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Revisiting Sharpes Single Index Model

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ABSTRACT

An investor needs to have proper knowledge about security analysis and portfolio theory for making correct investment decisions. This can be done either through traditional or modern approach of portfolio construction. A rational investor wants to maximize his return by minimizing his risk. There are several models having the opinion that, by holding assets from different industries in a portfolio, risk can be considerably reduced. Analysts are of the opinion that when at least 15 or more stocks are added to a portfolio, unsystematic risk can considerably be reduced. Studies have shown that systematic risk accounts for about one fourth of the total risk (Mandal, 2013). The present study explores how to construct optimum portfolio by applying Sharpes single index model and there by illustrating the same by comparing hypothetically proposed random portfolios from a given set of scrips among all the scrips in the study.

Keywords: investment management, portfolio management, portfolio return, portfolio risk

INTRODUCTION

In the year 1950, Harry Markowitz proposed a new model stating that in order to obtain benefits of diversification, majority of investors invest in a number of securities. He emphasized on the fact that diversification helps to reduce portfolio risk effectively. Markowitz Model is very information intensive and lacks simplicity. As new securities are added in a portfolio, there is greater requirement of computation of co-variance. In order to overcome complexities of Markowitz Model, William Sharpe developed a new and simpler model to analyse portfolios. According to his model, security‘s return is correlated to a single index which is usually a market index. All securities that are traded on the exchange will be a part of the market index. The index movement will also indicate the changes in the security prices.

In Simple index model (SIM), optimal portfolio is constructed by analysing the reason behind inclusion of a particular stock based on the associated variables under consideration. The present research seeks to construct an optimal portfolio using Sharpe‘s Single Index model and taking into consideration stocks of Nifty 50. The study is relevant in present times because the composition of stocks included in Nifty 50 has changed in recent years. This study gains more importance as stocks included in Nifty 50 represents majority of market capitalisation of NSE. With the boom in stock market operations post economic reforms and increasing investment in securities in recent years, it would be of great help to prospective investors for constructing optimum portfolio and diversify their risk effectively.

Every investor undergoes confusion while selecting securities forhis portfolio. He also faces dilemma while deciding about the proportion of investment tobe made in each security. To help investors get out

of such chaotic situations, Sharpe's Single Index model may be used to construct an optimal portfolio. This helps the investor to find a portfolio that best suits his needs. The present study is undertaken to prove that by applying this model an individual can construct a portfolio with maximum return for a given level of risk.

OBJECTIVES OF THE STUDY

- To calculate the risk and return of all stocks included in NIFTY 50 using SIM.
- To construct an Optimal Portfolio using stocks listed in NIFTY 50 and calculate proportion for each selected stock to be invested in the OptimalPortfolio.
- To construct two random Portfolios to compare with the Optimal Portfolio and evaluate the performance of these two Portfolios vis- a – vis optimum portfolio.

RESEARCH METHODOLOGY

In this research the sample size constitutes **50 shares** of Nifty Index. And as there was considerable volatility post corona the period of study is taken between 2012 and 2017. The price movements of NSE Nifty index and stock prices from 2012-2017 are thefundamental data for the study. The main source of information is **nseindia.com, Magazines** and **journals**. The data collected from sources has been analysed using ratios and formulae. Tools like Arithmetic mean, standard deviation, Alpha, Beta, Covariance, Sharpe Index, Treynor's ratio and Jensen's measure are used. T**Microsoft Excel** package is used for performing calculations and analysis.

ANALYSIS AND INTERPRETATIONS

TABLE 1 : LIST OF NIFTY 50 SHARES AND SYMBOLS

S.NO	COMPANY NAME	INDUSTRY	SYMBOL
1	Adani Ports and Special Economic Zone Ltd.	SERVICES	ADANIPORTS
2	Ambuja Cements Ltd.	CEMENT & CEMENT PRODUCTS	AMBUJACEM
3	Asian Paints Ltd.	CONSUMER GOODS	ASIANPAINT
4	Aurobindo Pharma Ltd.	PHARMA	AUROPHARMA
5	Axis Bank Ltd.	FINANCIAL SERVICES	AXISBANK
6	Bajaj Auto Ltd.	AUTOMOBILE	BAJAJ-AUTO
7	Bajaj Finance Ltd.	FINANCIAL SERVICES	BAJFINANCE
8	Bharat Petroleum Corporation Ltd.	ENERGY	BPCL
9	Bharti Airtel Ltd.	TELECOM	BHARTIARTL
10	Bharti Infratel Ltd.	TELECOM	INFRATEL
11	Bosch Ltd.	AUTOMOBILE	BOSCHLTD
12	Cipla Ltd.	PHARMA	CIPLA
13	Coal India Ltd.	METALS	COALINDIA
14	Dr. Reddy's Laboratories Ltd.	PHARMA	DRREDDY
15	Eicher Motors Ltd.	AUTOMOBILE	EICHERMOT

16	GAIL (India) Ltd.	ENERGY	GAIL
17	HCL Technologies Ltd.	IT	HCLTECH
18	HDFC Bank Ltd.	FINANCIAL SERVICES	HDFCBANK
19	Hero MotoCorp Ltd.	AUTOMOBILE	HEROMOTOCO
20	Hindalco Industries Ltd.	METALS	HINDALCO
21	Hindustan Petroleum Corporation Ltd.	ENERGY	HINDPETRO
22	Hindustan Unilever Ltd.	CONSUMER GOODS	HINDUNILVR
23	Housing Development Finance Corporation	FINANCIAL SERVICES	HDFC
24	I T C Ltd.	CONSUMER GOODS	ITC
25	ICICI Bank Ltd.	FINANCIAL SERVICES	ICICIBANK
26	Indiabulls Housing Finance Ltd.	FINANCIAL SERVICES	IBULHSGFIN
27	Indian Oil Corporation Ltd.	ENERGY	IOC
28	IndusInd Bank Ltd.	FINANCIAL SERVICES	INDUSINDBK
29	Infosys Ltd.	IT	INFY
30	Kotak Mahindra Bank Ltd.	FINANCIAL SERVICES	KOTAKBANK
31	Larsen & Toubro Ltd.	CONSTRUCTION	LT
32	Lupin Ltd.	PHARMA	LUPIN
33	Mahindra & Mahindra Ltd.	AUTOMOBILE	M&M
34	Maruti Suzuki India Ltd.	AUTOMOBILE	MARUTI
35	NTPC Ltd.	ENERGY	NTPC
36	Oil & Natural Gas Corporation Ltd.	ENERGY	ONGC
37	Power Grid Corporation of India Ltd.	ENERGY	POWERGRID
38	Reliance Industries Ltd.	ENERGY	RELIANCE
39	State Bank of India	FINANCIAL SERVICES	SBIN
40	Sun Pharmaceutical Industries Ltd.	PHARMA	SUNPHARMA
41	Tata Consultancy Services Ltd.	IT	TCS
42	Tata Motors Ltd.	AUTOMOBILE	TATAMOTORS
43	Tata Steel Ltd.	METALS	TATASTEEL
44	Tech Mahindra Ltd.	IT	TECHM
45	UPL Ltd.	FERTILISERS & PESTICIDES	UPL
46	UltraTech Cement Ltd.	CEMENT & CEMENT PRODUCTS	ULTRACEMCO
47	Vedanta Ltd.	METALS	VEDL
48	Wipro Ltd.	IT	WIPRO
49	Yes Bank Ltd.	FINANCIAL SERVICES	YESBANK
50	Zee Entertainment Enterprises Ltd.	MEDIA & ENTERTAINMENT	ZEEL

(Source: www.nse.com)

The study involvescalculation of average return, variance, alpha and beta of the securities. These values from the basic secondary data for the formation of optimal portfolio were calculated using Microsoft Excel

Return = (Today's price- Last year's price)*100

Last years price

Average return of security	$Ri_{\_} = \Sigma Ri/n$
Average return of the market	$Rm = \Sigma Rm/n$
Variance of security	$\sigma i^2 = \Sigma (Ri-Ri)^2 /(n-1)$
Variance of market	$\sigma m^2 = \Sigma (Rm-Rm)^2 /(n-1)$
Covariance of Security & Market COV R,M	$= \Sigma(Ri-Ri_{\_})*(Rm-Rm_{\_})/ (n-1)$
Beta of security	$\beta = COV\ R, M / \sigma^2 m$
Alpha of security	$\alpha = Ri_{\_} - \beta\ Rm_{\_}$

TABLE 2 : SUMMARY TABLE SHOWING RISK AND RETURN OF NIFTY SHARES

S.No	Name of the security	Return(Ri)	Alpha (α)	Beta (βi)	Variance(σi^2)
1	ADANIPORTS	28.54	4.34	1.92	1242.11
2	AMBUJACEM	7.7	-4.16	0.94	352.59
3	ASIANPAINT	24.72	16.71	0.64	207.47
4	AUROPHARMA	72.3	21.76	4.01	12432.45
5	AXISBANK	24.87	-5.36	2.4	2482.34
6	BAJAJ-AUTO	11.66	0.63	0.88	259.83
7	BAJFINANCE	80.01	61.36	1.48	1866.09
8	BPCL	50.9	28.12	1.81	2345.99
9	BHARTIARTL	10.08	-1.88	0.95	607.83
10	INFRATEL	23.36	3.64	1.57	1954.59
11	BOSCHLTD	23.9	-3.63	2.19	2558.47
12	CIPLA	10.76	-6.45	1.37	896.05
13	COALINDIA	3.13	-8.26	0.9	585.69
14	DRREDDY	8.83	1.15	0.61	1028.09
15	EICHERMOT	71.65	31.26	3.21	5210.64
16	GAIL	18.57	-2.33	1.66	1070.48

17	HCLTECH	26.94	19.9	0.56	1191.6
18	HDFCBANK	24.29	10.65	1.08	639.4
19	HEROMOTOCO	19.65	3.75	1.26	657.26
20	HINDALCO	30.44	17.02	1.07	4078.41
21	HINDPETRO	86.4	45.58	3.24	7990.73
22	HINDUNILVR	21.95	9.94	0.95	435.97
23	HDFC	17.18	5.02	0.97	362.09
24	ITC	7.88	3.37	0.36	49.13
25	ICICIBANK	21.83	-7.73	2.35	1900.79
26	IBULHSGFIN	47.16	26.77	1.62	2438.38
27	IOC	35.33	17.61	1.41	1523.14
28	INDUSINDBK	34.6	20.64	1.11	658.77
29	INFY	17.53	10.2	0.58	640.24
30	KOTAKBANK	25.82	13.16	1.01	369.92
31	LT	15.53	-4.37	1.58	820.54
32	LUPIN	15.94	9.42	0.52	2222.76
33	M&M	10.79	-1.16	0.95	390.31
34	MARUTI	46.83	24.28	1.79	1388.13
35	NTPC	5.99	5.06	0.07	192.56
36	ONGC	8.79	-2.18	0.87	767.67
37	POWERGRID	17.09	4.32	1.01	987.39
38	RELIANCE	23.83	11.53	0.98	1276.3
39	SBIN	22.97	-8.96	2.54	2358.5
40	SUNPHARMA	13.8	7.95	0.46	1565.84
41	TCS	19.16	10.85	0.66	692.43
42	TATAMOTORS	11.45	4.32	0.57	861.26
43	TATASTEEL	24.92	11.78	1.04	2579.87
44	TECHM	26.76	13.72	1.04	2573.36
45	UPL	48.94	32.19	1.33	1351.16
46	ULTRACEMCO	17.56	13.37	0.33	159.56
47	VEDL	30.27	22.1	0.65	5483.87
48	WIPRO	13.16	4.55	0.68	410.72
49	YESBANK	41.02	19.02	1.75	1937.66
50	ZEEL	24.99	17.42	0.6	241.45
	NIFTY	12.59	0	1	322.94

(Source: Summarized from the secondary data)

RISK ANALYSIS OF SECURITIES

The total risk of securities is divided in to two; the systematic risk which cannot be diversified and unsystematic or security specific risk which can be reduced by diversification. Systematic and unsystematic risks are measured by using Sharpe's index model.

Systematic Risk of Securities

The systematic risk indicates non diversifiable part of the risk of a security. It is calculated using the following formulae.

Systematic risk = $\beta i^2 \sigma^2_m$ Where

σ^2_m = Variance of Market

Market Risk is represented by NIFTY, from table No. 2 = 322.94 %

The result of calculation of systematic risk of securities is given in the table below.

TABLE 3: SYSTEMATIC RISK OF NIFTY SHARES

S.No	Name of the security	βi	βi²	σm²	Systematic Risk(βi²*σm²)
1	ADANIPORTS	1.92	3.69	322.94	1190.49
2	AMBUJACEM	0.94	0.88	322.94	285.35
3	ASIANPAINT	0.64	0.41	322.94	132.28
4	AUROPHARMA	4.01	16.08	322.94	5192.91
5	AXISBANK	2.4	5.76	322.94	1860.13
6	BAJAJ-AUTO	0.88	0.77	322.94	250.08
7	BAJFINANCE	1.48	2.19	322.94	707.37
8	BPCL	1.81	3.28	322.94	1057.98
9	BHARTIARTL	0.95	0.90	322.94	291.45
10	INFRATEL	1.57	2.46	322.94	796.01
11	BOSCHLTD	2.19	4.80	322.94	1548.85
12	CIPLA	1.37	1.88	322.94	606.13
13	COALINDIA	0.9	0.81	322.94	261.58
14	DRREDDY	0.61	0.37	322.	120.17

				94	
15	EICHERMOT	3.21	10.30	322.94	3327.61
16	GAIL	1.66	2.76	322.94	889.89
17	HCLTECH	0.56	0.31	322.94	101.27
18	HDFCBANK	1.08	1.17	322.94	376.68
19	HEROMOTOCO	1.26	1.59	322.94	512.70
20	HINDALCO	1.07	1.14	322.94	369.73
21	HINDPETRO	3.24	10.50	322.94	3390.09
22	HINDUNILVR	0.95	0.90	322.94	291.45
23	HDFC	0.97	0.94	322.94	303.85
24	ITC	0.36	0.13	322.94	41.85
25	ICICIBANK	2.35	5.52	322.94	1783.44
26	IBULHSGFIN	1.62	2.62	322.94	847.52
27	IOC	1.41	1.99	322.94	642.04
28	INDUSINDBK	1.11	1.23	322.94	397.89
29	INFY	0.58	0.34	322.94	108.64
30	KOTAKBANK	1.01	1.02	322.94	329.43
31	LT	1.58	2.50	322.94	806.19
32	LUPIN	0.52	0.27	322.94	87.32
33	M&M	0.95	0.90	322.94	291.45
34	MARUTI	1.79	3.20	322.94	1034.73
35	NTPC	0.07	0.00	322.	1.58

				94	
36	ONGC	0.87	0.76	322.94	244.43
37	POWERGRID	1.01	1.02	322.94	329.43
38	RELIANCE	0.98	0.96	322.94	310.15
39	SBIN	2.54	6.45	322.94	2083.48
40	SUNPHARMA	0.46	0.21	322.94	68.33
41	TCS	0.66	0.44	322.94	140.67
42	TATAMOTORS	0.57	0.32	322.94	104.92
43	TATASTEEL	1.04	1.08	322.94	349.29
44	TECHM	1.04	1.08	322.94	349.29
45	UPL	1.33	1.77	322.94	571.25
46	ULTRACEMCO	0.33	0.11	322.94	35.17
47	VEDL	0.65	0.42	322.94	136.44
48	WIPRO	0.68	0.46	322.94	149.33
49	YESBANK	1.75	3.06	322.94	989.00
50	ZEEL	0.6	0.36	322.94	116.26

(Source: Summarized from the secondary data in the Table 2)

Unsystematic Risk of the Securities

Unsystematic risk refers to that portion of risk which is caused due to factors uniqueor related to a firm or industry. The total Risk of the security is the sum of systematic risk and non-systematic risk, the unsystematic risk is fond out by deducting systematic risk from total risk. i.e.,

Unsystematic risk = Variance of security- Systematic risk.

The unsystematic risk is calculated using the formula, Unsystematic risk = $\sigma^2_i - \beta_i^2 \sigma^2_m$

Where

σ_i^2 = Variance of security β_i = Beta of Security

$\sigma^2 m$ = Variance of market index

Market is represented NIFTY INDEX From Summary table 2,

σm^2 = (322.94%)

TABLE 4 : UNSYSTEMATIC RISK OF NIFTY SHARES

S.No	Name of the security	Beta βi	βi^2	σm^2	σi^2	Systematic Risk($\beta i^2 * \sigma m^2$)	Unsystematic Risk(σei^2) $=\sigma i^2-(\beta i^2 * \sigma m^2)$
1	ADANIPORTS	1.92	3.69	322.94	1242.11	1190.49	51.62
2	AMBUJACEM	0.94	0.88	322.94	352.59	285.35	67.24
3	ASIANPAINT	0.64	0.41	322.94	207.47	132.28	75.19
4	AUROPHARMA	4.01	16.08	322.94	12432.45	5192.91	7239.54
5	AXISBANK	2.4	5.76	322.94	2482.34	1860.13	622.21
6	BAJAJ-AUTO	0.88	0.77	322.94	259.83	250.08	9.75
7	BAJFINANCE	1.48	2.19	322.94	1866.09	707.37	1158.72
8	BPCL	1.81	3.28	322.94	2345.99	1057.98	1288.01
9	BHARTIARTL	0.95	0.90	322.94	607.83	291.45	316.38
10	INFRATEL	1.57	2.46	322.94	1954.59	796.01	1158.58
11	BOSCHLTD	2.19	4.80	322.94	2558.47	1548.85	1009.62
12	CIPLA	1.37	1.88	322.94	896.05	606.13	289.92
13	COALINDIA	0.9	0.81	322.94	585.69	261.58	324.11
14	DRREDDY	0.61	0.37	322.94	1028.09	120.17	907.92
15	EICHERMOT	3.21	10.30	322.94	5210.64	3327.61	1883.03
16	GAIL	1.66	2.76	322.94	1070.48	889.89	180.59
17	HCLTECH	0.56	0.31	322.94	1191.6	101.27	1090.33
18	HDFCBANK	1.08	1.17	322.94	639.4	376.68	262.72
19	HEROMOTOCO	1.26	1.59	322.94	657.26	512.70	144.56
20	HINDALCO	1.07	1.14	322.94	4078.41	369.73	3708.68
21	HINDPETRO	3.24	10.50	322.94	7990.73	3390.09	4600.64
22	HINDUNILVR	0.95	0.90	322.94	435.97	291.45	144.52
23	HDFC	0.97	0.94	322.94	362.09	303.85	58.24

24	ITC	0.36	0.13	322.94	49.13	41.85	7.28
25	ICICIBANK	2.35	5.52	322.94	1900.79	1783.44	117.35
26	IBULHSGFIN	1.62	2.62	322.94	2438.38	847.52	1590.86
27	IOC	1.41	1.99	322.94	1523.14	642.04	881.10
28	INDUSINDBK	1.11	1.23	322.94	658.77	397.89	260.88
29	INFY	0.58	0.34	322.94	640.24	108.64	531.60
30	KOTAKBANK	1.01	1.02	322.94	369.92	329.43	40.49
31	LT	1.58	2.50	322.94	820.54	806.19	14.35
32	LUPIN	0.52	0.27	322.94	2222.76	87.32	2135.44
33	M&M	0.95	0.90	322.94	390.31	291.45	98.86
34	MARUTI	1.79	3.20	322.94	1388.13	1034.73	353.40
35	NTPC	0.07	0.00	322.94	192.56	1.58	190.98
36	ONGC	0.87	0.76	322.94	767.67	244.43	523.24
37	POWERGRID	1.01	1.02	322.94	987.39	329.43	657.96
38	RELIANCE	0.98	0.96	322.94	1276.3	310.15	966.15
39	SBIN	2.54	6.45	322.94	2358.5	2083.48	275.02
40	SUNPHARMA	0.46	0.21	322.94	1565.84	68.33	1497.51
41	TCS	0.66	0.44	322.94	692.43	140.67	551.76
42	TATAMOTORS	0.57	0.32	322.94	861.26	104.92	756.34
43	TATASTEEL	1.04	1.08	322.94	2579.87	349.29	2230.58
44	TECHM	1.04	1.08	322.94	2573.36	349.29	2224.07
45	UPL	1.33	1.77	322.94	1351.16	571.25	779.91
46	ULTRACEMCO	0.33	0.11	322.94	159.56	35.17	124.39
47	VEDL	0.65	0.42	322.94	5483.87	136.44	5347.43
48	WIPRO	0.68	0.46	322.94	410.72	149.33	261.39
49	YESBANK	1.75	3.06	322.94	1937.66	989.00	948.66
50	ZEEL	0.6	0.36	322.94	241.45	116.26	125.19

(Source: Secondary data from Table .2)

Total Risk of Securities

Total risk of a security is the sum of systematic and unsystematic risks.

Total Risk = Systematic Risk + Unsystematic Risk.

TABLE 5 : TOTAL RISK OF NIFTY SHARES

S.No	Name of the security	Beta βi	βi^2	σm^2	σi^2	Systematic Risk($\beta i^2 * \sigma m^2$)	Unsystematic Risk(σei^2)=σi^2-($\beta i^2 * \sigma m^2$)	Total Risk
1	ADANIPORTS	1.92	3.69	322.9	1242.	1190.49	51.62	1242.1

				4	11			1
2	AMBUJACEM	0.94	0.88	322.94	352.59	285.35	67.24	352.59
3	ASIANPAINT	0.64	0.41	322.94	207.47	132.28	75.19	207.47
4	AUROPHARMA	4.01	16.08	322.94	12432.5	5192.91	7239.54	12432.45
5	AXISBANK	2.4	5.76	322.94	2482.34	1860.13	622.21	2482.34
6	BAJAJ-AUTO	0.88	0.77	322.94	259.83	250.08	9.75	259.83
7	BAJFINANCE	1.48	2.19	322.94	1866.09	707.37	1158.72	1866.09
8	BPCL	1.81	3.28	322.94	2345.99	1057.98	1288.01	2345.99
9	BHARTIARTL	0.95	0.90	322.94	607.83	291.45	316.38	607.83
10	INFRATEL	1.57	2.46	322.94	1954.59	796.01	1158.58	1954.59
11	BOSCHLTD	2.19	4.80	322.94	2558.47	1548.85	1009.62	2558.47
12	CIPLA	1.37	1.88	322.94	896.05	606.13	289.92	896.05
13	COALINDIA	0.9	0.81	322.94	585.69	261.58	324.11	585.69
14	DRREDDY	0.61	0.37	322.94	1028.09	120.17	907.92	1028.09
15	EICHERMOT	3.21	10.30	322.94	5210.64	3327.61	1883.03	5210.64
16	GAIL	1.66	2.76	322.94	1070.48	889.89	180.59	1070.48
17	HCLTECH	0.56	0.31	322.94	1191.6	101.27	1090.33	1191.60
18	HDFCBANK	1.08	1.17	322.94	639.4	376.68	262.72	639.40
19	HEROMOTOCO	1.26	1.59	322.94	657.26	512.70	144.56	657.26
20	HINDALCO	1.07	1.14	322.94	4078.41	369.73	3708.68	4078.41
21	HINDPETRO	3.24	10.50	322.94	7990.73	3390.09	4600.64	7990.73
22	HINDUNILVR	0.95	0.90	322.9	435.9	291.45	144.52	435.97

				4	7			
23	HDFC	0.97	0.94	322.94	362.09	303.85	58.24	362.09
24	ITC	0.36	0.13	322.94	49.13	41.85	7.28	49.13
25	ICICIBANK	2.35	5.52	322.94	1900.79	1783.44	117.35	1900.79
26	IBULHSGFIN	1.62	2.62	322.94	2438.38	847.52	1590.86	2438.38
27	IOC	1.41	1.99	322.94	1523.14	642.04	881.10	1523.14
28	INDUSINDBK	1.11	1.23	322.94	658.77	397.89	260.88	658.77
29	INFY	0.58	0.34	322.94	640.24	108.64	531.60	640.24
30	KOTAKBANK	1.01	1.02	322.94	369.92	329.43	40.49	369.92
31	LT	1.58	2.50	322.94	820.54	806.19	14.35	820.54
32	LUPIN	0.52	0.27	322.94	2222.76	87.32	2135.44	2222.76
33	M&M	0.95	0.90	322.94	390.31	291.45	98.86	390.31
34	MARUTI	1.79	3.20	322.94	1388.13	1034.73	353.40	1388.13
35	NTPC	0.07	0.00	322.94	192.56	1.58	190.98	192.56
36	ONGC	0.87	0.76	322.94	767.67	244.43	523.24	767.67
37	POWERGRID	1.01	1.02	322.94	987.39	329.43	657.96	987.39
38	RELIANCE	0.98	0.96	322.94	1276.3	310.15	966.15	1276.30
39	SBIN	2.54	6.45	322.94	2358.5	2083.48	275.02	2358.50
40	SUNPHARMA	0.46	0.21	322.94	1565.84	68.33	1497.51	1565.84
41	TCS	0.66	0.44	322.94	692.43	140.67	551.76	692.43
42	TATAMOTORS	0.57	0.32	322.94	861.26	104.92	756.34	861.26
43	TATASTEEL	1.04	1.08	322.9	2579.	349.29	2230.58	2579.8

				4	87			7
44	TECHM	1.04	1.08	322.94	2573.36	349.29	2224.07	2573.36
45	UPL	1.33	1.77	322.94	1351.16	571.25	779.91	1351.16
46	ULTRACEMCO	0.33	0.11	322.94	159.56	35.17	124.39	159.56
47	VEDL	0.65	0.42	322.94	5483.87	136.44	5347.43	5483.87
48	WIPRO	0.68	0.46	322.94	410.72	149.33	261.39	410.72
49	YESBANK	1.75	3.06	322.94	1937.66	989.00	948.66	1937.66
50	ZEEL	0.6	0.36	322.94	241.45	116.26	125.19	241.45

(Source: Secondary data from Tables 2 to 4)

CONSTRUCTION OF OPTIMAL PORTFOLIOUSING SHARPE'S OPTIMIZATION MODEL

The construction of optimal portfolio using Sharpe's single index model involvesfollowing steps.

1. Ranking of the securities based on excess return over risk i.e. (Ri - Rf)/ β ratio.
2. Calculation of Cut-off point
3. Selection of securities based on the cut-off point
4. Calculation of Weight of each security in the portfolio.

Ranking of Securities

The NIFTY securities are ranked based on (Ri - Rf)/ β ratio.Where;

Ri= Return of the securityRf = the risk free rate.

The latest MIBOR (Mumbai Inter Bank Offer Rate) is taken as risk free rate Rf. The present rate is 6.05 %. Hence, 6.05% is taken as risk free rate for calculation.

Table 6 given in the next page shows the rank of securities based on (Ri - Rf)/β ratio.

TABLE 6: RANKING OF NIFTY SHARES

S.No	Name of the security	Return(Ri)	Risk Free Rate(Rf)	(Ri-Rf)	Beta (βi)	(Ri-Rf)/βi	Rank
1	ADANIPORTS	28.54	6.05	22.49	1.92	11.71	28
2	AMBUJACEM	7.7	6.05	1.65	0.94	1.76	48
3	ASIANPAINT	24.72	6.05	18.67	0.64	29.17	7

4	AUROPHARMA	72.3	6.05	66.25	4.01	16.52	27
5	AXISBANK	24.87	6.05	18.82	2.4	7.84	36
6	BAJAJ-AUTO	11.66	6.05	5.61	0.88	6.38	40
7	BAJFINANCE	80.01	6.05	73.96	1.48	49.97	1
8	BPCL	50.9	6.05	44.85	1.81	24.78	11
9	BHARTIARTL	10.08	6.05	4.03	0.95	4.24	45
10	INFRATEL	23.36	6.05	17.31	1.57	11.03	30
11	BOSCHLTD	23.9	6.05	17.85	2.19	8.15	35
12	CIPLA	10.76	6.05	4.71	1.37	3.44	46
13	COALINDIA	3.13	6.05	-2.92	0.9	-3.24	50
14	DRREDDY	8.83	6.05	2.78	0.61	4.56	44
15	EICHERMOT	71.65	6.05	65.6	3.21	20.44	15
16	GAIL	18.57	6.05	12.52	1.66	7.54	37
17	HCLTECH	26.94	6.05	20.89	0.56	37.30	2
18	HDFCBANK	24.29	6.05	18.24	1.08	16.89	24
19	HEROMOTOCO	19.65	6.05	13.6	1.26	10.79	32
20	HINDALCO	30.44	6.05	24.39	1.07	22.79	12
21	HINDPETRO	86.4	6.05	80.35	3.24	24.80	10
22	HINDUNILVR	21.95	6.05	15.9	0.95	16.74	26
23	HDFC	17.18	6.05	11.13	0.97	11.47	29
24	ITC	7.88	6.05	1.83	0.36	5.08	42
25	ICICIBANK	21.83	6.05	15.78	2.35	6.71	38
26	IBULHSGFIN	47.16	6.05	41.11	1.62	25.38	9
27	IOC	35.33	6.05	29.28	1.41	20.77	14
28	INDUSINDBK	34.6	6.05	28.55	1.11	25.72	8
29	INFY	17.53	6.05	11.48	0.58	19.79	19
30	KOTAKBANK	25.82	6.05	19.77	1.01	19.57	20
31	LT	15.53	6.05	9.48	1.58	6.00	41
32	LUPIN	15.94	6.05	9.89	0.52	19.02	21
33	M&M	10.79	6.05	4.74	0.95	4.99	43
34	MARUTI	46.83	6.05	40.78	1.79	22.78	13
35	NTPC	5.99	6.05	-0.06	0.07	-0.86	49
36	ONGC	8.79	6.05	2.74	0.87	3.15	47
37	POWERGRID	17.09	6.05	11.04	1.01	10.93	31
38	RELIANCE	23.83	6.05	17.78	0.98	18.14	23
39	SBIN	22.97	6.05	16.92	2.54	6.66	39
40	SUNPHARMA	13.8	6.05	7.75	0.46	16.85	25
41	TCS	19.16	6.05	13.11	0.66	19.86	18
42	TATAMOTORS	11.45	6.05	5.4	0.57	9.47	34

43	TATASTEEL	24.92	6.05	18.87	1.04	18.14	22
44	TECHM	26.76	6.05	20.71	1.04	19.91	17
45	UPL	48.94	6.05	42.89	1.33	32.25	5
46	ULTRACEMCO	17.56	6.05	11.51	0.33	34.88	4
47	VEDL	30.27	6.05	24.22	0.65	37.26	3
48	WIPRO	13.16	6.05	7.11	0.68	10.46	33
49	YESBANK	41.02	6.05	34.97	1.75	19.98	16
50	ZEEL	24.99	6.05	18.94	0.6	31.57	6

(Source: Summarized from the secondary data of Table 2)

Calculation of Cut-Off Point

The securities are rearranged based on the rank of (Ri - Rf)/ β ratio.

Then the cut off rate is calculated using the formulae.

$$C_i = \frac{\sigma^2 mi \sum_{i=1}^{i} \frac{(R_i - R_f)*\beta_i}{\sigma^2 ei}}{1 + \sigma m^2 \sum_{i=1}^{i} \frac{\beta_i^2}{\sigma^2 ei}}$$

Where

m = Market variance σ^2

Ri - Rf = Market risk premium

σei^2 = Unsystematic risk of the security

The calculation of cut-off point is shown in the table given in the next page.

From the table it seen that the cut- off point Ci shows a character of increasing gradually and after reaching a peak value it starts decreasing gradually. This point is highest cut off rate and it will be denoted as C*.

The cut-off point determines which securities are to be included in the portfolio. The Securities with (Ri-Rf)/ β values up to cut off point C* (**27.4375)** are included in the portfolio. Securities with (Ri-Rf)/ β values beyond cut off point are excluded from the Portfolio.

TABLE 7: CUTOFF CALCULATION OF NIFTY SHARES

Rank	Name of the security	(Ri - Rf)	Beta (βi)	(Ri-Rf)/βi	σei²	(Ri-Rf)*β	(Ri-Rf)*β/σei²	Σ ((Ri-Rf)*β/σei²)	σm²	β²/σei²	Σ (β²/σei²)	σm²*Σ ((Ri-Rf)*β/σei²)	1+σm²(Σ (β²/σei²)	Cut off	Status
1	BAJFINANCE	73.96	1.48	49.97	1158.72	109.46	0.0945	0.0945	322.94	0.0019	0.0019	30.507	1.610	18.9430	IN
2	HCLTECH	20.89	0.56	37.30	1090.33	11.70	0.0107	0.1052	322.94	0.0003	0.0022	33.972	1.703	19.9442	IN
3	VEDL	24.22	0.65	37.26	5347.43	15.74	0.0029	0.1081	322.94	0.0001	0.0023	34.923	1.729	20.1998	IN
4	ULTRACEMCO	11.51	0.33	34.88	124.39	3.80	0.0305	0.1387	322.94	0.0009	0.0031	44.784	2.012	22.2629	IN
5	UPL	42.89	1.33	32.25	779.91	57.04	0.0731	0.2118	322.94	0.0023	0.0054	68.404	2.744	24.9282	IN
6	ZEEL	18.94	0.6	31.57	125.19	11.36	0.0908	0.3026	322.94	0.0029	0.0083	97.719	3.673	26.6067	IN
7	ASIANPAINT	18.67	0.64	29.17	75.19	11.95	0.1589	0.4615	322.94	0.0054	0.0137	149.039	5.432	**27.4375**	IN
8	INDUSINDBK	28.55	1.11	25.72	260.88	31.69	0.1215	0.5830	322.94	0.0047	0.0184	188.268	6.957	27.0611	OUT
9	IBULHSGFIN	41.11	1.62	25.38	1590.86	66.60	0.0419	0.6248	322.94	0.0016	0.0201	201.787	7.490	26.9413	OUT
10	HINDPETRO	80.35	3.24	24.80	4600.64	260.33	0.0566	0.6814	322.94	0.0023	0.0224	220.061	8.227	26.7495	OUT
11	BPCL	44.85	1.81	24.78	1288.01	81.18	0.0630	0.7445	322.94	0.0025	0.0249	240.415	9.048	26.5706	OUT
12	HINDALCO	24.39	1.07	22.79	3708.68	26.10	0.0070	0.7515	322.94	0.0003	0.0252	242.687	9.148	26.5294	OUT
13	MARUTI	40.78	1.79	22.78	353.4	73.00	0.2066	0.9580	322.94	0.0091	0.0343	309.392	12.076	25.6208	OUT
14	IOC	29.28	1.41	20.77	881.1	41.28	0.0469	1.0049	322.94	0.0023	0.0366	324.524	12.804	25.3446	OUT
15	EICHERMOT	65.6	3.21	20.44	1883.03	210.58	0.1118	1.1167	322.94	0.0055	0.0420	360.637	14.572	24.7493	OUT
16	YESBANK	34.97	1.75	19.98	948.66	61.20	0.0645	1.1812	322.94	0.0032	0.0453	381.470	15.614	24.4311	OUT
17	TECHM	20.71	1.04	19.91	2224.07	21.54	0.0097	1.1909	322.94	0.0005	0.0457	384.598	15.771	24.3861	OUT
18	TCS	13.11	0.66	19.86	551.76	8.65	0.0157	1.2066	322.94	0.0008	0.0465	389.662	16.026	24.3141	OUT
19	INFY	11.48	0.58	19.79	531.6	6.66	0.0125	1.2191	322.94	0.0006	0.0472	393.707	16.231	24.2572	OUT
20	KOTAKBANK	19.77	1.01	19.57	40.49	19.97	0.4932	1.7123	322.94	0.0252	0.0724	552.965	24.367	22.6935	OUT
21	LUPIN	9.89	0.52	19.02	2135.44	5.14	0.0024	1.7147	322.94	0.0001	0.0725	553.743	24.408	22.6874	OUT
22	TATASTEEL	18.87	1.04	18.14	2230.58	19.62	0.0088	1.7235	322.94	0.0005	0.0730	556.584	24.564	22.6584	OUT
23	RELIANCE	17.78	0.98	18.14	966.15	17.42	0.0180	1.7415	322.94	0.0010	0.0740	562.408	24.885	22.6002	OUT
24	HDFCBANK	18.24	1.08	16.89	262.72	19.70	0.0750	1.8165	322.94	0.0044	0.0784	586.623	26.319	22.2890	OUT
25	SUNPHARMA	7.75	0.46	16.85	1497.51	3.57	0.0024	1.8189	322.94	0.0001	0.0785	587.392	26.365	22.2796	OUT
26	HINDUNILVR	15.9	0.95	16.74	144.52	15.11	0.1045	1.9234	322.94	0.0062	0.0848	621.145	28.381	21.8858	OUT
27	AUROPHARMA	66.25	4.01	16.52	7239.54	265.66	0.0367	1.9601	322.94	0.0022	0.0870	632.995	29.099	21.7535	OUT
28	ADANIPORTS	22.49	1.92	11.71	51.62	43.18	0.8365	2.7966	322.94	0.0714	0.1584	903.139	52.161	17.3144	OUT
29	HDFC	11.13	0.97	11.47	58.24	10.80	0.1854	2.9820	322.94	0.0162	0.1746	963.003	57.378	16.7834	OUT
30	INFRATEL	17.31	1.57	11.03	1158.58	27.18	0.0235	3.0054	322.94	0.0021	0.1767	970.578	58.065	16.7153	OUT
31	POWERGRID	11.04	1.01	10.93	657.96	11.15	0.0169	3.0224	322.94	0.0016	0.1783	976.051	58.566	16.6658	OUT
32	HEROMOTOCO	13.6	1.26	10.79	144.56	17.14	0.1185	3.1409	322.94	0.0110	0.1892	1014.332	62.113	16.3305	OUT
33	WIPRO	7.11	0.68	10.46	261.39	4.83	0.0185	3.1594	322.94	0.0018	0.1910	1020.305	62.684	16.2770	OUT
34	TATAMOTORS	5.4	0.57	9.47	756.34	3.08	0.0041	3.1635	322.94	0.0004	0.1914	1021.620	62.823	16.2620	OUT
35	BOSCHLTD	17.85	2.19	8.15	1009.62	39.09	0.0387	3.2022	322.94	0.0048	0.1962	1034.124	64.357	16.0686	OUT
36	AXISBANK	18.82	2.4	7.84	622.21	45.17	0.0726	3.2748	322.94	0.0093	0.2054	1057.567	67.346	15.7034	OUT
37	GAIL	12.52	1.66	7.54	180.59	20.78	0.1151	3.3899	322.94	0.0153	0.2207	1094.732	72.274	15.1470	OUT
38	ICICIBANK	15.78	2.35	6.71	117.35	37.08	0.3160	3.7059	322.94	0.0471	0.2678	1196.782	87.472	13.6820	OUT
39	SBIN	16.92	2.54	6.66	275.02	42.98	0.1563	3.8622	322.94	0.0235	0.2912	1247.248	95.047	13.1224	OUT
40	BAJAJ-AUTO	5.61	0.88	6.38	9.75	4.94	0.5063	4.3685	322.94	0.0794	0.3706	1410.764	120.697	11.6885	OUT
41	LT	9.48	1.58	6.00	14.35	14.98	1.0438	5.4123	322.94	0.1740	0.5446	1747.846	176.877	9.8817	OUT
42	ITC	1.83	0.36	5.08	7.28	0.66	0.0905	5.5028	322.94	0.0178	0.5624	1777.071	182.626	9.7306	OUT
43	M&M	4.74	0.95	4.99	98.86	4.50	0.0455	5.5483	322.94	0.0091	0.5715	1791.780	185.575	9.6553	OUT
44	DRREDDY	2.78	0.61	4.56	907.92	1.70	0.0019	5.5502	322.94	0.0004	0.5720	1792.383	185.707	9.6517	OUT
45	BHARTIARTL	4.03	0.95	4.24	316.38	3.83	0.0121	5.5623	322.94	0.0029	0.5748	1796.291	186.628	9.6250	OUT
46	CIPLA	4.71	1.37	3.44	289.92	6.45	0.0223	5.5846	322.94	0.0065	0.5813	1803.479	188.719	9.5564	OUT
47	ONGC	2.74	0.87	3.15	523.24	2.38	0.0046	5.5891	322.94	0.0014	0.5827	1804.950	189.186	9.5406	OUT
48	AMBUJACEM	1.65	0.94	1.76	67.24	1.55	0.0231	5.6122	322.94	0.0131	0.5959	1812.399	193.430	9.3698	OUT
49	NTPC	-0.06	0.07	-0.86	190.98	0.00	0.0000	5.6122	322.94	0.0000	0.5959	1812.392	193.438	9.3694	OUT
50	COALINDIA	-2.92	0.9	-3.24	324.11	-2.63	-0.0081	5.6041	322.94	0.0025	0.5984	1809.774	194.245	9.3170	OUT

Calculation of Optimal Portfolio

The proportion to be invested in each security (weight) is calculated using the following equation.

$$X_i = \frac{Z_i}{\sum_{i=1}^{N} Z_i}$$

$$Z_i = \frac{\beta_i}{\sigma_{ei}^2}\left(\frac{R_i - R_f}{\beta_i} - C^*\right)$$

C* is the cut off rate.

The calculation of optimal portfolio is shown in the table below.

TABLE 8 CALCULATION OF OPTIMUM PORTFOLIO

Rank	Name of the security	Beta (βi)	σei²	(Ri-Rf)/βi	C*	βi/σei²	(Ri-Rf)/ βi-C*	Zi	ΣZi	Weight(Xi=Zi/ΣZi)
1	BAJFINANCE	1.48	1158.72	49.97	18.943	0.001277	31.03	0.0396	0.1351	0.293
2	HCLTECH	0.56	1090.33	37.30	19.9442	0.000514	17.36	0.0089	0.1351	0.066
3	VEDL	0.65	5347.43	37.26	20.1998	0.000122	17.06	0.0021	0.1351	0.015
4	ULTRACEMCO	0.33	124.39	34.88	22.2629	0.002653	12.62	0.0335	0.1351	0.248
5	UPL	1.33	779.91	32.25	24.9282	0.001705	7.32	0.0125	0.1351	0.092
6	ZEEL	0.6	125.19	31.57	26.6067	0.004793	4.96	0.0238	0.1351	0.176
7	ASIANPAINT	0.64	75.19	29.17	27.4375	0.008512	1.73	0.0148	0.1351	0.109
Total								**0.1351**		**1.000**

MEASURING RETURN AND RISK OF OPTIMAL PORTFOLIO

The return and risk of optimal portfolio is required for evaluation of portfoliowith other portfolios.

Calculation of Portfolio Alpha in Optimal Portfolio

The portfolio alpha is the weighted average of the specific returns (alpha) of the individual securities. The Portfolio alpha is calculatedusing the equation

Portfolio	Σ wi αi,
=	
Alpha (αp)	

	i=1

Where Wi= weight of security, αi = Alpha of security

TABLE 9: CALCULATION OF ALPHA OF OPTIMAL PORTFOLIO

Rank	Name of the security	Weight(Xi=Zi/ΣZi)	Alpha(α)	Alpha*Weight(α*Xi)
1	BAJFINANCE	0.293	61.36	18.0009
2	HCLTECH	0.066	19.9	1.3133
3	VEDL	0.015	22.1	0.3393
4	ULTRACEMCO	0.248	13.37	3.3122
5	UPL	0.092	32.19	2.9743
6	ZEEL	0.176	17.42	3.0652
7	ASIANPAINT	0.109	16.71	1.8259
Total		**1.000**		**30.8311**

Calculation of Portfolio Beta in Optimal Portfolio

The portfolio beta is the weighted average of the beta coefficient of the individualsecurities. The portfolio beta is calculated using the equation.

$$\text{Portfolio Beta } (\beta_p) = \sum_{i=1}^{n} w_i \beta_i$$

Where

w_i = Proportion of investment in security i.

β_i = beta of individual securities.

Thαe table below shows the calculation of beta of optimal portfolio.

Table 10: Calculation of beta of optimal portfolio

Security	Beta (βi)	Weight (wi)	Beta * Weight (wi βi)
BAJFINANCE	1.48	0.293	0.4342
HCLTECH	0.56	0.066	0.0370
VEDL	0.65	0.015	0.0100
ULTRACEMCO	0.33	0.248	0.0818
UPL	1.33	0.092	0.1229
ZEEL	0.6	0.176	0.1056
ASIANPAINT	0.64	0.109	0.0699
Total		**1.000**	**0.8613**

(Source: Secondary data from the table 2 and table 7)

Calculation of Return of the Optimal Portfolio

The expected return of a portfolio is calculated using the formulae

$$\mathbf{Rp = \alpha p + \beta p * Rm}$$

Where,

α_p = Portfolio alpha

β_p = Portfolio beta

R_m = Market Return

The table below shows the calculation of return of optimal portfolio.

Table 11: calculation of return of optimal portfolio

PORTFOLIO	PORTFOLIO ALPHA(α_p)	PORTFOLIO BETA(β_p)	MARKET RETURN (Rm)	PORTFOLIO RETURN ($\alpha p+\beta p*Rm$) (%)
OPTIMAL PORTFOLIO	30.83	0.86	12.59	**41.67**

Calculation of Residual Variance (Unsystematic Risk)In Optimal Portfolio

Unsystematic risk or Residual variance of a portfolio is given by the equation

$$\text{Unsystematic risk} = \Sigma\, w_i\ \sigma_{ei}^{\ 2}$$

Where

Wi = weight of security i in portfolio

$\sigma_{ei}^{\ 2}$ = residual variance of individual securities.

The table given below shows the calculation of unsystematic risk of optimal portfolio.

Table 12: Calculation of unsystematic risk of optimal portfolio

Security	Residual Variance (σ_{ei}^2)	Weight (wi)	$(Wi)^2$	$\bar{w}*\sigma^2$ $(\%^2)$
BAJFINANCE	1158.72	0.293	0.086063	99.7234
HCLTECH	1090.33	0.066	0.004355	4.7487
VEDL	5347.43	0.015	0.000236	1.2601
ULTRACEMCO	124.39	0.248	0.061374	7.6343
UPL	779.91	0.092	0.008537	6.6583
ZEEL	125.19	0.176	0.030961	3.8760
ASIANPAINT	75.19	0.109	0.011940	0.8978
Total		**1.000**		**124.7985**

Calculation of Systematic Risk of Optimal Portfolio

Systematic risk of a portfolio is calculated using the equation given below.

$$\text{Systematic risk of Portfolio} = \beta_p^2 \sigma_m^2$$

Where,

β_p= Beta of Portfolio

σ_m^2 = Variance of market index.

The table below shows the calculation of systematic risk of optimal portfolio.

Table 13: Calculation of systematic risk of optimal portfolio

Portfolio	Portfolio Beta(βp)	β^2	Variance of Market (σm^2)	Systematic Risk ($\beta p^2 \sigma m^2$)
OPTIMAL PORTFOLIO	0.86	0.74	322.94	239.57

Calculation of Total Risk of Portfolio

The total risk of a portfolio is sum of systematic risk and unsystematic risk of a portfolio.This may be expressed as:

$$\sigma p^2 = \beta p^2 \sigma m^2 + \Sigma^n_{i=1} W_i \sigma ei^2$$

Table 14: Calculation of total risk of optimal portfolio

Portfolio	Unsystematic Risk	Systematic Risk	Total Risk (%)
OPTIMAL PORTFOLIO	124.80	239.57	364.37

CONSTRUCTION OF PORTFOLIO #2

A portfolio is constructed selecting 7 securities in random from remaining NIFTY 50 shares. Microsoft excel solver was used to find out the weight of securities.

The table below represents the securities selected and their proportion (weight) in the portfolio#2.

Table 15: Calculation of Portfolio #2

SL No.	Security	Weight (Wi) Portfolio #2
1	ADANIPORTS	0.10
2	BPCL	0.20
3	CIPLA	0.29
4	ITC	0.05
5	INDUSINBK	0.06
6	LUPIN	0.20
7	TCS	0.10
Total		**1.00**

Calculation of Alpha of Portfolio #2

The table below shows the calculation of alpha of portfolio#2.

Table 16: Calculation of alpha of portfolio #2

SL No.	Security	Weight (Wi)	Alpha (αi)	αi * wi (%)
1	ADANIPORTS	0.10	4.34	0.43
2	BPCL	0.20	28.12	5.62
3	CIPLA	0.29	-6.45	-1.86
4	ITC	0.05	3.37	0.17
5	INDUSINBK	0.06	20.64	1.28
6	LUPIN	0.20	9.42	1.88
7	TCS	0.10	10.85	1.09
TOTAL		**1.00**		**8.62**

Calculation of Portfolio Beta of Portfolio #2

The table below shows the calculation of beta of portfolio#2.

Table 17: Calculation of beta of portfolio #2

Sl No.	Security	Beta (βi)	Weight (wi)	βi * wi
1	ADANIPORTS	1.92	0.10	0.19
2	BPCL	1.81	0.20	0.36
3	CIPLA	1.37	0.29	0.39
4	ITC	0.36	0.05	0.02
5	INDUSINBK	1.11	0.06	0.07
6	LUPIN	0.52	0.20	0.10
7	TCS	0.66	0.10	0.07
Total			**1.00**	**1.21**

Calculation of Return of the Portfolio #2

The table below shows the calculation of return of portfolio#2.

Table 18: Calculation of Return of portfolio #2

Portfolio	Portfolio Alpha (α_p)	Portfolio Beta (β_p)	Market Return (R_m)	Portfolio Return $R_p = \alpha_p + \beta_p * R_m$ (%)
PORTFOLIO #2	8.62	1.21	12.59	23.85

Calculation of Unsystematic Risk in Portfolio #2

The table below shows the calculation of unsystematic risk of portfolio#2.

Table 19 Calculation of unsystematic risk of portfolio #2

Security	Residual Variance (σ^2_{ei})	Weight (w_i)	w_i^2	$w_i^2 * \sigma^2_{ei}$
ADANIPORTS	51.62	0.10	0.010000	0.5162
BPCL	1288.01	0.20	0.040000	51.5204
CIPLA	289.92	0.29	0.082944	24.0471
ITC	7.28	0.05	0.002500	0.0182
INDUSINDBK	260.88	0.06	0.003844	1.0028
LUPIN	2135.44	0.20	0.040000	85.4176
TCS	551.76	0.10	0.010000	5.5176
Total		**1.00**		**168.0399**

Calculation of Systematic Risk in Portfolio #2

The table below shows the calculation of systematic risk of portfolio#2.

Table 20: Calculation of systematic risk of portfolio #2

Portfolio	Portfolio Beta βp	Variance of market σ_m^2	Systematic Risk $(\beta p^2 \sigma_m^2)$
PORTFOLIO #2	1.21	322.94	472.82

Calculation of Total Risk of Portfolio #2

The table below shows the calculation of total risk of portfolio#2.

Table 21: Calculation of total risk of portfolio #2

Portfolio	Unsystematic risk	Systematic risk	Total Risk
PORTFOLIO #2	168.04	472.82	640.86

CONSTRUCTION OF PORTFOLIO # 3.

A portfolio was constructed selecting 7 securities in random from remaining NIFTY 50 shares. Microsoft Excel solver was used to find out the weight of securities in the portfolio.

The table below shows securities selected and their proportion (weight) in the portfolio #3.

Table 22:Calculation of Portfolio #3

Sl No.	Security	Weight (wi)
1	TECHM	0.14
2	WIPRO	0.09
3	KOTAKBANK	0.15
4	GAIL	0.14
5	BOSCHLTD	0.12
6	INFY	0.16
7	DRREDDY	0.20
Total		**1.00**

Calculation of Beta of Portfolio #3

The table below shows the calculation of beta of portfolio#3.

Table 23: Calculation of beta of portfolio #3

Sl No.	Security	Weight (wi)	Beta (βi)	βi * wi
1	TECHM	0.14	1.04	0.15
2	WIPRO	0.09	0.68	0.06
3	KOTAKBANK	0.15	1.01	0.15
4	GAIL	0.14	1.66	0.23
5	BOSCHLTD	0.12	2.19	0.26
6	INFY	0.16	0.58	0.09
7	DRREDDY	0.20	0.61	0.12
Total		**1.00**		**1.07**

Calculation of Unsystematic Risk in Portfolio #3

The table below shows the calculation of beta of portfolio#3.

Table 24: Calculation of unsystematic risk of portfolio #3

Security	Residual Variance (σ_{ei}^2)	Weight (w_i)	$w_i^2 * \sigma_{ei}^2$
TECHM	2224.07	0.14	43.5918
WIPRO	261.39	0.09	2.1173
KOTAKBANK	40.49	0.15	0.9110
GAIL	180.59	0.14	3.5396
BOSCHLTD	1009.62	0.12	14.5385
INFY	531.60	0.16	13.6090
DRREDDY	907.92	0.20	36.3168
Total		**1.00**	**114.6239**

Calculation of Systematic Risk in Portfolio #3

The table shown below calculates the systematic risk of portfolio #3.

Table 25: Calculation of systematic risk of portfolio #3

Portfolio	Portfolio Beta β_p	β_p^2	Variance of market σ_m^2	Systematic Risk $\beta_p^2 \sigma_M^2$
PORTFOLIO #3 (Portfolio with same risk as optimal portfolio)	1.07	1.14	322.94	369.73

Calculation of Total Risk of Portfolio #3

The table below shows the calculation of total risk of portfolio#3.

Table 26: Calculation of total risk of portfolio #3

Portfolio	Unsystematic Risk	Systematic Risk	Total Risk
PORTFOLIO #3	114.62	369.73	484.35

Calculation of Alpha of Portfolio #3

The table below shows the calculation of alpha of portfolio#3.

Table 27: Calculation of alpha of portfolio #3

SL No.	Security	Alpha (α_i)	Weight (w_i)	$\alpha_i * w_i$
1	TECHM	13.72	0.14	1.92
2	WIPRO	4.55	0.09	0.41
3	KOTAKBANK	13.16	0.15	1.97
4	GAIL	-2.33	0.14	-0.33
5	BOSCHLTD	-3.63	0.12	-0.44
6	INFY	10.20	0.16	1.63
7	DRREDDY	1.15	0.20	0.23
Total			**1.00**	**5.40**

Calculation of Return of the Portfolio #3

The table below shows the calculation of return of portfolio#3.

Table 28: Calculation of return of portfolio #3

Portfolio	Portfolio Alpha (αp)	Portfolio Beta (βp)	Market Return (Rm)	Portfolio Return Rp= αp + βp*Rm
PORTFOLIO #3	5.40	1.07	12.59	18.87

CONCLUSION

It is observed from the study that Sharpes single index holds good even now as the optimum portfolio has revealed return (41.67%) much higher that other random portfolios (portfolio 2 is 23.85% and portfolio 3 yielded 18.87%) and also showed minimum risk (364.37) when compared to other set of portfolios 2 and 3 which had 640 and 484 respectively.

REFERENCES

1. Kothari C.R, *Research Methodology: Methods and Techniques*, New Age International Pvt.Ltd., New Delhi, 2004.

2. Gupta K Shashi, Gupta Neeti, *Financial Management*, Kalyani Publishers, Ludhiana, 2013.

3. Dr. Chandra Prasanna, *Investment Analysis and Portfolio Management*, Tata McGraw- Hill Publishing Company Limited, 2004.

4. Pandian Punithavathy, Meera E, Machiraju H.R, *Investment Management*, Vikas Publishing House PVT LTD, New Delhi, 2011.
5. Kevin.S, *Portfolio Management,* Printice Hall of India Pvt. Ltd, New Delhi, 2003

MAGAZINES, JOURNALS & NEWS PAPERS

JOURNALS

1. Chauhan . A. Apurva, *A study on usage of Sharpe's single index model in Portfolio Construction,* Global Journal for Research Analysis, 2014

WEBSITES

1. http://www.nseindia.com
2. http://www.bse.com

3. http://www.investopedia.com
4. http:// www.cochinstockexchange.com
5. http://www.fidelity.com
6. http://www.finance.yahoo.com
7. http://www.satco.in
8. http:// www.onlinetradingconcepts.com
9. http:// www.capitalmarket.com