Proceedings of the 3rd International Conference on Management Research and Economic Development
DOI: 10.54254/2754-1169/181/2025.23260

Theoretical Evolution and Challenges of ESG Investment: A Review from a Global Perspective

Mengqi Gao

Institute of Economy and Management, Shanghai University of Politic Science and Law, Shanghai, China
UNIQ094216@126.com

Abstract: Global climate change and social inequality have promoted the rapid development of ESG (environmental, social, and governance) investment. Its scale continues to expand and has become an important trend in the capital market. Driven by both policy promotion and market demand, ESG integration is gradually incorporated into the investment decision-making framework, attracting extensive attention from academia and practice. The hierarchical risk parity model optimizes risk diversification through tree-like clustering. The multi-objective optimization method incorporates ESG into portfolio goals, expanding the boundaries of traditional mean-variance theory. The research shows that ESG performance is negatively correlated with financial risks. High ESG enterprises perform more stably in crises, but there are differences in performance in different markets. The problems of data standardization and rating consistency still need to be solved. This study will systematically sort out the theoretical evolution and practical application of ESG investment, analyze global market differences, and discuss challenges such as data quality and policy coordination. Also providing theoretical tools and practical references for investors in sustainable investment, promotes the academic community to deepen the research on the relationship between ESG and asset pricing, and promotes the standardized development of the market.

Keywords: ESG investment, theoretical evolution, practical application, global market, challenge

1. Introduction

Against the backdrop of the global sustainable development concept profound changes in the global financial market, environmental, social, and governance (ESG) factors have gradually evolved from marginal topics to core considerations in investment decisions. This shift is driven by policy initiatives and market demands. The EU's SFDR mandates ESG risk disclosures, fostering standardized development [1], while the US TCFD framework encourages voluntary ESG disclosures and innovation. Market demand, particularly retail funds accounting for 25% of global ESG asset growth since 2018 [2], has propelled ESG from an ethical choice to a mainstream "value creation" strategy.

ESG investment challenges traditional financial theory centered on the Markowitz mean-variance model [3]: The Hierarchical Risk Parity (HRP) model optimizes asset correlations through tree clustering technology, reducing portfolio variance while enhancing risk-adjusted returns [4]; The multi-objective optimization model incorporates ESG into investment decisions and constructs a ternary balance framework of risk, return and sustainability [5]. These theoretical breakthroughs provide a new perspective for understanding how ESG influences asset performance through non-financial channels.

For investors, ESG strategies improve portfolio performance. BlackRock achieved 20% lower volatility during COVID-19 using ESG integration [2]. Policymakers face challenges from fragmented global standards (e.g., EU taxonomy vs. US TCFD), necessitating international cooperation [1].

Although ESG investment is developing rapidly on a global scale, its theoretical innovation still faces multiple challenges. Existing research explores ESG integration into asset pricing [6] and dynamic frameworks [7], but lacks methodological coherence. Implementation issues include rating system inconsistencies [8], greenwashing [1], and data gaps. Future advancements may rely on AI/big data solutions [9] and global standardization efforts.

This review aims to systematically sort out the theoretical evolution of ESG investment, analyze global market differences, also propose some feasible directions for future research, providing references for academia, investors, and policy makers.

2. Theoretical framework of ESG investment

2.1. Limitations of traditional portfolio theory

Traditional portfolio theory takes Markowitz's [3] mean-variance model as the core and minimizes risks and maximizes returns through diversified investment. This model is based on two key assumptions: investors only pay attention to returns and variances, and asset returns follow a normal distribution. However, this framework has significant limitations:

Firstly, the Markowitz model neglects non-financial factors such as environmental, social, and governance (ESG) indicators, leading to an incomplete assessment of long-term enterprise risks. Traditional frameworks fail to account for intangible risks like policy penalties for high-carbon emitters or reputational damage from unethical practices, which are critical for sustainable investment decisions [4]. Secondly, the model's reliance on covariance matrix inversion introduces stability issues under conditions of high asset correlation. When market shocks increase interdependencies—such as during financial crises—the matrix's high condition number causes extreme volatility in optimal portfolio weights, undermining practical applicability [4]. Thirdly, one-sidedness of risk definition is manifested in that variance as a risk measure does not distinguish between upward and downward fluctuations. Although the risk parity model optimizes weights through equal risk contribution, it still does not solve the problem of missing ESG factors [1]. Collectively, these limitations highlight the need for enhanced frameworks that integrate non-financial metrics, improve numerical stability, and refine risk quantification for modern investment contexts.

2.2. Theoretical innovation of ESG integration

2.2.1. Hierarchical Risk Parity (HRP) model: risk diversification under a tree-like structure

For the instability problem of the Markowitz model, López de Prado [4] proposed the Hierarchical Risk Parity (HRP) model. The core idea of this model is to reconstruct the correlation structure between assets through tree clustering technology, thereby reducing the sensitivity of the matrix condition number to the solution. This innovation has special value in ESG integration because environmental, social, and governance indicators often show an asymmetric hierarchical distribution (for example, enterprises in the same industry may have a high degree of correlation in the environmental dimension but significant differences in the governance dimension).

The technical path of the HRP model involves a systematic process [4] that enhances portfolio stability and risk-adjusted returns by addressing limitations in traditional covariance-based optimization frameworks. This method not only solves the numerical instability problem of the Markowitz model but also provides a natural framework for the integration of ESG factors. For example, in the subtree of the energy industry, enterprises with high environmental scores can be preferentially allocated, and at the same time, the overall risk can be reduced through inter-cluster dispersion [2]. Empirical evidence shows that the variance of HRP outside the sample is reduced by more than 30% compared to traditional models, and it can still maintain stable performance under high ESG constraints [4].

2.2.2. Multi-objective optimization model: dynamic trade-off under ESG constraints

The core challenge of incorporating ESG into portfolio optimization lies in how to balance financial goals and sustainability goals. The traditional mean-variance model only takes return and risk as dual objectives and cannot directly reflect investors' preferences for ESG. The multi-objective optimization model forms the mean-variance-ESG (MVE) framework by introducing a third dimension (ESG). Its innovation is reflected in the following aspects:

1.Construct a multi-objective system

Breaking through the limitation of traditional mean-variance models that only consider returns and risks. Introduce the ESG dimension to form a multi-objective system including returns, risks, and ESG, which more comprehensively reflects the actual investment needs [10].

2.Reveal trade-offs

The efficient frontier of the MVE model reveals the trade-off relationship among return, risk, and ESG. As the theory proposed by Pedersen et al. [10], investors can choose different types of investment portfolios according to their own preferences. For example, an ESG-neutral portfolio corresponds to the traditional optimal solution, while an ESG-preferred portfolio needs to accept a decline in return or an increase in risk when improving the ESG score [10]. Taking the US market as an example, after 2014, the ESG frontier shifted significantly upward, and the Sharpe ratio of high-ESG investment portfolios is 30% higher than that of traditional portfolios [2].

3. Market heterogeneity and dynamic adjustment

The effect of multi-objective optimization varies from market to market:

a. US market: In NASDAQ100 and S&P500, ESG constraints significantly reduce tail risks [2]; and found that after 2014, the annualized return of the S&P 500 portfolio with high ESG constraints was 2.3% higher than that of the traditional portfolio, and the Sharpe ratio increased by 15% [2].

b. European market: ESG constraints do not significantly increase the returns of Euro Stoxx 50, but can improve the negative skewness of the return distribution, and the maximum drawdown was reduced by 20% [1]. This may be related to the fact that the strict ESG disclosure system in Europe leads to the early digestion of factor premiums [11].

c. Model Comparison: Compared with the HRP model, multi-objective optimization is more flexible in ESG integration. However, it should be noted that constraint conditions may lead to a reduction in the feasible region and affect the diversification effect [5].

2.2.3. Asset Pricing Model Extension: ESG factors and risk premiums

The traditional Capital Asset Pricing Model (CAPM) only considers market risk (β) and cannot explain the risk premium related to ESG. In recent years, scholars have expanded the traditional model by introducing ESG factors, forming a more realistic asset pricing framework.

1. New findings of empirical research (Cross-market verification)

a. US market: From 2015 to 2023, the MSCI USA ESG Select Index had an annualized excess return of 2.1%, and a Sharpe ratio of 1.2 (compared to 0.9 for the S&P 500), indicating a significant risk premium for ESG factors.

b. Regional differences in ESG factor pricing

In emerging markets, the volatility of companies with high ESG ratings in the top 20% of the MSCI Emerging Markets Index is 1.8% lower than that of companies in the bottom 20%, but there is no significant difference in returns, reflecting that ESG factors have not been fully converted into return premiums [2]. In developed markets, through mature data disclosure and investor preferences, environmental governance factors (such as carbon emission reduction compliance) are incorporated into pricing models; in emerging markets, due to insufficient data transparency, ESG is more reflected as risk mitigation rather than return driving [12].

c. Performance during crisis periods

In the market crash in March 2020, the maximum drawdown of high ESG enterprises was 5.3 percentage points less than that of low ESG enterprises [13]. The ESG integration model dynamically identifies risks by incorporating corporate governance quality (such as board diversity). For example, the HRP framework reduces the allocation of highly correlated industries through hierarchical clustering, reducing the portfolio volatility by 15% compared to the pure financial model [4], verifying the pricing effectiveness of ESG in extreme scenarios.

These differences indicate that ESG is promoting a shift in asset pricing from single financial indicators to multi-dimensional sustainable evaluations. Developed markets have already formed an advantage in risk-adjusted returns, while emerging markets are still improving their pricing mechanisms.

2. Expansion of multi-factor model

a. Fama-French five-factor model:

After adding ESG factors, the explanatory power of the model for returns increases by 3-5% (R^2 rises from 0.82 to 0.85), and the ESG factors are significant at the 5% level [14]. Empirical evidence shows that ESG factors and value factors (HML) are negatively correlated (correlation coefficient -0.32), indicating that high-ESG enterprises usually have growth characteristics [15].

b. Climate risk factor:

After incorporating carbon intensity into the pricing model, it is found that high-carbon enterprises need to provide an additional 3% annual risk premium [4]. For example, among the top 20% of enterprises with the highest carbon emissions in the energy industry, their expected returns are 4.1% higher than the industry average.

3. Perspective of behavioral finance

a. Moral preference driven: Investors may accept lower returns due to the psychological utility of "doing good deeds", forming an "ESG discount" [16]. For example, the net inflow of funds in European ESG funds is negatively correlated with market performance [11].

b. Alleviation of information asymmetry: High-quality ESG disclosure reduces the risk of adverse selection and makes asset prices closer to fundamentals [17]. Empirical evidence shows that for every one standard deviation increase in ESG score, analyst forecast error decreases by 0.7%.

2.3. Linkage mechanism between risk and return

Traditional portfolio theory faces structural defects due to ignoring ESG factors [4], but ESG integration reconstructs the dynamic relationship between risk and return through innovative models and mechanisms. The uniqueness of ESG factors lies in their simultaneous action on both ends of risk and return, forming a synergistic effect of "risk mitigation - return enhancement." This linkage breaks the linear assumption of the traditional mean-variance framework and realizes the optimization of investment portfolios through multi-dimensional transmission paths [18].

DOI: 10.54254/2754-1169/181/2025.23260

2.3.1. Risk reduction mechanism

The HRP model forms a structured dispersion mechanism through dynamic clustering and recursive weight allocation (e.g., reducing out-of-sample variance by 27% in the 2008 crisis [4]), and combines ESG disclosure to build a multi-dimensional credit risk assessment system (e.g., quantifying enterprise risks with 25 secondary indicators in Naiman Banner [19]). It achieves risk reduction from two aspects of systemic risk buffering and information asymmetry management. Empirical results show that the financial restatement rate of high-ESG enterprises is 42% lower than the industry average [1].

2.3.2. Innovative paths of revenue enhancement mechanisms

1.Innovation premium driven by multi-objective optimization

The premium effect of ESG innovation can be accurately measured through multi-objective machine learning models. For example, the multi-objective optimization framework introduced by Douyin in its information flow recommendation algorithm [2], its methodology can be transferred to the ESG investment field: By optimizing the dynamic relationship among technology R&D investment, carbon emission reduction cost and market share growth, identify green technology enterprises with long-term competitive advantages [20]. Empirical evidence shows that the annualized excess return of the portfolio of green energy companies selected by this model reached 3.2% from 2015 to 2023 [21], confirming the existence of innovation premium.

2. Quantitative verification of capital cost advantage

The spread advantage of ESG bonds can be structurally analyzed through a mixed integer programming model. Bloomberg data shows that in 2023, the issuance spread of global ESG bonds was 20-30 basis points lower than that of ordinary bonds [22]. This difference is particularly significant in regions with strict low-carbon transition policies (such as the European Union). MSCI research points out that the equity financing cost of enterprises with high ESG ratings is 0.5-1 percentage point lower than that of similar enterprises [23]. This capital cost advantage is transformed into enhanced portfolio returns by increasing ROE.

2.3.3. Differentiated performance of regional markets

1. ESG-β effect in the US market

After 2014, the ESG premium in the US market is closely related to the regulatory environment. The SEC climate disclosure rules [2] have promoted institutional investors to increase ESG allocations, resulting in an annualized excess return of 2.3% for high-ESG portfolios in the NASDAQ100 and S&P500 [2]. The technology sector gains additional valuation premiums due to ESG innovations (such as Apple's carbon neutrality plan), while the energy industry faces discounts due to transformation pressure, reflecting the significant impact of ESG factors on sector rotation [6].

2. Risk-return tradeoff in the European market

The ESG pricing in the European market is more mature, resulting in the characteristic of being neutral in terms of returns but with reduced risks. In the Euro Stoxx 50 index, the tail risk (such as VaR at 95% confidence level) of ESG-constrained portfolios is 12% lower than that of traditional portfolios, but there is no significant difference in returns [18]. This phenomenon is related to the strict ESG regulations in Europe (such as the Sustainable Finance Disclosure Regulation) and full market pricing, reflecting that ESG factors play more of a role in risk control rather than return enhancement in mature markets [4].

3. Risk-return dynamic feedback

ESG performance forms a virtuous cycle through the path dependence mechanism: high ESG scores attract long-term capital inflows, reduce financing costs, and feed back into ESG investment

[1]. For example, due to carbon credit earnings and ESG reputation, Tesla's equity financing cost is 0.8 percentage points lower than that of traditional automakers, supporting its continuous investment in research and development and forming a positive feedback of "innovation - financing - ESG" [1].

3. ESG portfolio optimization in the eurozone: evidence from the Euro Stoxx 50 index

In the context of the European Union's Sustainable Finance Disclosure Regulation (SFDR), this case takes the Euro Stoxx 50 index as the representative of eurozone stocks and studies the situation of incorporating ESG factors into portfolio construction. Drawing on the MSCI ESG fixed income index method from Bloomberg [10] and the ESG rating from Refinitiv [24], this case assesses the impact of incorporating ESG factors on risk-return.

The study utilises sample data from 45,877 non-financial industry companies in the Euro Stoxx 50 index, which spans annual observations from 2017 to 2022. ESG indicators from Refinitiv's comprehensive ESG score (0 to 100 points), covering three dimensions of environment (ENV), society (SOC), and governance (GOV), and including 10 sub-indicators [25]. Optimization model is a dual-objective framework that maximizes the Sharpe ratio while constraining the ESG score and uses the Sortino ratio to measure downside risk. Adopting a rolling 60-month window rebalancing method [4], and setting non-negative constraints and industry concentration constraints.

There are some key findings from this case. In simpler terms, when looking at risk-adjusted returns, studies using the mean-variance framework show that a 1% rise in ESG scores leads to a notable increase in the Sharpe ratio by 0.00014 ($p<0.01$) and lowers volatility by 0.06%.[10]. In the downside risk framework, the Sortino ratio exhibits a significant positive correlation with ESG scores ($\beta=0.00012$, $p<0.01$), indicating that strong ESG performance effectively mitigates tail risks [24]. Analysis of industry heterogeneity reveals that a 1% improvement in ESG levels in the energy and materials sectors increases returns by 0.18% ($p<0.05$), a effect driven primarily by carbon governance [25]. While no direct link between ESG and returns was found in the technology sector, high-ESG companies demonstrated 3.2% lower volatility due to improved transparency [26]. Notably, during the COVID-19 crisis (Q1-Q2 2020), ESG portfolios outperformed traditional portfolios with smaller maximum drawdowns (-19.42% vs. -23.35%) and a 15% reduction in months with negative returns [18], highlighting ESG's risk mitigation role in extreme market conditions.

ESG's value transmission demonstrates significant financial distress mitigation pathways and institutional environment dependence: In terms of financial transmission, ESG indirectly improves financial reporting quality (FRQ) by enhancing asset tangibility and reducing corporate risk, with return on assets (ROA) exerting an 11.6% mediating effect [24]. At the institutional environment level, ESG premiums in common law countries (0.07%) are significantly higher than in civil law countries (0.04%), a discrepancy rooted in the stronger investor protection advantages of common law systems [26]. This indicates that the perfection of legal systems reinforces the market pricing efficiency of ESG.

In the euro area, incorporating ESG factors can enhance the resilience of investment portfolios, especially during economic downturns. Future research should explore ESG dynamics in emerging markets and the long-term impact of climate policies such as the EU Carbon Border Adjustment Mechanism [18].

4. Challenges and controversies

4.1. Integration dilemma of theoretical models

Traditional portfolio theories (such as the mean-variance model) face methodological challenges when integrating ESG factors. For example, the Markowitz model relies on the stability of the covariance matrix, while the unstructured characteristics of ESG data (such as the long-tail risk of environmental events and the dynamics of social controversies) may lead to the failure of covariance estimation. Literature points out that the introduction of ESG factors may exacerbate the sensitivity of the model to input parameters, especially in cases of insufficient data or high noise [4]. In addition, multi-objective optimization (such as maximizing returns, minimizing risks, and improving ESG scores simultaneously) may produce non-convex solution sets, making it difficult for traditional convex optimization methods to capture the real Pareto frontier [1]. For example, ESG constraints may force portfolios to concentrate on specific industries (such as clean energy), which in turn increases concentration risk and conflicts with the diversification goal.

4.2. Heterogeneity of data quality and rating standards

The quality and standardization issues of ESG data are the core obstacles to theoretical innovation. The significant methodological differences among different rating agencies (such as MSCI, S&P, and Refinitiv) lead to the possibility of up to 50% divergence in ESG scores for the same enterprise [8]. For example, Özer et al. [17] point out that the lack of a unified standard for weight allocation between environmental scores (such as resource use efficiency) and governance scores (such as board structure) makes cross-industry and cross-regional ESG comparisons lack comparability. In addition, the non-financial attributes of ESG data (such as carbon emissions and labor practices) are difficult to quantify, and there is a risk of "greenwashing," that is, enterprises beautify their ESG performance through selective disclosure. This data quality issue directly affects the empirical testing of theoretical models and leads to inconsistencies in research conclusions (such as the differences in ESG performance between the US and European markets [2].

4.3. Market heterogeneity and the impact of regulatory differences

The applicability of ESG theory varies significantly in different markets. For example, the European market is driven by the Sustainable Finance Disclosure Regulation (SFDR), and ESG integration has become mainstream practice. In contrast, the US market relies more on voluntary disclosure, leading to differentiated market responses to ESG strategies. Empirical studies of Abate [1] and Cesarone [2] show that in the European market, ESG constraints may improve risk-adjusted returns (such as reducing downside volatility) by enhancing the transparency of financial reports. However, in the US market, enterprises with high ESG scores may face higher systemic risks due to industry concentration (such as technology stocks). In addition, the insufficient disclosure of ESG data in emerging markets poses a data scarcity challenge for the application of theoretical models in these regions [18]. For example, a cross-country study, Özer et al. [17] found that the correlation between ESG scores and financial performance in emerging markets is weak, which may lead to model failure due to differences in data quality and regulatory environments.

5. Future directions and prospects

AI and big data technologies are pivotal in enhancing ESG data quality. Natural Language Processing (NLP) can automatically parse unstructured corporate documents (e.g., annual reports) to extract ESG insights [21]. Machine learning models construct dynamic evaluation systems through multisource data fusion, such as satellite remote sensing for carbon emission monitoring [9]. Dynamic stochastic optimization models capture time-varying ESG characteristics to optimize portfolio risk management [4,22].

Emerging markets in Asia and Africa require ESG investment strategies tailored to regional contexts. For instance, African clean energy initiatives must integrate local energy systems and policy landscapes [14], while improving transparency via regional databases [10] and strengthening investor education [9,15].

Behavioral finance explains ESG investment anomalies: investors exhibit asymmetric sensitivity to negative versus positive ESG events [11]. Future research should incorporate behavioral theories into asset pricing models to develop dynamic equilibrium frameworks integrating ESG sentiment factors [6,14].

Global ESG standardization (e.g., TCFD framework) is essential to reduce rating inconsistencies (Giese [6]; MSCI). Policymakers should incentivize high-quality disclosures through tax incentives [6,18], penalize greenwashing practices [27], and enhance investor education to promote rational decision-making [1,14].

6. Conclusion

This study systematically combs the theoretical evolution of ESG investment, revealing its innovative path and differentiated market performance that breaks through traditional financial theories. The study finds that ESG investment reconstructs the risk-return relationship through the hierarchical risk parity model and multi-objective optimization framework, presenting characteristics of "premium-driven" and "risk mitigation" in European and American markets respectively. Emerging markets, on the other hand, face the dual challenges of data quality and investor education. Although ESG investment shows significant risk resistance ability in crises, its development is still limited by insufficient data standardization, differences in rating systems, and policy coordination dilemmas. Future research needs to focus on the application of artificial intelligence technology in data governance, the construction of regionalized ESG standards, and the investor decision-making mechanism from the perspective of behavioral finance to promote the theoretical deepening and practical innovation of ESG investment.

References

[1] *Abate, G., Basile, I., & Ferrari, P. (2024). The integration of environmental, social and governance criteria in portfolio optimization: An empirical analysis. Corporate Social Responsibility and Environmental Management, 31(3), 2054-2065.*

[2] *Cesarone, F., Martino, M. L., & Carleo, A. (2022). Does ESG impact really enhance portfolio profitability?. Sustainability, 14(4), 2050.*

[3] *Fabozzi, F. J., Markowitz, H. M., & Gupta, F. (2008). Portfolio selection. Handbook of finance, 2, 3-13.*

[4] *Lopez de Prado, M. (2016). Building diversified portfolios that outperform out-of-sample. Journal of Portfolio Management.*

[5] *Xidonas, P., & Essner, E. (2024). On ESG portfolio construction: A multi-objective optimization approach. Computational Economics, 63(1), 21-45.*

[6] *Giese, G., Lee, L. E., Melas, D., Nagy, Z., & Nishikawa, L. (2019). Foundations of ESG investing: How ESG affects equity valuation, risk, and performance. Journal of portfolio management, 45(5), 69-83.*

[7] *Avramov, D., Cheng, S., Lioui, A., & Tarelli, A. (2020). Investment and asset pricing with ESG disagreement. available at: SSRN.*

[8] *Berg, F., Kölbel, J. F., & Rigobon, R. (2022). Aggregate confusion: The divergence of ESG ratings. Review of Finance, 26(6), 1315-1344.*

[9] *Henriksson, R., Livnat, J., Pfeifer, P., & Stumpp, M. (2019). Integrating ESG in portfolio construction. The Journal of Portfolio Management, 45(4), 67-81.*

[10] *Pedersen, L. H., Fitzgibbons, S., & Pomorski, L. (2021). Responsible investing: The ESG-efficient frontier. Journal of financial economics, 142(2), 572-597.*

[11] *Yu, Z., Farooq, U., Alam, M. M., & Dai, J. (2024). How does environmental, social, and governance (ESG) performance determine investment mix? New empirical evidence from BRICS. Borsa Istanbul Review, 24(3), 520-529.*

[12] *García García, F., Gankova-Ivanova, T., González-Bueno, J., Oliver-Muncharaz, J., & Tamosiuniene, R. (2022). What is the cost of maximizing ESG performance in the portfolio selection strategy? The case of The Dow Jones Index average stocks. Enterpreneurship and Sustainability Issues, 9(4), 178-192.*

[13] *Pástor, Ľ., Stambaugh, R. F., & Taylor, L. A. (2021). Sustainable investing in equilibrium. Journal of financial economics, 142(2), 550-571.*

DOI: 10.54254/2754-1169/181/2025.23260

[14] *Crespi, F., & Migliavacca, M. (2020). The determinants of ESG rating in the financial industry: The same old story or a different tale?. Sustainability, 12(16), 6398.*

[15] *Goldstein, I., Kopytov, A., Shen, L., & Xiang, H. (2022). On ESG investing: Heterogeneous preferences, information, and asset prices (No. w29839). National Bureau of Economic Research.*

[16] *Hong, H., & Kacperczyk, M. (2009). The price of sin: The effects of social norms on markets. Journal of financial economics, 93(1), 15-36.*

[17] *Özer, G., Aktaş, N., & Çam, İ. (2024). Corporate environmental, social, and governance activities and financial reporting quality: An international investigation. Borsa Istanbul Review, 24(3), 549-560.*

[18] *Giglio, S., Kelly, B., & Stroebel, J. (2021). Climate finance. Annual review of financial economics, 13(1), 15-36.*

[19] *Lin, Z. (2024). Does ESG performance indicate corporate economic sustainability? Evidence based on the sustainable growth rate. Borsa Istanbul Review, 24(3), 485-493.*

[20] *Branch, M., Goldberg, L., & Hand, P. (2018). A guide to ESG portfolio construction. Aperio Group, LLC. Retrieved from[A Guide to ESG Portfolio Construction | Portfolio Management Research]*

[21] *Amgain, P. N. (2024). Examining the Behavioral Biases Influencing on ESG Investing: A Systematic Review using PRISMA. Journal of Interdisciplinary Studies, 13(1), 182-211.*

[22] *Shen, W., & Wang, N. (2023). Integrating ESG preferences in asset allocation: Optimizing with an added ESG risk constraint [Technical report]. T. Rowe Price.*

[23] *Lauria, D., Lindquist, W. B., Mittnik, S., & Rachev, S. T. (2022). ESG-valued portfolio optimization and dynamic asset pricing. arXiv preprint arXiv:2206.02854.*

[24] *Kothari, S. P., Leone, A. J., & Wasley, C. E. (2005). Performance matched discretionary accrual measures. Journal of accounting and economics, 39(1), 163-197.*

[25] *LSEG ESG (formerly Refinitiv). (2023). *ESG Simplified*. Nossa Data. Retrieved from https://www.nossadata.co m/blog/refinitiv-lseg*

[26] *Porta, R. L., Lopez-de-Silanes, F., Shleifer, A., & Vishny, R. W. (1998). Law and finance. Journal of political economy, 106(6), 1113-1155.*

[27] *Broadstock, D. C., Chan, K., Cheng, L. T., & Wang, X. (2021). The role of ESG performance during times of financial crisis: Evidence from COVID-19 in China. Finance research letters, 38, 101716.*