



The Role of Carbon Emissions Disclosure in Moderating Firm Size, Profitability, Liquidity, and Firm Value in Southeast Asian Nations

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Tran Thi Phuong Thanh ^{1*}

¹ Department of Financial Accounting, School of Accounting, University of Economics Hochiminh city, Hochiminh, Vietnam

*Corresponding author: phuongthanh@ueh.edu.vn

Abstract

Research purpose:

The paper examines the value relevance of carbon emission disclosure in moderating the effect of firm size, profitability, and liquidity on the firm value.

Research motivation:

The disclosure of carbon emissions becomes an interesting issue that needs to be studied because business activities cannot be separated from environmental issues. Although emissions disclosure research, up to now, is quite popular with a variety of research trends, it seems to be most limited to developed countries and be infant in developing countries. Therefore, it is necessary to do more extensive research on carbon emissions-firm value relationships in emerging markets like Vietnam and other southeast Asian countries. Moreover, it is vital to combine many internal factors into one study which are identified based on signalling theory as well as agency theory in order to explore their relationships with each other.

Research design, approach, and method:

This study using a panel dataset extracted from listed firms in 6 Southeast Asian countries from 2018 to 2022 based on the Thompson Reuter database. The model of Ohlson (1995) is adjusted to operationalize value relevance as the ability of factors to explain the market value. This study also compares countries applying environmental protection policies or not.

Main findings:

The results of the study prove that the carbon emissions score can moderate the effect of firm size, liquidity on a company's market value. Furthermore, there are differences in the market value of firm sectors, and of groups of nations classified based on level of emissions trading Scheme implementation.

Practical/managerial implications:

Companies are expected to pay more attention to the climate change caused by their business activities. Furthermore, preparers of financial statements and investors can have better understandings of the market valuation implications of the carbon emissions disclosure or state agencies can enact more stringent regulations on companies that are likely to generate large carbon emissions and pollute the environment.

Keywords: Carbon Emission Disclosure, Firm Value, Value Relevance, Southeast Asian Nations.

1. INTRODUCTION

Increasing global warming and climate change has led many countries to find ways to unite to solve the problem. Raising awareness to combat climate change should be done by the wider community and stakeholders (Hapsoro, D., & Falih, Z. N., 2020). Environmental preservation that is not appropriately conducted will cause disasters, such as floods, landslides, heat waves, disease outbreaks, pollution of wells caused by untreated waste, wildfires, and others (Anggraeni, 2015). Such disasters can cause disruption of human activities and the firm's operational chains. When the firm's operational chain is disrupted, the economy of the firm and even the economy of the country can also be disrupted.

In this context, the Paris Agreement that is a legally binding international treaty on climate change was adopted by 196 Parties at the UN Climate Change Conference (COP21) in Paris, France, on 12 December 2015 (UNFCCC, 2023). To achieve the goals of this Agreement, more and more countries, regions, cities and companies are establishing carbon neutrality targets by reducing greenhouse gas emissions and developing a green economy (UNFCCC, 2023; Ghersi, 2014). Zero-carbon solutions are becoming a new competitive trend in economic fields, especially in the energy and transportation sectors, and have created many new business opportunities for pioneers (UNFCCC, 2023).

A system is needed to control the firm's negative impact on the environment. The system contains measurements, assessments, disclosures, and controls related to waste, pollution, or other factors that could harm the environment. The government is expected to play a role in helping to overcome these problems by issuing appropriate regulations related to social and environmental responsibility. Currently, the negative impacts caused by the firm's operational activities are not only perceived by the environment around the firm but also spread to other areas that are more widespread and detrimental to many parties (Pratiwi, 2017).

Economists argue that greenhouse gas (GHG) emissions pricing - carbon pricing - is the most cost-effective regulatory approach to reducing a company's negative impact on the environment. Carbon pricing can be done using one of two tools – a carbon tax or a greenhouse gas emissions trading system (ETS) (Haite, E., 2018). With ETS, the government sets limits on GHG emissions by specific sources and distributes allowances approximately equal to the limit. ETS can play a significant role in realizing the needed decarbonization to reach net zero according to the objective of the Paris Agreement (ICAP, 2022). The first mandatory ETS started operating in 2002, and has steadily increased in recent years (Haite, E., 2018). In Southeast Asian nations, Vietnam and Indonesia are under ETS development, while Malaysia and Thailand are under consideration for ETS in 2022 (ICAP, 2022). Specifically, in Vietnam, the government issued Decree 06/2022/ND-CP, which provides regulations under the Law on Environmental Protection (2021) and outlines a roadmap for the implementation of the NCM and the ETS. In Indonesia, in 2021, the Presidential Regulation No. 98 on the Instrument for the Economic Value of Carbon was issued, providing a national framework for carbon pricing instruments (CPI), including an ETS. Based on this regulation, in 2023, the Ministry of Energy and Mineral Resources (MEMR) announced the launch of the mandatory, intensity-based ETS for the power sector (ICAP, 2022).

Industry growth is positively correlated with an increase in emissions from corporate operations. Therefore, stakeholders expect the disclosure of information related to carbon emissions (Hapsoro et al., 2020). The role of the accounting field is to provide specific guidance for the information disclosure by businesses about the environment. In which, information on social and environmental responsibility should be disclosed to stakeholders, especially the general public, as the party most affected by negative impacts of companies from public activities (Hapsoro et al., 2020). Environmental information disclosure, specifically emissions information, in the company's annual financial statements is expected to be useful to users. Although in most countries around the world, including in Southeast Asian countries such as Vietnam or Indonesia, disclosure of carbon emissions is still voluntary, but companies are willing to disclose their carbon emissions to enhance the firm's value in the eyes of both foreign and local investors (Pratifri & Zulaikha, 2016).

Based on the above arguments, the disclosure of carbon emissions becomes an interesting issue that needs to be studied because business activities cannot be separated from environmental issues. It is primarily intended for businesses with a large impact on the environment, such as the power sector or agriculture (IPCC, 2014). Therefore, the emissions disclosure is expected to be a positive signal of the enterprise's commitment to responding to environmental issues and to receive a positive response from investors (Hapsoro et al., 2020).

Previous studies have examined the value relevance of emissions disclosed by firms, based on voluntary or mandatory disclosures (Choi et al., 2021; Hapsoro et al., 2020; Matsumura et al., 2014). Saka and Oshika (2014) concluded that the carbon emissions disclosure was positively related to the market value of equity and that the positive relationship became stronger in line with the amount or volume of carbon emissions that was getting bigger. Therefore, it is vital to consider the inclusion of carbon emissions disclosure as a component in the disclosure of non-financial aspects. Some researchers predict that concern about the relationship between carbon or greenhouse gas (GHG) emissions and global climate change will drive a redistribution of value from uncontrolled firms to transfer carbon emissions to successful control companies (Hapsoro et al., 2020). Despite this heightened interest, there is little research regarding the association between carbon emissions, their disclosures, and firm value (Hapsoro et al., 2020). Southeast Asian nations provide an ideal research setting, as all of these nations require to voluntarily report their companies' levels of carbon emissions. Thus, motivated

by concern about climate-change risk and carbon emission levels as expressed by investors, regulators, standard-setters, and other stakeholders, we estimate the effects on firm value of carbon emissions and of the act of voluntarily disclosing carbon emissions of companies listed on the Stock Exchange in Southeast Asian nations.

With the size of the firm, income before extraordinary items, profitability and liquidity followed by the carbon emission disclosure are expected to increase the positive effect on the firm value. It is corresponding to the results of Saka and Oshika's research (2014), which stated that the carbon emissions disclosure was positively related to the market value of equity and that the positive relationship became stronger in line with the amount or volume of carbon emissions that was getting bigger. Consequently, it is essential to consider the inclusion of carbon emissions disclosure as a component in the disclosure of non-financial aspects. It is also supported by the results of Hermawan, Aisyah, Gunardi, and Putri's (2018) study, which stated that firm size and profitability affected the disclosure of carbon emissions. However, research conducted by Matsumura, Prakash, and Vera-Munoz (2014) found the opposite result, namely that on average, companies that disclosed carbon emissions of one thousand metric tons experienced a decline in corporate value of US \$ 212,000. Hence, research to test the ability of carbon emission disclosure in moderating the effect of firm size, income before extraordinary items, profitability, and liquidity on the firm value becomes very important and needs to be carried out.

Although emissions disclosure research, up to now, is quite popular with a variety of research trends, it seems to be most limited to developed countries such as the United States, Canada, and Australia that correlates with practices of carbon emissions disclosure in these countries (Choi et al., 2020). However, academic study on emissions is still infant in developing countries. There are a few highlighted studies in developing countries such as Indonesia (e.g., Dody et al., 2020), China (, e.g., Chin et al., 2021, Shen, 2020). In the context of Vietnam, a few studies focused on carbon emissions, but in a limited sector such as the power sector, however, it has never been adequately concerned, especially in value relevance topics.

From the above analysis, it is necessary to do more extensive research on carbon emissions-firm value relationships in emerging markets like Vietnam and other southeast Asian countries. It is necessary to combine many internal factors into one study which are identified based on signaling theory as well as agency theory in order to explore their relationships with each other. As a result, it will help to narrow the existent research gaps.

This study focuses on the following research objectives:

- Examine the influence of firm size, income before extraordinary items, profitability, and liquidity on the firm value.
- Investigate the moderation effect of carbon emission disclosure on firm size, income before extraordinary items, profitability, and liquidity - firm value.
- Investigate the differences in market value between three groups of nations based on level of ETS implementation including under development, under consideration, and till not consideration.
- Investigate the differences in market value between periods before and after the year that emissions reducing regulations were issued.
- Investigate the differences in market value between sectors of firms.

The analysis of the panel dataset is extracted from non-financial listed firms in 6 Southeast Asian countries during the period from 2018 to 2022.

This study contributes to the literature as follows. First, the study provides insight that carbon emission disclosure can moderate the effect of firm size, profitability, and liquidity variables on firm value in six Southeast Asian countries. To the author's knowledge, this is the first study to do so. Second, the study concludes that there are differences in firm value for nations' groups that are developing ETS, under consideration and not yet. Third, there is a difference in firm value of the mining, quarrying, oil, and gas extraction sector compared to other sectors based on this study's conclusion. Furthermore, the results of this study are expected to encourage companies to pay more attention to the climate change caused by their business activities, and to contribute to prompting state agencies to enact more stringent regulations on companies that are likely to generate large carbon emissions and pollute the environment.

The remainder of the paper is structured as follows. Section 2 reviews relevant literature, section 3 describes research methodology, empirical results and discussion are provided in the fourth section. Finally, the last section presents the conclusion.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

2.1. Underlying theories

Signaling Theory

Signaling theory states that a good financial statement is a signal that the company is doing well. This theory explains why companies provide information on financial reporting to users (Ross, 1977).

Signaling theory is the basis for companies to be willing to disclose information voluntarily, in addition to the information mandatorily required by related regulations. The signals can be in the form of certain information, for example, carbon emissions disclosure (Hapsoro et al., 2020). This research is based on this theory to determine emissions disclosure, although voluntary, but is considered a positive signal that the company sends to users. Specifically, the signal is that a company cares about the environment. This is to attract investors to invest, increase a positive reputation, and at the same time, can impact on the relationship between firm size, profitability, liquidity and the value of the company.

Agency Theory

Agency theory deals with the separation between ownership and management of a company. Separation leads to the emergence of agency cost and creates a conflict of interest between the principal and the agent (Jensen and Meckling, 1976). Shaw (2004) argues that company management as an agent of shareholders will act with full awareness of his interests. Therefore, carbon emissions information disclosed by management as an agent should be known by the capital owner as a principal, in the hope that the principal can make the right and correct decisions according to his/her own interests.

2.2. Literature review

Carbon Emission Disclosure

The increase in business activities of companies will produce more and more carbon. This is one of the causes of increasing carbon emissions in the world. Companies are expected to be transparent to the public, especially investors, that the company has shown concern for the environment. Such transparency is reflected in the disclosure of information on carbon emissions. Through this disclosure, it is expected that the public, especially investors will increasingly believe that not only financial information but also other important non-financial information such as emissions disclosures (Hapsoro et al., 2020).

In this study, the author uses the method to measure emissions information from Refinitiv that is Refinitiv ESG company scores. These scores are designed to transparently and objectively measure a company's relative ESG performance, commitment and effectiveness across 10 main themes, based on publicly available and auditable data (see **Table 1**).

Table 1. Score range.

Score range	Description	
0 to 25	First Quartile	Scores within this range indicate poor relative ESG performance and insufficient degree of transparency in reporting material ESG data publicly.
> 25 to 50	Second Quartile	Scores within this range indicate satisfactory relative ESG performance and moderate degree of transparency in reporting material ESG data publicly.
> 50 to 75	Third Quartile	Scores within this range indicate good relative ESG performance and above average degree of transparency in reporting material ESG data publicly.
> 75 to 100	Fourth Quartile	Scores within this range indicate excellent relative ESG performance and high degree of transparency in reporting material ESG data publicly.

Source: <https://www.refinitiv.com/en/sustainable-finance/esg-scores#t-score-range>

Value relevance of firms' emissions disclosures

The primary purpose of a firm that has gone public is to increase the prosperity of the owner or shareholders by increasing the firm value (Salvatore, 2005). Firm value is very important because of the high value of the firm will be followed by high shareholder wealth (Brigham & Houston, 2010). The firm value is crucial to know because it reflects the firm's performance and can affect the perception of investors on the firm.

The existence of carbon emission disclosure is an interesting issue to study because the company's operational activities cannot be separated from environmental issues. The results of Saka and Oshika's research (2014) stated that the carbon emissions disclosure was positively related to the market value of equity and that the positive relationship became stronger

in line with the amount or volume of carbon emissions that was getting bigger. Therefore, it is crucial to consider the inclusion of carbon emissions disclosure as a component in the disclosure of non-financial aspects. It is supported by the results of Hermawan et al. (2018) research, which stated that company size and profitability affected the disclosure of carbon emissions.

In the accounting research of the mandated or voluntary firms' environmental disclosures, there are three broad categories. The first category examines the market valuation of environmental disclosures that are mandated either by accounting standards (Choi et al., 2021; Connors et al., 2013; Johnston et al., 2008; Campbell et al., 1998). The second category investigates the market valuation of environmental capital expenditures (Cho, Freedman, and Patten 2012; Clarkson, Li, and Richardson 2004). The third broad category determines more recent research on the market valuation of voluntarily disclosed carbon emissions. According to this category, Griffin et al. (2017) used carbon emissions data to examine stock price responses and found that greenhouse gas emissions were negatively related to stock prices. Furthermore, this negative relationship is more pronounced for carbon-intensive companies. Similarly, using manually collected carbon emissions data from 2006 to 2008 voluntarily disclosed by S&P 500 companies to CDP, Matsumura et al. (2014) found that, on average, for every 1000 tons of carbon emissions, business value decreases by \$212,000. A study by Chapple et al. (2013) examines the potential valuation impact of an impending emissions trading scheme on 58 Australian listed companies by using a modified Ohlson (1995) valuation model, showing that the value of a firm is negatively related to the intensity of the emissions trading. In general, these studies concluded that the negative influence of carbon emissions on a firm's value. Because of the negative influence of carbon emissions on a firm's value according to previous work, the emissions score is expected to have a positive impact on the market value of the company.

In the research of emissions disclosure' moderated role, the research results of Hapsoro, D., & Falih, Z. N. (2020) from listed companies in Indonesia showed that firm size and liquidity had a positive and significant effect on firm value. However, profitability had a positive and insignificant effect on firm value. Besides, environmental disclosure moderated the effect of firm size and profitability on firm value. However, carbon emission disclosure did not moderate the effect of liquidity on firm value.

The study was conducted to answer the research gap due to differences in the results of previous studies that have not found consistent results in seeing the presence of carbon emission disclosure. Extending value relevance research from Hapsoro et al. (2020), the purpose of this study is to test the ability of carbon emission disclosure in moderating the effect of firm size, profitability, and liquidity on the value of firms located in the ASEAN region.

2.3. Development of hypotheses

The Effect of Firm size, Profitability, Liquidity on Firm Value

Firm size defines that the number of assets owned by the firm. Information on firm size is significant to investors (Lischewski & Voronkova, 2010). Big firms can process resources better than small or medium entities (Chen & Chen, 2011). Research on the effect of firm size on firm value has been done by several researchers (Hapsoro et al., 2020; Putra and Lestari, 2016; Prasetya, Tommy, and Taerang, 2014). These studies showed that firm size affect firm value.

Profitability is the ability of a company to generate profits over a period. Profitability is considered as a significant indicator to measure the financial performance of a firm, so it can be employed as a reference to assess the firm (Al-Matari, Al-Swidi, & Hanim, 2014). The higher the profitability ratio reflects a higher level of profit earned by the firm (Fahmi, 2011). Firms with high profitability are considered to have good performance. Research on the effect of profitability on firm value has been conducted by several researchers. Chen and Chen (2011) and Anjarwati, Chabachib, Demi (2016) revealed that profitability had a positive and significant impact on firm value. However, the results of Thaib and Dewantoro (2017) study showed that profitability did not affect firm value.

Liquidity is a ratio that describes a firm's ability to meet obligations that must be paid with the current leverage (Kasmir 2010; Thaib and Dewantoro, 2017). A company with a high level of liquidity shows that the company has a good chance to continue to grow. The more liquid a company is, the more credibility it receives from creditors and investors. Therefore, the company can easily get loans from creditors and contribute capital from investors, thereby increasing the value of the company in the eyes of creditors and potential investors (Thaib and Dewantoro, 2017; Hapsoro et al., 2020). In the value relevance research, some studies showed that liquidity had a positive effect on firm value (Rompas's, 2013; Putra and Lestari, 2016). Based on above arguments, this study proposes the following hypotheses:

H₁: Firm size has a significant role in increasing firm value

H₂: Profitability has a significant role in increasing firm value

H₃: Liquidity has a significant role in increasing firm value

The Effect of Firm size, Profitability, Liquidity on Firm Value with Carbon Emission Disclosure as Moderation Variable

Before deciding to invest, investors will consider many aspects, including the factor of firm size. Other information

investors need to consider includes information on carbon emissions disclosures. The larger the company, the more pressure the environment creates to express issues related to environmental issues and social responsibility (Choi et al., 2013). With the carbon emissions disclosure, investors increasingly believe that the company is the right place to invest (Brammer and Pavelin, 2006). The disclosure of carbon emissions information can be a positive signal for investors and through that, the company hopes investors are willing to invest. The larger the company, the more carbon emissions disclosure will make investors willing to invest their capital in the company, which in turn can increase the firm value (Hapsoro et al., 2020).

Before investing, investors must analyze the information on the financial statements. In financial statements, a company's profit is an important piece of information that investors often pay attention to. According to Jannah and Muid (2014), higher corporate profits and earnings indicate that a company's financial performance is getting better. A company's better financial performance indicates that companies have the financial ability to incorporate carbon-reduction strategies into their business strategies. Furthermore, Freedman and Jaggi (2005) concluded that companies with good performance will disclose more details about the environment because they can generate more environmental impact reduction than other companies. Additionally, Choi et al. (2013) suggested that companies with good financial performance can afford for the cost of human or financial resources needed for voluntary carbon emissions disclosure. Therefore, disclosure of carbon emissions is expected to incentivize investors to trust the company more by investing in the company so that its value will increase.

Besides information about profitability, the liquidity is also of interest to investors. Liquidity is used to measure a firm's ability to meet its short-term liabilities (Horne & Wachowicz, 2001). Companies with high liquidity are considered to have good prospects, especially through the support of non-financial information so that investors have more confidence that the firm is a suitable place to invest (Putra & Lestari, 2016). Non-financial information can be emissions disclosures. In general, the firm will disclose information if it can increase the firm value. However, if such information could harm the company's position or reputation, the company will withhold such information (Jannah & Muid, 2014).

Based on the above analysis, this study suggests the following hypotheses:

H₄: Carbon emission disclosure moderates the effect of firm size on firm value

H₅: Carbon emission disclosure moderates the effect of profitability on firm value

H₆: Carbon emission disclosure moderates the effect of liquidity on firm value

Control Variables: group of ETS, firm sector, and year

The second research objective is to investigate the differences in market value and emissions disclosure between three groups of nations based on level of ETS implementation including under development, under consideration, and till not consideration. Most of the previous papers conducted research in only one specific country such as the US, Australia, Indonesia (Choi et al., 2021; Hapsoro et al., 2020; Matsumura et al., 2014). These nations already implemented ETS or are under development. This study expects that there are differences in firm value among Southeast Asian nations which implement ETS or not.

Environmental regulation can increase a company's costs because the company might need to disclose additional information to the government and pay extra taxes on excess emissions. Thus, the implementation of new carbon regulations will decrease the value of firms that are directly affected by the regulations compared to unaffected firms (Choi et al., 2021). In November 2021, Vietnam's government issued its revised "Law on Environmental Protection". The Law establishes a mandate for the Ministry of Natural Resources and Environment (MONRE) and the Ministry of Finance to design a national crediting mechanism (NCM) and a domestic ETS. The framework legislation also empowers MONRE to set the ETS cap and determine the method of allowance allocation. It allows for the inclusion of domestic and international offsets in the ETS. In July 2022, Vietnam issued an official decision to approve a National Strategy for Addressing Climate Change through 2050 ("Decision 896/QD-TTg") in which the country commits to achieving net-zero GHG emissions by 2050, with a mid-term target of 43.5% below BAU levels by 2030. This decision follows "Decree 06/2022/ND-CP", which provides regulations under the Law on Environmental Protection and outlines a roadmap for the implementation of the NCM and the ETS. The accompanying "Decision 01/2022/QD-TTg" lists the sectors and facilities with emissions inventory obligations (ICAP, 2022).

For Indonesia, in 2021, a voluntary intensity-based pilot was conducted in the power generation sub-sector. The pilot involved 32 generators, representing more than 75% of energy sector emissions, with an average carbon price of USD 2 per tonne of CO₂. The pilot familiarized stakeholders with ETS compliance and offset mechanisms, and informed the development of the mandatory national ETS. In October 2022, the Ministry of Environment and Forestry released Regulation 21/2022 "Guidelines for Carbon Economic Value Implementation", providing the legal basis for the implementation of a cross-sectoral ETS in Indonesia and covering details on offsets, sector-specific carbon trade roadmaps, MRV procedures, and institutional arrangements. This was followed in December by MEMR's Regulation

16/2022 “Guidelines for Carbon Economic Value Implementation for the Power Generation Sub-sector”, which provides the legal basis for implementing the ETS for power generators (ICAP, 2022).

Based on the above analysis, the author expects the differences in market value between periods before and after the year that emissions reducing regulations were issued (2021) and between sectors of firms.

The research model of the current study is shown in Figure 1.

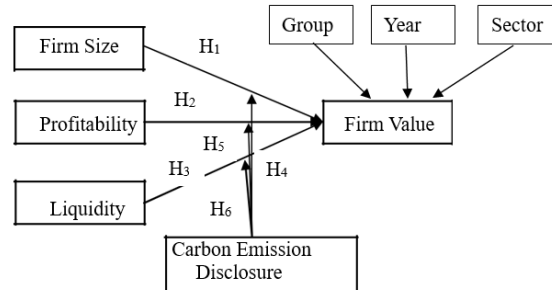


Figure 1 Research Model

3. METHODOLOGY

3.1. Sample

We focus on all companies that reported carbon emissions during 2018-2022. Only publicly companies (exclude banks and financial institutions) that listed on the Stock Exchange of six Asia countries¹ are selected for analysis and their financial data are downloaded from Thomson Reuters. Our final sample includes 1,170 firm-year observations.

For Vietnam and Indonesia, ETS are under consideration in 2021. As a result, this study considers 2021 as the limit year and thus the sample in this study comprise observations before and after 2021 for comparison.

3.2. Empirical model

Following the accounting-based valuation model of Ohlson (1995), previous studies related to value relevance consider the linear relation between accounting amount (e.g., the book value of equity, earnings per share, etc.) and market value of the firm (or equity) (Choi et al., 2021; Hapsoro et al., 2020; Matsumura et al., 2014).

The moderated role of emissions disclosure is tested in a regression where the firm value was proxied using Tobin's Q or Q ratio. Tobin's Q formula proposed by Chung and Pruitt (1994) is as follows:

$$\text{Tobin's Q} = \frac{(\text{MVCS} + \text{PS} + \text{BVD})}{\text{Total Asset}}$$

Description:

MVCS = Market value of common stock

PS = Preferred stock

BVD = Book value of debt

According to Choi et al. (2013), the size of the firm is a reflection of the total firm value's assets on the financial position statement. Therefore, in this study, the size of the asset was calculated as the logarithm of the total assets, as follows:

$$\text{Size} = \text{Ln Total Assets}$$

Profitability is a firm's ability to earn profits concerning sales, total assets, and own capital (Sartono, 1998). ROA was calculated by the following formula:

$$\text{ROA} = \text{Profit after Tax} / \text{Total Asset.}$$

Liquidity was proxied with the current ratio. The current ratio (CR) is the ratio used to measure a firm's ability to

¹ The countries are: Malaysia, Indonesia, Philippines, Thailand, Vietnam, and Singapore

	N	1170	1170	1170	1170	1170	1170	1170
EMS*SIZE	Correlation Coefficient	-.223**	.473**	-.138**	.015	1.000	.611**	.823**
	Sig. (2-tailed)	.000	.000	.000	.604	.	.000	.000
	N	1170	1170	1170	1170	1170	1170	1170
EMS*ROA	Correlation Coefficient	.172**	.080**	.510**	.100**	.611**	1.000	.631**
	Sig. (2-tailed)	.000	.006	.000	.001	.000	.	.000
	N	1170	1170	1170	1170	1170	1170	1170
EMS*LIQUI	Correlation Coefficient	-.170**	.297**	-.025	.434**	.823**	.631**	1.000
	Sig. (2-tailed)	.000	.000	.389	.000	.000	.000	.
	N	1170	1170	1170	1170	1170	1170	1170

** . Correlation is significant at the 0.01 level (2-tailed).

4.3. Regression analyses

In **Table 4**, the adjusted R^2 statistic in Model is 22.5% and confirms that the explanatory power of the model improves.

ROA is statistically and positively significant (confirm H2), while liquidity do not impact on firm value (reject H3). The firm size is statistically and negatively significant (reject H1). Emissions score plays a moderating role for firm size and liquidity on firm value (confirm H4, H6). However, Emission score is not moderated for the relationship between ROA and firm value (reject H5).

Table 4. Regression results
Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	19.686	1.722		11.431	.000
SIZE	-.854	.079	-.351	-10.757	.000
ROA	.093	.017	.263	5.441	.000
LIQUI	.099	.090	.044	1.101	.271
EMS*SIZE	.001	.000	.163	3.334	.001
EMS*ROA	-.019	.028	-.034	-.679	.497
EMS*LIQUI	-.006	.002	-.168	-3.207	.001

a. Dependent Variable: FV

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.479 ^a	.229	.225	2.683730440000000

a. Predictors: (Constant), EMS*LIQUI, ROA, SIZE, LIQUI, EMS*SIZE, EMS*ROA

4.4. One way ANOVA results

Using SPSS, ANOVA analyses were used for variables with more response categories—groups of nations, year, and sectors of firms. If sig value of Homogeneity of variances test is greater than 0.05, we use the result of ANOVA test. In contrast, Welch's test, or unequal variances test in post hoc analytic processing is accepted for the hypotheses.

Table 5 shows that sig of Homogeneity of variances tests of nations' groups is 0.000 (< 0.05), Welch's test is conducted. The Welch test sig. in the Robust Tests is less than 0.05, there are statistically significant differences in the groups of nations.

Table 5. One way ANOVA results for three groups of nations
Test of Homogeneity of Variances

FV				
Levene Statistic	df1	df2	Sig.	
32.675	2	1167	.000	

Robust Tests of Equality of Means

FV				
	Statistic ^a	df1	df2	Sig.
Welch	46.885	2	448.826	.000

a. Asymptotically F distributed.

Post Hoc Tests are conducted (**Table 6**) to analysis the differences between groups of nations. Tamhane test shows that there is a difference in firm value between groups. Specifically, group 3 (includes Singapore and Philippines, till not ETS consideration) has a difference in firm value with remaining two groups. Furthermore, based on the mean differences, the firm value of group 3 is lower than that of the group of nations.

Table 6. Post hoc Tests for three groups of nations

Multiple Comparisons						
Dependent Variable: FV						
Tamhane						
(I) GROUP	(J) GROUP	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1	2	-.212559040000000	.229641528000000	.732	-.762597367000000	.337479287000000
	3	1.036599927000000 [*]	.176460615000000	.000	.612075911000000	1.461123943000000
2	1	-.212559040000000	.229641528000000	.732	-.337479287000000	.762597367000000
	3	1.249158967000000 [*]	.156217175000000	.000	.875262586000000	1.623055348000000
3	1	-.103659992700000 [*]	.176460615000000	.000	-1.461123943000000	-.612075911000000
	2	1.249158967000000 [*]	.156217175000000	.000	-1.623055348000000	-.875262586000000

*. The mean difference is significant at the 0.05 level.

Table 7 shows that sig value of Homogeneity of variances test is greater than 0.05, we use the result of ANOVA test. The years before or after 2021 do not affect to firm value, significantly.

Table 7. One way ANOVA results for financial years before and after 2021**Test of Homogeneity of Variances**

FV	Levene Statistic	df1	df2	Sig.
	3.011	1	1168	.083

ANOVA

FV	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	29.426	1	29.426	3.172	.075
Within Groups	10834.998	1168	9.277		
Total	10864.424	1169			

Lastly, **Table 8** shows that sig of Homogeneity of variances tests of firm sectors are 0.000 (< 0.05), Welch's test is conducted. The Welch test sig. in the Robust Tests is less than 0.05, there are statistically significant differences in the firm sectors.

Table 8. One way ANOVA results for sectors**Test of Homogeneity of Variances**

FV	Levene Statistic	df1	df2	Sig.
	15.018	13	1156	.000

Robust Tests of Equality of Means

FV	Statistic ^a	df1	df2	Sig.	
	Welch	99.790	13	194.369	.000

a. Asymptotically F distributed.

Post Hoc Tests are conducted to analysis the differences between sectors. Tamhane test shows that there is a difference in firm value between groups of sectors. Furthermore, based on the mean differences, the firm value of manufacturing sector is higher than that of the groups, while the firm value of finance and insurance sector is lower than.

4.5. Discussion

The results of data analysis show that the firm value is positively affected by profitability. This result is completely

supported by signaling Theory and previous studies (Chen and Chen, 2011; Anjarwati et al., 2016). In addition, the effects of firm size, and liquidity on the firm value, moderated by carbon emissions score are consistent with agency theory the conclusion discovered in the study of Hapsoro et al. (2020), Putra & Lestari (2016), Jannah & Muid (2014).

The findings indicate that there are differences in firm value among Southeast Asian nations which implement ETS or not, and the differences in market value between sectors of firms.

In our context, liquidity does not significantly relate to the firm value. The rejection of hypothesis H3 in this study is the same with the study of Hermawan and Mafulah (2014).

5. CONCLUSION

Using emissions data reported from 2018 to 2020 and from 2021 to 2022, this article examines the effects of carbon emissions on firm value. The findings support the hypothesis that the emissions score is positively associated with firm value. The differences in the coefficients from the two subsample periods, three groups of nations including ETS under development, ETS under consideration, and not yet consideration are statistically significant in the one way Anova and Welch test.

Results are robust and not influenced by bias in criterion evaluation, subjective assessment. This research focuses on the emissions disclosure and collects data from six Southeast Asian countries where capital markets have less development than EU's or US's.

This paper provides other empirical evidence in current literature. First, it is one of the first papers focus on the emissions disclosure from Asian countries. The analysis uses a sample of listed companies from several Asian nations disclose emissions information during the period with five years while previous studies focus on other countries or other continents with a shorter surveyed period. Secondly, compared with prior studies, the valuation model of Ohlson (1995) is adjusted to measure the sensitivity, cause, and effect between the book and market value of a given firm and access the effects of disclosure levels for nonfinancial information (carbon emissions).

This research also contributes to the current debate on value relevance of emissions disclosures, so that users of financial statements can rely on this understanding to make decisions. Furthermore, there are implications provided to regulatory agencies and standard setters for considering before the issue of the new regulation.

Nowadays, the need of emissions information has become increasingly popular not only in the finance term but also in other fields of economics. As a result, the educational system needs to improve in order to meet practices. The findings of this study contribute to educational materials in the accounting and other fields. Therefore, lecturers, accountants, valuers, and students can use it as a real case study to practice.

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