

A Study on Impact of Stock Market Movements on GREENEX

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Abstract : *Maintaining ecological balance by reducing pollution is the priority of the nations across the world. The governments of countries today are pressurizing the industries to adopt environment friendly technologies in production to reduce the emission of harmful gasses in the environment. Companies too are raising funds for green projects. Consumers today too are sensitized towards environmental protection and prefer purchasing products from companies adopting green technologies in production. Investors are investing in green projects as such projects increase the reputation of the company. Thus, with the objective of enabling investor to take more informed decisions in the green theme of India BSE launched BSE- GREENEX the first environmental friendly equity Index. It measures the performance of the company in terms of carbon emissions. The Index comprises of 20 stocks based on a minimum carbon footprint, market capitalization and turnover. The present paper explains the concept of GREENEX and construction of the index. A comparative study is done for SENSEX and GREENEX to see the impact of stock market movements on GREENEX.*

Index Terms - Environment, Sustainability, SENSEX GREENEX

1. Introduction

World today is facing the problem of ecological imbalance and environment unsustainability. In spite of paying much attention by the Governments of the countries towards environment sustainability and large amount of resources are earmarked for environment protection, still less progress is achieved towards environment sustainability. So with the objective to sensitize companies and investors towards the need of environment protection and sustainability and putting efforts for achieving the same, BSE launched the first environmental friendly equity Index known as GREENEX. The aim of the index is to enable investors to take more informed decisions considering the green theme of India and for companies to adopt environment friendly technologies to reduce their carbon footprint. It measures the performance of the companies in terms of carbon emissions. The top 20 stocks were selected based on minimum carbon footprint, market capitalization and turnover. The index assesses the carbon efficiency of firms, based on energy and financial data. In order to understand GREENEX, BSE-SENSEX is analyzed since GREENEX is formed out of the stocks of BSE 100. SENSEX is the oldest stock index of India started in 1986. It is the market weighted stock of 30 companies that are selected on the basis of financial soundness and performance. As of March 15, 2017 the full market capitalization of SENSEX is Rs. 4,986,299 crores and free float capitalization is Rs. 2,687,777 crores. SENSEX is used by analyst and investors to observe the overall growth of particular industries which reflects booms and busts of the India Economy.

1.2 Meaning of GREENEX

Climate change is the major concern of all the economies of the world. Countries all around the world are putting great efforts in reducing carbon emissions and control of greenhouse gases in the atmosphere. To control the carbon emissions, many strategic efforts are taken by the government as well as the socially responsible firms. Companies today are adopting green technologies as it helps in cost savings, gaining competitive advantage and gaining customer's loyalty. To address the issue of sustainability and to sensitize the companies towards environment protection, BSE launched India's first carbon efficient index GREENEX which is developed by BSE and IIM Ahmadabad. It measures the performance of the company in terms of carbon emissions. The Index comprises of 20 stocks based on a minimum carbon footprint, market capitalization and turnover. GREENEX assesses the energy efficiency of the firms based on energy and financial data. The top-ranking companies from each sector like power, steel, cement have made it to the new index called BSE-GREENEX. gTrade Carbon Ex Ratings Services Private Limited is a company based in India, which has co-developed the BSE-GREENEX Index in close association with the BSE. GREENEX is the third real time index to utilize stock level capping aimed at diversifying investments subject to regulatory and statutory diversification requirements. The index will allow investors to track companies that invest in energy efficient practices. Investors can invest in those mutual funds which invest in companies that are part of GREENEX. The GREENEX will allow asset managers to create products to help investors put their money in green enterprises.

GREENEX comprises of 12 sectors including Finance, Transport Equipments, Healthcare, Information Technology, Capital Goods, FMCG, Oil & Gas, Power, Metal, Telecom, Agriculture and Housing. Finance sector has highest market capitalization in the index which is 23.15% while the lowest market capitalization is of housing sector which is 0.67%.

Table 1: S&P BSE GREENEX Sector-wise Market Capitalization

S.No	Index/Sectors	Free Float Market Capitalization (%)
	S&P BSE GREENEX	100
1	Finance	23.15
2	Transport Equipment	21.56
3	Healthcare	12.25

4	Information Technology	10.33
5	Capital Goods	6.1,
6	FMCG	5.76
7	Oil & Gas	5.43
8	Power	4.47
9	Metal, Metal Products & Mining	4.03
10	Telecom	3.73
11	Agriculture	2.53
12	Housing Related	0.67

Source: www.bseindia.com

The companies constituting the index under the sectors specified comprises of Bharti Airtel Ltd, Cipla Ltd, DLF Ltd, Dr. Reddy's Laboratories Ltd, Eicher Motors Ltd, Gail India Ltd, HCL Technologies Ltd, Hindalco Industries Ltd, Hindustan Petroleum Corp Ltd, Housing Development Finance Corp, ICICI Bank Ltd, ITC Ltd, Kotak Mahindra Bank Ltd, Larsen & Toubro Ltd, Lupin Ltd, Mahindra & Mahindra Ltd, Maruti Suzuki India Ltd, NMDC Ltd, Power Grid Corp of India Ltd, Reliance Infrastructure Ltd, State Bank of India, Sun Pharmaceutical Industries Ltd, Tata Consultancy Services Ltd, Tata Motors Ltd, UPL Ltd.

The closing price of these 25 stocks as on 28 Nov 2017 is given below.

Table 2: Companies Comprising GREENEX

S. No	COMPANY	Closing Price (in Rs)
1	Bharti Airtel Ltd	492.2
2	Cipla Ltd	610.5
3	DLF Ltd	230.2
4	Dr Reddy's Laboratories Ltd	2288.25
5	Eicher Motors Ltd	30512.05
6	Gail India Ltd	462.35
7	HCL Technologies Ltd	859.05
8	Hindalco Industries Ltd	250.75
9	Hindustan Petroleum Corp Ltd	418.15
10	Housing Development Finance Corp	1725.55
11	ICICI Bank Ltd	313.75
12	ITC Ltd	256.95
13	Kotak Mahindra Bank Ltd	1028
14	Larsen & Toubro Ltd	1212.3
15	Lupin Ltd	832.85
16	Mahindra & Mahindra Ltd	1435.05
17	Maruti Suzuki India Ltd	8626.2
18	NMDC Ltd	126.5
19	Power Grid Corp of India Ltd	208.15
20	Reliance Infrastructure Ltd	457.7
21	State Bank of India	332.65
22	Sun Pharmaceutical Industries Ltd	543.7
23	Tata Consultancy Services Ltd	2684.9
24	Tata Motors Ltd	415.95
25	UPL Ltd	762.25

Source: www.bseindia.com

1.3 Eligibility Criteria and Index Construction

The S&P BSE GREENEX is constructed by taking common stocks from the companies in the S&P BSE 100. S&P Trucost Limited provided Greenhouse gas (GHG) emission numbers. The GHG emission numbers (C), average six-month float market capitalization (M), and six-month median annualized traded value (T) are scaled from 0 to 100 within the sector. Annualized traded value is calculated by taking the

median of the monthly medians of the daily traded values over the six-month period. The annualization is calculated using 250 trading days in a year.

Points are assigned to the above mentioned parameters from 1-50 within the sector.

- For C: For 0-2, 1 point is assigned; for 2-4, 2 are assigned, etc. For scale of 48-50, 25 points are assigned. For scale beyond 50, 1000 are assigned.

- For M & T: For 0-2, 50 points are assigned; for 2-4, 49 are assigned, etc.

For sectors where there is only one stock, 25 points are assigned for GHG emission numbers (C), average six-month float market capitalization (M) and six-month median annualized traded value (T).

The composite point for a stock is arrived by taking the summation of the points multiplied by their respective weights, where C is weighted 50%, M is weighted 40%, and T is weighted 10%. Stocks are ranked on the basis of composite points. The top 25 stocks are selected for the base composition.

During semi-annual rebalancing, the following inclusion/exclusion rules are applied:

- If a non-constituent ranks within the top 15 stocks, it is automatically selected for index inclusion.
- If an existing constituent ranks beyond the top 35 stocks, it is removed from the index.

In cases where two or more stocks have the same composite rank, the stock selection is performed based on the following order:

1. GHG emission numbers (C).
2. Average six-month float market capitalization (M).
3. Six-month median annualized traded value (T).

Constituent Weightings: Each stock in the index is weighted based on its capped float-adjusted market capitalization. The stock capping limit is 6% and is applied in conjunction with the quarterly share updates. Stocks that exceed the 6% cap between share updates are brought back to 6% at the subsequent quarterly share update.

1.4 Research Methodology:

Objectives of the study

- To understand the concept of GREENEX
- To study the market trends of BSE SENSEX from Jan 2012 to Oct 2017
- To study the stock market movements of GREENEX from Jan 2012 to Oct 2017
- To analyze the relationship between GREENEX and BSE SENSEX.

Research Study: The research study is descriptive in nature as it explains the Index Construction for GREENEX. Correlational research method is applied to study the relationship between GREENEX and SENSEX. The study is based on secondary data analyzing the trends of GREENEX and SENSEX of the past five years (2012-2017).

Data Analysis Tools:

The data analysis has been done by analyzing the trends of SENSEX and GREENEX for five years from Jan 2012- Oct 2017 using time series graph. Time series graph of SENSEX and GREENEX is created in MS-Excel using the data of monthly average value. Correlation coefficient is calculated using advanced excel. Correlation analysis is used to study the relationship of movement of GREENEX and SENSEX in a particular period to see how the stock movements in both affect each other. The descriptive statistics of the data is analyzed. Monthly average values from Jan 2012 to Oct 2017 of GREENEX and BSE SENSEX are taken to facilitate a comparative study.

2. Literature Review

Rajib Bhattacharya (2013) conducted a study to highlight the growing concern of investors across the world about environment. Investors nowadays prefer to invest in companies which are following business practices and environment friendly technologies to reduce the carbon footprint. The performance of BSE-GREENEX is analysed vis-à-vis BSE SENSEX and BSE 500 to test whether an investor get the incentives by investing in green stocks. The study found that BSE-GREENEX performed over and above BSE-SENSEX and BSE 500. The study revealed that the daily returns on BSE-GREENEX are constantly above the mean daily returns on BSE SENSEX and BSE-500 indices for the period 2008-2012. The study concluded that investing in green stocks is more rewarding than other stock Indices.

Kumari *et al.* (2013) examined the carbon credit effects on stock market. The relationship between GREENEX and carbon credit is rightly skewed and symmetric. The economic and social factors like oil and gas, power, population and IIP influence the decision to enter this segment.

Bammi (2013) examined the effect on stock prices of firms after becoming the part of BSE- GREENEX. The impact is visible on daily return series of the stocks to test its efficiency in the Indian capital markets. The analysis is carried using daily stock return series of the BSE-GREENEX companies. The results revealed that existing investors responded negatively with the companies entering into the BSE GREENEX index. The reason for this could be that the investors were not concerned about the green image of the company.

Divya&Shirisha (2014) studied the impact of the economic factors like CARBONEX, IIP and automobile on GREENEX and also the relationship between NIFTY, GREENEX and CARBONEX. The results thus obtained showed that IIP and automobile sector influenced to a great extent the GREENEX global carbon credits during the analysis period of 2010-2014.

Asia Pacific Index Limited (2017) created a methodology for constructing S&P BSE Sustainability Indices. It explained eligibility criteria for index construction of S&P BSE GREENEX and also the index calculation and index maintenance along with the data and policies of Index. GREENEX is formed from S&P BSE 100 companies. Every stock of the index is weighted based on capped float adjusted market capitalization. Index is maintained by rebalancing by adding the stocks as replacements for those removed from index to maintain fixed count of 25 stocks. The index is governed by index committee of Dow Jones and BSE which revise the Index policy and their dividends.

3. Data Analysis

The data for monthly average values of SENSEX and GREENEX is taken to compute the time series graph and coefficient of correlation between the two. The data for correlation coefficient is computed using advanced excel and the time series graphs are created to see the trends and volatility in these indices. The following table represents the closing data of BSE GREENEX and SENSEX of 5 years from Jan 2012 to Oct 2017.

Table 3: Monthly Average Values of SENSEX&GREENEX

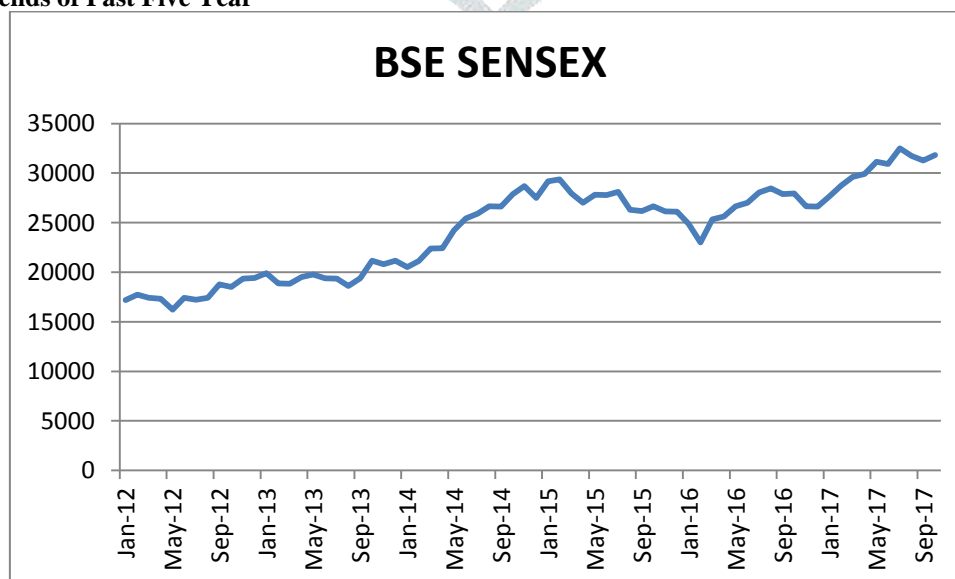
Month	GREENEX	% Change	SENSEX	% Change
12-Jan	1415.9		17193.55	
12-Feb	1469.93	3.82	17752.68	3.25
12-Mar	1443.04	-1.83	17404.2	-1.96
12-Apr	1426.36	-1.16	17318.81	-0.49
12-May	1328.49	-6.86	16218.53	-6.35
12-Jun	1433.99	7.94	17429.98	7.47
12-Jul	1432.16	-0.13	17236.18	-1.11
12-Aug	1436.78	0.32	17429.56	1.12
12-Sep	1557.47	8.4	18762.74	7.65
12-Oct	1519.53	-2.44	18505.38	-1.37
12-Nov	1575.13	3.66	19339.9	4.51
12-Dec	1615.82	2.58	19426.71	0.45
13-Jan	1618.5	0.17	19894.98	2.41
13-Feb	1514.78	-6.41	18861.54	-5.19
13-Mar	1486.17	-1.89	18835.77	-0.14
13-Apr	1595.35	7.35	19504.18	3.55
13-May	1591.5	-0.24	19760.3	1.31
13-Jun	1547.95	-2.74	19395.81	-1.84
13-Jul	1540.59	-0.48	19345.7	-0.26
13-Aug	1464.47	-4.94	18619.72	-3.75
13-Sep	1562.13	6.67	19379.77	4.08
13-Oct	1708.62	9.38	21164.52	9.21
13-Nov	1692.61	-0.94	20791.93	-1.76
13-Dec	1705.81	0.78	21170.68	1.82
14-Jan	1652.63	-3.12	20513.85	-3.1
14-Feb	1704.04	3.11	21120.12	2.96
14-Mar	1778.01	4.34	22386.27	5.99
14-Apr	1788.6	0.6	22417.8	0.14
14-May	1943.27	8.65	24217.34	8.03
14-Jun	2078.27	6.95	25413.78	4.94
14-Jul	2132.03	2.59	25894.97	1.89
14-Aug	2220.93	4.17	26638.11	2.87
14-Sep	2265.86	2.02	26630.51	-0.03
14-Oct	2337.34	3.15	27865.83	4.64
14-Nov	2359.43	0.95	28693.99	2.97
14-Dec	2242.98	-4.94	27499.42	-4.16
15-Jan	2411.62	7.52	29182.95	6.12
15-Feb	2430.78	0.79	29361.5	0.61
15-Mar	2389.92	-1.68	27957.49	-4.78
15-Apr	2278.48	-4.66	27011.31	-3.38
15-May	2369.72	4	27828.44	3.03
15-Jun	2351.15	-0.78	27780.83	-0.17

15-Jul	2362.77	0.49	28114.56	1.2
15-Aug	2239.58	-5.21	26283.09	-6.51
15-Sep	2214.24	-1.13	26154.83	-0.49
15-Oct	2281.43	3.03	26656.83	1.92
15-Nov	2234.94	-2.04	26145.67	-1.92
15-Dec	2252.48	0.78	26117.54	-0.11
16-Jan	2132.1	-5.34	24870.69	-4.77
16-Feb	1980.43	-7.11	23002	-7.51
16-Mar	2179.51	10.05	25341.86	10.17
16-Apr	2246.18	3.06	25606.62	1.04
16-May	2343.54	4.33	26667.96	4.14
16-Jun	2398.19	2.33	26999.72	1.24
16-Jul	2504.77	4.44	28051.86	3.9
16-Aug	2526.08	0.85	28452.17	1.43
16-Sep	2466.77	-2.35	27865.96	-2.06
16-Oct	2502.09	1.43	27930.21	0.23
16-Nov	2373.92	-5.12	26652.81	-4.57
16-Dec	2329.4	-1.88	26626.46	-0.1
17-Jan	2460.08	5.61	27655.96	3.87
17-Feb	2513.32	2.16	28743.32	3.93
17-Mar	2564.05	2.02	29620.5	3.05
17-Apr	2580.38	0.64	29918.4	1.01
17-May	2676.12	3.71	31145.8	4.1
17-Jun	2630.34	-1.71	30921.61	-0.72
17-Jul	2750.13	4.55	32514.94	5.15
17-Aug	2675.55	-2.71	31730.49	-2.41
17-Sep	2629.49	-1.72	31283.72	-1.41
17-Oct	2677.9	1.84	31814.22	1.7

Source: www.bscindia.com

The data can be interpreted through time series graph. A time series graph illustrates the data points at successive time intervals. It shows how the values of the variables change over time. The time interval taken for the analysis is from Jan 2012- Oct 2017. From the time series graph, changes in values of BSE SENSEX and GREENEX are observed for the given period of time.

Figure 1: SENSEX Trends of Past Five Year



As seen from the time series graph, BSE SENSEX shows volatility over the years. The highest value being recorded in July 2017 when the index was 32514.94, which is the highest in 5 years. The slump in SENSEX was recorded in May 2012 when it fell to the lowest level of 16218.53. Continuous rise in BSE Index is seen from Jan 2014-Nov 2014 which can be seen in the graph by the continuously rising portion of the line during this period of time.

The Time series Graph for GREENEX is given below. The trends in GREENEX can be seen from the graph.

Figure 2: GREENEX Trends of Past Five Years



The graph takes the values of GREENEX from Jan 2012. GREENEX was at its highest in July 2017 that is 2750.13 and the lowest during May 2012 i.e. 1328.49. GREENEX too shows similar pattern of increase in values from Jan 2014-Nov 2014 which can be seen in the graph by the continuously rising portion of the line during this period of time. Both SENSEX and GREENEX show the same trends which show the interrelatedness between the two.

Table 4: Coefficient of correlation

	GREENEX	SENSEX
GREENEX	1	
SENSEX	0.991302316	1

The coefficient of correlation is a statistical technique to see the degree of relatedness between the variables. The co-efficient of correlation between GREENEX and SENSEX is 0.99 which implies there is a strong positive correlation between the two. The relationship is positive because as SENSEX increases, GREENEX also increases and vice versa. ...

The value of co-efficient of determination i.e. R^2 is 0.98 which means 98 % variation in values of GREENEX is explained by SENSEX. The model explains all the variability of the response data around its mean. Analyzing the past trends, it is concluded that movement in GREENEX is influenced to a greater extent by movement in SENSEX. As the stock market behaves, GREENEX stocks behave accordingly.

Table 5: Descriptive Statistics for GREENEX

Mean	2044.913
Standard Error	51.77227
Median	2217.585
Mode	#N/A
Standard Deviation	433.1579
Sample Variance	187625.8
Kurtosis	-1.49993
Skewness	-0.16841
Range	1421.64
Minimum	1328.49
Maximum	2750.13
Sum	143143.9
Count	70
Confidence Level(95.0%)	103.2829

The mean value of GREENEX is 2044.91 and median is 2217.58 which are the measures of central tendency. They show that GREENEX revolves around these values. Since median is greater than mean the data is skewed to the left hence we have negative value for skewness. The standard deviation for the data is 433.15 which show the spread of data.

Table 6: Descriptive Statistics for SENSEX

Mean	24314.96329
Standard Error	554.3384
Median	26006.255
Mode	#N/A
Standard Deviation	4637.927804
Sample Variance	21510374.32
Kurtosis	-1.308256371
Skewness	-0.165048487
Range	16296.41
Minimum	16218.53
Maximum	32514.94
Sum	1702047.43
Count	70
Confidence Level(95.0%)	1105.874836

The Mean value for SENSEX is 24314.96 and median is 26006.25. The range of the data is 16296.41 which indicate the wide difference between the highest and the lowest value. The data for SENSEX is negatively skewed.

4. Conclusion

BSE GREENEX has gained popularity over the years and has performed well. The sustainability Index launched by BSE SENSEX achieved the purpose of enabling investors to invest in Green stocks and the value of these stocks increased over time and are becoming popular among investors. It shows the popularity of companies investing in green technologies. The findings of the study revealed that SENSEX is highly volatile over the years in comparison to GREENEX. The strong positive correlation implies that as SENSEX increases, the increase is reflected in the GREENEX too. The GREENEX value has increased by 52.87% which shows the high growth potential. So GREENEX is a good investment option for the investors to diversify their portfolio and contributing towards environmental sustainability.

5. References

- [1] Bammi, R. (2013), "BSE GREENEX Impact on Indian Stock Market Performance: An Event Study". *International Journal of Research Excellence in Management*, 7-12
 - [2] Bhattacharya, R. (2013), "Effect of Going Green on Stock Prices: A Study on BSE-GREENEX". *International Journal of Computer Applications*, 32-37
 - [3] BSE-GREENEX Index factsheet (2012)
http://www.bseindia.com/downloads/about/abindices/file/BSE_GREENEX%20Factsheet.pdf
 - [4] "BSE launches India's first Carbon Efficient Live Index called GREENEX" (2012) <https://economictimes.indiatimes.com/bse-launches-indias-first-carbon-efficient-live-index-called-GREENEX/articleshow/12038414.cms>
 - [5] Divya, S. (2014), "A Study On GREENEX (BSE)". *IRJA-Indian Research Journal*
 - Kumari, Divya et al. (2013), "An Analysis On Carbon Credits (India)". *Asia Pacific Journal of Marketing & Management Review*, 62-69.
 - [6] "Let's Make Sense of the SENSEX and Nifty" (2015) <https://www.tflguide.com/SENSEX-nifty/>
- S&P BSE Sustainability Indices Methodology(2017). Asia Index Private Limited: Index Methodology