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Carbon Emission and Consumer Trust: The Influence of Environmental, Social, and Governance Initiatives on Corporate Financial Performance

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KEYWORDS

ESG (Environmental, Social, Governance), carbon emission, company performance, regression analysis

ABSTRACT

Climate change, driven largely by carbon dioxide and greenhouse gas (GHG) emissions, has become one of the most pressing global challenges, triggering extreme weather events, biodiversity loss, and rising sea levels. While international agreements such as the Paris Agreement and COP26 have set ambitious targets to limit global warming, the corporate sector plays a critical role in achieving these goals. Corporate Social Responsibility (CSR) and the Environmental, Social, and Governance (ESG) framework have encouraged firms to integrate sustainability into their operations, aiming not only for regulatory compliance but also for enhanced corporate reputation, consumer trust, and long-term competitiveness. This study investigates the relationship between carbon emissions and financial performance of corporates in Taiwan's electronics industry, focusing on the top 50 companies by market capitalization from 2018 to 2022. Using data from the Taiwan Economic Journal (TEJ), the Market Observation Post System (MOPS), and company sustainability reports, we conduct statistical analysis and establish multiple linear regression models to analyze the correlations between total carbon emissions (TCE) and financial indicators such as return on equity (ROE) and earnings per share (EPS). The results reveal that high carbon emissions are significantly and negatively associated with both ROE and EPS, suggesting that companies with better ESG initiatives experience operational and reputational advantages. The findings highlight the financial and strategic importance of robust ESG practices, not only for improving efficiency and reducing risk but also for attracting investors and consumers..

1. BACKGROUND OF CLIMATE CHANGE AND GLOBAL CARBON PRICING

Climate change refers to the long-term alteration of the Earth's climate system, largely driven by carbon dioxide and other greenhouse gas (GHG) emissions. Over the past century, industrial activities, fossil fuel combustion, deforestation, and large-scale land-use changes have significantly increased the concentration of these gases in the atmosphere. As a result, average global air and ocean temperatures have risen, triggering a cascade of environmental and social impacts. These include more frequent and intense extreme weather events (e.g., storms, floods, heatwaves, droughts), widespread forest fires, biodiversity loss, and rising sea levels that threaten coastal communities. Climate change is no longer a distant risk; it is a present-day reality, causing extensive loss of life, damage to property, economic disruptions, and displacement of communities around the world.

Recognizing the urgent need to limit global warming, the international community has taken important steps. The 2015 Paris Agreement under the United Nations Framework Convention on Climate Change (UNFCCC) set a collective goal of limiting the increase in global average temperature to well below 2°C above pre-industrial levels, with efforts to cap the rise at 1.5°C (Huang & Zhai, 2021). Achieving these targets requires swift and ambitious reductions in global emissions. At the 26th

Conference of the Parties (COP26), world leaders emphasized the need for accelerated climate action, calling for a 45% reduction in global carbon emissions by 2030 and net-zero emissions (carbon neutrality) by 2050 to avoid the most catastrophic impacts of climate change (Huang & Zhai, 2021).

In parallel with government actions, the corporate sector has emerged as a critical stakeholder in the global response to climate change. As major emitters and economic actors, companies bear a significant responsibility in achieving emission reduction targets and promoting sustainable development. The United Nations first formalized the notion of Corporate Social Responsibility (CSR) in 1999, calling on businesses to adhere to ethical norms, support human rights, and contribute to the well-being of employees, communities, and the environment alongside profit-making (Nyantakyi, et. al., 2023). In 2004, the UN further advanced these ideas through the Environmental, Social, and Governance (ESG) framework (Ding et. al. 2024), as articulated in the influential "Who Cares Wins" report. This framework urged companies to move beyond traditional financial performance measures and explicitly incorporate environmental sustainability, social responsibility, and robust governance into their strategies and operations.

Empirical research has demonstrated that firms implementing effective energy transition strategies and controlling their GHG emissions can experience improvements in operational and financial performance (Nishitani et. al., 2014). Beyond operational efficiencies, ESG commitment can strengthen corporate reputation, enhance consumer perceptions, reduce operational and regulatory risks, and improve the resilience of supply chains. In today's fast-changing and sustainability-conscious environment, companies with strong ESG practices are seen as trustworthy, forward-looking, and better positioned for long-term success. Consumers, investors, and other stakeholders are paying closer attention to firms' environmental performance, and ESG commitments have become central to how firms build and maintain trust.

This study aims to investigate the relationship between carbon emissions and corporate performance, focusing on the top 50 electronics companies in Taiwan by market capitalization over the period 2018–2022. Specifically, we explore how companies' efforts to reduce carbon emissions and strengthen ESG practices influence their operating performance and consumer trust. By analyzing the impacts of corporate carbon reduction strategies on market performance, this research provides evidence-based recommendations for future carbon management practices, ESG integration, and competitive positioning in sustainability-oriented markets.

The organization of this article is as follows. Section 2 presents the literature review, while Section 3 describes the research methodology. A series of statistical analyses and the results on the correlations between ESG and company financial performance are presented in Section 4. Concluding remarks and suggestions for further work are given in Section 5..

2. LITERATURE REVIEW

2.1 ESG Framework

In recent years, ESG principles have emerged as a global standard for evaluating the non-financial performance of companies (Nyantakyi et. al., 2023). ESG covers three primary dimensions: environmental sustainability, social responsibility, and corporate governance. Together, they assess how effectively a company protects the natural environment, addresses societal concerns, and ensures ethical business conduct. These indicators reflect not just an organization's efforts to reduce environmental harm or meet regulatory requirements, but also its broader responsibility toward stakeholders, including employees, customers, suppliers, investors, and society at large.

Corporations are increasingly expected to balance profit maximization with ethical and sustainable practices. Good ESG performance involves minimizing environmental impacts, responding to social needs (such as labor rights, diversity, and community development), and strengthening governance frameworks that ensure transparency, accountability, and stakeholder trust. The proactive disclosure of ESG strategies and supply chain details boosts investor confidence and forces companies to self-examine their sustainability commitments (Abdul Rahman & Alsayegh, 2021). Transparent ESG communication can also enhance a company's reputation, improve stakeholder relationships, and increase international competitiveness, as firms that are seen as responsible actors gain a reputational edge in global markets.

Importantly, ESG has evolved from being a voluntary reporting mechanism to a critical benchmark in global finance. Investors now integrate ESG metrics into decision-making processes, recognizing that sustainability risks (such as climate change, labor unrest, or governance failures) can significantly affect long-term profitability and market value (Galbreath, 2013).

2.2 ESG Assessment Models in Taiwan

Taiwan has established its own robust ESG evaluation systems to align with international sustainability trends while addressing local industry needs. One prominent initiative is the Taiwan Sustainability Assessment (TSA) framework, which is designed to evaluate how companies manage ESG risks and opportunities across four interconnected dimensions: Social, Economic, Environmental, and Disclosure (SEED) (Huang, et. al. 2023). This framework encourages companies to go beyond superficial compliance by systematically reviewing their sustainability visions, formulating clear strategies, setting

measurable goals, and implementing specific actions to advance sustainable development. By adapting international standards to Taiwan's local context, the TSA ensures that the assessment reflects both global best practices and domestic operational realities.

Since 2016, Taiwan has conducted an annual corporate sustainability performance assessment, using data from CSR reports and public sources such as official websites and annual filings on the Market Observation Post System (https://emops.twse.com.tw/). By 2023, more than 800 listed companies already participated in the assessment, reflecting the high degree of ESG integration across Taiwan's corporate landscape. This widespread participation indicates that ESG is no longer peripheral but has become mainstream in corporate evaluation and strategic planning.

On the other hand, Taiwan's economy is heavily dependent on the electronics and semiconductor industries, which generate over 50% of the nation's GDP through exports (Industrial Development Administration, MOEA, https://www.ida.gov.tw/). However, these industries also pose considerable environmental challenges. According to Taiwan's 2050 Net Zero Emissions Roadmap (https://www.cca.gov.tw/en/climatetalks/), the electronics sector is the second-largest industrial carbon emitter, contributing 22% of the country's total emissions. Notably, the semiconductors, photovoltaic panels, and electronic manufacturing services industries account for 80% of the electronic sector's emissions footprint. Facing rising regulatory and market pressures, Taiwanese electronics firms have adopted comprehensive low-carbon and ESG strategies to strengthen their competitive positions and align with global sustainability goals. Table 1 shows some low carbon transformation strategies from a few selected main electronics companies in Taiwan. These initiatives demonstrate that leading firms are moving beyond compliance to embrace ESG as a strategic asset, integrating sustainability goals into product design, supply chain management, and innovation roadmaps.

Table 1 Low carbon transformation strategies for Taiwan's electronics industry

Stock Code	Company Name	Corporate ESG Low Carbon Transformation Strategy 2023
2330	TSMC	Working with suppliers to strengthen low-carbon management, through carbon inventories, energy-saving and carbon reduction counselling, encouraging suppliers to introduce carbon capture equipment, and pioneering renewable energy co-procurement to reduce indirect carbon emissions along the value chain.
2317	Hon Hai	Improving energy efficiency and reducing carbon emissions through technological improvements, equipment upgrade and construction of renewable energy facilities; introducing technical modifications to major manufacturing processes and critical technologies to reduce energy wastage and achieve carbon reduction and cost-effectiveness.
2303	UMC	Focusing on green manufacturing and supply chain carbon counselling; investing in the research and development of low power consumption components and various high-efficiency chips, which can be applied to realize low-carbon products such as electric vehicles, thereby facilitating the global net-zero transition.
2301	Lite-On	Optimizing processes and plant operations; promoting a wide range of energy-saving measures, including upgrade of air compressors, adoption of high-efficiency equipment, new process technology and management system refinement to enhance energy efficiency and equipment operation performance.
2357	ASUS	Noting that supply chain is a major source of GHG emissions, with more than 90% of the emissions coming from key suppliers, including panel, motherboard, IC, cable, power supply, mechanical parts, keyboard, battery, hard disc and assembly foundries; ASUS works with these key suppliers to promote the Carbon Reduction Collaboration Program, encouraging them to increase the use of renewable energy, improve energy efficiency, and helping them set GHG reduction targets to promote sustainable development.
2356	Inventec	Promoting a series of activities such as low-carbon product design, green procurement, eco-greening, energy-saving and carbon reduction projects, pollution prevention equipment and waste treatment, as well as the purchase of green building plant and carbon rights.

2.3 Global Pressures on Carbon Reduction

International regulatory developments are adding further urgency to corporate ESG efforts. For example, the Clean Competition Act in the United States proposes carbon tariffs on domestic and foreign manufacturers in high-emission industries (Li, et. al., 2024). Meanwhile, the European Union plans to implement its Carbon Border Adjustment Mechanism (CBAM) in 2027, which will impose tariffs on carbon-intensive imports, including steel, cement, aluminum, and certain electronic products (Shuai, et. al., 2025). Major international technology companies — such as Apple, Amazon, Dell, and HP — have also announced ambitious carbon reduction goals and now require suppliers worldwide to register and monitor their carbon footprints annually. Suppliers that fail to meet these targets risk losing critical business relationships.

For Taiwan's export-driven economy, these developments create both challenges and opportunities. On the one hand, there is a significant risk that companies that cannot demonstrate meaningful carbon reductions are subject to tariffs, market exclusion, or reputational damage. On the other hand, firms that proactively implement carbon reduction strategies can gain competitive advantages, secure long-term customer relationships, and position themselves as leaders in the global sustainability transition. To meet these challenges, companies must adopt environmentally friendly energy sources, develop sustainable business models, and align operations with international expectations (Nishitani, et. al., 2014). Government support is also crucial, especially for small and medium-sized enterprises (SMEs), which may lack the resources to pursue low-carbon transformation on their own. Strategic policy interventions, capacity-building initiatives, and financial incentives can help SMEs integrate into sustainable supply chains and navigate future market and regulatory pressures.

2.4 ESG and Corporate Performance

A substantial body of empirical research has investigated the relationship between ESG practices and corporate performance. Studies consistently show that firms with stronger ESG profiles tend to achieve better financial and operational outcomes. As an example, Chakrabarty & Wang (2013) found that more internationalized corporations are more effective in reducing GHG emissions, which translates into improved sales performance and enhanced product leadership.

Implementing ESG strategies not only strengthens corporate reputation but also fosters comprehensive risk management and long-term strategic planning, allowing firms to navigate fast-changing environments, stabilize production resources, and promote effective operations. Ultimately, these factors enhance the firm's overall competitiveness and resilience. Corporate governance, as the third pillar of ESG, plays a particularly critical role in driving performance. Wu & Huang (2018), examining listed Taiwanese firms between 2002 and 2016, found that directors' shareholding ratios were positively and significantly associated with firm performance. Similarly, Elsayed & Elbardan (2018), studying 350 U.S. companies, reported a positive relationship between executive compensation and firm outcomes. Indeed, good corporate governance ensures the presence of risk management mechanisms, effective organizational structures, accountability systems, and transparent reporting, all of which help build trust among stakeholders. These governance practices not only improve resource efficiency but also enhance the organization's long-term sustainability, growth potential, and value creation.

2.5 The Role of Innovation, Cash Management, Growth, and Size

In executing ESG initiatives, several internal business variables significantly affect firm outcomes. Innovation capability has been identified as a key driver of competitive advantage and superior firm performance (Helfat & Peteraf, 2003). Besides, Hull & Rothenberg (2008) demonstrated that R&D expenditures are significantly positively correlated with Return on Assets (ROA), while Gupta et. al. (2017) found that in developed countries, R&D intensity positively correlates with firm value. Investing in research and development enhances a company's capacity to introduce new products, improve processes, and increase energy efficiency, all of which contribute to both sustainability outcomes and financial returns.

Cash management is another critical factor. Boisjoly (2009) found that firms that proactively manage their cash ratios achieve better cash flow, ensuring liquidity and operational stability. Furthermore, productivity improvements from process innovations not only reduce capital expenditure but also enhance overall firm value. Revenue growth rate serves as an important indicator of a company's operational health and future prospects. An increase in revenue typically signals business expansion, improved market positioning, and the potential for share price appreciation. Mak & Kusnadi (2005) reported a significant positive correlation between revenue growth rate and corporate performance. On the other hand, firm size, often measured by total assets, plays a dual role. Larger firms tend to have more resources to invest in sustainability initiatives and are better equipped to absorb regulatory shocks. Setiadharma and Machali (2017) observed that a company's assets have an indirect effect on profitability, reflecting the firm's capacity to leverage its scale for enhanced operational efficiency and financial outcomes.

In summary, the literature review reveals that ESG considerations have become deeply embedded in corporate strategy and performance evaluation, with wide-ranging implications across industries and national economies. In Taiwan, where the electronics sector plays a pivotal economic role but faces high environmental risks, understanding the interaction between ESG practices, carbon reduction efforts, stakeholder trust, and corporate outcomes is vital. This study empirically examines these relationships, offering actionable insights for corporate leaders, policymakers, and stakeholders seeking to navigate the evolving landscape of sustainable and responsible business practices.

3. RESEARCH METHODOLOGY

3.1 Data Samples

This study analyses the electronics industry among the top 50 enterprises in Taiwan in terms of market capitalization between 2018 and 2022. The data samples are solicited from electronics companies with an average corporate governance rating between the top 6% and 20% and a market capitalization of more than NTD$10 billion. These enterprises must not be in high energy-consuming or high-polluting industries. The data samples include corporate financial information, carbon emissions, and corporate governance, which can be obtained from the Taiwan Economic Journal (https://www.tejwin.com/en/), the Market Observation Post System (https://emops.twse.com.tw/), and the annual sustainability reports of the companies. After screening, there are 22 eligible companies. To avoid bias or error in the research results, any enterprises with incomplete disclosure or lack of relevant information are excluded from the sample collection process.

3.2 Variables and Hypotheses

While corporations are traditionally expected to pursue the best interests of their shareholders, modern business practices increasingly emphasize the importance of considering the interests of a broader group of stakeholders — including employees, consumers, suppliers, local communities, and the environment. This stakeholder-oriented approach aligns with ESG principles, reflecting the idea that long-term corporate success depends not only on financial returns but also on responsible environmental and social practices.

Building on insights from the existing literature, this study identifies a set of key independent variables related to ESG that can influence corporate performance:

(i) Total Carbon Emissions (TCE): representing the environmental footprint of a company, this variable directly captures the extent of the firm's contribution to GHG emissions.

TCE = the sum of direct emissions from businesses (Scope 1) and indirect emissions from businesses (Scope 2) (, Anquetin et. al., 2022; Mejia & Kajikawa, 2024), taking the natural logarithm as ln(CO2).

(ii) Directors' and Supervisors' Shareholding (DSH): reflecting managerial ownership, this variable indicates the alignment of management's interests with those of shareholders.

$$\text{DSH} = \frac{\text{Number of Shares held by Directors and Supervisors}}{\text{Total number of shares}} \times 100\%$$

(iii) Ratio of Independent Directors and Supervisors (IDR): measuring board independence, this governance factor can affect oversight quality and risk management.

$$\text{IDR} = \frac{\text{Number of Seats of Independent Directors and Supervisors}}{\text{Total Number of Seats of Directors and Supervisors Seats}} \times 100\%$$

(iv) Corporate Governance Assessment (CGA): a broader indicator of governance quality, capturing transparency, accountability, and compliance. It ranks companies on the basis of their ratings, which are assigned as follows: 7 for companies with ranking up to 5%; 6 for those in 6%-20%; 5 for those in 21%-35%; 4 for those in 36%-50%; 3 for those in 51%-65%; 2 for those in 66%-80%; and 1 for those in 81%-100%.

(v) Research and Development Expense Ratio (RDE): indicating the firm's investment in innovation, which can drive product development and process improvements, including those related to energy efficiency and emission reduction.

$$\text{RDE} = \frac{\text{R\&D Expenses of the Current Year}}{\text{Net Income of the Current Year}} \times 100\%$$

(vi) Cash Reinvestment Ratio (CRIR): reflecting the extent to which earnings are reinvested back into the firm, potentially supporting long-term sustainability initiatives.

$$\text{CRIR} = \frac{\textbf{Cash Flow from Operations} - \textbf{Dividends Paid}}{\text{Operating Income}} \times 100\%$$

(vii) Revenue Growth Rate (RGR): capturing business expansion, which can correlate with both increased resources for sustainability and potential scaling of emissions.

$$\text{RGR} = \frac{\text{Revenue of Current Year} - \text{Revenueof Previous Year}}{\text{Revenue of Previous Year}} \times 100\%$$

(viii) Company Size (SIZE): typically measured by total assets or market capitalization, influencing a firm's capacity to invest in ESG initiatives and respond to regulatory pressures.

$$\text{SIZE} = \ln(\text{Total Assets})$$

The independent variables are hypothesized to influence corporate performance, which is assessed using two dependent variables:

(i) Return on Equity (ROE): a profitability measure indicating how effectively a company generates income from shareholders' equity.

$$\text{ROE} = \frac{\text{Net Income}}{\text{Shareholders' Equity}} \times 100\%$$

(ii) Earnings per share (EPS): reflecting the portion of a company's profit allocated to each outstanding share, commonly used by investors to assess firm value and performance.

$$\text{EPS} = \frac{\text{Net Income} - \text{Preferred Dividends}}{\text{Average Common Shares}} \times 100\%$$

By incorporating environmental factors (such as TCE), governance characteristics (DSH, IDR, CGA), innovation investment (RDE), financial reinvestment strategies (CRIR), business growth (RGR), and firm scale (SIZE), the study is positioned to holistically examine how carbon emissions interact with internal management practices and operational dynamics to shape overall corporate performance. Specifically, the analysis aims to determine whether firms that actively manage and reduce carbon emissions, alongside implementing strong governance and innovation strategies, achieve superior financial outcomes compared to their peers. As such, the following two hypotheses are formulated:

H1 : Negative relationship between total corporate carbon emissions and ROE

H2 : Negative relationship between total corporate carbon emissions and EPS

4. 4RESULTS AND DISCUSSION

This study used IBM SPSS Statistics software for data analysis. The correlation between corporate ESG initiatives, carbon emissions and corporate performance was investigated to test the above hypotheses.

4.1 Statistics of Data Samples

Table 2 shows the minimum, maximum, mean, median, and standard deviation of each variable of the collected data samples.

Table 2 Statistics of data samples

	Minimum value	Maximum values	Average	Median	Standard Deviation
ROE	1.26	80.87	19.62	16.16	12.85
EPS	0.58	210.70	20.91	8.18	38.14
TCE	7.41	16.23	12.22	12.39	2.04
DSH	1.77	53.62	13.17	7.33	12.02
IDR	17.00	63.00	39.04	38.00	11.38
CGA	3.00	7.00	6.28	7.00	0.94
RDE	0.00	28.32	6.01	3.84	6.82
CRIR	-64.63	50.88	6.55	7.66	14.41
RGR	-18.77	111.34	10.57	6.44	17.51
SIZE	16.92	22.33	19.40	19.36	1.20

For the dependent variables, ROE has a minimum value of 1.26, a maximum value of 80.87, and an average of 19.62, indicating that most enterprises have the ability to utilize their shareholders' equity to generate profits. EPS has a minimum value of 0.58, a maximum value of 210.70, and an average of 20.91, which indicates that there is a wide range of EPS among the enterprises. This means that some enterprises need to improve the rate of return on their capital investment.

For the independent variables, the minimum value of TCE is 7.41, the maximum value is 16.23, and the average value is 12.22. Although all companies are in the electronics industry, the products produced by each company are different, leading

to differences in manufacturing processes. This, in turn, causes differences in carbon emissions. The minimum value of DSH is 1.77, the maximum value is 53.62, and the average value is 13.17, depicting a big difference in the percentage of directors' and supervisors' shareholding among companies. The indicates that some internal executives have less confidence in the future of their own companies. The minimum value of IDR is 17.00, the maximum value is 63.00, and the average value is 39.04. This indicates that some enterprises have a higher proportion of independent directors and supervisors. CGA has a minimum value of 3.00, a maximum value of 7.00, and a mean of 6.28, indicating that most of the firms tend to be in the top 6% to 20% of the assessment. RDE has a minimum value of 0.00, a maximum value of 28.32, and a mean of 6.01. The difference in research and development expenses may be due to the difference in products manufactured and innovation strategies of the companies. The minimum value of CRIR is -64.63, the maximum value is 50.88, and the mean is 6.55. This shows that some companies have negative CRIR, indicating poor investment or management. The minimum value of RGR is -18.77, the maximum value is 111.34 and the average value is 10.57. A negative RGR indicates that the company has reduced its revenue as compared with the previous period, which may be attributed to factors such as economic recession, competitive market and reduced consumer demand. The minimum value of SIZE is 16.92, the maximum value is 22.33 and the average value is 19.40, indicating that there is no significant difference in the total assets held by the firms.

4.2 Variance Inflation Factor (VIF)

The VIF (Marcoulides & Raykov, 2018) measures the degree of the variance of a regression coefficient is inflated due to multicollinearity, i.e., how strongly one independent variable is linearly related to the others. An VIF value of 1 indicates no multicollinearity, VIF> 5 indicates moderate concern, while VIF> 10 indicates serious multicollinearity issue. As can be seen in Table 3, all reported VIF values are well below 5, which suggests that multicollinearity is not a major issue in this study.

Table 3 Variance of Inflation Factor of independent variables

Variable	VIF
Total carbon emissions (TCE)	3.730
Shareholding of Directors and Supervisors (DSH)	1.396
Independent directors and supervisors Ratio (IDR)	1.230
Corporate Governance Review (CGA)	1.218
Research and Development Expenses (RDE)	1.449
Cash Reinvestment Tatio (CRIR)	1.111
Revenue Growth Rate (RGR)	1.154
Company Size (SIZE)	3.604

4.3 Multiple Linear Regression Analysis

We employed multiple linear regression (MLR) model (Alexopoulos, 2010) to investigate how corporate characteristics — particularly ESG performance indicators, carbon emissions, governance structures, and operational metrics — influence corporate financial performance. The corporate financial performance is measured using two key dependent variables, i.e.,

(i) ROE, an indicator of how effectively a firm generates profits from shareholders' equity, often reflecting internal efficiency, profitability, and financial health; and

(ii) EPS, an important market measure of per-share profitability, relevant to investors and reflecting both operating success and capital structure impacts.

The MLR model is structured as:

$$Y_{it} = \alpha + \beta_1 TCE_{it} + \beta_2 DSH_{it} + \beta_3 IDR_{it} + \beta_4 CGA_{it} + \beta_5 RDE_{it} + \beta_6 CRIR + \beta_7 RGR_{it} + \beta_8 SIZE_{it} + \varepsilon$$

where i indexes firm (1-22 firms), t indexes year (2018–2022), α is the intercept, ε is the residual (error term), while Y_{it} is either ROE or EPS, i.e., the dependent variables.

Based on the MLR model, we can quantify how much variation in ROE and EPS can be explained by the independent variables from the perspective of environmental impact (TCE), governance features (DSH, IDR, and CGA),

innovation expenses (RDE), financial reinvestment (CRIR), growth dynamics (RGR), and firm size. In other words, by using ROE and EPS, the study captures both internal profitability and shareholder-level profit indicators, giving a rich understanding of performance drivers. Besides, incorp environmental, governance, innovation, and financial factors enables a holistic analysis pertaining to influences firm performance. With data spanning 22 firms over five years, the model is able to control for cross-sectional differences and temporal trends, improving reliability over simple cross-section or time-series models. Tables 4 and 5 summarize the results.

Table 4 Results of regression analysis on ROE

Variable Name	Non-standardized coefficients		Standardized Coefficients	T	Significance
	B	Standard Error	B		
(Constant)	36.096	17.134		2.107	0.038**
TCE	-2.180	0.707	-0.346	-3.082	0.003***
DSH	0.172	0.073	0.161	2.344	0.021**
IDR	0.303	0.073	0.269	4.171	0.000***
CGA	-1.049	0.877	-0.077	-1.196	0.234
RDE	0.126	0.132	0.067	0.958	0.340
CRIR	0.072	0.055	0.081	1.326	0.188
RGR	0.398	0.046	0.541	8.675	0.000***
SIZE	-0.144	1.181	-0.013	-0.122	0.903
Note: *** denotes a significant level of 1 per cent, ** denotes a significant level of 5 per cent and * denotes a significant level of 10 per cent.					

Referring to Table 4 for the ROE model, TCE is negatively and significantly associated with ROE (B = -2.180, p = 0.003***), strongly supporting **Hypothesis 1** of this study. Specifically, as firms' carbon emissions increase, their return on equity declines. This suggests that firms with higher emissions may not only face direct environmental costs but also reputational costs, as stakeholders and the public may interpret high emissions as a lack of ESG commitment. This, in turn, can dampen customer loyalty, erode investor confidence, and increase financing or regulatory burdens — all of which negatively affect profitability. This finding aligns with Chakrabarty & Wang (2013), which showed that internationalized multinational corporations often achieve lower greenhouse gas emissions, which enhances their market reputation, investor appeal, and sales outcomes. The present study reinforces this by showing that even at the firm-level, environmental performance plays a tangible role in financial outcomes.

Other notable findings in the ROE model include: (i) DSH positively and significantly affects ROE (B = 0.172, p = 0.021**), suggesting that when directors and supervisors have greater ownership stakes, they may be more incentivized to improve firm performance and profitability; (ii) IDR also shows a strong, positive, and significant effect (B = 0.303, p = 0.000***), highlighting the governance benefit of having more independent oversight, which may enhance decision-making quality and align management actions with shareholder interests; and (iii) RGR shows the most substantial positive effect on ROE (B = 0.398, p = 0.000***), reinforcing the intuitive result that firms with strong revenue expansion also generate stronger returns for equity holders. Besides, other variables, such as CGA, RDE, CRIR, and SIZE, did not show statistically significant effects on ROE in this model.

For the EPS model, as shown in Table 5, TCE again shows a negative association (B = -5.885, p = 0.060*), which is marginally significant at the 10% level, supporting **Hypothesis 2**. This result suggests that higher carbon emissions can erode a firm's earnings per share, possibly due to the same reputational, regulatory, and operational pressures discussed above. Even though the effect is weaker compared to ROE, the consistency across both dependent variables strengthens the conclusion that poor environmental performance has meaningful financial repercussions.

Table 5 Results of regression analysis on EPS

Variable Name	Non-standardized coefficients		Standardized Coefficients	T	Significance
	B	Standard Error	B		
(Constant)	13.435	74.879		0.179	0.858
TCE	-5.885	3.091	-0.315	-1.904	0.060*
DSH	0.638	0.321	0.201	1.989	0.049**
IDR	-0.484	0.318	-0.144	-1.522	0.131
CGA	-12.987	3.832	-0.320	-3.389	0.001***
RDE	0.757	0.576	0.135	1.313	0.192
CRIR	0.311	0.239	0.117	1.300	0.196
RGR	0.049	0.200	0.022	0.244	0.808
SIZE	8.472	5.159	0.267	1.642	0.104
Note: *** denotes a significant level of 1 per cent, ** denotes a significant level of 5 per cent and * denotes a significant level of 10 per cent.					

Other results in the EPS model include: (i) DSH again shows a positive and significant effect (B = 0.638, p = 0.049**), suggesting alignment between ownership and per-share profitability; (ii) interestingly, CGA shows a negative and significant effect on EPS (B = -12.987, p = 0.001***), which may indicate that firms scoring higher on governance reviews could face short-term profitability pressures, possibly due to the costs of implementing governance improvements or the scrutiny applied to profit-driven decisions. Other variables, including IDR, RDE, CRIR, RGR, and SIZE, did not show statistically significant effects on EPS.

4.4 Discussion

Several key observations and insights can be derived based on the results, as follows.

- Environmental performance is important — Firms with higher carbon emissions face significant negative impacts on both ROE and, to a lesser extent, EPS, highlighting the importance of sustainability efforts not just for regulatory compliance but also for financial health;
- Governance structures drive performance — Both director shareholding and board independence appear to play constructive roles in improving financial performance, confirming the value of ownership alignment and independent oversight;
- Revenue growth is critical for ROE — While not strongly affecting EPS in this model, revenue growth remains a key driver of return on equity, underscoring the importance of expansion strategies.

These findings contribute to the growing body of research demonstrating that ESG factors, particularly environmental impacts, are not just ethical or compliance issues but are directly linked to financial outcomes. Firms aiming to improve shareholder value should prioritize reducing carbon emissions, strengthening governance structures, and driving sustainable growth. Investors and stakeholders, in turn, should factor ESG performance into their evaluations of corporate health and long-term profitability.

5. CONCLUSIONS AND RECOMMENDATIONS

In this study, we have examined the interplay between ESG initiatives and corporate financial performance through statistical analyses. We have analyzed data collected from the Taiwan Economic Journal (TEJ), the Market Observation Post System (MOPS), and the annual sustainability reports of the top 50 electronics companies in Taiwan by market capitalization from 2018 to 2022. We have examined the correlation between carbon emissions and other governance variables with respect to corporate financial performance through multiple linear regression models.

The results indicate TCE is negatively and significantly correlated with both ROE and EPS. This finding implies that when a company's carbon emission rate is high, it could lead to a decrease in ROE and EPS. Indeed, high carbon emissions not only harm the environment, but also make the general public and stakeholders believe that the company lacks attention to environmental protection, which in turn affects the willingness to consume and invest. By reducing energy consumption and waste emissions, companies can lower their operating costs. In addition, a good social responsibility policy can help increase consumers' satisfaction. Companies that follow ESG standards are often able to access more financing opportunities and are more resilient to regulatory and market changes. The results of this study show that companies with good ESG performance can attract more investors and consumers to reduce operational risks and drive business success. Our findings provide a reference for future corporate carbon emission management to promote the company image and achieve long-term competitiveness and success in the international market.

Compared with European and American countries, Taiwan is still at the beginning of the concept of corporate sustainability, and many companies are yet to fully disclose their GHG emissions data. This has the limited number of data samples used in our analysis. With the improvement of the GHG emission disclosure system, it will be helpful to collect more data samples and conduct more extensive and detailed analyses. In addition, it is suggested that the study could be extended to cover different industries to examine whether there are differences in the correlation between carbon emissions and corporate performance in other industries. Meanwhile, with the improvement of the Scope 3 disclosure system, the future study can also include Scope 3 carbon emissions (Anquetin et. al., 2022; Mejia & Kajikawa, 2024) in the calculation, so as to study the correlation between carbon emissions and the financial performance of enterprises and the effectiveness of carbon reduction with more precise data disclosure

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