.89
TRANSPORT CORPORATION OF INDIA LTD	TCI	0.034744	27.98
HINDUSTAN COPPER LIMITED	HINDCOPPER	0.408972	26.68
GRANULES INDIA LIMITED	GRANULES	0.353858	26.2
VIP INDUSTRIES LTD Ltd	VIPIND	0.005367	25
BHARAT RASAYAN LTD	BHARATRAS	0.015944	22.94
GUJRAT NARMADA VALLEY FERTILIZERS AND CHEMICALS LTD.	GNFC	0.53228653	20.11
JK LAKSHMI CEMENT LIMITED	JKLAKSHMI	0.130861	19
BLUE STAR LTD	BLUESTARCO	0.199111	17
JUST DIAL LTD	JUSTDIAL	0.06476	16.61
AMBER ENTERPRISES INDIA LTD	AMBER	0.156393	16.4
CENTURY TEXTILE AND INDUSTRIES LTD	CENTURYTEX	0.064078	14.95
NETWORK 18 MEDIA & INVESTMENTS LTD	NETWORK18	0.03985	14.92
TATA COFFEE LIMITED	TATACOFFEE	0.227804	14.33
INDIA CEMENTS LTD	INDIACEM	1.069989	14.18
GARWARE TECHNICAL FIBRES LIMITED	GARFIBRES	0.104482	13
GR INFRA PROJECTS Ltd	GRINFRA	0.00629475	13
APOLLO TYRES LIMITED	APOLLOTYRE	1.363964	12.5
MANAPPURAM FINANCE COMPANY LTD	MANAPPURAM	0.81988105	12.08
CAPLIN POINTS LABORATORIES LTD	CALIPOINT	0.022752	11.75
AEGIS LOGISTICS LTD	AEGISCHEM	0.12328	11
KALPATARU POWER TRANSMISSION LTD	KALPATPOWR	0.219007	10.61
MMTC LTD	MMTC	0.028302	10.24
JUBILANT INGREVIA LIMITED	JUBLINGREA	0.274366	7.8
CEAT LIMITED	CEATLTD	0.300103	6
FINOLEX CABLES LIMITED	FINCABLES	0.217725	4.7
GRAPHITE INDIA LTD	GRAPHITE	0.237789	4.48
TV 18 BROADCAST LIMITED	TV18BRDCST	0.116857	3.8
GLENMARK PHARMACEUTICAL LTD	GLENMARK	0.635702	1.2
CASTROL INDIA LTD.	CASTROLIND	1.76	-3.11
RBL BANK LIMITED	RBLBANK	2.233527	-5.3
WOCKHARDT LIMITED	WOCKPHARMA	0.144433	-7.3
PNB HOUSING LIMITED	PNBHOUSING	0.115894	-9.89
CHEMPLAST SANMAR LTD	CHEMPLASTS	0.01006	-21.75

(Source: National Stock Exchange)

These Companies have been selected using representative sampling technique covering major sector such as healthcare, chemical and pharmaceuticals; Information technology, Housing and real estate, consumer goods, transport, metal, electricals, construction material, banking and financial, media and entertainment, auto and auto parts, power and textile etc.

The Value of the selected companies constitute the 16.32 percent of the value of the market capitalisation of NIFTY 250 Small Cap valuation and 0.04% of the valuation of the Gross Domestic Product of the Indian economy as per the valuation of 2021. Further the table is showing the absolute return on the equity share prices of the selected companies ranked from highest to lowest. The above absolute return means profit or loss earned due to the difference in the monthly equity share price in National Stock Exchange and does not include any dividend declared by the company during the study period or Earning per share calculated by the company in their financial statement. In terms of absolute return M/s Brightcom Group is showing highest return of 115 percent in terms of monthly variation in prices of equity share price followed by M/s Shree Renuka Sugar Ltd (74.14), M/s Laxmi Organic Industries(61), M/s JB Chemicals and Pharmaceuticals Ltd(50.6), Housing and Urban Development Company(38.06) and M/s JK Paper Mills Ltd (33.92). All other sample companies in order of their ranking in terms of absolute return due to increase or decrease in the equity share prices during the study period have been presented in Table 1. In terms of market capitalisation RBL Bank is on the top with 2.23 percent share, following by Castrol India (1.76), Housing and Urban Development Company (1.56), JK Paper (1.46), Apollo Tyre (1.36) percent and India Cement Ltd with 1.06 percent.

Table 2 showing selected securities showing excess return to beta ratio and their rank according to the Highest mean excess return to beta

Stock Code	Expected Return (%)	Long Term Beta Value	Mean Excess Return of Security ($\bar{R}_i - R_f$)	Mean Excess Return to Beta ($(\bar{R}_i - R_f)/\beta_i$)	Rank
RENUKA	74.14	2.02	69.39	34.35149	5
BCG	115	1.63	111.25	67.63803	2
MMTC	10.24	1.48	5.49	3.709459	28
TV18BRDCST	3.8	1.42	-0.95	-0.669010	33
HUDCO	2.33	1.43	-2.42	-1.692310	34
NETWORK18	14.92	1.89	10.17	5.380952	24
HINDCOPPER	26.68	1.88	21.93	11.66489	16
LXCHEM	61	1.28	56.25	43.94531	4

CASTROLIND	-3.11	1.1	-7.86	-7.145450	38
MANAPPURAM	12.08	1.56	7.33	4.698718	26
WELCORP	31.89	1.36	27.14	19.95588	7
INDIACEM	14.18	0.14	9.43	67.35714	3
JKPAPER	33.92	1.55	29.17	18.81935	8
APOLLOTYRE	12.5	1.35	7.75	5.740741	22
AEGISCHEM	11	1.22	6.25	5.122951	25
RBLBANK	-5.3	1.6	-10.05	-6.281250	37
GNFC	20.10	1.79	15.35	8.575419	18
WOCKPHARMA	-7.03	1.9	-11.78	-6.200000	36
GRANULES	26.02	1.27	21.27	16.74803	11
KALPATPOWR	10.61	1.27	5.86	4.614173	27
GRAPHITE	4.48	2.32	-0.27	-0.116380	32
TCI	27.98	0.957	23.23	24.27377	6
FINCABLES	4.7	1.59	-0.05	-0.031450	31
JKLAKSHMI	19	0.9	14.25	15.83333	13
GLENMARK	1.2	1.43	-3.55	-2.482520	35
PNBHOUSING	-9.89	1.68	-14.64	-8.714290	39
CHEMPLASTS	-21.75	1.59	-26.5	-16.66670	40
JUBLINGREA	7.8	1.67	3.05	1.826347	29
TATACOFFEE	14.33	1.2	9.58	7.983333	19
JUSTDIAL	16.61	1.17	11.86	10.13675	17
CENTURYTEX	14.95	1.53	10.2	6.666667	21
BLUESTARCO	17	0.839	12.25	14.60072	14
JBCHEPHARM	50.6	0.266	45.85	172.3684	1
CEATLTD	6	1.16	1.25	1.077586	30
GRINFRA	13	1.1	8.25	7.500000	20
AMBER	16.4	0.82	11.65	14.20732	15
VMART	22.13	1.09	17.38	15.94495	12
BHARATRAS	22.94	1.07	18.19	17.00000	9
VIPIND	25	1.2	20.25	16.87500	10
CAPLIPOINT	11.75	1.29	7	5.426357	23

In the table no. 2, while calculating expected return from the monthly opening and closing equity share prices of the above listed companies, it is observed that share prices of M/s JB Chemicals and Pharmaceuticals Ltd is having greater return on the equity share prices during the tenure of 5 years, which is 50.6 percent with compared excess of absolute return to risk free return and beta of the respective security, similarly it is also observed that the company is having long term beta value is 0.266, which is considered as highly defensive stock, the stock is also earning return greater than the NIFTY small cap 250 index return as well as the pharmaceutical industry, which are 23 percent and 12.1 percent respectively. The outcome of the present paper when compared with a study analysis conducted by Roa and Varia in August, 2022 reveals that Indian Pharmaceutical Industry is growing at the rate of 12.1% on year to year basis led by 6.6 percent price hike, it is also stated that some growth is coming from the new product launches, which is about 1.5 percent, this has also been stated that this growth is without any impact of covid 19. It is also pertinent to mention here that selected companies in the present paper paid an average dividend of 9.8 percent during the last 5 years which is also greater than the dividend paid by the pharma industry i.e. 0.84 percent. Another second highest ranking company M/s Brightcom Group engaged in the business of Ad-tech, new media and digital marketing solution to the businesses across the world is giving an expected average absolute return of 115 percent during the study period and which is from Information Technology sector but this company is considered as very volatile reason being it's long term beta value is 1.63, which is considered as aggressive in market terms. A study conducted by NNK Sandilya and Hari KishnaVermula published in NVEO concluded that technological advancement at an exponential rate, the marketing worldview has shifted to newer more customer and content centric approaches like digital marketing techniques leverage the power of internet and web based social networking to reach to a more targeted set of audience. Modern marketing techniques provide sound marketing stage with the capacity to reach a large number of customers. The Indian digital marketing industry is of 1billion US dollar and expected to grow more in future at the rate of 12.5 percent. The share of Information Technology Industry is 8 percent in the Indian GDP. The India Cement which is ranked third belongs to construction material sector; this sector contributed about 8.2 percent in the Indian GDP. Laxmi Organic Industries Ltd is ranked 4th from chemical and pharmaceuticals sector. Shree Renuka Sugar Ltd is the next in the line is a producer of sugar and come from consumer section. Further, by using the equation $(\bar{R}_i - R_f)/\beta_i$, wherein \bar{R}_i is the expected percentage return on security, which has been come out after taking average from the monthly prices of the last 5 years from January, 2018 to December, 2022. R_f is the risk free return. β_i is a measure used in fundamental analysis to determine the volatility of an assets or portfolio in relation to the overall market. The overall market has a Beta of 1.0 and individual stocks are ranked according to how much they deviate from the market. The stock that swings more than the market having beta value of greater than 1, and moves less, it is less than 1. High beta stock tend to be riskier but proved the potential for higher return, on the other hand lower beta stock pose less risk, but typically yield lower return. Therefore, expected return from a security have been paired with long term beta value and excess return to beta ratio of all the securities have been calculated and on the basis of outcome all the securities have been ranked from greater value to the lower. Thus on the basis of excess of absolute return over risk free return to beta ratio have been calculated and depicted in the table 2 and all the companies have been ranked from 1 to 40 on the basis of highest to lowest excess return to beta ratio and all the companies have been rearranged in table 3 to proceed further in terms of Sharpe's Single Index Model.

Table 3 showing companies according to the excess return to beta ratio and further calculations as per Sharpe Index Model to find out the cut off rate as to which security is to be included in the portfolio.

Stock Code	$(\bar{R}_i - R_f)/\beta_i$	$\{(\bar{R}_i - R_f) \times \beta_i\}/\sigma^2$	$\Sigma\{(\bar{R}_i - R_f) \times \beta_i\}/\sigma^2$	β_i^2/σ_i^2	$\Sigma\beta_i^2/\sigma_i^2$	Cut off Rate C_i
BCG	367.5	0.016333333	0.016333333	4E-05	0.0000444	0.336648
RENUKA	86.7375	0.122127221	0.138460554	0.0014080095	0.001452409	2.773343
JBCHEPHARM	76.4166667	0.371094303	0.509554857	0.004856196	0.006308605	9.301552
LXCHEM	35.15625	0.532544379	1.042099236	0.015147929	0.021456534	14.90211
JKPAPER	29.17	0.134258398	1.176357634	0.004602619	0.026059153	15.79123
TCI	29.0375	0.103497438	1.279855073	0.003564268	0.029623422	16.39716
WELCORP	27.14	0.104963367	1.38481844	0.003867479	0.0334909	16.90549
VIPIND	25.3125	0.114398701	1.49921714	0.004519455	0.038010355	17.34639
VMART	24.8285714	0.082277419	1.58149456	0.00331382	0.041324175	17.62362
GRANULES	23.6333333	0.146783687	1.728278247	0.006210875	0.04753505	18.01434
BLUESTARCO	20.4166667	0.052519169	1.780797416	0.002572367	0.050107418	18.07776
BHARATRAS	20.2111111	0.123144946	1.903942363	0.006092933	0.056200351	18.20357
HINDCOPPER	18.275	0.039626986	1.943569348	0.002168371	0.058368722	18.20556
JKLAKSHMI	17.8125	0.071920615	2.015489963	0.004037649	0.062406371	18.19220
GNFC	15.35	0.049610854	2.065100817	0.003231977	0.065638348	18.11238
AMBER	14.2073171	0.06966682	2.134767637	0.004903587	0.070541936	17.95243
NETWORK18	12.7125	0.024806988	2.159574625	0.001951385	0.072493321	17.86825
JUSTDIAL	11.86	0.053999319	2.213573944	0.004553062	0.077046383	17.65106
INDIACEM	11.7875	0.05427178	2.267845725	0.004604181	0.081650564	17.44431
TATACOFFEE	10.6444444	0.068489233	2.336334958	0.00643427	0.088084834	17.12481
CAPLIPOINT	8.75	0.036538165	2.372873123	0.00417579	0.092260625	16.87681
CENTURYTEX	8.5	0.055429862	2.428302986	0.00652116	0.098781785	16.50657
KALPATPOWR	8.37142857	0.02797096	2.456273945	0.003341241	0.102123026	16.32644
AEGISCHEM	7.8125	0.036650873	2.492924818	0.004691312	0.106814338	16.06969
GRINFRA	7.5	0.416114522	2.90903934	0.055481936	0.162296274	13.81747
APOLLOTYRE	7.04545455	0.055533082	2.964572422	0.007882115	0.170178389	13.57380
MMTC	6.1	0.017096886	2.981669308	0.002802768	0.172981157	13.47935
MANAPPURAM	5.63846154	0.048066447	3.029735754	0.008524745	0.181505902	13.18910
JUBLINGREA	1.82634731	0.032755437	3.062491192	0.017934944	0.199440846	12.36750
CEATLTD	1.5625	0.007694675	3.070185867	0.004924592	0.204365439	12.15716
FINCABLES	-0.0714285	-0.000262364	3.069923503	0.003673095	0.208038533	11.98210
GRAPHITE	-0.27	-0.000809771	3.069113732	0.002999152	0.211037685	11.84054
TV18BRDCST	-0.8636363	-0.003755988	3.065357744	0.004349039	0.215386724	11.63118
GLENMARK	-2.4825174	-0.029626824	3.03573092	0.011934185	0.227320909	11.02045
HUDCO	-2.6888888	-0.010203694	3.025527226	0.003794762	0.231115672	10.83437
RBLBANK	-6.7	-0.055776813	2.969750413	0.008324897	0.239440569	10.32721
WOCKPHARMA	-13.088888	-0.031727468	2.938022945	0.002424	0.241864569	10.13160
CASTROLIND	-13.1	-0.057075014	2.88094793	0.004356871	0.24622144	9.787940
PNBHOUSING	-16.266666	-0.042487862	2.838460068	0.002611959	0.248833399	9.558886
CHEMPLASTS	-16.666666	-0.241821625	2.596638443	0.014509298	0.263342697	8.337716

By making the comparison of excess return to beta ratio and cut off rate, it is observed that only first 11 securities namely JBChemicals and Pharmaceuticals Ltd, Brightcom Group, India Cement Ltd, Laxmi Organic Industries Ltd, Shree Renuka Sugar Ltd, TCI, Welcorp, JK Paper, Bharat Rasayan, VIP Industries and Granules to be included in the portfolio. The cut of rate is 16.26 calculated using Sharpe Index Model.

Table 4 Table showing Stock to be included in the optimum Portfolio, Beta Value, Systematic and Non-Systematic Risk in the Suggested Portfolio.

Stock Code	Z Value	Proportion of Each security to be included in the proposed Portfolio	Expected return from the proposed portfolio	Beta Value	Non-Systematic Risk
BCG	0.015508673	1.76	2.023938325	0.005279839	0.62723
RENUKA	0.096493627	10.95	8.118503786	0.087601875	5.45031
JBCHEPHARM	0.282684562	32.08	16.23220029	0.192476683	7.62887
LXCHEM	0.256767924	29.14	17.77441804	0.466214244	14.34887
JKPAPER	0.050465164	5.73	1.942550487	0.057268587	0.71257
TCI	0.038607957	4.38	1.225883836	0.035050288	0.34468
WELCORP	0.034553774	3.92	1.250474371	0.039212116	0.39757

VIPIND	0.032119517	3.64	0.911242149	0.029159749	0.18814
VMART	0.021947485	2.49	0.551176841	0.017434423	0.09172
GRANULES	0.033711255	3.83	0.995421442	0.034430411	0.19087
BLUESTARCO	0.005687792	0.65	0.109727983	0.003872752	0.00583
BHARATRAS	0.01230112	1.40	0.320230616	0.012563538	0.02591
HINDCOPPER	0.000352625	0.04	0.010676357	0.000480196	0.00011

Z Value is defined as a numerical measurement that describe a value's relationship to the mean of a group of values, it is measured in terms of standard deviations from the mean, it further indicates that if it is zero, it indicates that the data point's score is identical to the mean score and if it is one it means it is one standard deviation from mean, the positive value of Z indicates that the score is above mean and negative vice versa. In finance volatility is a statistical measure of dispersion of return for a given security or market index, the higher the volatility, riskier the security and volatility of a security is either measured by standard deviation or variance between returns from the same security or market index. It further indicates the uncertain amount of risk associated with the security and a lower volatility means that a security's value does not fluctuate dramatically and tend to be steady. In the Table 4 all the security are having Z value is lowest, therefore it can be concluded that share price of the security will not fluctuate dramatically. Further Beta value of the portfolio recommended is also less than one therefore, it can be concluded that all the securities are defensive. Non-systematic risk associated with the security is also lowest and less than one except Renuka, JBCHEPHARMA and LXCHEM where more risk is 5.45, 7.63 and 14.35 respectively.

Findings:

- The recommended securities are shown in table 4 with the systematic risk of 20.24 percent and non-systematic risk of 30.01 percent with a total risk of the recommended portfolio is 50.25 percent.
- Z value of all the securities in the portfolio constructed in the present paper is found at lowest and it describe that the market price of the share will not change dramatically in the short term.
- There is no relation between the percentage share of market capitalisation, absolute return and excess return to beta ratio. The present paper reveals that RBL Bank followed by Castrol India Limited are on the top in terms of market capitalisation but ranked 38 and 37 in terms of absolute return, whereas in terms of excess return to beta ratio these two companies are ranked 38 and 39 respectively in the present analysis. However, there seems some relation between absolute return and excess return to beta, but this too is also affected by the Beta value of the company.
- Indian economy is expected to grow during the coming years and it is estimated that till 2030 it will be world's third largest economy and consequently the stock market. Further, Small Cap shares market have been remain sluggish from 2018 and expected to grow faster in 2023 and onwards.
- During the study period the stock prices of sample companies showed slow growth, therefore, growth of absolute return and risk also remain low.
- The Market capitalisation share of Healthcare, Chemical and Pharmaceuticals is 14.98 percent in the NIFTY 250 Small Cap Index, this sector contribute 9.1% in the Indian GDP, further NIFTY Pharma has given yearly return of 57.27 percent, therefore, it is suggested to invest 32.08 percent of total portfolio value in JB Chemicals and Pharmaceutical Ltd as it is having lower beta value of 0.19 as against investment risk of 7.63 percent; 29.14 of the portfolio value in LX Chemicals, 5.73 percent in JK Paper and 4.38 percent in TCI and rest as per table 4.
- The Information Technology companies contribute their share of 6.11 percent in NIFTY 250 Small Cap and IT sector is grooming sector of Indian Economy and particularly digital marketing is a new concept in Indian economy, so it is suggested to invest in Bright Com Group, it is giving an absolute return on equity share at the rate of 115 percent and mean excess return to beta is 67.64 percent. Although the company is having higher beta value of 1.63 which is considered as aggressive, so to keep the share in portfolio restricted to 1.76 percent of the total value of the portfolio.
- The portfolio constructed using Sharpe's Index Model is given in the Table 4 above, which is expected to give 61 percent return with 20.24 percent non-systematic risk and 30.01 per of systematic risk and with a total risk of 50.25 percent.

LIMITATION OF STUDY

The present study is based upon the historical data, therefore, it not free from limitations of secondary data. Further, to arrive at the objectives of this paper William Sharpe's Single Index Model has been used, so the study is not free from empirical limitations of the model.

SUGGESTIONS FROM THE STUDY

Before making investment in the recommended portfolio, the investors should study the performance and financial statement of the company and analyse the stock in terms of risk, sensitivity, holding period and return. It is also suggested to invest in complete portfolio instead of opting for a single company. The portfolio has been constructed using Share's Single Index Model; the result may differ while using other models.

CONCLUSION

This study proposes a new investment strategy for classical portfolio problem. In addition, a new combination stock from the Pharma index is proposed for solving the new investment strategy portfolio problem. Experimental results show that the feasible of the investment strategy with optimal portfolio idea and electiveness of the combination assets on the investment strategy. This study applied the Sharpe Single Index model to generate an efficient combination of securities from sample (Pharma companies) of shares and has come up with a subsequent pattern. The analysis of the portfolio provides the rationale for forming an optimal portfolio of the securities instead of buying only a single security.

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