

ESG FACTORS AND STOCK MARKET IMPLICATIONS IN BRAZIL

1 INTRODUCTION

In recent years, Environmental, Social, and Governance (ESG) factors have gained significant attention in finance, particularly in the context of investment decision-making, portfolio management and policy shaping (Galletta et al., 2022). As global awareness of sustainability challenges grows, investors are increasingly integrating ESG considerations into their strategies, seeking not only financial returns but also positive societal impact, or, trying to link ESG assets characteristics to their own expectations. This shift reflects a broader recognition that corporate practices related to environmental stewardship, social responsibility, and effective governance can materially affect financial performance and risk outcomes.

The concept of ESG investing has evolved beyond mere ethical considerations to encompass a strategic approach aimed at enhancing long-term financial resilience and sustainable growth (Wang et al., 2022). By evaluating companies based on their ESG practices, investors aim to identify firms better equipped to deal with emerging challenges, such as climate change regulations, social inequality, and governance failures. This proactive stance not only mitigates risks associated with regulatory changes and reputational harm but also positions investors to capitalize on opportunities arising from shifting consumer preferences and regulatory incentives favoring sustainable business practices (Shi et al., 2022).

The Brazilian market presents a prolific environment to develop studies in this global trend towards ESG integration. With its diversity of industries and economic sectors, Brazilian market may offer a perspective on how ESG factors influence corporate behavior and financial outcomes. By examining the Brazilian market through the lens of ESG factor investing, this study seeks to uncover insights into the relationship between ESG performance and stock market returns, volatility, and firm valuation metrics.

This paper contributes to the existing literature by providing empirical evidence on the impact of ESG factors on financial markets within the Brazilian context. Specifically, it explores how firms' ESG scores, derived from comprehensive data on environmental impact, social policies, and governance practices, correlate with their market performance and risk profiles. By leveraging a dataset encompassing diverse sectors and ESG metrics, this research aims to inform investors, policymakers, and corporate leaders about the implications of ESG integration for market dynamics and investor decision-making.

2 THEORETICAL FRAMEWORK

Works analyzing the relationship between investment metrics and ESG practices are already well established in the field of finance. Besides professional attention, we can see the proliferation of studies testing factors to explain returns, the factor zoo discussed by Cochrane (2011) goes on many paths. One of them comprises factors related to environmental, social and governance practices (Hua Fan and Michalski, 2020).

On one hand, some studies deal with climate change issues and investment decision criteria to mitigate undesirable changes. Wu et al. (2023), for example, argued in favor of enhanced risk management in banks to prevent new sources of systemic risk. The authors say that it is of special concern to non-state-owned banks since they may be more exposed to volatility coming from climate change shocks. In connection with these results, Javadi and Masum (2021) find that climate change is a relevant factor that influences loan costs, specially to borrowers in locations which are more sensible to climate changes.

Going beyond the financial sector, Sautner et al. (2023) show that it is possible to identify firm level exposure to climate change risks. Some characteristics as job creation under

disruptive green technology introduction and new green patents registration are good sources of information that may be explored to predict future behavior of these firms. Also analyzing firm level climate change motivated potential implications, Santi (2023) proposed a measure to try to identify investors' sentiment to climate factors. The author found that investors' sentiment is related to over and under performance of stocks depending on its dependence of high or low carbon emission activities. In the study, high emission stocks underperformed low emission stocks when investors care about climate change.

Exploring price crash risk in China, Lin and Wu (2023) found that firms evidencing climate risk face less risk of drastic stock prices downturns. This result is connected with the results achieved by Song et al. (2023), who find that investor attention and analyst coverage help firms protect themselves from crash risk. The concern is shared also with institutional investors, as demonstrated by Krueger et al. (2020). Zhang et al. (2022) reinforces the importance of disclosing environmental impact information from polluting companies.

Climate risk criteria is also being treated in fixed income markets. Agliardi and Agliardi (2021) model how bond prices may be affected by shocks coming from changes in climate policies to determine risk and portfolio consequences. They find that the "greenness" of a bond may benefit issuers that may be seen as of lower risk, when compared to others. Arif et al. (2022), with data from COVID-19 period, also find that green bonds are well suited to diversify equity portfolios on the medium and the long runs. Han and Li (2022), with data from USA and European markets, point out that portfolios should have green bonds to have better risk-return performance. On the other hand, Reboredo and Ugolini (2020) find low level of connection between green bond markets and stock markets. In Brazil, Guimarães and Malaquias (2022) find that ESG-related funds present better risk-return relationship during periods of strong financial constraints.

Obviously, such perceptions also have branches in portfolio management. In a framework that tries to capture climate change risk and its influences on portfolio risk, Engle et al. (2020) uses ESG scores to model climate risk exposures and construct hedged portfolio against climate change news. Their work also points the importance to hedge against climate changes, especially when it is not so easy to hedge against this kind of risk with usual instruments.

3 METHODOLOGY

This research analyses Brazilian firms' characteristics and its assets capital market behavior. We collected data available in Refinitiv Eikon database with regards to firm level characteristics related to environmental, social and governance practices. We also collected market data from the same source.

We conduct the ordinary least squares regression to analyze cross-sectional data. We separate the analyses using returns and volatility as dependent variables. We also divide independent variables between sets of general ESG scores and specific energy-related measures. At the end we have 4 models considering returns and 4 models considering volatility as dependent variables.

4 ANALYSIS AND DISCUSSION OF RESULTS

Initially we collect 2022 data for 109 firms listed in B3 (all that are available at Refinitiv Eikon database). The 109 firms analyzed in this work come from 33 economic sectors. Generally, the main sectors are Utilities, Financial Services, Real Estate, Oil & Gas, Food & Tobacco and Metals & Mining. Total market capitalization of the 109 firms in 2022 was USD 712,730 million. We remove data for Grid Loss Percentage, Renewable Energy Supply and

Renewable Energy Supply Score, for low levels of data availability. Therefore, we end with 16 ESG scores, including main scores and sub scores.

We also performed some exploratory regressions and found no significant relationship between Returns and ESG Score. On the other hand, regressing Volatility against ESG Score we found negative and significant relationship at 5% level. These initial results suggest no potential impact to returns in adhering to green, social and governance practices. On the other hand, we may say that firms with higher ESG Scores have lower risk. Notably, the ESG Controversies Score (ECSC) shows negative correlations with most other scores, suggesting that companies with higher controversies tend to have lower ESG ratings across other dimensions.

Table 5: Returns - OLS Regression Results

Variable	Model 1	Model 2	Model 3	Model 4
Intercept	0.0290 (0.245)	0.0214 (0.179)	-0.5863** (-2.114)	
ESG Score	-0.0025 (-1.144)			
Environmental Pillar Score		-0.0022 (-1.036)	-0.0015 (-0.720)	
Social Pillar Score		-0.0000817 (-0.029)	-0.0011 (-0.408)	
Governance Pillar Score		-0.0002 (-0.079)	0.0008 (0.387)	
ESG Controversies Score			0.0060** (2.416)	
Resource Use Score				0.0051 (1.366)
Resource Reduction Policy				0.1390 (0.489)
Policy Water Efficiency				-1.0990*** (-2.820)
Targets Energy Efficiency Score				-0.0024 (-1.429)
Environment Management Team				0.3952 (0.279)
Environment Management Team Score				-0.0065 (-0.349)
Environment Management Training				0.3409 (1.453)
Electricity Produced				4.348e-10 (0.621)
Renewable Energy Use Ratio				8.735e-05 (0.031)
Renewable Energy Use Ratio Score				0.0015 (0.394)
Mkt. Cap (M)	8.85e-06*** (2.593)	8.952e-06*** (2.591)	1.28e-05*** (3.428)	1.641e-05* (1.948)
R ²	0.060	0.066	0.116	0.738

*** p < 0.01, ** p < 0.05, * p < 0.10

The models regressed goes from 1 to 8. Models 1 to 4 have returns as dependent variable. Models from 5 to 8 have volatility, standard deviation, as dependent variable. Models 1, 2, 3, 5, 6 and 7 deals with ESG Scores, its sub scores for environmental, social and governance practices individually and a specific score dealing with controversies the firm faced with regards to ESG practices. Models 4 and 8 look at relationships between returns-volatility and energy related efficiency and practices metrics.

Across the four models examined in Table 5, there were no distinct patterns regarding the influence of environmental, social, and governance (ESG) factors on financial returns. In

Model 1, while the overall ESG score shows a negative coefficient that is not statistically significant, subsequent models try to expand this understanding. Model 3 highlights a significant positive relationship between returns and ESG Controversies, suggesting that firms embroiled in ESG-related controversies may experience higher returns, possibly reflecting market dynamics or strategic responses. Notably, specific pillar scores within ESG, such as environmental and social metrics, generally show non-significant coefficients across the models, indicating a nuanced impact or potential interaction effects not captured by individual pillar scores alone.

Variable	Model 5	Model 6	Model 7	Model 8
Intercept	0.0320*** (0.003)	0.0322*** (0.003)	0.0387*** (0.006)	
ESG Score	-5.903e-05 (-1.263)			
Environmental Pillar Score		-2.369e-05 (-0.517)	-3.109e-05 (-0.673)	
Social Pillar Score		-6.43e-05 (-1.072)	-5.319e-05 (-0.877)	
Governance Pillar Score		2.971e-05 (0.702)	1.997e-05 (0.464)	
ESG Controversies Score			-6.363e-05 (-1.171)	
Resource Use Score				2.228e-05 (0.138)
Resource Reduction Policy				0.0326** (2.647)
Policy Water Efficiency				0.0137 (0.812)
Targets Energy Efficiency Score				0.0001 (1.434)
Environment Management Team				-0.0465 (-0.758)
Environment Management Team Score				0.0006 (0.766)
Environment Management Training				-0.0113 (-1.109)
Electricity Produced				4.153e-12 (0.137)
Renewable Energy Use Ratio				2.302e-05 (0.189)
Renewable Energy Use Ratio Score				-0.0001 (-0.909)
Mkt. Cap (M)	-1.445e-07* (-1.956)	-1.403e-07* (-1.886)	-1.813e-07* (-2.208)	6.409e-07 (-1.754)
R ²	0.075	0.090	0.101	0.522

*** p < 0.01, ** p < 0.05, * p < 0.10

Now in Table 6, the overall ESG Score exhibits non-significant coefficients in Model 5, implying that aggregated ESG performance does not significantly influence corporate volatility in these specifications, especially considering Market Capitalization as control variable and contrary to initial results. Similarly, when examining individual pillars of ESG, such as the Environmental, Social, and Governance Pillar Scores, the regression results consistently show non-significant coefficients across the models. This suggests that variations in environmental, social, or governance practices, as captured by these scores, do not independently drive changes in corporate volatility.

Model 7 provides a perspective with the inclusion of the ESG Controversies Score, revealing a non-statistically significant negative coefficient. While market capitalization

emerges as a robust predictor of volatility across the models, the influence of specific ESG factors on corporate volatility appears limited or context-dependent

5 CONCLUSION

In conclusion, this study provides insights into the integration of Environmental, Social, and Governance (ESG) factors within investment strategies in the Brazilian market. The findings reveal a nuanced relationship between ESG scores and financial outcomes, reflecting both challenges and opportunities for investors. While the direct impact on stock returns shows variability across sectors and time periods, the consistent negative association between ESG scores and stock volatility suggests that companies with higher ESG ratings tend to exhibit lower risk profiles. This correlation underscores the potential for ESG considerations to contribute to long-term financial stability and resilience. Moreover, the study underscores the dual role of ESG criteria, not only as ethical imperatives but also as indicators of operational efficiency and risk management practices that can mitigate volatility and enhance shareholder value over time. Moving forward, further research could explore sector-specific impacts and the evolution of ESG metrics over extended investment horizons to refine strategies that align financial objectives with sustainable development goals.

Key findings from this study include: (i) firms with higher ESG ratings tend to exhibit lower stock volatility, indicating potential risk mitigation benefits for investors; (ii) companies involved in more ESG controversies tend to have lower ESG ratings across ESG dimensions in general and in sub scores; (iii) ESG factors have potential to enhance long-term shareholder value. These findings may help investors, banks and policymakers adjust their procedures to consider the implications of ESG adoption in firms' performance.

REFERENCES

- Agliardi, E. and Agliardi, R. (2021). Pricing climate-related risks in the bond market. *Journal of Financial Stability*, 54:100868.
- Andrade, L. P., Bressan, A. A., Iquiapaza, R. A., and Moreira, B. C. d. M. (2013). Determinantes de adesão ao Índice de Sustentabilidade Empresarial da BM&FBOVESPA e sua relação com o valor da empresa. *Brazilian Review of Finance*, 11(2):181–213.
- Arif, M., Naeem, M. A., Farid, S., Nepal, R., and Jamasb, T. (2022). Diversifier or more? Hedge and safe haven properties of green bonds during COVID-19. *Energy Policy*, 168:113102.
- Banz, R. W. (1981). The relationship between return and market value of common stocks. *Journal of Financial Economics*, 9(1):3–18.
- Cochrane, J. H. (2011). Presidential Address: Discount Rates. *The Journal of Finance*, 66(4):1047–1108. _eprint: <https://onlinelibrary.wiley.com/doi/pdf/10.1111/j.1540-6261.2011.01671.x>.
- Engle, R. F., Giglio, S., Kelly, B., Lee, H., and Stroebe, J. (2020). Hedging Climate Change News. *The Review of Financial Studies*, 33(3):1184–1216.
- Fama, E. F. and French, K. R. (1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics*, 33(1):3–56.
- Filho, M. and Figueiredo, M. A. (2008). Responsabilidade social e investimento social privado: entre o discurso e a evidência. *Revista Contabilidade & Finanças*, 19:89–101. Publisher: Universidade de São Paulo, Faculdade de Economia, Administração e Contabilidade, Departamento de Contabilidade e Atuária.

- Galletta, S., Mazzù, S., and Naciti, V. (2022). A bibliometric analysis of ESG performance in the banking industry: From the current status to future directions. *Research in International Business and Finance*, 62:101684.
- Group, L. S. E. (2023). Environmental, social and governance scores from Iseg.
- Guimarães, T. and Malaquias, R. (2022). Performance of Equity Mutual Funds considering ESG investments, Financial Constraints, and the COVID-19 Pandemic. *Brazilian Business Review*.
- Han, Y. and Li, J. (2022). Should investors include green bonds in their portfolios? Evidence for the USA and Europe. *International Review of Financial Analysis*, 80:101998.
- Hua Fan, J. and Michalski, L. (2020). Sustainable factor investing: Where doing well meets doing good. *International Review of Economics & Finance*, 70:230–256.
- Javadi, S. and Masum, A.-A. (2021). The impact of climate change on the cost of bank loans. *Journal of Corporate Finance*, 69:102019.
- Krueger, P., Sautner, Z., and Starks, L. T. (2020). The Importance of Climate Risks for Institutional Investors. *The Review of Financial Studies*, 33(3):1067–1111.
- Lin, B. and Wu, N. (2023). Climate risk disclosure and stock price crash risk: The case of China. *International Review of Economics & Finance*, 83:21–34.
- Lioui, A. and Tarelli, A. (2022). Chasing the ESG factor. *Journal of Banking & Finance*, 139:106498.
- Pedersen, L. H., Fitzgibbons, S., and Pomorski, L. (2021). Responsible investing: The ESG-efficient frontier. *Journal of Financial Economics*, 142(2):572–597.
- Pereira, A. F. A., Stocker, F., Mascena, K. M. C. d., and Boaventura, J. M. G. (2020). Corporate Social Performance and Financial Performance in Brazilian Companies: Analysis of the Influence of Disclosure. *BBR. Brazilian Business Review*, 17:540–558. Publisher: Fucape Business School.
- Reboredo, J. C. and Ugolini, A. (2020). Price connectedness between green bond and financial markets. *Economic Modelling*, 88:25–38.
- Roll, R. and Ross, S. A. (1980). An Empirical Investigation of the Arbitrage Pricing Theory. *The Journal of Finance*, 35(5):1073–1103. Publisher: [American Finance Association, Wiley].
- Ross, S. (1977). Return, Risk and Arbitrage. *Risk and Return in Finance*, Vol. I.
- Santi, C. (2023). Investor climate sentiment and financial markets. *International Review of Financial Analysis*, 86:102490.
- Sautner, Z., Van Lent, L., Vilkov, G., and Zhang, R. (2023). Firm-Level Climate Change Exposure. *The Journal of Finance*, 78(3):1449–1498. *_eprint:* <https://onlinelibrary.wiley.com/doi/pdf/10.1111/jofi.13219>.