

Does Carbon Emission Disclosure Affect Market Performance? Evidence from Sri Lanka

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University of Ruhuna,
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Aloy Nires, J.*

Department of Accounting, Faculty of Management Studies and Commerce
University of Jaffna

Abstract

The study aims to investigate the relationship between the disclosure of carbon emissions and the market performance of publicly listed companies in Sri Lanka. This is done by analyzing companies that reported their emission data on the Carbon Disclosure Project (CDP) from 2018 to 2022. The analysis utilizes dynamic panel data estimation with a two-step GMM regression to address potential endogeneity. The study indicates that higher levels of Carbon Emission Disclosure (CED) result in increased Tobin's Q, supporting previous research and promoting wider acceptance and understanding of CED and its impact on market performance. This study is a pioneering effort to examine the influence of CED on market performance, using the GMM system. The researcher has not found any prior studies conducted in Sri Lanka that evaluate all publicly listed companies disclosing emissions-related data as identified by CDP.

Keywords: Dynamic Panel, Endogeneity, Market Performance

Introduction

The issue of global warming has garnered international attention since the Intergovernmental Panel on Climate Change (2007) reached the conclusion that human activity is the primary cause of global warming. The cost of environmental degradation due to human activity is already substantial and increasing. It was valued at US\$6.6 trillion, or 11% of the global GDP (UNEP Finance Initiative and PRI, 2011). The Triple Bottom Line framework incorporates social, environmental, and financial considerations, offering an effective way to tackle growing concerns regarding climate change and the long-term viability of business activities (Slaper & Hall, 2011).

Various stakeholder groups press companies to publish information regarding Green House Gas (GHG) and take action to minimize GHG emissions in response to rising legislation and knowledge of climate change concerns (Kolk et al., 2008). The approach to managing carbon

risk may change depending on how carbon reduction policies are implemented and communicated, affecting a company's performance, financial situation, and changes in that position. In a world where carbon is limited, the capability to mitigate climate-related risks within the supply chain, reduce regulatory costs, avoid costly litigation and other reputational threats, hedge against physical climate risk, invest in low-carbon assets, and innovate around novel product and technology opportunities will all have an impact on costs and revenue (Lash & Wellington, 2007). Despite this, international accounting standards do not require the disclosure of greenhouse gas data. Nevertheless, some businesses share their GHG data to communicate their GHG reduction plans and initiatives.

The term "environmental, social, and governance disclosure" (ESG) pertains to the information provided by a company regarding its performance in these areas. ESG encompasses environmental considerations such as water usage, energy, and climate change; social responsibility issues like gender equality and human rights; and matters pertinent to corporate governance, including bribery, corruption as well as shareholder protection as defined by ISO 26000:2010. ESG information may be presented in a standalone sustainability report or integrated with financial data in a company's annual report. The Code of Best Practice on Corporate Governance provides the fundamental framework pertaining to ESG concerns in Sri Lanka. Several studies have been conducted in the past to examine the relationship between environmental disclosure and financial performance. (King & Lenox, 2001; Nishitani & Kokubu, 2012; Matsumura et al., 2014; Kleimeier & Viehs, 2016). However, these investigations are based on industrialised nations with clear and well-established legal frameworks governing environmental disclosures and handling. Given the variations in the regulatory environment and how they affect emission control, it is appropriate to conduct a separate study focusing on emerging economies such as Sri Lanka, where relatively few research studies have examined this topic.

The research investigates how the disclosure of carbon emissions in Sri Lanka relates to market performance. In Sri Lanka, businesses voluntarily use the Carbon Disclosure Project (CDP) to disclose carbon emission data, as it is not a mandatory requirement. The research offers significant inputs to the existing pool of knowledge. First, it is the premier study to examine the connection between carbon emission disclosure and market performance, considering all listed companies disclosing their emission levels. Second, it is the maiden attempt conducted in the Sri Lankan context leveraging the system GMM.

Environmental concerns and businesses' impacts on the environment are growing worldwide, and stakeholders are demanding precise and reliable information about an organisation's environmental performance. As environmental concerns continue to grow, companies both in the public and private sectors are increasingly sharing detailed information about their environmental initiatives and performance to meet the demand for greater transparency. However, the financial benefits of doing so are unclear, particularly in the Sri Lankan scenario.

Research by Brouwers, Schoubben, Van Hulle, and Van Uytbergen in 2014 revealed that about half of global carbon emissions originate from Asia. This underscores the need to prioritize environmental responsibility and business sustainability in the region. Unlike in the US and Europe, there has been limited research on how environmental regulations affect the performance of Asian enterprises. As climate change affects both Western and non-Western countries, it's crucial to address environmental concerns and responsibilities in Asia. Sri Lanka serves as a research site for examining the connection between carbon emission disclosure and

market performance. Despite high rankings in evaluations by the GRI, CDP, Carbon Knights, and Refinitiv, there is a lack of literature on sustainability reporting in Asian countries compared to other regions like North America, Europe, and Oceania (Aouadi & Marsat, 2018; Aboud & Diab, 2018). Previous findings on the link between sustainability reporting and company performance are inconclusive and require further empirical research. While certain studies found a positive correlation between sustainability reporting and corporate outcomes, others found no such correlation (Johari & Komathy, 2019; Aouadi & Marsat, 2018; Gunarsih & Ismawati, 2019; Kasbun et al., 2017; Raneses, 2020; Suttipun & Saelee, 2015; Burhan & Rahmanti, 2012). According to Beatty and Shimshack (2010) and Alsaifi et al. (2020), carbon emissions have had a negative impact on business performance.

It is interesting to note that Sri Lanka and other developing countries lack a solid legal system and policy framework to address environmental challenges, as Chakrabarty (2009) highlighted. This means that companies operating in these economies may not be subject to direct regulatory pressure to tackle climate change, unlike those in developed economies, as Manrique and Marti-Ballester (2017) noted. As a result, companies, whether high or low polluters, may not have incentives to reduce their carbon emissions, as pointed out by Fikru (2014). However, climate change is increasingly recognised as a critical economic and policy issue and is now regarded as a climate emergency or crisis. Although internal economic factors, as suggested by Boiral et al. (2012), can provide companies with the confidence to implement emission control strategies without legislative constraints.

This study provides valuable insights by probing the nexus between carbon emissions and market performance. Regulators and institutions can use the data to persuade companies to espouse emission practices at low levels. It also underscores the potential benefits of improved environmental disclosure practices for firms operating in emerging economies like Sri Lanka. The principal outcomes of the study have important implications for policymakers, managers, investors, and firms operating in Sri Lanka and other emerging economies in assessing environmentally friendly practices and their likely outcomes.

One of the primary obstacles Sri Lanka faces is its heavy dependence on fossil fuels, especially oil, for producing electricity. This dependence has resulted in a marked rise in greenhouse gas emissions, exacerbating climate change. In response to this challenge, Sri Lanka is committed to reaching the target of generating 70% of its electricity from renewable sources by 2030 (Public Utilities Commission of Sri Lanka, 2022). This provides the country with an opportunity to invest in renewable energy infrastructure, including solar and wind power, to decrease carbon emissions and enhance the country's long-term economic outlook.

The study is divided into five sections. The subsequent section reviews the theoretical foundations, empirical literature, and hypothesis formulation. The third section covers sample and data collection, operationalization, conceptual framework, econometric model, and statistical analysis. In the fourth section, the test results are presented. The final section summarizes the study's conclusions, limitations, and future research directions.

Theoretical perspectives, related research, and hypothesis development

Various theoretical perspectives exist on how carbon emissions disclosure affects firm value. Some scholars have looked at social contract ideas to explain the disclosure of carbon emissions. Legitimacy theory, resource-based view, and trade-off theory are some of the

theories that earlier researchers have used to define environmental disclosure, business value, and carbon emissions disclosure.

Legitimacy Theory

According to Suchman's legitimacy theory, an organisation must align its actions with socially constructed beliefs, values, norms, and definitions to survive. In order for a company to succeed, it is imperative that it achieves socially desirable objectives and shares economic, social, or political benefits with influential groups. As society becomes more aware of environmental and social issues, there is a growing expectation for corporations to take responsibility for the environment, society, and their employees. Legitimacy theory offers a solid framework for corporations to report on their social and environmental impact. It underscores the voluntary nature of including environmental and social data contained in annual reports. The theory distinguishes between financial performance and corporate reputation on one side and social and environmental responsibility that aligns with societal expectations on the other. An organisation's existence and growth depend on achieving specific socially acceptable goals for society, and it must acknowledge its place within the community in order to succeed. Companies must ensure that their practices and social values are compatible with evolving social expectations, including legal, ethical, and economic considerations. Failing to do so can lead to a loss of public support, ultimately endangering the organization's reputation. To establish legitimacy, businesses must align with social values, comply with laws, engage in public service, conduct environmental audits and conservation efforts, and support environmental activists.

Legitimacy, as described by Suchman (1995, p.574), pertains to the perception that an entity's actions are appropriate, desirable, and conform to a socially established methodology composed of values, norms, beliefs, and definitions. A company requires societal acceptance to endure, legitimacy theory emphasises. Any organization operating within society through a social contract is considered to operate under this theory (Suchman, 1995). For an organization to succeed and grow, socially desirable societal goals must be achieved, and economic, social, or political benefits must be distributed to groups that grant it power (Shocker & Sethi, 1973, p. 97). The increased mindfulness of social and environmental issues has led to a rising anticipation of corporate responsibility towards employees, the environment, and society.

Legitimacy theory is a widely recognized theoretical perspective for sustainability reporting. It explains the voluntary nature of social and environmental disclosure data in annual reports (Deegan & Gordon, 1996; O'Donovan, 2002; Patten, 1991). This theory differentiates between aspects of corporate reputation and financial performance that align with the organization's expectations, and aspects related to social and environmental responsibility that conform to societal expectations. Due to the social contract, which underpins an organization's existence and growth by achieving specific socially acceptable purposes for society, the organization must acknowledge its role in the community. Companies also strive to make their practices and social values consistent. However, they must operate within the confines of dynamic social expectations, including legal, ethical, and economic ones, or risk public disapproval (Dowling & Pfeffer, 1975). These factors constantly place the legitimacy of organizations at risk. Representing businesses in line with social values, adherence to the law, involvement in

community service, carrying out environmental audits and conservation efforts, and supporting environmental activists are all ways to establish legitimacy (Mousa & Hassan, 2015).

Trade-off Theory

According to Friedman (1970), a company's main objective is to maximise profits. Ethical commitments are expected to incur more costs than benefits, decreasing the company's value. The cost of environmental operations includes resource mismatch costs, operating costs, implementation costs, maintenance costs, certification and audit costs, and even agency fees (Jensen, 1986; Klassen & Whybark, 1994; Palmer et al., 1995; Alberti et al., 2000). Recent studies have defined corporate social responsibility (CSR) as opposing the company's interests. According to Chen and Metcalf (1980), funding for environmental concerns may take away resources that could have been used for other profitable ventures. To achieve better environmental performance, financial success must be sacrificed.

Gray and Shadbegian (1995) /state that environmental regulations lead to the allocation of resources to unproductive activities such as waste treatment and environmental audits, ultimately impacting businesses' productivity. Jaggi and Freedman (1992) argued that a company's environmental commitment would not be rewarded with an increase in market value due to this allocation of resources. To investigate the impact of CSR events on stock price performance, Krüger (2015) conducted a short-term event study. It was found that CSR events, including environmental events, resulted in an overall negative response, indicating that agency expenses were the leading cause of the decline in stock prices.

Resource-based Theory

The resource-based approach to business challenges the traditional trade-off theory and demonstrates why businesses are now motivated to assume environmental responsibility. As established by Wernerfelt in 1984, the resource-based perspective emphasises that a firm's competitive position in the market is determined by its resources rather than its products. This means businesses with access to valuable resources are more likely to succeed in the marketplace.

Russo and Fouts (1997) anticipated that environmental concerns would set businesses apart in the marketplace. Thus, they included environmental initiatives in their competitive advantages. Businesses that take environmental responsibility seriously benefit from the support of stakeholders, which boosts sales, opens up rich financing channels and maintains a stable workforce. In particular, customers' growing worries about environmental issues encourage them to buy green products, which boosts the sales of environmentally conscious businesses.

Baron (2009) states that investors value companies with greater environmental responsibility and financial return. These benefits are especially evident in times of crisis. Furthermore, according to Bhattacharya, Korschun, and Sen (2009), companies that practice environmental management are more likely to win over the support and trust of their workforce, which in turn fosters job satisfaction and identification. These factors increase workers' loyalty to their employers and lower the employee turnover rate.

In sum, accepting environmental responsibility has both quantitative and qualitative advantages. The measurable benefits are production savings, policy support, favourable taxation, and stakeholder recognition. This intangible reputation aids businesses in attracting investment, boosting sales, and keeping staff members. These material and immaterial advantages help businesses project a favourable image and improve their bottom line. According to the resource-based view, so few businesses publicly declare themselves to be carbon neutral, which can be interpreted as a unique resource for businesses, and these kinds of potential competitive advantages can encourage businesses to take on environmental responsibilities. Overall, environmental responsibility is a crucial aspect of modern business practices, and it can lead to a wide range of benefits for businesses, investors, employees, and customers.

Related Research

The surge in carbon markets and carbon regulation has generated heightened interest in carbon accounting and disclosure. According to research by Stanny and Ely (2008), Prado-Lorenzo et al. (2009), Bowen and Wittneben (2011), Ziegler et al. (2011), and Haigh and Shapiro (2012), this trend is well-supported. Chapple et al. (2011) observed a decline in market value for high carbon emitters under a national emissions trading system while investigating the correlation between carbon emissions and business value. Furthermore, Aggarwal and Dow (2011), Matsumura et al. (2011), and Griffin et al. (2012) indicate an inverse connection between carbon emissions and corporate value.

Multiple research studies have demonstrated an adverse link between carbon emissions, disclosure, and company value. This unfavorable association may lead to the transfer of firm value (Chapple et al., 2013; Matsumura et al., 2014). When a corporation discloses its carbon footprint, shareholders could react negatively, assuming the company will bear the cost of transparency. Investors tend to prioritize the financial health of the firm over its environmental performance (New et al., 2018; Siregar & Deswanto, 2018). In a competitive market, companies should focus more on the increased cost of CSR, which could potentially result in subpar financial performance (Bragdon & Marlin, 1972).

In 2018, Laskar and Maji carried out a study on the impact of sustainability reporting on the market-to-book ratio in four Asian countries: South Korea, Japan, Indonesia, and India. The Global Reporting Initiatives (GRI 3.1) framework was utilized to evaluate business sustainability. The results indicated that Japan had the highest disclosure quality, followed by Indonesia, South Korea, as well as India in that order. The research also found that business sustainability had a positive impact on certain regression outcomes.

In another study, Husnaini and Basuki (2020) examined the relationship between firm value, sustainability reporting (SR), and the corporate governance scorecard (ACGS) using data from 359 company observations in Asia, including Malaysia, Singapore, Indonesia, the Philippines, and Thailand. The findings discovered that sustainability reporting and ACGS significantly decrease firm value. However, this study is constrained due to the lack of disclosure of sustainability practices by many Asian companies, and the voluntary nature of ACGS.

Triansyah et al. (2020) carried out research utilizing a set of 16 Indonesian manufacturing firms during the period from 2014 to 2018. The study explored factors influencing carbon emission disclosure (CED), including company size, profitability, growth, environmental committees, and gender diversity. The researcher used a checklist based on the Carbon Disclosure Project's measuring sheet to assess the level of CED. Carbon emission disclosure varies depending on the company's size, the findings suggest. Larger corporations face more pressure from their economic activities, attracting increased public and government attention. Therefore, these businesses are more likely to disclose their carbon emissions. However, the disclosure of carbon emissions is not dependent on gender diversity, environmental committees, corporate expansion, or profitability. The study highlights that Indonesian manufacturing companies reveal significantly less information about their carbon emissions. This calls for society and the government to hold corporations more accountable for their environmental impact and to encourage more carbon emission disclosure.

Kengatharan et al. (2020) conducted research to determine the influence of CSR disclosure on Tobin's Q. The researchers used quantitative data obtained from 31 manufacturing companies listed in Sri Lanka. The study found that every sustainability parameter had an adverse effect on Tobin's Q based on the regression analysis. The report advocates that implementing sustainable business practices can help increase a company's value and attract new customers, thus enhancing the wealth of its owners. However, incorporating sustainable concepts into a company's core activities can increase expenses and reduce performance.

Nimanthi and Priyadarshanie (2021) conducted a study on the influence of environmental disclosure practices on firm performance with a sample of fifty firms from 2015 to 2018. The study employed regression analysis and found a significant and positive correlation between environmental disclosure and financial performance. Nevertheless, no notable correlation was found between environmental disclosure and market performance.

Thayaraj and Karunaratne (2021) examined listed Sri Lankan companies following Global Reporting Initiative (GRI) guidelines to investigate the impact of sustainability reporting on financial performance. The study discovered that Sri Lankan companies' disclosure levels must meet the standard set by foreign-listed businesses. Regression analysis revealed that social, environmental, and economic disclosures significantly affect Return on Assets (ROA).

Ramadhan, Rani, and Wahyuni (2023) explored the impact of COVID-19, green innovation, and carbon emission disclosure on financial performance and business value. The study focused on Indonesian firms registered at the Indonesia Stock Exchange between 2015 and 2021, with a sample of 48 organizations chosen using purposive sampling. The study utilized path analysis and found that green innovation had a significant and high-quality impact. COVID-19 had a sizable negative effect on overall financial performance, while carbon emission disclosure had no discernible effect. The study also revealed that COVID-19 negatively impacted business value, while financial performance and carbon emission disclosure significantly impacted firm value. However, financial performance alone cannot significantly offset the impact of carbon emission disclosure on company value. It can, however, offset both the negative effects of COVID-19 and the positive effects of green innovation on business value.

Most studies conducted on this topic in the context of emerging countries have utilized relatively small sample sizes. For example, Anggita, Nugroho, and Suhaidar (2022) examined 16 Indonesian businesses, Ramadhan, Rani, and Wahyuni (2023) evaluated 48 Indonesian firms, and Pipin, Edfan, and Adhitiya (2021) analyzed 39 Indonesian companies and 25 Australian companies. Triansyah et al. (2020) studied 16 companies, Nimanthi and Priyadarshanie (2021) investigated 50 companies from five sectors, whereas Kengatharan et al. (2020) focused solely on manufacturing companies. The use of limited sample sizes raises concerns about the potential for incorrect generalization of findings. In an effort to tackle this issue, the research adopts a wider perspective by examining all publicly listed companies in Sri Lanka that report data on carbon emissions. This approach aims to offer a more thorough insight into the subject. Notably, to the researcher's knowledge, no study has incorporated all listed firms that disclose carbon emission information in Sri Lanka using the system GMM. The study hypothesized the following based on past empirical results though the impact of carbon emission on market performance requires further probing.

H₁: CED relates positively to market performance as proxied by Tobin's Q, ceteris paribus

Materials and Methods

Sample and data collection

As of March 31, 2023, there are 289 companies listed under the Colombo Stock Exchange (CSE) Sri Lanka, divided into 20 different sectors. My study focuses on CSE-listed companies in Sri Lanka, particularly those that disclosed their emission data on the CDP between 2018 and 2022. The study consists a sample of 75 listed companies selected through manual collection of carbon emission data, as no direct database provides this information.

Operationalization

Table 1 provides a comprehensive overview of the variables included for analysis, including dependent, independent, and control variables. It also indicates the source of each variable's inclusion, a detailed definition, and the method used to compute it. This amount of specific information is crucial for precise analysis and comprehension of data, as it provides a distinct grasp of the factors and their interconnections.

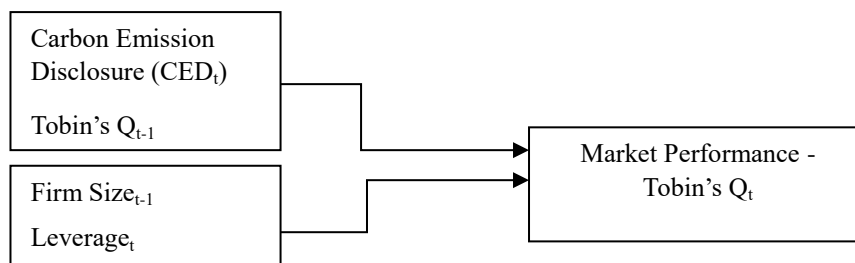
Table 1: Operationalization of Variables

Construct	Variable	Definition	Measurement	Source
<i>Environmental Disclosure</i>	Carbon Emission Disclosure (CED)	Defined as whether a company discloses its carbon emission data based on the Carbon	Carbon disclosure is a dummy variable that indicates whether the firm disclosed carbon information. A Dichotomous variable - 0 for no disclosure;	Li et al. (2014), Kumar and Firoz (2019)

		Disclosure Project (CDP)	otherwise, 1.	
<i>Firm-Specific Characteristics</i>	Firm size	Total asset value of the company has been used as a proxy for size. The natural logarithm of the actual value has been taken to standardize the data range.	Log of total assets	Matsumura et al. (2014)
	Leverage	It represents the external sources of financing as a proportion of total assets	Debt / Total Assets	Giannarakis et al. (2017), Griffin et al. (2017)
<i>Market Performance</i>	Tobin's Q	Tobin's Q represents the market value of the firm about its book value	Market Value of Equity + Market Value of Liabilities / Book Value of Equity + Market Value of Liabilities	(King and Lenox, 2001; Wang et al., 2014; Delmas et al., 2015).

Conceptual model

A conceptual framework was formulated to outline the link between CED and Tobin's Q, based on the literature references.



The given equation aims to investigate the causality between CED and Market Performance (MP) to validate whether MP has a positive coefficient. To ensure a comprehensive analysis, the research leverages proxies for firms' financial resources (Clarkson et al., 2011), including leverage (LEV) and lag of firm size (FS). Besides, the equation also considers the lag of Tobin's Q as explanatory variable.

Econometric model

To test the hypothesis about the association between the level of carbon disclosures and the market performance of listed companies, the researcher uses the following dynamic panel regression model:

$$TOB_{it} = \beta_0 + \beta_1 TOB_{it-1} + \beta_2 CED_{it} + \beta_3 FS_{it-1} + \beta_4 LEV_{it} + \epsilon_{it}$$

Where;

FS: Firm size; LEV: Leverage; TOB: Tobin's Q; β_0 : Intercept of the regression; β_1 - β_4 : Coefficient of the variables; ϵ : Residual error; i: Firms; t: Period (from 2018 to 2022).

Statistical analysis and the problem child – endogeneity

Endogeneity occurs when a predictor variable (x) in a regression model is correlated with the model's error term (e), resulting in biased and inconsistent parameter estimates, as noted by Roberts and Whited (2013). The issue of endogeneity is often due to simultaneity and omitted variables, as indicated by Hill et al. (2021). Companies facing financial challenges might prioritize cost reduction over investing in environmental activities, potentially leading to reduced disclosure of their environmental impact. Consequently, the financial performance of selected firms can influence their carbon emission disclosure, creating the issue of "reverse causality." Endogeneity is frequently considered a major obstacle for scholars aiming to establish causal relationships using specific models, as noted by Wolfolds and Siegel (2019). To address potential endogeneity, the study utilizes Generalized Method of Moments (GMM) estimation to test the robustness of results, as recommended by Wintoki et al. (2012) and Mubeen et al. (2020). Generalized Method of Moments (GMM) is a statistical analysis method that offers several advantages over the commonly used Ordinary Least Squares (OLS) regression in research. GMM is particularly useful for addressing issues like measurement error and endogeneity, which are commonly encountered in social and economic science research. Additionally, GMM can yield accurate and consistent estimates of coefficients, thereby enhancing the validity and reliability of statistical analysis in various research contexts. The regression output of GMM in Table 4 demonstrates that the results are robust to the estimation method used, as the model is free from autocorrelation and over identification problems.

Data Analysis

The listed companies in Sri Lanka had an average carbon disclosure score of just 35 out of 100, which is important to note. This indicates a low level of disclosure, which is expected as emission disclosure is not mandated by law in the country. In comparison to other emerging countries, the CED value is notably lower, suggesting a lack of transparency in this area (Kumar & Firoz, 2018; Li et al., 2014).

Table 2: Descriptive statistics

Variable	Mean	Std. Dev.
TOB	1.15	.65
LEV	37.02	23.60
FS	9.85	.46
CED	.35	.29

The mean value of TOB is 1.15, signifying that the companies' current market value exceeds the value of their total assets. However, this interpretation should be approached with caution, as a high ratio may indicate that the market or company is overvalued. Concerning control variables, the logarithm of total assets points to an average total asset value of 7,079 million rupees. The mean leverage value is 37.02, indicating that the firms relied less on debt to finance their assets during the reference period. There is notable variation among firms, as evidenced by the range of LEV values, which range from 0.03 to 97.03, with a standard deviation of 23.60. The standard deviation values for the other variables are below 1, indicating a low degree of dispersion.

Inferential statistics

Table 3 sums up the correlation matrix of the variables used in the study. To examine the correlation between two explanatory and control variables, the results reveal that the lag of Tobins Q positively correlates with the Tobins Q at 0.1 level. Other variables positively correlated with market performance, as proxied by Tobins Q, but the relationship is statistically insignificant. In contrast, as proxied by the log of total assets, the size lag is negatively and insignificantly correlated with Tobins Q. Multi-collinearity would pose a serious threat as it would invalidate the model if a relationship exists among predictors. The Right-Hand Side (RHS) variables are not highly correlated, indicating that there doesn't seem to be a significant issue with multicollinearity.

Table 3: Pairwise correlations

Variables	L.TOB	L.FS	LEV	TOB	CED
L.TOB	1.000				
L.FS	-0.128* (0.026)	1.000			
LEV	0.023 (0.686)	0.081 (0.160)	1.000		
TOB	0.830* (0.000)	-0.105 (0.068)	0.035 (0.500)	1.000	

CED	0.041 (0.482)	0.310* (0.000)	0.051 (0.324)	0.025 (0.630)	1.000
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*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Two-step system GMM

Table 4: Dynamic panel data estimation

TOB	Coef.	St.Err.	t-value	p-value	[95% Conf Interval]		Sig
L.TOB	-.565	.177	-3.18	.001	-0.912	-.217	** *
CED	2.208	.586	3.77	.000	1.06	3.356	** *
L.FS	9.201	5.97	1.54	.123	-2.5	20.902	
LEV	-.311	.237	-1.31	.189	-.775	.153	
Constant	-19.085	13.473	-1.42	.157	-45.491	7.321	
Mean dependent var		1.134	SD dependent var				0.639
Number of obs		300	Number of groups				75
Group variable		No	Chi-square				73.365
Number of instruments		11	Prob > Chi2				0.000

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

$$TOB_{it} = -19.085 - .565 TOB_{it-1} + 2.208 CED_{it} + 9.201 FS_{it-1} - .311 LEV_{it} + \epsilon_{it}$$

It is apparent from Table 4 that the hypothesis (H_1) has been accepted. The coefficient value of the CED variable is 2.208, which suggests that CED has a favourable effect on Tobin's Q and a probability value of 0.000, indicating that the impact is statistically significant at the 99% confidence level. While it is commonly believed that there is a negative causality between CED and Tobin's Q, some previous studies suggest a positive association between environmental disclosure in annual reports and corporate financial performance (Al-Tuwaijri et al., 2004; Cox & Douthett, 2009; Moneva & Cueller, 2009; Cho et al., 2010). Furthermore, Murray et al. (2006) found a positive relationship between social and environmental disclosure levels and financial returns. Magness (2010) also discovered that investor reactions favoured companies with prior environmental disclosure. In terms of size effect, the test results reveal that the size of the companies has a positive effect on market performance, as represented by Tobin's Q, with a coefficient value of 9.201, which is statistically insignificant. It exemplifies that a 1% change in total assets causes a 0.92-unit change in Tobin's Q. The Wald Chi-2 value is 73.365 at $p < 0.01$, indicating that all predictors are significant and collectively produce the chi-square value.

Robustness checks

Testing for auto correlation

In System GMM, the AR1 and AR2 tests are used to check whether the lagged dependent variable (AR1) and the second lag (AR2) are valid instruments to control for endogeneity in the model. The AR1 test in System GMM tests the validity of the lagged dependent variable (AR1) as an instrumental variable for controlling endogeneity in the model. In contrast, the AR2 test checks whether the second lag is correlated with the errors. The purpose of these tests is to ensure that the instrumental variables are valid and can be used to identify the causal effect of the regressors on the dependent variable. The resulting test outcomes for AR(1) and AR(2) are presented in the table below.

Table 5: Arellano-Bond test for autocorrelation

Arellano-Bond test for AR(1) in first differences:	$z = -1.97$	$\text{Pr} > z = 0.049$
Arellano-Bond test for AR(2) in first differences:	$z = -1.14$	$\text{Pr} > z = 0.254$

Table 5 shows that the AR1 test is statistically significant, implying that the lagged outcome variable (Tobins Q) is a valid instrument and can be used to address the model's endogeneity problem. The AR2 test is not significant, suggesting that the second lag is not a necessary instrument and that including it may lead to overfitting the model.

Testing overidentifying restrictions

The Sargan-Hansen test is often used to check whether the instrumental variables used in regression analysis are effective. It tests whether the model's over identifying restrictions hold, which means that the instruments used are exogenous and uncorrelated with the error term. If the null hypothesis is not rejected by the test, it indicates that the instruments are valid and the regression analysis is reliable.

Table 6: Sargan and Hansen test for checking the instruments' validity

Sargan test of overid. restrictions: (Not robust, but not weakened by many instruments.)	$\text{chi}2(5) = 1.19$	$\text{Prob} > \text{chi}2 = 0.977$
Hansen test of overid. restrictions: (Robust, but weakened by many instruments.)	$\text{chi}2(5) = 0.49$	$\text{Prob} > \text{chi}2 = 0.998$

The p-values of Sargan and Hansen's test are 0.977 and 0.998, respectively. It indicates that the model does not suffer from an over identification problem.

Conclusions

The evidence presented in this study suggests that CED has a favourable effect on market performance, as indicated by Tobin's Q. The findings lead to a conclusion that companies that disclose their carbon emission information tend to receive financial benefits in the form of improved Tobin's Q. This could be because capital markets and purchasing companies use

carbon disclosure information to make informed decisions, and reward companies that perform well.

Suppose Tobin's Q reflects the value investors place on carbon policies and the expected stock returns. This suggests that stakeholders care about global warming and that a proactive climate change strategy is necessary for companies to achieve sustainable economic success. Even companies that are not in environmentally sensitive industries need to adopt this strategy.

The findings of this study are valuable for academics, managers, and policymakers, as there is a dearth of research in this field in emerging countries. In Sri Lanka, there have been no studies on the impact of CED on market performance using GMM, which makes this study an essential addition to the literature. The study finds that higher levels of CED result in increased market performance, which challenges the traditional views on the economic implications of environmental responsibility. Further, the findings of the study are contrary to those of Kengatharan et al. (2020) and Nimanthi and Priyadarshanie (2021) since the first found a negative impact of environmental, economic, and social activities on Tobin's Q, and the latter found no significant relationship at all. It sheds light on the findings of my study, which require further probing.

This result also has practical implications for investors in making equity investment choices and for company managers in increasing market performance through CED. The research also controls for endogeneity issues common in corporate finance research. As environmental policies can be complex, the results of this study will be crucial for managers who need clarification about the results of their emission disclosures. Overall, the study enhances our understanding of the relationship between CED and market performance in the Sri Lankan context.

Limitations and future research directions

It is important to note several boundaries that may stimulate further exploration. The study focuses solely on companies listed on CSE and their carbon emission data as reported under the CDP, resulting in a relatively small and specific sample size. It is also imperative to recognise that the findings of this research may only be universally applicable if it excludes the financial services sector, which has distinct characteristics and is subject to stringent regulatory standards. Therefore, additional research is necessary to examine the influence of carbon emissions across diverse sectors of the economy to gain a complete understanding of the issue.

The researcher gathered information on carbon emissions from the integrated reports of each company. However, it is vital to note that the disclosure of this information is voluntary, making it challenging to verify the accuracy of the emission figures. Additionally, environmental regulations vary significantly between countries, so it is crucial to consider the specific context of Sri Lanka when interpreting the study results. Furthermore, the reliability of the findings may be influenced by endogeneity and sampling bias, as the researcher relies on data obtained through voluntary reporting on carbon emissions. This research is restricted to a country; therefore, future research could encompass multiple economies or conduct similar analyses to compare various nations in order to obtain a more comprehensive picture.

Finally, a comparative study between developing and developed countries can offer insights into whether similar findings hold true across different contexts.

The study evaluates firm performance solely on market-based measures without considering other accounting-based measures. However, future research could incorporate additional indicators such as market value added, return on assets, earnings per share, economic value added, and net profit margin to ensure a more comprehensive analysis. These measures can offer a more detailed understanding of companies' overall performance, aiding them in making informed decisions about their prospects.

The research on CED prevalence in Sri Lanka relied exclusively on integrated reports as the primary data source. However, future studies should consider integrating other media sources such as company websites, brochures, magazines, and newspapers to garner a more comprehensive and vivid understanding of CED prevalence. The information from these sources can offer an in-depth understanding of the prevalence and characteristics of corporate environmental disclosure practices in Sri Lanka's business environment.

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