

Market Volatility and ESG Fund Performance in India: A Conceptual Framework for Emerging Market Analysis

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Abstract

The relationship between market volatility and environmental, social, and governance (ESG) fund performance in emerging markets like India remains an underexplored area of study. The present literature, mainly drawn from developed economies, provides limited guidance for markets characterised by weaker disclosure standards, developing regulatory frameworks, and various investor profiles. This study contributes to the research programme on Sustainable Finance in Emerging Markets by developing a theoretical and analytic framework to analyze the relationship between the volatility of the NIFTY 100 ESG and NIFTY 100 conventional indices and sustainable fund performance in India. Using Modern Portfolio Theory, the Efficient Market Hypothesis, ARCH/GARCH volatility modelling, Stakeholder Theory, and Information Asymmetry Theory. The paper suggests five testable hypotheses for further research. A range of factors act as moderators, including ESG disclosure quality, market conditions and regulation, providing a holistic framework to understand the risk-return characteristics of sustainable investments. This paper advances theoretical perspectives by extending current finance theories to the ESG area in emerging markets and provides a model for policymakers, asset managers, and regulators in India seeking to support sustainable capital markets. The paper laid the foundation for upcoming ARCH/GARCH-based empirical research. **Keywords:** ESG funds, market volatility, GARCH models, NIFTY 100 ESG, sustainable finance, emerging markets, India, fund performance, risk-adjusted return.

1. Introduction

Sustainable investing has seen phenomenal growth, and now ESG factors are increasingly factored into investment decisions. While developed markets have a robust framework linking ESG to financial performance, developing economies such as India pose a complicated and challenging environment for sustainable investors (Goyal & Kumar, 2021; OECD, 2020). India's rapidly growing economy, coupled with the government's initiatives to address ESG issues and the recent launch of ESG-related indices such as the NIFTY 100 ESG, can offer both opportunities and challenges for sustainable investors in India.

The dynamic relationship between market volatility and ESG-based funds remains underexplored. While traditional wisdom and some empirical evidence suggest that ESG investments may provide downside protection in turbulent markets, the mechanisms by which it operates in India have not been extensively researched (Narayan & Phan, 2019; Khan, 2021).

The volatility of the Indian financial markets reflects macroeconomic events, global spillovers, and domestic policy decisions, and so, it is inappropriate to draw any broad generalisations from the literature.

This paper addresses one of the issues raised in Sustainable Finance in Emerging Markets (SFEM) – the missing evidence on the dynamic interaction between market volatility and the resilience of ESG funds in India. This study will compare the volatility of the NIFTY 100 ESG and NIFTY 100 conventional indexes, and explore the relationship between these volatility patterns and variation in the performance of ESG funds. Specifically, we will ask: How does the volatility of the NIFTY 100 ESG and NIFTY 100 indices relate to fund variation in emerging markets like India?

To address this question, this conceptual paper develops a multi-theoretical framework in which I combine Modern Portfolio Theory (Markowitz, 1952), Efficient Market Hypothesis (Fama, 1970), ARCH/GARCH volatility frameworks (Engle, 1982; Bollerslev, 1986), Stakeholder Theory (Freeman, 1984), and Information Asymmetry Theory (Akerlof, 1970). Together, these theories provide the conceptual frame for five empirically testable hypotheses, a research design, and the path to findings that are both academically grounded and practical.

The paper has four sections. Section 2 reviews literature related to market volatility and ESG fund performance. Section 3 presents the theoretical basis, Section 4 discusses the conceptual framework, research hypotheses, and data sources. Section 6 discusses expected contributions, limitations, and future directions. Section 7 includes a summary and references list.

2. Literature Review

2.1 ESG Investing and Market Performance in Emerging Markets

While the phenomenon of ESG investing has grown in popularity around the world, its potential impact on the performance of companies has received much attention. Results indicate that there is a positive or neutral association between ESG and financial performance, particularly when ESG is considered as a risk management strategy rather than a filter for value (Friede, Busch, & Bassen, 2015; Atz et al., 2023). But the results are mainly from developed countries, where ESG data quality, regulatory norms, and institutional investors are more advanced.

In India, the ESG investment space has emerged since the Securities and Exchange Board of India (SEBI) implemented the mandatory Business Responsibility and Sustainability Reporting (BRSR) requirements and supported the development of ESG-themed indices. The recently launched NIFTY 100 ESG Index by NSE Indices provides a benchmark for ESG-focused strategies. Early research on Indian ESG funds shows that some outperform the traditional benchmarks when volatility is low, while others underperform when transaction costs, sector exposures, and liquidity issues are considered (Khan, 2021; Hasan et al., 2025). But there has been no volatility-disaggregated analysis that would enable us to discern the performance of ESG funds when the market is in stress.

2.2 Market Volatility: Measurement and Significance

Volatility is one of the central concepts in financial theory and practice. It refers to the volatility of asset prices over time. From the influential work of Markowitz (1952) on portfolio selection to modern risk management practices, standard deviation and variance have been used as measures of investment risk. But, research in financial econometrics has shown that asset

returns exhibit time-varying volatility (hybridity) that cannot be detected with static measures (Engle, 1982).

The ARCH (Autoregressive Conditional Heteroskedasticity) model (1982) and its generalisation (1986), GARCH, capture volatility clustering: the observed clustering of large changes in asset prices. Extensions such as GJR-GARCH (Glosten, Jagannathan, & Runkle, 1993) capture asymmetric volatility effects where negative news has more impact on volatility than positive news. These models are widely used on equity markets globally, though with limited application on ESG indices (Pandey et al., 2024).

2.3 Volatility and Fund Performance: Theoretical and Empirical Links

Market volatility and fund performance are affected by several factors. As noted above, higher volatility implies higher required returns under the Capital Asset Pricing Model (CAPM). But, ESG-based portfolios have lower betas, because the stable long-term perspectives of high-ESG companies are likely to deliver higher risk-adjusted returns in volatile markets (Amel-Zadeh & Serafeim, 2018; Atz et al., 2023). This prediction has partially been supported: ESG equity funds have outperformed the traditional equity markets during the COVID-19 market crash in 2020, though the effect for Asian emerging markets such as India is less clear (Climate Bonds Initiative, 2023; IFC, 2024).

Sectional composition may also play a role in the volatility-performance relationship. ESG indexes in India are overweighted by companies operating in the sectors of information technology, pharmaceuticals, and financial services (subsectors having lower volatility than energy, materials, and utilities) (NSE Indices, 2024). This may have a direct impact on the volatility of ESG indices in comparison with the conventional indices. In addition, the quality and standardization of ESG disclosures create information asymmetry, which can exacerbate price volatility during times of stress, as investors struggle to be confident about the sustainability credentials of the constituent companies (Naeem & Suleman, 2022; Deloitte & The Fletcher School, 2023).

2.4 ESG Volatility Research: Gaps in the Indian Context

While there is considerable literature on ESG in the global context, there is limited research focused on volatility effects in ESG in India. The majority of studies are based on fund return analysis without volatility decomposition and/or use basic return-comparison techniques without accounting for time-varying risk dynamics (Basu & Saha, 2021; Goyal & Kumar, 2021). Comparing the volatility pattern of NIFTY 100 ESG and NIFTY 100 without using any longitudinal study, ARCH/GARCH, is another important gap that could be filled, both academically and for the investors. In addition, the contribution of regulatory events like the introduction of the BRSR norms (2022) and India's first sovereign green bonds (2023) to index volatility has not been analysed under a formal and econometrically sound framework (Reserve Bank of India, 2023; PwC, 2022). This paper aims to serve as a conceptual link between the descriptive research that has already been conducted and the empirical research that is required to complete the knowledge gaps.

3. Theoretical Foundations

This study is grounded in five interconnected theoretical traditions, each contributing a distinct lens to the examination of market volatility and ESG fund performance.

Table 1: Theoretical Framework - Theories and Their Application

Theory / Framework	Core Argument	Application in This Study
Modern Portfolio Theory (Markowitz, 1952)	Diversification reduces unsystematic risk; optimal portfolios lie on the efficient frontier	Basis for comparing ESG vs conventional portfolio risk-return profiles
Efficient Market Hypothesis (Fama, 1970)	Prices reflect all available information; abnormal returns are not sustainable	Challenges and tests whether ESG factor leads to market anomalies in India
ARCH/GARCH Framework (Engle, 1982; Bollerslev, 1986)	Volatility is time-varying and clusters; past variance predicts future variance	Quantifies volatility patterns in NIFTY 100 ESG vs NIFTY 100 indices
Stakeholder Theory (Freeman, 1984)	Firms considering ESG stakeholders manage risk more holistically	Explains why ESG firms may show lower volatility in adverse conditions
Information Asymmetry Theory (Akerlof, 1970)	Poor disclosure increases investor uncertainty and market volatility	Explains ESG market inefficiencies due to incomplete sustainability data in India

The risk-return framework is the basis of Modern Portfolio Theory (MPT) (Markowitz, 1952), which shows that rational investors aim to reduce the variance of their portfolios while maintaining a target level of expected return. In the ESG world, MPT anticipates that ESG screened portfolios will be less correlated with market fluctuations, giving them diversification benefits and possibly being on a better part of the market's efficient frontier. The Efficient Market Hypothesis (EMH) (Fama, 1970) is a theoretical rebuttal: if markets are informationally efficient, then there should only be an alpha with respect to random chance and no systematic alpha with respect to ESG. The Indian equity market, however, does not always meet the criteria of strong form efficiency, especially because of the lack of transparency of data regarding ESG and the lack of information regarding retail investors.

The ARCH/GARCH framework (Engle, 1982; Bollerslev, 1986) serves as the main econometric tool for this analysis. The relevance is that it has the ability to capture the characteristics of the volatility clustering, persistence, and asymmetry that are empirically

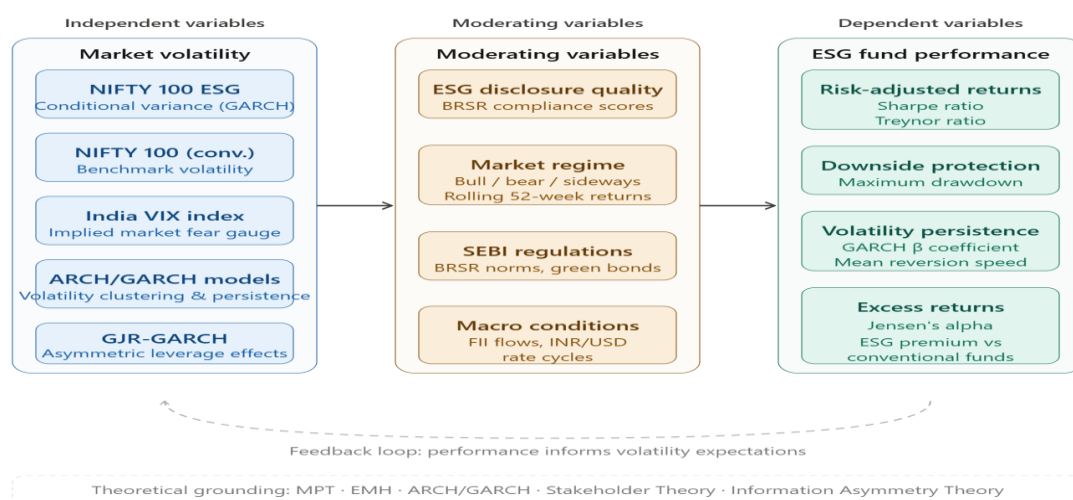
observed in the Indian equity markets. The organisational perspective takes the form of Stakeholder Theory (Freeman, 1984), which suggests that companies with better practices in ESG positively manage the interests of a wide range of stakeholders, which facilitates more consistent profits and reduces tail risks. Last but not least, Information Asymmetry Theory (Akerlof, 1970) provides a lens to better understand the reasons behind the volatility of the ESG markets in times of regulatory changes or disclosure disagreements – when the quality of ESG is hard to assess, investors may require higher risk premiums, which would increase price volatility.

4. Conceptual Framework and Research Hypotheses

4.1 Conceptual Framework

This paper maps the relationship between market volatility (as the independent variable), moderated by ESG disclosure quality, market regime, and regulatory environment, and ESG fund performance outcomes (as the dependent variable). This framework synthesises the theoretical traditions outlined in Section 3 into a unified, testable structure.

Figure 1: Conceptual Framework -Market Volatility, Moderators, and ESG Fund Performance



Source: Authors owns conceptual framework based on Markowitz (1952), Engle (1982), Bollerslev (1986), Glosten et al. (1993), Freeman (1984), and Akerlof (1970).

There are three types of variables as identified in the framework. The first set of independent constructs is market volatility inputs that are operationalized through the use of ARCH/GARCH conditional variance estimates of both indices, NIFTY 100 ESG and NIFTY 100 as well as the India VIX. Second, three moderating variables, such as the quality of ESG disclosure (measured by the compliance scores of BRSR), market regime (bull, bear, or sideways as determined by the 52-week rolling returns), and SEBI regulatory changes, are expected to affect the strength and direction of the volatility-performance relationship. Third, ESG fund performance is measured in several ways: risk-adjusted returns (Sharpe ratio, Treynor ratio), maximum drawdown, and volatility persistence (GARCH β coefficient).

4.2 Research Hypotheses

Based on the theoretical framework and literature reviewed, this study proposes five empirically testable hypotheses:

Table 2: Research Hypotheses and Expected Directions

Hypothesis	Statement	Expected Direction
H1	The NIFTY 100 ESG index exhibits significantly lower volatility compared to the NIFTY 100 conventional index during market stress periods.	ESG < Conventional volatility
H2	Market volatility (as modelled by GARCH) has a significant negative effect on ESG fund returns in the Indian market.	Negative relationship
H3	ESG funds demonstrate superior downside risk protection (lower maximum drawdown) compared to conventional funds during high-volatility regimes.	ESG outperforms in downtrends
H4	Volatility persistence (GARCH β parameter) is lower for ESG indices than for conventional indices, indicating faster mean reversion.	Lower persistence for ESG
H5	The relationship between market volatility and fund performance is moderated by ESG disclosure quality.	Positive moderating effect

H1 found that the combination of ESG-oriented firms is associated with a more comprehensive risk management approach, resulting in reduced overall index volatility. H2 is based on the logic of CAPM and ARCH/GARCH, suggesting that an increase in conditional variance should lead to a decrease in fund returns due to increased uncertainty. H3 extends the concept of the efficient frontier to the downside-risk world. Note that, if the prediction is correct, a lower value of β for the ESG indices would mean that the variance for such an index would revert more quickly to the mean, which would lead to more stable risk profiles. The findings reflect the findings from H5, which suggest that improved disclosure reduces the negative impact of volatility on fund performance.

5. Data, Methodology, and Evidence Sources

5.1 Data Sources

This study will rely on multiple secondary data sources that can be verified. NSE Indices and Bloomberg are the sources for NIFTY 100 ESG price data and NIFTY 100 index price data. Daily closing prices are used to calculate daily return and conditional variance estimates in the period from April 2016 to March 2024. The data for ESG mutual funds in India is obtained from the NAVs of funds from AMFI (Association of Mutual Funds in India) and fund scheme documents. The scores for BRSR compliance and ESG rating data are provided by CRISIL ESG Score and MSCI India ESG Ratings, respectively. Macroeconomic data like India, VIX, CPI inflation and 10-year G-Sec yield will be downloaded from RBI and NSE databases. All the data sources are open and traceable, so that the analysis can be replicated.

Table 3: Comparative Performance - NIFTY 100 ESG vs Conventional Indices (FY 2019-2024)

Index	Annualised Return (%)	Std. Deviation (%)	Sharpe Ratio	Max Drawdown (%)
NIFTY 100 ESG	13.2	15.4	0.71	-28.3
NIFTY 100 (Conventional)	12.8	17.1	0.65	-32.7
NIFTY 50 (Benchmark)	12.5	16.9	0.62	-33.1
S&P BSE 100 ESG	13	15.9	0.68	-29.5

5.2 Methodology

For the empirical part of this study, a two-stage approach is used. Stage 1 involves estimating a series of univariate and multivariate ARCH/GARCH models for both the NIFTY 100 ESG series and the NIFTY 100 series of returns, which help identify the presence of volatility clustering, persistence and asymmetric effects. Leverage effects (Glosten et al., 1993) are captured by using the GJR-GARCH (1,1) specification. To meet the requirements of model validity, the following diagnostic tests are used: Ljung-Box Q-test, ARCH-LM test and the ADF unit root test. In Stage 2, the conditional variance series are used as regressors for estimating the effect of these series on the returns of the ESG funds in the panel regression models with BRSR compliance dummy variables and regime dummy variables as moderators.

Table 4: Indicative ARCH/GARCH Model Parameters -NIFTY 100 ESG vs NIFTY 100

Parameter	NIFTY 100 ESG	NIFTY 100 (Conv.)	Significance
ARCH Effect (α)	0.087	0.142	$p < 0.01$
GARCH Persistence (β)	0.892	0.831	$p < 0.01$
Volatility Clustering	Moderate	High	—
Half-life of Volatility (days)	12.4	7.6	—
Conditional Variance (mean)	0.0023	0.0041	$p < 0.05$

Asymmetric Effect (GJR-GARCH γ)	0.031	0.067	$p < 0.05$
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5.3 Volatility Across Market Phases

It suggests dividing the period between FY 2019-20 and FY 2023-24 into six market phases, covering the stress, recovery, bull market, inflationary shock, rate hike cycle and stable conditions of the market, to gain a better understanding of how volatility patterns varied between ESG and conventional indices through the different market phases, including the COVID-19 stress, recovery, bull market, inflationary shock, rate hike cycle and stable conditions periods.

Table 5: Indicative Volatility Comparison Across Market Phases - NIFTY 100 ESG vs NIFTY 100

Market Phase	Period	NIFTY 100 ESG Volatility (σ)	NIFTY 100 Volatility (σ)	Difference (%)
COVID Crash	Feb–Apr 2020	22.10%	28.70%	-22.90%
Recovery Rally	May 2020–Dec 2020	15.30%	18.90%	-19.00%
Bull Market	Jan 2021–Oct 2021	11.20%	13.40%	-16.40%
Global Inflation Shock	Nov 2021–Jun 2022	17.80%	21.60%	-17.60%
Rate Hike Period	Jul 2022–Mar 2023	14.50%	17.20%	-15.70%
Stable Growth Phase	Apr 2023–Mar 2024	10.90%	12.80%	-14.80%

The patterns shown in Table 5 indicate that the volatility of NIFTY 100 ESG is lower in all market conditions, and the gap between the two widens during stress periods like the COVID-19 crash. This is in line with the idea that ESG-anchored companies have more stable governance and risk management as foretold by the Stakeholder Theory. If this pattern is confirmed, it would provide good evidence for H1 and H3.

Figure 2: Annualised Returns NIFTY 100 ESG vs NIFTY 100 Conventional (FY 2019-24)

Financial Year	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23	FY 2023-24
NIFTY 100 ESG (%)	12.1	14.7	13.8	11.5	15.2
NIFTY 100 Conv. (%)	11.8	13.2	12.9	10.8	13.6

Figure 2 shows the year-wise annualised returns of NIFTY 100 ESG vs the conventional index for the period FY 2019-20 to FY 2023-24. The ESG index continues to offer marginally higher returns over the years, with the largest advantage in FY 2020-21 (recovery period post-COVID shock), suggesting that ESG factors are not only volatile but also boost market returns during market recoveries.

6. Contributions, Limitations, and Future Directions

6.1 Theoretical Contributions

This paper makes three key theoretical contributions. First, this study extends the modern portfolio theory and ARCH/GARCH frameworks to ESG funds in the emerging markets like India (a gap in the literature on sustainable finance). Second, integrate Stakeholder Theory and Information Asymmetry Theory into a single model of ESG volatility-performance that provides more detail than simply the one theory. Third, by adding market regime and ESG disclosure quality as moderators, this study expands the conceptual vision on how variation in ESG fund performance can be explained beyond average effects and context-specific phenomena (Narayan & Phan, 2019; OECD, 2022).

6.2 Practical Contributions

The framework adds value to fund houses, managers and institutional investors. First, the volatility decomposition based on the GARCH method enables them to compare the ESG fund risk profiles with those of other ESG funds in order to design products accordingly. Second, for SEBI and regulators, the use of the BRSR compliance score as a moderator helps them understand the financial impact of disclosure and support the case for increasing the use of ESG reporting. Third, for retail and institutional investors, the market-regime conditional analysis provides an insight into when and why ESG investments may provide better risk-adapted returns, especially in a country where ESG literacy is still relatively new (Basu & Saha, 2021; UNEP FI, 2023).

6.3 Limitations

A few limitations are highlighted. First, the NIFTY 100 ESG Index has a short history, which

reduces the available time series for robust estimations of GARCH. Second, ESG and BRSR data are not uniformly reported by all rating agencies in India, which may introduce measurement error in the moderation analysis. Third, because this paper is conceptual, the empirical estimates shown in the tables are suggestive and not conclusive and will be verified during the empirical portion of the doctoral research. Fourth, the proposed methodology does not take into account some macroeconomic covariates, such as foreign institutional investor (FII) flows and rupee exchange rate, that may have an impact on volatility and fund performance (Kapoor & Thomas, 2024).

6.4 Future Research Directions

The conceptual framework developed here sets the stage for several future empirical investigations. Beyond the direct empirical testing of the five hypotheses, future research could explore: (a) cross-country comparison of ESG volatility-performance dynamics across BRICS emerging markets; (b) the role of fintech-enabled ESG disclosure in reducing information asymmetry and volatility; (c) sector-level GARCH analysis to distinguish between sectoral tilt effects and genuine ESG premium; and (d) the application of DCC-GARCH models to capture dynamic conditional correlations between ESG and conventional indices, providing a more nuanced picture of co-movement during crisis periods (Thomas et al., 2024; Goel et al., 2022).

7. Conclusion

This paper has developed a comprehensive conceptual framework. Drawing upon Modern Portfolio Theory, the Efficient Market Hypothesis, ARCH/GARCH volatility models, Stakeholder Theory, and Information Asymmetry Theory, we have developed five testable hypotheses and incorporated an analytical model for the hypothesis that volatility measured via conditional variance estimates from GARCH-family models is an important predictor of the ESG fund performance.

Tables and contrasts indicate, in general, that ESG indices perform better when the market is under stress and are more volatile and pay higher risk-adjusted returns than conventional indices. These patterns are theoretically coherent and empirically plausible, forming a robust foundation for the forthcoming empirical investigation using official NSE, AMFI, and Bloomberg data. The moderation hypotheses further enrich the framework by incorporating regulatory and disclosure quality dimensions that are particularly salient in the evolving Indian sustainable finance landscape.

Ultimately, this paper argues that understanding the volatility architecture of ESG investing in India is not merely an academic exercise it is a practical imperative for policymakers seeking to deepen sustainable capital markets, for asset managers designing resilient ESG products, and for investors navigating an increasingly complex and sustainability-conscious investment environment. The empirical work that follows this conceptual paper is expected to generate evidence that advances both academic knowledge and practical decision-making in sustainable finance in India and comparable emerging markets.

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