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The Financial Feasibility of Investing in a Sustainability Index in India

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Abstract

ESG is at the center of dialogue for investments, corporate governance and management. It used as an acronym for 'Environmental, Social and Governance' factors. The rapid rise of ESG has led to the prominence of socially responsible investing and has created a dual objective for investor's capital. Researchers have previously studied the volatility of sustainable investments and whether SRI affects portfolio performance. Analyzing the financial feasibility of investing in a sustainability index was done by utilizing the historical data of returns on BSE ESG Index, NIFTY 500 Index and the BSE ESG 100 Index from October 2017 to April 2024. S&P BSE 100 ESG Index was used as a proxy for a sustainability index and the S&P BSE 100 Index was the index used to proxy traditional investments. This study has utilized financial ratios along with EGARCH and Granger causality test to understand the risk-reward characteristics of sustainable investments and compare them with traditional investments to understand whether it is financially viable to be a sustainably responsible investor. T test was conducted to identify whether is a significant difference between the returns of the sustainability index and its parent index. Results suggest that the sustainability index has a lower risk-adjusted return than traditional investments however, there is not a significant difference between the returns of the sustainability index and its parent index. There is a presence of strong persistent volatility in the sustainability index and negative shocks have a greater impact on the volatility of the index. Data also suggests a bi-directional relationship between the S&P 500 ESG Index and India's sustainability index. The study recommends investors to consider the cost associated with investing in sustainability themed instruments while also taking into considerations the factors which are responsible for volatility of sustainable investments as well as the asymmetrical impact of negative shocks on returns.

Keywords: *Volatility, Socially Responsible Investing (SRI), Environmental Social Governance (ESG), EGARCH, Granger Causality, India, Sustainability Index.*

1. Introduction

ESG is at the center of dialogue for investments, corporate governance and management. It used as an acronym for 'Environmental, Social and Governance' factors. It is a framework used to evaluate a company's impact beyond financial performance. Environmental factors assess how a company manages its environmental footprint, such as carbon emissions and resource usage. Social factors examine the company's relationships with stakeholders, including employees, communities, and customers, focusing on diversity, labour practices, and human rights. Governance evaluates the company's leadership, transparency, and accountability structures. ESG integration into business decisions aims to promote sustainability, ethical behaviour, and long-term value creation, appealing to investors seeking to align their portfolios with principles of social responsibility and sustainability.

The modern roots of social investing can be traced back to the 1960's. A series of themes, from the Anti-Vietnam war movement to the civil rights movement and later, the Bhopal and Exxon Valdez incidents have served to escalate sensitivity to the issues of social responsibility and accountability (Schueth,

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2003). This has caused investors to have a dual objective for their capital. This led to a rise of Socially Responsible Investing (SRI). In the last 20 years, Socially Responsible Investing has attracted investors and academics alike. According to PwC, ESG assets are growing at a CAGR of 12.9% and are on pace to constitute 21.5% of total global AuM by 2026. The market is quickly adopting to these trends, leading rise to a number of ESG related financial services and products such as environmentally responsible ETF's, green bonds to finance eco-friendly products and thematic mutual funds. Investors are also growing fond of these products and thus the academic research focuses on the same. According to Revelli & Viviani (2015), SRI research in the last decade has focused on the costs of SRI investing beyond those associated with traditional investments and whether it affects performance of portfolio. Kempf & Osthoff (2007), suggest that, for SRI investors, net of cost maximum abnormal returns are achieved when investors utilise several socially responsible screening approaches at the same time and restrict themselves to the stocks with extreme socially responsible ratings. Thus, although abnormal returns can be earned by SRI investors, they need to estimate the excess cost associated with sustainable investments. Adler & Kritzman (2008) suggests that the cost of socially responsible investing increases with the investor's skill, cross-sectional dispersion of the universe, fraction of the universe that is restricted, and the number of securities in the portfolio. This study will follow similar lines as it looks to explore the risk-reward characteristics of sustainable investments and compare it with traditional investments to understand whether there are extra costs associated with being a socially responsible investor.

2. Literature Review

2.1 Risk-Reward of Sustainability Indices

Studies have analysed the performance of sustainability based indices and funds in order to establish whether there is a financial argument to invest in them and not just for the purpose of socially responsible investing. Sudha (2015), employed financial ratios and descriptive statistics of the annualized returns to study the risk-reward of investing in S&P ESG India Index by studying data from 2005 to 2012 and it was found that it is financially viable to invest in that sustainability index. Tripathi & Kaur (2021) evaluated and compared the performance of socially responsible indices in select developed and developing countries across market conditions over 12 years and they found that developing countries of India and China earned significant positive excess returns, outperforming the general indices, in bear and bull conditions, respectively. Similar results were found for Istanbul (Yilmaz et al., 2020). The present study aims to verify whether these findings still hold true today in India and considers a relatively recent time span from 2017-2024 in order to get an impact of investing in a sustainability index in India which reflects the recent history and performance of the index. The talks around and push for sustainability has seen tremendous growth post 2020 and the researchers wish to investigate whether current investors in India would financially benefit from investing in this particular sustainability index.

2.2 Impact of US ESG Index returns on India ESG Index retuns

The volatility spillovers between sustainability indices has been vastly investigated by researchers, mostly applying VAR models of the GARCH family (Karakaya & Kutlu, 2022; Sahoo & Kumar, 2023) and these studies found a bi-directional relationship between the indices. Findings indicated asymmetry impact of positive and negative shocks to the volatility of the indices. Engle-granger models have also been applied to study the direction of volatility spillovers which can be applied to study the direction of volatility spillovers between the sustainability indices as well (Atukeren et al., 2021; Hong et al., 2009). These articles provide evidence for the volatility spillovers between sustainability indices and using these articles as precedents, the present study investigates whether there is presence of spillover of returns between the indices as well and the US ESG Index has been utilised for that means. The aim here is to find whether changes in returns of one sustainability index would lead to future change in the other index and whether or not it is relevant for the investors to track the returns of

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other global sustainability indices in order to speculate the future returns of India's sustainability indices.

2.3 Asymmetry in the Impact of Negative and Positive Shocks

Studies have applied the EGARCH, GJR GARCH and TARCH models to study the impact of the positive and negative shocks or "good news" and "bad news" on the volatility of the sustainability indices (Sabbaghi, 2022; Jin, 2022; Roy, 2017; Ti et al., 2019). The results find that the impact of negative shocks is greater than the impact of positive shocks of the same magnitude on the volatility of indices which is generally true for financial time series data. The present study would like to investigate whether this holds true for the sustainability index in India. The leverage effect introduced by Black (1976) was found in the studies and high values of log likelihood were found which suggests that EGARCH model is the correct technique to study this objective. Therefore, an EGARCH model has been utilized by the researchers as the technique to test for the asymmetry in the impact of positive and negative shocks. The results of the study would set the expectations of investors for when positive or negative 'news' comes into the picture, the investors would have an idea of which of the two would cause more deviation in their holdings and they could make plans accordingly.

3. Research Problem

The research problem for this study has been defined as The Financial Feasibility of Investing in a Sustainability Index in India.

4. Research Objective

The objectives being studied in this research paper are as follows:

1. To explore the differences in the risk-reward characteristics of sustainability index and other market indices.
2. To study the impact of returns of a US Sustainability Index on the returns of India's Sustainability Index.
3. To study the asymmetry in the impact of positive and negative shocks on the volatility of the Sustainability Index.

5. Hypothesis

The hypotheses of this paper are as follows:

H1. To identify whether there is a significant difference between the returns of S&P BSE 100 ESG Index and S&P BSE 100 Index.

H2. To study the relationship between S&P BSE 100 ESG Index returns and S&P 500 ESG Index returns.

6. Research Methodology

6.1 Research Design

The study utilized a descriptive research design as the objective was to explore the characteristics of various indices and compare them. Further, longitudinal study was conducted by collecting and analysing time series data.

6.2 Data Collection

This research investigates the S&P BSE 100 ESG Index as a sustainability benchmark and assesses its financial viability. Daily data was collected from secondary sources from October 26, 2017 to April 3, 2024 (1594 observations) for several indices. The primary focus is the S&P BSE 100 ESG Index, which tracks companies with strong environmental, social, and governance (ESG) practices. The S&P BSE 100 Index, representing the conventional S&P BSE 100 companies, serves as a benchmark for performance comparison. Additionally, the NIFTY 500, obtained from Yahoo Finance, captures the broader Indian stock market's returns. Finally, the S&P 500 ESG Index (March 16, 2020 to April 3, 2024; 1005 observations) from Yahoo Finance provides an international reference for ESG investing.

The S&P BSE 100 ESG Index is a float-adjusted market capitalization weighted index that selects companies with high ESG scores from S&P Global. These companies comprise 75% of the market capitalization within each sector of the S&P BSE 100 Index. The ESG Index further excludes companies involved in specific controversial businesses, those not aligned with UN Global

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Compact principles, and those facing significant ESG controversies. By comparing the S&P BSE 100 ESG Index with the S&P BSE 100 Index, it can determined if companies with strong ESG practices outperform or underperform relative to those with lower ESG scores. Further, Nifty 500 is a stock market index that tracks the performance of the top 500 largest companies in India, based on their market capitalization (total market value) and trading activity. It's like a giant basket containing the biggest and most actively traded Indian stocks. Therefore, it is used to track the returns of the broader Indian market. Finally, the S&P 500 ESG Index is an Index which captures the US stocks, offers an international perspective on ESG investing, providing valuable insights about its impact to the Indian ESG Index.

6.3 Data Analysis Tool

6.3.1 Financial Ratios

Data was analyzed using a variety of descriptive statistics and financial ratios. The Sharpe Ratio indicates the historic average differential return per unit of historic variability of the differential return (Sharpe, 1994). Treynor Ratio is the ratio of the excess return to the systematic risk of that return (Pilotte & Sterbenz, 2006). Jensen's Alpha measures the realized returns on any security or portfolio and can be expressed as a linear function of its systematic risk, the realized returns on the market portfolio, the risk-free rate and a random error, which has an expected value of zero (Jensen, 1968). The Sortino Ratio is similar to the Sharpe Ratio but uses downside risk rather than standard deviation as the measure of risk (Rollinger & Hoffman, n.d.). Further, to test whether there is a significant difference between the returns of the S&P BSE 100 ESG Index and the S&P BSE 100 Index, a T test was conducted on Microsoft Excel with the following null and alternative hypotheses:

Null Hypothesis (H_0): S&P BSE 100 ESG Index returns are not significantly different than S&P BSE 100 Index returns.

Alternative Hypothesis (H_A): S&P BSE 100 ESG Index returns are significantly different than S&P BSE 100 Index returns.

6.3.2 Granger Causality Test

The Granger Causality Test is employed using the data of daily returns of the 2 indices to test the 2nd hypothesis of the paper. This test uses the following null and alternative hypotheses:

Null Hypothesis (H_0): S&P 500 ESG Index returns does not Granger-cause S&P BSE 100 ESG Index returns.

Alternative Hypothesis (H_A): S&P 500 ESG Index returns Granger-causes S&P BSE 100 ESG Index returns.

The test is conducted in RStudios using the 'lmtest' package. In the time series shown in Figure 1, 'ESG100' represents the data of the daily returns of S&P BSE 100 ESG Index returns and 'ESG500' represents the data of the daily returns of S&P 500 ESG Index. This data is compared by employing the granger-causality test which produces an F test statistic with a corresponding p-value. If the p-value is less than a certain significance level (i.e. $\alpha = .05$), then the null hypothesis can be rejected and it can be concluded that there is sufficient evidence to say that S&P 500 ESG Index returns Granger-causes time S&P BSE 100 ESG Index returns.

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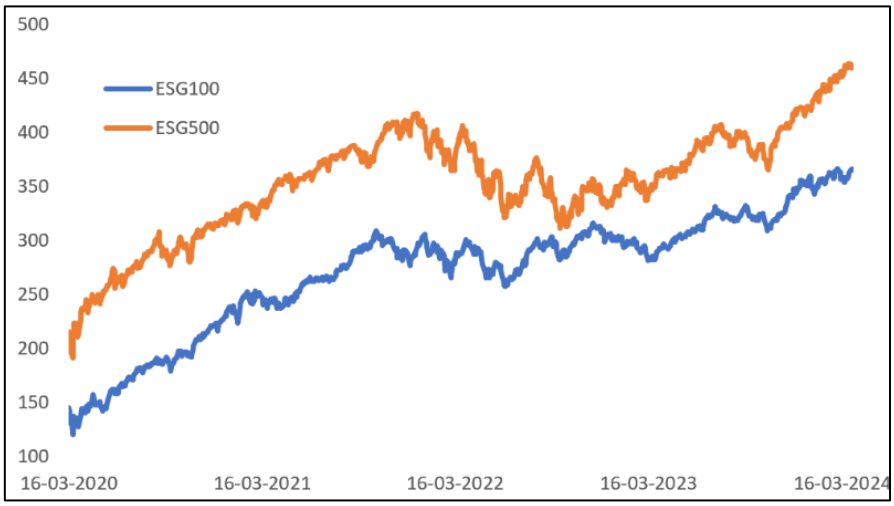
Figure 1: **Trend of S&P BSE 100 ESG Index and S&P 500 ESG Index**

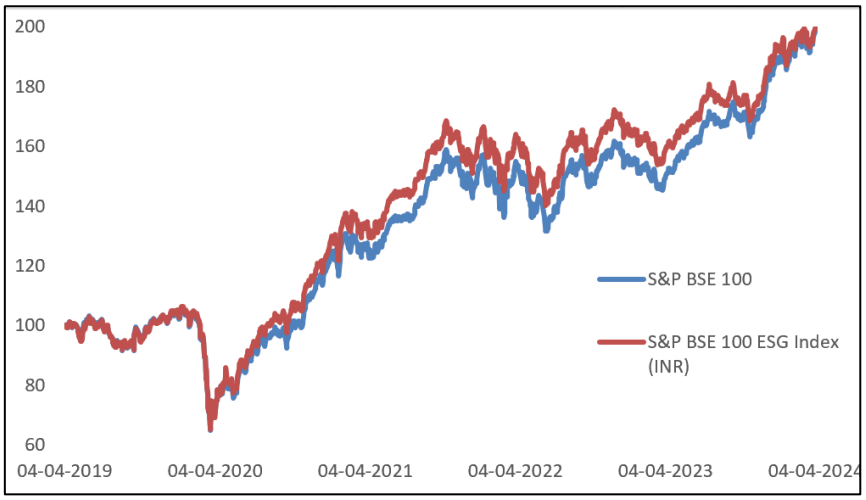


Source: BSE Website

6.3.3 EGARCH model

This paper employs the Exponential Generalized Autoregressive Conditional Heteroskedasticity (EGARCH) methodology of Nelson et al., (1991) using RStudio on the S&P BSE 100 ESG Index and S&P BSE 100 Index. The reason for running a egarch model is to capture the asymmetry in the impact of "good news" or "bad news" with equal magnitude on the volatility faced by the time series (Engle et al., 1993). In order to run an EGARCH model, the data needs to be stationary as well as contain ARCH effects. The time series can be said to be stationary when its mean and variance are constant over time. From figure 2, it can be seen that the time series exhibit non-stationarity while their log differences plot in figure 3 and figure 4 respectively show signs of stationarity.

Figure 2: **Trend of S&P BSE 100 ESG Index and S&P BSE 100 Index (at base form of 100)**



Source: S&P Website

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Figure 3: Trend line of the rClose series of the S&P BSE 100 ESG Index

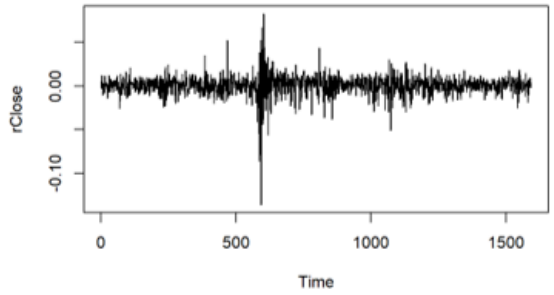
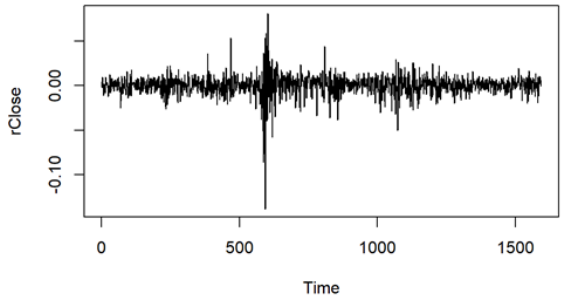


Figure 4: Trend line of the rClose series of the S&P BSE 100 Index



Source: Researcher's Analysis

Augmented Dickey-Fuller (ADF) Test will be conducted on the "rClose" series which consists of the log differences series. Further analysis is conducted on this time series, the ARCH LM test is conducted to test for presence of ARCH elements in the series. Once the tests are completed, the EGARCH model can be applied. The EGARCH variance equation with a normal distribution is shown in figure 5:

Figure 5: **EGARCH variance equation**

$$\mathrm{Ln}(\sigma_t^2) = \omega + \beta \ln(\sigma_{t-1}^2) + \gamma \frac{u_{t-1}}{\sqrt{\sigma_{t-1}^2}} + \alpha \left[\frac{|u_{t-1}|}{\sqrt{\sigma_{t-1}^2}} - \sqrt{\frac{2}{\pi}} \right]$$

Source: Brooks (2014)

7. Findings

7.1 Risk-reward of Investing in a Sustainability Index

Table 1: Descriptive Statistics of Daily Returns Various Indices

	S&P BSE 100 ESG Index	NIFTY 500 Index	S&P BSE 100 Index
Mean	0.0439%	0.0573%	0.0551%
Standard Error	0.0288%	0.0274%	0.0278%
Median	0.1114%	0.1254%	0.1053%
Standard Deviation	1.1477%	1.0917%	1.1094%
Sample Variance	0.0132%	0.0119%	0.0123%
Kurtosis	24.2655	18.9206	19.6212
Skewness	-1.8429	-1.4562	-1.2835
Range	22.5301%	20.4993%	21.4437%
Minimum	-14.5783%	-12.8085%	-12.9603%
Maximum	7.9518%	7.6908%	8.4834%

Source: Primary Analysis of the Researcher

Descriptive statistics of the various indices indicate that the average daily returns of the Nifty 500 Index for the period were the highest followed by the S&P BSE 100 Index and the sustainability index had the lowest average return for the period. However, the index with the highest return did not portray the highest volatility, as measured by the standard deviation. Standard deviation was the highest for the sustainability index, followed by the S&P BSE 100

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and the NIFTY 500 index was the least volatile. The sustainability index also had the highest daily drawdown but did not show the same upside potential.

Table 2: Annualized Financial Ratios comparing Sustainability Index and Underlying Index

	S&P BSE 100 ESG Index	**S&P BSE 100 Index**
Sharpe Ratio	0.5641	0.8626
Treynor Ratio	0.1000	0.1529
Sortino Ratio	0.6353	1.0091
α	-0.0633	-0.0087

Source: Primary Analysis of the Researcher

The financial ratios show similar results. Return earned for every unit of risk, which was measured by the Sharpe Ratio. The Sharpe Ratio value for the S&P BSE 100 Index was 0.8626 and 0.5641 for the sustainability index. Sharpe Ratio is an important ratio if an investor is concerned about total risk, i.e., systematic and unsystematic risk. However, if the investor holds a well-diversified portfolio, then analyzing the Treynor Ratio should be considered which measures the return earned by the investor for every unit of systematic risk. Systematic risk in Treynor's Ratio is measured by beta (β). The Treynor Ratio for S&P BSE 100 Index was 51% higher than the sustainability index, further showing the lower risk adjusted returns provided by the S&P BSE 100 ESG Index. Both, Sharpe and Treynor Ratio consider upside and downside risk, i.e., take into account the volatility in upwards and downwards movement but some investors are only concerned with downwards movement and volatility. Thus, the Sortino Ratio is considered. Sortino Ratio for the sustainability index was 0.6353 and 1.0091 for the S&P BSE 100 Index respectively. This means, even if only downside risk and volatility is considered, the S&P BSE 100 Index still comes out on top and is much better than the sustainability index. Lastly, Jensen's Alpha (α) for both the indices were calculated. α represents the excess returns that the index earned compared to the return it should have earned as per the Capital Asset Pricing Model (CAPM). Although both the funds earned negative excess returns, the returns for the S&P BSE 100 index were much closer to the expected value, whereas the sustainability index underperformed by 6%. The four financial ratios calculated for both the indices suggest that the S&P BSE 100 ESG Index has underperformed compared to S&P BSE 100 Index in every aspect for risk and reward. Thus, for the given time period, it does not seem financially viable to invest in the sustainability index for a rational investor.

Further, the researchers wanted to see if there was a significant difference between the returns of the S&P BSE 100 ESG Index and the S&P BSE 100 Index and a T test was employed for that purpose. The results in Table 3 reveal that the p value is greater than 0.05, thus the Null hypothesis is accepted and it can be said that there is no significant difference between the returns of the S&P BSE 100 ESG Index and the S&P BSE 100 Index. This implies that although the sustainability index provides lower returns and has worse performance with regards to the ratios, ultimately the returns of the sustainability index are not significantly different than the returns of the parent index.

Table 3: T Test Results

	S&P BSE 100 ESG Index	S&P BSE 100 Index
Mean	0.000438832	0.00055124
Variance	0.000132	0.000123
Observations	1593	1593
P value (2 tail)	0.77873677	

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Source: Analysis of the Researcher

The lower returns on S&P BSE 100 ESG Index are likely explained by the omission of securities due to several reasons such as exclusions based on business activities like coal mining and military contracting, exclusions based on UNGC or company-specific controversies that affect various stakeholders (as seen in table 4). The S&P BSE 100 ESG Index averaged an annual actual return of 14.83% over the past 5 years. Out of the 49 stocks not included in the S&P BSE 100 ESG Index as compared to S&P BSE 100 Index, 34 stocks outperformed the sustainability index's annual return. The exclusion of these high performing shares inevitably means that the overall performance of the ESG Index would not be more than the parent index given that the low performing companies excluded did not see major dips enough to counteract the outperformers.

Table 4: Ten largest outperformers that were not included in sustainability index

Script Code	Ticker	Annualized Returns
512599	ADANIENT	89%
541154	HAL	71%
500251	TRENT	63%
533179	PERSISTENT	62%
540180	VBL	60%
540762	TIINDIA	59%
533758	APLAPOLLO	58%
500049	BEL	55%
500400	TATAPOWER	47%
543220	MAXHEALTH	47%

Source: Google Finance

7.2 Relationship between S&P 500 ESG Index and S&P BSE 100 ESG Index

A granger causality test was first conducted to see whether 'ESG500' granger-causes 'ESG100'. It was found that at an order of 3 lags, the p-value was less than 0.05 (Table 5), therefore the null hypothesis can be rejected and the alternative hypothesis will be accepted that the S&P 500 ESG Index returns Granger-cause S&P BSE 100 ESG Index returns.

Table 5: Granger Causality Test Result for returns of S&P 500 ESG Index Granger-causing returns of S&P BSE 100 ESG Index

Null Hypothesis	Observations	F- statistic	Probability
S&P 500 ESG Index returns do not Granger-cause S&P BSE 100 ESG Index returns	998	66.743	< 2.2e-16

Source: Analysis of the Researcher

Although the null hypothesis was rejected, it is also possible that there is a case of reverse causation happening as well. That is to say that ESG100 is granger-causing ESG500. To rule out the possibility, granger test is performed with reversed x and y time series to test whether ESG100 granger-causes ESG500 or not. It was found that the p-value for this test was less than 0.05 as well (Table 6) which meant that there is a case of Reverse causation between the 2 time series. Thus, it can concluded that there is a bi-directional relationship between the returns of S&P 500 ESG Index and S&P BSE 100 ESG Index and both indices are useful for predicting the future returns of the other index.

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Table 6: Granger Causality Test Result for returns of S&P BSE 100 ESG Index reverse Granger-causing returns of S&P 500 ESG Index

Null Hypothesis	Observations	F- statistic	Probability
S&P BSE 100 ESG Index returns do not Granger-cause S&P 500 ESG Index returns	998	6.1531	0.0003815

Source: Analysis of the Researcher

These indices may be in two different geographies but impact of global events such as the COVID-19 led to similar responses by investors in either country. The trade ties between countries due to Globalisation also leads to the spillover effects from changes in one country to another country. For example, if there is an economic crisis in USA leading to fall in its national income, this would lead to a decrease in the national income of India as well and some investors wouldn't want to hold on to their assets which might feel this impact therefore leading to selling behaviour and a fall in share price. Therefore, it is recommended for investors to track the movement of the S&P 500 ESG Index as well to get a gauge on future returns of the S&P BSE 100 ESG Index.

7.3 Impact of Positive and Negative Shocks on the Volatility

Table 7: ADF Test Result

Null Hypothesis	Observations	Dickey-Fuller	Probability
'rClose' is not Stationary	1593	-10.711	0.01

Source: Analysis of the Researcher

Table 8: ARCH LM Test Result

Null Hypothesis	Observations	Chi-squared	Probability
There are no ARCH effects in 'rClose'	1593	511.27	<2.2e-16

Source: Analysis of the Researcher

The Augmented Dickey-Fuller Test was conducted on rClose which was found to be stationary (Table 7). Further, the ARCH LM test was conducted to test for Arch Effects in the test assets and the p-value was found to be less than 0.05, therefore the null-hypothesis of No ARCH effects is rejected and it can be said that there is presence of ARCH effects in the test assets as shown by Table 8.

Table 9: EGARCH model output for S&P BSE 100 Index

Parameters	Estimate	Std Error	T value	Probability
mu	0.000298	0.0000212	1.405496	0.15987
ar1	0.097543	0.117022	0.833550	0.40453
ma1	-0.002459	0.117673	-0.020901	0.98333
omega	-0.294984	0.006370	-46.310836	0.0000
alpha1	-0.110946	0.008835	-12.557087	0.0000
beta1	0.968136	0.000866	1117.934296	0.0000
gamma1	0.170991	0.010932	15.641350	0.0000

Source: Analysis by the Researcher

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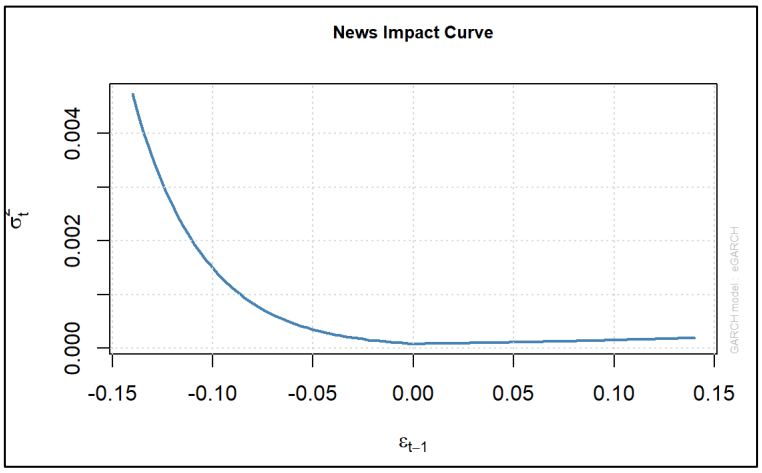
Table 10: EGARCH model output for S&P BSE ESG 100 Index

Parameters	Estimate	Std Error	T value	Probability
mu	0.000306	0.000219	1.40067	0.16131
ar1	0.097046	0.015290	6.34696	0.0000
ma1	-0.010462	0.012638	-0.82788	0.40774
omega	-0.297792	0.021090	-14.11996	0.0000
alpha1	-0.114859	0.014743	-7.79078	0.0000
beta1	0.967712	0.002250	430.07847	0.0000
gamma1	0.164558	0.022380	7.35295	0.0000

Source: Analysis by the Researcher

Further, the EGARCH model was applied and from table 9 and 10 it can be seen that both indices display a roughly identical results when it comes to the impact of "news" on volatility. Analysis indicate that both the indices experience a greater volatility due to negative shocks compared to positive shocks of the same magnitude which can be seen by the news impact curve in Figure 6 (Engle et al., 1993). The arch and garch coefficients, represented by alpha1 and beta1 show that there is a significant effect of the absolute value of past shocks on current volatility and highlight a strong persistence in the volatility dynamics. Therefore this model adequately captures the "Leverage effect" introduced by Black (1976).

Figure 6: **News Impact Curve obtained from the EGARCH models**



Source: Analysis by the Researcher

A possible reason for this behavior would include the fact that investors are generally more sensitive to negative news than positive news and tend to be loss aversive. Therefore, leading to a more dramatic reaction to negative news even though the magnitude of both the news are the same. In case of panic selling by the investors, it would lead to a fall in the share prices of the companies and thereby increase the debt-to-equity ratio which in turn would increase the financial leverage of the company. A higher financial leverage would imply greater financial risk for the investors and in turn would lead to greater volatility and also increase the expectations of the investors for a greater risk premium. When these companies experience increased volatility, the index would feel the shock based on the amount of weightage the company has in the index and the asymmetric impact of the news will be based on to the sustainability index.

8. Conclusions & Recommendations

This paper attempted to study the financial feasibility of investing in a sustainability (ESG) focused index by studying the S&P BSE 100 ESG index in particular. From the study, it was found that

the sustainability index underperformed the NIFTY 500 Index which was used as a representative of the returns from investing in the Indian maket as well as S&P BSE 100 Index which included the companies that did not have a good ESG score or were involved in business models that are excluded from a sustainability index. It was also found that the sustainability index had greater daily drawdown when compared to the other two indices while not providing as much upside return and the returns of the sustainability index is not significantly different than the returns of its parent index. Further, it was seen that the returns of a sustainability index of USA impacts the future returns of the sustainability index in India and the opposite is true as well. Which corroborates the results of other studies which have studied the volatility spillover effects or directional relationship between the global sustainability indices. This result implies that the index is sensitive to negative and positive shocks from not only domestic events, but also shocks in returns of global sustainability indices. Finally, asymmetry in the impact of negative and positive shocks of the same magnitude on the index was studied and it was found that negative shocks of the same magnitude have a greater impact on the volatility of the index which is generally true for most financial time series data of returns. Therefore, this study concludes that S&P BSE 100 ESG Index may not be a financially viable benchmark for a rational investor. This sentiment is shared by various fund managers in India because no mutual funds or ETFs are currently benchmarking this Index in India, while there are mutual funds and ETFs that are tracking the NIFTY 100 ESG Index.

The research suggests that investors should utilise a multitude of financial ratios and analyse volatility of both, the normal, non-ESG index and the ESG index. This research does not suggest that there is no space for sustainable investing in India, rather it suggests that investors who desire to invest in such securities should do so after taking into the account the associated costs i.e. giving up potential returns, and the increased risk i.e. volatility of these securities.

9. Limitations

The study acknowledges the limitations that secondary financial data is always a sample which means that there is presence of sampling error in the study. The study also provides results that are specific to the time period for which data is studied and studying a different time period would lead to a difference in the results. It is important to note that our data is being heavily influenced by the global pandemic COVID 19 which increased the volatility for the period and an analysis of just the past 3 years might yield different results.The study is also limited to the objectives that were set and there might be other factors that could be studied in this topic. The financial ratios are based on assumptions are sensitive to the inputs that are used, so a change in the methodoly to calculate the ratios would lead to significant change in the ratio and thus the interpretation can also change.

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