

ESG Disclosure: Impact on Carbon Footprint Reduction and Increased Market Return of Companies

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Abstract

This study examines the impact of carbon footprint reduction and increased market returns on ESG, aiming to fill the gap in understanding the real effects of ESG reporting, particularly on carbon footprints and market returns in US companies listed on the NASDAQ from 2014 to 2022. The dependent variable of this study is market return, measured from EPS. This study also uses two independent variables to investigate the companies' sustainability (ESG disclosure and GHG scope 1). ESG disclosure exhibits a positive and significant relation towards EPS. On the other hand, GHG scope 1 shows a negative and significant relationship with EPS. This suggests that improved ESG reports and reduced emissions will enhance the company's financial performance, leading to increased EPS and attracting more investors. However, the need for further research to solve the discrepancies and investigate other variables affecting the connection between emissions, financial performance, and ESG disclosure is urgent and of utmost importance.

Keywords: ESG, Carbon Footprint, Market Return

1. Introduction

According to the Intergovernmental Panel on Climate Change (2001), Climate change is one of the world's biggest problems. The main cause is increasing carbon dioxide concentrations from fossil fuel emissions ([Archer, 2005](#); [Solomon et al., 2009](#)). In 2022, the global emission of CO₂ reached a new high of over 36.8 Gigatonne, which grew by 0.9% (U.S. Energy-Related Carbon Dioxide Emissions, 2023). This is a serious and urgent issue globally, especially in the USA. The USA is one of the countries with the world's highest carbon footprint (CF), listed second just before China. Based on U.S. Environmental Protection Agency data, in 2022, CF in the USA reached 6,343 million tons of CO₂e, or the equivalent of 12.6% of the total global CF, and the carbon footprint keeps increasing annually. Carbon footprint (CF) is a measure of gas emissions such as CO₂, CH₄, and N₂O from the impact of human activities on the environment and is relevant to climate change or global warming ([Wackernagel & Rees, 1998](#)). The perpetrators of these activities vary, from individuals to governments and companies such as the industrial sector ([Pertsova, 2007](#)). As major contributors to carbon emissions, companies are aware of the risks and climate transition they will face ([Luo & Tang, 2023](#)). On the other hand, companies are also asked by their stakeholders to pay more attention to and manage their

carbon footprint ([Jeswani et al., 2008](#)).

Greenhouse gases (GHGs) are one of the carbon footprints, and human activities are one of the most contributors to the rise of GHGs. Greenhouse gases are established by their watts per square meter (Wm^{-2}). The impacts of CO_2 in this world have been discussed for more than 100 years, it is proven that CO_2 could effectively trap heat ([Tyndall, 1862](#); [Weart, 2004](#)). The preindustrial levels of CO_2 concentration rise from time to time while the GHG total emission was around 84.6% CO_2 , 7.9% CH_4 , 5.5 N_2O , and 2% from the others ([Johnson et al., 2007](#)). Global greenhouse gases can be divided into five economic sectors such as: industry, transport, buildings, energy, and AFOLU (Forestry, agriculture, and land uses) ([Lamb et al., 2021](#)). [Zandalinas et al. \(2021\)](#) explain that reducing carbon emissions is one of the main priorities in facing the existing challenges of climate change. Currently, developing companies have also started to take steps to reduce their carbon footprint and communicate steps and results to stakeholders in environmental, social, and governance (ESG) reports ([KPMG, 2020](#)). With ESG, we can find out the company's concrete efforts to reduce carbon emissions ([Kim et al., 2021](#)). So that investors can assess the extent of company transparency and accountability in dealing with existing environmental problems ([Eccles et al., 2011](#); [Yin et al., 2023a](#)).

Environmental, social, and governance (ESG) is a practice of measuring, disclosing, and accounting for all stakeholders inside and outside the company ([Huber et al., 2017](#)). The importance of ESG Disclosure is due to the increasing number of investors seeking information to make investment decisions. However, studies on the impact of ESG reporting are still very limited. In addition, investors may increasingly realize that sustainable practices by companies will add value to their investments in the long term ([Huber et al., 2017](#)). Strong ESG disclosure not only reflects a company's social and environmental responsibility but is also a potential indicator of good financial performance ([Raimo et al., 2021](#)). Furthermore, corporate sustainability needed to create long term value with minimum environmental damage. There are a few research about environmental performance that leads to improved financial performance ([Delmas et al., 2015](#)).

The study conducted by [Syed et al. \(2022\)](#) investigates and found that economic policy uncertainty and geopolitical risk affect carbon emissions. Furthermore, green technologies are essential for reducing CO_2 emissions and emphasize their role in achieving sustainable business growth ([Obobisa et al., 2022](#)). Other research shows that the adoption of renewable energy reduces emissions levels in the USA and the interesting part is the impact of other variables on emissions depends on the specific level of economic development ([Zhao et al., 2024](#)). Concerning the previous research above, we found several gaps, including the lack of studies related to the real impact of ESG reporting, especially on mitigating carbon footprints on market returns. Therefore, our study fills the research gap by contributing to the literature in adding to growing literature on the real impact of ESG reporting, specifically on carbon footprint mitigation on market returns by using earnings per share (EPS) of the United States, Green House Gasses (GHG) and Environmental, Social, and Governance (ESG) disclosure score.

2. Literature Review

Environmental, Social, Governance (ESG) disclosure. The world these days are facing several issues such as the COVID-19 pandemic, climate change, and international conflict. Society nowadays is searching for alternatives to maintain the environment ([Garel & Petit-Romec, 2021](#); [Nordhaus, 2019](#)). During the issues, the government and several companies are looking for more sustainable and ethical way in order to run a long-term business ([Chen & Xie,](#)

2022). Recently Environment, Social, and Government are becoming the issue that are correlated one and another, each of the pillars has separated value that combined to be ESG disclosure score. ESG disclosure score shows the public about the company performance in three pillar sectors (Pulino et al., 2022). Right now, investors are involving corporate ESG information as their consideration before investing in financial assets and it investors to invest based on their investment choices or preference (Krueger et al., 2024). Prior research shows that ESG disclosure score has a positive impact towards firm performance, especially in environment and social pillar (Pulino et al., 2022). While ESG disclosure score regulation differs in several countries, the demand for more sistematic report rises and led to the establishment of world initiatives such as global reporting initiatives and the United Nations Global Compact. United nations (UN) Principle known to have Responsibility of ESG communication between different parties while still increasing the awareness of ESG Disclosure score. ESG disclosure scores have a significant impact on company performance, this can be seen by big-cap companies having significantly higher ESG disclosure score than mid-cap companies. Prior Works has studied the connection between the ESG disclosure score and financial performance, and the results shows that a high transparency of ESG disclosure score transparency leads to the improvement of financial performance and it also advisable for investor, decision maker and company management to consider the importance of the ESG disclosure score.

Carbon Footprint and Market Return. The substantial amount of scientific evidence supporting past indications of climatic changes, as well as the detrimental effects and vulnerabilities shown in a variety of natural and human activities validates the pressing need for prioritizing climate change issues in social and political agendas (Seixas & Ferreira, 2021). One of the primary contributing factors of climate change is rising carbon dioxide concentrations such as urbanization, agriculture, industrial work and greenhouse effects which promotes climatic changes globally (Kabir et al., 2023). The measurement of the entire quantity of carbon dioxide emissions, both directly and indirectly, that result from an activity or accumulation over a product's life cycle, defines the term carbon footprint (Wiedmann & Minx, 2008). Due to climate change concerns, stakeholders demand clearer and consistent disclosure on how the companies handle carbon emissions (Qian & Schaltegger, 2017). Companies that disclose carbon emissions and actively reduce their carbon footprint can see a positive impact on their valuation and outperform the market (Karim et al., 2021). According to the IPCC assessment, it is vital that every sector reduce their greenhouse gas emissions (Hennessy et al., 2022). In China, A study that examines ESG disclosure and carbon footprint reduction finds an improvement of performance for polluting companies. However, a strict institutional environment weakens this effect, while media attention strengthens it. The study highlights ESG disclosure as a tool for sustainability and emphasizes the roles of regulators and media in promoting transparency and green development (Yin et al., 2023a). In addition, another study by (Qian & Schaltegger, 2017) shows a positive correlation between increased carbon disclosure transparency and subsequent improvements in carbon performance. Disclosing more about carbon emissions leads to companies reducing their carbon footprint, even for those with a bad track record, but this effect is weaker for very energy-intensive industries. Looking from another perspective, A study shows companies that revealed more information about their carbon emissions tended to have better financial results in the period studied. Additionally, the study suggests that companies with strong financial performance were more likely to disclose their carbon emissions in a detailed way, compared to companies with lower financial

performance whose disclosure was less thorough ([Alsaifi et al., 2020](#)). **H₁: There is an adverse effect of carbon footprint on company market return.**

Environmental, Social, Governance (ESG) disclosure and market return. In contrast with limited study of ESG disclosure with carbon footprint, there are substantial studies that conduct correlation between ESG disclosure and market return ([Chang et al., 2021](#)). Companies are held responsible for both their financial success and their positive influence on society ([Bui et al., 2020](#)). Academics and businesses have been debating the link between ESG and its financial performance for years ([Aydoğmuş et al., 2022](#)). In addition, society nowadays understands the importance of ESG activities to create a sustainable business, especially stakeholders ([Tsang et al., 2023](#)). Similarly, another study states that ESG is becoming increasingly important for investors and company managers. Increasingly, investment firms are now considering a company's sustainability efforts when deciding where to invest their money ([Chu et al., 2022](#)). This argument is supported by several works that show ESG disclosure has a significant impact on mainstream interest among asset managers ([Broadstock et al., 2021](#)). Another prior works that also shows ESG company indices which have a good ESG disclosure have a huge impact in creating positive and significant return in short and long horizon ([Chang et al., 2021](#)). On the other hand, A findings from examining the relationship between corporate sustainability and financial performance (CSFP) suggest a generally positive link between sustainability and financial performance, but this can be inconclusive, particularly when measuring sustainability through Corporate Social Responsibility ([Rahi et al., 2024](#)). More broadly, A study underlines the importance of ESG factors not just for individual companies, but for the entire stock market and the overall economy. Their research on how well ESG indexes predict market returns could be especially interesting for policymakers and regulators. It highlights the growing influence of sustainable investing on the financial system ([Chu et al., 2022](#)). Looking from another perspective, investors are increasingly drawn to own companies with strong ethical practices. They are motivated by a desire to support positive corporate behavior while allowing them to invest without compromising their financial goals ([Pedersen et al., 2021](#)).

Furthermore, A study with a large dataset finds that ESG combined score has a positive and highly significant with firm value. This is aligned with the stakeholder theory, where companies that address the needs of various stakeholders, not just shareholders, tend to be rewarded by the market ([Aydoğmuş et al., 2022](#)). In addition, the stakeholder theory suggests that a company's success hinges on meeting the needs or interests of all partners ([Freeman, 1984](#)). Backed with the same theory, a prior study from German, shows that both company's overall ESG performance and its scores in each factor (environment, social, and governance) have a positive effect on its financial performance (ROA). Further analysis finds that, among the three factors, governance performance seems to have the strongest impact on financial performance compared to environmental and social factors ([Velte, 2017](#)). The findings are consistent with newer studies that show ESG disclosure had a significant positive impact on all firms' operational, financial, and market performance (ROA, ROE, and Tobin's Q) ([Alareeni & Hamdan, 2020](#)). Similarly, a study in China suggests that strong ESG performance can lead to higher stock returns for A-listed companies in China. Interestingly, this trend is more notable for non-state-owned companies in eastern regions. The study further explores the reasons behind this by demonstrating that ESG performance can improve a company's financial health and innovation capabilities, contributing to positive stock returns ([Yin et al., 2023b](#)). **H₂: Environmental, Social, and Governance (ESG) positively correlated to market return (EPS).**

3. Research Method

We use annual data from US firms listed in NASDAQ from 2014 to 2022. Based on data availability, the total data observation is 135 from 15 listed firms. All the data was collected from Bloomberg. This study evaluated firms' value using Earnings per Share (EPS) (Bashatweh et al., 2023). This measure is used as the criterion variable to represent market return. Hence, we also investigated the company's sustainability based on Environment, Social, and Governance (ESG) Disclosure and Greenhouse Gases (GHG) Scope 1 as the control variables. Table 1 records summary statistics and a normality test. The results show that EPS has the lowest mean (3.846889), ranging from a minimum of -3.32 to a maximum of 18.36, indicating that the data have significant variation. Further, ESG Disclosure has the middle mean and max score compared to others, 63.61681 and 81.27, sequentially. Furthermore, GHG Scope 1 has the highest mean and max, 4371.018 and 68000, respectively.

Table 1. Summary statistics and normality test

Variable	Mean	Std. Dev	Min	Max	Skewness	Kurtosis
<i>Dependent Variable</i>						
EPS	3,846889	3,202769	-3,32	18,36	1,453827	6,199074
<i>Independent Variables</i>						
ESG Disclosure	63,61681	8,458312	35,84	81,27	-0,5874655	3,428533
GHG Scope 1	4371,018	15705,17	1,9	68000	3,518674	13,50047

We use panel data regression as the main methodology introduced by [Hausman \(1978\)](#). Panel data regression integrates cross-sectional and time series data. The parameter of this model is estimating the least square, which we call the Ordinary Least Square (OLS) method. Firstly, we select the most fitted model between random effect models (REM) and fixed effect models (FEM). The results show the unobserved time variant is correlated with control variables. Therefore, we used the FEM. The model expressed as follows: $Y_{it} = X_{it}\beta + V_i + \epsilon_{it}$

Where the Y_{it} represents the criterion variable, X_{it} shows input variables, β presents a vector of parameter, v is an unobserved time-variant individual effect, i and t represent individual and time, respectively.

4. Findings and Discussions

The Hausman test was run and showed that the probability of chi-squared was 0.0372 (see Table 2). This result indicates that the p-value of our study was lower than the significance of 5%; moreover, we rejected the null hypothesis. Therefore, we used the fixed effect model rather than the random effects model.

Table 2. Hausman Test

$\text{chi2 (2)} = (b-B)' [(V_b - V_B)^{-1}] (b-B)$ $= 6.58$ $\text{Prob} > \text{chi2} = 0.0372$

Table 3 depicts ESG Disclosure and GHG Scope 1 on EPS. The results show that ESG disclosure is positively significant at a 1% level. In line with ([Bashatweh et al., 2023a](#)), better ESG disclosure reports will increase the value of the companies. Having a better ESG disclosure report means that the company has good financial performance, which boosts investors' confidence in investing in the company. It also signifies that the companies can handle

environmental, social, and governance issues, thus managing risks that impact their profitability. Conversely, GHG Scope 1 is negatively significant at a 10% level on EPS. This results support [Midttun & Gjengedal \(2019\)](#) Research has found that companies with the highest GHG emissions will decrease EPS. By reducing their carbon footprint and increasing expense transparency, companies can attract investors' confidence in them. These results confirmed our hypotheses that the carbon footprint has an adverse effect on market returns and that ESG has a correlated relationship with market returns. We also ran the robustness test of ESG disclosure and GHG scope 1 on EPS, as shown in Table 4. The results show that ESG disclosure has consistency of data with the positive and significant 1% level for the fixed effect model and random effect model and 5% level for GLS. It shows that ESG has a significant impact on EPS. In contrast, GHG is inconsistent in all models, with the result of negative and significant at a 10% level for the fixed effect model and positive (significant) for the random effect model (GLS).

Table 3. Regression Result

Variable	Coefficient	Std. Error	t	p-value
Constant	-4.2883	2.9155	-1.4700	0.1440
ESG Disclosure	0.1487	0.0435	3.4200	0.0010***
GHG Scope 1	-0.0003	0.0002	-1.9000	0.0600*
F-value	8.1700	Prob > F	0.0005***	

Dependent Variable: EPS, ***Sig at 1%, **Sig at 5%,
*Sig at 10%

Table 4. Robustness Test

Variable		FE	RE	GLS
Constant	Coefficient	-4.288272	-4.158305	-1.190803
	t-value	-1.47	-1.65	-0.58
	p-value	0.144	0.099	0.561
ESG Disclosure	Coefficient	0.1487299	0.1243015	0.0770657
	t-value	3.42	3.23	2.42
	p-value	0.001***	0.001***	0.015**
GHG Scope 1	Coefficient	-0.0003035	0.0000223	0.0000309
	t-value	-1.90	0.68	1.80
	p-value	0.060*	0.495	0.071*
F-test	F-value			

Dependent Variable: EPS, ***Sig at 1%, **Sig at 5%,
*Sig at 10%

However, our findings on the direct impact of GHG emissions Scope 1 on financial performance differ from some previous research. In contrast to [Gallego-Álvarez et al. \(2015\)](#) Our results do not support the notion that direct GHG Scope 1 affects financial performance. Our findings reveal inconsistency despite their research suggesting a possible positive correlation between lower emissions and financial performance. In the fixed-effects model, we find a negative and significant connection that could be interpreted as lower EPS caused by higher Scope 1 emissions. On the other hand, the random-effects model indicates a positive correlation.

Additionally, our results deviate from those of [Kumari & Patel \(2020\)](#), who investigated the relationship between the intensity of carbon emissions and several financial performance metrics in Indian companies. Their study revealed contradictory findings, showing positive connections for some financial indicators (ROE) and negative correlations for others (ROA, ROIC, and ROS) for specific company categories (clean vs. filthy firms). Our analysis indicates inconsistent results with Scope 1 emissions, focusing only on EPS as the financial performance metric. The divergent results are probably due partly to the different scope of research (EPS vs. multiple financial measures) and the particular setting of Indian companies. This inconsistency across studies highlights the complexity of the relationship between emissions data and financial performance metrics. Variables like industry, business size, and the regulatory environment could have a moderate impact.

5. Conclusion

This study aims to fill the gap in the real impact of ESG reporting, especially on carbon footprints on market returns in US companies listed on NASDAQ from 2014 to 2022. The dependent variable of this study is market return, which is measured from EPS. This study also uses two independent variables to investigate the companies' sustainability (ESG disclosure and GHG scope 1). ESG disclosure exhibits a positive and significant relation towards EPS. On the other hand, GHG scope 1 shows a negative and significant relationship with EPS. This indicates that better ESG reports and reducing emissions will improve the company's financial performance, increasing the EPS and attracting investors. Hence, we suggest further research to solve the discrepancies and investigate other variables affecting the connection between emissions, financial performance, and ESG disclosure.

Open data statement: The data supporting this study is openly available upon request.

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