

**An Analytical Study on Construction of Optimal Portfolio Using Sharpe's Single Index  
Model In Bse Sensex Index Stocks**

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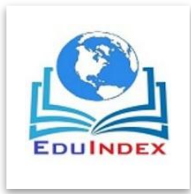
**ABSTRACT**

This study analyzes the construction of optimal portfolio using Sharpe's Single index model in BSE SENSEX index stocks. For analysis, the researcher collected data from the official website of Bombay Stock Exchange. The period of study covers from 1<sup>st</sup> April 2014 to 31<sup>st</sup> March 2019. The collected data has been tested by different statistical tools. The findings of the study reveal that, among the optimum portfolio stocks, the maximum investment should be made in Titan with a proportion of 51.8417% and followed by Hindu with a proportion of 16.7871%, Martui with a proportion of 14.5253% and Indu with a proportion of 14.3647%. Moreover, the companies selected for the investment are steadily growing in the topical years.

**KEY WORDS:**Optimum Portfolio, Cut-off Value, Sharpe's Index Model.

**INTRODUCTION**

Investment is the process of exchanging income during one period of time for an asset that is expected to produce incomes in future periods. Therefore, consumption in the current period is foregone to obtain a greater yield in the future. For an economy as a whole to invest, total production must exceed total consumption. Throughout the history of capitalism, investment has been primarily the function of private business; during the 20<sup>th</sup> century, however, Governments in planned economies and developing countries have become important investors (www.britannica.com). The economic growth of a county can be fortified



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through the use of proper investment. In the modern world, different range of investment opportunities exists namely postal savings, bank deposits, gold, real estate, mutual funds, equity shares, preference shares, bonds and so on. However, investment in the share market i.e., equity share and preference share play a vital role in the mindset of aggressive investors. The primary objective of the investment is to get maximum returns from investment in the future period. Hence, investors are willing to take high-risk security to get maximum return from the investment. The selection of suitable security in share market with the right combination of risk and return is very difficult for the investor. To select the optimum portfolio for the investor Sharpe Single Index model exist. Henceforth, the researcher has taken an attempt to study the construction of an optimal portfolio using Sharpe's single index model in BSE SENSEX index stocks.

## **REVIEW OF LITERATURE**

Saurabh Singh and Jayant Gautam (2014), the study highlighted that the single index model & the construction of an optimal portfolio. From the empirical analysis, it can be concluded that out of 10 companies Federal and Yes bank is selected for investment purpose.

S Poornima and Aruna P Remesh (2017), the study analysed that optimal portfolio using Sharpe's Single Index Model. For this purpose of analysis, the monthly closing prices of 10 companies from the banking sector and 10 companies from IT sector listed in the Bombay stock exchange (BSE) were selected. The empirical findings of the study exposed that Canara Bank has shown the highest return of 17.07 per cent and Jai Balaji Industries has shown the highest negative return of -8.098 per cent. The banking sector and metal sector have been identified as a high return with high-risk portfolios.

Imroz Mahmud (2018), this study applied Sharpe's single-index model of portfolio construction offers better investment alternatives to the investors of the Dhaka Stock Exchange (DSE). The study discovered that three industries occupy a hefty chunk (65.78 per cent) of the proposed investment portfolio. The constructed portfolio offers a monthly return of 2.1489 per cent and carries 1.9516 per cent risk as measured by the standard deviation. The beta of the optimal portfolio is only 0.124003. The constructed portfolio outperforms



every individual stock as well as the market index in terms of offering the optimal risk-return combinations. Therefore, this five-and-a-half-decade-old model offers a great opportunity for Bangladeshi investors to optimize return and efficiently diversify risk.

Madan K. M. And Manoj kumara n. V (2018), the study analyzed the risk and returns of various investment avenues and examined Portfolio by considering both the Sharpe single index model and CAPM approach. The empirical findings of the study found that after considering the calculation of excess return to beta ratio Infosys Ltd stands first by resulting excess return (32.50) and TCS Ltd at least with -24.258. Under cutoff point can make out investment proportion on 4 companies which are Infosys Ltd (34 per cent), Tech Mahindra (32 per cent), BPCL (29 per cent) and Dalmia Bharat Ltd (5 per cent).

Navya V and Sibin Mohamed Sadique (2019), the study examined that Optimal Portfolio Construction from Selected Stocks of BSE Sensex using Sharpe's Single Index Model. The results of the study exposed that, when comparing the cut-off values and excess return to beta, it is found that HUL, Kotak bank, HDFC bank, Reliance Industries, Maruti Suzuki and Asian paints have excess return to beta values higher than the cut off values. The optimal portfolio must contain the stocks of HUL, Kotak bank, HDFC bank, Reliance Industries, Maruti Suzuki and Asian paints.

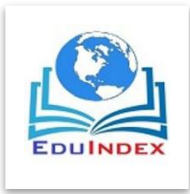
### **OBJECTIVES OF THE STUDY**

The overall objective of the study is to construct an optimal portfolio using Sharpe's Singleindex model by using the BSE SENSEX stocks. The following are the more specific objective they are;

1. to calculate the risk and return of the constructed optimal portfolio by using Sharpe's Single Index Model.
2. to compute the proportion of investment to be made into each of the stock of the optimal portfolio stock.

### **METHODOLOGY OF THE STUDY**

To analyse the optimum portfolio construction inequity stocks, the researcher has chosen the BSE SENSEX Index. It represents the 30 most liquid and financially sound



companies which trade on the Bombay Stock Exchange (BSE). It is the benchmark index of BSE and key sectors of the Indian economy constitute the SENSEX. The researcher has selected all the stocks in BSE SENSEX index. The data collected for this study are daily open, high, low and closing prices of selected stocks and SENSEX index. Instead of using the closing price itself, the researcher used the average of these four prices. According to Shilpa Lodha *et al.*, majority of prior researchers have used only closing prices as if trading is done only at the closing price, rather the average of these four prices can yield better results as it can control volatility up to some extent. All the data have been collected from the official website of Bombay Stock Exchange i.e., [www.bseindia.com](http://www.bseindia.com). The sample included for the study from 1<sup>st</sup> April 2014 to 31<sup>st</sup> March 2019.

## TOOLS USED FOR THE STUDY

### RETURN

The daily returns are calculated as follow;

$$R_t = \text{LN} (P_t / P_{t-1}) * 100$$

Where:  $R_t$  = Return of the day 't'; LN = Natural Logarithm;  $P_t$  = closing price of the day and

$P_{t-1}$  = closing price of the day ( $t-1$ )

### RISK-FREE RATE OF RETURN (RF)

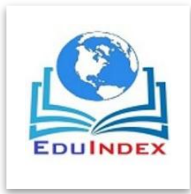
The Risk-free rate of return is the required return on a risk-free asset. This study used 91 days Treasury bills for risk-free rate of return.

### BETA

A beta coefficient is a measure of the volatility or systematic risk of an individual stock in comparison to the unsystematic risk of the entire market. If the beta value shows 1, the security's price moves with the market. If the beta value is less than 1, means that the security is theoretically less volatile than the market. If the beta value more than 1 means that the security's price is theoretically more volatile than the market.

$$\beta = \frac{\text{Covariance} (R_e, R_m)}{\text{Variance} (R_m)}$$

Here: Covariance = measure of a stock's return relative to that of the market



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Variance = Measure of how the market moves relative to its mean

$R_e$  = Stock return and  $R_m$  = market return

### EXCESS RETURN TO BETA RATIO

The excess return to beta ratio is calculated as follow;

$$= (R_n - R_f) / \beta$$

Where,  $R_i$  = the expected return on the stock,

$R_f$  = the return on a riskless asset,

$\beta_i$  = systematic risk of an individual stock in comparison to the unsystematic risk of the entire market.

### CUT-OFF POINT

The Cut-off Point is calculated as follow;

$$C_i = (\sigma^2_m * \sum ((R_n - R_f) \beta_i) / \sigma^2_{e_i}) / (1 + \sigma^2_m * \sum \beta_i^2 / \sigma^2_{e_i})$$

Where  $e$  = security variance

$m$  = market variance

### THE PROPORTION OF INVESTMENT OF EACH STOCK

$$W_i = Z_i / \sum Z_i$$

Where  $Z_i = \beta_i^2 / \sigma^2_{e_i} (R_n - R_f / \beta - C)$

### DATA ANALYSIS AND INTERPRETATION

TABLE 1.1

#### EXCESS RETURN TO BETA RATIO OF BSE SENSEX INDEX STOCKS

Security Name	Return	Beta	RF	$(R_n - R_f) / \beta$	Rank
HINDUNILVR	103.73	0.58	5.03	170.5420	1
TITAN	145.16	0.87	5.03	161.8105	2
HDFCBANK	113.23	0.80	5.03	134.7633	3
ASIANPAINT	-101.69	-0.82	5.03	130.0327	4
NESTLEIND	80.15	0.60	5.03	125.8998	5
INDUSINDBK	128.00	1.04	5.03	117.8466	6
MARUTI	122.80	1.02	5.03	115.5018	7
POWERGRID	61.90	0.70	5.03	81.7477	8
HDFC	79.45	1.10	5.03	67.9388	9
ULTRACEMCO	60.82	1.07	5.03	52.1565	10
KOTAKBANK	55.75	1.04	5.03	48.7923	11



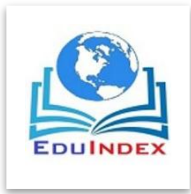
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BAJFINANCE	52.90	1.17	5.03	40.8137	12
BAJAJ-AUTO	34.82	0.85	5.03	35.0711	13
RELIANCE	37.57	1.13	5.03	28.8269	14
TATASTEEL	26.47	1.48	5.03	14.5011	15
NTPC	11.83	0.81	5.03	8.4312	16
HEROMOTOCO	12.02	0.92	5.03	7.6399	17
LT	8.92	1.20	5.03	3.2449	18
BHARTIARTL	4.82	0.86	5.03	-0.2349	19
TCS	-7.30	0.48	5.03	-25.8188	20
ITC	-16.02	0.76	5.03	-27.6458	21
SUNPHARMA	-18.23	0.81	5.03	-28.6770	22
M&M	-39.89	1.00	5.03	-44.6991	23
AXISBANK	-63.63	1.45	5.03	-47.3758	24
HCLTECH	-26.42	0.58	5.03	-53.8634	25
ONGC	-71.49	1.11	5.03	-68.9400	26
ICICIBANK	-113.01	1.43	5.03	-82.8144	27
SBIN	-178.43	1.64	5.03	-112.1451	28
TECHM	-84.73	0.70	5.03	-127.3883	29
INFY	-149.08	0.81	5.03	-189.8158	30

**Source: Compiled from secondary data**

The table 1.1 exhibits the excess return to beta ratio for BSE SENSEX stocks. The researcher ranked each stock based on excess return to beta ratio. It is clear that, Hindunilvrstocks yielded the maximum excess return to beta ratio (170.5420) and followed by Titan (161.8105) HDFC Bank (134.7633) and so on. The lowest excess return to beta ratio are Infosys (-189.8158), TECHM (-127.3883), SBI (-112.1451) and so on.

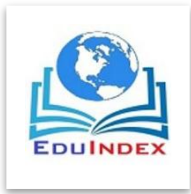


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**TABLE 1.2**  
**CUT-OFF VALUE OF BSE SENSEX INDEX STOCKS**

Security	$(R_n - R_f)/\beta$	$((R_n - R_f)/\beta)/\sigma^2 e_i$	$\sum((R_n - R_f)/\beta)/\sigma^2 e_i$	$\sigma^2 m \sum((R_n - R_f)/\beta)/\sigma^2 e_i$	$\beta^2/\sigma^2 e_i$	$\sum \beta^2/\sigma^2 e_i$	$1 + \sum \beta^2/\sigma^2 e_i$	$C_i$
HINDU	170.5420	177.3140	177.3140	85.3086	0.3483	0.3483	1.3483	63.2729
TITAN	161.8105	68.9823	246.2963	118.4971	0.3198	0.6680	1.6680	71.0401
HDFC BAN	134.7633	207.0483	453.3446	218.1114	0.9905	1.6585	2.6585	82.0433
ASIAN	130.0327	99.0145	552.3591	265.7489	0.5129	2.1714	3.1714	83.7961
NSE	125.8998	92.0785	644.4376	310.0493	0.2604	2.4318	3.4318	90.3458
INDU	117.8466	83.0113	727.4488	349.9874	0.7670	3.1988	4.1988	83.3544
MARTI	115.5018	83.6412	811.0900	390.2285	0.7529	3.9517	4.9517	78.8076
POWER	81.7477	74.2223	885.3123	425.9380	0.4394	4.3911	5.3911	79.0076
HDFC	67.9388	51.8528	937.1651	450.8852	0.9160	5.3071	6.3071	71.4884
ULTRA	52.1565	32.1378	969.3029	466.3473	0.7051	6.0122	7.0122	66.5053
KOTAK	48.7923	8.8968	978.1997	470.6276	0.1971	6.2092	7.2092	65.2812
BAJU	40.8137	0.8882	979.0879	471.0550	0.0299	6.2392	7.2392	65.0701
BAJAJ	35.0711	27.0067	1006.0947	484.0484	0.5556	6.7948	7.7948	62.0991
RELIANCE	28.8269	5.3761	1011.4708	486.6349	0.2377	7.0325	8.0325	60.5831
TATA	14.5011	4.9365	1016.4073	489.0099	0.7445	7.7771	8.7771	55.7146
NTPC	8.4312	5.3090	1021.7163	491.5642	0.4098	8.1869	9.1869	53.5072
HERO	7.6399	5.0773	1026.7936	494.0070	0.5571	8.7439	9.7439	50.6989
L&t	3.2449	1.1341	1027.9276	494.5526	0.5044	9.2484	10.2484	48.2567
BHARTIAIR	-0.2349	-0.1125	1027.8152	494.4985	0.3563	9.6047	10.6047	46.6301
TCS	-25.8188	-4.9516	1022.8636	492.1162	0.0437	9.6484	10.6484	46.2149
ITC	-27.6458	-10.3758	1012.4877	487.1242	0.2175	9.8659	10.8659	44.8306
SUNPHAR	-28.6770	-10.5133	1001.9745	482.0661	0.2412	10.1071	11.1071	43.4017
MM	-44.6991	-7.8591	994.1153	478.2849	0.1775	10.2846	11.2846	42.3839
AXIX	-47.3758	-2.0433	992.0720	477.3019	0.0906	10.3752	11.3752	41.9600
HCL	-53.8634	-9.1590	982.9130	472.8953	0.0580	10.4331	11.4331	41.3619
OIL	-68.9400	-19.0023	963.9107	463.7530	0.3395	10.7726	11.7726	39.3924
ICICIC	-82.8144	-3.5818	960.3288	462.0297	0.0879	10.8605	11.8605	38.9553
SBI	-112.1451	-2.4598	957.8691	460.8463	0.0587	10.9192	11.9192	38.6642
TECH	-127.3883	-7.0393	950.8298	457.4596	0.0274	10.9466	11.9466	38.2919
INFOSYS	-189.8158	-14.2420	936.5878	450.6075	0.0495	10.9961	11.9961	37.5629

Source: Compiled from secondary data



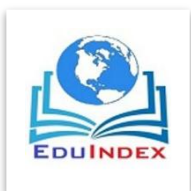
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The table 1.2 displays the Cut-Off value of BSE SENSEX stocks. To construct an optimal portfolio, the selection of the securities depends upon on a unique cut-off value. Hence, the securities with higher ratios of excess return to beta ratio are considered for optimal portfolio. The lower rates of securities of the beta ratio are left out. ANestleind stock reveals the highest cumulated value of Ci is 90.3458. Moreover, the cumulated values start to decline after Nestleindstock but the excess returns to beta ratio are higher than Ci value up to Maruti stock.

**TABLE 1.3**  
**COMPARISON BETWEEN EXCESS RETURN TO BETA VALUES AND Ci**  
**VALUES OF BSE SENSEX INDEX STOCKS**

Security	$(R_n - R_f)/\beta$	Ci
HINDUNILVR	170.5420	63.2729
TITAN	161.8105	71.0401
HDFCBANK	134.7633	82.0433
ASIANPAINT	130.0327	83.7961
NESTLEIND	125.8998	90.3458
INDUSINDBK	117.8466	83.3544
MARUTI	115.5018	78.8076
POWERGRID	81.7477	79.0076
HDFC	67.9388	71.4884
ULTRACEMCO	52.1565	66.5053
KOTAKBANK	48.7923	65.2812
BAJFINANCE	40.8137	65.0701
BAJAJ-AUTO	35.0711	62.0991
RELIANCE	28.8269	60.5831
TATASTEEL	14.5011	55.7146
NTPC	8.4312	53.5072
HEROMOTOCO	7.6399	50.6989
LT	3.2449	48.2567
BHARTIARTL	-0.2349	46.6301
TCS	-25.8188	46.2149
ITC	-27.6458	44.8306
SUNPHARMA	-28.6770	43.4017
M&M	-44.6991	42.3839
AXISBANK	-47.3758	41.9600



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HCLTECH	-53.8634	41.3619
ONGC	-68.9400	39.3924
ICICIBANK	-82.8144	38.9553
SBIN	-112.1451	38.6642
TECHM	-127.3883	38.2919
INFY	-189.8158	37.5629

Source: Compiled from secondary data

The table 1.3 shows the comparison between the excess return to beta values and  $C_i$  values of BSE SENSEX index stocks. It is clear that Hindunilvr, Titan, HDFC Bank, Asianpaint, Nestleind, Indusindbk, Martiand Powergrid gives positive results and rest of the stocks  $C_i$  values are start to decline. Hence, only these stocks are considered for the optimal portfolio construction for the study.

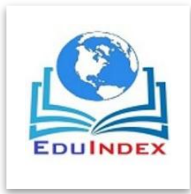
TABLE 1.4

**ZI VALUES AND PROPORTION OF INVESTMENT OF OPTIMAL PORTFOLIO**

Security	$\beta * \sigma_{2ei}$	$(R_n - R_f) / \beta / C_i$	$(R_n - R_f) / \beta / - C_i$	$Z_i$	$X_i$	$X_i (\%)$
HINDUNILVR	0.5567	170.5420	107.2691	59.7120	0.1679	16.7871
TITAN	2.0315	161.8105	90.7704	184.4020	0.5184	51.8417
HDFCBANK	0.5226	134.7633	52.7200	27.5514	0.0775	7.7456
ASIANPAINT	-1.0778	130.0327	46.2367	-49.8342	-0.1401	-14.0101
NESTLEIND	0.8159	125.8998	35.5540	29.0092	0.0816	8.1555
INDUSINDBK	1.4814	117.8466	34.4922	51.0956	0.1436	14.3647
MARUTI	1.4080	115.5018	36.6942	51.6668	0.1453	14.5253
POWERGRID	0.7662	81.7477	2.7401	2.0996	0.0059	0.5903
Total				355.7023	1	100

Source: Compiled from secondary data

The table 1.4 displays the  $Z_i$  values and proportion of investment of optimal portfolio stocks. After identification of optimal portfolio stocks, the proportion of investment to be made in each stock is to be identified. Hence, the researcher calculated the  $Z_i$  and  $X_i$  values. The proportion of investment in each stock indicates the weights on each security and they sum up to 100 per cent. Through the Sharpe Single index model, we can able to find out the proportion of investments to be made for an optimal portfolio. Among the optimum



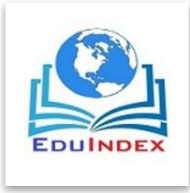
portfolio stocks, the maximum investment should be made in Titan with a proportion of 51.8417% and followed by Hindunilvr with a proportion of 16.7871%, Martui with a proportion of 14.5253% and Indusindbk with a proportion of 14.3647%. Moreover, the companies selected for the investment are steadily growing in the topical years.

### **MAJOR FINDINGS OF THE STUDY**

- It is found out that in excess return to beta ratio, Hindunilvr stocks yielded the maximum excess return to the beta ratio (170.5420) and followed by Titan (161.8105) HDFC Bank (134.7633) and so on. The lowest excess return to beta ratio is Infosys (-189.8158), Techm(-127.3883), SBI (-112.1451) and so on.
- The securities with higher ratios of excess return to beta ratio are considered for the optimal portfolio. The lower rates of securities of the beta ratio are left out. A Nestleind stock reveals the highest cumulated value of  $C_i$  is 90.3458. Moreover, the cumulated values start to decline after Nestleind stock but the excess returns to beta ratio are higher than  $C_i$  value up to Marti stock.
- It is found out that, Hindunilvr, Titan, HDFC Bank, Asian, Nestleind, Indusindbk, Marti and Powergrid gives positive results and rest of the stocks  $C_i$  values are starting to decline. Hence, only these stocks are considered for the optimal portfolio construction for the study.
- It is found out that, among the optimum portfolio stocks, the maximum investment should be made in Titan with a proportion of 51.8417% and followed by Hindunilvr with a proportion of 16.7871%, Martui with a proportion of 14.5253% and Indusindbk with a proportion of 14.3647%. Moreover, the companies selected for the investment are steadily growing in the topical years.

### **CONCLUSION**

This researcher has taken an attempt to study the construct an optimal portfolio using Sharpe's Single index model by using the BSE SENSEX stocks. The data collected for this study are daily open, high, low and closing prices of selected stocks and SENSEX index. It is found out that in excess return to beta ratio, Hindunilvr stocks yielded the maximum excess



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### References

1. www.britannica.com, accessed on 01<sup>st</sup>December 2019.
2. *Risk governance & control: financial markets & institutions*, 4 (2) 110-115.
3. *International Journal of Management, IT & Engineering*, 7 (12) 283-298.
4. JEMA, 16 (1) 61-92
5. *International journal for innovative research In Multidisciplinary field*, 4 (6) 301-307.
6. *Journal of the Gujarat research study society*, 21 (5) 362-376.
7. [www.bseindia.com](http://www.bseindia.com)
8. www.rbi.org.in