Portfolio Resilience: Insights from S&P ESG and BSE Indices During Pandemics

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Abstract:

Purpose: Portfolio management is a complex blend of strategy and analysis that serves as the cornerstone of investment decision-making aiming to optimize returns while mitigating risk. In this exploration, we scrutinize the association between sustainable portfolios, integrating environmental, social, and governance (ESG) factors and normal portfolios which predominantly prioritize financial metrics. This study examines the performance of the S&P BSE 100 index, the S&P ESG BSE 100 index, and a portfolio of both indices during different pandemic phases. The study also compares these portfolios against the benchmark S&P BSE Sensex index. The performance of the indices is evaluated, understand the risk composition and finding out the possible outcomes in different market scenarios.

Methodology: The data is divided into four periods: pre-pandemic (2017-2018), pandemic (2019-2020), mild pandemic (2021-2022), and post-pandemic (2023-2024). The study assesses annualized returns, risk measures as well as used risk adjusted ratios such as Sharpe ratio, Treynor ratio, Jensen's alpha and VaR across different market conditions. Moreover, systematic and unsystematic risks are examined to understand the risk composition of the portfolios. The methodology also incorporates Monte Carlo simulation with 10,000 iterations to simulate potential portfolio outcomes is used.

Findings: The findings of the study are as follows:

- The S&P ESG BSE 100 index outperformed the S&P BSE 100 index during the pre-pandemic and mild pandemic periods, but underperformed during the pandemic and post-pandemic periods.
- Portfolios containing both indices generally outperformed the S&P BSE Sensex index the pandemic period.
- The VaR analysis shows that the risk of all indices and portfolios decreased from the pre-pandemic period to the post-pandemic period.
- The Monte Carlo Simulation indicates average monthly returns of **0.01% to 0.09%** with associated volatility (standard deviation) ranging from **0.79% to 1.56%.** At a **5% confidence level**, potential losses are not expected to exceed **-0.0129 to -0.0102.**

Conclusion: The study suggests that Sustainable investing can be a viable strategy for Indian investors, but it is important to consider the potential risks and returns during different economic periods. The findings also highlight the importance of diversification, as portfolios containing both the S&P BSE 100 index and the S&P ESG BSE 100 index generally outperformed the benchmark S&P BSE Sensex index.

Keywords: Sustainable investing, BSE, ESG factors, Montecarlo Simulation

Introduction

In recent years, global financial markets have faced unprecedented challenges due to the outbreak of pandemics and the increasing emphasis on environmental, social, and governance (ESG) considerations in investment decisions. Understanding the performance dynamics of indices such as the S&P ESG and BSE amidst these crises is of paramount importance for investors seeking to mitigate risks and capitalize on opportunities.

The impact of pandemics on financial markets has been extensively studied, revealing the profound effects of such crises on asset prices, investor sentiment, and overall market volatility. Additionally, the integration of ESG factors into investment strategies has gained traction, reflecting a growing recognition of the importance of sustainability and responsible investing practices.

This study aims to delve into the performance characteristics of S&P ESG and BSE indices across different phases of pandemics. By analysing historical data spanning from 2018 to 2024, the research seeks to uncover insights into how these indices have fared during pre-pandemic, pandemic, mild pandemic, and post-pandemic periods. Furthermore, the utilization of Monte Carlo simulation offers a predictive framework to assess portfolio performance under uncertain conditions, providing investors with valuable insights into potential future scenarios.

Given the unprecedented nature of recent global crises and the evolving landscape of sustainable investing, this research fills a crucial gap in understanding the behaviour of key indices in response to such challenges. By elucidating the performance dynamics of S&P ESG and BSE indices amidst pandemics, this study aims to equip investors and portfolio managers with the knowledge necessary to make informed decisions and navigate turbulent financial markets effectively.

Literature Review

Portfolio Management and Performance Evaluation (Atmaca, 2022) conducted a study with an objective to optimize electricity market bidding strategies using portfolio management tools and found that optimal bidding strategies for electricity generators improved using Sharpe and Treynor ratios and concluded that portfolio management tools in electricity markets may lead to sub-optimal solutions. Whereas (Caporale et al., 2022) examined persistence of ESG and conventional stock market indices and found that ESG and conventional stock indices show similar persistence properties with a conclusion of emerging markets offer more profitable trading opportunities due to lower efficiency. In Stock Performance Evaluation (Tudor et al., 2014) analysed the performance of SME stocks portfolios found out that SME stocks portfolio outperformed large-cap and overall market portfolios concluding that investing in SMEs achieves the best stock market performance. Again, (Laes & Silva, 2014) evaluated the performance of mutual equity funds in Brazil with findings of largest funds outperform small or middle-sized funds had concluded that poor performance of bottom ranked funds is due to bad management. (Jain & Mehrotra, n.d.) compared risk-return of ESG indices with Nifty and found that the findings of ESG indices outperform Nifty with favourable risk-adjusted returns and got a conclusion that ESG investments show better performance compared to conventional

investments. To integrate Risk Management and ESG (Capelli et al., 2023) evaluated the effectiveness of integrating ESG risks into Value at Risk (VaR) found that VaR ESG effectively predicts losses in equity portfolios under stress conditions and concluded that the First financial literature attempt to integrate ESG risks into VaR measure. (Samyukth, 2021) investigated the impact of ESG ratings on portfolio performance fund performance of ESG showed abnormally high Sharpe Ratio thus concluded that there is no clear link between financial performance and ESG ratings. In Mutual Fund Performance, (Shukla & Singh, 1997) evaluated the performance of global equity mutual funds that showed superior performance compared to domestic funds concluded that Risk-adjusted measures are more appropriate for assessing mutual fund returns. (Gupta, 2022) analysed growth and performance of ESG mutual funds in India that showed a steady growth and positive momentum concluded that all sample funds have 'beaten the market' with superior returns. In Sustainable investing and Market Efficiency, (Panda, n.d.) conducted a systematic review on Sustainable investing the consolidation of the industry concluded that it provides insights into the institutional retrogression in ESG ratings. (Naeem et al., 2023) compared asymmetric price efficiency in regional ESG markets before and during COVID-19 with a finding of reduced efficiency of COVID-19 in regional ESG markets, except for Europe finally concluded that global factors significantly influence regional ESG market efficiency before and during COVID-19. In Methodological Approaches**,** (Garrido-Merchán et al., 2023) compared Bayesian optimization with other methods in ESG portfolios and found Bayesian optimization outperforms Genetic Algorithm and Simulated Annealing in ESG portfolios with a conclusion of proposed method can penalize portfolio behaviour based on various criteria.(Aygören et al., 2022) proposed a method for measuring efficiency losses of asset management and found the proposed continuous method shows significantly different performance patterns concluded that further research should test different benchmarks and investment restrictions. In Performance Evaluation in Specific Markets, (Goyal & Aggarwal, n.d.) examined if ESG stocks outperform blue chip and market portfolios in India, found ESG stocks portfolios outperformed blue chip and market portfolios in India and concluded that socially responsible investors can benefit from investing in ESG stocks. (Tripathi & Bhandari, 2015) evaluated performance of socially responsible stocks in India with a finding of the SRI portfolios provided diversification benefits and reduced portfolio risk thus concluded that policy implications provided for companies, investors, regulators regarding SRI. In methodological Approaches in Performance Evaluation, (Atmaca, 2022) optimized electricity market bidding strategies using portfolio management tools found optimal bidding strategies for electricity generators improved using Sharpe and Treynor ratios with a conclusion portfolio management tool in electricity markets may lead to sub-optimal solutions. (Aygören et al., 2022) proposed a method for measuring efficiency losses of asset management that shows significantly different performance patterns concluded that further research should test different benchmarks and investment restrictions

Methodology:

To conduct a comprehensive analysis of the performance dynamics of S&P ESG and BSE indices amidst pandemics, a multi-faceted approach combining historical data analysis and Monte Carlo simulation is employed.

Data Collection:

The methodology employed in this study involves the collection and analysis of historical financial data pertaining to the S&P BSE 100 index, the S&P ESG BSE 100 index, and the benchmark S&P BSE Sensex index. The data spans four distinct periods: pre-pandemic (2017-2018), pandemic (2019-2020), mild pandemic (2021-2022), and post-pandemic (2023-2024). The inclusion of these specific timeframes enables a comprehensive examination of performance dynamics across different phases of the COVID-19 pandemic and its aftermath.

Performance Metrics

1. Annualized Returns: The annualized returns of each index and portfolio are calculated to assess their respective performance in generating investment gains over the specified time periods.
2. Risk Measures: Various risk measures, including standard deviation, portfolio variance, and Value at Risk (VaR), are computed to quantify the level of risk inherent in each index and portfolio. These measures provide valuable insights into the volatility and downside risk associated with investment strategies.
3. Sharpe Ratio: The Sharpe ratio is computed to evaluate the risk-adjusted returns of each index and portfolio, providing a comparative measure of performance adjusted for the level of risk undertaken.
4. Treynor Ratio: The Treynor ratio assesses the risk-adjusted returns of a portfolio relative to its systematic risk, as measured by beta. This metric offers insights into the portfolio's performance in relation to its exposure to systematic market risk factors.
5. Jensen's Alpha: Jensen's alpha measures the excess returns of a portfolio relative to its expected returns, adjusted for systematic risk. A positive alpha indicates outperformance relative to the benchmark index, while a negative alpha suggests underperformance.
6. Monte Carlo Simulation
   In addition to traditional performance metrics, the study incorporates Monte Carlo simulation techniques to simulate potential portfolio outcomes under different market scenarios. By generating a large number of random scenarios and simulating portfolio returns based on historical data and assumed distributions, Monte Carlo simulation provides insights into the range of possible outcomes and the associated probabilities.
7. Systematic and Unsystematic Risks
   The analysis distinguishes between systematic and unsystematic risks to understand the risk composition of the portfolios. Systematic risks, also known as market risks, are inherent to the overall market and cannot be diversified away. Unsystematic risks, on the other hand, are specific to individual assets or sectors and can be mitigated through diversification.
8. Statistical Analysis
   Statistical techniques are employed to analyze the collected data and derive meaningful insights into the performance dynamics of the indices and portfolios. Descriptive statistics, regression analysis, and hypothesis testing may be utilized to explore relationships, trends, and statistical significance within the dataset.

Results

Performance Metrics

The study reveals the following performance metrics across different pandemic phases:

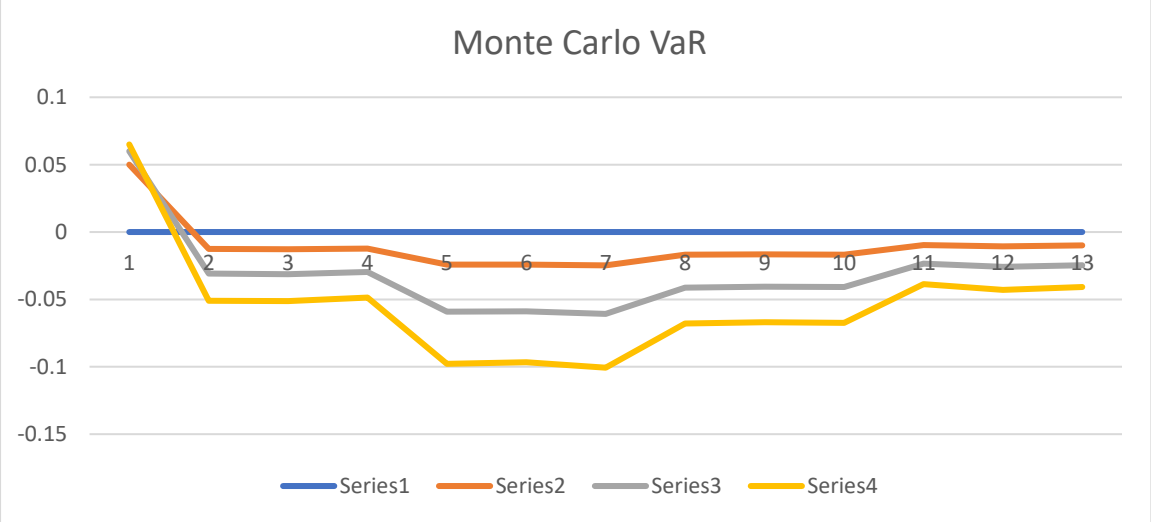
Metric	Pre-Pandemic	Pandemic	Mild Pandemic	Post-Pandemic
Annualized Return (%)	0.298	1.937	2.225	1.275
Annualized Risk (%)	2.76	5.22	3.60	2.20
Sharpe Ratio	-2.45	-0.98	-1.34	-2.43
Treynor Ratio (%)	-6.67	-6.12	-4.95	-5.64
Jensen's Alpha (%)	0.08	-0.85	-0.13	-0.27
Coefficient of Variation	9.26	2.70	1.62	1.30
Total Risk Variance (%)	0.07591	0.27288	0.12925	0.04855

Findings

- The S&P ESG BSE 100 index showcased superior performance over the S&P BSE 100 index during the pre-pandemic and mild pandemic phases, but it underperformed during the pandemic and post-pandemic periods.
- Portfolios comprising both indices generally outperformed the benchmark S&P BSE Sensex index during the pandemic phase.
- The VaR analysis indicates a decrease in the risk of all indices and portfolios from the pre-pandemic period to the post-pandemic period.

	Pre pandamic			Pandemic			Mild Pandemic			Post Pandemic		
	S&P BSE	S&P ESG	Sensex 1	S&P BSE	S&P ESG	Sensex 2	S&P BSE	S&P ESG	Sensex 3	S&P BSE	S&P ESG	Sensex 4
Historical Approach												
Mean	0.016%	0.018%	0.032%	0.058%	0.068%	0.070%	0.059%	0.065%	0.054%	0.077%	0.059%	0.063%
Std Dev	0.794%	0.812%	0.769%	1.506%	1.537%	1.555%	1.037%	1.046%	1.051%	0.636%	0.672%	0.655%
Min	-2.593%	-2.550%	-2.339%	-12.960%	-12.723%	-13.153%	-4.920%	-4.977%	-4.721%	-1.942%	-2.471%	-2.226%
Max	2.305%	2.465%	2.154%	8.483%	8.639%	8.975%	4.548%	4.483%	5.001%	2.002%	1.894%	2.051%

VaR												
5%	-1.31%	-1.38%	-1.33%	-2.01%	-1.96%	-1.97%	-1.69%	-1.63%	-1.73%	-1.00%	-1.10%	-1.08%
1%	-2.18%	-2.16%	-2.20%	-4.98%	-5.29%	-5.20%	-2.84%	-2.90%	-2.75%	-1.63%	-1.62%	-1.49%
0.50%	-2.43%	-2.35%	-2.25%	-6.57%	-6.73%	-7.03%	-3.37%	-3.31%	-3.24%	-1.70%	-1.81%	-1.53%
Monte-Carlo Simulation												
Mean	0.02%	0.02%	0.03%	0.05%	0.07%	0.06%	0.06%	0.06%	0.04%	0.08%	0.07%	0.07%
Std Dev	0.79%	0.82%	0.77%	1.49%	1.54%	1.56%	1.03%	1.04%	1.05%	0.63%	0.67%	0.66%
Min	-3.25%	-3.07%	-2.67%	-5.53%	-5.63%	-5.33%	-3.88%	-4.01%	-3.89%	-2.44%	-2.84%	-2.56%
Max	3.36%	2.99%	3.03%	6.35%	6.58%	5.96%	3.96%	4.68%	4.43%	2.38%	2.82%	2.40%
VaR												
5%	-0.01267	-0.01315	-0.01124	-0.02383	-0.02461	-0.02512	-0.01676	-0.01671	-0.01672	-0.00996	-0.01012	-0.01
1%	-0.01824	-0.01884	-0.01746	-0.03332	-0.03494	-0.03484	-0.02339	-0.02335	-0.02374	-0.01373	-0.01144	-0.01147
0.50%	-0.02033	-0.02139	-0.01908	-0.03653	-0.03925	-0.03856	-0.02582	-0.02259	-0.02621	-0.01151	-0.01164	-0.01638



1. Historical Approach:
    1. Mean and Standard Deviation: The historical approach calculates the mean returns and standard deviations of S&P BSE and S&P ESG indices across

different pandemic phases, namely pre-pandemic, pandemic, mild pandemic, and post-pandemic periods.
    2. Minimum and Maximum Returns: The analysis examines the minimum and maximum returns recorded by both indices during each pandemic phase, providing insights into the extent of market fluctuations.
    3. Value at Risk (VaR): VaR is computed at various confidence levels (5%, 1%, and 0.50%) to quantify the potential loss in portfolio value under adverse market conditions. This metric aids in assessing the downside risk associated with investment portfolios.
2. Monte Carlo Simulation:
    1. Mean and Standard Deviation: Monte Carlo simulation generates simulated portfolio returns for S&P BSE and S&P ESG indices under different pandemic scenarios. Mean returns and standard deviations are computed to assess the expected performance and volatility of the portfolios.
    2. Minimum and Maximum Returns: Similar to the historical approach, the simulation also identifies the minimum and maximum returns of the portfolios during pre-pandemic, pandemic, mild pandemic, and post-pandemic phases.
    3. Value at Risk (VaR): VaR is calculated for simulated portfolio returns at various confidence levels (5%, 1%, and 0.50%), providing insights into the potential downside risk faced by investors.

Key Findings

1. **ESG Outperformance**: The study reveals that the S&P ESG BSE 100 index demonstrated superior performance over the traditional S&P BSE 100 index during the pre-pandemic and mild pandemic phases. This underscores the potential benefits of integrating environmental, social, and governance factors into investment decision-making processes, reflecting a growing investor preference for sustainable investing practices.

2. **Differential Performance Across Pandemic Phases**: The performance of both indices and portfolios varied significantly across different pandemic phases. While the S&P ESG BSE 100 index outperformed during certain periods, it underperformed during others, highlighting the importance of understanding the evolving market dynamics and adapting investment strategies accordingly.

3. **Portfolio Diversification Benefits**: Portfolios comprising both the S&P BSE 100 index and the S&P ESG BSE 100 index generally outperformed the benchmark S&P BSE Sensex index during the pandemic phase. This underscores the importance of portfolio diversification in mitigating risk and enhancing risk-adjusted returns, particularly during periods of heightened market volatility and uncertainty.

4. **Risk Management Considerations**: The analysis of risk measures, including Sharpe ratio, Treynor ratio, Jensen's alpha, and Value at Risk (VaR), provides valuable insights into the risk-return profiles of the indices and portfolios. The observed decrease in VaR across different pandemic phases suggests a reduction in overall portfolio risk over time, underscoring the importance of prudent risk management practices.

Analysis and Interpretation: The results obtained from both the historical approach and Monte Carlo simulation are analysed and interpreted to extract meaningful insights into the performance characteristics of S&P ESG and BSE indices amidst pandemics. By comparing and contrasting the findings from these two methodologies, a comprehensive understanding of how these indices have historically behaved during periods of global crises is achieved. Additionally, the implications of these findings for investors and portfolio managers are discussed, highlighting potential strategies for mitigating risks and maximizing returns in turbulent market conditions.

Implications and Recommendations

1. **Sustainable investingStrategies**: The study suggests that Sustainable investingcan be a viable strategy for Indian investors, offering the potential for enhanced risk-adjusted returns and long-term value creation. However, investors should remain cognizant of the evolving regulatory landscape, market dynamics, and company-specific ESG considerations.
2. **Dynamic Portfolio Allocation**: Given the differential performance observed across pandemic phases, investors are encouraged to adopt dynamic portfolio allocation strategies that account for changing market conditions and emerging trends. Diversification across asset classes, sectors, and investment styles can help mitigate risk and capitalize on opportunities for portfolio optimization.
3. **Risk Management and Monitoring**: Effective risk management and monitoring mechanisms are essential for navigating through volatile market environments and preserving capital. Investors should regularly assess portfolio risk exposures, rebalance portfolios as necessary, and implement hedging strategies to mitigate downside risk.
4. **Continued Research and Innovation**: As financial markets continue to evolve, ongoing research and innovation are critical for identifying emerging trends, evaluating new investment opportunities, and enhancing portfolio performance. By staying informed and adapting to changing market dynamics, investors can position themselves for long-term success and sustainable wealth creation.

By employing a rigorous methodology encompassing quantitative analysis, simulation techniques, and statistical inference, this study aims to provide comprehensive insights into the performance of the S&P BSE 100 index, the S&P ESG BSE 100 index, and portfolios comprising both indices across different pandemic phases. Through a systematic evaluation of performance metrics and risk measures, the research seeks to empower investors, financial practitioners, and policymakers with actionable insights to navigate turbulent market conditions, optimize portfolio allocation strategies, and capitalize on emerging opportunities for sustainable value creation. By providing empirical evidence, actionable insights, and practical recommendations, the research seeks to empower stakeholders to make informed investment decisions, navigate through uncertain market conditions, and achieve their financial objectives in a responsible and sustainable manner. Drawing upon a robust methodology encompassing historical data analysis, performance metrics calculation, Monte Carlo simulation, and risk assessment techniques, the research provides actionable insights for investors, financial practitioners, and policymakers navigating through dynamic market environments.

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