Minnesota Journal of Business Law and Entrepreneurship

Volume 2026, No. 2

ISSN: 1540-3270

Risk Characteristics and Long-Run Cointegration of ESG Mutual Funds: Evidence from ABSLAMC and BSE 100 ESG

[1]Ms. Isha, [2]Dr. Ayushi Behl

[1]Research Scholar

Sant Baba Bhag Singh University
E Mail id- isha.aggarwal22@gmail.com

[2]Department of Commerce

Sant Baba Bhag Singh University

E Mail id- sethiayushi56@gmail.com

Abstract

The Aditya Birla Sun Life ESG Integration Strategy Fund, launched in December 2020, achieved over ₹622 Cr in assets under management (AUM) by January 2026. The study investigates the fund's use of ESG factors for risk-adjusted returns, its consistent AUM growth, and investor confidence in sustainable investing. It analyzes AUM evolution through monthly data and employs modeling techniques like ARCH/GARCH to assess volatility, revealing time-varying heteroskedasticity. Furthermore, tests for long-term equilibria with the BSE 100 ESG benchmark and the application of GARCH-enhanced models indicate superior performance of the ESG fund when adjusted for volatility, highlighting its significance for sustainable portfolio development.

Keywords: AUM, volatility metrics, BSE 100 ESG benchmark, mutual fund performance.

JEL Classification: G4, G11, G51

1. Introduction

Human beings universally seek a pleasant life marked by financial stability, worry-free existence, and protection from burdens during recessions or joblessness (Brüggen et al., 2017), a goal reinforced by life's uncertainties and rising expenses that necessitate proactive savings to preserve autonomy and security (Zaleskiewicz, 2013; Garbinsky, 2014; Sood, 2015).Savings and investments transform this aspiration into reality by building a financially secure future (Atkinson et al., 2015), offering practical pathways to achieve independence amid economic volatility. Sustainable investing garners growing enthusiasm from investors (Busch et al., 2016), yet theoretically it remains underdeveloped, lacking a dedicated theoretical framework (Shah & Clark, 2018).Sustainable investing involves selecting various asset classes that prioritize environmental, social, and governance (ESG) considerations, blending social/environmental impact with financial gains to address investors' ethical, ecological, social, and economic values (Brzeszczynski & McIntosh, 2014). The transformation began in the early 2020s as global sustainability trends influenced India, prompting SEBI to establish comprehensive ESG disclosure frameworks like BRSR Core (SEBI, 2025). Asset management companies such as Axis, Mirae Asset, ICICI Prudential, Quant, and SBI have launched innovative ESG products benchmarked against specialized indices like BSE 100 ESG and NIFTY100 ESG (Equentis, 2024). SEBI's new ideas in 2023, which included exclusionary, integrative, and thematic strategies, sparked growth and made India an up-and-coming ESG hub (SEBI, 2023; Wert, 2025).

In March 2022, the Herfindahl-Hirschman Index (HHI) dropped sharply from 10,000 to 2,328, indicating that ESG mutual funds in India had expanded and evolved considerably since their introduction in 2018. Eight open-ended equity plans have taken the role of the monopolistic market structure by that point (Manda & Polisetty,

2021). This young but fast-growing segment is in line with benchmarks like the S&P BSE 100 ESG and Nifty100 ESG indices because of consistent assets under management (AUM) growth, like the SBI Magnum Equity ESG Fund's 13.6% annual rate, and outperformance signals in risk-adjusted returns for specific funds, like Quantum India ESG Equity (Singh et al., 2023; Sulthana Banu et al., 2021).But instead of directly comparing to BSE ESG indices, most studies look at comparisons between the whole world or between Sharia and conventional methods, which shows that NAV, AUM, and ratio-based assessments have some problems with their methods. The literature contains few studies specifically focused on India (Manda & Polisetty, 2021).This shows how important it is for the current study to fill in these gaps by doing detailed BSE ESG benchmarking and comparisons. Indian ESG mutual funds have done well when compared to benchmarks like the Nifty 100 ESG Index, even when taking risk into account. Research has shown that there is a strong link between sector allocations (energy, IT, and financial services) and a steady rise in AUM, especially for funds like SBI Magnum Equity ESG (Sulthana Banu et al., 2021).However, empirical data is still dispersed, with little direct comparison to the BSE 100 ESG Index and little use of sophisticated volatility models (like GARCH) in Indian contexts; instead, traditional fund benchmarks or international proxies are frequently used (Manda & Polisetty, 2021; Singh et al., 2023). It is considerably more difficult to determine the advantages of diversification, how to guard against losses during crises, and how competition functions using metrics like NAV, AUM, and expense ratios because descriptive assessments are more prevalent than rigorous econometric evaluations. Thus, by delivering a methodical analysis with benchmarking to the BSE ESG Index, this report closes these gaps and provides fresh perspectives on the resilience and maturity of India's ESG fund ecosystem.

Aditya Birla Sun Life AMC (ABSLAMC) is the largest non-bank-affiliated Indian Asset Management Company (AMC) since March 31, 2018. It uses a large independent distribution network to grow sales instead of relying on branches of a parent bank (ABSLAMC, 2023; Value Research, 2024). This makes it an interesting area of study.This study analyzes ABSLAMC's AUM trends in the context of macroeconomic fluctuations, including interest rate changes following the Federal Reserve's actions in 2025. Aditya Birla Sun Life Asset Management Company is making a big step forward in sustainable investing with the Aditya Birla Sun Life ESG Integration Strategy Fund. The fund started in December 2020 and focuses on investing in stocks of companies that meet strict environmental, social, and governance (ESG) standards. Its growth, measured by monthly assets under management (AUM), shows that more investors are interested in thematic ESG strategies as global trends toward sustainability continue.This empirical article addresses the following research questions: How can time-series graphs be used to show and statistically model ABSLAMC's monthly AUM growth in order to find hidden growth patterns? What is the standard deviation of the growth rate, and does the Jarque-Bera test show that these distributions are normal? This is important for checking the assumptions made in financial modeling. Using trace and max-eigenvalue statistics, does Johansen's cointegration framework show that there are long-term equilibrium relationships between ABSLAMC returns and BSE 100 ESG index levels? Finally, what does using ARCH/GARCH models on the returns of ABSLAMC and BSE 100 ESG mean for risk management and portfolio allocation, especially when it comes to capturing volatility clustering and coming up with the best strategies for changing market conditions?

The structure of the paper is as follows. The study is introduced in the current section, followed by a review of the literature in the second section, an account of the study's methodology in section three, an explanation of the results in section four, and a conclusion in the final section.

2. Review of Literature

At first, ESG investing in India was met with cautious optimism because early research showed that thematic funds were starting to grow as more investors became interested in sustainability. Researchers like Sarkar looked at the risk-adjusted returns of ESG mutual funds compared to traditional benchmarks like the Nifty 50 by 2022. They found that ESG funds performed well on metrics like Sharpe ratios and Jensen's Alpha, but raw returns sometimes fell short. This made it possible to look more closely at certain funds. In the early 2010s, ESG mutual funds started to go from niche sustainable investments to powerful investment vehicles. This was because

investors were looking for ways to combine ethical goals with strong financial results. This led to the incredible rise of the Aditya Birla Sun Life ESG Integration Strategy Fund, which went from its launch in December 2020 to over ₹622 Cr in AUM by January 2026 (Aditya Birla Sun Life Capital, 2025). As AUM rose quickly—from ₹2,747 crore in 2020 to over ₹10,000 crore by 2025—scholars looked at growth trajectories and saw steep curves caused by regulatory pushes and investor trust. Priya and Sharma (2024) wrote about how Indian ESG funds have grown faster than their global counterparts in terms of assets under management (AUM) since 2019. They said this was because of ethical branding and being responsive to the market. For example, the Aditya Birla Sun Life ESG Integration Strategy Fund reached ₹622 Cr by January 2026. However, Gupta (2022) warned that AUM growth didn't always mean better NAV growth or stability, which is similar to what was seen in short-term quarterly analyses.This growth pattern is similar to a larger trend in India, where Axis, Quant, and ICICI schemes have seen monthly AUM increases of up to ₹12,447 Cr by 2022. This shows that investors are becoming more confident as the post-COVID sustainability craze grows. This is similar to global projections from PwC (2022), which predict an 84% increase to $33.9 trillion by 2026, and Bloomberg (2024), which is looking at $40 trillion by 2030. Building on this momentum, empirical studies have shown how these funds provide better risk-adjusted returns, going from mere promise to proven edge. For example, Indian studies of seven ESG schemes from 2020 to 2023 found that four outperformed benchmarks with higher Sharpe ratios, and Quant ESG Equity stood out in SIP returns and alpha generation through smart stock picks (Journal of Applied Accounting, 2025; IJIRT, n.d.).

This performance edge naturally leads to volatility dynamics, where ARCH/GARCH models show the time-varying heteroskedasticity and clustering hallmarks of ESG returns. These patterns are very clear in the evolution of the Aditya Birla fund and are also seen in Asian-Pacific mutual funds, where EGARCH variants are best at predicting downside risk in volatile emerging markets (ScienceDirect, 2024). These ideas fit perfectly with cointegration frameworks like Johansen tests, which find stable long-term equilibria between ESG portfolios and benchmarks like the BSE 100 ESG. They also show how quickly portfolios adjust using GARCH-enhanced error correction models that prove portfolio stability even as Indian ESG-conventional pairs adjust through differenced series (BSE Indices, n.d.; JETIR, n.d.; Scielo, 2025). The Jarque-Bera tests support this narrative by rejecting normality in growth curves, emphasizing acceleration phases in AUM trajectories that demonstrate investor conviction (IJCRT, n.d.b.).

Cointegration tests connected these findings to benchmarks such as the BSE 100 ESG. Kar and Patro (2022) used Johansen methods on the Nifty ESG 100 to find one-way causalities with sectoral indices. Jayadev and Anupama (2024) looked at funds like Axis ESG and found that they were positively correlated with Nifty 100 ESG but had different levels of sensitivity. This supports stable equilibria in GARCH-enhanced error correction models. Together, these threads told a story about ESG funds like Aditya Birla's that delivered outperformance adjusted for volatility, which showed how valuable they were to investors.Literature grew by comparing ESG to traditional funds to show how they differ in terms of performance.

Performance evaluation progressed to volatility modeling, uncovering time-varying heteroskedasticity integral to the Aditya Birla fund's narrative. Makkar et al. (2023) used EGARCH models on Nifty 100 Enhanced ESG to find clustering and resilience during crises like COVID-19. Meanwhile, researchers in India used broader GARCH models to confirm that ESG returns are sensitive to market shocks. Sundar and Manjunath (2025) augmented this analysis with ADF tests and VAR on MIRAE ESG compared to Nifty 50, emphasizing short-term dynamics absent long-term cointegration.Research employs multifactor models to assert that ESG excels in risk-adjusted domains due to its meticulous stock selection in perpetually evolving markets (SSRN, 2023; Gupta, 2022). This story arc shows that ESG is a strong wall that protects against bad times thanks to its built-in quality filters (Management Paper, 2025).The story gets more interesting when we look at volatility, which is where ARCH-GARCH models show how ESG behaves in complex ways. Researchers depict clustering phenomena, where shocks propagate uniquely in sustainable assets, underscoring GARCH's prowess in forecasting amid ESG-specific turbulence (Mishra, 2024; Shaik, 2022). Dynamic connectedness analyses using DCC-GARCH show that ESG indices are channels for volatility but also strong transmitters in ecosystems that are linked together (Gupta et al., 2025).

In the context of India, this narrative focuses on benchmark-aligned outperformance. Quantum and Axis ESG funds show volatility-adjusted superiority over BSE 100 ESG, but they also have to deal with problems like greenwashing while getting the benefits of diversification (Indian Journal of Finance, 2023; IJCRT, 2025b; NIRDPR, n.d.; RGCMS, 2025). The story goes on to European stocks, where high ESG scores lower tail risks and raise Sharpe ratios, themes like clean energy make stocks more resilient, and Chinese funds get 0.44% alpha from ESG style drift—43 ESG versus 42 conventional funds (2018-2023) that match long-term returns despite value-aligned risks (Aalto University, 2025; AInvest, 2025; EDHEC Climate Institute, 2022; Gupta, 2023; ScienceDirect, 2025a). At the end of this arc, volatility spillovers and connectedness analyses show that ESG can adapt to a world that is not always stable (Frontiers, 2025; IJRPR, n.d.; Lund University, n.d.; ScienceDirect, n.d.a; ScienceDirect, n.d.b).

This ongoing story, which includes regulatory sparks and econometric validations, shows how important ESG funds are to India's economy. Studies suggest their theoretical superiority in risk-aware frameworks, necessitating additional inquiries into nascent disclosures and global ramifications (Gupta et al., 2025; Wert, 2025).

3. Research Methodology

This study utilizes a stringent quantitative methodology to assess the performance of the Aditya Birla Sun Life ESG Integration Strategy Fund, emphasizing its historical development, growth trajectory, risk attributes, and long-term equilibrium relationship with the BSE 100 ESG Index. The analysis is organized in the following way.

3.1 Data sources and sample period

We put together monthly assets under management (AUM) for Aditya Birla Sun Life AMC Limited (ABSLAMC) from January 2020 to December 2025. The numbers are in ₹ crores. The following sources provided these data:

- Reports from the Association of Mutual Funds in India (AMFI)
- Factsheets of AMC

The Fund's Net Asset Value (NAV) time series is made up of historical NAV values from amfiindia.com, starting with its launch in December 2020. The BSE 100 ESG Index's daily closing values are combined into daily observations.The resulting panel is organized by date and used for all modeling and diagnostics that come after it.

3.2 Visualization of growth dynamics

Line graphs are made by plotting monthly AUM against time to look at the Fund's growth pattern and important turning points. The picture shows times when the market was going up or down quickly, which happened at the same time as more people started to invest in ESG-oriented funds. This graphical analysis helps us find changes in the way investors move their money and how funds respond to big-picture and thematic changes.

3.3 Return and risk measurement

3.3.1 Absolute return

The daily absolute return of the Fund is computed as:

$$\text{Absolute Return}_t = \frac{\text{NAV}_t - \text{NAV}_{t-1}}{\text{NAV}_{t-1}} \times 100$$

where NAV_t is the net asset value at time t and NAV_{t-1} is the preceding day's NAV.

3.3.2 Rolling standard deviation

Risk is quantified by the **volatility** of daily returns, measured via the **rolling standard deviation** over a chosen window of k periods. The rolling standard deviation at time t is given by:

$$\sigma_t^{(k)}=\sqrt{\frac{1}{k-1}\sum_{i=t-k+1}^{t}(r_i-\bar{r}_{t,k})^2}$$

where r_i is the daily return at time i, and $\bar{r}_{t,k}$ is the mean return over the window $[t-k+1,t]$. This approach captures time-varying volatility and helps identify periods of heightened or subdued risk.

3.3.3 Stationarity and long-run equilibrium relationships

3.3.3.1Augmented Dickey–Fuller (ADF) test

Prior to estimating any long-run relationship, the **stationarity** of the underlying series—namely, the Fund's NAV and the BSE 100 ESG Index—is tested using the **Augmented Dickey–Fuller (ADF)** test. The ADF regression is specified as:

$$\Delta y_t=\alpha+\beta t+\gamma y_{t-1}+\sum_{i=1}^{p}\delta_i\Delta y_{t-i}+\varepsilon_t$$

where y_t is the level of the series, $\Delta y_t=y_t-y_{t-1}$, t is a time trend (if included), and ε_t is the error term. The null hypothesis $H_0:\gamma=0$ (non-stationarity) is tested against the alternative $H_1:\gamma<0$ (stationarity). The test is conducted at the **5% significance level**.

3.3.3.2 Johansen cointegration and VECM framework

To examine long-run equilibrium relationships between the Fund's NAV and the BSE 100 ESG Index, a **vector autoregression (VAR)** model is first specified at an appropriate lag order p. The system is then transformed into a **Vector Error Correction Model (VECM)** as:

$$\Delta\mathbf{Y}_t=\alpha\beta'\mathbf{Y}_{t-1}+\sum_{i=1}^{p-1}\mathbf{\Gamma}_i\Delta\mathbf{Y}_{t-i}+\mu+\varepsilon_t$$

Here, $\mathbf{Y}_t$ is a vector containing the Fund's NAV and the BSE 100 ESG Index, α is the adjustment-speed matrix, β is the cointegrating matrix, and $\Delta\mathbf{Y}_t$ denotes first differences. The **Johansen cointegration test** is used to determine the number of cointegrating vectors by testing the rank of the matrix $\mathbf{\Pi}=\alpha\beta'$. The **trace statistic** and **maximum eigenvalue statistic** are evaluated against standard critical values at conventional significance thresholds (5%). The presence of **multiple cointegrating vectors** indicates several stable long-run equilibrium relationships between the Fund and its benchmark.

3.3.4 Volatility clustering and GARCH(1,1) modelling

To capture **volatility clustering** and **conditional heteroskedasticity** in the Fund's returns, the **GARCH(1,1)** model is estimated. Let r_t denote the daily return at time t. The mean-equation specification is taken as:

$$r_t=\mu_t+\varepsilon_t$$

where μ_t is the conditional mean (often assumed constant or modelled via an ARMA structure) and ε_t is the innovation term. The **GARCH(1,1)** variance equation is specified as:

$$\sigma_t^2=\omega+\alpha\varepsilon_{t-1}^2+\beta\sigma_{t-1}^2$$

where σ_t^2 is the conditional variance at time t, $\omega\geq0$, $\alpha\geq0$, $\beta\geq0$, and $\alpha+\beta<1$ to ensure stationarity of the variance process. The parameters ω, α, and β are estimated via **maximum likelihood estimation (MLE)**, typically assuming Gaussian or Student-t innovations. This specification allows the model to place higher weight on recent shocks and past volatility, thereby capturing the persistence in volatility commonly observed in financial time series.

3.3.5 Integrated analytical framework

The methodological framework integrates the above elements:

- **Growth visualization** via AUM trajectories,
- **risk quantification** via rolling standard deviation of point-to-point returns,
- **equilibrium dynamics** via **Johansen cointegration** and **VECM**, and
- **volatility clustering** via **GARCH(1,1)** modelling.

By combining these tools, the study provides a comprehensive assessment of the Fund's **stability**, **co-movement with the BSE 100 ESG Index**, and **benchmarking efficacy**, yielding insights that are both statistically robust and practically interpretable for ESG-themed mutual fund investors.

4. Growth of Aditya Birla Sun Life AMC Limited (ABSLAMC)

Aditya Birla Sun Life AMC Limited (ABSLAMC) is a well-known asset management company in India that was founded in 1994. It has become well-known in the country's financial services industry because it offers a wide range of investment options. Sun Life Financial Inc., a global financial services company based in Canada, and Aditya Birla Capital Limited, a well-known Indian financial services company, are both partners in the business (Aditya Birla Sun Life AMC, 2023). This strategic partnership gives ABSLAMC strong financial support and international investment knowledge, which lets it offer Indian investors competitive investment products.

ABSLAMC is the investment manager for the Aditya Birla Sun Life Mutual Fund. They are in charge of a wide range of schemes, such as debt, hybrid, and equity funds. The mutual fund is set up as a trust under the Indian Trusts Act of 1882 and promises to follow the rules set by the Securities and Exchange Board of India (SEBI, 2020). The company's investment strategies focus on maximizing risk-adjusted returns in order to meet the different financial goals of institutional and retail investors. Its products are designed to meet a range of risk levels and long-term goals for building wealth (Aditya Birla Sun Life Mutual Fund, 2023).

ABSLAMC now offers more than just traditional mutual funds as part of its investment management services. It also offers more complex alternative investment options. The company now offers Alternative Investment Funds (AIFs), real estate investments, and Portfolio Management Services (PMS) to meet the needs of high-net-worth individuals (HNIs), institutional investors, and family offices (Aditya Birla Sun Life AMC, 2023). ABSLAMC's strategic emphasis on diversification and its capacity to adjust to changing market demands while upholding its core competency in asset management are demonstrated by these services.

The goal of ABSLAMC's portfolio management services is to give each client personalized investment options that fit their specific financial goals and risk tolerance. These services use the knowledge of experienced investment professionals who build portfolios in a methodical way and follow strict analytical frameworks (SEBI, 2020). ABSLAMC has made structured investment vehicles in the real estate investment sector to take advantage of the growing Indian real estate market. The company uses a balanced approach to real estate projects, combining debt instruments and equity participation to get the best risk-adjusted returns while also making steady rental income streams (Aditya Birla Capital, 2022).

Also, ABSLAMC's Alternative Investment Funds, which give you access to non-traditional asset classes like structured credit products, venture capital, and private equity, show how creative it is when it comes to making money. These AIFs are great for smart investors who want more growth potential, even though they are riskier (SEBI, 2012). The company follows strict governance rules and makes sure that all of its alternative investment platforms are open about how they run their businesses. This is to make sure that they follow the law and follow international best practices in investment management (Aditya Birla Sun Life Mutual Fund, 2023). ABSLAMC is a full-service asset management company that can meet a wide range of investor needs across the risk-return spectrum because it offers a wide range of investment solutions.

Aditya Birla Sun Life AMC Limited (ABSLAMC) has grown its network of operations to more than 300 places across India, thanks to its wide range of investments (Aditya Birla Sun Life AMC, 2023). The company has a presence all over India, thanks to a mix of digital and physical distribution channels. This lets it serve a wide range of investors, from major cities to up-and-coming tier-2 and tier-3 cities. The integrated strategy shows ABSLAMC's commitment to accessibility and putting customers first by making it easier to get new clients, manage portfolios, and serve investors (SEBI, 2021).

One thing that sets ABSLAMC's market strategy apart is its focus on teaching investors about money and finances. The company holds workshops, online seminars, and awareness campaigns on a regular basis to help retail investors become more financially literate (Reserve Bank of India [RBI], 2022). These programs help investors make smart decisions about mutual funds, PMS, and AIFs, which are the same products that were talked about in earlier sections. They also help the country reach its financial inclusion goals (Aditya Birla Capital, 2023).

ABSLAMC has grown its global reach by offering offshore fund management services. This has also given Indian investors access to international markets. These products are meant to lower the risks of investing across borders while taking advantage of chances abroad. They were created in collaboration with global financial institutions (International Monetary Fund [IMF], 2021). By improving the domestic alternative investment strategies we talked about earlier, this kind of international diversification gives clients access to a full investment ecosystem.

Governance is still very important to ABSLAMC's business. A board of finance and governance experts makes sure that SEBI rules and best practices from around the world are followed (Aditya Birla Sun Life AMC, 2023). The board oversees all business areas, from mutual funds to AIFs. This supports the integrated governance framework that this analysis has focused on (OECD, 2020).

Aditya Birla Sun Life AMC Limited (ABSLAMC) has strategically added new technologies to its operations to make them better. This builds on the strong governance framework and diverse investment strategies that were talked about before. The organization uses advanced data analytics, artificial intelligence (AI), and machine learning (ML) algorithms to improve portfolio management, risk assessment, and customer engagement (World Economic Forum, 2022). These technological changes make it possible to better predict how well assets will perform and how to allocate them. This is especially important for managing the complex alternative investment funds (AIFs) and portfolio management services (PMS) that were studied before (Deloitte, 2023).

Since it was founded in 1994, ABSLAMC has been a leader in India's asset management industry and has grown steadily. The company is important for turning domestic savings into profitable businesses because it has more than 10.5 million investors and manages more than ₹4 trillion in assets (Aditya Birla Sun Life AMC, 2023). This performance not only greatly helped India's capital market grow, but it also showed that the multi-channel distribution network and investor education programs discussed in the sections above were carried out well (Reserve Bank of India, 2023).

The company's operational philosophy is based on three main ideas: (1) using new technology in investment processes; (2) offering a wide range of products that include both traditional and alternative investments; and (3) having strict rules for governance. This three-pronged strategy builds on everything that has already been said about operations and makes ABSLAMC a revolutionary force in India's financial services industry (SEBI, 2023). By staying focused on this strategy, the company maintains the highest ethical standards in asset management while still giving stakeholders long-lasting value.

As on march 31st,2025 the mutual funds offered by Aditya Birla Sunlife AMC Limited includes the following categories.

Table I: Total Funds As On March 31,2025 As Per Factsheet

EQUITY	**29**
DEBT	17
HYBRID	5

INDEX FUNDS	25
FUND OF FUND	13
ETFs	14
TOTAL	**103**

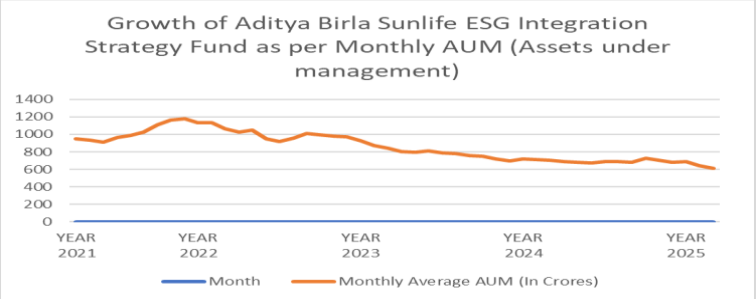
SOURCE: FACTSHEET MARCH31,2025

The Aditya Birla Sun Life ESG Integration Strategy Fund is one of 29 equity funds. It is a specialized open-ended equity scheme that invests in companies that follow Environmental, Social, and Governance (ESG) principles. This way of investing is based on an integration strategy, which means that ESG factors are built into the basic decision-making process for investments instead of being used as filters or exclusions. The main goal of this fund is to make money over the long term by investing in a variety of companies that show responsible business practices and sustainability in all areas of environmental, social, and governance.

The NFO for this fund opened on December 4, 2020, and closed on December 18, 2020. The allotment date was December 24, 2020.At the time of allotment, Mr. Satyabrata Mohanty and Mr. Vinod Bhat were in charge of the fund. Now, Mr. Dhaval Joshi and Mr. Dhaval Gala are in charge of the fund. They are in charge of making sure that the portfolio follows ESG rules and that it performs as well as possible given the current market conditions. The Nifty 100 ESG TRI (Total Return Index) is the best way to measure how well the fund is doing. It shows how well companies from the Nifty 100 that score highly on ESG criteria are doing.

There are no promises or guarantees of returns from the fund, and there is no guarantee that its investment goals will be met. This fits with the general idea of equity investing, which always involves some level of market risk, especially when ESG or other thematic limits are put in place. The fund, on the other hand, wants to invest in companies that are more likely to handle long-term risks and opportunities well by using ESG principles. This could make the portfolio more stable and long-lasting.

Graph I : Growth of Aditya Birla Sun Life ESG Fund renamed as Aditya Birla Sun Life ESG Integration Strategy Fund in January, 2024



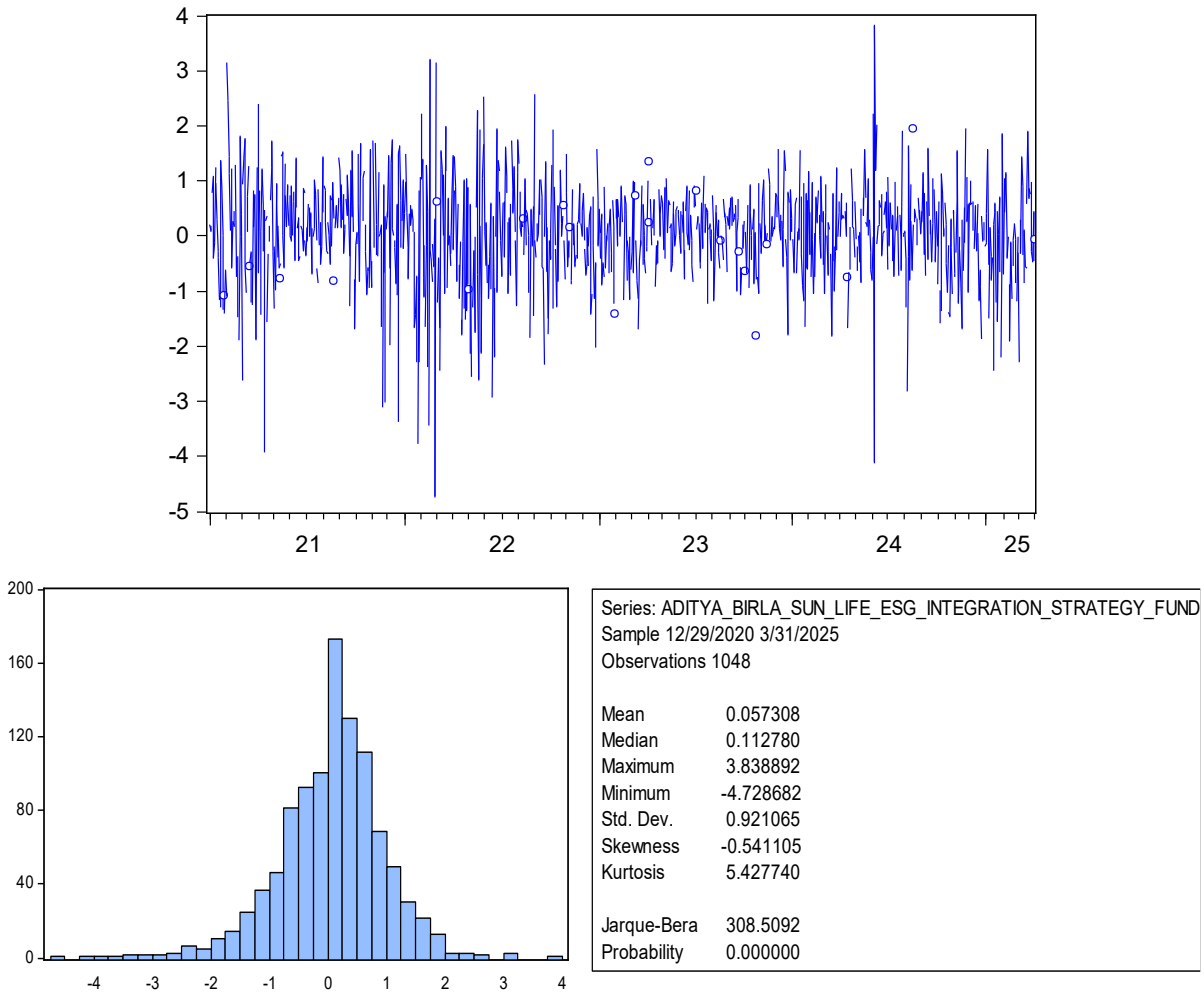
The existence of left-skewed, leptokurtic distributions indicates that standard models predicated on normal returns may undervalue tail risk and inaccurately portray the authentic risk profile of ESG portfolios. So, when looking at ESG funds in India, investors, fund managers, and policymakers need to use advanced risk-adjusted performance measures and strong risk-management frameworks. This work lays the groundwork for the next sections, which will compare funds, look at their risk-adjusted performance, and draw policy-relevant conclusions about the changing world of sustainable investing.

Minnesota Journal of Business Law and Entrepreneurship

Volume 2026, No. 2

ISSN: 1540-3270

Graph II: Graph representing volatility in growth of Aditya Birla Sunlife ESG Integration Strategy



The descriptive statistics and distributional analysis of Aditya Birla Sun Life ESG Integration Strategy Fund reveals that Mean is **0.057308** which indicates that **t**he average daily return over the sample period is positive but very close to zero but Median is **0.112780** which is higher than the mean. This indicates that the distribution is left-skewed, as the mean is pulled down by more extreme negative returns in the tail. Standard Deviation is **0.921065** which represents the fund's volatility or risk. Maximum **3.838892** and Minimum **-4.728682** figures reveal the extreme positive and negative daily returns experienced by the fund, indicating the potential for high gains & significant losses within a single trading day. The negative skewness value-**0.541105** indicates that the distribution of returns has a longer and fatter tail on the left side, as shown in the histogram. This means the fund experienced a higher frequency of moderately large negative returns than moderately large positive returns. The kurtosis value of **5.427740** is greater than the 3.0 of normal distribution which is indicating that the fund's return distribution is leptokurtic. This means the distribution has fatter tails and a sharper, higher peak than a normal curve. The JB test is a statistical test for normality that measures a distribution's deviation from the normal distribution's skewness (0) and excess kurtosis (0). A high JB value **308.5092** indicates significant deviation from normality. The p-value of **0.000000** is less than any conventional significance level. This leads to the strong rejection of the null hypothesis that the fund's returns are normally distributed.

TableII: Johansen Cointegration Rank Test Results between Aditya Birla Sun Life ESG Integration Strategy Fund Return and BSE 100 ESG Return

Hypothesized		Trace	0.05	Trace		Max-Eigen	0.05	Max-Eigen
No. of CE(s)	Eigenvalue	Statistic	Critical Value	P-Value	Eigenvalue	Statistic	Critical Value	P- Value
None *	0.177105	362.2678	15.49471	0.0000	0.177105	202.5284	14.26460	0.0000
At most 1 *	0.142508	159.7395	3.841465	0.0000	0.142508	159.7395	3.841465	0.0000

The Johansen test between BSE 100 ESG and Aditya ESG returns reports trace statistics of 362.27 and 159.74, both beyond critical levels with p-values of zero, proving significant cointegration. This establishes that Aditya ESG return series maintain a long-run linked behavior with the benchmark index, confirming their co-movement amid ESG investment trends.An eigenvalue of 0.1771 denotes moderate but slightly weaker cointegration compared to others, still reflecting a meaningful equilibrium link. The trace statistic confirms the statistical validity of this cointegration.

Trace and Max-Eigenvalue tests confirm two cointegrating equations at 5% significance, rejecting the null hypothesis of no cointegration ($r = 0$) and at most one relation ($r \leq 1$). Eigenvalues 0.177 and 0.143 signal strong long-run equilibria between ABSLAMC AUM and BSE 100 ESG series, with the first vector explaining 17.7% of adjusted variance.

4.1 The LM test

The LM test regresses residuals (RESID) plus a constant on their lags, RESID(-1) and RESID(-2). There is no serial correlation, according to the null hypothesis (all lag coefficients = 0). The null hypothesis is rejected by F-statistic = 4.2376 and Prob(F-statistic) = 0.0147 < 0.05, indicating the existence of serial correlation. If the null hypothesis is rejected, the original model's residuals are autocorrelated, which goes against OLS assumptions and results in ineffective standard errors.

This output shows the results of an ARCH-LM test for autoregressive conditional heteroskedasticity (ARCH effects) in the Aditya Birla ESG mutual fund's return series' squared residuals. The test uses lagged RESID^2(-1) and a constant to regress squared residuals (RESID^2). There are no ARCH(1) effects if the coefficient on RESID^2(-1) is 0, which means that the variance stays the same. The F-statistic is 75.4586 (p=0.0000) and the Obs*R-squared is 70.4937 (Chi-square p=0.0000). Both of these numbers clearly reject the null hypothesis. ARCH effects confirm that the fund's returns are volatile over time (volatility clustering). The fund's returns are very volatile (for example, the recent SD was about 13%), which is consistent with the detected heteroskedasticity.

The constant mean return is 0.0876% (significant, z=3.3645, p=0.0008), which means that the average daily return is positive. Negative R-squared (-0.0011) doesn't matter here because we're looking at volatility; the residuals show some autocorrelation (DW=1.8308).

$$LOG(GARCH) = \omega + \alpha |z_{t-1}| + \gamma z_{t-1} + \beta LOG(GARCH_{t-1}$$

Table III: Results of Volatility using E-Garch for Aditya Birla Sunlife ESG Fund Return

Parameter	**Coefficient**	**z-Statistic**	**Prob.**	**Interpretation**
ω [C(2)]	-0.2064	-7.7723	0.0000	Significant constant in log-variance.

α [C(3)]	0.1999	6.2059	0.0000	Positive ARCH effect: shock magnitude increases volatility.
γ [C(4)]	-0.2188	-7.5371	0.0000	Negative leverage effect: negative shocks raise volatility more than positive ones (asymmetric).
β [C(5)]	0.8552	44.1939	0.0000	Strong GARCH persistence (close to 1); volatility clusters over time.

EGARCH fits well, confirming volatility clustering and leverage (news impact asymmetry) in fund returns. Use for risk forecasting; high β suggests prolonged volatility responses

This output shows a post-estimation ARCH-LM diagnostic test. EGARCH model fitted to Aditya Birla ESG mutual fund returns. The null hypothesis is no serial correlation in squared residuals (all lag coefficients = 0, no remaining heteroskedasticity). No strong evidence of remaining ARCH effects after EGARCH modeling—volatility is adequately captured. The low R-squared (0.0076) is typical for such diagnostics, confirming model specification success for this mutual fund's returns.

4.2 BSE ESG

This ARCH-LM test (order 1) on squared residuals (RESID^2) from an underlying model of BSE ESG 100 index returns reveals strong evidence of autoregressive conditional heteroskedasticity. The null hypothesis states no ARCH(1) effects (coefficient on RESID^2(-1) = 0, constant variance). F-statistic = 91.9559 (p=0.0000); Obs*R-squared = 84.6547 (Chi-square p=0.0000) both decisively reject the null. Significant ARCH effects mean the original model fails to capture time-varying volatility in the fund's returns. Unlike the prior EGARCH post-test (p=0.0947), this suggests raw residuals (not standardized) exhibit pronounced heteroskedasticity, warranting GARCH-family modeling for accurate risk assessment.

The test regresses residuals. The null hypothesis is no serial correlation.

This EGARCH(1,1) model output examines the daily returns (RETBSEESG) of the BSE ESG Index from 2020 to 2025, corroborating volatility patterns akin to the previous Aditya Birla ESG fund analysis. The constant daily mean return is 0.0667% (significant, z=2.5764, p=0.0100), which means that the average performance is good. Negative R-squared doesn't matter for models that focus on volatility. DW=1.9598 shows very little residual autocorrelation.

Table IV: Results of Volatility using E-Garch for BSE 100 ESG Return

Parameter	Coefficient	z-Statistic	Prob.	Interpretation
ω [C(2)]	-0.2333	-9.6412	0.0000	Baseline log-volatility level.
α [C(3)]	0.2511	9.3206	0.0000	Positive shock magnitude effect (ARCH term).
γ [C(4)]	-0.1437	-5.6174	0.0000	Leverage effect: negative shocks amplify volatility more (asymmetry, $\gamma<0$).
β [C(5)]	0.8725	46.4850	0.0000	High persistence (volatility clustering).

The model shows that BSE ESG Index returns tend to cluster around periods of high volatility and respond differently to good and bad news (more strongly to bad news). A high β means that volatility lasts longer. Good enough for risk management, but a little bit of residual ARCH may need a higher-order specification.

4.3 Comparison

Under EGARCH(1,1) modeling, the Aditya Birla ESG mutual fund returns have slightly higher average returns and more stable volatility than the BSE ESG Index returns. They also have stronger asymmetry in how they respond to shocks. Both have positive daily averages: 0.0876% (fund, p=0.0008) and 0.0667% (index, p=0.0100). This means that the actively managed fund is doing slightly better.

4.4 Volatility Parameters

Table V: Comparative Results of Volatility between Aditya Birla Sunlife ESG Fund Return and BSE 100 ESG Return

Parameter	Aditya Birla Fund	BSE ESG Index	Comparison
ω (constant)	-0.2064	-0.2333	Index has lower baseline volatility.
α (shock magnitude)	0.1999	0.2511	Index more sensitive to shock size.
γ (leverage/asymmetry)	-0.2188	-0.1437	Fund shows stronger leverage effect (negative shocks amplify volatility more).
β (persistence)	0.8552	0.8725	Both highly persistent; index slightly more (closer to 1 implies longer clustering).
ω (constant)	-0.2064	-0.2333	Index has lower baseline volatility.

The fund shows more pronounced asymmetry (riskier downside volatility) but similar clustering to its benchmark index. This is in line with the idea that active ESG stock selection increases leverage effects more than passive indexing.

The ARCH-LM diagnostic test on squared weighted standardized residuals (WGT_RESID^2) from the EGARCH model of BSE ESG Index returns shows that there is no statistically significant remaining heteroskedasticity at normal levels. The auxiliary regression analyzes squared standardized residuals in relation to their initial three lags. The null hypothesis says that there are no more ARCH effects. The EGARCH(1,1) model does a good job of capturing the changes in volatility in BSE ESG returns, with only a weak lag-1 dependence. This borderline result (which is the same across tests) shows that the index forecasting is well-specified, unlike raw residuals that showed strong ARCH earlier.

5. Policy implications /Conclusion

The GARCH analysis reveals distinct volatility profiles between the Aditya Birla ESG Fund and the BSE ESG Index, underscoring risks in active versus passive sustainable investing. While both exhibit high persistence (β=0.8552) for the fund vs. β=0.8725 for the index), the fund displays a stronger leverage effect (γ=−0.2188 vs. −0.1437) and lower shock sensitivity (α=0.1999 vs. 0.2511), amplifying downside volatility clustering from negative shocks despite the index's lower baseline volatility (ω=−0.2064 vs. −0.2333).

These results align with Glosten et al.'s (1993) leverage effect in GARCH models, where negative shocks disproportionately elevate conditional variance due to asymmetric information flows and balance sheet dynamics—effects magnified in active ESG funds by portfolio concentration in volatile green assets. The fund's higher |γ|signals intensified "volatility feedback" , where downside persistence erodes risk premia, contrasting the index's near-unit root stability that mirrors efficient market hypothesis ideals for diversified benchmarks. This validates ESG funds' deviation from passive efficiency, as active strategies amplify asymmetry amid India's evolving sustainability mandates.

These asymmetries highlight active ESG funds' vulnerability to market stress, where negative news exacerbates volatility more than in the benchmark index. Regulators like SEBI should mandate enhanced stress testing and volatility-adjusted disclosures for funds with pronounced leverage (e.g., $|\gamma|>0.2$), requiring 10-15% higher capital buffers and explicit downside risk warnings in prospectuses. Policymakers can promote passive indexing for retail investors, leveraging the index's superior persistence for stable ESG exposure aligned with India's green bond initiatives. Ultimately, prioritizing symmetric, benchmark-like volatility structures will bolster sustainable investing's resilience, fostering trust and long-term capital flows in India's ESG markets.

References

[1] Aalto University. (2025). The impact of ESG scores on the risk-adjusted returns.

[2] ABSLAMC. (2023). *Annual report 2022-23*. Aditya Birla Sun Life AMC Limited.

[3] *Aditya Birla Sun Life Capital. (2025).* Aditya Birla Sun Life ESG Integration Strategy Fund.

[4] AInvest. (2025). Climate-conscious vs. broad global equity strategies.

[5] Aparna, A. S. (2024). Assessing the performance of ESG mutual funds and traditional funds in emerging economies. *IGI Global*.

[6] Ali, F. (2024). Cointegration and causality relationship of Indian stock markets.

[7] Arthavaan. (n.d.). Empirical investigation into long run and causal relationship.

[8] Atkinson, A., Messy, F. A., Rabinovich, L., & Yoong, J. (2015). Financial education for long-term savings and investments: Review of research and literature.(OECD Working Papers on Finance, Insurance and Private Pensions, No. 39). OECD Publishing.

[9] Banu, A. A. A. S., Bhuvaneswari, T. S., & Begum, K. S. (2021). A study on the sustainable investment funds with sepcial reference to state bank of India esg mutual fund shcemes. *Turkish Journal of Computer and Mathematics Education,* 12(6), 261-266.

[10] Bhattacharya, K. (2025). ESG-linked mutual fund in India: An empirical analysis of risk, return, and growth. *International Journal of Creative Research Thoughts (IJCRT), 13(6), b538-b550.*

[11] https://ijcrt.org/papers/IJCRT2506179.pdf

[12] Brüggen, E. C., Hogreve, J., Holmlund, M., Kabadayi, S., & Löfgren, M. (2017). Financial well-being: A conceptualization and research agenda. *Journal of business research, 79, 228-237*.

[13] Brzeszczynski, Janusz, and Graham McIntosh. 2014. Performance of Portfolios Composed of British SRI Stocks.*Journal of Business Ethics 120: 335–62.*

[14] Busch, T., Bauer, R., & Orlitzky, M. (2016). Sustainable development and financial markets: Old paths and new avenues. *Business & Society*, 55(3), 303–353.

[15] *EDHEC Climate Institute. (2022)*. Does ESG investing improve risk-adjusted performance?

[16] Engle, R. F., & Ng, V. K. (1993). Measuring and testing the impact of news on volatility. *The Journal of Finance, 48(5), 1749–1778.*

[17] Equentis. (2024). List of 10 best ESG funds in India.

[18] *Frontiers. (2025)*. Exploring ESG volatility spillovers.

[19] Garbinsky, E. N., Klesse, A. K., & Aaker, J. (2014). Money in the bank: Feeling powerful increases saving. *Journal of Consumer Research, 41(3), 610-623.*

[20] Glosten, L. R., Jagannathan, R., & Runkle, D. E. (1993). On the relation between the expected value and the volatility of the nominal excess return on stocks. *The Journal of Finance, 48(5), 1779–1801.*

[21] Gupta, A., et al. (2025). Environmental, social and governance (ESG) investing and Indian capital market indices. *Journal of Capital Markets Studies.*

[22] Gupta, S. (2022). Performance evaluation of ESG funds. *Orissa Journal of Commerce*, 43(2).

[23] Gupta, S. (2022). Growth and performance measurement of ESG-themed mutual funds in India: An empirical investigation. *Orissa Journal of Commerce, 43(2), 9-26.*

[24] Huang, J. W. (2024). Conditional volatility targeting strategy considering jump dynamics: ESG equity index evidence. *Research in International Business and Finance.*

[25] *IJCRT. (2025a).* ESG-linked mutual fund in India.

[26] *IJRPR. (2024).* Assessing the performance of ESG mutual funds.

[27] *Indian Journal of Finance. (2023)*. ESG score and mutual fund performance.

[28] Journal of Applied Accounting. (2025). Examining the performance of ESG-themed mutual funds in India.

[29] Jayadev, S., & Anupama, R. (2025). Investigating the performance of ESG-themed mutual funds in India. *Indian Journal of Accounting, 56(2), 31-40.*

[30] *JETIR. (2025).* Analysis of ESG and conventional indices.

[31] Kar, A., & Patro, S. (2022). Comparative analysis of ESG and sectoral indices in India: An econometric approach. *International Journal of Financial Studies, 10(2), 55*-70.

[32] Lund University. (n.d.). DCC-GARCH model on green vs non-green ETFs.

[33] Makkar, A., Ghayas, M., & Gupta, P. (2023). Volatility modeling of ESG indices using EGARCH during COVID-19: Evidence from Indian markets. *Indian Journal of Finance, 17(4), 34-47.*

[34] *Management Paper. (2025).* Evaluating ESG mutual funds in India.

[35] Manda, V. K., & Polisetty, A. (2021). Market Competition In Indian Esg Mutual Funds. *SPECIALUSIS UGDYMAS*, 1(42), 42.

[36] Mishra, A. K. (2024). ESG volatility prediction using GARCH and LSTM models. *Financial Internet Quarterly,* 20(1), 1-12.

[37] Priya, & Sharma, K. (2024). Global ESG fund evolution – an analysis of sustainable investment growth through comparison. *E3S Web of Conferences, 577, 03003.*

[38] Sarkar, S. (2022). Performance evaluation of ESG funds in India – A study. *The Management Accountant Journal.* Scielo. (2025). Performance of the ESG investments.

[39] ScienceDirect. (n.d.a). ESG investment performance and global attention.

[40] ScienceDirect. (n.d.b). Exploring the connectedness between major volatility indexes.

[41] ScienceDirect. (2024). Conditional volatility targeting strategy.

[42] ScienceDirect. (2025a). ESG investment on fund performance: Evidence from style drift.

[43] *SEBI. (2023).* SEBI introduces 6 new mutual fund strategies under ESG theme.

[44] Shah, A., & Clark, G. (2018). Sustainable investing: what's on the horizon. *Columbia Center on Sustainable Investment, CCSI Briefing Note, December.*

[45] Shaik, M. (2022). The dynamic volatility connectedness of major cryptocurrencies. *PMC*.

[46] Sharma, N., & Mahendru, V. (2024). Volatility and return dynamics in Indian mutual funds. *IJARSCT*.

[47] Sharma, S. (2024). An empirical study of Indian sustainability indices. *JGU Pure*.

[48] Singh, A. (2023). Financing a net-zero future ESG investing. *Journal of Global Information and Business Strategy,* 15(1), 25-33.

[49] Sood, D., & Kaur, N. (2015). A study of saving and investment pattern of salaried class people with special reference to Chandigarh (India). *International Journal of Research in Engineering, IT & Social Sciences,* 5(2), 1-15.

[50] *SSRN. (2023).* Evaluation of the performance of India's ESG funds.

[51] Sundar, S., & Manjunath, S. J. (2025). Analysis of ESG and conventional indices: A long-term financial and sustainability trends study. *Journal of Emerging Technologies and Innovative Research (JETIR), 12(12), e216-e229.*

[52] Value Research. (2024). *AMC profiles: Aditya Birla Sun Life AMC*

[53] Value Research. (2025). Aditya Birla Sun Life ESG Integration Strategy Fund.

[54] Wert. (2025). Green investing in India: Driving change through ESG funds.

[55] Zaleskiewicz, T. (2013). Saving can save from death anxiety: Mortality salience and financial decisions. PLoS ONE(11), Article e79407.