

Study of Differences between Returns and Volatility of Sustainability Indices (BSE GREENEX and BSE CARBONEX) and BSE 100

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Abstract: With social responsibility and sustainability becoming important areas in business, investors are looking to invest in 'green stocks', that are stocks of companies having green practices. However, they are often skeptical whether such stocks can match the returns provided by conventional investing. The paper thus studies the differences between returns and volatility of sustainability indices (viz. BSE GREENEX and BSE CARBONEX) and BSE 100. For the purpose of the study, closing prices of the indices for the past 5 years are taken. To study differences in average returns, t-test is used and to study differences in variances (volatility), F-test is used. The results show that there is no significant difference between the returns and volatility of BSE 100 and sustainability indices. It is concluded that for the same amount of risk (volatility), sustainable indices match the returns of BSE 100.

Index Terms - Sustainability index, volatility, returns.

I. INTRODUCTION

Stock market indices measure a specific sector of the stock market. It is generally calculated using the weighted average prices of selected stocks. Stock indices act as tools for financial managers and investors to broadly explain the market and compare the evaluate on specific investments by comparing with the returns on the index.

In Bombay Stock Exchange (BSE), BSE 100, established in 1989, measures the performance and stock prices of the 100 most liquid and largest companies in the S&P BSE LargeMidCap index. It is a broad-based index, i.e. the index represents or reflects the movement of the entire market.

BSE is taking multiple steps in the field of Corporate Social Responsibility (CSR) and sustainability. Introduction of thematic indices to represent green stocks is one of them. S&P BSE GREENEX and S&P BSE CARBONEX are two indices that are thematic indices on the Bombay Stock Exchange. S&P BSE GREENEX, launched in February 2012 by the Minister of Corporate Affairs, measures the performance of 25 companies from the S&P BSE 100. These companies are selected on the basis of liquidity, market capitalization and low greenhouse gas emissions. GREENEX is the country's first carbon-efficient live index. S&P BSE CARBONEX measures the performance of the companies in the S&P BSE 100 by using weights which are assigned as per companies' relative carbon performance. Launched in 2012, its objective is to provide the investors with an index showing companies' commitment to mitigating the outcomes of climate change and taking steps in future to combat environmental problems.

Thus, the paper studies whether there is any difference between the returns earned from sustainability indices (BSE GREENEX and BSE CARBONEX) and BSE 100 and if there is difference in the volatility (also a measure of risk) of sustainability indices and BSE 100.

II. REVIEW OF LITERATURE

Kreander, N., Gray, R. H., Power, D. M., & Sinclair, C. D (2005) discussed the differences in performance of ethical funds and non-ethical funds in Europe using Jensen's measure. They found that there is no significant difference between their performance.

Rob Bauer, Kees Koedijk, Roger Otten (2005) studied the ethical and unethical mutual funds from Germany, the UK and the USA. It was found that then there is no significant difference between their performance, though earlier the ethical funds were not able to match the returns of conventional funds.

Maria Ceu Cortez, Florinda Silva and Nelson Areal (2009) explored the performance of socially responsible mutual funds from seven European countries. The results depict that European SR funds have a neutral performance with respect to both conventional and socially responsible benchmarks.

Rajib Bhattacharya (2013) studied difference in performance and variability of daily returns of green BSE GREENEX with BSE SENSEX and BSE 500 and tried to develop a model using linear multivariate regression to predict prices of these three indices over a day. The results show that the green index had better performance than BSE SENSEX and BSE 500.

Vanita Tripathi and Varun Bhandari (2014) studied Socially Responsible Investing (SRI) by an extensive literature review. They found that SRI matches the returns earned from conventional investing and that there is no detriment in investing in SR

stocks. A comparative analysis of ESG (Environmental Social and Governance) Index and GREENEX against NIFTY, SENSEX and CNX 500 showed that SR indices have better returns than conventional indices but have higher systematic risk.

Sumit Kumar Maji & Ashoke Mondal (2015) compared risk and return of GREENEX with conventional BSE indices, returns of certain companies in the GREENEX with other companies (control companies) and market response to green investing. The result showed that GREENEX as an index is performing better than other traditional BSE indices. However, more than 50% of the GREENEX companies are underperforming as compared to control companies. Investors make decisions based on financial and economic factors, but don't consider environmental factors of the company a lot.

Vanita Tripathi and Varun Bhandari (2015) empirically compared the performance of SR stocks portfolio to portfolios of general companies in India using absolute rate of return and various risk adjusted measures like Sharpe ratio, Treynor ratio, Jensen's α , Information ratio, Fama's decomposition measure and dummy regression. They found that SR stocks portfolios had lower relative risk in spite of having higher systematic risk. ESG Index and GREENEX Index provided positive net selectivity in pre-crisis, crisis and post crisis period. Thus, diversifying in socially responsible stocks portfolios is rewarded in terms of higher returns in Indian context.

Rangotra Rahul (2016) studied if there is any significant difference between risk and returns of socially responsible investments and conventional investments. Returns and risks of socially responsible indices of Asia and India were taken, (S&P Asia Alternative Energy Index, S&P Asia Water Index and S&P BSE CARBONEX and S&P BSE GREENEX) and compared with that of conventional indices (S&P Asia Pacific BMI and S&P BSE SENSEX) in past 10 years. The results showed that there isn't any significant difference between SRI indices and conventional indices, except, risk being significantly more in S&P Asia Alternative Energy Index than S&P Asia Pacific BMI.

Vanita Tripathi and Varun Bhandari (2016) compared performance of green index (BSE ESG) with general index (CNX NIFTY). Sector wise study was done using Sharpe ratio, Treynor ratio, Double Sharpe ratio, M2 measure, etc. The results show that BSE ESG outperform CNX NIFTY especially in the sectors of Fast Moving Consumer Goods (FMCG), financial sector and Information Technology (IT).

Alka Bramhandkar, Hormoz Movassaghi and Judy Qiu (2018) studied the difference in performance of socially conscious (SC) mutual funds and conventional mutual funds during bullish and bearish period. It was found that while SC funds didn't perform as good as conventional funds during both periods, by adopting more social screens, increasing investment horizon and during boom market conditions, the performance of SC funds improve.

Doug H Witte, Thomas M Krueger and Edward C Chang (2019) compared the risk and returns of SRI funds in the USA from 2007 to other mutual funds using risk-adjusted return measures, risk and conventional return. While, SRI funds have positive returns, they are not able to match other mutual funds on an average. Also, SR funds with low expense ratios give a better return.

III. RESEARCH GAP

While previous literature compared performance of green indices with conventional ones, the comparison has not been done with the index that GREENEX and CARBONEX are derived from, i.e. BSE 100. The previous studies don't capture the different types of investor behavior when it comes to green investing.

The two kinds of green investing behavior can be-

- Handpicking only green stocks and investing only in them, as in case of BSE GREENEX.
- Investing in a variety of stocks but giving higher weightage to green stocks, as in case of BSE CARBONEX.

Thus, there is scope for comparing these two kinds of green investing behavior against conventional investing behavior and compare returns and volatility.

IV. RESEARCH OBJECTIVES

The study aims to compare volatility and return of BSE 100 index with sustainability indices, namely BSE GREENEX and BSE CARBONEX. This is to understand whether sustainable indices have returns and volatility different from BSE 100, which is the underlying index for both GREENEX and CARBONEX.

1. To compare returns of sustainability indices (BSE GREENEX and BSE CARBONEX) and general index (BSE 100).
2. To compare volatility of sustainability indices (BSE GREENEX and BSE CARBONEX) and general index (BSE 100).

V. HYPOTHESES

The following hypotheses will be tested. Hypotheses 1 and 2 will be tested by using t-test and 3 and 4 will be tested by using F-test (Levene's Test for Equality of Variances).

- H0 :1 There is no significant difference in the returns of BSE 100 and BSE GREENEX.
- H0 :2 There is no significant difference in the returns of BSE 100 and BSE CARBONEX.
- H0 :3 There is no significant difference in the volatility of BSE 100 and BSE GREENEX.
- H0 :4 There is no significant difference in the volatility of BSE 100 and BSE CARBONEX.

VI. RESEARCH METHODOLOGY

Since the three indices under study are BSE indices, BSE website is used to collect historical values of the three indices, BSE 100, BSE GREENEX and BSE CARBONEX. 5-Years historical data of the closing prices of the indices, from 1st January 2014 to 31st December 2018 is collected for the purpose of the study. The returns for the indices are calculated. Annualized returns are calculated by multiplying each year's average daily returns by 250 (assuming that the stock market is open for 250 days in a year).

The descriptive statistics is then calculated including statistics such as mean, standard deviation, skewness and kurtosis. Augmented Dickey Fuller Test (ADF Test) is run to test if the data is stationary. For testing of hypotheses to understand if there is any significance difference in returns and risk of the indices, t-test and F-test (Levene's Test for Equality of Variances) are done for both daily returns and annualized returns.

VII. DATA ANALYSIS AND INTERPRETATION

Table 1: Descriptive Statistics

Returns		BSE 100	BSE CARBONEX	BSE GREENEX
N		1232	1232	1232
Minimum		-6.4894	-6.4241	-6.099
Maximum		3.2571	3.3309	3.6504
Mean		0.0461	0.04623	0.03745
Std. Deviation		0.8611	0.85805	0.87673
Variance		0.741	0.736	0.769
Skewness	Statistic	-0.615	-0.592	-0.444
	Std. Error	0.07	0.07	0.07
Kurtosis	Statistic	3.345	3.28	2.472
	Std. Error	0.139	0.139	0.139

From the descriptive statistics in Table 1, BSE CARBONEX has the highest mean and BSE GREENEX has the lowest mean. The standard deviation of BSE GREENEX is highest and that of BSE CARBONEX is the lowest. However, the differences between the means and the standard deviations are marginal and it has to be tested whether the difference between the means and standard deviations of the indices are significantly different or if there is statistically no difference between the mean returns and standard deviation (volatility) of the indices.

Table 2: Summary of Stationarity Test

Returns	ADF Test Statistic	p-Value
BSE 100	-32.25225	0.0000
BSE CARBONEX	-32.27331	0.0000
BSE GREENEX	-32.70982	0.0000

From the Stationarity tests in Table 2, the p-values of the ADF statistic of the returns all the three indices are 0.000, which is less than 0.05. Thus, the null hypothesis of the ADF test (which states that the data has unit root and is thus not stationary) is rejected and the returns are stationary.

Table 3: Summary of t-test and F-test results- Daily Returns

Returns Compared		BSE 100 and BSE GREENEX	BSE 100 and BSE CARBONEX
t Test	t statistic	0.246	-0.005
	p-value	0.806	0.996
F Test	F statistic	1.132	0.004
	p-value	0.287	0.947

Table 4: Summary of t-test and F-test results- Annualized Returns

Returns compared		BSE 100 and BSE GREENEX	BSE 100 and BSE CARBONEX
t Test	t statistic	0.229	-0.004
	p-value	0.824	0.997
F Test	F statistic	0.213	0.02
	p-value	0.657	0.891

While comparing values of daily returns and annualized returns in Table 3 and Table 4 respectively, the p values of the t-statistic for both groups of indices (BSE 100 & BSE GREENEX and BSE 100 & BSE CARBONEX) are greater than 0.05. Thus, the null hypothesis (that there is no significant difference in the returns) is accepted. Also, the p values of the F-statistic for both

groups of indices are more than 0.05 and thus, the null hypothesis (that there is no significant difference in the volatility) is accepted.

Thus, as per the results of the tests done, it can be interpreted that in case of both BSE GREENEX and BSE CARBONEX, the returns gained, and the volatility is not significantly different from that of BSE 100.

VIII. CONCLUSION AND SUGGESTIONS

Results show that the returns earned and the volatility of GREENEX and CARBONEX is not significantly different from that of BSE 100. This means that for the same amount of risk, both the sustainability indices are able to match the returns of a traditional index. Thus, investors having a green perspective while investing are not losing out on returns and can enjoy the same returns as other traditional investors, with an additional benefit of investing in green stocks and contributing to their social responsibility as investors.

Based on the results found out, the following recommendations are suggested:

- Since there is no significant difference between returns of the indices and the green indices match the returns of the conventional index. Thus, the investors are not penalized or have negative consequences by investing in green stocks.
- Encourage the use of green stocks since this way companies involved in green activities get higher investments and liquidity in stock market.
- Other companies should be encouraged to start green initiatives using the financial incentive of attracting investors and in the bargain, having a positive impact on the environment.
- Investors can construct a portfolio which is a mix of green and conventional stocks and use the methodology used in the study to compare portfolios and choose a portfolio that maximizes returns.
- Mutual funds in India can introduce and popularize funds investing in such green stocks or have a mix of green stocks to cater to socially responsible investors.

IX. SCOPE FOR FUTURE RESEARCH

Further research can be done in this field of study. The risk and returns of green indices of developing countries can be compared with that of developed countries. Difference between risk and return of green and traditional indices can be compared for different economies to check if results are based on various types of economies. There are major policy changes that government takes and some are related to various environmental regulations. Thus, the change in return and volatility before and after these policy changes can be analyzed.

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