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Effects of Time Horizon in ESG Investing: Empirical Evidence from Indian Equity Indices

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Abstract

With a growing focus on sustainability, Environmental, Social, and Governance (ESG), investing has become a significant buzzword in India. Environment, Social, and Governance (ESG) investing has become a major topic of discussion in India as investors become more aware of the importance of sustainability beyond just financial returns. But an important question still remains: Can ESG-investing actually outperform traditional capital market investing, and does that turn out to vary with the length of the investment term? In this study, the authors compare the performance of BSE ESG 100 Index and BSE 100 Index on various investment periods.

The study employs the monthly closing index from October 2017 through March 2026, and determines short-, medium-, and long-term rolling Compound Annual Growth Rate (CAGR) returns. The descriptive statistics of the two indices are used to understand the return and the risk features of the two indices, and paired-sample t-tests are conducted to assess if the difference in the returns between similar periods of investment is statistically significant.

The results suggest that the BSE ESG 100 Index has superior mean returns compared to BSE 100 Index over all the investment horizons studied. However, this benefit of ESG investing does not seem to be statistically proven over shorter time horizons, indicating that ESG investing approaches might not always yield short-term financial returns. However, with longer investment time horizons the difference in return becomes statistically significant with BSE ESG 100 outperforming in the medium to long-term. The evidence shows that the financial returns of ESG practices can be delayed, as the benefits of better governance, resource efficiency, stakeholder relations and long-term business resilience will come through over time.

The study therefore emphasizes that the time horizon of investment is an important factor to consider when assessing the performance of ESG. Patience might pay off for investors who approach the investment process with a long-term time horizon, allowing them the time to potentially reap the benefits of value creation from ESG integration.

Keywords: ESG Investing, Sustainable Finance, BSE ESG Index, BSE 100 Index, ESG Performance

Introduction

The investment industry has undergone tremendous changes in recent times due to the growing popularity of sustainable investing. The growing significance of environmental, social, and governance factors in financial markets is reflected in the emerging trend of developing new indices that incorporate ESG criteria. These indices include companies that use sustainable business practices and demonstrate responsible behaviour towards ESG factors.

Many research studies focused on the impact of strong environmental, social, and governance (ESG) traits on their financial performance (Giese et al., 2019). BSE ESG 100 is one of the most popular ESG index available in Indian equity market. This index includes companies that follow ESG principles and gives investors the opportunity to allocate funds to investments that align with their financial goals and values. In contrast, broad market indices such as the BSE 100 are not based on ESG criteria and cover all market segments. It makes sense to investigate whether there is any difference between ESG and Non ESG indices and how it affects investor returns (Debnath & Dinda, 2023).

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Research on the impact of ESG investing on performance remains divided. Some studies indicate that firms with strong ESG compliance demonstrate superior risk-adjusted performance due to better governance and stakeholder management (Aydoğmuş et al., 2022). In contrast, other studies argue that ESG constraints may limit the investment universe, potentially affecting performance negatively (Dorfleitner et al., 2016). In developing economies like India, the ESG ecosystem is still at a nascent stage, and academic literature in this area remains limited. Therefore, further empirical research is required to address these issues (Zheng, 2025).

As discussed above, the objective of the present study is to examine whether there is any significant difference between the returns of BSE ESG 100 and BSE 100 over the same time periods. To achieve this objective, the study uses annualised returns (CAGR) across different time periods (observations) and applies appropriate statistical techniques, including paired sample tests, to analyse the differences. The comparison periods are kept consistent to ensure fairness in evaluating both indices.

The findings of this study will contribute to the existing literature on sustainable investing, particularly in the Indian context. Investors will gain insights into whether ESG investing involves a trade-off between sustainability and profitability. Additionally, policymakers and business practitioners can use the findings to better understand and implement ESG-integrated strategies to enhance market growth and stability.

Literature Review

There are several complementary theoretical frameworks that ESG investing is based on. Stakeholder theory asserts that firms must generate value for a diverse array of constituents not solely shareholders and that ESG practices function as a mechanism for long-term value creation and risk reduction (Freeman, 1984). On the other hand, agency theory says that adopting ESG could lead to managers who only care about short-term results or costs that lower returns for shareholders. The stakeholder theory advocates for a favourable ESG-performance relationship through long-term value creation, whereas agency theory underscores potential disadvantages, including elevated costs and misaligned managerial incentives (Cardillo & Basso, 2025). Equilibrium model states that, green assets will have lower long-term returns than their non-ESG counterparts. This is because the preference-driven demand premium lowers expected yields. In the short term, though, ESG investments can do better than non-ESG investments because of factors like price pressure, earnings quality, and investor behaviour (Kräussl et al., 2024; Pástor et al., 2021).

Research on ESG investing throughout economic cycles indicates that performance is contingent upon context. Sustainable stocks demonstrate enhanced resilience during financial distress, including the COVID-19 pandemic (Daugaard & Ding, 2022; Mishra et al., 2023). Evidence from emerging economies like China shows that ESG performance acts as a safeguard during crises, with high-ESG portfolios experiencing less severe drawdowns compared to their low-ESG counterparts (Broadstock et al., 2021). Hence ESG can be considered as a mechanism for mitigating downside risk (Kräussl et al., 2024).

The correlation between ESG investing and financial performance is notably influenced by the investment time horizon, a factor that has garnered increasing academic scrutiny. Research published in academic journals and policy studies consistently indicates that ESG advantages are predominantly realised by patient, long-term investors and ESG outperformance may be contingent upon the temporal scope of analysis, with short-horizon evaluations obscuring the value-creation mechanisms inherent in ESG screening criteria (Bertelli & Torricelli, 2024).

Investments in ESG index funds are recommended in both developed and emerging markets, as over 50% of the time, ESG indices outperform non-ESG indices over extended periods. It is also demonstrated that ESG investments, when evaluated over an extended time frame, generally yield superior returns on invested capital compared to conventional investments in non-sustainable indices (Atz et al., 2023) and demonstrates that Investors with longer horizons tend to favour high-ESG firms, showing patience and reduced selling after negative earnings surprises, which aligns with the long-term benefits of ESG investing (Volodina & Trachenko, 2023). Short-horizon analyses have been demonstrated to consistently underestimate ESG benefits. Static snapshots of ESG performance, like short-term comparison, don't show the value that comes from improving ESG ratings over time. Transient ESG rating increases are unlikely to produce dependable performance enhancements, whereas enduring, medium-to-long-term advancements in ESG ratings result in quantifiable total shareholder return

(TSR) benefits. This information has direct effects on quantitative strategies that are sensitive to time horizons (Clare et al., 2025).

One of the most useful new methods for looking at how time horizons affect ESG investing is to use rolling return windows instead of fixed-period. This methodology across various international markets, revealed that daily returns of ESG indices in all examined countries do not produce positive alpha. But when the focus changes to one-year rolling returns, ESG indices in all countries except Brazil exhibited positive, statistically significant alpha. The Indian ESG index has the highest alpha at 4.82%, followed by China's at 1.49%. This finding highlights the supreme significance of time horizon selection in ESG performance evaluation and directly inspires research centred on Indian equity indices (Bodhanwala & Bodhanwala, 2022).

Investment horizon effects can be seen not only at the index level, but also at the level of institutional ownership and firm-level ESG behaviour. Companies owned by short-term investors have a lot more ESG problems than companies owned by long-term investors, who have problems that cost a lot less (Gloßner, 2019). Long-term institutional investors are more inclined to advocate for CSR initiatives (Kim et al., 2018), whereas funds with extended investment horizons and less management-friendly orientations are considerably more likely to endorse environmental and social shareholder proposals (Kräussl et al., 2024). Long-term institutional investors substantially mitigate ESG decoupling—the disparity between firms' reported and actual ESG commitments while short-term investors exhibit no significant impact. These results have significant policy ramifications: regulatory frameworks ought to encourage long-term institutional ownership to improve corporate accountability and foster more meaningful ESG practices (Eliwa & Elmaghrabi, 2025).

There are now a number of indices that keep track of ESG performance in Indian stock markets in a systematic way. The Nifty 100 ESG Index, the Nifty 100 Enhanced ESG Index, the Nifty 100 ESG Sector Leaders Index, and the S&P BSE 100 ESG Index are the main benchmarks. The way these indices choose their members, how they weight different sectors, and how they screen for members are all different. The average returns of the Nifty50 and Nifty100 ESG indices surpass those of alternative safe-haven assets, including gold, silver, and 10-year treasury bonds, while also validating the phenomenon of volatility clustering via GARCH modelling (Kumar et al., 2025).

The comparison of the S&P ESG India Index to the Nifty and CNX 500 indices found that the returns were not statistically significant, but the ESG index was less volatile during the study period. The ESG index had an annualised return of 27.2%, while the Nifty and CNX 500 had returns of 20.36% and 17.98%, respectively. This difference is partly due to the fact that the ESG index is made up of a small number of sectors. This initial evidence established the foundation for subsequent, more stringent empirical enquiries (Sudha, 2015). Comparison of ESG with traditional indices in India, USA, Germany, Japan, Brazil, and China shows that negative news has a less severe effect on the volatility of ESG indices in most countries, which supports the idea that ESG investing can help reduce risk (Bodhanwala & Bodhanwala, 2022).

Indian ESG indices, like the Nifty 100 ESG, do not have significantly lower returns than the Nifty 50; in fact, they have often outperformed it. This goes against the common belief that investing in ESG stocks hurts financial performance (Pandey et al., 2024).

The increasing popularity of Environmental, Social, and Governance (ESG) investment has prompted a great deal of study into how it affects stock performance throughout various time periods and markets. The time-varying character of ESG relevance that is, how different ESG components affect returns in the short and long term is a major subject that emerges from the literature.

Governance characteristics are crucial in the short term because they capture immediate firm-level hazards that can have a big impact on stock prices, like fraud, poor management, and regulatory concerns. However, environmental and social variables become more significant over longer investment horizons because of their combined effect on long-term financial success and business sustainability. This demonstrates how ESG materiality is changing over time (Giese et al., 2019). Investors with longer investment horizons typically like companies with higher ESG scores, which supports the long-term viewpoint. Their research supports the idea that ESG investing is consistent with long-term value building techniques by demonstrating that these investors are more patient and are less inclined to sell holdings after negative earnings surprise.

Research Methodology

This study has been done using secondary data which is obtained from the official website of Bombay Stock Exchange (BSE). The data set includes the close price of the BSE ESG Index from October 2017 onwards and BSE 100 Index for the same timeframe. The analysis is for the time interval 10/2017 to 03/2026, giving a total of 102 monthly observations for each index. The BSE 100 Index is chosen as the market indicator for the overall conventional equity market. The same observation period and identical data points at the end of each month make the results easy to compare and consistent throughout the analysis. The monthly closing values were used to compute rolling returns to assess the performance of the index for various investment horizons. The time period of investment was taken as 6 months, 1 year, 3 year, and 5 year. The rolling return windows allow the study to evaluate whether the relative performance of the model portfolios (ESG and conventional) is consistent through the various entry and exit windows and not driven by a specific start or end date. As with each rolling return to the BSE ESG Index, each corresponding rolling return to the BSE 100 Index is calculated over the same period, the resulting observations are matched pairs. Therefore, the rolling-return analysis serves as the basis for the ensuing comparative statistical analysis. The rolling returns were then annualised using the Compound Annual Growth Rate (CAGR) method. The investment horizons vary in length and annualisation can make sense of this. To make it possible to compare with the BSE 100 Index, overlapping rolling windows have been maintained for each investment horizon, ensuring that each of the observations of returns of BSE ESG Index is matched with an observation of returns of BSE 100 Index over the same period. This process produces similar time-series observations across the investment horizons and makes sure that discrepancy in returns is not due to discrepancy in the measurement periods. Next, descriptive statistical analysis of the annualised rolling-return series were performed for each investment horizon to analyse the risk-return characteristics of the two indices and the consistency of the two indices across the investment horizon. The following statistics were included in the analysis: mean, median, standard deviation, minimum, maximum, and range. Central tendency of the returns was assessed using the mean and median, while the variability of the returns and the associated risk was assessed by the standard deviation. The minimum and maximum indicated the extreme returns captured, while the range gave an indication of the overall range of the captured returns. These descriptive measures first describe the general performance and risk features of the BSE ESG and BSE 100 indices and thus serve as a basis to decide whether the differences observed are sufficiently large for further statistical testing. After descriptive analysis, hypothesis testing was performed to check if the difference between returns of BSE ESG Index and BSE 100 Index was statistically significant for each investment period. Four hypotheses were developed for the four investment periods. The null hypothesis (H_0) is that there is no difference between the mean annualised rolling returns of the BSE ESG Index and BSE 100 Index while the alternative hypothesis (H_1) is that there is a difference between the mean annualised rolling returns of the BSE ESG Index and BSE 100 Index. Since the observations for the two indices are naturally matched, a paired-sample t-test was used for testing these hypotheses. Specifically, each rolling return of the BSE ESG Index is correlated with the return of the BSE 100 over the same investment timeframe and same starting and ending periods. The test is thus a measure of the mean difference between each pair of observations and not as two independent samples. By controlling for common market movements and time-specific market conditions, this approach will give a more valid picture of whether the ESG index has a statistically different performance from the conventional index. The paired-sample t-test assumes that the differences between paired observations are normally distributed with mean of zero and that the variables are continuously measured. The test is fairly strong because it has a relatively large number of rolling observations for every investment horizon. The level of significance (α) was established as 0.05 (5%). If the p-value is less than 0.05, the null hypothesis is rejected, suggesting that the mean returns of the two indices are statistically different. If the p-value is 0.05 or less, the null hypothesis is rejected, suggesting a statistically significant difference between the mean returns. On the other hand, if the p-value is greater than or equal to 0.05, it would not reject the null hypothesis, which means that there is no statistically significant difference between the mean returns. The overall methodology is basically sequential analytical. The monthly index values comprise the raw data and are used to calculate the same four investment horizons in terms of rolling returns; these annualised returns are then qualitatively analysed using descriptive

statistics to define the risk-return characteristics of the investment horizons; and the differences between the investment horizons are then statistically tested using paired-sample t-tests. This is a sequential process that both addresses whether the BSE ESG Index has different return characteristics as compared to the BSE 100 and whether any such difference is statistically significant over time periods ranging from short to long.

Results and Discussions

Below table shows the descriptive statistics for BSE ESG Index and BSE 100 Index.

Table 1: Descriptive Statistics BSE 100 ESG vs BSE 100

	6 Months		*1 Year*		*3 Years*		*5 Years*	
	BSE 100 ESG	*BSE 100*	*BSE 100 ESG*	*BSE 100*	*BSE 100 ESG*	*BSE 100*	*BSE 100 ESG*	*BSE 100*
Mean	14.52%	13.88%	13.81%	13.20%	15.28%	14.79%	15.25%	14.77%
Median	11.28%	11.69%	9.77%	8.83%	15.03%	14.62%	15.02%	14.89%
STDEV	25.04%	24.60%	18.26%	18.10%	4.40%	4.15%	3.24%	3.53%
Min	-42.51%	-43.97%	-26.15%	-26.59%	5.52%	2.84%	8.98%	9.45%
Max	93.04%	83.44%	79.51%	71.46%	28.94%	26.63%	23.66%	23.17%
Range	135.55%	127.41%	105.66%	98.05%	23.41%	23.79%	14.68%	13.72%

The results show that the BSE ESG Index always has higher average returns than the BSE 100 Index, no matter how long the time period. The ESG index has slightly better returns over the six months and one year, but it also has a slightly higher standard deviation and a broader range, which means it is more volatile and spread out in the near term.

The ESG index continues to fare better than the average and median returns over a three-year period. It also shows stronger downside protection, as seen in higher minimum returns. The two indices' volatility differences become very small, which means that performance is more stable. The ESG index has a higher return than the BSE 100 over the past five years and is also less volatile, which means it has better long-term risk efficiency. This observation is also supported by the fact that the range and median values are quite steady.

The results show that ESG investments may have a little more short-term risk, but they tend to give better and more stable risk-adjusted returns over the medium to long term. This makes them better for long-term investment plans. The following summary table presents the key paired t-test statistics across different time horizons, highlighting the comparative performance of the BSE ESG Index and the BSE 100 Index.

Table 2: Paired t-Test Statistics Across Different Time Horizons

Time Period	*Mean (ESG)*	*Mean (BSE 100)*	*t-Statistic*	*p-Value (Two-Tail)*	*Result (5% Level)*
6 Months	0.1452	0.1388	1.6140	0.1098	Not Significant
1 Year	0.1381	0.1320	1.9073	0.0597	Not Significant (borderline)
3 Years	0.1528	0.1479	2.1472	0.0355	Significant
5 Years	0.1525	0.1477	4.1861	0.0001	Highly Significant

The paired t-test results show that the difference in returns between the BSE ESG Index and the BSE 100 Index changes over time.

The p-value (0.1098) is more than 0.05 in the short term (6 months), which means that the difference in returns is not statistically significant, even if ESG displays slightly higher mean returns. In the same way, the p-value (0.0597) is just above the 5% significance level for the 1-year period, which means that the difference is on the edge of being statistically significant but not quite. The p-value (0.0355) is less than 0.05 throughout the three-year period, which means that there is a statistically significant difference between the two indices, with ESG

doing better. This trend gets stronger during the next five years, when the p-value is very low (0.0001), which shows that the ESG index is significantly better.

The results indicate that there is no statistically significant advantage to ESG investing over the short-term but there is a clear and statistically significant advantage to investing in ESG over medium to long-term period. This is consistent with the notion that ESG efforts are associated with more favourable long-term investment returns.

The study's outcomes provide some important insights into the differences between ESG-based investing and traditional market indices. Clearly the BSE ESG Index generates higher average returns for every time period. However, the manner of this outperformance is dependent on the investment time period. The average return of the ESG index is slightly better in the near term (6 months to 1 year), but with a higher standard deviation and range as well, the ESG index is slightly more volatile in this timeframe. It also implies that valuing ESG investments can be a dynamic process that depends on market conditions and can be rapid. This could be because investor mood changes, the sector they are in changes, or the expenses of switching to more environmentally friendly methods. This is further confirmed by the results of the paired t-test reported above as the differences in the returns are not statistically significant at 5% level. Targeting the ESG seems to be no clear short-term benefit over the regular index.

The medium-term (3 years) results, on the other hand, show that ESG investment is a better option. Not only do the ESG index have higher average and median returns, but it also is better at avoiding losses with higher minimum returns. The fact that the variations in volatility are getting smaller suggests that ESG performance will become more stable over time. The paired t-test shows that this difference is statistically significant, which means that ESG investments start to make considerable extra returns when looked at over a longer period of time.

This is more evident in the long-term (5 years) results. The ESG index shows a higher return and lower volatility than the BSE 100, thus giving it a better risk adjusted performance. The very significant t-test results demonstrate that outperformance on the ESG is not random but a reliable pattern. This is consistent with the notion that ESG considerations add value over the long run, enhance corporate governance and reduce long-term risk. A ton of real-world data on ESG financial performance, all over the world. This study reinforces that a positive correlation between corporate sustainability and financial performance. These findings contrast with evidence suggesting that sustainable investing does not consistently yield superior returns, and that firms involved in ESG controversies may offer higher expected returns as compensation for reputational and regulatory risks (Hong & Kacperczyk, 2009).

Overall, the data reveal a transition pattern: ESG investments may seem to be rather unstable and not very different from regular investments in the short run, but their benefits become clearer and more statistically significant over longer investment periods. This study could be expanded to other Indian and Global ESG indices; macroeconomic conditions and variations in ESG rating of the sectors could also be explored in future research.

Conclusion

The research shows that the BSE ESG Index always does better than the BSE 100 Index, and that this difference gets bigger over time. In the short term, there aren't any statistically significant distinctions between ESG investments and other types of investments. The findings indicate that ESG investing is more advantageous for long-term investment strategies due to its superior returns, enhanced stability, and improved risk efficiency. The results of both descriptive statistics and paired t-test analysis support the assumption that investing based on ESG leads to long-term financial success.

From an investment perspective, the findings suggest that investors with longer investment horizons may benefit more from ESG-focused portfolios, but short-term investors may not notice significant differences compared to typical indices. So, you shouldn't think of ESG investing as a way to earn quick money; instead, you should think of it as a long-term strategy to invest. The study highlights the growing importance of ESG investing in today's financial markets, showing that investment strategies that focus on sustainability can lead to both moral value and better financial returns over time.

Research and Managerial Implications

The results of this study have specific implications for researchers, individual investors, portfolio managers, companies and policy makers in the field of sustainable finance. The main message is the correlation of the ESG orientation with financial performance seems to be driven by the investment horizon. The BSE ESG 100 Index outperformed the BSE 100 Index in terms of mean annualised returns in all the 4 investment horizons considered. However, there was no statistically significant difference after 6 months or 1 year, but there was after 3 years and even more after 5 years. The results indicate that financial returns of ESG-oriented investing could be more apparent in the long term as opposed to the short, especially when investing for longer periods of time.

Implications for Investors

The results indicate that for individual investors, rather than relying on short-term excess returns, it is more important to consider ESG investments from a medium- to long-term perspective. Lack of statistically significant differences across six month and one year time horizons suggest that investors should not rely on the idea that ESG-themed investments will on average outperform the overall market return in the short-term. Therefore, investors choosing to invest with ESG should not rely solely on the short-term relative performance when making their investment choices.

The answers are more relevant for investors who have longer financial goals. However, the statistically significant difference was found over three years and the stronger difference over five years suggests that investing with ESG may be more suitable for investors who can tolerate short-term investment volatility and are prepared for long-term investment. Investors with a longer-term horizon, for example, those aiming to save for retirement, children's education or wealth building can think about incorporating ESG investing with a long-term strategy within a diversified portfolio instead of solely focusing on short-term market timing. Importantly, the findings should not be read as an assurance of better results on an ESG investment. The evidence suggests that the ESG index has a historical link to superior returns on longer time horizons, but does not prove that ESG investments will perform better in all market conditions. ESG should therefore be taken into account along with the valuation, diversification, risk appetite, liquidity needs, and asset allocation of the investor.

Implications for Portfolio Managers

The results are relevant for portfolio managers' performance assessment, asset allocation and investment horizon choice. The BSE ESG 100 generated mean annualised returns of 14.52%, 13.81%, 15.28%, and 15.25% over six-month, one-year, three-year, and five-year horizons, respectively, compared with 13.88%, 13.20%, 14.79%, and 14.77% for the BSE 100. The extent of outperformance is relatively small over the shorter investor time horizons, but becomes more compelling as the time horizon extends.

It's therefore important that portfolio managers not judge ESG strategies based on quarterly or annual performance. The short-term evaluation period may not reflect the potential financial impacts of the integration of ESG. Rather, longer rolling periods, such as 3- and 5-year periods, should be part of the performance attribution and strategy evaluation. This would enable managers as well as their clients to determine whether the fluctuations in the market were merely temporary or if they had a pattern of performance that could be noticed for a longer duration.

The risk results are an added factor. The BSE 100 was more volatile than the ESG Index in the short term but not in the long term (over 5-year horizon) as the standard deviation of the BSE 100 (3.53%) was higher than that of the ESG index (3.24%). This indicates that the risk profile of investments in ESG issues could also vary based on investment time horizon. Thus, portfolio managers must not evaluate ESG strategies on the basis of returns alone and should take a multi-period perspective when evaluating both returns and risks. ESG integration may thus be of specific interest when it comes to long-term strategic asset allocation and not short-term return enhancement or market timing.

Implications for Companies

The results indicate that ESG efforts are more like "long-term strategic investments" in the eyes of companies, as opposed to a short-term tactic that is likely to yield immediate market valuation or shareholder return. Rising

up the value of investments for environmental efficiency, employee welfare and stakeholder relations, governance systems, transparency, and responsible business practices can come at a high cost in the early stages. The economic returns on these types of schemes can take time to pay off.

Therefore, corporate managers need to consider ESG investments through a longer-term perspective, rather than thinking in short-term terms about their immediate share price or short-term financial performance. Reducing resource consumption, increasing employee productivity, gaining stakeholder confidence, enhancing corporate image, developing better governance, and lowering long-term environmental and regulatory risk to the company can over time lead to improved financial results.

The results also have implications for business communication. ESG-progress firms should make sure to provide investors with clear and consistent information on their ESG goals, progress towards ESG goals, measurable results and the timeframe for measurable results. This can make it easier for investors to consider ESG spending as a one-off cost rather than an investment in their long-term value creation. The present study, however, does not prove that any specific corporate ESG practice causes positive stock returns; hence companies should not expect that all ESG practices will necessarily lead to better financial results.

The Impact on Policy Makers and Market Institutions

The results also underpin the need for policy and market measures to foster long-term engagement in sustainable finance for both policy makers and market institutions. As financial impacts of ESG integration become more evident over longer time horizons, a significant focus on short-term performance can deter investors from continuing in an ESG-integrated investment strategy.

Therefore, policy efforts should be directed towards enhancing the quality, comparability, consistency and transparency of ESG reporting. Standardisation of ESG reporting and the development of well-defined measurement frameworks can help investors to better compare companies and mitigate information asymmetry. A more consistent approach to disclosing ESG information on the other hand, could also enhance the ability of institutional investors and portfolio managers to use ESG information when making long-term investment decisions.

Sustainable investment can be further facilitated by the market institutions promoting investor education and by creating reliable ESG indices, benchmarks and analytical tools. These actions can help investors make decisions about ESG investments on a more relevant time frame, instead of relying on short-term price movement as a sign of success or failure of an ESG approach. The results confirm that sustainable finance is evaluated based on financial performance, risk and long-term value creation in a market environment.

Scope for Future Research

The present study is an empirical study to provide evidence on the relationship between ESG investing and investment horizon in the BSE ESG 100 Index and BSE 100 Index. The results suggest that ESG outperformance is statistically significant for medium- to long-term time horizons, but also suggest a number of research opportunities. Possible further research opportunities following this analysis include increasing the number of indices, the length of the observations period, the number of variables used and the dynamics of how the ESG characteristics impact investment performance.

A key research question is how to compare different ESG benchmarks. This study concentrates on the BSE ESG 100 Index and the BSE 100 Index. While this gives a consistent point of comparison, there are other ESG benchmarks in the market in India that employ different methods to security selection, weightages and screening on ESG. There are several ESG indexes available in the Indian market, such as Nifty 100 ESG Index, Nifty 100 Enhanced ESG Index, Nifty 100 ESG Sector Leaders Index and S&P BSE 100 ESG Index. The present study found that these indices outperform over the longer-term, which could be because of the BSE ESG 100 or because this is a quality of ESG investing in India as a whole. A comparative study between these indices may be able to decide whether the superior performance observed in the present study is specific to the BSE ESG 100 or it is a general characteristic of ESG investing in India.

The effect of the sector composition should also be explored in the future. ESG indices can have different sectoral weights and include different components than

market indices. As a result, some returns may reflect sector exposure, in addition to the ESG features. In some cases, for instance, the relative performance of an ESG index can vary due to commodity price fluctuations, interest rate movements, technology shifts, regulatory shifts or other sector-specific influences. Thus, sector-adjusted benchmarks or matched portfolios could be utilized in future studies to separate the ESG effects from the sector allocation effects. This would give a better idea of whether or not ESG traits are themselves associated with better returns.

The other promising field is individual ESG dimensions analysis. The current research adopts a holistic approach to the concept of ESG. But, environmental, social and governance concerns can have different impacts on the economy and may or may not be felt at the same time. Some governance characteristics could impact investor confidence and corporate risk in a relatively short period of time, whereas environmental investments could take several years to see benefits. The literature also indicates that the materiality of the ESG components may vary through time. It might therefore be interesting to study the ESG components in isolation and see if there is a better correlation between that score and long-term equity returns.

Heterogeneity in ESG ratings needs to be given more consideration in the future. There can be variation in the way that ESG performance is measured, with varying methodologies, indicators, weights, and definitions. This means that two firms may be given vastly different ESG ratings based on the rating agency's methodology. Future work may build on this research by analysing portfolios that have different data providers for their ESG ratings to determine if the return relationship observed is consistent across alternative ESG ratings. This would mitigate the risk that the empirical findings are driven to some extent by the methodology of ESG performance measurement.

There can also be a more in-depth study of the investment horizon. Four horizons were used in the present study, 6 months, 1 year, 3 years and 5 years. Future studies might be more detailed and apply other time horizons, such as two years, seven years, and ten years, or adopt rolling windows for closer insights into the time when ESG outperformance is statistically significant. This method may help determine if there is a specific length of time when the ESG advantage is stronger.

For future analysis, various market and economic regimes can be added. Several important market conditions are covered in the current study period, but a longer historical period would enable the researcher to look into ESG performance for bull markets, bear markets, high-inflation markets, tightening monetary policy, economic slowdowns, and financial crises. There are indications in the literature that ESG portfolios could exhibit resilience in financial stress conditions. Thus, a regime-based analysis might suggest that the link between returns and ESG investing may shift based on the overall market environment.

An extension of interest would be to look at risk-adjusted performance. In the present study, the major comparisons are made based on annualised CAGR returns as well as descriptive statistics like standard deviation, minimum, maximum and range. There are other metrics that could be added in future research, including Sharpe ratio, Sortino ratio, Jensen's alpha, Treynor ratio, maximum drawdown and downside risk. This would allow for a more thorough evaluation of the potential for ESG portfolios to deliver higher returns, based on the amount of risk taken.

The investment behaviour of investors and institutional ownership could also be explored. The literature reviewed in the study suggests that investor horizon could affect corporate ESG actions and that longer-term institutional investors could foster greener ESG actions. Future studies might then examine the interaction between market level and firm level ownership data to explore the possibility that more long-term institutional ownership leads to stronger ESG performance and that this ultimately leads to increased shareholder returns.

Last but not least, the analysis could be expanded to developed and emerging markets beyond India. Comparisons across countries might show that the association of ESG and investment horizon is more related to the level of ESG markets, regulatory structures, investor preferences, or economic development. The long-term ESG effect that has been noticed in India could be country specific or a global trend, and the research would help give answers.

Limitations of the Study

While the findings of the study are useful for understanding the interplay between ESG investing and

investment horizon in the Indian equity market, the following limitations should be noted: The study does offer valuable insights into the link between ESG investing and investment horizon in the Indian equity market, but there are some limitations that need to be recognised when interpreting the findings: The limitations do not diminish the validity of the results, but suggest limits in which the findings can be interpreted, as well as opportunities for further research.

The first constraint is that of the choice of indices. A comparison is done only between the BSE ESG 100 Index and BSE 100 Index. This method gives a single answer to the question of "how do you compare an ESG-based benchmark with a wide market-based benchmark," but does not reflect the full Indian ESG investment landscape. ESG indices can have varying weights, constituents, methodologies and screening criteria. Hence, the performance seen in the BSE ESG 100 cannot be extrapolated to all the other ESG indexes and ESG mutual funds in India. There are also a number of other ESG benchmarks using different construction methods that are recognised by the study.

The second is the time of the observation. The analysis is done for the period from October 2017 to March 2026, covering 102 monthly observations. The start of the study period is based on the date of the BSE ESG Index's inception. This gives a homogeneity in the data set, but also limits it to a relatively short time span. The history of India's ESG investing has also come a long way, and a longer history would allow for greater time to see various economic and market cycles. The results may thus be typical of a particular timeframe rather than the long-term relationship between ESG investing and market performance.

A third constraint is using data at the index level. The study does not analyse performances at a company level but rather the performance of the BSE ESG 100 index and BSE 100 index as composite indices. It is therefore not possible to conclude whether certain ESG practices or characteristics on the company level contributes to the observed difference in performance. An index-level analysis can prove that an association exists between the returns and an index that has been constructed based on ESG principles, but it may not be possible to find out which environmental, social or governance mechanisms are responsible for the difference.

One disadvantage of the study is the use of ESG as a single measure. Corporates' performance may be affected by environmental, social and governance issues in varying ways and in varying timeframes. Incorporating all three dimensions into one ESG index makes it hard to figure out which of the three dimensions has the strongest impact on the overall long-term performance. The literature indicates that governance aspects might be more relevant in the short term while environmental and social issues in the long term. The present methodology does not allow these individual effects to be isolated.

Another restriction is the composition of the sectors. The differences between the BSE ESG 100 and the BSE 100 may partially account for the differences in sector allocation and not just ESG characteristics. The return differential observed may be affected by the relative exposure of the ESG index to specific sectors, as performance of those sectors will impact the index's return differential. The study is not based on a sector neutral portfolio, nor on statistical controls to isolate the pure ESG effect. Hence, the outperformance that has been observed has to be understood as an outperformance of the ESG index when compared to the chosen broad-market index and not as a proof of the positive effect of ESG features on performance.

Rolling CAGR returns are also used to form the basis of the study for four investment timeframes – six-month, one year, three years, and five years. Although rolling windows offer a usefully convenient method for looking at the evolution of performance over the investment horizon, the observations obtained from the windows are not entirely independent. Rolling periods with the same adjacency have a significant amount of common base data for each month. This feature may affect the statistical characteristics of the observations, and should be taken into account when evaluating the significance tests. The study is based on paired observations, as each ESG return is paired with the BSE 100 return during the same time period.

One more restriction concerns the statistical method. Reversal of treatments is analysed with descriptive statistics and paired-sample t-tests. The paired t-test was used for comparing matched observations, and the study states that one can assume that the differences in the paired observations are approximately normally distributed. Financial return series may, however, have

non-normality, autocorrelation, volatility clustering, among other characteristics that may not be captured by applying a simple t-test. Further analyses using more sophisticated statistical methods might give further support to the results.

The analysis is also mainly skewed towards returns and volatility, rather than a full array of risk adjusted performance measures. The study looks at standard deviation, minimum, maximum and range but does not compute any of the measures like Sharpe ratio, Sortino ratio, Jensen's alpha, maximum drawdown, downside deviation etc. This means that the reporting on improved risk efficiency over time should be viewed with care and shouldn't be seen as a full picture of risk adjusted performance.

One caveat is that macroeconomic and market variables are not explicitly controlled for. The returns of equity securities can be affected by a variety of factors such as interest rates, inflation, foreign exchange rates, commodity prices, the growth of economies, liquidity conditions, and international movements in the securities markets. The paired design helps to eliminate common market movements to some degree since both indices are part of the same broader market context, but is not sufficient to eliminate the impact of these factors on the ESG return differential.

Last of all, the study does not establish causality, only a statistical association. It is not conclusive from the results that the better performance of the BSE ESG 100 over the longer horizons is due to the ESG characteristics. There may be other reasons for the outcome, such as the allocation of a specific sector, constituents, company size, valuation, profitability, growth or changes in investor appetite.

The results should be interpreted as an indication of the link between ESG related investing and longer investment periods, and not as a definitive conclusion of the universal superiority of investing in ESG. Even so, the results of this study can serve as a base for further empirical study, and the study also shows that investment horizon is important when assessing the performance of ESG investments.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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