

Effect of Going Green on Stock Prices: A Study on BSE-GREENEX

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ABSTRACT

Environmental concern is becoming an important invest theme for progressive investors the world over. Investors are opting to invest in organizations which utilize environment-friendly technologies and business practices to reduce their carbon footprint. Such businesses are known as green businesses. Investors are preferring organizations which have environmental concerns built into their vision and mission. To provide these progressive investors with a benchmark to assess the performance of green stocks vis-à-vis the rest of the market, certain green stock market indices have been constructed all over the world which constitute of stocks of companies guided green business philosophy. In India BSE-GREENEX is such an index. This paper analyzes the performance of BSE-GREENEX vis-à-vis other broad based indices like the BSE-SENSEX and the BSE-500 to test whether it is financially rewarding too for the investors to invest in green stocks. Moreover this paper also attempts to model the said three indices for prediction over a very short period of a day. The analysis unveils the superior performance of BSE-GREENEX over BSE-SENSEX & BSE-500.

General Terms

Green Stock Performance, Predictive Modeling.

Keywords

Environmental Concern, Green Business, Green Stock Market Indices, BSE_GREENEX, Predictive Modeling.

1. INTRODUCTION

1.1 The concept of going green

Green is often used as a synonym for environmental or ecological, especially as it relates to products and activities aimed at minimizing damage to our planet Ramey (2009). Going green refers to activities, usually of corporate enterprises, involving activities with a deliberate aim to reduce emission of pollutants, produce goods which are environment friendly and resorting to technologies which promote environmental protection. Thus going green indicates increase in green investment. Green investments are allocation of resources necessary to reduce greenhouse gas and air pollutant emissions, without significantly reducing the production and consumption of non-energy goods (Eyraud et al 2011). There is no unique definition among investors of what green investing entails. In a generic sense, green investments refer broadly to low carbon and climate resilient investments made in companies, projects and financial instruments that operate primarily in the renewable energy, clean technology, environmental technology or sustainability related markets as well as those investments that are climate change specific (Inderst et al 2012). There are three main components of green investment i.e low-emission energy supply, energy efficiency and carbon capture & sequestration.

1.2 Generic effects of going green on business

Organizations going green benefit from triple benefits i.e. in terms of social costs, environmental benefits and financial gain. Going green results in cost savings, gaining competitive advantage, employee retention, customer loyalty, regulatory compliance & risk management (Graci & Kuehnel). Increasing pro-social and pro-environmental behavior on the part of the customers are prompting more and more corporate organizations to go green (Griskevicius et al 2010). Consumer demand for green technology products is on the rise. On the other hand, a failure to go green might lead to negative consequences e.g. consumer and investor backlash as well as regulatory action (PWC 2008).

Scholars and researchers have cited numerous empirical evidence of benefits that accrue to industries from going green. Various Corporate environmental announcements have a effect on the financial valuation of a firm (Videen 2010). Environmental quality in production and the consumers' preference for environmental quality determine the probability of trading as well as the level of trade (Borsky et al). Brown (2009) has cited example of large refiners in wholesale reformulated gasoline market in California gaining both in terms of market share and profits by going green. In real estate, significant positive relationship between the greenness and the residential property prices has been proved empirically (Aroul 2009). Green building benefits were cited to be real even against risks factors involved of going green, which were controllable (Durmus-Pedini & Ashuri 2010). In case of logistics service providers, adoption of green initiatives not is viewed as a short-lived trend or as an established practice. Instead, it can be described as a potential business opportunity as it has a potential positive effect on the organization's image and brand (Isaksson 2012). Luna has cited examples implementation of several green initiatives to reduce cost of operation in tight fiscal situations. Going green has been found to have positive effects in hospitality industry (Micioni 2009). In tourism industry, there are evidences of increasing importance of environmental responsibility alongside financial objectives as green thinking begins to shape the qualities consumers seek in the travel products they purchase (Rheem 2009). Welsh: Going green is the key to aviation industry as well (Welsh 2010). Leaders of electronics and chemical industries are striving to become more efficient and green for the future (Boyd et al). These facts are corroborated by the fact that global total new investment in clean energy has increased from USD 52 Billion in 2004 to USD 243 Billion in 2010 (World Economic Forum 2011).

The benefits of going green is not only limited to the organizations but to the society as a whole as it is associated with various macroeconomic benefits (Schatzki 2008). The

concept of the green economy has gained currency to a large extent because it provides a response to the multiple crises that the world has been facing in recent years – the climate, food and economic crises – with an alternative paradigm that offers the promise of growth while protecting the earth's ecosystems and, in turn, contributing to poverty alleviation. Thus developing economies must make transition to a green economy a part of their national agenda (UN-DESA). Urban transport, buildings and energy are key sectors for green economic growth (The London School of Economic and Political Science 2012). Going green is also associated with employment generation. Specific attention is placed on the energy efficiency sector within the growing green economy. The energy efficiency market is well established and growing. The combination of a strong foundation with increased investment and entrepreneurial interest, and low relative cost to implement methods, make the energy efficiency industry a focal point for growing green jobs regionally (Scarpa 2009).

1.3 Impact of green business on securities markets

Green Mutual Funds choose industries within energy conservation, fair-trade, sustainability, or companies that have the best environmental practices and can prove to be a profitable venture (UNC Charlotte IDEAS Centre 2012) as investors are becoming more and more progressive and environmental concern is increasingly becoming an investment theme (EDHEC-RISK Institute 2010).

Progressive investors need a benchmark to track the performance of green stocks vis-à-vis the rest of the market. Considering this requirement, financial service organizations like Standard & Poor's & International Financial Corporation in collaboration with environmental impact tracking company like Trucost, have formulated different green and carbon-efficient indices constituted by stocks of corporate entities which use green technologies and strive to reduce carbon footprint.

The first Green Stock Index, the Living Planet Green Tech Europe Index1 is an innovative green index, launched in 2011 by the WWF International subsidiary, the Living Planet Fund Management Company and the European broker Cheuvreux. The Index, calculated and published by Standard & Poor's consists of 50 European listed companies that are most engaged in providing eco-friendly solutions addressing the world's important environmental challenges. It covers various Green sectors, in particular relating to energy efficiency, water management, renewable energy, waste management, biomass, eco products and services, and finally, alternative energy and transportation. Other prominent green indices include CELS which tracks U.S.-traded clean-energy companies and QGRD which covers smart grid and grid infrastructure firms. The NASDAQ® Clean Edge® Green Energy Index (CELS) is a modified market capitalization-weighted index designed to track the performance of companies that are primarily manufacturers, developers, distributors, or installers of clean-energy technologies. The NASDAQ OMX® Clean Edge® Smart Grid Infrastructure Index (QGRD) is designed to act as a transparent and liquid benchmark for the smart grid and electric infrastructure sector. The Index includes companies that are primarily engaged and involved in electric grid; electric meters, devices, and networks; energy storage and management; and enabling software used by the smart grid and electric infrastructure sector. Till recently NYSE Euronext and Bloomberg New Energy Finance (BNEF) announced the launch of three

regionally-focused clean energy stock indexes. The new indexes will cover the Americas; the Europe, Middle East and Africa (EMEA) region; and Asia and Oceania.

1.4 BSE-GREENEX – The Indian Green Index

The BSE-GREENEX is the 25th dynamic index of the Bombay Stock Exchange. It is a first of its kind benchmark index, which assess the carbon performance of stocks based on quantitative performance based criteria. Unlike existing global indices that measure environmental performance through various scaled quantitative criteria, the BSE-GREENEX applies sector specific proprietary algorithms to assess energy efficiency performance of various companies based on publicly disclosed energy and financial data. The BSE-GREENEX is the first step in creating an inclusive market based mechanism for the promotion of energy efficient practices amongst the large Indian business enterprises. BSE Ltd. in association with gTrade Carbon Ex Ratings Services Private Limited (gTrade) has co-developed the BSE-GREENEX. The BSE-GREENEX is the outcome of the joint collaboration which consists of 20 largest and most efficient companies on the carbon emissions front from the BSE-100 Index. One of the parameters for measurement of environmental performance used in BSE-GREENEX calculation, and received from gTrade, is emissions intensity viz. total emissions upon total revenue (which is assumed to be a close proxy for energy efficiency). Mandatory disclosures on energy usage by assessed companies make it possible to estimate these numbers for listed companies. Additionally, BSE-GREENEX is the first environmental friendly equity index to be publicly disseminated on a real-time basis, providing a new tool for use by "green" retail and institutional investors to track the performance of India's largest and most liquid, energy efficient stocks. The index can be licensed for the development of green financial products including mutual funds, ETFs and structured products. BSE-GREENEX is also India's first objective green equity index to employ index constituent weight capping. Index constituent weights are capped at 6 percent during dynamic rebalancing, in an effort to increase the diversification within the index and ensure greater compliance with international regulatory and statutory investment guidelines.

2. OBJECTIVES OF THE STUDY

The study has been carried out with two objectives. Firstly, the study has been done to assess the performance of BSE-GREENEX vis-à-vis two other broad based indices i.e. BSE-SENSEX & BSE-500. The assessment has been done on the two parameters of daily returns and variability in daily returns. Secondly, the values of the said three indices have been subjected to predictive modeling by linear multivariate regression methods to assess the comparative predictability of BSE-GREENEX vis-à-vis BSE-SENSEX & BSE-500 over very short periods i.e. a day.

3. METHODOLOGY

Daily closing values of the BSE GREENEX were taken along with those of BSE SENSEX and BSE 500 from <http://www.bseindia.com>. These indices commenced from different dates. To facilitate a comparative study, values were taken from October 1st 2008 from which date the values of all the three indices were available. Closing values of the indices were taken up to March 28th 2013 i.e. the last trading day of the 2012-13 fiscal. Daily returns on these indices were calculated by the formula $r_t = (v_t - v_{t-1})/v_{t-1}$ where r_t is the daily return and v_t & v_{t-1} are the current and previous days' values

of the indices respectively. Then the averages of these daily returns of the three indices were calculate on quarterly basis. These quarterly averages were also calculated on a cumulative basis. The standard deviations of the daily returns were also calculated quarterly on cumulative basis.

Predictive modeling on these indices have also been done on the assumption that daily closing value of any index on any day is dependant on the immediately preceding 7 days closing values of that index. Thus a linear multivariate regression equation is sought to be framed where the regressant variable would be the closing value of the index on any day and the predictor / regressor variables would be the immediately preceding 7 days' values of that index. Thus if a day's closing value (price) is depicted by Y_t and its immediately preceding 7 days closing values (prices) are depicted by $Y_{t-1}, Y_{t-2}, \dots, Y_{t-7}$, then the regression equation is:

$$Y_t = \alpha + \beta_1.Y_{t-1} + \beta_2.Y_{t-2} + \beta_3.Y_{t-3} + \beta_4.Y_{t-4} + \beta_5.Y_{t-5} + \beta_6.Y_{t-6} + \beta_7.Y_{t-7}$$

The values of β_1, \dots, β_7 are tested for their t statistic at 5% level of significance and their p values for assessing their statistical significance. Statistically insignificant coefficients are filtered out and valid regression equations have been constructed considering only the statistically significant coefficient.

To test the predictive ability of the constructed regression equations, the predicted values are compared with the actual daily closing prices from April 1st 2013 to June 13th 2013 and the Mean Absolute Percentage Error (MAPE) is calculated for each equation.

4. FINDINGS

The amplitude and pattern of the fluctuation of daily returns of the BSE-GREENEX index is quite different from those of BSE-SENSEX and BSE-500 indices.

Fig1. Daily Returns on BSE-GREENEX

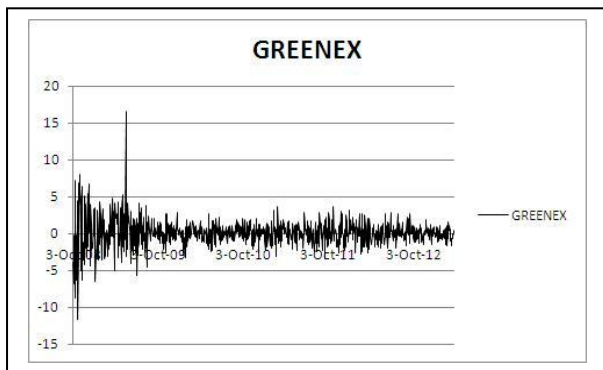


Fig 2. Daily Returns on BSE-SENSEX

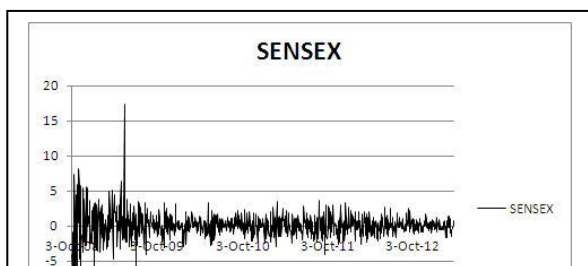
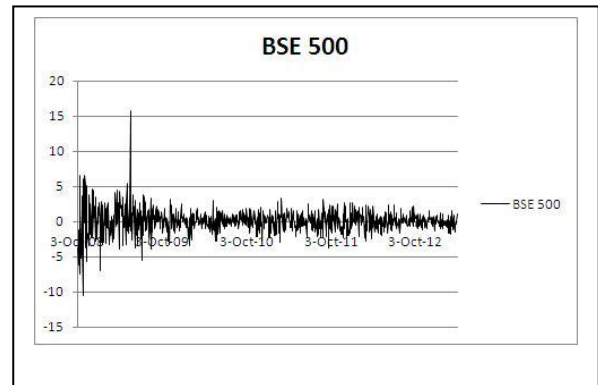


Fig 3. Daily Returns on BSE-500



The mean daily returns on BSE-GREENEX is consistently above the mean daily returns on BSE-SENSEX and BSE-500 indices.

Table 1. Mean daily returns (calculated quarterly)

Quarters	BSE-SENSEX	BSE-500	BSE-GREENEX
2008Q4	-0.467	-0.516	-0.426
2009Q1	0.036	-0.015	0.064
2009Q2	0.761	0.828	0.799
2009Q3	0.275	0.289	0.305
2009Q4	0.039	0.077	0.110
2010Q1	0.000	0.015	0.006
2010Q2	0.020	0.044	-0.007
2010Q3	0.201	0.189	0.144
2010Q4	0.037	-0.001	0.059
2011Q1	-0.093	-0.118	-0.118
2011Q2	-0.048	-0.031	-0.034
2011Q3	-0.205	-0.197	-0.264
2011Q4	-0.084	-0.148	-0.093
2012Q1	0.192	0.252	0.258
2012Q2	0.011	-0.010	-0.002
2012Q3	0.127	0.130	0.142
2012Q4	0.061	0.088	0.067
2013Q1	-0.054	-0.114	-0.139

Source: <http://www.bseindia.com> and own calculations

Fig 4. Mean daily returns (calculated quarterly)

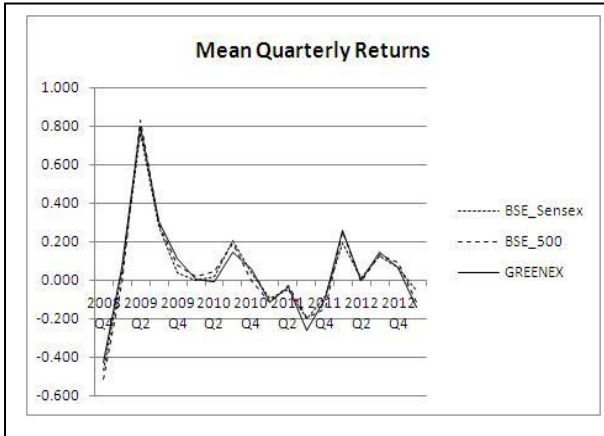


Fig 5. Mean daily returns (calculated quarterly on cumulative basis)

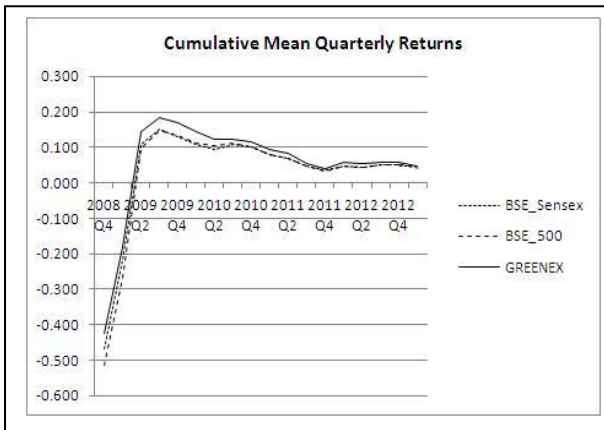


Table 2. Mean daily returns (calculated quarterly on cumulative basis)

Quarters	BSE-SENSEX	BSE-500	BSE-GREENEX
2008Q4	-0.467	-0.516	-0.426
2009Q1	-0.216	-0.265	-0.181
2009Q2	0.110	0.099	0.146
2009Q3	0.151	0.147	0.185
2009Q4	0.129	0.133	0.170
2010Q1	0.107	0.113	0.143
2010Q2	0.095	0.103	0.121
2010Q3	0.108	0.114	0.124
2010Q4	0.100	0.101	0.117
2011Q1	0.081	0.079	0.093
2011Q2	0.069	0.069	0.082
2011Q3	0.046	0.047	0.053
2011Q4	0.036	0.032	0.042

2012Q1	0.047	0.048	0.057
2012Q2	0.045	0.044	0.053
2012Q3	0.050	0.049	0.059
2012Q4	0.051	0.052	0.059
2013Q1	0.045	0.042	0.048

Source: <http://www.bseindia.com> and own calculations

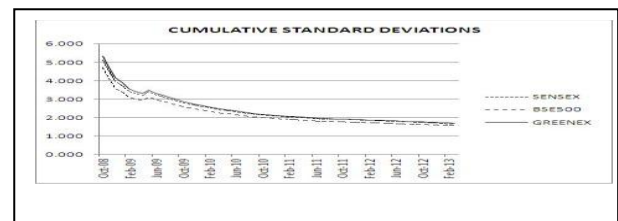
However,. The variability of the daily returns on BSE-GREENEX is consistently above those on BSE-SENSEX and BSE-500.

Table 3. Quarterly Standard Deviations of returns (calculated on cumulative basis)

Quarters	BSE-SENSEX	BSE-500	BSE-GREENEX
2008Q4	3.954	3.609	4.176
2009Q1	3.303	2.993	3.413
2009Q2	3.239	2.977	3.315
2009Q3	2.912	2.692	2.989
2009Q4	2.660	2.466	2.716
2010Q1	2.461	2.289	2.512
2010Q2	2.317	2.154	2.358
2010Q3	2.173	2.019	2.210
2010Q4	2.077	1.934	2.107
2011Q1	2.015	1.880	2.043
2011Q2	1.946	1.815	1.970
2011Q3	1.906	1.775	1.925
2011Q4	1.878	1.746	1.894
2012Q1	1.834	1.712	1.860
2012Q2	1.789	1.671	1.816
2012Q3	1.743	1.627	1.773
2012Q4	1.699	1.587	1.730
2013Q1	1.659	1.552	1.690

Source: <http://www.bseindia.com> and own calculations

Fig 6. Quarterly Standard Deviations of returns (calculated on cumulative basis)



During the period from October 1st 2008 till March 28th 2013, the variation of daily returns on BSE-SENSEX has reduced from 3.954 to 1.659 showing a reduction of 58.04%. The corresponding figures for BSE-500 and BSE-GREENEX are

57% and 59.53% respectively. Thus BSE-GREENEX has been achieving stability in daily returns at a faster rate than BSE-SENSEX and BSE-500.

For prediction on a very short term i.e. a day, the regression equation for BSE SENSEX, considering only the statistically significant coefficients becomes:

$$Y_t = 4.03913 + 1.07251.Y_{t-1} - 0.09541.Y_{t-2} + 0.02282.Y_{t-7}$$

This indicates that the closing value on any day is largely dependent on the previous day's value and to a lesser extent on the 2nd and 7th previous days' values. The MAPE for the period from April 1st 2013 to June 13th 2013 comes to only 0.777%.

For prediction on a very short term i.e. a day, the regression equation for BSE GREENEX, considering only the statistically significant coefficients becomes:

$$Y_t = 4.9578 + 0.9967.Y_{t-1}$$

This indicates that the closing value on any day is largely dependent on the previous day's value only. The MAPE for the period from April 1st 2013 to June 13th 2013 comes to only 0.774%.

Thus BSE-GREENEX is slightly more predictable than BSE-SENSEX and is dependant only on the previous day's value thus making its modeling even simpler than BSE-SENSEX.

5. FURTHER RESEARCH

Similar studies can be carried out on other green indices not only in India but also in other countries. It is also a subject of further research into the field regarding how much of the appreciation in the price of green stocks is attributable to the financials of the organizations and how much is attributable to the behavioral aspects of the investors.

6. CONCLUSION

Investing in green stocks is thus found to be comparatively more rewarding to investors. Investing in organizations committed to environmental concerns provide long term value to its stakeholders including its shareholders. Going green thus helps to achieve enhancing shareholders' wealth by capitalizing on social costs, environmental benefits and financial gain. However the findings of this study should be verified for validity by conducting similar studies on other green indices of various countries and considering more variables.

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