Research Paper ICI Value : 61.33| SJIF Impact Factor(2019) : 8.045|ISI Value:1.433

Volume - 7, Issue- 9,September 2019 |e-ISSN : 2347 - 9671| p- ISSN : 2349 - 0187

EPRA International Journal of Economic and Business Review -Peer Reviewed Journal

IMPACT OF DEMONETIZATION ON INDIAN STOCK MARKET-USING SHARPE'S SINGLE INDEX MODEL

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ABSTRACT

Demonetization has affected the Indian stock market. Investors in stock market face two types of risk: systematic and unsystematic risk. The risk faced by investors due to demonetization represents systematic risk spread across the Indian stock market. The effect is experienced by the Indian investors on the changes in stock prices immediately on certain stocks and on the returns in the medium term and long term. This research paper is an attempt to measure the returns of selected stocks in NSE using Holding Period of Return and CAPM Model in the pre and post demonetization. The impact of demonetization on stock prices of selected sectors in NSE is studied applying Sharpe's Single Index Model in portfolio construction with demonetization as key factor. The study uses stock prices of five selected sectors, Information Technology, Real Estate, Automobiles, FMCG and Banking sectors. Five companies from each sector were considered for this study. Sharpe's Single Index Model was applied for an optimal portfolio construction to analyse the impact of demonetization during the pre and post demonetization period.

KEYWORDS: *Demonetization, CAPM Model, Sharpe's single index model, systematic risk and unsystematic risk, NSE.*

INTRODUCTION

The effect of demonetization is experienced by the Indian investors on the changes in stock prices immediately on certain stocks and on the returns in the medium term and long term. This research paper is an attempt to measure the returns of selected stocks in NSE using Holding Period of Return and CAPM Model in the pre and post demonetization. The impact of demonetization on stock prices of selected sectors in NSE is studied applying Sharpe's Single Index Model in portfolio construction with demonetization as key factor. The study uses stock prices of five selected sectors, Information Technology, Real Estate, Automobiles, FMCG and Banking sectors. Five companies from each sector were considered for this study. The investors' dilemma in selecting stocks and the proportion of investment to be made in each security in the post demonetization period has affected many sectors of the economy. The Sharpe's Single Index Model helps an investor in deciding about an optimal portfolio that suits his needs.

OBJECTIVES

- To measure the Holding period returns of the selected stocks during pre and post demonetization period;
- To find the expected returns of the selected stocks during pre and post demonetization period, using CAPM Model; and
- To construct an optimal portfolio to study the impact of demonetization on stock prices of selected sectors in NSE for both the periods.

SCOPE OF THE STUDY

The study is limited to know the impact of demonetization on the selected stocks of NSE for constructing an optimal portfolio. The scope of the present study is limited to find out the returns during the pre and post demonetization considering the stock prices of selected sectors. The stock prices considered for the study is from 15th March 2014 to 15th June 2019 on daily basis.

METHODOLOGY

This study is empirical in nature and the data considered in this study was collected from secondary sources. NSE Nifty is considered for the study and so data from NSE website has been used. Holding Period of Return and CAPM Model were used for determining the returns of the stocks for the period from 15th March 2014 to 15th June 2019 on daily basis. Stock returns for the study period during pre and post demonetization period have been calculated. SIM is used for

Optimal portfolio construction for both pre and post demonetization periods to know the changes in selection of stocks that have been included in the portfolio.

Methods and tools for analysis

Holding Period Return (HPR)

Holding Period Return = (End of Period Value – Initial Value) / Initial Value * 100

Capital Asset Pricing Model (CAPM)

$$E(R)= R_f + \beta (R_m - R_p)$$

Sharpe's Single Index Model (SIM)

- Cut off rate (Ci) is calculated as under:

$$Ci= \frac{(\sigma^2 m\Sigma (Ri-Rf)\ \beta/\sigma^ei)}{1+ \sigma^2 m\Sigma\ \beta i^2/\sigma^ei}$$

- The proportion of each stock to be invested in portfolio is calculated as under: Wi=Zi/ΣZi

Where $Zi= \beta i^2/\sigma^2 ei\{((R_i-R_f/\beta)-C^*)\}$

DATA ANALYSIS AND INTERPRETATION

The study covers a period of sixty-three months' time period on daily basis. Five sectors and five companies' stocks in each sector, namely, Automobiles(Bajaj Auto Ltd, Hero Moto Corp Ltd, Mahindra and Mahindra Ltd, Maruti Suzuki India Ltd and Tata Motors Ltd), Banking(Axis Bank Ltd, HDFC Bank Ltd, ICICI Bank Ltd, Kotak Mahindra Bank Ltd and State Bank of India Ltd), FMCG (Britannia Industries Ltd, Colgate-Palmolive Ltd, Hindustan Unilever Ltd, ITC Ltd, Nestle India Ltd, Information Technology (HCL Technologies Ltd, Infosys Ltd, Tech Mahindra Ltd, Tata Consultancy Services Ltd and Wipro Ltd), Real Estate (Ansal Properties and Infrastructure Ltd, Brigade Enterprises Ltd, Godrej Industries Ltd, Kolte Patil Developers Ltd and Puravankara Ltd) have been considered for the study. Applying SIM helps investors to know whether the selection of stocks differ due to impact of demonetization on stock prices during the pre and post demonetization period. The returns from selected stocks during pre and post demonetization were calculated using Holding Period Return (HPR), the expected returns of the selected stocks were calculated using CAPM Model. The study period covered from 15th March 2014 to 15th June 2019, taken as 2 equal parts for pre(from 15th March 2014 to 7th November 2016) and post (from 8th November 2016 to 15th June 2019) demonetization Period. MS Excel is used in the analysis. The results are tabulated below:

Table-1: Stock Returns: Pre and Post demonetization Period

			Pre Demonetization		Post Demonetization	
SL.NO	Industry	Stock	Mean Returns (%)	CAPM Returns (%)	Mean Returns (%)	CAPM Returns (%)
1	Automobiles	Bajaj Auto	19.013	10.902	-2.522	19.626
2	Automobiles	Hero Moto	36.160	10.386	-8.555	10.571
3	Automobiles	M and M	25.112	9.762	-24.205	21.051
4	Automobiles	Maruti	95.6	6.448	14.79	16.677
5	Automobiles	Tata Motors	49.37	12.697	-51.84	28.554
6	Banking	Axis	-2.60	7.107	39.53	21.959
7	Banking	HDFC	37.057	10.257	48.288	17.837
8	Banking	ICICI	-27.615	11.515	33.846	24.055
9	Banking	Kotak	19.361	9.031	44.341	8.728
10	Banking	SBI	-19.526	11.364	28.488	27.925
11	FMCG	Britannia	126.30	7.604	9.074	15.909
12	FMCG	Colgate	-1.349	9.235	12.922	8.228
13	FMCG	HUL	31.475	7.984	59.5	16.859
14	FMCG	ITC	-7.885	8.199	8.915	9.272
15	FMCG	Nestle	26.212	8.719	43.292	15.476
16	IT	HCL	-15.255	7.979	22.538	13.505
17	IT	Infosys	-35.484	9.074	-1.808	16.943
18	IT	TCS	8.479	8.429	15.674	10.082
19	IT	TechMahindra	-31.60	10.063	41.113	15.084
20	IT	Wipro	8.995	8.126	-6.462	12.262
21	Real Estate	Ansal	20.983	11.719	-32.098	26.221
22	Real Estate	Brigade	106.60	12.439	-25.386	19.542
23	Real Estate	Godrej	59.504	9.230	89.305	23.147
24	Real Estate	Kolte Patil	39.222	10.117	64.224	28.960
25	Real Estate	Puravankara Ltd	7.063	11.278	59.504	31.614

Table 1 shows that during the pre-demonetization period the realized mean return of Britannia Industries Ltd had the highest mean return (126.30) while Infosys Ltd had the lowest (-35.484) among the selected stocks. Tata Motors Ltd had the highest expected return (12.697) as per CAPM model whereas Axis Bank Ltd had the lowest expected return (7.107). But, during the post demonetization period, Godrej Industries Ltd has the highest realized mean return (89.305) whereas Tata Motors Ltd has lowest realized return (- 51.84). Puravankara Ltd has the highest return (31.614) as per the CAPM Model while Colgate- Palmolive Ltd has the lowest return (8.228).

Construction of Optimal Portfolio Using Sharpe's Single Index Model

Table-2: Pre demonetization: Post demonetization: Mean Return, Sensitivity Index and Excess Return to Beta Ratio

Sl No	Security Name	Ri	B	σ^2ei	(Ri-Rf/β)	Rank
1	Bajaj Auto	19.013	0.3184	2.3012	36.21	14
2	Hero Moto	36.160	0.2702	2.4660	106.14	10
3	M &M	25.112	0.2120	2.8806	83.16	12
4	Maruti	95.6	0.3867	2.2590	227.88	05
5	Tata Motors	49.37	0.485	5.6539	86.37	11
6	Axis	-2.60	-0.035	13.2889	288	04
7	HDFC	37.057	0.2580	1.2017	114.65	09
8	ICICI	-27.615	0.3750	13.7468	-93.6	20
9	Kotak	19.361	0.144	6.2418	82.5	13
10	SBI	-19.526	0.361	16.8758	-74.82	19
11	Britannia	126.30	0.0113	3.5799	10515.4	01
12	Colgate	-1.349	0.0163	6.0898	-467.18	24
13	HUL	31.475	0.0466	2.1581	515.02	02
14	ITC	-7.885	0.0666	4.0361	-230.78	23
15	Nestle	26.212	0.115	2.6114	162.89	07
16	HCL	-15.255	0.0461	7.2881	-493.17	25
17	Infy	-35.484	0.148	10.4208	-290.27	22
18	TCS	8.479	0.088	1.9732	11.35	17
19	TechMahendra	-31.60	0.240	11.6995	-162.83	21
20	Wipro	8.995	0.0598	2.0269	25.33	16
21	Ansal	20.983	0.394	10.4640	34.27	15
22	Brigade	106.60	0.461	6.7238	215.01	06
23	Godrej	59.504	0.169	3.9150	309.61	03
24	Kolte Patil	39.222	0.245	8.6874	129.56	08
25	Puravankara	7.063	0.353	6.4908	-1.18	18

R_f is the risk free rate of return of 5 years bond yield (7.48%). Table 2 shows that Rm (18.234) is the market return (Nifty 50) and $\sigma^2$is the Market variance(0.8761%). Britannia Industries Ltd (105.1504) ranks first based on excess return to beta ratio among 25 companies while HCL Ltd (-4.9317) ranks last. Stocks with negative returns are ignored while constructing a portfolio

Table-3 : C_i of Selected Stocks : Post Demonetisation Period

Rank	Security Name	$(Ri-Rf)\beta/\sigma^2_{ei}$	$Б_m^2*\Sigma(R_i-Rf)\beta/\sigma^2_{ei}$	β^2/σ^2_{ei}	$\Sigma\beta^2/\sigma^2_{ei}$	$1+\sigma_m^2*\Sigma\beta^2/\sigma^2_{ei}$	Ci
1	Britannia	0.3751	0.0033	0.0036	0.0036	1.00003	0.00329
2	HUL	0.5182	0.0078	0.1006	0.1042	1.00091	0.00782
3	Godrej	2.2587	0.0276	0.7295	0.8337	1.00730	0.02741
4	Maruti	15.0846	0.1598	6.6196	7.4534	1.06530	0.14998
5	Brigade	6.7959	0.2193	3.1607	10.6141	1.09299	0.020065
6	Nestle	0.8249	0.2265	0.5064	11.1205	1.09743	0.20643
7	Kolte Patil	0.8952	0.2344	0.6909	11.8115	1.10348	0.21240
8	HDFC	6.3508	0.2900	5.5392	17.3507	1.15201	0.25175
9	Hero Moto	3.1424	0.3176	2.9605	20.3112	1.17795	0.26958
10	Tata Motors	3.5934	0.3490	4.1604	24.4716	1.21440	0.28741
11	M&M	1.2975	0.3604	1.5602	26.0318	1.22807	0.29347
12	Kotak	0.2741	0.3628	0.3322	26.3640	1.23096	0.29473
13	Bajaj	1.5953	0.3768	4.4055	30.7695	1.26957	0.29677
14	Ansal	0.5084	0.3812	1.4835	32.2531	1.28257	**0.29724**
15	Wipro	0.0447	0.3816	0.1764	32.4295	1.28412	0.29719
16	TCS	0.0446	0.3820	0.3925	32.8220	1.28755	0.29670
17	Puravankara	-0.0227	0.3818	1.9198	34.7417	1.30437	0.29272

Among 25 companies, 17 are selected companies for construction of optimal portfolio. Table 3 shows that the Britannia Industries Ltd (10515.4) ranks first rank and Puravankara Ltd. (-1.190) ranks last as per the excess return to beta ratio value. Ci indicates the cut-off rate. Ci values show the values in increasing order and at the point 0.29724 (Ansal properties and Infrastructure Ltd.) C_i is the highest and after this point the values are gradually decreasing. Thus, to construct the optimal portfolio only 14 stocks, from Britannia Industries Ltd., to Ansal properties and Infrastructure Ltd., could be included.

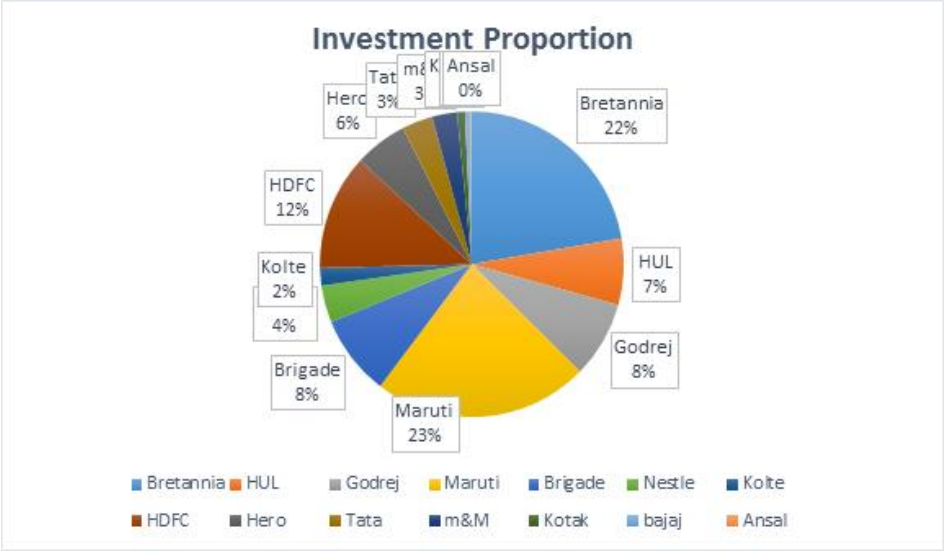
The next step is to know the proportion of investment to be made in each of the selected stocks and the same is presented below.

Table-4: Investment Proportion of Selected Stocks

Sl No	Security Name	$\beta/6^2_{ei}$	(Ri-Rf/β)	Zi	Investment proportion (Xi)
1	Britannia	0.3157	105.1504	33.0972	**0.2226**
2	HUL	2.1593	5.1502	10.4792	**0.0705**
3	Godrej	4.3168	3.0961	12.0821	**0.0813**
4	Maruti	17.1183	2.2788	33.9210	**0.2282**
5	Brigade	6.8562	2.1501	12.7040	**0.0855**
6	Nestle	4.4037	1.6289	5.8643	**0.0395**
7	Kolte Patil	2.8202	1.2956	2.8156	**0.0189**
8	HDFC	21.4699	1.1465	18.2346	**0.1227**
9	Hero Moto	10.9596	1.0614	8.3736	**0.0563**
10	Tata Motors	8.5781	0.8637	4.8596	**0.0327**
11	M&M	7.3595	0.8316	3.9330	**0.0265**
12	Kotak	2.3070	0.8250	1.2176	**0.0082**
13	Bajaj	13.8364	0.3621	0.8983	**0.0060**
14	Ansal	3.7653	0.3427	0.1714	**0.0012**

Table 4 and Pie chart 1 describes the allocation of funds for various stocks to get the maximum benefits of the optimal portfolio.

Chart-1



While the investor can invest 23% of his investment in Maruti Suzuki Ltd, 22% in Britannia Ltd., he can invest 12% in HDFC Ltd and less than 10% in the other companies' stocks. namely, HUL, Godrej, Brigade, Nestle, Kolte, Hero Moto corpo, Tata Motors, Mahindra and Mahindra, Kotak, Bajaj and Ansal .

The analysis of stocks to be included in portfolio construction during the post demonetization period is made and the results are tabulated below.

Table-5: Post demonetization: Mean Return, Sensitivity Index and Excess Return to Beta Ratio

Sl No	Security Name	Ri	β	σ^2ei	(Ri-Rf/β)	Rank
1	Bajaj Auto	-2.522	0.869	1.525	-11.51	19
2	Hero Moto	-8.555	0.221	2.310	-72.58	25
3	M &M	-24.205	0.971	5.926	-32.64	22
4	Maruti	14.790	0.658	1.924	11.11	18
5	Tata Motors	-51.840	1.508	3.594	-39.34	23
6	Axis	39.530	1.036	2.468	30.94	13
7	HDFC	48.288	0.741	0.619	55.07	09
8	ICICI	33.846	1.186	2.725	22.23	15
9	Kotak	44.341	0.0891	1.812	413.69	01
10	SBI	28.488	1.463	3.202	14.36	16
11	Britannia	80.93	0.603	5.293	121.81	02
12	Colgate	12.922	0.0533	1.421	102.06	03
13	HUL	59.500	0.671	1.194	77.53	04
14	ITC	8.915	0.128	2.051	11.21	17
15	Nestle	43.292	0.572	2.452	62.60	07
16	HCL	22.538	0.431	2.179	34.94	12
17	Infy	-1.808	0.677	5.448	-13.72	20
18	TCS	15.674	0.186	1.959	44.03	10
19	TechMahendra	41.113	0.544	2.955	61.86	08
20	Wipro	-6.462	0.342	6.576	-40.76	24
21	Ansal	-32.098	1.341	13.149	-29.51	21
22	Brigade	69.700	0.863	4.605	72.10	06
23	Godrej	89.305	1.121	5.084	72.99	05
24	Kolte Patil	64.224	1.537	7.448	36.90	11
25	Puravankara	59.504	1.727	4.972	30.12	14

Rf is the risk free rate of return of 5 years bond yield (7.48%), Rm (21.456%) is the market return (Nifty 50) and σ^2 is the Market variance (0.5457%). Table 5 shows that Godrej Industries Ltd., (89.305) ranks first based on excess return to beta ratio among 25 companies and Tata Motors Ltd (-51.84) ranks last. In the above table, Bajaj Auto Ltd., Hero Moto Corpo Ltd., M&M Ltd., Tata Motors Ltd., Infosys Ltd. Companies with negative returns are ignored for selection of portfolio.

Table-6 : C_i of Stocks: Post Demonetisation Period

Rank	Security Name	$(Ri-Rf)\beta/\sigma^2_{ei}$	$E_m^2*\Sigma(R_i-Rf)\beta/\sigma^2_{ei}$	β^2/σ^2_{ei}	$\Sigma\beta^2/\sigma^2_{ei}$	$1+\sigma_m^2*\Sigma\beta^2/\sigma^2_{ei}$	Ci
1	Kotak	1.8128	0.0099	0.4382	0.4382	1.0024	0.009869
2	Britannia	8.3684	0.0556	6.8702	7.3084	1.0399	0.053428
3	Colgate	0.2040	0.0567	0.1999	7.5082	1.0410	0.054441
4	HUL	29.2266	0.2162	37.6990	45.2073	1.2467	0.173387
5	Godrej	18.0423	0.3146	24.7160	69.9236	1.3816	0.227725
6	Brigade	11.6614	0.3783	16.1750	86.0982	1.4698	0.257344
7	Nestle	8.3556	0.4239	13.3465	99.4447	1.5427	0.274752
8	Tech Mahindra	6.1951	0.4577	10.016	109.4611	1.5973	0.286517
9	HDFC	48.8797	0.7244	88.7523	198.2134	2.0817	0.347992
10	TCS	0.7776	0.7286	1.7659	199.9793	2.0913	0.348417
11	Kolte Patil	11.7052	0.7925	31.7188	231.6981	2.2644	**0.349993**
12	HCL	2.9793	0.8088	8.5265	240.2246	2.3109	0.349982
13	Axis	13.4521	0.8822	43.4832	283.7078	2.5482	0.346199
14	Puravankara	18.0673	0.9808	59.9181	343.6890	2.8755	0.341079
15	ICICI	11.4752	1.0434	51.6102	395.2993	3.1571	0.330487
16	SBI	9.5995	1.0958	66.8447	462.1440	3.5219	0.311132
17	ITC	0.0896	1.0963	0.7988	462.9428	3.5263	0.310886
18	Maruti	2.5003	1.1099	22.5065	485.4493	3.6491	0.304161

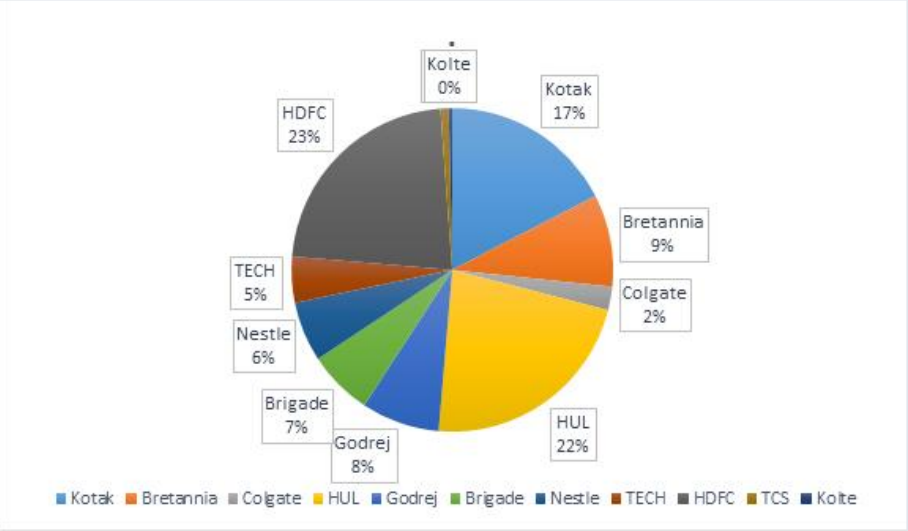
Aamong 25 companies, only 18 companies could be selected for construction of optimal portfolio. Table 6 shows that the Kotak Mahindra bank Ltd (413.69) is ranked first and Maruti Suzuki India Ltd. (11.11) ranked last as per the excess return to beta ratio value. Ci values show that the values are in increasing order and at the point 0.349993 (Kolte Patil Developers Ltd) lies the highest cut-off point after this point the values are gradually decreasing. To apply SIM model for optimal construction of portfolio companies from Kotak Mahindra bank Ltd., to Kolte Patil Developers Ltd., in the table are included and the rest of companies are ignored.

Table-7: Proportion of Investment: Post Demonetisation Period

Sl No	Security Name	β/σ^2_{ei}	(Ri-Rf/β)	Zi	Investment proportion (Xi)
1	Kotak	4.9181	4.1369	18.6246	**0.1742**
2	Britannia	11.3933	1.2181	9.8905	**0.0925**
3	Colgate	3.7497	1.0206	2.5148	**0.0235**
4	HUL	56.1834	0.7753	23.8936	**0.2235**
5	Godrej	22.0485	0.7300	8.3782	**0.0784**
6	Brigade	18.7422	0.7210	6.9532	**0.0650**
7	Nestle	23.3331	0.6260	6.4415	**0.0602**
8	Tech Mahindra	18.4125	0.6186	4.9453	**0.0462**
9	HDFC	119.7737	0.5507	24.0459	**0.2249**
10	TCS	9.4941	0.4403	0.8577	**0.0080**
11	Kolte Patil	20.6368	0.3690	0.3931	**0.0037**

Out of total 25 stocks considered for the study, 18 securities have positive returns and from these only 11 stocks are eligible for construction of optimal portfolio. The final step is to find out the proportion of investment in each of these selected stocks in portfolio. It describes the allocation of funds for various stocks to get the maximum benefits of the optimal portfolio. Table 7 and pie chart 2 show the proportion to be invested in various stocks which comprise of the optimal portfolio.

Chart-2



While the investor can invest highest proportion of 22-23 % in HDFC Bank Ltd., and HUL., he can invest less than 10% in the remaining 9 companies' stocks.

FINDINGS

During pre-demonetization Period

- Out of 25 stocks from various selected sectors of Nifty50 only 17 stocks were considered for ranking the securities based on 'excess return to beta ratio' values . Finally 14 stocks are chosen for inclusion in optimal portfolio based on cut-off point of 0.29724.
- Out of 14 stocks selected, the maximum number of stocks is from the automobiles sector (5 stocks) followed by Real estate sector (4 stocks) and FMCG sectors (3 stocks) while lowest proportion is occupied by banking sector stocks. Out of 5 banks, only one bank (HDFC) considered for optimal portfolio. None of the stocks from IT sector is included in optimal portfolio construction.
- The maximum proportion of (22.82%) investment to be made in Maruti Suzuki India Ltd and least proportion of investment to be made in Ansal properties and Infrastructure Ltd (0.12%).
- The Tata Motors stock had highest beta while the Axis Bank stock had negative beta.
- Majority of the stocks have their beta less than 1 and are referred to as defensive stocks.

During post-demonetization Period

- Out of 25 stocks from various selected sectors of Nifty 50 only 18 stocks were considered for ranking the securities based on 'excess return to beta ratio' values during post-demonetization period. Finally 11 stocks were chosen for inclusion in optimal portfolio based on cut-off point of 0.349993.
- Out of 11 stocks selected, the maximum number of stocks is from FMCG sector (4 stocks) followed by Real estate sector (3 stocks) and Banking sector (2 stocks). The lowest proportion occupied by IT sector; out of 5 companies, two stocks are considered for optimal portfolio. The study considered 5 stocks from automobiles sectors but none of them is included in optimal portfolio construction. .

- Maximum proportion of 22.49 percentage could be invested in HDFC Bank Ltd and the least proportion in Kolte Patil Developers Ltd (0.37%).
- Puravankara stock had the highest beta (1.727) while Colgate-Palmolive Ltd stock had the lowest beta (0.053).

CONCLUSION

To conclude there is a significant impact of demonetization where demonetization has badly affected the stock prices of automobile and realty sector as those stocks are not included in the portfolio constructed during post demonetization period. The impact of demonetization is, thus, found to be positive in the banking sector and FMCG sectors. Sharpe's model used to construct optimal portfolio revealed that there is a difference in the stocks included in portfolio during pre and post demonetization period. Four stocks of FMCG are included for optimal portfolio during post demonetization. The real estate sector, technology and financial sectors were affected due to demonetization in the short term and is felt in the medium term also. The negative impact experienced in the Automobile Industry has significantly affected the Indian market in the medium term and is expected to last for some more period. The government has started initiating measures to revive the same through tax reforms and incentives. Thus, this study concludes that there is an impact on Indian stock market due to demonetization. This implies that, investors have to keep updated for investment information available in the market for better investment choice with low risk and reap higher returns.

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