Size Effect and Seasonality In Size-Sorted Portfolios: Evidences from India

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Abstract

The size or market cap of a company is a reflection of its business activities. The style managers have argued that it is not mandatory to invest in a large cap stock. A style based on mid-cap or small-cap can also result in abnormal returns. Once a portfolio strategy is drawn, the next focus of a portfolio manager is to identify if any specific time in a calendar year exists which may result in significant abnormal returns. The objective of present study is to examine the size effect, i.e., size of the stock affect the return performance of the size-sorted portfolio or not. In addition to this, the seasonal performance of the portfolios has also been examined to study Month of the Year anomaly. The present study has taken a time period of around 20 years, i.e., March 1995 to March 2015. The findings of the present study have given various cues for size effect and seasonality in size-sorted portfolios. For a longer-term investment, all size-sorted portfolios perform significantly. Therefore investors can invest in any types of size-sorted portfolio depending upon their income level.

Keywords: Equity Portfolios, Indian Stock Market, Size Effect, Seasonality.

Introduction and Background of Study

Banz (1981) was first to document size effect. Banz and Reinganum (1981), Cook and Rozeff (1984), & Chan, Chen, and Hsieh (1985) explored explanatory power of the size effect and documented that there is an inverse relationship in the size of the firm and its stock return behavior. The size or market cap of the company is a reflection of its business activities. Fama and French (1993) interpreted size as a proxy for some unknown source of risk. Some researchers are of the opinion that the large cap stocks outperform the market while other say that it is small cap and sometimes mid-cap stock outperform even the large cap stocks. The style managers have argued that it is not mandatory to invest in a large cap stock. A style based on mid-cap or small-cap can also result in abnormal returns. Therefore it is always beneficial for investors and fund managers to understand whether a significant difference in average performance of a large cap portfolio and small cap or mid cap portfolio exists or not. Whether such type of difference exists or not, the understanding of this will help them to develop a profitable investment strategy.

Once a portfolio strategy is drawn, the next focus of a portfolio manager is to identify if any specific time in a calendar year exists which may result in significant abnormal returns. These

seasonal anomalies are found in many stock markets around the world. Like other anomalies, seasonal or calendar anomalies are also an indication of less than perfect efficient market as these may result in significant abnormal returns to investors. Many other calendar anomalies were identified in the late nineties and in the beginning of this century in developed as well as emerging capital markets of the world. Some of these studies were by Aggarwal and Tandon (1994) and they documented mixed evidences of various calendar anomalies in international markets. Other significant contributions were made by Balaban (1994), Arumugam (1997), Bhabra, Dhillon and Ramirez (1999), Choudhary (2000), Honghui & Singal (2001), and Chen & Singal (2004) documented the prolonged calendar anomalies in various capital markets of the world.

Objectives and Hypothesis

The objective of present study is to examine the size effect, i.e., size of the stock affect the return performance of the size-sorted portfolio or not. In addition to this, the seasonal performance of the portfolios has also been examined to study Month of the Year anomaly. The present study has examined two hypotheses, i.e.,

1. There is no significant difference between average returns of size-sorted portfolios.

2. There is no significant different in average returns of size-sorted portfolios during various months of the year.

Research Methodology

The present study has taken a time period of around 20 years, i.e., March 1995 to March 2015. At first monthly observations were obtained for more than 1200 companies listed on Bombay Stock Exchange having data available since 1995 but for final analysis only those companies were included which were having Rs. 100 million or more than Rs. 100 million market cap on March 2015. The final sample consists of 734 companies falling under the limit of market capitalization earlier. The monthly observations of adjusted closing prices for all these companies were obtained and then these stocks were converted into quintiles, i.e., five equally weighted portfolios. The five portfolios are called as, Very Large Cap, Large Cap, Mid-Cap, Small-Cap and Very Small cap portfolios. These portfolios were examined for size effect and seasonal anomaly. For this, one sample t-test, paired t-test and ANOVA has been used. The descriptive statistics has also been used to understand the nature of various size-sorted portfolios. Hawawini and Keim (2000) has documented that the size effect has been reproduced like value effect for various sample periods and many stock markets of the world. Therefore the present study has also made an additional analysis of size effect over different time frames. Considering the trend of Indian stock market index, i.e., S&P BSE Sensex, the following time frames have been identified for analysis.

January 1995-February 2000	First Phase, The early Phase of Indian Stock Market
March 2000-March 2003	Second Phase , Bearish
April 2003-December 2007	Third Phase, Bullish
January 2008-December 2008	Fourth Phase, Financial Crisis 2008

January 2009-April 2015 Fifth Phase, Consolidation of Indian Stock Market showing upside momentum

Analysis of Results

As discussed above, the present study has divided the companies into different portfolios based on their size. Therefore before testing the statement of hypothesis of present study, the descriptive statistics has been run to understand the characteristics of various size-sorted portfolios. As shown in Table I, the portfolio based on very small cap stocks has shown highest mean returns followed by small-cap and mid-cap portfolios. The very large-cap based portfolio has shown the least mean returns during the time period of this research. The very small-cap portfolio is not benefited by highest returns but also has shown the highest volatility in terms of standard deviation coefficient and very large-cap portfolio has shown least volatility. The coefficients of skewness, kurtosis and results of Jarque-Bera statistics have confirmed that the return distribution of all size-sorted portfolios in non-normal distributed.

Table-I Descriptive Statistics-size Sorted Portfolios

	Very Large Cap	Large Cap	Mid-Cap	Small-Cap	Very Small-Cap
Mean	2.357	2.397	2.506	2.535	2.562
Median	2.855	2.537	2.308	1.940	1.329
Std. Dev.	7.809	9.765	10.12	10.62	10.86
Skewness	-0.039	0.473	0.644	0.7311	0.82
Kurtosis	4.167	5.404	5.536	5.527	4.83
Jarque-Bera	13.74	67.05	81.26	85.60	61.10
Probability	0.001	0.000	0.000	0.000	0.000

In the next step, pair-wise correlation between all portfolios has been examined and it has been identified that all size-sorted portfolios are highly correlated. It gives an indication the whenever there is momentum in the stock market, all portfolios perform better and in case of economic slowdown all portfolios underperform. The results of pair-wise correlation can be seen in Table II given below.

Table-II Correlation Matrix of Various Size- Sorted Portfolios

	Very Large Cap	Large Cap	Mid-Cap	Small-Cap	Very Small-Cap
Very Large Cap	1	0.92	0.88	0.85	0.80
Large Cap	0.92	1	0.95	0.93	0.90
Mid-Cap	0.88	0.95	1	0.95	0.91
Small-Cap	0.85	0.93	0.95	1	0.91
Very Small-Cap	0.80	0.90	0.91	0.91	1

The duration of the current study is more than twenty years. Since 1995, Indian stock market has set many landmarks and investment activities have also been increased through stock

market products. The five size-based portfolios taken in the study has also seen various shades of bull and bear phenomenon. The under-root tree of Indian bourse has become a developed tree with several branches. It is expected that all types of stocks has performed well in last two decades. Therefore it will be useful for researcher and academician to see whether the mean return of all size sorted portfolios have increased significantly or there is only an absolute increase in mean return which can be insignificant in statistical terminology. For this, one sample t-test has been applied and the results obtained are very pleasant. As shown in Table III below, all size-sorted portfolios have shown significant positive returns in last two decades.

Table III One Sample T-Test for Size-Sorted Portfolios

	t-statistic	df	p-value	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Very Large Cap	4.685	240	0	2.357	1.3661	3.3481
Large Cap	3.811	240	0	2.397	1.1579	3.6363
Mid-Cap	3.846	240	0	2.506	1.2225	3.7903
Small-Cap	3.707	240	0	2.535	1.1883	3.8834
Very Small-Cap	3.661	240	0	2.56	1.1839	3.9415

The next step is to test the statement of null hypothesis to identify whether two size sorted portfolios perform significantly different from each other over a longer period of time or it makes no difference in mean return performance of various-size sorted portfolios in a long run period. The hypothesis has been tested through pair-wise t-test and ANOVA (Table V). It is interesting to find that no significant p-value was obtained for different pair-wise t-tests accepting the statement of null hypothesis. It indicates that in a long run the size of the stock cannot help the investors to develop a strategy to earn abnormal returns. It indicates the efficiency of Indian stock market in weak form. The size effect does not persist in the long run. The results of ANOVA have further strengthened the argument of non-existence of size-effect in Indian stock market.

Table IV Paired Sample T-Test of Size Sorted Portfolios

	Mean	Standard Deviation	Std. Error of Mean	t-statistic	p-value
Very Large Cap – Large Cap	-0.04001	4.02457	0.25925	-0.154	0.877
Very Large Cap – Mid-Cap	-0.14931	4.85919	0.31301	-0.477	0.634
Very Large Cap – Small-Cap	-0.1788	5.65977	0.36458	-0.49	0.624
Very Large Cap – Very Small-Cap	-0.20564	6.55412	0.42219	-0.487	0.627
Large Cap – Mid-Cap	-0.1093	3.11977	0.20096	-0.544	0.587
Large Cap – Small-Cap	-0.13879	3.85111	0.24807	-0.559	0.576
Large Cap – Very Small-Cap	-0.16564	4.69532	0.30245	-0.548	0.584

	Mean	Standard Deviation	Std. Error of Mean	t-statistic	p-value
Mid-Cap – Small-Cap	-0.02949	3.34483	0.21546	-0.137	0.891
Mid-Cap – Very Small-Cap	-0.05633	4.47951	0.28855	-0.195	0.845
Small-Cap – Very Small-Cap	-0.02684	4.59354	0.2959	-0.091	0.928

Table V Results of ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	7.787	4	1.947	0.02	0.999
Within Groups	117499	1200	97.916		
Total	117506	1204			

At the same time a question appears whether the non-existence of size effect also continue in different market phenomenon, viz., bull phase, bear phase, or any other crisis at stock market. To answer this, it is important to analyze the data in different time frames. The above section has already discussed the criterion of fragmenting the overall duration of the study into different phases. Therefore the following section has discussed the evidences obtained for size persistence in different phases of the market.

The results are further interesting to observe. Phase I, Phase II and Phase IV have shown almost negligible evidences of out-performance of various size-sorted portfolios from their mean returns. Phase II and Phase IV are crystal clear bear phases of the Indian stock markets. Phase I of the Indian stock market was known when the market needed various reforms and policy frameworks to stand competitive with global scenario.

Table VI Results of Different Time Frame

Tests→ Portfolios↓	t-statistic	df	p-value	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Phase-I						
Very Large Cap	1.715	58	.092	1.83568	-.3064	3.9778
Large Cap	.607	58	.546	.69240	-1.5917	2.9765
Mid-Cap	.946	58	.348	1.13621	-1.2688	3.5412
Small-Cap	.452	58	.653	.51377	-1.7621	2.7896
Very Small-Cap	.985	58	.329	1.25467	-1.2947	3.8041
Phase-II						
Very Large Cap	.016	37	.988	.01947	-2.4945	2.5335
Large Cap	.268	37	.790	.36302	-2.3854	3.1115
Mid-Cap	.439	37	.663	.65922	-2.3838	3.7022

Tests→ Portfolios↓	t-statistic	df	p-value	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Small-Cap	.214	37	.832	.28615	-2.4239	2.9962
Very Small-Cap	.520	37	.606	.76884	-2.2262	3.7639
Phase-III						
Very Large Cap	5.041	143	.000	3.18754	1.9378	4.4373
Large Cap	4.214	143	.000	3.63227	1.9285	5.3360
Mid-Cap	4.026	143	.000	3.55520	1.8096	5.3008
Small-Cap	4.077	143	.000	3.95803	2.0392	5.8768
Very Small-Cap	3.686	143	.000	3.57201	1.6562	5.4878
Phase-IV						
Very Large Cap	-1.423	11	.182	-4.80315	-12.2323	2.6260
Large Cap	-1.836	11	.094	-7.38935	-16.2483	1.4696
Mid-Cap	-1.965	11	.075	-7.91018	-16.7700	.9497
Small-Cap	-1.767	11	.105	-7.41060	-16.6420	1.8208
Very Small-Cap	-1.688	11	.120	-6.84503	-15.7699	2.0798
Phase-V						
Very Large Cap	3.884	74	.000	2.96028	1.4416	4.4790
Large Cap	3.039	74	.003	3.32069	1.1435	5.4979
Mid-Cap	2.680	74	.009	2.92817	.7514	5.1050
Small-Cap	2.192	74	.032	2.66852	.2430	5.0940
Very Small-Cap	1.910	74	.060	2.27807	-.0980	4.6541

It was the time when Harshad Mehta and Ketan Mehta scam occurred and various strict actions were taken by regulators to provide stable and well-regulated stock markets to the market participants. The Indian stock market did not pick its pace at that time. Hence the slow momentum time frame of Phase I and bearish phenomenon of Phase II and Phase IV has not shown any significant performance by various size sorted portfolios from their mean return performance. Although these results are not similar for Phase III and Phase V which represent a rising trend in Indian stock market have shown evidences of significant performance of various size sorted portfolios. As indicated in above Table, except for very small-cap portfolio in last phase, rest all portfolios have significantly performed well in bull phases. But whether the portfolios are significantly different from each other in terms of their mean return performance or not? For this, the pair-wise t-test and ANOVA has been applied to various size-sorted portfolios during different time frames. The evidences obtained have shown that there is no persistence in size anomalous behavior on Indian stock market.

Table VII: Paired Sample T-Test during Different Time Frames

| Tests→ Portfolios↓	Phase-I		Phase-II		Phase-III		Phase-IV		Phase-V	
	t-statistic	p-value	t-statistic	p-value	t-statistic	p-value	t-statistic	p-value	t-statistic	p-value
Very Large Cap – Large Cap	2.780	.007	-.702	.487	-1.193	.235	2.621	.024	-.803	.425
Very Large Cap – Mid-Cap	1.126	.265	-.896	.376	-.883	.379	3.408	.006	.067	.947
Very Large Cap – Small-Cap	2.471	.016	-.361	.720	-1.457	.147	2.245	.046	.472	.639
Very Large Cap – Very Small-Cap	.697	.489	-.799	.429	-.677	.499	1.671	.123	.975	.332
Large Cap – Mid-Cap	-.764	.448	-.707	.484	.365	.716	1.147	.276	2.008	.048
Large Cap – Small-Cap	.391	.697	.176	.862	-.923	.357	.024	.981	2.019	.047
Large Cap – Very Small-Cap	-.773	.443	-.583	.564	.164	.870	-.835	.421	2.152	.035
Mid-Cap - Small-Cap	1.430	.158	.847	.403	-1.397	.165	-.581	.573	1.062	.292
Mid-Cap - Very Small-Cap	-.174	.863	-.166	.869	-.047	.962	-1.150	.274	1.449	.152
Small-Cap - Very Small-Cap	-1.163	.250	-.860	.395	.984	.327	-.597	.563	.876	.384

The last phase have shown that there is significantly difference in the mean return series of large cap from mid-cap, small-cap and very small-cap stocks. The phase IV indicated that during the crisis time, the very large cap stocks significantly outperform the mid cap and small cap stocks. But no such evidences were obtained through ANOVA.

Table VIII Results of ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Phase-I					
Between Groups	650.011	11	59.092	.976	.469
Within Groups	13871.389	229	60.574		
Total	14521.400	240			
Phase-II					
Between Groups	1418.386	11	128.944	1.377	.185
Within Groups	21443.693	229	93.641		
Total	22862.079	240			

	Sum of Squares	df	Mean Square	F	Sig.
Phase-III					
Between Groups	1778.892	11	161.717	1.629	.092
Within Groups	22734.382	229	99.277		
Total	24513.274	240			
Phase-IV					
Between Groups	1539.810	11	139.983	1.262	.248
Within Groups	25397.223	229	110.905		
Total	26937.033	240			
Phase-V					
Between Groups	2064.232	11	187.657	1.633	.090
Within Groups	26308.050	229	114.882		
Total	28372.282	240			

The above analyses have focused on examination of size effect during different phases of the market and in overall duration. The evidences obtained have shown that the Indian stock market is quite efficient for size related information and the investors may not be able to earn significant abnormal returns by making a portfolio on the basis of size of the stocks. The next section deals with the testing the anomalous behavior of size sorted portfolios during various months of the year. The examination of seasonality in return series of various size sorted portfolios the analysis based for overall duration of the study period only because number of observations were not adequate under different time frames. Therefore the results may be robust using small number of observation during phases of the market. As can be seen from the charts given below, the December, November, April, May, and August months have reported comparatively higher returns than other months of the year and January, February, March and October months have shown relatively lower or negative returns. There can a possibility that the investors may strategize their investment decision during various months of the year which may result in significant abnormal returns to them negating the existence of efficient market hypothesis.
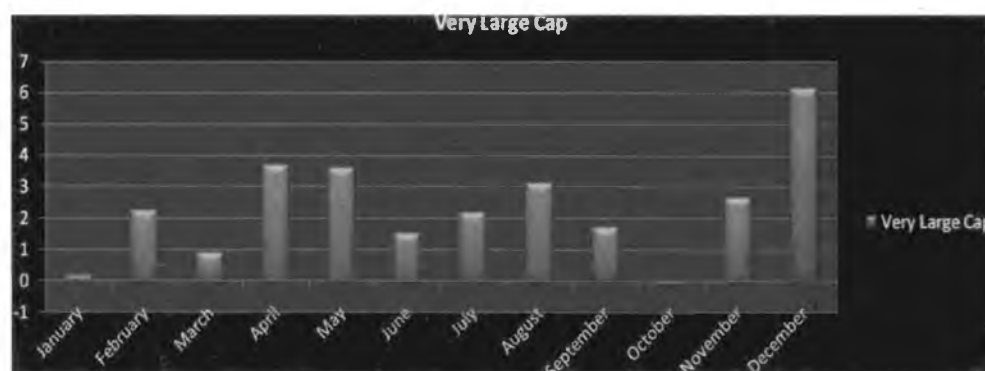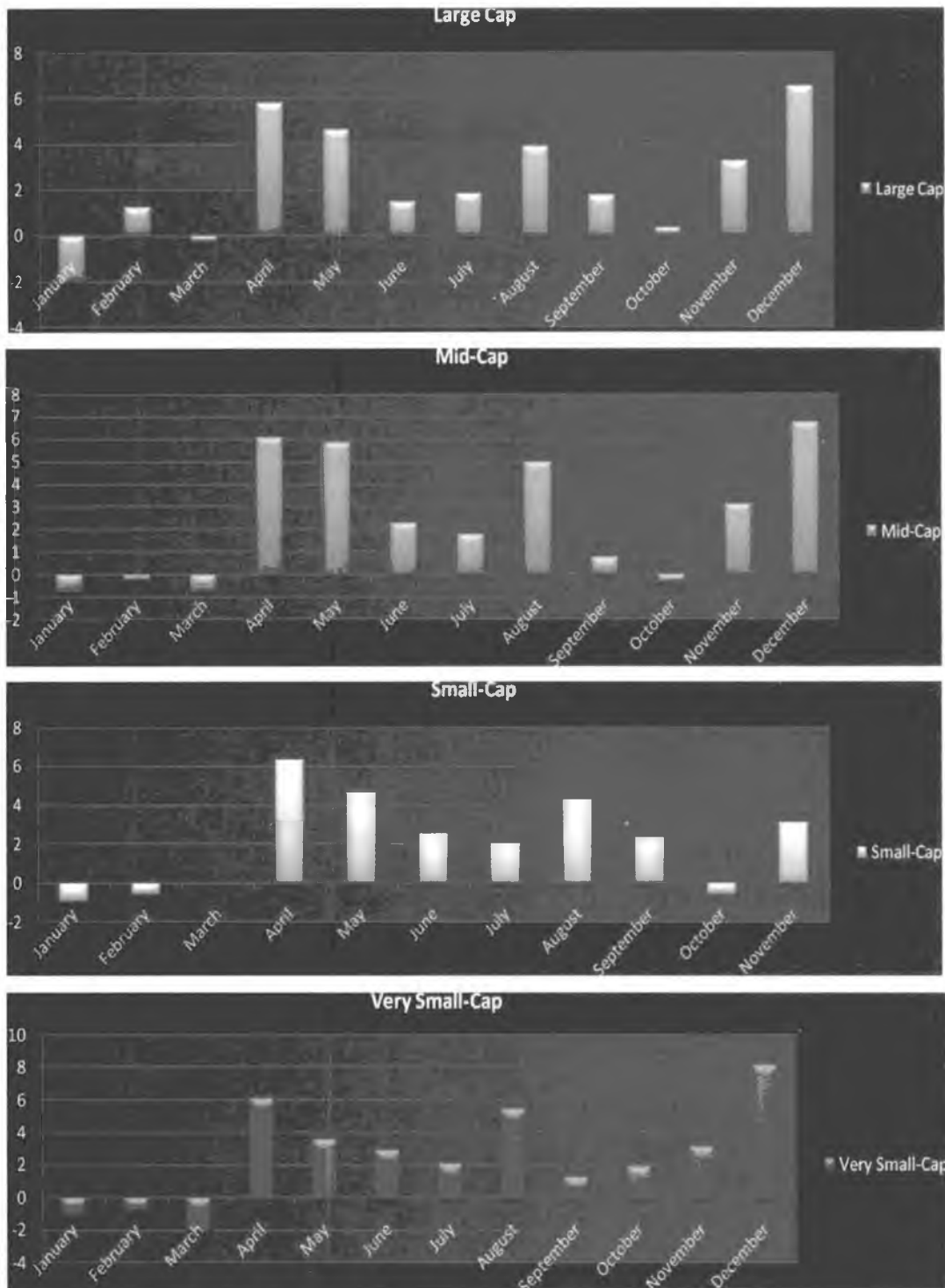
As shown in above charts, there seems to be a difference in mean return performance of portfolios during various months of the year. But it is also mandatory to examine the statistical significance of this difference. The same has been shown in Table IX. The results are exciting as December month has significantly shown higher performance than average performance of rest of the year. All size-sorted portfolios have given the evidences of positive December effect in Indian stock market. In addition to this, the evidences of negative February effect are found for small-cap portfolios and positive April effect is found for Mid-cap portfolios. Significant positive effect means that month gives significantly higher returns than the average of rest of the year's return and significant negative effect means that month will result in significantly lower returns than the average returns of rest of the year. These results indicate that the investors can earn significant abnormal returns on their portfolio if they enter into a long position in a month with least return and take a short position in December month.

Table IX T-statistic Results of Seasonality in Size Sorted Portfolios

	Very Large Cap		Large Cap		Mid-Cap		Small-Cap		Very Small-Cap	
	Mean	t-statistic	Mean	t-statistic	Mean	t-statistic	Mean	t-statistic	Mean	t-statistic
January	.169	-1.330.20	-2.025	-2.090.05	-.781	-1.280.21	-.966	-1.230.23	-1.158	-1.510.15
Rest of the Year	2.527		2.761		2.760		2.807		2.912	
February	2.254	-0.050.96	1.213	-0.610.55	-.252	-1.650.12	-.622	-1.940.07	-0.867	-2.090.05
Rest of the Year	2.337		2.467		2.712		2.776		2.886	
March	1.044	-0.670.51	-0.274	-1.390.18	-.495	-1.620.12	.486	-1.190.25	-1.545	-2.870.01
Rest of the Year	2.447		2.602		2.734		2.675		2.947	
April	3.681	0.790.44	5.798	1.730.10	6.039	1.910.07	6.326	1.970.06	6.091	1.700.10
Rest of the Year	2.208		2.050		2.140		2.144		2.253	
May	3.590	0.620.54	4.618	0.790.44	5.836	1.110.28	4.620	0.710.49	3.574	0.370.72
Rest of the Year	2.216		2.157		2.158		2.299		2.482	
June	1.510	-0.500.62	1.459	-0.410.69	2.262	-0.100.92	2.505	0.001.00	2.911	0.120.90
Rest of the Year	2.405		2.444		2.483		2.492		2.542	
July	2.168	-0.120.91	1.842	-0.290.78	1.744	-0.360.73	2.010	-0.240.81	2.109	-0.200.84
Rest of the Year	2.345		2.410		2.530		2.537		2.615	
August	3.135	0.590.56	3.875	0.890.38	4.984	1.320.20	4.241	0.870.39	5.421	1.490.15
Rest of the Year	2.257		2.225		2.236		2.334		2.314	
September	1.711	-0.460.65	1.736	-0.420.68	.747	-1.230.23	2.301	-0.110.92	1.217	-0.840.41
Rest of the Year	2.387		2.419		2.621		2.510		2.696	
October	-.102	-1.540.14	0.322	-1.130.27	-.337	-1.660.11	-.602	-1.610.12	1.882	-0.270.79
Rest of the Year	2.551		2.548		2.719		2.774		2.636	
November	2.661	0.200.84	3.252	0.500.62	3.092	0.320.75	3.077	0.310.76	3.101	0.310.76
Rest of the Year	2.300		2.281		2.408		2.440		2.525	
December	6.142	2.920.01	6.530	2.390.03	6.736	2.290.03	6.537	2.160.04	8.140	2.340.03

*Source: Calculations done by Authors. p-value is given with italics values.

Conclusion

In nutshell, the evidences obtained in the present study can be highlighted with the help of following points.

1. The overall performance of the Indian stock market has improved in last two decades.

2. For a longer-term investment, all size-sorted portfolios perform significantly. Therefore investors can invest in any types of size-sorted portfolio depending upon their income level.

3. The Bull phenomenon has given strong evidences of higher significant returns of all portfolios in comparison to their average returns which is not so in case of bear phenomenon.

4. The investors can earn significantly higher returns on all portfolios in the month of December because of existence of December Effect.

5. February is a good month to enter into a long position for small-cap stocks.

6. The evidences of existence of seasonal anomalies indicate that the Indian market is less than perfectly efficient in weak form.

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