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Expanding the Efficient Frontier: A Utility-Based Model for ESG-Driven Portfolio Selection

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ABSTRACT

This paper proposes a utility-based framework that extends the traditional efficient frontier to incorporate Environmental, Social, and Governance (ESG) factors as a direct component of the investor's utility function. While conventional portfolio theory focuses on the risk-return trade-off (Markowitz 1952), it ignores the nonfinancial satisfaction of investors from sustainable and ethical investments. This paper proposes a three-dimensional utility function that embeds expected return, portfolio risk, and ESG utility. This model addresses heterogeneous investor preferences and allows for the optimality of portfolios that maximize both financial and sustainability performance. Theoretically, the implications extend toward portfolio selection and asset pricing, showing how ESG issues and rational investment behavior are not necessarily in conflict and can coexist without giving up returns. While there is a difficult road ahead for ESG measurement and data standardization, this framework lays the platform for the unification of ethical values with financial goals, offering a complete perspective for future empirical testing in sustainable finance.

Introduction

Modern Portfolio management has evolved and expanded its frontiers beyond the traditional risk-return paradigm to include, among other dimensions of investment performance, including ESG considerations. (Markowitz, 1952) mean variance theory focused solely on optimizing expected return for a given risk, it neglected investors' ethical and sustainability preferences. Due to increased awareness of the contribution of ESG to long-term value creation and risk mitigation, it is an increasing scholarly pursuit to integrate these considerations into portfolio optimization (Pedersen et al., 2021)

Rather than viewing ESG as a constraint, recent research shows it can enhance portfolio performance by reducing downside risk and capturing opportunities in sustainable sectors (Pástor et al., 2021). This evolution reframes investor utility as multidimensional deriving satisfaction both from financial returns and from societal impact. Accordingly, this study proposes that incorporating ESG into the utility function extends the efficient frontier, providing a framework for rational and ethical portfolio choice.

Literature Review

Markowitz's mean-variance optimization remains the foundational model for portfolio selection, positing that rational investors maximize expected return for a given level of risk, or equivalently, minimize risk for a given expected return. The model assumes investors are risk-averse, returns are normally distributed, and markets are frictionless, with no transaction costs or taxes. Asset returns are fully characterized by their means, variances, and covariances, and investors' preferences are solely financial, ignoring non-pecuniary considerations such as ethical or social values Xaviera & Rahman, 2024.

A common practice in responsible investing is to impose ESG (Environmental, Social, and Governance) constraints within the mean-variance framework, such as requiring portfolio ESG scores to exceed a threshold. While this method is straightforward, it is criticized for its lack of nuance: it treats ESG as a binary screen rather than a continuous trade-off, failing to capture the marginal rate of substitution between financial and ethical utility. Empirical studies show that such constraints can have unintended effects on portfolio efficiency and may not reflect the true preferences of investors who value both financial and ethical outcomes (Wedajo et al., 2024; Meilanda et al., 2024). Moreover, rigid ESG constraints may reduce diversification and potentially impact risk-adjusted returns, especially if ESG scores are not perfectly aligned with financial performance (Xaviera & Rahman, 2024).

Another approach treats ESG as an "alpha" signal, positing that high ESG scores proxy for superior risk management or future financial outperformance. While there is evidence that ESG performance can

positively influence firm value and credit ratings, especially in the context of mandatory disclosure and regulatory environments (Wedajo et al., 2024; Pomortsev & Astakhova, 2022; Drab, 2022), this perspective may sidestep the core issue: many investors seek ESG exposure for intrinsic ethical reasons, not just for financial gain. Treating ESG solely as a risk or return factor fails to account for the non-pecuniary utility derived from aligning investments with personal or societal values (Pane & Nainggolan, 2024).

Recent literature bridges ESG investing with microeconomic utility theory, emphasizing that investor preferences often extend beyond financial returns to include social preferences, "warm-glow" giving, and other non-pecuniary benefits (Pane & Nainggolan, 2024). Stakeholder theory and agency theory are frequently invoked to explain the integration of ESG into corporate and investment decision-making (Meilanda et al., 2024; Pane & Nainggolan, 2024). These frameworks recognize that investors may derive utility from contributing to social or environmental goals, and that such preferences can be systematically incorporated into portfolio optimization models, moving beyond the limitations of the standard mean-variance approach.

The Theoretical Model: A Three-Dimensional Utility Framework

The Proposed Utility Function

The proposed model extends traditional mean variance analysis by adding a third component ESG utility (Ω_p) to form:

$$U = f\,(E[R_p], \sigma_p, \Omega_p)$$

Where $E[R_p]$ is expected return, σ_p is portfolio risk, and Ω_p represents ESG utility. Ω_p can be measured as the weighted average ESG score of portfolio assets (Pedersen et al., 2021). This approach captures heterogeneous investor preferences i.e., some willing to trade modest financial returns for sustainability benefits (Pástor et al., 2021) thus embedding ethical considerations within rational portfolio choice.

The Three-Dimensional Efficient Surface

Including Ω_p transform the two-dimensional efficient frontier into a three-dimensional "efficient surface," in which the portfolios are efficient if no other combination offers higher return, lower risk, or greater ESG utility simultaneously. Portfolios once deemed suboptimal may become efficient when their ESG contribution is considered (Brière et al., 2017). This framework thus broadens efficiency to encompass both financial and sustainability factors.

Investor Indifference and Optimality

Investor preferences are represented by indifference surfaces in $E[R_p]$, σ_p, and Ω_p space. The optimal portfolio will lie at the tangency of the indifference and efficient surfaces, capturing the investor's ideal trade-off between risk, return, and ESG utility. This model formalizes ESG as a valid source of investor satisfaction rather than a constraint.

The optimal portfolio was determined at the point of tangency between the investor's indifference surface and the efficient surface. This point represented the equilibrium where the investor achieved the maximum attainable utility given their unique risk aversion and ESG sensitivity. The framework provided a versatile analytical structure for understanding heterogeneity among investors and demonstrated how portfolio choice could vary based on ethical and sustainability considerations. Ultimately, this model expanded traditional portfolio theory by recognizing ESG as a genuine source of utility rather than an external constraint, integrating financial performance, risk management, and ethical value into a unified optimization paradigm.

Implications of the Model

Portfolio Choice

The model accommodates a spectrum of investor types from profit maximizers focused solely on financial return to universal owners giving importance to sustainability (Pedersen et al., 2021). Most investors balance these priorities, in line with the findings that ESG preferences shape allocation decisions (Hartzmark & Sussman, 2019). This approach enables asset managers to design customized portfolios reflecting varied ESG sensitivities.

Asset Pricing

ESG utility introduces an ESG premium, where sustainable assets attract higher demand, raising prices and lowering expected returns (Pástor et al., 2021). Conversely, unsustainable assets offer higher returns to compensate for reputational or transition risks (Dobrick et al., 2025). The model thus aligns ethical investing with equilibrium asset valuation, explaining differences in risk premia between sustainable and non-sustainable assets.

Discussion, Limitations, and Future Research

Measurement of ESG Utility (Ω_p):

Differing methodologies has created inconsistency in ESG ratings (Berg et al., 2022). Ongoing international efforts to standardize ESG disclosures and develop harmonized taxonomies, were expected to improve data reliability and comparability (Faccia et al., 2021).

Investor Heterogeneity:

Another key factor was the heterogeneity is the investors' preferences towards environmental (E), social (S), and governance (G) dimensions. Some investors might be more inclined towards environment due to climate concerns while some might be towards governance in companies. To capture this existent model can be extended as a weighted function:

$$\Omega_p = w_E E_p + w_S S_p + w_G G_p$$

Where w_E , w_S, and w_G represented investor-specific weights, reflecting individual ethical priorities (Krueger et al., 2020).

Future Research:

As corporate ESG performance evolves, the efficient surface shifts dynamically due to regulatory pressures, technological innovation, and stakeholder expectations, suggesting future models should capture how changes in ESG metrics alter portfolio efficiency (Fatemi et al., 2018). Further, integrating macroeconomic variables like climate policy shocks or ESG disclosure reforms could enhance how sustainability trends influence risk, return and ESG utility.

Conclusion

The utility based ESG model expands Markowitz's efficient frontier into a multidimensional framework that unites financial efficiency with ethical preference. By recognizing ESG as a source of investor utility, it aligns sustainable finance with modern portfolio theory, offering a more comprehensive and realistic foundation for portfolio selection.

References

- Berg, F., Kölbel, J. F., & Rigobon, R. (2022). Aggregate Confusion: The Divergence of ESG Ratings. *Review of Finance*, *26*(6), 1315–1344. https://doi.org/10.1093/rof/rfac033

- Brière, M., Peillex, J., & Ureche-Rangau, L. (2017). Do Social Responsibility Screens Matter When Assessing Mutual Fund Performance? *Financial Analysts Journal*, *73*(3), 53–66. https://doi.org/10.2469/faj.v73.n3.2

- Dobrick, J., Klein, C., & Zwergel, B. (2025). ESG as risk factor. *Journal of Asset Management*, *26*(1), 44–70. https://doi.org/10.1057/s41260-024-00382-z

- Faccia, A., Manni, F., & Capitanio, F. (2021). Mandatory ESG Reporting and XBRL Taxonomies Combination: ESG Ratings and Income Statement, a Sustainable Value-Added Disclosure. *Sustainability*, *13*(16), 8876. https://doi.org/10.3390/su13168876

- Faculty of Economic Sciences, HSE University, Pomortsev, G. S., Astakhova, A. A., & Joint Department with the Bank of Russia, HSE University. (2022). Identification of factors for assessing credit rating of non-financial companies. *Russian Management Journal*, *20*(3), 361–384. https://doi.org/10.21638/spbu18.2022.303

- Fatemi, A., Glaum, M., & Kaiser, S. (2018). ESG performance and firm value: The moderating role of disclosure. *Global Finance Journal*, *38*, 45–64. https://doi.org/10.1016/j.gfj.2017.03.001

- Hartzmark, S. M., & Sussman, A. B. (2019). Do Investors Value Sustainability? A Natural Experiment Examining Ranking and Fund Flows. *The Journal of Finance*, *74*(6), 2789–2837. https://doi.org/10.1111/jofi.12841

- Krueger, P., Sautner, Z., & Starks, L. T. (2020). The Importance of Climate Risks for Institutional Investors. *The Review of Financial Studies*, *33*(3), 1067–1111. https://doi.org/10.1093/rfs/hhz137

- Markowitz, H. (1952). Portfolio Selection. *The Journal of Finance*, *7*(1), 77. https://doi.org/10.2307/2975974

- Meilanda, P., Fuadah, L. L., & Mukhtaruddin, M. (2024). Development of the Role of Environmental, Social, and Governance (ESG) and Capital Structure with Firm Value: A Systematic Literature Review. *International Journal of Research and Review*, *11*(12), 218–233. https://doi.org/10.52403/ijrr.20241226

- Pane, J. F. R., & Nainggolan, Y. A. (2024). Board Characteristics and ESG Performance: An Empirical Study of Public Companies in Indonesia. Syntax Literate; Jurnal Ilmiah Indonesia, 9(11). https://doi.org/10.36418/syntax-literate.v9i11.16921

- Pástor, Ľ., Stambaugh, R. F., & Taylor, L. A. (2021). Sustainable investing in equilibrium. *Journal of Financial Economics*, *142*(2), 550–571. https://doi.org/10.1016/j.jfineco.2020.12.011

- Pedersen, L. H., Fitzgibbons, S., & Pomorski, L. (2021). Responsible investing: The ESG-efficient frontier. *Journal of Financial Economics*, *142*(2), 572–597. https://doi.org/10.1016/j.jfineco.2020.11.001

- Wedajo, A. D., Salah, A. A., Bhat, Mohd. A., Iqbal, R., & Khan, S. T. (2024). Analyzing the dynamic relationship between ESG scores and firm value in Chinese listed companies: Insights from generalized cross-lagged panel model. *Discover Sustainability*, *5*(1), 336. https://doi.org/10.1007/s43621-024-00546-2

- Xaviera, A., & Rahman, A. (2024). THE ROLE OF BUSINESS STRATEGY IN MODERATING THE EFFECT OF ESG PERFORMANCE ON FIRM VALUE. *Jurnal Akuntansi Bisnis*, *17*(1), 70. https://doi.org/10.30813/jab.v17i1.4967