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ESG-Informed Portfolio Allocation and Risk–Return Analysis: A Python-Based Comparison of 3:2:1 And 60:40 Strategies For Retail Investors in India

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ABSTRACT

The study assesses the performance of ESG-informed portfolio optimisation strategies relative to the 60:40 portfolio allocation approach in the period of 2014-2024 for retail investors. The study uses quantitative research methodology and secondary data from Indian financial markets to study the measures of return, volatility, diversification, risk-adjusted performance, long-term growth and downside risk using statistical and risk-adjusted portfolio analysis techniques using Python. The results show that the mean return and the compound annual growth rate of the 3:2:1 portfolio outperformed the mean return and compound annual growth rate of the 60:40 portfolio slightly. The 60:40 portfolios, however, showed favor in having lower volatility, lower beta, better Sharpe and Treynor ratios, higher alpha and better drawdown protection. The findings indicate that the inclusion of commodities slightly increases the long-term return potential of the portfolio, but does not necessarily lead to higher portfolio efficiency. Another area of focus of the study is the stabilizing effect of fixed-income exposure on diversified retail portfolio construction. The results add to the existing body of research on ESG-oriented investment strategies, sustainable finance and/or resilient retail portfolio allocation in emerging markets contexts.

Keywords: ESG-oriented portfolio thinking; retail investors; portfolio diversification; financial inclusion; sustainable wealth creation

Introduction

1.1. ESG-Oriented Investing and Sustainable Finance

The increasing importance of environmental, social, and governance (ESG) concepts in the financial sector has changed how investors assess asset allocation and portfolio performance (Verma & Bansal, 2021). The growing body of literature also indicates that ESG investing has evolved as a mechanism to balance sustainability objectives with financial performance, particularly in managing the risk–return trade-off in investment decisions (Tiwari et al., 2023). This change is of particular interest to retail investors, whereby decisions to invest are not measured solely based on their returns and risks, but also on their role in sustainable and inclusive wealth generation. ESG-conscience investment approaches can be a good bridge between the financial performance and the larger development objectives in the emerging economies, where participation in the financial performance is still uneven. It has been indicated in one of the studies in India that financial practices that are environmentally focused can have a positive impact on the financial performance at the firm level, and thus, ESG-conscious allocation is becoming more relevant when it comes to the design of the portfolio (Rao et al., 2023; Mezghani et al., 2025). Simultaneously, it has been acknowledged that financial inclusion is one of the key contributors to socio-economic development since it increases access to financial opportunities and enhances the ability to build sustainable wealth over time (Mishra et al., 2024; Bahloul & Ben Amor, 2022). Sustainability research has increasingly evolved beyond firm-level financial performance to incorporate broader economic and social dimensions, particularly in emerging market

contexts (Sabirali & Mahalakshmi, 2023).

ESG investing is now widely linked to capital market risk management, ESG value creation and portfolio resilience in recent years. Sustainability investment strategies have the potential to shape investor decisions, asset pricing, and portfolio construction, not just in the corporate world but in the broader landscape of global financial systems as well (Billio et al., 2022). Incorporating ESG principles into investment strategies signifies a shift from traditional profit-driven approaches to more responsible and resilience-focused financial models. In emerging markets, there are also broader investment goals for ESG-conscious investing, including financial inclusion, economic stability, and sustainable wealth building, especially for retail investors who are searching for diversified investment opportunities in an unstable market environment (Lin, 2025).

1.2. Portfolio Diversification and Retail Investment in Emerging Markets

The increased interplay between sustainable finance, financial inclusion, and retail portfolio management (Dsouza et al., 2025). Recent empirical evidence also highlights a significant linkage between financial inclusion, ESG factors, and sustainable economic growth, reinforcing the role of inclusive financial systems in achieving broader developmental outcomes (Jain et al., 2024). The 60:40 model of portfolio allocation has traditionally been adopted as a standard allocation model due to its perceived balance between growth and stability. Nevertheless, the suitability of conventional patterns of allocation has been questioned by the fluctuating market conditions, sustainability issues and the increasing demand for more inclusive financial products (Khan et al., 2025). Studies indicate that financial inclusion is an important factor towards sustainable development, more so in developing and emerging economies, by enhancing engagement in formal finance and facilitating a more equitable economic performance (Chen et al., 2025). Equally, financial inclusion has been attributed to the advancement towards the United Nations Sustainable Development Goals as well, which implies that investment processes must be appraised based on their financial efficiency and developmental aspects of the whole process (Sharma and Changkakati, 2022). The design of diversified and practical retail portfolios is even more significant in developing countries where access, awareness and affordability are still significant challenges (Persaud & Thaffe, 2023; El Khoury et al., 2025).

Prior research on ESG-investing has largely been on the institutional investment approach, on the sustainability performance of the firm, and on developed financial markets (Matos, 2020). There is little empirical research on diversified retail portfolio allocation policies in emerging markets like India. Moreover, the previous literature has not explored adequately whether an alternative portfolio structure of 3:2:1 (30% equity, 20% fixed-income, and 10% cash) can be more resilient and provide better portfolio diversification and sustainable wealth creation compared to the standard 60:40 equity-to-fixed-income mix (YADAV, 2025). The link between ESG oriented portfolio thinking and financial inclusion with diversified retail investment strategies has therefore not been sufficiently explored.

The motivation for this study arises due to market dynamics and growing retail participants in emerging markets, which have forced the evaluation of traditional portfolios while considering sustainability. This contributes to the literature by providing empirical evidence on portfolio allocation strategies within an ESG-oriented and financial inclusion framework in an emerging market (in the context of India). The problem addressed in the study is that the old retail investment models may not be able to determine the current needs of investors seeking financial strength and long-term wealth creation (Ali et al., 2024).

However much the 60:40 portfolio is a respected standard, the traditional structure may lack comprehensiveness to accommodate those investors who invest in variable markets and work in a more policy-oriented environment that is increasingly being drawn towards the practices of ESG and inclusiveness. It is therefore significant to assess the fact that another model, such as the 3:2:1 allocation model, could be more diversified, more flexible and applicable in the environment of inclusive retail investing. Theoretically, the research is grounded on Modern Portfolio Theory (MPT) that describes the contribution of diversification in asset classes towards helping investors in maximising the risk-return trade-off. The gap in the research is the absence of evidence between portfolio design and ESG awareness and financial inclusion, particularly in the case of developing economies. The study aims to provide empirical evidence on whether a diversified portfolio strategy can support high returns while ensuring sustainability in wealth creation. Thus, with this objective, the study has been conducted to address the following research problems.

- a. To compare the return, risk, and risk-adjusted performance of the 3:2:1 and 60:40 portfolio frameworks for retail investors.
- b. To examine whether a diversified asset allocation can align with ESG oriented investment outcomes and support more sustainable.
- c. To assess how these portfolio frameworks can contribute to inclusive wealth creation by aligning retail

investment practices with financial inclusion and sustainable development goals.

The aim of the study is to compare the performance of the 3:2:1 portfolio framework with the traditional 60:40 portfolio from an ESG-oriented and financial inclusion perspective using Indian market data during 2014–2024. To compare the performance of the portfolio framework of 3:2:1 and 60:40 portfolio framework from an ESG-oriented and financial inclusion perspective based on the Indian market data during 2014–2024. This study aims to analyze and calculate portfolio return, portfolio risk, diversification efficiency, and risk-adjusted performance to check whether diversified allocation strategies can help retail investors create sustainable wealth, maintain portfolio resilience and financial stability in emerging market conditions. In the following pages of this paper, we continue as follows. Section 2 reviews relevant ‘Literatures,’ Section 3 embodies the ‘Theoretical Framework,’ Section 3 digs into the ‘Materials and Methods.’ Section 5 outlines the ‘Data analysis and Results.’ Section 5 illustrates the ‘Discussions’ and Section 6 unfolds Limitation of the study and Section 7 outline the ‘Conclusions and ‘practical implications & future directions.’

Literature review

➤ ESG Portfolio Strategies and Risk Management

The ESG-conscious investment literature is increasingly causing the view that sustainability issues are no longer marginal to portfolio construction, but are core to the investment analysis. The initial research in this line has demonstrated that ESG disclosure may lead to a positive impact on portfolio-level outcomes by enhancing transparency and aiding investors in detecting firms with better long-term governance and risk-management practices, thus leading to better portfolio performance under some market conditions (Bermejo Climent et al., 2021; Mezghani et al., 2025) This assertion is further supported by recent evidence in the form of a review, indicating that ESG has become a significant aspect of the portfolio creation, with literature indicating that it is becoming increasingly pertinent in terms of risk management, allocation approach, and long-term investment choice (Nóbrega et al., 2025). Simultaneously, the wider applicability of ESG-conscious portfolio design increases in the economies where access to finance inclusiveness continues to be a development priority, as financial inclusion has been established to be contingent upon structural, institutional and policy-related variables in the emerging markets, including the BRICS economies (Pandey et al., 2023). It has prompted scholars to explore ESG not to receive an ethical shortcut, but to evaluate it as a financially appropriate variable in the allocation of assets.

Another similar line of research is on the question of whether or not ESG integration is indeed better than profitability. Recent evidence also highlights that sustainable indices exhibit significant return and volatility spillovers across emerging markets, indicating that sustainability-oriented investments are closely interconnected and require careful portfolio allocation for effective risk diversification (Sahoo & Kumar, 2023). Empirical evidence also suggests that the financial benefits of sustainable practices are conditional on the degree of ESG adherence, with ESG-sensitive firms exhibiting stronger performance linkages compared to non-ESG firms (Singh, 2023).

Although interest in sustainable investing has been on the rise, this has not been a unilateral phenomenon. Other works show that the ESG effect could increase portfolio profitability through efficiency and the minimised exposure to poorly-managed companies, but they also observe that the advantages of portfolio design, screening intensity, and the goals of investors (Cesarone et al., 2022). It becomes evident that ESG investing cannot be considered as something inherently superior, but instead it is a method whose merit lies in the way it is implemented in a portfolio context. The resilience aspect of ESG investing is also one of the dimensions that has received significant scholarly interest, particularly during crises (El Khoury et al., 2025). The studies analysing the shock of lockdowns in China claim that ESG investing can become more like a vaccine against equity, which provides a comparatively better level of protection in times of market devastation. This is an indication that ESG-based portfolios can offer downside protection and defensive attributes that are very applicable to investors who are worried about uncertainty and tail risk (Dai, 2022; Ali et al., 2024). This is especially significant to retail investors, who tend to be more susceptible to the vast market declines.

➤ Sustainable Investing and Portfolio Development

Recent works have also expanded the argument on screening to optimisation. Prior research further categorises ESG investment literature into themes such as risk–return dynamics, investor preferences, and ESG information usage, highlighting its growing relevance in portfolio construction (Tiwari et al., 2023). The existence of strong optimisation models, including ESG preferences, shows that sustainable investing can be incorporated in a systematic way in the selection of a portfolio without the need to discard the formal risk–return premises. These models indicate that the preferences of ESG can be reflected in the disciplined way of portfolio building, which enables investors to pursue sustainability goals without losing their analytical rigour (Escobar-Anel & Jiao, 2024). This adds to the argument that ESG-conscious investing is not an

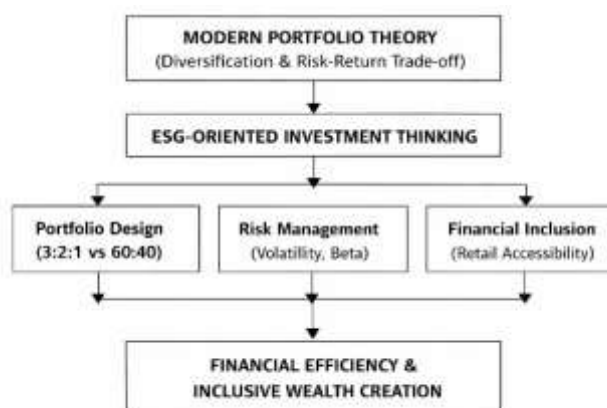
independent normative practice but can be regarded as consistent with the modern portfolio theory (Dsouza et al., 2025). ESG disclosure is also associated in the literature with the price of assets and the financial performance of the firm. The asset-pricing literature suggests that ESG disclosure can have the potential to change the forecast returns and market value, modifying how investors perceive risk, quality, and future performance, thus supporting the economic importance of sustainability information in capital markets (Khandelwal et al., 2023). In addition to disclosure, the opportunities to change the approach to the price and management of the portfolio in the long run allow stating that ESG-valued optimisation can change the perspectives of the financial sphere on the strategic role of chosen sustainability preferences regarding the dynamic asset-pricing strategy (Lauria et al., 2025; Mezghani et al., 2025).

This trend towards responsible investing in a wider portfolio is backed by broader portfolio studies. The study conducted across the world has revealed that ESG and Sharia-compliant investments have the potential to be strategic in constructing risk-averse portfolios, more so among investors who aim at diversifying their investments and embracing value-based investment strategies (Mirza et al., 2025; Bahloul & Ben Amor, 2022). Simultaneously, the critical reviews of sustainable finance warn that fund sustainability measurement is still a complex methodologically, and the networks and indicators used by researchers vary considerably (Popescu et al., 2021). Sustainable portfolios continue to be reported as being designed efficiently by optimisation research in the event that appropriate constraints and objectives are well defined (Varmaz et al., 2024). There is additional empirical evidence in China that ESG performance has the potential to play a role in stock returns, and this increases the argument that sustainability metrics are becoming more applicable in investment decision-making in a variety of markets (Yin et al., 2023). On balance, the reviewed literature suggests that the ESG-conscious building of a portfolio has become a serious subject of financial research with consequences on profitability, resiliency, and strategic allocation of assets.

2.1 Research Gap

Although there is a growing body of literature on ESG-oriented investing and sustainable portfolio optimisation and financial inclusion, there is little comparative work on the traditional and diversified portfolio frameworks in the context of informed ESG and retail investment framework, especially in emerging economies like India. The existing literature mainly examines firm-level ESG performance, sustainable indices, and optimisation models, with sparse literature studying the effect of diversified portfolio structures on retail investors' long-term growth, risk-adjusted efficiency, and sustainable wealth creation (Tiwari et al., 2023; Escobar-Anel & Jiao, 2024). Furthermore, as reported in the literature, diversification benefits of allocation strategies that focus on ESG and commodity inclusion are inconsistent in an environment of volatile markets (Cesarone et al., 2022; Sahoo & Kumar, 2023). However, it is unclear whether such alternatives to the standard 60:40 asset mix (as can be achieved through a different portfolio structure, e.g., 3:2:1) can deliver better diversification and more resilient investment results than the 60:40 asset mix in emerging markets.

Theoretical Framework



Author's own creation

The present study is based on the theory of Modern Portfolio Theory (MPT) which was introduced by Markowitz (1952) (Markowitz, 1952; Verma & Bansal, 2021). In this short video MPT introduces the concept of diversification: the idea that investors can get the best of both worlds – risk and return – by spreading out their investments among asset classes that have differing correlation structures. The idea behind this is that a risk and reward diversified portfolio will be less volatile than a portfolio consisting of only high-risk or only low-risk assets, yet will have the same expected return. This principle is demonstrated in the traditional

60:40 portfolio, which allocates 60% of investments to equity to capture growth opportunities and 40% to bonds for stability to reduce risk (Khan et al., 2025).

Thus, portfolio diversification has been one of the main principles of portfolio construction and long-term investment management. But the market conditions and the rising relevance of ESG and the broadening scope of focus on portfolio construction beyond traditional financial indicators (Mezghani et al., 2025). Investment decisions for ESG-oriented investment are more and more including sustainability, resilience and financial inclusion in emerging markets (Tiwari et al., 2023; Bahloul & Ben Amor, 2022). New research further indicates that investors are more and more considering their portfolios for profitability and long-term stability, responsible investment practices and sustainable wealth creation. Hence, the current study is an amalgamation of MPT, risk management and the incorporation of ESG-based investment approach to determine if diversification of portfolio structures can improve sustainable wealth creation, portfolio stability and long-term financial resilience for retail investors.

Materials and Methods

Research Design

This study is based on quantitative research design whereby the performance of the 3:2:1 portfolio framework is compared to the traditional 60:40 portfolio framework using secondary market data from Indian financial markets for the 2014-2024 period. A time-series is used to test portfolio return, volatility, diversification and risk-adjusted performance across various market conditions. Both portfolio structures are evaluated for comparative efficiency, stability and long-term growth potential using financial and statistical software tools based on Python.

Sampling Design

This study examines three broad asset classes that are representative of the traditional assets that retail investors pursue – equities, fixed-income securities, and commodities. The analysis is conducted from 2014 to 2024 to reflect varying market conditions, which encompass the growth stage, market volatility and economic uncertainty. The 3:2:1 portfolio (50% equities, 30% bonds, and 20% commodities) and the traditional 60:40 portfolio (60% equities, 40% bonds) are considered. Equities exposure is represented using NIFTY 50, bond exposure by using NIFTY government bond proxies and commodity exposure by using NIFTY Commodities.

Data Collection Methods

The secondary monthly time-series data used in the study are obtained from trustworthy sources like NSE India, Investing.com and Reserve Bank of India database (National Stock Exchange of India, 2026; Investing.com, 2026; Reserve Bank of India, 2026). The data collected consists of historical index values, bond data, commodity market data, and macroeconomic data for portfolio comparison and risk/return analysis. To complement the interpretation of findings and to evaluate the wider economic environment that may impact on portfolio performance, articles from academic journals, financial reports, white papers and government publications were also consulted.

Analytical Approach

The data were analysed using Python (version 3.x) and standard financial libraries including NumPy, Pandas, and Matplotlib. The descriptive statistics including mean return, variance, standard deviation, covariance and correlation assessed the risk, return and diversification efficiency of the portfolio. Performance measures – Sharpe ratio, Treynor ratio, alpha, beta – were used to assess risk adjusted performance. For long-term portfolio growth and downside risk metrics, Compound Annual Growth Rate (CAGR) and maximum drawdown were used. Further, Monte Carlo simulation and Modern Portfolio Theory (MPT) was used to assess portfolio efficiency and the appropriateness of portfolio allocation under varying market conditions. The portfolios were assumed to be rebalanced annually and a government security proxy was employed as risk-free rate in the risk adjusted calculations. Because of the lack of consistent ESG scoring information for all asset classes selected, the ESG dimension was informed into the portfolio allocation analysis conceptually.

Data analysis and Results

Descriptive Statistics of Asset Classes and Portfolios

Table1: Descriptive Statistics of Asset Classes and Portfolios

Series	Mean Return	Standard Deviation	Variance	Minimum Return	Maximum Return
NIFTY 50	0.011489	0.046102	0.002125	-0.232464	0.146800
Commodity	0.012096	0.060971	0.003717	-0.238900	0.199100
Bond Proxy	0.005985	0.000579	0.000000335	0.004819	0.007450
Portfolio 3:2:1	0.009752	0.032143	0.001033	-0.154180	0.103167
Portfolio 60:40	0.009283	0.027651	0.000765	-0.137236	0.090261

Author's own compilation

The following descriptive statistics provide some interesting insights as to the return and risk properties of the asset classes and portfolio designs selected. The highest average monthly return was found in commodities (1.21) and the lowest in the bond proxy (0.60) with lower volatility in the bond proxy (0.0006) as compared with the commodities (0.0610). The average monthly return of NIFTY 50 is 1.15 and the level of volatility is moderate as 0.0461. The mean monthly return of the 3:2:1 portfolio (0.98) was slightly higher than the 60:40 portfolio (0.93). The higher return did come with higher volatility though, evidenced by the higher standard deviation for the 3:2:1 portfolio (0.0321) than for the 60:40 portfolio (0.0277). The results indicate that the 60:40 portfolio was rather more stable and risk efficient during the period of the study, although the 3:2:1 allocation had slightly higher return potential.

Correlation and Diversification Analysis

Table 2: Correlation, Covariance, and Portfolio Association Analysis

Measure	Variable 1	Variable 2	Value
Correlation	NIFTY 50 Return	Commodity Return	0.852284
Correlation	NIFTY 50 Return	Bond Proxy Monthly	-0.047329
Correlation	Commodity Return	Bond Proxy Monthly	-0.090593
Covariance	NIFTY 50 Return	Commodity Return	0.002395652
Covariance	NIFTY 50 Return	Bond Proxy Monthly	-0.000001241
Covariance	Commodity Return	Bond Proxy Monthly	-0.000003141
Portfolio Correlation	Portfolio 3:2:1	Portfolio 60:40	0.986193

Author's own compilation

The correlation analysis will give an idea about diversification potential of the selected asset classes. The level of positive correlation between risky assets, NIFTY 50 and commodities was found as 0.8523, which shows that they behaved closely during the study period and have little diversification benefit. The fixed-income

exposure, in turn, exhibited weak negative correlations with NIFTY 50 (-0.0473) and commodities (-0.0906) which underpinned the stabilising effect of the fixed-income exposure in the portfolios. Again, this finding is confirmed by the covariance results, which are slightly negative with the risky assets. The 3:2:1 and 60:40 portfolios showed a very high correlation (0.9862), but this did not mean there were no differences in asset allocation weights which led to some noticeable differences between return, volatility and downside protection. Overall, the results indicate that bonds served as a better diversifier of the portfolio and also made it more stable than commodities during this period.

Risk-Adjusted Performance Evaluation

Table 3: Risk-Adjusted Performance Measures

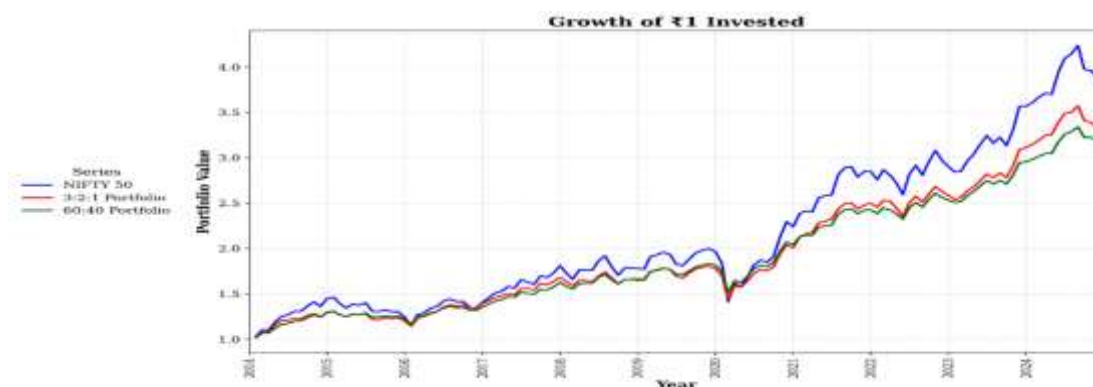
Metric	Portfolio 3:2:1	Portfolio 60:40
Sharpe Ratio	0.148017	0.155103
Beta	0.687667	0.599766
Treynor Ratio	0.006919	0.007151
Alpha	0.000286	0.000386

Author's own compilation

When examining the risk-adjusted performance measures, it can be seen that the 60:40 portfolio was more efficient than the 3:2:1 portfolio for the period of the study. The 60:40 portfolio had the superior Sharpe ratio (0.1551) as compared to the 3:2:1 portfolio (0.1480), meaning it had a higher excess return for every unit of total risk. Likewise, the 60:40 portfolio had a lower beta (0.5998) than the 3:2:1 portfolio (0.6877), meaning that the 60:40 portfolio was less sensitive to market fluctuations. The 60:40 portfolio (0.00715) also had a higher Treynor ratio than the 3:2:1 portfolio (0.00692), indicating a higher systematic risk adjusted performance. The abnormal return performance of the two portfolios was positive, but the 60:40 portfolio had slightly better abnormal return performance. Overall, the results suggest that the 60:40 portfolio was risk-return efficient, less sensitive to the market, and provided greater protection against downside risk during the study period.

Growth Performance and Wealth Accumulation

The long-term growth analysis shows that both diversified portfolios performed very well during the study period, but neither exceeded the performance of the pure equity portfolio. The 3:2:1 portfolio had marginally better CAGR (11.57) as compared to the 60:40 portfolio (11.13) with NIFTY 50 having the highest CAGR (13.13) and indicating better long term return on full equity exposure. The results indicate that diversification helped to stabilize a portfolio, but had a slight negative effect on long-term annualized returns compared to a pure equity portfolio. The growth performance of the 3:2:1 portfolio was marginally better than that of the two diversified portfolios, but the difference between the two diversified portfolios was limited. This suggests that the 3:2:1 split could be a bit more enticing for growth investors, but also with increased volatility and more severe declines.



Author's own compilation

Figure 1: Cumulative Growth of ₹1 Invested in NIFTY 50, 3:2:1 Portfolio, and 60:40 Portfolio (2014-2024)

Figure 1 illustrates the cumulative growth of ₹1 invested in NIFTY 50, the 3:2:1 portfolio, and the 60:40 portfolio during 2014–2024. The figure above indicates that NIFTY 50 had the highest terminal value, implying better long-term wealth creation when invested in full equity exposure. The 3:2:1 portfolio's CAGR was slightly higher than the 60:40 portfolio's, which is reflected in its diversified portfolio. But diversification with both portfolios had a relatively more steady growth trend, underscoring the stabilising impact of fixed-income exposure. The figure also includes the significant market drawdown experienced in 2020 and the recovery in all investment strategies in the second half of the year.

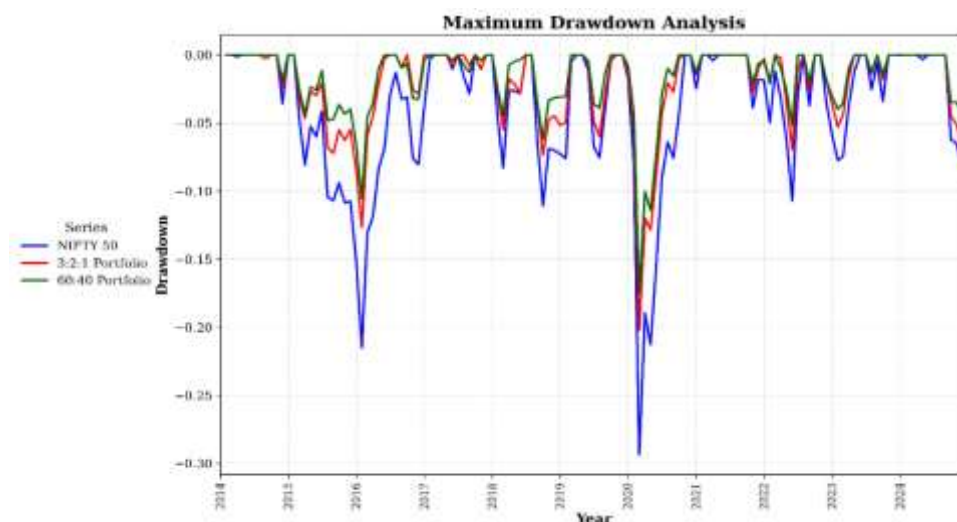
Downside Risk and Maximum Drawdown Analysis

Table 4: Growth and Downside Risk Measures

Metric	Portfolio 3:2:1	Portfolio 60:40	NIFTY 50
CAGR	0.115683	0.111290	0.131252
Maximum Drawdown	-0.202167	-0.174787	-0.293439

Author's own compilation

The maximum drawdown analysis highlights the defensive benefits of diversification and downside protection. NIFTY 50 recorded the deepest maximum drawdown (-29.34%), indicating higher vulnerability during market stress, whereas the diversified portfolios experienced comparatively lower losses. The 3:2:1 portfolio registered a maximum drawdown of -20.22%, while the 60:40 portfolio showed the lowest downside risk at -17.48%. These findings suggest that diversification improved portfolio resilience, although the traditional equity-bond allocation provided stronger capital preservation than commodity inclusion. Despite the 3:2:1 portfolio generating slightly higher CAGR, the 60:40 portfolio demonstrated better downside protection and more stable portfolio behaviour, making it relatively more suitable for risk-averse investors during volatile market conditions.



Author's own compilation

Figure 2: Maximum Drawdown of NIFTY 50, 3:2:1 Portfolio, and 60:40 Portfolio (2014-2024)

The drawdown performance of NIFTY 50, 3:2:1 portfolio and 60:40 portfolio are shown in figure 2 for the period from 2014 to 2024. The biggest and recurrent losses were seen in Nifty 50, suggesting more adverse risk in pure equity exposure. The diversified portfolios, on the other hand, experienced relatively smaller drawdowns, underscoring the role of diversification in providing stability. The 60:40 portfolio approach provided more downside protection and capital preservation in all instances compared to a 3:2:1 portfolio approach, especially during the market disruption in 2020. Overall, the figure suggests that diversification lowers downside risk, and that the traditional 60:40 split had more drawdown resilience in bad markets.

Hypothesis Testing Results

Table 5: Summary of Hypothesis Testing Results

Hypothesis	Test Used	Statistic	p-value	Decision (5%)	Interpretation
H1: 3:2:1 > 60:40 (Returns)	Paired t-test	t = 0.8025	0.2118	Not Supported	No significant difference in mean returns
H2: 60:40 < 3:2:1 (Risk)	F-test (Variance)	F = 1.3513	0.0873	Not Supported	Risk difference exists but not statistically significant
H3: Commodity improves diversification	Correlation	r = 0.8523	—	Not Supported	High positive correlation limits diversification benefit
H4: Diversification supports stability	CAGR & Drawdown	CAGR: 11.66% vs 11.21%	—	Conceptually Supported	60:40 shows better downside protection

Author's own compilation

The statistical analysis showed that the performance of the 3:2:1 portfolio and the 60:40 portfolio in terms of return were statistically similar ($p = 0.2118$). However, the volatility of the 60:40 portfolio was not different from that of the 3:2:1 portfolio, and the variance difference was not statistically significant ($p = 0.0873$). High correlation of equities with commodity ($r = 0.8523$) indicates low diversity arising from commodity inclusion. While both portfolios achieved similar long-term growth, the 60:40 portfolio offered superior downside protection, lower market sensitivity and better risk adjusted performance. The CAPM analysis also showed that the returns of the portfolio were mainly driven by the market movement, and there was no statistically significant abnormal return for the 3:2:1 portfolio. The results overall indicate that the diversification according to the principles of ESG did not yield statistically significant results when compared to the 60:40 portfolio, though the small alpha from this portfolio was statistically significant.

Table 6: CAPM-Based Validation

Portfolio	Alpha	p-value (Alpha)	Beta	p-value (Beta)	R ²
3:2:1	0.00029	0.543	0.688	< 0.001	0.972
60:40	0.000395	< 0.001	0.600	< 0.001	0.999

Author's own compilation

The CAPM analysis shows that the overall movement in the market had a significant impact on both portfolios with high beta significance and explanatory power (R²) indicating a strong influence. The 3:2:1 portfolio had a beta of 0.688, meaning that it is relatively more sensitive to market fluctuations than a 60:40 portfolio, which had a beta of 0.600. The portfolio with weights of 3:2:1 has a positive alpha, though it was not statistically significant ($p = 0.543$), indicating that there is no difference between the abnormal return generated and the market risk exposure. The 60:40 portfolio, by contrast, had a small but statistically significant alpha ($p < 0.001$) for comparatively superior risk-adjusted performance and portfolio efficiency over the course of the study.

Comparative Portfolio Performance Assessment

Table 7: Overall Comparative Performance of Portfolios

Metric	Portfolio 3:2:1	Portfolio 60:40
Mean Return	0.009752	0.009283
Standard Deviation	0.032143	0.027651
Variance	0.001033	0.000765

Sharpe Ratio	0.148017	0.155103
Beta	0.687667	0.599766
Treynor Ratio	0.006919	0.007151
Alpha	0.000286	0.000386
CAGR	0.115683	0.111290
Maximum Drawdown	-0.202167	-0.174787

Author's own compilation

The comparative portfolio analysis reveals a clear trade-off between return enhancement and risk management. The 3:2:1 portfolio generated slightly higher mean return (0.009752) and CAGR (0.115683) than the traditional 60:40 portfolio, indicating marginally stronger long-term growth potential. However, this higher return was accompanied by greater volatility, as reflected in its higher standard deviation (0.032143), variance (0.001033), beta (0.687667), and deeper maximum drawdown (-0.202167). In contrast, the 60:40 portfolio demonstrated superior risk-adjusted performance, recording better Sharpe ratio (0.155103), Treynor ratio (0.007151), alpha (0.000386), and lower downside risk (-0.174787). These findings suggest that while the 3:2:1 portfolio was relatively more growth-oriented, the 60:40 portfolio remained more stable, defensive, and efficient on a risk-adjusted basis during the study period.

Discussion and Practical implication

H1: The 3:2:1 portfolio allocation generates higher average returns and long-term growth compared to the traditional 60:40 portfolio.

Results show that the 3:2:1 portfolio had slightly greater mean returns and CAGR than the 60:40 portfolio across the study period, which may indicate higher growth potential. Commodities were modestly added to the portfolio's structure to enhance returns and aid in diversification. The findings are consistent with previous research that emphasizes the rise of ESG-focused and diversified investing strategies in emerging markets (Jain et al., 2024). Based on the findings, the diverse allocation frameworks could offer better growth possibilities for retail investors aiming for long-term capital gains and sustainable wealth creation.

But the 3:2:1 portfolio did not have the same return performance without greater volatility, higher beta, and greater maximum drawdowns as compared to the 60:40 portfolio. This suggests that the extra growth was coming with a higher degree of sensitivity to the market and risk going down. While commodities had marginal positive effects on generation of returns, their effects on portfolio stability and risk-adjusted efficiency were not statistically significant (El Khoury et al., 2025). The results thus partially corroborate H1, with the 3:2:1 portfolio having slightly higher return and growth performance, while the traditional 60:40 portfolio had a relatively more stable and risk-efficient performance in turbulent times.

H2: The 60:40 portfolio demonstrates superior risk-adjusted performance, as measured by Sharpe ratio, Treynor ratio, and alpha, compared to the 3:2:1 portfolio.

Comparatively, the 60:40 portfolio always did better on the Sharpe ratio, Treynor ratio, alpha, and downside protection. These findings point to the indicator that the old allocation was still more efficient in risk-to-return transformation. This is the reason why the 60: 40 portfolio, although yielding less money, had more outstandingly better risk-adjusted results and reduced market sensitivity (Ali et al., 2024). The empirical findings thus indicate that diversification effects in this paper were operating less on the impact of commodity exposure and rather the presence of a stable fixed-income element, which minimised aggregate portfolio risk when the market was being stressed. The 60:40 portfolio seems to be more suitable for investors who want to preserve their capital more strongly, have less volatility, and have more possibilities to regulate their downside. The 3:2:1 portfolio can still be taken into consideration by comparatively growth-oriented investors, who are ready to accept a bit higher instability, as it has a rather minor superiority in returns and CAGR. The findings support H2, indicating that the 60:40 portfolio provided superior risk-adjusted efficiency and portfolio stability during the study period.

H3: The inclusion of commodities in the 3:2:1 portfolio enhances diversification benefits relative to the traditional equity-bond portfolio.

The correlation analysis is an important tool and gives insights into the diversification effectiveness of commodity inclusion in the 3:2:1 portfolio structure. The results indicate that the commodities prices and NIFTY 50 exhibited a high degree of positive correlation for the period under analysis, suggesting that they tracked a similar overall trend. This meant that the diversification benefit that was anticipated from the commodity exposure was limited and its impact on overall portfolio risk was not nearly as great. The results

corroborate with previous research such as that conducted by Singh (2023), Sahoo and Kumar (2023), and Khan et al. (2025) who have found that during periods of market uncertainty, sustainability-oriented investment strategies and sustainable indices in emerging markets tend to have correlated return movements and volatility spillovers.

The bond proxy, on the other hand, had a weak negative correlation with both equities and commodities, thus indicating the stabilising value of holding fixed-income securities in diversified portfolios. This suggests that the stability of a portfolio was more closely related to the proportion of bonds allocated to the portfolio rather than the proportion of commodities included, further highlighting the value of fixed-income securities in managing downside risk and enhancing portfolio resilience (Dsouza et al., 2025). The findings also reinforce the view that diversification efficiency is not just limited to alternative asset inclusion, but also the correlation among asset classes and how well ESG is embedded in portfolio strategies (Singh, 2023). However, the results are not very strong for H3 since the inclusion of commodities only offers some diversification benefits when compared with the standard equity-bond portfolio model.

H4: Diversified portfolio structures contribute to financial inclusion and sustainable wealth creation by improving accessibility, stability, and resilience for retail investors.

At a more general level, the findings will be relevant in the debate on sustainable and resilient investment allocation, demonstrating that diversification is not to be judged based on the increase in returns only, but also based on efficiency and resilience (Bahloul & Ben Amor, 2022). This is important to long-term household investment, inclusive financial planning, and accountable portfolio construction. This further reinforces the view that ESG-oriented investment strategies are closely linked to managing the risk–return trade-off rather than purely maximising returns (Tiwari et al., 2023).

The current results are generally in line with the previous research, indicating that the portfolio design can be considered not only in terms of the return, but also in terms of the efficiency and resilience of the risk. To illustrate this point, it has been previously determined that the quality of disclosure and characteristics related to sustainability can affect the outcomes of a portfolio, yet not all strategies and market environments will have such an outcome (Bermejo Climent et al., 2021). On the same note, there is some evidence that ESG-oriented portfolio inclusion is not necessarily associated with an increase in profitability, which is not unlike the current observation that the 3:2:1 portfolio provided a modest increase in returns as compared to the 60:40 portfolio (Cesarone et al., 2022).

The superior protection of the downside witnessed in the 60:40 portfolio also compares with studies that emphasise the defensive nature of sustainable and resilience-oriented investment strategies at times of crisis (Dai, 2022). Moreover, this topic is currently addressed by the literature that focuses on robust and sustainable portfolio optimisation, stating that the key aspects of allocation choices are investor preferences, risk tolerance, portfolio stability, and not only return maximisation (Escobar-Anel & Jiao, 2024; Varmaz et al., 2024). The major weakness of the current research is that the bond component is captured using a yield-based proxy, which can limit the accuracy in portfolio comparison. Besides, the analysis is limited to a set of Indian market proxies within the 2014-2024 timeframe, which can be a weakness of greater generalisation.

The framework can be further developed in the future to include direct ESG indices, financial inclusion factors, and other asset classes to understand whether sustainability-linked portfolio construction enhances the resilience and long-term investor performance. Despite generating relevant information, the research has several limitations. The first limitation is that it uses historical market data (which may not reflect all possible future developments or structural economic changes). A second limitation is that, although the study uses several proxy measures for each asset class, these do not exactly reflect the actual investment portfolios of retail investors worldwide. A third limitation is that it excludes individual investor factors, such as the tax implications of investments, transaction costs, and liquidity restrictions related to investments. A fourth limitation is that the study's treatment of ESG is conceptual (and not empirical) because it does not utilise an ESG-specific index or firm-level ESG scores. Lastly, the study's findings were limited to India during 2014-24. Therefore, the ability to generalise the study's findings across countries or over time may be limited.

Limitation of the Study

There are some limitations in the study which should be noted. Firstly, the analysis is based upon historical market data, which is not necessarily an accurate indicator of future market behaviour. Second, the study makes an assumption of market efficiency, while the financial market could be affected by behavioural and structural factors. Thirdly, the studied time period might fail to reflect future unprecedented market shocks or structural economic changes. Moreover, the analysis is based predominantly on market portfolio indicators and does not consider any factors that are specific to the investor, including taxation, transactions costs, liquidity needs, and investor financial goals. Moderate risk tolerance of investors is also assumed in the study, which can differ according to the preferences of investors. Lastly, the market proxies selected may not capture all the possible categories of retail investment opportunities in practice.

Conclusion

The research has been done between the performance of 3:2:1 and traditional 60:40 portfolio frameworks in the period 2014-2024 with respect to NIFTY 50, NIFTY Commodities and a government bond proxy. The results show that the 3:2:1 portfolio had slightly higher mean and CAGR, suggesting a slight edge in the long-term performance perspective. But, it was coupled with increased volatility, increased beta and greater drawdowns. Conversely, the 60:40 portfolio always outperformed on the risk adjusted performance measures, including better Sharpe ratio, Treynor ratio, alpha and downside protection. The results suggest that the 3:2:1 portfolio is more growth focused, but the traditional 60:40 allocation is more risk efficient. The study further highlights the importance of fixed-income exposure in enhancing portfolio stability and resilience. The results indicate that, beyond return expectations, volatility and tolerance, downside protection, and investment resilience should be all taken into consideration when making a portfolio selection. The work also advances the on-going debate on ESG-driven investments, sustainable finance, and inclusive wealth building in emerging market settings.

9.1 Practical Implications and Future Research Directions

The results are applicable to investors, financial planners and policy makers in the formulation of balanced and resilient investment portfolios. It seems more appropriate to discuss the traditional portfolio (60:40) for the risk-averse investor, who wants stability and downside protection, and the 3:2:1 portfolio for the growth-oriented investor willing to tolerate a relatively higher level of risk and volatility. The study also underscores the role of fixed income exposure in providing stability, which can be especially important in countries with emerging markets, where commodities diversification benefits may not always exist. In terms of policies, the ESG-directed portfolio approaches can facilitate financial inclusion and sustainable wealth generation by promoting access to and diversity of investment options. Other future research can include the introduction of ESG-based indices, other asset classes and also behavioural finance variables as well as cross-country comparison to further explore sustainability-linked portfolio performance and long-term financial resilience.

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References

1. Ali, S., Yousaf, I., & Vo, X. V. (2024). Comovements and hedging effectiveness between conventional and Islamic cryptocurrencies: Evidence from the COVID-19 pandemic. *International Journal of Emerging Markets*, 19(12), 4383–4408. <https://doi.org/10.1108/IJOEM-10-2021-1571>
2. Bahloul, S., & Ben Amor, N. (2022). A quantile regression approach to evaluate the relative impact of global and local factors on the MENA stock markets. *International Journal of Emerging Markets*, 17(10), 2763–2786. <https://doi.org/10.1108/IJOEM-03-2020-0251>
3. Bermejo Climent, R., Garrigues, I. F. F., Paraskevopoulos, I., & Santos, A. (2021). ESG disclosure and portfolio performance. *Risks*, 9(10), 172. <https://doi.org/10.3390/risks9100172>
4. Billio, M., Costola, M., Hristova, I., Latino, C., & Pelizzon, L. (2024). Sustainable finance: A journey toward ESG and climate risk. *International Review of Environmental and Resource Economics*, 18(1), 1-75.
5. Cesarone, F., Martino, M. L., & Carleo, A. (2022). Does ESG impact really enhance portfolio profitability?. *Sustainability*, 14(4), 2050. <https://doi.org/10.3390/su14042050>
6. Chen, C., Pal, S., Mahalik, M. K., & Gozgor, G. (2025). The impact of financial inclusion on sustainable development: Evidence from BICS economies. *Research in International Business and Finance*, 103224. <https://doi.org/10.1016/j.ribaf.2025.103224>
7. Dai, Y. (2022). Is ESG investing an 'equity vaccine' in times of crisis? Evidence from the 2020 Wuhan Lockdown and the 2022 Shanghai Lockdown. *Borsa Istanbul Review*, 22(5), 992-1004. <https://doi.org/10.1016/j.bir.2022.07.003>
8. Dsouza, S., Singh, N. P., & Oliyide, J. A. (2025). Dynamic connectedness among the BRICS markets and the recent pandemic: An application of TVP-VAR approach. *International Journal of Emerging Markets*, 20(9), 3721–3743. <https://doi.org/10.1108/IJOEM-11-2022-1673>
9. El Khoury, R., Mensi, W., Alshater, M. M., & Kang, S. (2025). Extreme risk spillovers and hedging strategies between Indonesia sectorial stocks and commodity markets. *International Journal of*

- Emerging Markets, 20(1), 428–467. <https://doi.org/10.1108/IJOEM-11-2022-1721>
10. Escobar-Anel, M., & Jiao, Y. (2024). Robust portfolio optimisation with environmental, social, and corporate governance preference. *Risks*, 12(2), 33. <https://doi.org/10.3390/risks12020033>
 11. Investing.com. (2026.). Nifty commodities historical data. Investing.com. Retrieved March 24, 2026, from <https://in.investing.com/indices/cnx-commodities-historical-data>
 12. Jain, P., Kanoujiya, J., & Rastogi, S. (2024). Impact of financial inclusion and ESG on the sustainable growth of the nation: Moderating role of poverty. *Vision: The Journal of Business Perspective*. Advance online publication. <https://doi.org/10.1177/09722629241271509>
 13. Khan, S., Rehman, M. Z., Shahzad, M. R., Khan, N. U., & Razak, L. A. (2025). How prone are emerging markets' sectoral indices to global uncertainties? Evidence from the quantile connectedness approach with portfolio implications. *International Journal of Emerging Markets*, 20(4), 1569–1592. <https://doi.org/10.1108/IJOEM-12-2022-1920>
 14. Khandelwal, V., Sharma, P., & Chotia, V. (2023). ESG disclosure and firm performance: an asset-pricing approach. *Risks*, 11(6), 112. <https://doi.org/10.3390/risks11060112>
 15. Lauria, D., Lindquist, W. B., Mittnik, S., & Rachev, S. T. (2025). Environmental, social and governance-valued portfolio optimisation and dynamic asset pricing. *Journal of Risk and Financial Management*, 18(3), 153. <https://doi.org/10.3390/jrfm18030153>
 16. Lin, W., & Wang, J. (2025). Sustainable finance and carbon Neutrality: The role of green bonds, ESG investments, and carbon pricing. *Journal of Environmental Management*, 395, 127731.
 17. Markowitz, H. (1952). Portfolio selection. *The Journal of Finance*, 7(1), 77–91. <https://doi.org/10.1111/j.1540-6261.1952.tb01525.x>
 18. Matos, P. (2020). ESG and responsible institutional investing around the world: A critical review.
 19. Mezghani, T., Ben Hamadou, F., & Boujelbène-Abbes, M. (2025). Network connectedness and portfolio hedging of green bonds, stock markets and commodities. *International Journal of Emerging Markets*, 20(5), 2154–2181. <https://doi.org/10.1108/IJOEM-02-2023-0160>
 20. Mirza, N., Tudor, C. D., Horobet, A., & Belascu, L. (2025). Optimising global risk-conscious portfolios: the strategic role of Sharia-compliant and ESG investments. *Sustainability Accounting, Management and Policy Journal*. <https://doi.org/10.1108/SAMPJ-08-2024-0879>
 21. Mishra, D., Kandpal, V., Agarwal, N., & Srivastava, B. (2024). Financial inclusion and its ripple effects on socio-economic development: a comprehensive review. *Journal of Risk and Financial Management*, 17(3), 105. <https://doi.org/10.3390/jrfm17030105>
 22. National Stock Exchange of India. (2026.). Historical index data. NSE India. Retrieved March 24, 2026, from <https://www.nseindia.com/reports-indices-historical-index-data>
 23. Nóbrega, M. B., Felipe, I. J. D. S., & Araújo, R. L. F. D. (2025). ESG IN PORTFOLIO CONSTRUCTION: WHAT DOES THE SCIENTIFIC LITERATURE REVEAL?. *Revista de Administração de Empresas*, 65, e2024-0569. <https://doi.org/10.1590/S0034-759020250606x>
 24. Pandey, A., Kiran, R., & Sharma, R. K. (2023). Investigating the determinants of financial inclusion in BRICS economies: Panel data analysis using fixed-effect and cross-section random effect. *Sustainability*, 15(2), 1603. <https://doi.org/10.3390/su15021603>
 25. Persaud, A., & Thaffe, W. (2023). The state of financial inclusion research in developing countries. *Transnational Corporations Review*, 15(4), 22–34. <https://doi.org/10.1016/j.tncr.2023.08.002>
 26. Popescu, I. S., Hitaj, C., & Benetto, E. (2021). Measuring the sustainability of investment funds: A critical review of methods and frameworks in sustainable finance. *Journal of Cleaner Production*, 314, 128016. <https://doi.org/10.1016/j.jclepro.2021.128016>
 27. Rao, A., Dagar, V., Sohag, K., Dagher, L., & Tanin, T. I. (2023). Good for the planet, good for the wallet: The ESG impact on financial performance in India. *Finance Research Letters*, 56, 104093. <https://doi.org/10.1016/j.frl.2023.104093>
 28. Reserve Bank of India. (2026). Database on the Indian economy. Reserve Bank of India. Retrieved March 24, 2026, from <https://data.rbi.org.in/BOE/OpenDocument/2409211437/OpenDocument/opendoc/openDocument.jsp>
 29. Sabirali, K. P., & Mahalakshmi, S. (2023). Corporate sustainability practices: A systematic literature review and bibliometric analysis. *Vision: The Journal of Business Perspective*. Advance online publication. <https://doi.org/10.1177/09722629231203125>
 30. Sahoo, S., & Kumar, S. (2023). Volatility spillover among the sustainable indices of emerging markets: Evidence from pre-COVID and COVID periods. *Vision: The Journal of Business Perspective*. Advance online publication. <https://doi.org/10.1177/09722629231212107>
 31. Sharma, U., & Changkakati, B. (2022). Dimensions of global financial inclusion and their impact on the achievement of the United Nations Development Goals. *Borsa Istanbul Review*, 22(6), 1238–1250.

- <https://doi.org/10.1016/j.bir.2022.08.010>
32. Singh, K. (2023). Green operations and corporate financial performance: Does the ESG sensitivity matter? *Vision: The Journal of Business Perspective*. Advance online publication. <https://doi.org/10.1177/09722629231194396>
 33. Tiwari, R., Sharma, N., & Sharma, N. K. (2023). Categorizing and understanding the evolution of literature on ESG investments: A bibliometric analysis. *Vision: The Journal of Business Perspective*. Advance online publication. <https://doi.org/10.1177/09722629231197574>.
 34. Varmaz, A., Fieberg, C., & Poddig, T. (2024). Portfolio optimisation for sustainable investments. *Annals of Operations Research*, 341(2), 1151-1176. <https://doi.org/10.1007/s10479-024-06189-w>
 35. Verma, R. K., & Bansal, R. (2021). Impact of macroeconomic variables on the performance of stock exchange: A systematic review. *International Journal of Emerging Markets*, 16(7), 1291–1329. <https://doi.org/10.1108/IJOEM-11-2019-0993>
 36. YADAV, A. (2025). GOLD AND REITS AS PORTFOLIO DIVERSIFIERS.
 37. Yin, X. N., Li, J. P., & Su, C. W. (2023). How does ESG performance affect stock returns? Empirical evidence from listed companies in China. *Heliyon*, 9(5).