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ESG Constraints and Portfolio Efficiency: A Review of Risk–Return Trade-offs in Modern Asset Allocation

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Abstract

ESG (Environmental, Social, and Governance) investing has become an important trend in global financial markets, as more investors consider sustainability factors alongside financial performance. However, research findings on how ESG constraints affect portfolio efficiency remain inconsistent. Some studies suggest that ESG integration does not harm risk-adjusted returns, while others argue that adding sustainability requirements may limit diversification and shift the efficient frontier. This paper reviews academic studies and industry reports published between 2010 and 2025 to examine how ESG constraints influence portfolio optimization under modern asset allocation models. The selected studies were organized into three thematic sections. The review finds that ESG integration generally does not significantly reduce long-term risk-adjusted returns, although its effect on the efficient frontier remains debated. Differences in ESG rating systems and regional regulatory environments contribute to these mixed results. Future research should focus on improving ESG measurement consistency and expanding empirical analysis in emerging markets.

Keywords

ESG constraints, portfolio efficiency, efficient frontier, risk–return trade-off, asset allocation

1. Introduction

Environmental, Social, and Governance (ESG) investing has gradually shifted from a niche ethical investment approach to a widely adopted strategy in global financial markets. Over the past decade, ESG assets under management have increased rapidly as institutional investors, asset managers, and regulators place greater emphasis on sustainability and long-term risk management. Climate change, corporate governance scandals, and social responsibility concerns have encouraged investors to consider non-financial factors alongside traditional financial indicators. At the same time, regulatory frameworks in regions such as the United States and the European Union have promoted greater transparency in ESG disclosure, further accelerating the integration of sustainability criteria into portfolio construction. As a result, ESG considerations have evolved beyond ethical preferences to become integral components of systematic risk assessment and investment decision-making. Modern portfolio theory suggests that introducing additional constraints into portfolio construction may influence diversification efficiency and risk–return outcomes. Since the development of the mean–variance framework proposed by Markowitz [1], portfolio optimization has focused

on balancing expected returns with acceptable levels of risk. When ESG screening or sustainability requirements are incorporated, the investment universe may become more restricted, potentially affecting the shape and position of the efficient frontier. In recent years, researchers have examined whether ESG-constrained portfolios perform differently from traditional unconstrained portfolios. Some studies find that ESG integration does not significantly reduce risk-adjusted returns and may even help manage long-term downside risk. Others argue that limiting investment choices through ESG screening can reduce diversification opportunities, which may lead to lower portfolio efficiency under certain conditions. Although the number of empirical studies has increased, conclusions remain inconsistent across different markets, time periods, and rating methodologies. These mixed findings suggest that the relationship between ESG constraints and portfolio efficiency is more complex than initially expected. Despite the growing body of research on ESG investing, several important gaps remain in the literature. First, empirical findings regarding the impact of ESG constraints on portfolio efficiency are inconsistent. While some studies report that ESG integration does not significantly compromise risk-adjusted returns, others suggest that additional screening requirements may reduce diversification and shift the efficient frontier inward. These conflicting conclusions create uncertainty for investors and researchers alike. Second, although recent studies have highlighted the issue of ESG rating divergence across different providers, limited research systematically examines how these inconsistencies affect portfolio optimization results. Differences in ESG scoring methodologies may lead to varying asset selections, which in turn influence portfolio construction outcomes. Finally, much of the existing literature focuses on specific regions or developed markets, with relatively less comparative analysis across regulatory environments. Variations in disclosure standards and policy frameworks may significantly shape ESG performance outcomes, yet cross-regional synthesis remains limited. These unresolved issues indicate the need for a structured literature review that clarifies areas of consensus, identifies sources of disagreement, and outlines directions for future research. Building on the identified research gaps, this review seeks to clarify how ESG constraints influence portfolio efficiency under modern asset allocation models. Specifically, it examines whether incorporating sustainability requirements alters efficient frontier positioning, affects risk-adjusted returns, and changes the performance of commonly used portfolios such as the global minimum variance and maximum Sharpe portfolios. In addition, this paper explores how ESG rating divergence and differences in regulatory environments may contribute to inconsistent empirical findings. By synthesizing recent academic studies and authoritative institutional reports, this review aims to identify areas of agreement and disagreement in the literature and to provide a clearer understanding of the current research landscape. Overall, the purpose of this study is to organize and evaluate existing evidence on ESG-constrained portfolio optimization, thereby offering insights for future research and practical investment decision-making.

2. Literature Review

2.1 The Evolution of ESG as Mainstream Finance

ESG investing did not emerge suddenly but developed from earlier forms of socially responsible investing (SRI). Early SRI strategies mainly relied on negative screening, excluding industries such as tobacco or weapons based on ethical concerns. Over time, this approach evolved into ESG integration, which evaluates environmental, social, and governance factors as measurable components of corporate performance rather than purely moral considerations. Unlike traditional SRI, ESG integration emphasizes systematic risk assessment and long-term value creation. ESG factors may influence firm stability, operational resilience, and exposure to regulatory risk. Amel-Zadeh and Serafeim [2] show that investors increasingly use ESG information for both ethical and financial decision-making purposes, reflecting a shift toward viewing sustainability as financially relevant rather than purely value-based. At the same time, ESG assets under management (AUM) have expanded rapidly across global markets. According to MSCI [3], global ESG assets have continued to grow significantly in recent years, reflecting increasing institutional participation and capital inflows. Institutional investors and asset managers increasingly incorporate ESG criteria into portfolio construction, particularly in Europe and North America. Regulatory frameworks have also played an important role in accelerating ESG adoption. In the European Union, sustainable finance disclosure regulations promote transparency, while in the United States, climate-related reporting initiatives encourage standardized ESG information. In addition, OECD [4] highlights the growing importance of ESG-related regulatory frameworks across developed markets, emphasizing the role of policy guidance in shaping sustainable investment practices.

These institutional and regulatory developments have helped transform ESG investing from a niche strategy into a mainstream financial practice.

2.2 ESG Constraints in Modern Portfolio Theory

Within the framework of modern portfolio theory introduced by Markowitz [1], introducing ESG constraints may affect diversification and portfolio efficiency. According to the mean–variance model, portfolio optimization depends on selecting assets that maximize expected return for a given level of risk. When certain firms are excluded due to ESG screening, the available investment universe may shrink, potentially influencing the position of the efficient frontier. Pedersen et al. [5] provide a theoretical model explaining how responsible investing can influence equilibrium asset prices and portfolio allocation. Their framework suggests that ESG preferences may affect both expected returns and asset demand, thereby shaping portfolio construction outcomes. Some studies argue that ESG constraints may shift the efficient frontier inward, reducing the maximum attainable return under certain risk levels. However, other research suggests that ESG integration can remove firms exposed to long-term sustainability risks, thereby improving portfolio resilience and downside protection. Overall, the impact appears context-dependent rather than universally positive or negative.

2.3 Data Reliability and ESG Measurement Challenges

One major issue in the ESG literature is rating divergence. Empirical comparisons of ESG methodologies [6] reveal substantial variation in measurement approaches. More recent research by Berg et al. [7] further demonstrates significant differences across major ESG rating agencies. Different providers often assign different ESG scores to the same company due to variations in data sources, weighting schemes, and evaluation criteria. These inconsistencies may lead to different portfolio construction outcomes and contribute to conflicting empirical findings. Another concern involves the reliability of corporate ESG disclosures. Inconsistent reporting standards and limited verification mechanisms create risks of greenwashing, where firms overstate their sustainability performance. Such measurement limitations may distort optimization results and reduce investor confidence. Finally, ESG implementation varies across regions. European markets tend to adopt stricter regulatory frameworks, while approaches in the United States and emerging markets differ in scope and enforcement. These regional differences affect available data and empirical outcomes, making cross-market comparisons more complex.

3. Discussion

3.1 Long-Term Performance and Risk Management Consensus

Meta-analytical evidence [8] suggests that ESG integration does not necessarily reduce long-term financial performance, a finding that can be further explained through the lens of Modern Portfolio Theory (MPT) and behavioral finance. From an MPT perspective, ESG factors act as additional dimensions of risk assessment, enabling investors to construct more efficient portfolios by incorporating non-traditional risks such as environmental liabilities, governance quality, and social instability. Rather than constraining diversification, ESG screening may enhance it by filtering out firms with asymmetric downside exposure, thereby maintaining or even improving long-term risk-adjusted returns. Behavioral finance reinforces this interpretation, as ESG-aligned firms often benefit from stronger investor confidence, reduced volatility due to reputational trust, and lower susceptibility to panic-driven selloffs during periods of market stress. However, the effects of ESG integration are not uniform across global markets. In developed regions such as the United States and Europe—where regulatory frameworks, disclosure standards, and investor awareness are more advanced—ESG strategies tend to exhibit more stable and consistent long-term performance. In contrast, emerging markets often show greater variability due to weaker institutional enforcement, inconsistent ESG reporting, and differing economic priorities, all of which can limit the effectiveness of ESG screening. These differences suggest that the financial materiality of ESG factors is partly dependent on market maturity and governance infrastructure. Importantly, the practical significance of ESG integration extends beyond performance neutrality. By excluding firms with weak governance structures or high environmental and social risks, ESG strategies can enhance corporate resilience and improve downside risk management. Firms with strong ESG profiles are generally better positioned to adapt to regulatory changes, avoid reputational damage, and sustain

operational stability during periods of uncertainty. This contributes to long-term value creation by mitigating tail risks, protecting brand equity, and strengthening stakeholder trust. Consequently, ESG factors should be viewed not merely as ethical considerations, but as financially relevant tools that support sustainable and resilient investment outcomes over extended time horizons.

3.2 Key Points of Disagreement

Despite these areas of consensus, significant disagreement remains in the literature. This debate can be understood through three key areas of divergence. First, there is disagreement over whether ESG constraints shift the efficient frontier inward. Some studies argue that limiting the investment universe reduces diversification opportunities, thereby lowering maximum attainable returns for a given level of risk. From a theoretical perspective, this aligns with traditional portfolio theory, where constraints reduce feasible optimization sets. However, others contend that excluding high-risk firms may enhance portfolio stability and preserve efficiency under certain conditions, particularly when ESG factors capture previously unpriced risks. These conflicting findings may stem from differences in investor preferences, such as varying tolerance for non-financial risks, as well as structural differences across markets. Second, another area of divergence involves short-term alpha generation. While some researchers report neutral performance effects, others find that ESG portfolios may underperform or outperform during specific market cycles. These inconsistencies can be partially explained by behavioral and market dynamics, including shifting investor sentiment toward sustainability and the timing of capital flows into ESG assets. As a result, short-term performance may reflect temporary pricing inefficiencies rather than fundamental value differences. Third, the impact of ESG rating inconsistencies and data reliability remains controversial. Differences in rating methodologies may lead to varying asset selection outcomes, which complicates cross-study comparisons and empirical conclusions. Some studies [5] suggest that ESG constraints may affect portfolio allocation through pricing adjustments, but the extent of this effect depends heavily on which data sources and scoring systems are used. From a practical perspective, these debates directly influence investment decision-making. Portfolio managers must balance the trade-off between ethical constraints and diversification efficiency, account for potential short-term volatility in ESG performance, and carefully evaluate the reliability of ESG data providers when constructing portfolios.

3.3 Factors Contributing to Discrepancies

Several underlying factors help explain these conflicting findings. First, variation in ESG measurement frameworks across rating agencies can produce substantially different ESG scores for the same firms. These methodological differences directly affect portfolio optimization, as inconsistent inputs may lead to divergent asset allocation decisions and risk assessments in practice. Second, differences in time horizon assumptions play a significant role. Studies focusing on short-term performance often reach different conclusions compared to those analyzing long-term investment cycles, where ESG-related benefits such as risk mitigation and resilience may become more evident. Third, regional regulatory and institutional differences further contribute to variation in outcomes. In Europe, stricter disclosure requirements and stronger regulatory support for sustainability tend to enhance ESG data quality and market integration. In contrast, the United States presents a more market-driven approach with varying standards, while emerging markets often face weaker enforcement, limited transparency, and differing economic priorities. These institutional differences shape both empirical findings and investor behavior across regions. Overall, these factors highlight that ESG's impact on portfolio efficiency is highly context-dependent. The interaction between data quality, investment horizon, and institutional environment not only explains theoretical inconsistencies but also has direct implications for real-world portfolio construction, risk management, and strategic asset allocation. From a practical investment perspective, ESG integration appears more beneficial in long-term portfolio construction than in short-term performance optimization.

4. Conclusion

This review has examined recent academic and institutional research on ESG-constrained portfolio optimization within the framework of modern asset allocation theory. By organizing the literature into thematic sections, it highlights both areas of agreement and ongoing debate regarding the impact of ESG integration on portfolio efficiency. Overall, existing evidence suggests that ESG integration does not necessarily compromise long-term risk-adjusted returns. However, findings remain sensitive to measurement methods, time horizons,

and regional regulatory contexts. The relationship between sustainability constraints and portfolio efficiency therefore appears to be context-dependent rather than universally positive or negative. These observations indicate that ESG investing has evolved beyond a purely ethical consideration and has become an important component of modern financial analysis. At the same time, methodological differences and data inconsistencies continue to limit definitive conclusions. Although ESG investing has attracted significant attention in recent years, several areas require further investigation. First, the development of more standardized ESG rating systems may help reduce inconsistencies across data providers and improve comparability in empirical research. Second, long-term performance evaluation across multiple market cycles would provide a clearer understanding of sustainability-constrained portfolio outcomes beyond short-term fluctuations. Third, more comparative research in emerging markets could expand the current evidence base, which remains heavily concentrated in developed economies. Finally, integrating climate risk modeling and forward-looking sustainability metrics into portfolio optimization frameworks may enhance the practical relevance of future studies.

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Conflicts of Interest

The authors declare no conflict of interest.

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