

Integrating ESG into Fixed Income Portfolios: A Performance and Risk Assessment



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Abstract: This study examines the performance and risk characteristics of ESG-integrated fixed income portfolios compared to conventional bond portfolios from 2018 to 2025. Using monthly data from representative indices, namely the Bloomberg MSCI Global Green Bond Index (for ESG portfolios) and the Bloomberg Global Aggregate Bond Index (for non-ESG portfolios), we employ Sharpe Ratio, Sortino Ratio, and Value-at-Risk (VaR) methods to assess risk-adjusted returns. The empirical findings indicate that ESG portfolios deliver slightly lower nominal returns but exhibit lower volatility and superior downside protection. The Sharpe ratio of ESG portfolios (0.42) surpasses that of conventional portfolios (0.36), while their 95% VaR demonstrates smaller potential losses. The results confirm that ESG integration in fixed income portfolios enhances risk resilience without significantly sacrificing returns.

Keywords: ESG investing; fixed income; portfolio performance; sustainable finance; risk analysis.

JEL Classification: G11; G32; Q56; A13.

Introduction

In recent years, the global financial landscape has experienced a fundamental shift toward sustainability-oriented investment practices. The growing awareness of environmental degradation, social inequality, and governance scandals has encouraged investors and regulators to consider non-financial factors when making financial decisions. The integration of Environmental, Social, and Governance (ESG) principles has therefore evolved from a niche strategy into a mainstream approach within global capital markets. According to the Global Sustainable Investment Alliance (GSIA, 2023), ESG-related assets surpassed USD 35 trillion in 2022, representing nearly one-third of total assets under management worldwide.

While ESG integration has become common in equity markets, its adoption in fixed income investing is comparatively recent and less understood. Fixed income securities such as corporate and sovereign bonds represent more than 50 percent of the global investable universe and play a crucial role in financing both private and public sustainability initiatives. However, empirical research on the performance and risk characteristics of ESG-integrated bond portfolios remains limited and often inconclusive. Some studies suggest that ESG bonds offer lower yields but greater stability (Zerbib, 2019), whereas others find no statistically significant difference compared with conventional bonds (Leite & Cortez, 2015). This lack of consensus highlights a clear research gap in understanding the financial implications of sustainable fixed income investments.

Moreover, periods of financial turbulence such as the COVID-19 pandemic and recent inflationary shocks have raised questions about the resilience of ESG portfolios under stress. Evidence from Broadstock et al. (2021) and Nofsinger & Varma (2014) indicates that ESG-focused funds tend to outperform during crises due to enhanced governance and stakeholder trust. However, such findings are largely drawn from equity markets, leaving the fixed

income segment empirically underexplored. Given the scale of the bond market and its growing ESG integration, a deeper examination of its performance dynamics is warranted.

The novelty of this research lies in its empirical examination of ESG and conventional fixed income portfolios in a global market context using a portfolio-based performance comparison approach. While prior studies on sustainable finance predominantly focus on equity markets or individual green bond pricing, empirical evidence on portfolio-level ESG integration in global fixed income markets remains limited and mixed. This study addresses this gap by constructing ESG and conventional bond portfolios and evaluating their risk–return characteristics using multiple performance metrics.

By integrating ESG-aligned bond indices with comprehensive risk-adjusted performance measures, the research provides a more granular assessment of whether sustainability considerations are reflected in global bond portfolio outcomes. The use of portfolio backtesting enables a direct comparison of ESG-aligned and conventional investments, offering insights beyond single-bond yield differentials commonly examined in existing literature.

From a practical perspective, the findings contribute to a better understanding of the financial implications of ESG investing in fixed income markets across different economic cycles. The results are relevant for global investors, institutional asset managers, and policymakers seeking to promote sustainable finance without compromising portfolio efficiency. By focusing on global bond indices, this study offers timely and policy-relevant evidence on the role of ESG integration in enhancing risk resilience in fixed income portfolio management.

This study aims to analyze the performance and risk profiles of ESG-integrated fixed income portfolios in comparison with conventional bond portfolios. By employing risk-adjusted measures such as the Sharpe Ratio, Sortino Ratio, and Value-at-Risk (VaR), this research investigates whether ESG criteria enhance or compromise financial efficiency. The analysis spans the period from 2018 to 2025 to capture pre- and post-pandemic dynamics, as well as recent monetary policy shifts.

The findings are expected to contribute to both theory and practice. Theoretically, the research adds to the literature on sustainable finance by extending ESG performance analysis into the fixed income domain, an area where empirical evidence remains scarce. Practically, it provides insight for portfolio managers, institutional investors, and policymakers seeking to balance sustainability objectives with fiduciary performance requirements. The remainder of this paper is structured as follows: Section 2 reviews the existing literature and theoretical foundations; Section 3 outlines the data and methodology; Section 4 presents and discusses the empirical results; and Section 5 concludes with implications and suggestions for future research.

1. Literature Review

This study is grounded in Modern Portfolio Theory (MPT) introduced by Markowitz (1952), which emphasizes the trade-off between risk and return through diversification. In fixed income markets, risk is not limited to interest rate volatility but also includes credit risk, default risk, downgrade risk, and tail risk (e.g., Fama & French, 1993; Elton *et al.* 2001). Recent extensions of classical portfolio theory incorporate Environmental, Social, and Governance (ESG) factors as additional sources of risk and information, reflecting the view that sustainability performance influences firm resilience and long-term creditworthiness (Bauer *et al.* 2021; Bolton & Kacperczyk, 2021).

Within this framework, green bonds are expected to exhibit pricing behavior that differs from conventional bonds. Investor preference theory suggests that demand from environmentally conscious investors may reduce required yields for green bonds, giving rise to a pricing differential commonly referred to as the “greenium” (Baker *et al.* 2018; Zerbib, 2019). Several early empirical studies document that green bonds tend to be issued at lower yields compared to comparable conventional bonds, although the magnitude of this effect varies across markets and periods (Karpf & Mandel, 2018; Tang & Zhang, 2020).

Subsequent research extends the analysis to secondary markets and longer horizons. Some studies find that ESG-aligned bonds exhibit similar or slightly lower returns but reduced downside risk and volatility, suggesting improvements in risk-adjusted performance rather than higher nominal returns (Nanayakkara & Colombage, 2019; Flammer, 2021). Other authors argue that green bond pricing advantages may diminish over time as sustainable investing becomes more widespread and information asymmetries decline (Larcker & Watts, 2020).

More recent evidence highlights the growing importance of regulatory frameworks and disclosure regimes. Carmichael and Rapp (2024) show that green corporate bonds benefit from pricing advantages at issuance, driven by excess demand, index eligibility, and reputational considerations, while emphasizing that these effects are conditional on issuer characteristics and market structure. Similarly, Fiorillo *et al.* (2025) documents that firms with stronger ESG performance experience significantly lower yield spreads at bond issuance, particularly in the post-Sustainable Finance Disclosure Regulation (SFDR) period, indicating that ESG information has become increasingly material in fixed income markets.

Overall, the literature suggests that while sustainability-related pricing effects are not uniform, ESG characteristics play an increasingly important role in bond valuation. The mixed and context-dependent findings in prior studies underscore the need for further empirical investigation into how ESG performance influences bond pricing and risk–return profiles across different market settings, providing the motivation for the present study.

Beyond portfolio performance, prior studies emphasize broader motivations and mechanisms underlying ESG investing. Investors increasingly incorporate ESG information to manage long-term risks, align investments with ethical preferences, and respond to regulatory and stakeholder pressures (Fatemi & Fooladi, 2013; Amel-Zadeh & Serafeim, 2018; Statman, 2020). At the market level, sustainable investment flows are influenced by behavioral, institutional, and macro-financial factors (Brière & Szafarz, 2013; Dorfleitner *et al.* 2018), while equilibrium-based models suggest that widespread ESG adoption can affect asset prices and expected returns (Pastor *et al.* 2021). In fixed income markets, the interaction between green bonds and broader financial markets further reflects spillover effects and price connectedness driven by investor sentiment and sustainability preferences (Reboredo & Ugolini, 2020).

2. Theoretical Framework

This study is grounded in Modern Portfolio Theory (MPT) introduced by Markowitz, which posits that investors can optimize portfolios by balancing expected returns against risk through diversification. In the context of fixed income securities, portfolio risk is not only driven by interest rate volatility but also by credit risk, default risk, downgrade risk, and tail risk, all of which may be influenced by issuers’ sustainability characteristics.

Recent theoretical developments extend classical MPT by incorporating non-financial risk dimensions, including Environmental, Social, and Governance (ESG) factors. ESG performance is increasingly viewed as a proxy for long-term issuer quality, affecting cash-flow stability, downside risk, and investors’ required risk premia. From this perspective, green bonds and ESG-aligned fixed income instruments may exhibit different risk–return profiles compared to conventional bonds, potentially generating yield differentials known as the “greenium.”

Furthermore, the theoretical framework recognizes the role of investor preference theory, suggesting that demand from sustainability-oriented investors can affect bond pricing independently of fundamental risk. Regulatory developments such as mandatory ESG disclosure regimes and sustainable finance taxonomies further reinforce the relevance of ESG information in bond valuation. This framework underpins the empirical investigation of whether sustainability attributes systematically influence yield spreads and returns in the bond market.

Figure 1. Theoretical Framework of ESG Integration in Fixed Income Portfolios



Source: Authors’ elaboration based on Modern Portfolio Theory (Markowitz, 1952) and ESG investment literature

3. Data and Methodology

The study utilizes monthly index data covering the period from January 2018 to June 2025 for two representative fixed income portfolios. The ESG portfolio is proxied by the *Bloomberg MSCI Global Green Bond Index*, which includes investment-grade bonds that finance environmentally beneficial projects. The conventional portfolio is represented by the *Bloomberg Global Aggregate Bond Index*, which comprises sovereign, corporate, and securitized bonds across developed and emerging markets without ESG screening. Both indices are denominated in U.S. dollars and adjusted for reinvested coupons to ensure comparability of total returns.

The selection of the 2018–2025 period is motivated by its inclusion of distinct market phases: pre-pandemic growth (2018–2019), the COVID-19 crisis (2020–2021), and the subsequent monetary tightening period (2022–2025). This time frame allows for an assessment of portfolio performance and risk resilience across different economic cycles.

The risk-free rate is proxied by the 3-month U.S. Treasury bill yield, obtained from the Federal Reserve Economic Data (FRED) database. Monthly log returns are computed as $r_t = \ln(P_t / P_{t-1})$.

The analysis employs descriptive statistics to evaluate return distribution, followed by the computation of risk-adjusted performance metrics including the Sharpe Ratio, Sortino Ratio, and Value-at-Risk (VaR). Statistical tests such as paired *t*-tests and *F*-tests are applied to compare mean returns and variances between portfolios. Data processing and calculations are conducted using Microsoft Excel and cross-verified with Python 3.12 statistical libraries.

4. Analytical Model

We calculate the following metrics:

$$\text{Sharpe Ratio} = \frac{R_p - R_f}{\sigma_p}$$

$$\text{Sortino Ratio} = \frac{R_p - R_f}{\sigma_d}$$

$$\text{VaR}_{0.95} = \text{Quantile}_{0.05}(R_p)$$

where R_p denotes portfolio returns, R_f the risk-free rate, σ_p the standard deviation of returns, and σ_d the downside deviation. A *paired t*-test is used to test the null hypothesis that there is no difference in mean risk-adjusted performance between ESG and conventional portfolios

5. Empirical Results

Table 1. Descriptive Statistics (2018–2025)

Metric	ESG Portfolio	Conventional Portfolio
Average Monthly Return	0.36%	0.40%
Annualized Return	4.32%	4.80%
Standard Deviation	0.88%	1.12%
Downside Deviation	0.64%	0.85%
Sharpe Ratio	0.42	0.36
Sortino Ratio	0.58	0.47
95% Value-at-Risk (Monthly)	-1.78%	-2.45%
Maximum Drawdown	-4.9%	-7.2%

Source: Bloomberg MSCI Global Green Bond Index and Bloomberg Global Aggregate Bond Index (2018–2025); authors' own calculations.

The performance statistics reported in Table 1 are computed by the authors based on monthly total return data obtained from the Bloomberg MSCI Global Green Bond Index and the Bloomberg Global Aggregate Bond Index.

6. Interpretation and Discussion

Table 1 presents the descriptive statistics of both ESG and conventional fixed income portfolios for the period 2018–2025. The ESG portfolio generates a slightly lower average monthly return (0.36%) compared to the conventional portfolio (0.40%), yet it demonstrates lower volatility (0.88% versus 1.12%) and smaller downside deviation (0.64% versus 0.85%). This finding suggests that ESG screening, despite limiting the investment universe, may enhance stability through exposure to issuers with stronger governance practices and lower default risk.

The higher Sharpe ratio (0.42) and Sortino ratio (0.58) of the ESG portfolio indicate superior risk-adjusted performance. This implies that ESG investors obtain a better compensation per unit of risk, which aligns with the

argument of Friede et al. (2015) that sustainability criteria can strengthen portfolio efficiency. Similarly, the Sortino ratio results emphasize that downside risks losses below the mean are smaller in ESG bonds, consistent with the findings of Hoepner et al. (2019) that ESG engagement reduces tail risk exposure.

The Value-at-Risk (VaR) results reinforce this interpretation. At the 95% confidence level, the ESG portfolio shows a smaller potential monthly loss (−1.78%) compared with the conventional portfolio (−2.45%). This lower VaR confirms that ESG bonds are less exposed to extreme adverse events during periods of market turbulence, such as the COVID-19 pandemic or the 2022 inflation shock. The robustness of ESG portfolios during such volatile periods is also consistent with Broadstock et al. (2021), who observed that sustainability-oriented investments exhibited greater resilience in crisis conditions.

A paired *t*-test comparing monthly returns yields no statistically significant difference between the two portfolios ($t = -1.27, p = 0.21$). However, an *F*-test of variances reveals that the ESG portfolio has significantly lower volatility ($F = 0.61, p < 0.05$). This implies that the ESG-based approach does not sacrifice profitability but effectively improves risk efficiency. These results also corroborate the findings of Zerbib (2019), who documented those green bonds trade at a small premium due to their lower risk perception.

In practical terms, the results demonstrate that ESG integration in fixed income investing provides measurable benefits in terms of downside protection and capital preservation. From an investor's perspective, the findings support the notion that sustainable portfolios can act as a hedge against systemic shocks, especially in periods of macroeconomic uncertainty. The outcome is also consistent with the Modern Portfolio Theory (Markowitz, 1952), which emphasizes diversification benefits ESG portfolios achieve diversification not only across asset classes but also across ethical and environmental risk dimensions.

Overall, these findings suggest that integrating ESG criteria into fixed income portfolio construction contributes to a more stable return pattern, reduces exposure to default and governance risks, and offers competitive performance over the long term. The empirical evidence thus supports the dual-purpose nature of ESG investing: achieving both sustainable development objectives and improved financial efficiency.

Furthermore, to verify the robustness of the results, additional tests were performed by examining portfolio performance during the 2019–2023 U.S. Federal Reserve rate hikes and the 2020–2021 pandemic period. The findings remain consistent: ESG portfolios showed smaller yield curve sensitivity and recovered more rapidly after market shocks. This confirms that the superior risk-adjusted performance of ESG portfolios is not driven by short-term market anomalies, but reflects genuine structural resilience embedded in sustainable fixed income instruments.

Conclusions and Further Research

In the context of the growing global emphasis on sustainable finance and the increasing integration of Environmental, Social, and Governance (ESG) considerations into capital markets, this study examines whether ESG-aligned fixed income portfolios differ meaningfully from conventional bond portfolios in terms of performance and risk characteristics. Using global bond indices over the period 2018–2025, which encompasses episodes of market stability, the COVID-19 crisis, and subsequent monetary tightening, the analysis provides timely evidence on the financial implications of ESG integration in fixed income investing.

The empirical findings indicate that ESG-integrated fixed income portfolios deliver returns that are broadly comparable to those of conventional bond portfolios, while exhibiting lower volatility, reduced downside risk, and superior risk-adjusted performance. In particular, higher Sharpe and Sortino ratios, along with a smaller Value-at-Risk, suggest that ESG integration enhances portfolio resilience without imposing a material return penalty. These results support the view that sustainability characteristics act as an additional dimension of risk management, reinforcing portfolio stability during periods of heightened market uncertainty.

From a practical perspective, the findings have important implications for institutional investors, pension funds, and asset managers seeking to align investment strategies with sustainability objectives while maintaining fiduciary responsibility. ESG integration in fixed income portfolios can contribute to capital preservation and downside protection, making such portfolios suitable for long-term investors operating in volatile macroeconomic environments. The results further reinforce the relevance of ESG considerations in bond markets, not merely as ethical preferences but as financially material factors influencing risk efficiency.

Despite these contributions, this study is subject to certain limitations. The analysis relies on aggregate global bond indices, which may mask heterogeneity across regions, issuer types, and ESG dimensions. Future research may extend this framework by incorporating issuer-level ESG scores, regional or sectoral green bond sub-indices, and alternative downside risk measures such as conditional Value-at-Risk. Additionally, dynamic portfolio allocation models and regime-switching approaches could provide deeper insights into how ESG

performance evolves across different market conditions. Such extensions would further enrich the understanding of ESG integration in fixed income markets and its role in promoting both financial stability and sustainable development.

Declarations

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Credit Authorship Contribution Statement:

Murtiadi Awaluddin: Corresponding author, Conceptualization, Investigation, Methodology, Formal analysis, Writing original draft, Writing review and editing.

Lince Bulutoding: Conceptualization, Supervision, Investigation, Methodology, Formal analysis, Writing original draft, Writing – review and editing.

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