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Green Gains: Unravelling the Performance Dynamics of ESG Indices Against Nifty 50

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Abstract
Environmental, Social, and Governance (ESG) investing has surged globally as investors increasingly prioritize responsible and sustainable investing criteria alongside traditional financial metrics. In India, this trend aligns with both a regulatory push for sustainable business practices and rising investor demand for funds meeting ESG standards. While the Nifty 50 index serves as a benchmark for Indian equity markets, it lacks ESG considerations, creating a gap for investors seeking financial performance alongside corporate responsibility. This paper examines the comparative performance of three ESG-focused indices - Nifty 100 ESG Index, Nifty100 Enhanced ESG Index and Nifty 100 ESG Sector Leaders Index - against the Nifty 50, providing insights on performance, risk resilience, and sectoral dynamics. Using return analysis, beta values, and descriptive statistics, this study identifies trends underscoring ESG indices' resilience during economic downturns Findings suggest that ESG indices offer competitive returns and lower volatility, making them viable options for risk-averse and socially conscious investors. These results contribute to the evolving discourse on ESG investments in emerging markets, highlighting their role in balancing financial returns with responsible investing principles.

1. Introduction

Context
As investors and regulators worldwide shift focus towards sustainable and ethical investments, Environmental, Social, and Governance (ESG) indices have gained prominence within capital markets. India is no exception; with its unique blend of high-growth sectors and an expanding investor base, the country has witnessed a notable rise in ESG-focused funds over the last decade. Regulatory incentives and growing awareness among investors—who increasingly seek returns aligned with broader social and environmental principles—further drive this shift. In this context, ESG indices represent a valuable addition to financial instruments, catering to investors who prioritize both corporate accountability and financial resilience.

Problem Statement
Despite global growth in ESG funds, India's market remains heavily reliant on traditional indices like the Nifty 50, which do not incorporate ESG screening criteria. The Nifty 50 is designed to reflect overall market activity and economic health but is dominated by sectors and companies that may not align with ESG values, limiting its appeal for investors who prioritize responsible investment options. Consequently, investors seeking ESG-compliant options face a dilemma: they may need to accept potentially lower returns and sectoral limitations in ESG

indices or invest in traditional indices that may conflict with their ethical considerations. This study addresses this gap by directly comparing the performance, sectoral composition, and resilience of leading ESG indices with the Nifty 50.

Research Objective

To conduct a detailed comparative analysis of the Nifty 100 ESG Index, Nifty100 Enhanced ESG Index and Nifty 100 ESG Sector Leaders Index indices against the Nifty 50. This comparison evaluates each index across three main dimensions: financial performance (returns and volatility), resilience during market downturns, and sectoral composition differences. By understanding these dimensions, this research assesses the effectiveness of ESG indices in India as viable investment options that balance ethical priorities with financial goals.

Research Scope

This study focuses on three ESG indices - Nifty 100 ESG Index, Nifty100 Enhanced ESG Index and Nifty 100 ESG Sector Leaders Index selected for their prominence and availability in the Indian market. These indices represent diverse approaches to ESG criteria, offering a meaningful cross-section for comparison. Through an examination of returns, beta values, CAGR, and sectoral allocation, this paper provides investors with a foundational understanding of ESG indices' strengths and limitations relative to the traditional market index.

2. Literature Review

ESG Investing Trends and the Indian Context : Globally, Environmental, Social, and Governance (ESG) investing has become integral to modern finance, with a strong trend toward integrating sustainability and financial returns. Studies indicate that ESG investments often offer competitive risk-adjusted returns, particularly in times of crisis (Friede et al., 2015). In India, regulatory support from the Securities and Exchange Board of India (SEBI) has strengthened ESG adoption through guidelines promoting transparency in corporate governance (SEBI, 2021). ESG investments are growing in India, supported by the launch of ESG indices like the Nifty 100 ESG. This alignment of India's capital markets with global standards shows increasing interest among investors in sustainable investment options (Kiran & Tadoori, 2021).

Comparative Analysis of ESG and Traditional Indices : Performance metrics like total returns, volatility and risk-adjusted returns are the commonly used measures to compare various indexes. Verheyden, Eccles, and Feiner (2016) found that ESG indices frequently match or outperform traditional indices, with lower volatility by adjusting sectoral compositions favoring technology and finance over high-impact sectors like energy. Studies by Sultana and Goud (2022) show that the Nifty 100 ESG Sector Leaders Index offers returns similar to its non-ESG counterparts, indicating that ESG investments can provide sustainable returns without compromising on performance. Similarly, Jain, Mehrotra, and Mendiratta (2023) found that ESG indices generally outperform the Nifty 50 on a risk-adjusted basis, which proves their potential to balance financial returns with social impact.

Resilience of ESG Indices During Economic Downturns : The capacity of the ESG indices, to recover quickly from market crashes, has been particularly evident during market crises. Beloskar and Rao (2023) conducted an event study around COVID-19, finding that ESG indices demonstrated lower volatility and slower declines than the Nifty 50, supporting the "flight to security" hypothesis where investors favor ESG during uncertainty. This is consistent with

global research showing ESG indices' tendency to avoid high-risk sectors, contributing to their stability during economic downturns. Kiran and Tadoori (2021) also noted increased efficiency and investor interest in Indian ESG indices post-COVID, underscoring the preference for sustainable investments during turbulent times.

Sectoral Composition and ESG Index Characteristics : Sectoral composition significantly impacts the performance dynamics of ESG indices. ESG indices, by design, underweight sectors like energy and industrials while overweighting sustainable sectors such as technology and finance (Sultana & Goud, 2022). This sectoral distribution aligns with investor preferences for stability and ethical compliance, creating a buffer against volatility. Rao and Ghosh (2023) highlight that the sectoral characteristics of ESG indices make them more resilient during market stress, adding value for risk-averse investors.

Table – 1 Research Gaps and Study Contributions

Research Gap	Existing Literature	Need for Study
Comparative Analysis Across Multiple ESG Indices	Studies by Jain et al. (2019) and Sultana & Goud (2022) focus on individual ESG indices	A comprehensive comparison of multiple ESG indices (Nifty 100 ESG Index, Nifty100 Enhanced ESG Index and Nifty 100 ESG Sector Leaders Index) against the Nifty 50.
Detailed Sectoral Composition Analysis	Sultana and Goud (2022) highlight sectoral weightings within ESG indices	Detailed analysis of specific sector contributions to performance and resilience in ESG indices.
Downside Protection Analysis	Beloskar and Rao (2023) found resilience in ESG indices during COVID-19	Expanded analysis of beta values and other indicators to establish ESG indices' appeal as downturn protection.
Longitudinal Performance of ESG Indices	Jain et al. (2023) provide short-term return insights	Long-term performance studies are necessary to validate the sustainability of ESG indices as long-term alternatives.
Correlation with Investor Sentiment	Kiran and Tadoori (2021) document post-COVID interest	Investigate the relationship between investor sentiment and ESG performance to understand behavioral impacts on returns.

This study aims to address these gaps by carrying out a comprehensive analysis of the Nifty 100 ESG Index, Nifty100 Enhanced ESG Index and Nifty 100 ESG Sector Leaders Index indices relative to the Nifty 50. By examining performance metrics, sectoral allocations, and resilience indicators, this research offers a deeper understanding of the role ESG indices play within India's financial landscape, presenting valuable insights for investors and policymakers alike.

3. Hypotheses

Based on the identified research gaps, the following hypotheses are framed to guide the

empirical analysis of ESG indices relative to the Nifty 50. These hypotheses address key aspects of financial performance, risk, resilience, sectoral composition, and investor sentiment.

Hypotheses 1: Financial Performance Hypothesis

H0: The ESG indices (Nifty 100 ESG Index, Nifty100 Enhanced ESG Index, and Nifty 100 ESG Sector Leaders Index) do not demonstrate similar or lower average returns compared to the Nifty 50.

H1: The ESG indices demonstrate similar or slightly lower average returns compared to the Nifty 50, possibly due to ESG screening criteria limiting exposure to certain high-performing sectors.

Hypotheses 2: Risk and Volatility Hypothesis

H0: The ESG indices do not exhibit lower volatility than the Nifty 50.

H1: The ESG indices exhibit lower volatility (risk) than the Nifty 50, indicating greater stability and resilience during market downturns.

Hypotheses 3: Market Sensitivity and Resilience Hypothesis

H0: The ESG indices do not have lower beta values compared to the Nifty 50.

H1: The ESG indices show lower beta values relative to the Nifty 50, indicating reduced sensitivity to market-wide volatility and greater resilience during economic downturns.

Hypotheses 4: Downside Protection Hypothesis

H0: The ESG indices do not demonstrate lower overall volatility or smaller volatility spikes during market downturns compared to the Nifty 50.

H1: The ESG indices demonstrate lower overall volatility and smaller volatility spikes during market downturns, indicating lower risk exposure and greater resilience under adverse conditions.

These hypotheses will be tested through the methodologies outlined in the research, aiming to provide a comprehensive analysis of the performance, resilience, and sectoral dynamics of ESG indices in the Indian market. This structured approach enables a nuanced understanding of ESG indices as alternative, responsible investment options for Indian investors.

4. Data Collection & Research Methodology

4.1 Data Collection

It is a quantitative study which performs a comparative analysis between the Nifty 50 index and ESG Indices. NIFTY is the most commonly used index which monitors the the behaviour of the most liquid and largest floating securities, so we have selected it as the benchmark index. The research is based upon secondary data collected from NSE website for the indexes under study the NSE Nifty 50, Nifty 100ESG, Nifty 100 Enhanced ESG, Nifty 100 ESG Sector Leaders and Nifty 100 ESG Sector Leaders from 01 Apr 2011 till 30 Sep 2024. The data collection and the research methodology is described in the following paragraphs.

Nifty 50 Index which is the main index on the National Stock Exchange of India (NSE), represents a selection of the largest and most liquid blue-chip companies in India. Tracking these major firms, the Nifty 50 spans a wide array of economic sectors, providing investors with streamlined exposure to the Indian market through a single, diversified portfolio. Launched in April 1996, this index serves as a popular benchmark and foundation for index funds and derivatives.

NSE Indices Limited was previously known as India Index Services & Products Limited (IISL).

It manages and owns the Nifty 50 Index. It is calculated using a float-adjusted, market capitalization-weighted approach, reflecting the aggregate market value of all its components relative to a specified base period. This method accounts for any changes to index components and actions by the corporates like rights issue or stock split, without disrupting the overall value of the index.

Since June 26, 2009, the Nifty 50 has employed this float-adjusted market capitalization method exclusively. The index undergoes a semi-annual review based on data from the six months ending in January and July, with any changes to constituent stocks taking effect on the last trading days of March and September. Market participants are given a four-week advance notice before any replacements are implemented.

Additional adjustments may occur if a constituent undergoes mergers, demergers, delisting, capital restructuring, or regulatory actions that impact its continued inclusion. Shareholder's approval is required for a stock tobe replaced in the index in cases of capital restructuring or voluntary delisting. For other events, such as trading suspension or regulatory findings, changes follow Exchange notifications. The guidelines on corporate actions related to demergers or spin-offs determine eligibility adjustments for continued inclusion.

Table 2 : Sector Composition: Nifty 50 Index

Sector	Weight(%)
Financial Services	34.25
Information Technology	12.92
Oil, Gas & Consumable Fuels	10.76
Fast Moving Consumer Goods	8.22
Automobile and Auto Components	7.43
Healthcare	3.99
Telecommunication	3.98
Construction	3.92
Metals & Mining	3.54
Power	3.12
Consumer Durables	2.47
Construction Materials	2.08
Consumer Services	1.46
Capital Goods	0.94
Services	0.93

*(As on 31 Oct 2024)

Table 3 : Top Constituents by Weightage: Nifty 50 Index

Company's Name	Weight(%)
HDFC Bank Ltd.	12.11
ICICI Bank Ltd.	8.38

Reliance Industries Ltd.	8.31
Infosys Ltd.	5.82
ITC Ltd.	4.18
Bharti Airtel Ltd.	3.98
Larsen & Toubro Ltd.	3.92
Tata Consultancy Services Ltd.	3.73
Axis Bank Ltd.	3.04

Nifty ESG Indexes

ESG (Environmental, Social, and Governance) investment strategies are becoming very popular among investors. The main goal of ESG investing is to achieve strong, risk-adjusted returns by focusing on companies that are socially responsible, environmentally friendly, and ethical. The Nifty ESG indices (Nifty100 ESG index and Nifty100 Enhanced ESG index) are structured to have a sector exposure similar to the Nifty 100 index, but with an added emphasis on companies with higher ESG scores. This gives greater weight to companies with better ESG performance in the portfolio.

ESG score measures the performance of the companies on Environmental, Social and Governance front. The companies are evaluated based on the Policy disclosures and three main factors viz Environmental, Social and Governance.

The Nifty100 ESG Index represents the performance of the Nifty 100 companies in the based on their Environmental, Social, and Governance (ESG) risk scores. In this index, each company's weight is adjusted according to both its free float market capitalization and its ESG risk score, giving higher weight to companies with lower ESG risks. The index as on 1st Apr 2011, has a base value of 1000.

Table 4 : Sector Composition: Nifty100 ESG Index

Sector	Weight(%)
Financial Services	31.32
Information Technology	18.61
Automobile and Auto Components	9.12
Fast Moving Consumer Goods	7.62
Healthcare	5.01
Oil, Gas & Consumable Fuels	4.99
Consumer Durables	4.47
Telecommunication	3.12
Consumer Services	3.07
Power	2.89
Metals & Mining	2.40
Construction Materials	2.14

Services	2.13
Construction	1.59
Capital Goods	0.66
Chemicals	0.45
Realty	0.40

Table 5 : Top Constituents by Weightage: Nifty100 ESG Index

Company's Name	Weight(%)
Infosys Ltd.	6.96
HDFC Bank Ltd.	6.38
ICICI Bank Ltd.	4.18
Axis Bank Ltd.	3.65
Bharti Airtel Ltd.	3.12
HCL Technologies Ltd.	3.09
Tata Consultancy Services Ltd.	2.56
Tech Mahindra Ltd.	2.33
Tata Motors Ltd.	2.14
Wipro Ltd.	2.03

Nifty100 Enhanced ESG Index represents companies in the Nifty 100 based on their Environmental, Social, and Governance (ESG) risk scores, while excluding those with high-risk profiles. To qualify, companies must be part of the Nifty 100 and have an ESG risk score. Companies in severe risk categories or with controversy ratings of 4 or 5 (on a scale of 1-5, where 1 is least controversial) are excluded. Additionally, companies involved in industries such as tobacco, alcohol, controversial weapons, or gambling are not eligible.

The index has a variable number of constituents, with each company's weight determined by its free-market capitalization and ESG risk score. Sector caps are applied, and individual stocks are limited to the lower of 8% or five times their weight based solely on free-float market capitalization. The index is reconstituted semi-annually.

Table 6 : Sector Composition: Nifty100 Enhanced ESG Index

Sector	Weight(%)
Financial Services	31.32
Information Technology	18.66
Automobile and Auto Components	9.14
Fast Moving Consumer Goods	7.64
Healthcare	5.03
Oil, Gas & Consumable Fuels	5.00
Consumer Durables	4.48
Telecommunication	3.13
Consumer Services	3.07
Power	2.89

Metals & Mining	2.40
Construction Materials	2.15
Services	2.13
Construction	1.59
Capital Goods	0.66
Realty	0.41
Chemicals	0.30

Table 7 : Top Constituents by Weightage: Nifty100 Enhanced ESG Index

Company's Name	Weight(%)
Infosys Ltd.	6.97
HDFC Bank Ltd.	6.38
ICICI Bank Ltd.	4.18
Axis Bank Ltd.	3.65
Bharti Airtel Ltd.	3.13
HCL Technologies Ltd.	3.10
Tata Consultancy Services Ltd.	2.56
Tech Mahindra Ltd.	2.34
Tata Motors Ltd.	2.15
Wipro Ltd.	2.03

Nifty100 ESG Sector Leaders Index

The Nifty100 ESG Sector Leaders Index focuses on high-performing companies within each sector of the Nifty 100 that effectively manage ESG risks and have no major controversies. It aims to cover about 75% of the free-float market capitalization of the eligible companies in each sector of the Nifty 100. The free-float market capitalisation determines the weight of each stock limiting to a cap of 10% per stock.

Table 8 : Sector Composition : Nifty100 ESG Sector Leaders Index

Sector	Weight(%)
Financial Services	28.29
Information Technology	14.03
Oil, Gas & Consumable Fuels	10.53
Automobile and Auto Components	8.12
Fast Moving Consumer Goods	5.62
Healthcare	5.28
Telecommunication	4.18
Power	4.14
Construction	3.93
Consumer Services	3.91

Metals & Mining	3.27
Consumer Durables	2.83
Construction Materials	2.19
Services	1.70
Capital Goods	0.98
Realty	0.53
Chemicals	0.47

Table 9 : Top Constituents by Weightage: Nifty100 ESG Sector Leaders Index

Company's Name	**Weight (%)**
HDFC Bank Ltd.	9.25
Reliance Industries Ltd.	9.14
ICICI Bank Ltd.	8.19
Infosys Ltd.	6.20
Bharti Airtel Ltd.	4.18
Tata Consultancy Services Ltd.	3.96
Larsen & Toubro Ltd.	3.93
Axis Bank Ltd.	3.20
Mahindra & Mahindra Ltd.	2.75
Hindustan Unilever Ltd.	2.42

4.2 Research Methodology

The details of the of the statistical tools used in this study are as follows:

Annual Returns We have computed the annual return of the Nifty indices, using the following formula:

Annual Return = (Value at Year End−Value at Year Start)/Value at Year Start×100

In this formula, the index's starting value is its level at the beginning of the year, and the ending value is its level at the close of the year. This calculation yields the yearly return as a percentage.

Table 10 : Comparison of Annual Returns of Nifty 50 with ESG Indices

Yearly Return	Nifty 50	Nifty 100 ESG	Nifty 100 ESG Enhanced	Nifty 100 ESG Sector Leaders
31-Mar-24	28.61	36.33	36.13	31.58
31-Mar-23	-0.60	-7.88	-7.78	-4.59
31-Mar-22	18.88	19.65	19.64	17.37
31-Mar-21	70.87	75.48	75.22	65.57
31-Mar-20	-26.03	-24.30	-24.88	-22.17
31-Mar-19	14.93	16.16	15.56	15.90
31-Mar-18	10.25	12.33	12.94	12.23
31-Mar-17	18.56	17.65	18.29	15.71
31-Mar-16	-8.87	-7.44	-7.16	-8.17
31-Mar-15	26.66	29.89	30.28	31.47
31-Mar-14	17.97	21.84	22.04	1.80*

31-Mar-13	7.31	6.12	6.12	
31-Mar-12	-9.10	-8.35	-8.01	
Average Annual Return	13.03	14.42	14.49	14.24

The Compound Annual Growth Rate (CAGR) represents the average annual growth rate of an investment, assuming that gains are reinvested over time. The formula to calculate CAGR is as follows:

CAGR = (Ending Value/Beginning Value)^(1/Number of Years) – 1

where:

- **Ending Value** is the investment's value at the end of the period,
- **Beginning Value** is the investment's initial value at the start of the period, and
- **Number of Years** is the total duration, in years, over which the investment has grown or declined.

The result is typically expressed as a percentage, indicating the consistent annual growth rate over the specified period.

Table - 11 : Comparison of CAGR of Nifty 50 with ESG Indices

CAGR As on 30 Sep 24	Nifty 50	Nifty 100 ESG	Nifty 100 ESG Enhanced	Nifty 100 ESG Sector Leaders
CAGR Since Inception	11.89%*	12.96%	13.02%	13.26%*
CAGR Last 5 FYs	13.94%	14.83%	14.60%	13.68%
CAGR Last 3 FYs	14.97%	14.54%	14.52%	13.79%
CAGR 1 FY	28.61%	36.33%	36.13%	31.58%
CAGR YTD 30 Sep 2024	7.52%	8.94%	8.96%	8.08%

* Nifty 3rd Nov 1995 Base Value 1000 and Nifty 100 ESG Sector Leaders index 1 Jan 2024 Base Value 1000

Correlation

Correlation analysis helps us see how strongly two variables, X and Y, are related to each other. It indicates if changes in one variable are linked to changes in the other. In 1896, Karl Pearson created a way to measure this relationship, called the Pearson's correlation coefficient, or r, which works best when the relationship is a straight line. The value of r shows both the strength and direction of the relationship: if r is positive, X and Y increase together; if r is negative, one increases while the other decreases,

$$r = \frac{n(\Sigma xy) - (\Sigma x)(\Sigma y)}{\sqrt{\left[n\Sigma x^2 - (\Sigma x)^2\right]\left[n\Sigma y^2 - (\Sigma y)^2\right]}}$$

Where n = No of values or elements, Σx = Sum of 1st values list, Σy = Sum of 2nd values list, **Σ**xy = Sum of the product of 1st and 2nd values, Σx2 = Sum of squares of 1st values, Σy2 = Sum of squares of 2nd values

Table - 12 : Comparison of Correlation of Nifty 50 with ESG Indices

	Nifty 50	*Nifty 100 ESG*	*Nifty 100 ESG Enhanced*	*Nifty 100 ESG Sector Leaders*
Nifty 50	1			
Nifty 100 ESG	0.981157456	1		
Nifty 100 ESG Enhanced	0.980579107	0.999589447	1	
Nifty 100 ESG Sector Leaders	0.984583405	0.986235995	0.986158366	1

Paired t-Test

The paired t-test compares the means of two related groups. In this case, the daily returns of the Nifty 50 and each of the ESG indexs.

Formula:

The test statistics t is calculated as follows:

$$t = \frac{X}{(\frac{SD}{\sqrt{n}})}$$

where:

- X = Mean of the differences between paired observations (i.e., the average of the daily return differences between the Nifty 50 and the ESG index).
- SD = Standard deviation of the differences.
- n = Number of paired observations (days in this case).
-

Table 13 : t-Test: Paired Two Sample or Means

	Nifty 50	*Nifty 100 ESG*	*Nifty 50*	*Nifty 100 ESG Enhanced*	*Nifty 50*	*Nifty 100 ESG Sector Leaders*
Mean	0.000339557	0.000371899	0.000339557	0.000373438	0.000395442	0.00040699
Variance	0.0000748859	0.0000760220	0.0000748859	0.0000760630	0.0000717747	0.0000679294
Observations	4931	4931	4931	4931	3925	3925
Pearson Correlation	0.981157456		0.980579107		0.984583405	
Hypothesized Mean Difference	0		0		0	
df	4930		4930		3924	
t Stat	-1.345850249		-1.38847846		-0.487109508	
P(T<=t) one-tail	0.089206351		0.082527064		0.313103969	
t Critical one-tail	1.645162766		1.645162766		1.64524204	

P(T<=t) two-tail	0.178412703	0.165054129	0.626207938
t Critical two-tail	1.960445292	1.960445292	1.960568722

F-Test

The F-test is a statistical test to determine if there is a significant difference between the variances of two datasets.It is particularly useful for comparing the volatility (measured as variance) of different indices. By assessing whether the variance of an ESG index, such as the Nifty 100 ESG Sector Leaders, is significantly lower than that of the Nifty 50, the F-test allows us to examine whether the observed differences in volatility are likely due to inherent stability in the ESG index or are merely the result of random fluctuations. A low p-value in the F-test indicates that the variance differences are statistically significant, supporting the hypothesis that one index may exhibit lower risk relative to another.

n an **F-test for equality of variances**, the test statistic FFF is calculated using the following formula:

$$F = \frac{S\frac{2}{1}}{S\frac{2}{2}}$$

where:

- S 2/1 is the variance of the first sample (e.g., the Nifty 50),
- S 2/2 is the variance of the second sample (e.g., the Nifty 100 ESG Sector Leaders).

In this setup:

- If F>1, the first sample has greater variance than the second.
- If F<1, the second sample has greater variance than the first.

The calculated FFF-statistic is then compared against a critical FFF-value from the F-distribution for a given significance level (e.g., 0.05) and degrees of freedom for each sample:

- **Degrees of freedom for Sample 1 (df1)** = n_1-1
- **Degrees of freedom for Sample 2 (df2)** = n_2-1

we reject the null hypothesis that the variances are equal, suggesting a significant difference in volatility between the two datasets, If the calculated FFF-statistic exceeds the critical FFF-value, or when the p-value is below the significance level.

Table – 14 F-Test Two-Sample for Variances

	Nifty 50	*Nifty 100 ESG Sector Leaders*
Mean	0.0003954	0.000407
Variance	0.00007177	0.00006793
Observations	3925	3925
df	3924	3924
F	1.056607	
P(F<=f) one-tail	0.042318	
F Critical one-	1.0539263	

tail

Table 15 :Descriptive Statistics

	Nifty 50	*Nifty 100 ESG*	*Nifty 100 ESG Enhanced*	*Nifty 100 ESG Sector Leaders*
Mean	0.000339557	0.000371899	0.000373438	0.00040699
Standard Error	0.000123235	0.000124166	0.000124199	0.000131556
Median	0	0	0	0
Mode	0	0	0	0
Standard Deviation	0.008653665	0.008719058	0.008721413	0.008241932
Sample Variance	0.0000749	0.0000760	0.0000761	0.0000679
Kurtosis	20.70227778	18.34056111	18.46205791	23.13513143
Skewness	-0.901813361	-0.773876689	-0.777025922	-1.020896439
Range	0.217368856	0.216715588	0.216750873	0.202589448
Minimum	-0.129788451	-0.125822274	-0.126083168	-0.117187396
Maximum	0.087580406	0.090893314	0.090667705	0.085402052
Sum	1.6743543	1.833835741	1.841420813	1.597434028
Count	4931	4931	4931	3925
Confidence Level(95.0%)	0.000241595	0.00024342	0.000243486	0.000257924

Regression Analysis

Regression analysis will help quantify the relationship between the returns of each ESG index and the Nifty 50 by determining how much the ESG index's returns (dependent variable) change in response to changes in the Nifty 50's returns (independent variable). Here:

- y (dependent variable): Daily returns of the ESG index
- x (independent variable): Daily returns of the Nifty 50

The resulting slope of the regression line (beta) represents the sensitivity of the ESG index to market movements, as reflected by the Nifty 50. Beta measures an index's sensitivity to market movements, with lower beta values indicating that an index is less affected by overall market volatility

$$\beta = \text{Cov}\,(R_{ESG}, R_{\text{Nifty }50}) \,/\, \text{Var}\,(R_{\text{Nifty }50})$$

where:

- R_{ESG} - represents the daily returns of an ESG index,
- $R_{\text{Nifty }50}$ represents the daily returns of the Nifty 50,
- Cov (R_{ESG},$R_{\text{Nifty }50}$) is the covariance between the ESG index and Nifty 50 returns
- Var ($R_{\text{Nifty }50}$) is the variance of Nifty 50 returns.

Table 16 : Beta Values with respective to Nifty 50

	Nifty 100 ESG	Nifty 100 ESG Enhanced	Nifty 100 ESG Sector Leaders

Beta W.r.t Nifty 50	0.988571748	0.988255857	0.957846196

5. Results & discussion

5.1 Hypotheses Testing

Hypothesis 1: Financial Performance Hypothesis

This study tests the **Financial Performance Hypothesis** to determine if ESG indices exhibit similar or lower returns compared to the Nifty 50.

- **Null Hypothesis (H0)**: The ESG indices (Nifty 100 ESG, Nifty 100 ESG Enhanced, and Nifty 100 ESG Sector Leaders) do not demonstrate similar or lower average returns compared to the Nifty 50.
- **Alternative Hypothesis (H1)**: The ESG indices demonstrate similar or slightly lower average returns compared to the Nifty 50, possibly due to ESG screening criteria limiting exposure to certain high-performing sectors.

Analysis

To investigate **Hypothesis 1: Financial Performance Hypothesis** - which proposes that ESG indices may have similar or slightly lower average returns compared to the Nifty 50 due to ESG screening - a combination of statistical testing and descriptive analysis was applied. Specifically, paired t-tests were conducted to assess daily returns, and further analysis of average annual returns and Compound Annual Growth Rates (CAGR) was carried out for each index.

The paired t-tests (Table -13) aimed to determine if there was any significant difference in daily returns between the Nifty 50 and each ESG index (Nifty 100 ESG, Nifty 100 ESG Enhanced, and Nifty 100 ESG Sector Leaders). For all three comparisons, the p-values exceeded the conventional threshold of 0.05, with results of 0.1784, 0.1651, and 0.6262 for Nifty 100 ESG, Nifty 100 ESG Enhanced, and Nifty 100 ESG Sector Leaders, respectively. These high p-values indicate that there is no statistically significant difference in returns between the Nifty 50 and the ESG indices. Consequently, we fail to reject the null hypothesis (H0), suggesting that ESG indices do not exhibit significantly different returns from the Nifty 50 based on daily performance data.

In addition to the statistical tests, an examination of average annual returns (Table 10) and CAGR (Table 11) offers further insights into the longer-term financial performance of the ESG indices compared to the Nifty 50. The average annual return for Nifty 50 stood at 13.03%, while the ESG indices posted higher values: 14.42% for Nifty 100 ESG, 14.49% for Nifty 100 ESG Enhanced, and 14.24% for Nifty 100 ESG Sector Leaders. A similar trend was observed for the CAGR since inception, with Nifty 50 at 11.89% compared to 12.96%, 13.02%, and 13.26% for Nifty 100 ESG, Nifty 100 ESG Enhanced, and Nifty 100 ESG Sector Leaders, respectively. These figures indicate that, contrary to expectations, the ESG indices have not underperformed the Nifty 50; rather, they have achieved comparable or even superior returns over the long term.

Recent performance data supports this conclusion. The 1-year CAGR for Nifty 50 was 28.61%, while the ESG indices outpaced it, with Nifty 100 ESG, Nifty 100 ESG Enhanced, and Nifty 100 ESG Sector Leaders posting returns of 36.33%, 36.13%, and 31.58%, respectively. Similarly, for year-to-date (YTD) 2024, Nifty 50 showed a CAGR of 7.52%, whereas Nifty 100 ESG and Nifty 100 ESG Enhanced achieved 8.94% and 8.96%, respectively. This consistent outperformance across both recent and long-term periods further challenges the assumption that ESG screening might limit returns.

Based on the paired t-tests and descriptive statistics, we accept the null hypothesis (H0). The ESG indices do not exhibit significantly lower returns than the Nifty 50; in many cases, they have even surpassed it. This finding challenges the notion that ESG-focused investing might limit financial performance and suggests that ESG indices can deliver returns comparable to or superior to traditional indices. These results highlight the potential for ESG indices to serve as attractive options for investors seeking both strong financial performance and alignment with sustainability and ethical investment principles.

Hypotheses 2: Risk and Volatility Hypothesis
H0: The ESG indices do not exhibit lower volatility than the Nifty 50.
H1: The ESG indices exhibit lower volatility (risk) than the Nifty 50, indicating greater stability and resilience during market downturns.
To investigate **Hypothesis 2: Risk and Volatility Hypothesis**, which suggests that ESG indices might display lower volatility than the Nifty 50, we conducted an analysis comparing the daily return volatility of the Nifty 50 with that of the Nifty 100 ESG Sector Leaders index. Lower volatility in ESG indices would suggest that these indices are potentially more stable and resilient, offering reduced risk exposure during market fluctuations—a key consideration for risk-averse investors.

Analysis :
To assess volatility, we calculated the standard deviation and variance of daily returns for both the Nifty 50 and the Nifty 100 ESG Sector Leaders index (Table 15). Standard deviation is a widely accepted measure of volatility, capturing the average deviation in daily returns and providing insight into the level of risk. Additionally, variance was calculated to quantify the dispersion of returns and enable a more precise comparison of volatility between the indices.
In order to find out the statistical significance, we conducted an **F-test** (Table 14). It tests whether two samples have significantly different variances. This will help to assess assess whether the observed difference in volatility between the Nifty 50 and Nifty 100 ESG Sector Leaders is meaningful or due to chance.

The Nifty 100 ESG Sector Leaders index showed a lower variance (0.00006793) compared to the Nifty 50 (0.00007177), showing lower volatility. This observation is also validated by the standard deviations, where the Nifty 100 ESG Sector Leaders index has a slightly lower standard deviation (0.00824) compared to the Nifty 50 (0.00865).
The F-test showed an F value of 1.0566 and P value of 0.0423, which is below the accepted threshold of 0.05. Hence, we can reject H0 and accept the alternative hypothesis (H1), showing that the Nifty 100 ESG Sector Leaders index has a significantly lower variance than the Nifty 50. This statistical result suggests that the difference in volatility between these indices is unlikely to be due to random variation and may reflect an inherent stability in the Nifty 100 ESG Sector Leaders index.

Interpretation and Conclusion :
From the combined results from the descriptive analysis and the F-test, we can accept the **alternative hypothesis (H1)**, suggesting that the Nifty 100 ESG Sector Leaders index demonstrates significantly lower volatility than the Nifty 50. This finding is consistent with the notion that ESG indices-particularly those with a sector-leading focus-may offer enhanced stability and resilience compared to conventional indices. It suggests that the Nifty 100 ESG

Sector Leaders index might offer a more stable investment option with less volatility.
Overall, these findings align with the broader view that ESG investments can provide lower risk exposure without necessarily sacrificing returns. For risk-averse investors or those seeking resilience in volatile markets, the Nifty 100 ESG Sector Leaders index may represent a compelling choice, combining the appeal of sustainable investing with the potential for greater stability.

Hypotheses 3: Market Sensitivity and Resilience Hypothesis
H0: The ESG indices do not have lower beta values compared to the Nifty 50.
H1: The ESG indices show lower beta values relative to the Nifty 50, indicating reduced sensitivity to market-wide volatility and greater resilience during economic downturns.
To test this, We have integrated the descriptive statistics, paired t-test results, and beta values provided for each ESG index relative to the Nifty 50. This approach will allow us to assess whether the ESG indices demonstrate significantly lower beta values, suggesting lower sensitivity to market volatility and potential resilience during downturns

Analysis :
The Descriptive Statistics **(Table 15)** provide initial insights into the volatility profiles of each index.
Standard deviation, a commonly used measure of volatility, reveals that the Nifty 100 ESG Sector Leaders index has a slightly lower standard deviation (0.00824) than the Nifty 50 (0.00865), suggesting it may experience less daily volatility. Although the Nifty 100 ESG and Nifty 100 ESG Enhanced indices show similar standard deviations to the Nifty 50, this small reduction in the Nifty 100 ESG Sector Leaders' volatility could indicate a marginally lower risk profile.
The **skewness and kurtosis values (Table 16)** for all indices also highlight certain risk characteristics; each index shows negative skewness, indicating a tendency towards negative returns, with the Nifty 100 ESG Sector Leaders index displaying the most pronounced negative skew.

The high kurtosis values across all indices suggest a tendency for extreme returns, with the Nifty 100 ESG Sector Leaders exhibiting the highest kurtosis, potentially reflecting a more concentrated distribution of returns
The paired t-test **(Table 13)** results further clarify the relationship in daily returns between the Nifty 50 and each ESG index. Since the p-values for all comparisons exceed 0.05, null hypothesis that the mean returns of each ESG index are significantly different from those of the Nifty 50, could not be rejected. This indicates that, on average, the returns of the ESG indices are similar to the Nifty 50. However, since the paired t-test primarily addresses mean returns rather than market sensitivity, it does not directly inform the hypothesis regarding beta valuesThe analysis of beta values offers a more specific view of market sensitivity. Beta values for the Nifty 100 ESG, Nifty 100 ESG Enhanced, and Nifty 100 ESG Sector Leaders indices are 0.9886, 0.9883, and 0.9578, respectively. The fact that all values are close to but slightly below 1 implies minor reductions in market sensitivity. The Nifty 100 ESG Sector Leaders, with a beta of 0.9578, is the most resilient in terms of sensitivity to market-wide movements.

Interpretation and Conclusion :
Considering the findings from descriptive statistics, paired t-tests, and Beta values we partially accept the alternative hypothesis (H1) that ESG indices have lower market sensitivity than the

Nifty 50. The Nifty 100 ESG Sector Leaders index shows reduced volatility and a lower beta, which could indicate a level of resilience during economic downturns. However, the differences in beta values across the ESG indices very marginal, meaning that while the ESG indices show some potential for reduced market sensitivity, this effect is not strongly reflected.

Hypotheses 4: Downside Protection Hypothesis
H0: The ESG indices do not demonstrate lower overall volatility or smaller volatility spikes during market downturns compared to the Nifty 50.
H1: The ESG indices demonstrate lower overall volatility and smaller volatility spikes during market downturns, indicating lower risk exposure and greater resilience under adverse conditions.

Analysis :
To evaluate Hypothesis 4: Downside Protection Hypothesis, we analysed the standard deviation and mean of daily returns for the Nifty 50 and each ESG index over the period from 11 Mar 2020 to 14 Apr 2020. This period included the WHO's pandemic declaration and India's initial lockdown phase, characterized by heightened market volatility and significant losses. The goal was to determine if the ESG indices exhibited lower overall volatility and smaller volatility spikes compared to the Nifty 50, indicating reduced risk exposure and resilience during adverse market conditions.

Table - 17 : Market Return (11 Mar to 14 Apr 2020)

	Nifty 50	Nifty 100 ESG	**Nifty 100 ESG Enhanced**	**Nifty 100 ESG Sector Leaders**
14-Apr-20	0.00%	0.00%	0.00%	0.00%
13-Apr-20	-1.29%	-0.96%	-1.03%	-0.93%
12-Apr-20	0.00%	0.00%	0.00%	0.00%
11-Apr-20	0.00%	0.00%	0.00%	0.00%
10-Apr-20	0.00%	0.00%	0.00%	0.00%
09-Apr-20	4.15%	3.86%	3.81%	3.86%
08-Apr-20	-0.49%	-0.25%	-0.34%	-0.34%
07-Apr-20	8.76%	9.09%	9.07%	8.54%
06-Apr-20	0.00%	0.00%	0.00%	0.00%
05-Apr-20	0.00%	0.00%	0.00%	0.00%
04-Apr-20	0.00%	0.00%	0.00%	0.00%
03-Apr-20	-2.06%	-2.25%	-2.43%	-2.35%
02-Apr-20	0.00%	0.00%	0.00%	0.00%
01-Apr-20	-4.00%	-3.88%	-3.92%	-4.18%
31-Mar-20	3.83%	3.92%	3.90%	3.66%
30-Mar-20	-4.38%	-3.57%	-3.59%	-3.69%
29-Mar-20	0.00%	0.00%	0.00%	0.00%
28-Mar-20	0.00%	0.00%	0.00%	0.00%
27-Mar-20	0.22%	0.20%	0.20%	0.42%
26-Mar-20	3.88%	4.01%	4.09%	4.36%

25-Mar-20	6.63%	6.52%	6.57%	6.50%
24-Mar-20	2.51%	2.47%	2.49%	2.57%
23-Mar-20	-12.98%	-12.58%	-12.61%	-11.72%
22-Mar-20	0.00%	0.00%	0.00%	0.00%
21-Mar-20	0.00%	0.00%	0.00%	0.00%
20-Mar-20	5.83%	5.65%	5.71%	5.87%
19-Mar-20	-2.43%	-2.72%	-2.76%	-1.99%
18-Mar-20	-5.55%	-5.53%	-5.57%	-5.62%
17-Mar-20	-2.50%	-2.19%	-2.24%	-2.06%
16-Mar-20	-7.61%	-7.21%	-7.26%	-7.19%
15-Mar-20	0.00%	0.00%	0.00%	0.00%
14-Mar-20	0.00%	0.00%	0.00%	0.00%
13-Mar-20	3.81%	3.27%	3.19%	3.19%
12-Mar-20	-8.30%	-8.05%	-8.03%	-7.89%
11-Mar-20	0.07%	-0.05%	-0.03%	0.06%
Total Return	-11.92%	-10.26%	-10.75%	-8.92%

The total returns over this period show that each ESG index experienced smaller losses than the Nifty 50. Specifically, the Nifty 50 had a total return of -11.92%, whereas the ESG indices had smaller declines, with the Nifty 100 ESG Sector Leaders index showing the least loss at -8.92%. This pattern suggests that the ESG indices, especially the Nifty 100 ESG Sector Leaders, may offer some level of downside protection, as they were less affected during this period of severe market stress.

Table – 18 : Descriptive Statistics (Covid-19 Period)

	Nifty 50	*Nifty 100 ESG*	*Nifty 100 ESG Enhanced*	*Nifty 100 ESG Sector Leaders*
Mean	-0.003406	-0.002931	-0.003072	-0.002548
Standard Error	0.007089	0.006915	0.006937	0.006738
Median	0	0	0	0
Mode	0	0	0	0
Standard Deviation	0.041939	0.040908	0.041039	0.039863
Sample Variance	0.001759	0.001673	0.001684	0.001589
Kurtosis	1.889731	1.996078	1.957003	1.562690
Skewness	-0.646575	-0.575431	-0.566351	-0.517167
Range	0.217369	0.216716	0.216751	0.202589
Minimum	-0.129788	-0.125822	-0.126083	-0.117187
Maximum	0.087580	0.090893	0.090668	0.085402
Sum	-0.119193	-0.102598	-0.107510	-0.089188
Count	35	35	35	35

Confidence Level(95.0%)	0.014407	0.014052	0.014097	0.013693

In terms of mean daily returns, the Nifty 100 ESG Sector Leaders again demonstrated the smallest negative return, with an average daily decline of -0.25% compared to -0.34% for the Nifty 50. This finding indicates that, on average, the ESG indices experienced less severe daily losses than the Nifty 50, reinforcing the idea of reduced downside exposure for the ESG indices during this volatile period. Lower mean daily losses suggest that these indices may provide smoother return profiles when markets are under pressure.

The standard deviation of daily returns, a measure of volatility, further supports the hypothesis of downside protection. The Nifty 100 ESG Sector Leaders had the lowest standard deviation at 3.99%, compared to 4.19% for the Nifty 50. This smaller standard deviation indicates reduced daily fluctuations for the ESG indices, particularly the Nifty 100 ESG Sector Leaders, which experienced smaller volatility spikes during the downturn. Lower volatility under stress is consistent with a more stable risk profile, suggesting that ESG indices may offer a buffer against sharp market declines.

On specific high-volatility days, such as 23 Mar 2020, when the Nifty 50 fell by -12.98%, the ESG indices showed slightly smaller losses. For instance, the Nifty 100 ESG Sector Leaders fell by -11.72% on this day, a smaller decline relative to the Nifty 50, illustrating its resilience in the face of extreme market movements. Moreover, on recovery days such as 25 Mar 2020, when the Nifty 50 increased by 6.63%, the ESG indices had similar movement, showing that they participate in market recoveries while providing some protection during declines.

Interpretation and Conclusion :
The results provide evidence supporting Hypothesis 4 (H1), suggesting that the ESG indices, particularly the Nifty 100 ESG Sector Leaders, demonstrate lower overall volatility and smaller volatility spikes compared to the Nifty 50 during market downturns. The combination of smaller total losses, lower mean daily declines, and reduced standard deviation underscores the potential of ESG indices for downside protection. These findings imply that the ESG criteria underlying these indices may contribute to resilience during periods of market stress, making them attractive options for investors seeking stability and reduced risk exposure in volatile conditions.

Conclusion
This study explored the comparative performance of ESG indices within the Indian financial market, emphasizing their resilience, competitive returns, and appeal to socially conscious investors. Through detailed quantitative analysis, the findings indicate that ESG indices, including the Nifty 100 ESG, Nifty 100 Enhanced ESG, and Nifty 100 ESG Sector Leaders, offer returns similar to or even superior to the Nifty 50, challenging traditional concerns over potential financial trade-offs in ethical investing.

Key insights from the study reveal that ESG indices generally show lower volatility, especially during economic downturns, and provide effective downside protection. This stability is driven by sectoral adjustments that overweight less volatile sectors like technology and finance while limiting exposure to high-impact industries Consequently, ESG indices emerge as viable options for investors seeking both stability and alignment with environmental, social, and

governance principles.

However, the study also acknowledges certain limitations, like the short timeframe of analysis, the lack of standardized ESG metrics, and a sectoral bias that may impact diversification potential. Future research is encouraged to address these areas, by

- Examining long-term performance across multiple market cycles
- Analysing regulatory impacts on ESG performance
- Investigating the behavioural factors influencing investor sentiment toward ESG investments.
- Exploring granular ESG impacts by capturing the distinct impacts of E, S, and G component.
- Conducting cross-country comparisons to assess Global ESG trends.

The results suggest that Investors should consider ESG indices, particularly the Nifty 100 ESG Sector Leaders, have demonstrated lower volatility and strong downside protection, making them ideal for risk-averse portfolios. In summary, ESG indices represent a promising pathway for investors in India to balance financial goals with ethical considerations. As regulatory frameworks and market interest in sustainable investing continue to evolve, the relevance of ESG indices in promoting responsible finance is likely to grow, paving the way for a more resilient and inclusive investment landscape.

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