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Determinants of carbon emission disclosure and sustainability reporting and their implications for investors' reactions: The case of Indonesia and Malaysia

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ABSTRACT

This study analyzed the effects of company size, leverage level, profitability, and company age on carbon emissions disclosure and sustainability reporting and the implications thereof on investor reactions. The manufacturing and mining companies listed on the Indonesian and Malaysian stock exchanges from 2017 to 2019 supplied the sample of this research. The analysis used the partial least squares approach to structural equation modeling. The results show that firm size and leverage significantly affect carbon emissions disclosure in Indonesia and Malaysia. Profitability and company age have no impact on carbon emissions disclosure in Indonesia. In Malaysia, profitability and company age do have a significant positive effect on carbon emissions disclosure. Company size has no effect in Indonesia, while in Malaysia, company size has a negative effect on sustainability reporting. Leverage level and company age have a significant positive effect on sustainability reporting in Indonesia, while in Malaysia, a company's level of leverage and age have no impact on sustainability reporting. Profitability has a significant effect on the sustainability report in Indonesia, while in Malaysia, profitability has a significant positive impact on the sustainability report. Company size does not affect investors' reactions in Indonesia, while company size has a significant negative effect on Malaysian. A company's level of leverage, profitability, and age do not affect investors' reactions. Carbon emissions disclosure has a significant positive effect on investors' responses in Indonesia, while in Malaysia, carbon emissions disclosure has no impact on investors' reactions. The sustainability report has a significant positive effect on investors' responses.

Contribution/Originality: This research compares carbon emissions disclosure in two countries in the ASEAN region, which has potential implications for several other ASEAN countries and strengthens the importance of the sustainability report as a supplement to corporate financial reporting.

1. INTRODUCTION

Global warming is a major issue that concerns the global community today. Among other factors, this situation was caused by carbon emissions from fires caused by human activities in Jambi, Pekanbaru, Sumatra, and Kalimantan in August and September 2019 (Tanjung, 2019). Indonesia's peatland fires are one of the world's primary sources of carbon emissions.

An understanding of the environmental impacts of companies' activities encourages companies to protect the environment and increase their ecological accounting. Environmental accounting (EA) is a social responsibility resulting from the environmental impact of social activities. EA includes methods to solve problems that occur due

to the company's production and development activities. EA is necessary for every company, particularly if the company is located in a community (Muda & Wahyuni, 2019). EA aims to provide stakeholders with information related to environmental costs. Participation in sustainability activities is seen as essential because the business and investment community demands and relies on various types of sustainability information for decision-making (Rounaghi, 2019).

Tang and Demeritt (2018) explained that reporting on carbon emissions will help increase the understanding of carbon emissions and climate change, forcing companies to disclose their performance and encouraging them to make positive changes related to the environment. Companies that disclose corporate carbon emissions can improve their financial performance, and carbon emissions reporting also increases companies' production of environmentally friendly products.

A detailed and transparent environmental responsibility disclosure report, especially on carbon emissions, is critical information for investors and other stakeholders in making investment decisions (Kalu, Buang, & Aliagha, 2016; Kelvin, Daromes, & Ng, 2017; Liao, Luo, & Tang, 2015; Purba, Elisabeth, & Ginting, 2018). If investors take the information on carbon emissions into account, there will be an increase in stock prices that exceeds the returns expected by investors.

The Malaysian government has issued policies and incentives for companies that require them to disclose sustainability reports (Qureshi, Rasiah, Al-Ghazali, Haider, & Jambari, 2019). In addition, Malaysia has formed an organization to motivate companies by rewarding the best companies in disclosing sustainability reports, namely the National Annual Corporate Report Award (NACRA). The sustainability report provides information to investors, government agencies, banks, and business partners.

Petcharat and Zaman (2019) analyzed the effect of the sustainability report on company returns and found that the sustainability report has a significant positive effect on stock returns. In contrast to previous research, Miralles-Quirós, Miralles- Quirós, and Gonçalves (2018) stated that investors do not consider sustainability disclosure as value relevant in Brazilian companies. The comparison of the index and stock returns of manufacturing companies and mining companies on the Jakarta Stock Exchange in 2019, with the composite stock price index (CSPI) and LQ45 index, can be seen in Table 1.

Table 1. Comparison of stock return index and returns in 2019.

Types	Manufacture	Mine	JCI	LQ45
Index	1.460.809	1.548.622	6.299.539	1.014.437
Stock returns	176.13%	-29.72%	148.539%	103.59%

Note: JCI: Jakarta composite index.
LQ45: Liquid 45 index.

The development of the characteristics of manufacturing companies is shown in Table 2:

Table 2. Development of manufacturing companies' financial ratios.

Variable	2017	2018	2019
Total sales (Trillion)	IDR 1.121	IDR 1.199	IDR 1.198
Total assets (Trillion)	IDR 1.134	IDR 1.189	IDR 1.262
DAR (%)	0.4933	0.510	0.466
DER (%)	1.0025	1.023	0.983
ROE (%)	0.1128	0.356	0.318
ROA (%)	0.0697	0.052	0.045
Company age (Years)	39.4855	40.239	40.949

Note: IDR: Indonesia Rupiah; DAR: Debt to assets ratio; DER: Debt to equity ratio; ROE: Return on equity; ROA: Return on assets.

The data in Table 2 shows that the company size, leverage, and profitability of manufacturing companies fluctuated from 2017 to 2019. The total sales increased from IDR 1.121 trillion in 2017 to IDR. 1.199 trillion in 2018, but in 2019 they decreased slightly to IDR. 1.198 trillion. In contrast, total assets increased every year, from

IDR 1.134 trillion in 2017 to IDR 1.189 trillion in 2018 and IDR 1.262 trillion in 2019. The reason for comparing the situation in Indonesia with that in Malaysia is that both countries have the same business environment, both are experiencing rapid economic growth (Maksum, Lubis, & Azhar, 2021), especially in the manufacturing sector, and both economies are still at a low level. Moreover, they are both countries with high levels of carbon emissions.

2. LITERATURE REVIEW

2.1. Agency Theory

Agency theory explains the relationship between the owner/principal of a company and its management (agent). The owners are interested in hiring managers to perform various activities to satisfy the interests of the equity owners. Jensen and Berg (2012) and Tauringana and Chithambo (2015) stated that agency theory explains corporate governance in aligning managerial and stakeholder interests regarding carbon emissions. According to Alexandrina and Oprişor (2016), this theory supports transparency and increased public accountability.

2.2. Stakeholder Theory

Disclosure is a company's effort to minimize social and political pressures by various stakeholders, including the community, employees, government, suppliers, capital markets, and others. Hahn, Reimsbach, and Schiemann (2015) argued that in stakeholder theory the aim is to create added value for stakeholders because stakeholders are necessary for the company's survival (Macve & Chen, 2010). In other words, the need to disclose carbon emissions information is driven by corporate investors, who are the company's main stakeholders.

2.3. Carbon Accounting

Carbon accounting is the part of EA that informs users of financial statements of the corresponding carbon dioxide emissions resulting from the firm's operational activities (San, Kasbun, Rahman, Meero, & Teh, 2022). Simply put, carbon accounting is the process of measuring, recording, and reporting the carbon produced by the company. Warren (2008) defined carbon accounting as the process of measuring the carbon emissions produced by a company and determining emission reduction targets. Warren (2008) presented several steps for implementing carbon accounting in companies, namely:

a. Measure the company's current carbon emissions.
b. Determine emission reduction targets.
c. Establish a system to monitor emissions issued and conduct periodic emission audits.
d. Report internally and externally regarding the reduction program and progress in achieving targets.

2.4. Sustainability Report

The sustainability report is prepared following the principles set by the Global Reporting Initiative (GRI), namely:

1) Balance.
2) Comparability.
3) Accuracy.
4) Timeliness.
5) Clarity.
6) Accountability.

Table 3 shows a way of measuring the sustainability report in which companies that do not make full disclosure are given a weight of 0, companies that only provide an explanation are given a weight of 1, and companies that provide an explanation accompanied by a quantitative number are given a weight of 2. This system of measurement

was proposed by Bhatia and Tuli (2017). In addition to the sustainability reports, disclosure on a scale of 0 to 2 is also used to measure the companies' quality of information disclosure on carbon emissions.

Table 3. Description of variable score for carbon emissions disclosure and sustainability report.

No.	Score	Criteria
1.	0	The company does not disclose the items on the questionnaire
2.	1	Companies only disclose in the narrative (Narrative qualitative)
3.	2	The company discloses in the form of a narrative equipped with monetary values, tables, or graphs (Monetary quantitative).

Source: Bhatia and Tuli (2017).

3. METHODS

This study employed a quantitative method using panel data from the 2017-2019 period. The data were gathered from the 2017-2019 company annual reports and sustainability reports, which were taken from the official websites of the Malaysia Stock Exchange (www.bursamalaysia.com) and Indonesia Stock Exchange (www.idx.co.id). The data collection techniques are detailed in Table 4:

Table 4. Research sample.

No	Criteria	Indonesian companies	Malaysian companies
1	Registered as a manufacturing company on the Indonesian or Malaysian stock exchange in 2017-2019.	185	208
2	Companies that issued a sustainability report separate from the annual report every year during 2017-2019	27	26
	Number of samples that met the criteria	27	26
Total sample data for three years of research		81	78

The data analysis tool was Warp PLS 7.0. The following equations were used:

Table 5. Measurement model equations.

No	Variable	Measurement model equation
1	Reflective exogenous latent variable firm size (ξ_1)	$X_{1.1} = \lambda_{X1.1}\xi_1 + \delta_1$ ..... (1)
		$X_{1.2} = \lambda_{X1.2}\xi_1 + \delta_2$ ..... (2)
2	Reflective exogenous latent variable leverage (ξ_2)	$X_{2.1} = \lambda_{X2.1}\xi_2 + \delta_3$ ..... (3)
		$X_{2.2} = \lambda_{X2.2}\xi_2 + \delta_4$ ..... (4)
3	The reflective exogenous latent variable profitability (ξ_3)	$X_{3.1} = \lambda_{X3.1}\xi_3 + \delta_5$ ..... (5)
		$X_{3.2} = \lambda_{X3.2}\xi_3 + \delta_6$ ..... (6)
4	Reflective exogenous latent variable company age (ξ_4)	$X_{4.1} = \lambda_{X4.1}\xi_4 + \delta_7$ ..... (7)
5	Endogenous latent variables formative carbon emissions (η_1)	$\eta_1 = \lambda_{Y1}Y_1 + \lambda_{Y2}Y_2 + \lambda_{Y3}Y_3 + \lambda_{Y4}Y_4 + \lambda_{Y5}Y_5 + \varepsilon_1$ .....(8)
6	Endogenous latent variables formative sustainability report (η_2)	$\eta_2 = \lambda_{Y1}Y_1 + \lambda_{Y2}Y_2 + \lambda_{Y3}Y_3 + \lambda_{Y4}Y_4 + \varepsilon_2$ ... (9)
7	Reaction reflective endogenous latent variables investor (η_3)	$Z_{1.1} = \gamma_{Y5.1} + \zeta_3$ ..... (10)

In equations numbered 1,2,3,4…..10, Table 5 describes the measurement model describing the effect of the reflective latent variables on the endogenous latent variables and thence on the reaction reflective endogenous latent variable.

All the variables are shown systematically in Table 6.

Table 6. Operational variables.

No	Variable	Definition	Indicators	Scale
1	Company size (X_1)	The scale is used to determine the size of a company	$Size = Log\ Total\ Assets$	Ratio
			$Size = Log\ Total\ Sales$	Ratio
2	Leverage (X_2)	The company's ability to use the money it borrows in its operational activities	$Debt\ to\ Assets\ Ratio = \frac{Total\ Liabilities}{Total\ Assets}$	Ratio
			$Debt\ to\ Equity\ Ratio = \frac{Total\ Liabilities}{Total\ Equity}$	Ratio
3	Profitability (X_3)	The company's profits on the level of sales, assets, and share capital	$ROA = \frac{Net\ Income\ After\ Taxes}{Total\ Liabilities}$	Ratio
			$ROE = \frac{Net\ Income\ After\ Taxes}{Total\ Equity}$	Ratio
4	Company age (X_4)	The years since the company was founded	$\sum$ years since the establishment of the company	Ratio
5	Carbon emissions (Y_1)	Carbon is emitted by burning fossil fuels into the atmosphere, rapidly increasing global warming. Measured using: • Climate change (CC) • Calculation of greenhouse gas (GHG) emissions • Energy consumption (EC) • GHG costs and reductions (CR) • Carbon emissions accountability (CEA)	Climate change (CC) $CC\ Index = \frac{revealed\ total\ CC\ score}{4\ (maximum\ score\ expected)}$	Ratio
			Emission calculation (GHG) $GHC = \frac{total\ revealed\ GHG\ score}{14\ (maximum\ score\ expected)}$	Ratio
			Energy consumption (EC) $EC\ Index = \frac{number\ of\ EC\ items\ disclosed}{6\ (maximum\ expected\ score)}$	Ratio
			GHG Costs and reductions (CR) $CR\ Index = \frac{total\ revealed\ CR\ score}{8\ (maximum\ score\ expected)}$	Ratio
			Carbon emissions accountability (CEA) $CEA\ Index = \frac{revealed\ total\ CEA\ score}{4\ (maximum\ score\ expected)}$	Ratio
6	Sustainability report (Y_2)	Disclosure of sustainability report according to GRI standards	General disclosure $General\ Index = \frac{General\ score\ total\ disclosed}{118\ (maximum\ score\ expected)}$	Ratio
			Economic performance $Economic\ Index = \frac{Total\ Economy\ score\ revealed}{26(maximum\ score\ expected)}$	Ratio
			Environmental performance (EP) $Environmental\ Index = \frac{Total\ Environment\ score\ revealed}{60\ (maximum\ score\ expected)}$	Ratio
			Social performance (SP) $Social\ Index = \frac{Total\ Social\ score\ revealed}{68\ (maximum\ score\ expected)}$	Ratio
7	Investor reaction (Z)	Cumulative abnormal return (CAR)	$\sum CAR$	Ratio

4. RESULTS AND DISCUSSION

4.1. Results

The results in Table 7 show that the indicators of Company Size, namely Total Assets (TA) and Total Sales (TS), have valid loading scores.

Likewise, Leverage Level, Profitability, Company Age and Investor Reaction also have valid indicators. The loading values of the Indonesian indicators are shown in Table 7.

The results of the loading factor calculations for each of the Indonesian indicators met the requirements for convergent validity as the loading factors were greater than 0.7 and the p-values lower than 0.05. The loading value of each Malaysian indicator is shown in Table 8.

Table 7. Loading value of each Indonesian indicator.

Variable	Indicator	Score loading	P-value	Convergent validity
Company size	TA <- X1.1	0.986	< 1 %	Valid
	TS <- X1.2	0.986	< 1 %	Valid
Leverage level	DAR <- X2.1	0.933	< 1 %	Valid
	DER <- X2.2	0.933	< 1 %	Valid
Profitability	ROA <- X3.1	0.916	< 1 %	Valid
	ROE <- X3.2	0.916	< 1 %	Valid
Company age	AGE <- X4	1.000	< 1 %	Valid
Investor reaction	CAR <- Z	1.000	< 1 %	Valid

Note: TA = Total assets; TS = Total sales; DAR = Debt to assets ratio; DER = Debt to equity ratio; ROA = Return on assets; ROE = Return on equity; AGE = Company age; CAR = Cumulative abnormal return.

Table 8. Loading value of each Malaysian indicator.

Variable	Indicator	Score loading	P-value	Convergent validity
Company size	TA <- X1.1	0.876	< 1 %	Valid
	TS <- X1.2	0.876	< 1 %	Valid
Leverage level	DAR <- X2.1	0.977	< 1 %	Valid
	DER <- X2.2	0.977	< 1 %	Valid
Profitability	ROA <- X3.1	0.984	< 1 %	Valid
	ROE <- X3.2	0.984	< 1 %	Valid
Company age	AGE <- X4	1.000	< 1 %	Valid
Investor reaction	CAR <- Z	1.000	< 1 %	Valid

Note: TA = Total assets; TS = Total sales; DAR = Debt to assets ratio; DER = Debt to equity ratio; ROA = Return on assets; ROE = Return on equity; AGE = Company age; CAR = Cumulative abnormal return.

The results of the loading factor calculations for each Malaysian indicator meet the requirements of convergent validity as the loading factors are greater than 0.7 and the p-values < 0.05. The indicator reliability results are shown in Table 9.

Table 9. Indonesia – weights of indicator values.

Variable	Indicator	P-value	Reliability
Carbon emissions disclosure	CC -> Y1.1	0.002	Reliable
	GHG -> Y1.2	0.003	Reliable
	EC -> Y1.3	<0.001	Reliable
	RC -> Y1.4	0.005	Reliable
	ACC -> Y1.5	0.003	Reliable
Sustainability report	General -> Y2.1	0.005	Reliable
	Economy -> Y2.2	<0.001	Reliable
	Environment -> Y2.3	<0.001	Reliable
	Social ->Y2.4	<0.001	Reliable

Note: Indicators are described in Table 6.

Table 10. Malaysia – weights of indicator values.

Variable	Indicator	P-value	Reliability
Carbon emissions disclosure	CC -> Y1.1	0.009	Reliable
	GHG -> Y1.2	0.005	Reliable
	EC -> Y1.3	0.021	Reliable
	RC -> Y1.4	0.005	Reliable
	ACC -> Y1 .5	0.013	Reliable
Sustainability report	General -> Y2.1	0.004	Reliable
	Economy -> Y2.2	0.002	Reliable
	Environment -> Y2.3	0.002	Reliable
	Social ->Y2.4	0.001	Reliable

Note: Indicators are described in Table 6.

Based on the test results contained in Table 10, the indicators of carbon emissions disclosure are reliable. Likewise, the sustainability report indicator is completely reliable.

The Indonesian outer model is shown in Table 11.

Table 11. Results of testing the measurement model (outer model) of Indonesia.

Variable	Indicator	Score loading	*P*-value	Convergent validity	AVE	Discriminant validity	Composite reliability	Reliability
Company size	TA <- X1.1	0.986	<0.001	Valid	0.972	Valid	0.986	Reliable
	TS <- X1.2	0.986	<0.001	Valid				
Leverage level	DAR <- X2.1	0.933	<0.001	Valid	0.871	Valid	0.931	Reliable
	DER <- X2.2	0.933	<0.001	Valid				
Profitability	ROA <- X3.1	0.916	<0.001	Valid	0.968	Valid	0.912	Reliable
	ROE <- X3.2	0.916	<0.001	Valid				
Company age	AGE <- X4	1.000	<0.001	Valid	1.000	Valid	1.000	Reliable
Carbon emissions disclosure	CC -> Y1.1	0.718	0.002	Valid	0.601	Valid	0.833	Reliable
	GHG -> Y1.2	0.781	0.003	Valid				
	EC -> Y1.3	0.802	<0.001	Valid				
	RC -> Y1.4	0.739	0.005	Valid				
	ACC -> Y1.5	0.787	0.003	Valid				
Sustainability report	General -> Y2.1	0.763	0.005	Valid	0.647	Valid	0.879	Reliable
	Economy -> Y2.2	0.805	<0.001	Valid				
	Environment ->Y2.3	0.864	<0.001	Valid				
	Social >Y2.4	0.868	<0.001	Valid				
Investor reaction	CAR <- Z	1.000	<0.001	Valid	1.000	Valid	1.000	Reliable

Note: TA = total assets; TS = total sales; DAR = debt to assets ratio; DER = debt to equity ratio; ROA = return on assets; ROE = return on equity; AGE = company age; CAR = cumulative abnormal return; AVE = average variance extracted.

The Malaysian outer model is shown in Table 12:

Table 12. Results of testing the measurement model (outer model) of Malaysia.

Variable	Indicator	Score loading	P-value	Convergent validity	AVE	Discriminant validity	Composite reliability	Reliability
Company size	TA <- X1.1	0.876	<0.001	Valid	0.767	Valid	0.868	Reliable
	TS <- X1.2	0.876	<0.001	Valid				
Leverage level	DAR <- X2.1	0.977	<0.001	Valid	0.955	Valid	0.977	Reliable
	DER <- X2.2	0.977	<0.001	Valid				
Profitability	ROA <- X3.1	0.984	<0.001	Valid	0.968	Valid	0.984	Reliable
	ROE <- X3.2	0.984	<0.001	Valid				
Company age	AGE <- X4	1.000	<0.001	Valid	0.968	Valid	1.000	Reliable
Carbon emissions disclosure	CC -> Y1.1	0.846	0.009	Valid	0.708	Valid	0.923	Reliable
	GHG -> Y1.2	0.946	0.005	Valid				
	EC -> Y1.3	0.722	0.021	Valid				
	RC -> Y1.4	0.925	0.005	Valid				
	ACC -> Y1 .5	0.790	0.013	Valid				
Sustainability report	General -> Y2.1	0.805	0.004	Valid	0.761	Valid	0.927	Reliable
	Economy -> Y2.2	0.884	0.002	Valid				
	Environment >Y2.3	0.883	0.002	Valid				
	Social>Y2.4	0.914	0.001	Valid				
Investor reaction	CAR <- Z	1.000	<0.001	Valid	1,000	Valid	1.000	Reliable

Note: TA = total assets; TS = total sales; DAR = debt to assets ratio; DER = debt to equity ratio; ROA = return on assets; ROE = return on equity; AGE = company age; CAR = cumulative abnormal return; AVE = average variance extracted.

4.1.1. R-Squared Value

Table 13 displays the Indonesian R-squared values.

Table 13. R-squared values for Indonesia.

No.	Variable	R-squared
1.	Y1 carbon emissions	0.193
2.	Y2 sustainability report	0.313
3.	Z investor reaction	0.324

Table 13 shows that 31.3% of the sustainability report variable is influenced by firm size, level of leverage, profitability, and firm age. Other variables outside of this study model define the residual 68.7%. The R-squared value for the inverter reaction variable is 0.324. The following table shows the R-squared values for Malaysia.

Table 14. R-squared values for Malaysia.

No.	Variable	R-squared
1.	Y1 carbon emissions	0.235
2.	Y2 sustainability report	0.170
3.	Z investor reaction	0.815

Based on Table 14, the carbon emissions variable has a value of 0.235 or 23.5%, which means that 23.5% of the variable is influenced by the variables of company size, leverage, profitability, and company age.

4.1.2. Value Predictive Relevance (Q^2)

Based on the analysis, the Q-squared value for Indonesia can be calculated as follows:

$Q^2 = 1 - (0.807 \times 0.687 \times 0.676)$

$Q^2 = 0.625$

This shows the analysis model can explain 62.5% of the diversity of data able to examine the phenomena. The Q-squared calculation for Malaysia is as follows:

$Q^2 = 1 - (0.765 \times 0.83 \times 0.185)$

$Q^2 = 0.876$

The Malaysian results explain 87.6% of the diversity of the data able to examine the phenomena in the study.

4.1.3. Hypothesis Testing Results

The Indonesian path diagram can be seen in Figure 1:

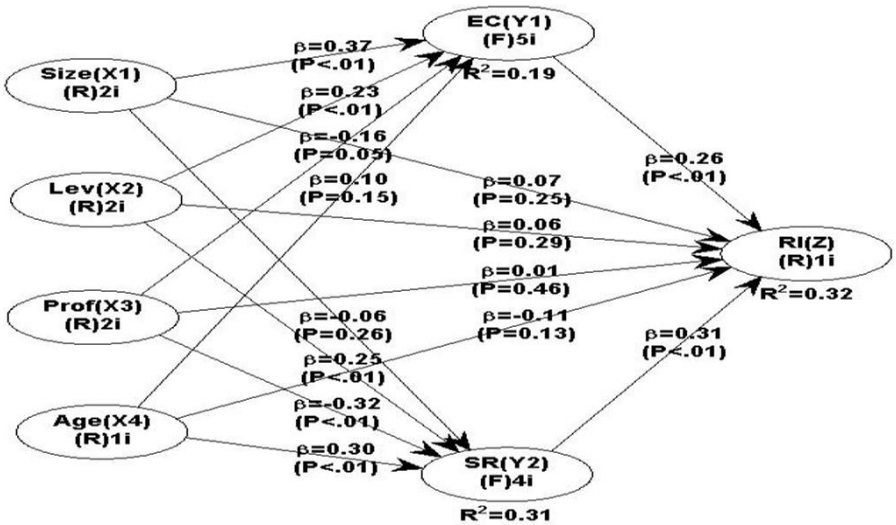

Figure 1. SEM-PLS model path diagram for Indonesia.

Note: Size(X1) = Company size (X1); Lev(X2) = Leverage (X2); Prof(X3) = Profitability (X3); Age(X4) = Company age (X4); EC(Y1) = Carbon emissions (Y1); SR(Y2) = Return on equity; RI(Z) = Investor reaction.

Figure 1 shows that Company size (X_1), Leverage (X_2), Profitability (X_3), and Company age (X_4) do not influence investor reaction. However, if the carbon emissions variable (Y_1) is used, the Company size (X_1) and Leverage (X_2) variables have a significant effect, while the Profitability (X_3) and Company age (X_4) variables have no significant effect in Indonesia. When the sustainability report (Y2) is used as a moderator, only the Leverage (X_2), Profitability (X_3), and Company age (X_4) variables have a significant effect in Indonesia.

The Malaysian path diagram can be seen in Figure 2:

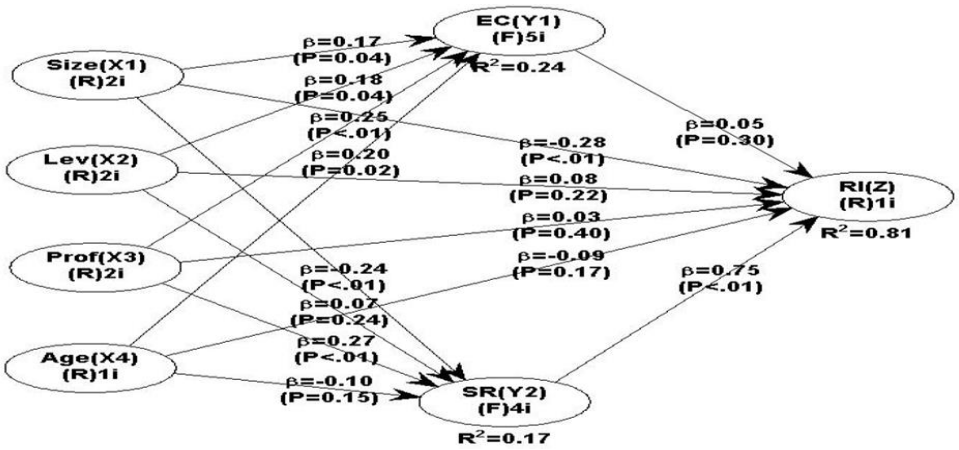

Figure 2. Path diagram of SEM-PLS model - Malaysia.

Note: Size(X1) = Company size (X1); Lev(X2) = Leverage (X2); Prof(X3) = Profitability (X3); Age(X4) = Company age (X4); EC(Y1) = Carbon emissions (Y1); SR(Y2) = Return on equity; RI(Z) = Investor reaction.

Figure 2 shows that only Company size (X_1) has a significant effect on investor reaction. However, if the carbon emissions variable (Y_1) is used, the Profitability (X3) variable has a significant effect in Malaysia. When the sustainability report (Y2) is used as a moderator, only the Company size (X_1) and Profitability (X_3) variables have a significant effect in Malaysia.

4.1.4. Direct Effect Test Results

The results of testing the direct effects are shown in Table 15 for Indonesia.

Table 15. Results of hypothesis testing for Indonesia's direct effects.

No	Variable	Path coefficient	P-value	Conclusion
1	Company size -> Carbon emissions	0.371	<0.001	Significant effect
2	Leverage -> Carbon emissions	0.232	0.009	Significant effect
3	Profitability -> Carbon emissions	-0.159	0.053	No effect
4	Company life -> Carbon emissions	0.101	0.154	No effect
5	Company size -> Sustainability report	-0.063	0.263	No effect
6	Leverage -> Sustainability report	0.246	0.006	Significant effect
7	Profitability -> Sustainability report	-0.316	<0.001	Significant effect
8	Company age -> Sustainability report	0.302	0.001	Significant effect
9	Company size -> Investor reaction	0.066	0.253	No effect
10	Leverage -> Investor reaction	0.056	0.288	No effect
11	Profitability -> Investor reaction	0.010	0.243	No effect
12	Company age -> Investor reaction	-0.113	0.127	No effect
13	Carbon emissions -> Investor reaction	0.264	0.004	Significant effect
14	Sustainability report -> Investor reaction	0.310	<0.001	Significant effect

The direct effects in Malaysia are shown in Table 16:

Table 16. Results of hypothesis testing for Malaysia's direct effects.

No	Variable	Path coefficient	P-value	Conclusion
1	Company size -> Carbon emissions	0.172	0.043	Significant effect
2	Leverage -> Carbon emissions	0.177	0.039	Significant effect
3	Profitability -> Carbon emissions	0.252	0.006	Significant effect
4	Company life -> Carbon emissions	0.204	0.021	Significant effect
5	Company size -> Sustainability report	-0.242	0.008	Significant effect
6	Leverage -> Sustainability report	0.070	0.245	No effect

No	Variable	Path coefficient	P-value	Conclusion
7	Profitability -> Sustainability report	0.268	0.004	Significant effect
8	Company age -> Sustainability report	-0.103	0.154	No effect
9	Company size -> Investor reaction	-0.276	0.003	Significant effect
10	Leverage -> Investor reaction	0.076	0.224	No effect
11	Profitability -> Investor reaction	0.026	0.399	No effect
12	Company age -> Investor reaction	-0.094	0.174	No effect
13	Carbon emissions -> Investor reaction	0.052	0.303	No effect
14	Sustainability report -> Investor reaction	0.750	<0.001	Significant effect

4.1.5. Indirect Effect Test Results

The path coefficients and p-values for the indirect effects are shown in Tables 17 and 18 for Indonesia and Malaysia, respectively.

Table 17. Results of hypothesis testing for Indonesia's indirect effects.

No	Variable	Path coefficient	P-value	Conclusion
1	Company size -> Carbon emissions -> Investor reaction	0.181	0.005	Significant effect
2	Leverage -> Carbon emissions -> Investor reaction	0.113	0.053	No effect
3	Profitability -> Carbon emissions -> Investor reaction	-0.078	0.134	No effect
4	Company age -> Carbon emissions -> Investor reaction	0.049	0.242	No effect
5	Company size -> Sustainability report -> Investor reaction	-0.033	0.321	No effect
6	Leverage -> Sustainability report -> Investor reaction	0.128	0.034	Significant effect
7	Profitability -> Sustainability report -> Investor reaction	-0.165	0.010	Significant effect
8	Company age -> Sustainability report -> Investor reaction	0.158	0.012	Significant effect

Table 18. Results of hypothesis testing for Malaysia's indirect effects.

No	Variable	Path coefficient	P-value	Conclusion
1	Company size -> Carbon emissions -> Investor reaction	0.021	0.386	No effect
2	Leverage -> Carbon emissions -> Investor reaction	0.021	0.382	No effect
3	Profitability -> Carbon emissions -> Investor reaction	0.031	0.335	No effect
4	Company age -> Carbon emissions -> Investor reaction	0.025	0.365	No effect
5	Company size -> Sustainability report -> Investor reaction	-0.179	0.006	Significant effect
6	Leverage -> Sustainability report -> Investor reaction	0.051	0.236	No effect
7	Profitability -> Sustainability report -> Investor reaction	0.197	0.003	Significant effect
8	Company age -> Sustainability report -> Investor reaction	0.076	0.145	No effect

4.2. Discussion

4.2.1. Effect of Company Size on Carbon Emissions Disclosure

Disclosure of carbon emissions is a part of all carbon mitigation activities and requires company costs and commitment to carry out carbon emissions disclosure (Luo, Tang, & Lan, 2013). The results of this study are consistent with previous studies (Ben-Amar, Chang, & McIlkenny, 2017; Borghei-Ghomi & Leung, 2013; Chithambo & Tauringana, 2014; Choi, Lee, & Psaros, 2013; Gonzalez-Gonzalez & Zamora, 2016; Andrea Liesen, Hoepner, Patten, & Figge, 2015; Luo et al., 2013; Yunus, Elijido-Ten, & Abhayawansa, 2016).

4.2.2. Effect of Leverage on Carbon Emissions Disclosure

The results of this study support stakeholder theory, in that the higher the company's leverage, the higher the lender's responsibility. Disclosure of information about social and environmental activities can increase creditors' trust in the company's management. The amount of information disclosed by companies can reduce agency costs (Luo et al., 2013). The results of this study are consistent with Zhang (2017), Yunus et al. (2016), Luo (2019), and Borghei-Ghomi and Leung (2013), who found that leverage influenced the disclosure of carbon emissions. On the

other hand, the results of this study are inconsistent with other research (Choi et al., 2013; Kalu et al., 2016; Kılıç & Kuzey, 2019) where leverage had no effect on carbon emissions disclosure.

4.2.3. Effect of Profitability on Carbon Emissions Disclosure

The results of this study are in line with research conducted by Chithambo and Tauringana (2014), Peters and Romi (2014), and Borghei-Ghomi and Leung (2013), which stated that profitability has no effect on the disclosure of carbon emissions in Indonesia. Meanwhile, in Malaysia, profitability has a significant positive effect on the disclosure of carbon emissions. Companies with high profitability have more funds to pay the costs associated with collecting and reporting information related to the disclosure of carbon emissions (Choi et al., 2013). Profitability affects carbon emissions disclosure. The company realizes that company profits must also be used for the benefit of the environment, not only for the benefit of investors. The findings on Malaysia are in line with those of Chithambo and Tauringana (2014) and Prado-Lorenzo, Rodríguez-Domínguez, Gallego-Álvarez, and García-Sánchez (2009). Profitability does not affect carbon emissions disclosure in Indonesia, but it does in Malaysia.

4.2.4. Effect of Company Age on Carbon Emissions Disclosure

Company age has a significant positive effect on the disclosure of carbon emissions in Malaysia. Older companies are considered well-established and have more resources to manage carbon emission issues than younger companies. The research results in Malaysia are in line with Kang and Gray (2011), who found that the age of a company can affect the disclosure of carbon emissions.

4.2.5. Effect of Company Size on Sustainability Reporting

Company size does not affect sustainability reporting in Indonesia. This indicates that large companies do not disclose more information in sustainability reports to gain legitimacy among their stakeholders because disclosures about company efforts regarding the economy, the environment, and society are no longer voluntary. The results of this study contradict previous research (Bhatia & Tuli, 2017; Dissanayake, Tilt, & Xydias-Lobo, 2016; Kansal, Joshi, & Batra, 2014; Mahmood & Orazalin, 2017; Matuszak, Różańska, & Macuda, 2019), which found that larger companies disclose more transparent and extensive information in their sustainability reports.

4.2.6. Effect of Leverage on Sustainability Reporting

Similarly, Aribi, Alqatamin, and Arun (2018) proved that companies with high leverage convey complete sustainability report information to investors. Barako and Brown (2008) found a positive relationship between power and voluntary disclosure in listed companies in Kenya. The results of this study are in line with Aribi et al. (2018) and Prado-Lorenzo et al. (2009). Meanwhile, in Malaysia, leverage does not affect sustainability reporting.

This finding supports those of Branco, Delgado, and Eugénio (2014) and Zorio, García-Benau, and Sierra (2013), who found that the level of leverage does not affect companies' disclosure of information in their sustainability reports. One of the reasons that leverage has no effect is that creditors and investors attach less importance to the sustainability report (Liu & Anbumozhi, 2009).

4.2.7. Effect of Profitability on Sustainability Reporting

The study showed that in Indonesia, companies with low profitability revealed more transparent information and detail to stakeholders in the sustainability report. In Malaysia, however, profitability had a significant positive effect on sustainability reporting. This finding supports signaling theory, which suggests that companies with high profitability will have more funds to present financial and non-financial information in their sustainability report. High profitability encourages company management to provide more information to increase stock prices. The

results of the research in Malaysia are in line with previous research (Branco et al., 2014; Kansal et al., 2014; Liu & Anbumozhi, 2009; Lucia & Panggabean, 2018; Ruhnke & Gabriel, 2013).

4.2.8. Effect of Company Age on Sustainability Reporting

The research results in Indonesia show that older companies will increase the information in their sustainability reports to maintain the company's image in the eyes of stakeholders. This is generally done to improve the company's image in the community. The company wants to prove that it has experience with sustainability in the business world. Company management can improve the quality of accounting information to produce complete information at a lower cost than younger companies (Bhatia & Tuli, 2017). The results of this study are in line with research by Bhatia and Tuli (2017), Mahmood and Orazalin (2017), Borghei-Ghomi and Leung (2013), Kansal et al. (2014), and Dissanayake et al. (2016), who stated that the age of a company affects the level of disclosure in its sustainability report.

4.2.9. Effect of Firm Size on Investor Reaction

The size of a company's assets, if not appropriately managed by the company, will not generate significant profits, and profits that are not maximized will make branch prices fall. This result is in line with the research of Fama and French (2012), which stated that the size of a company does not have a significant effect on stock returns, as large companies find it easier to get capital from debt so that later profits cannot be obtained. Therefore, investors do not respond to information on the company's size when making investment decisions. This study aligns with Shafana, Rimziya, and Jariya's (2013) research, which revealed that company size does not affect investor reactions. Large company size is not a factor influencing investors' decisions to invest in a company.

4.2.10. Effect of Leverage Level on Investor Reaction

The results showed that leverage does not affect investor reactions in Indonesia and Malaysia. This study contradicts Acheampong, Agalega, and Shibu (2014) and Abdullah (2015), who revealed a significant negative relationship between leverage and investor reaction, which indicated that force negatively affected investor reaction.

4.2.11. Effect of Profitability on Investor Reaction

The hypothesis testing results of this study showed that profitability does not affect investors' reactions in Indonesia and Malaysia. This finding contradicts the results of research by Todea, Zoicaş-Ienciu, and Filip (2009), who explained that profitability has a positive influence on the reaction of investors.

4.2.12. Effect of Company Age on Investor Reaction

The results showed that company age does not affect investors' reactions in Indonesia and Malaysia. The company's age is the length of time a company has operated since it was founded, and the data was based on the deed of establishment before the company made an initial public offering on the IDX or Malaysia Stock Exchange.

4.2.13. Effect of Carbon Emissions Disclosure on Investor Reaction

The disclosure of carbon emissions increases stock prices relative to companies that are not involved in carbon emissions. This is consistent with signaling theory, which emphasizes the importance of information released by companies in investors' decision-making. The carbon emissions disclosure signal reflects the company's business ethics. The study's results in Indonesia are in line with the research of Zamora-Ramírez, González-González, and Sabater Marcos (2016) and Liesen, Figge, Hoepner, and Patten (2017), who found a positive and significant relationship between carbon disclosure and abnormal stock returns.

4.2.14. Effect of Sustainability Reporting on Investor Reaction

Research by Naughton, Wang, and Yeung (2019) explained that by issuing sustainability reports, a company would receive some benefits, e.g., easier and quicker access to funding for both internal and external purposes, a good reputation, and a good relationship with stakeholders. Investors, creditors, and shareholders increasingly consider sustainability as the main factor that influences a company's success (Searcy & Elkhawas, 2012). Sustainability reporting provides various benefits to internal and external stakeholders; for instance, improving transparency affects the company's reputation positively (Glass, 2012; Simnett, Vanstraelen, & Chua, 2009). The results of this study are in line with the research of Naughton et al. (2019) and Nuzula and Kato (2011).

4.2.15. Effect of Company Size on Investor Reaction via Carbon Emissions Disclosure

In Indonesia, the company's size has a significant effect on investor reactions via the disclosure of carbon emissions. Meanwhile, in Malaysia, this mediating effect cannot be observed. The larger the company, the easier it is for the company to access internal and external resources.

4.2.16. Effect of Leverage on Investor Reaction via Carbon Emissions Disclosure

The results of the study showed that in Indonesia, leverage significantly affected investor reactions via the disclosure of carbon emissions, while in Malaysia, the disclosure of carbon emissions does not substantially affect investor reactions. The disclosure of carbon emissions is one way for companies to gain legitimacy.

4.2.17. Effect of Profitability on Investor Reaction via Carbon Emissions Disclosure

The study results on this pathway do not support stakeholder theory; this may be because the profitability and costs of carbon emissions disclosure are irrelevant, and investors have not felt the benefits of carbon emissions disclosure. Companies with high profitability that disclose their carbon emissions do not attract more investors.

4.2.18. Effect of Company Age on Investor Reaction via Carbon Emissions Disclosure

The results showed that the company's age has no significant effect on the reaction of investors via the disclosure of carbon emissions in either Indonesia or Malaysia. It may be that prospective investors are not keen to decide on an investment based on the age of the company and their disclosure of carbon emissions because investors are more interested in a company's financial performance than its environmental performance.

4.2.19. Effect of Company Size on Investor Reaction via Sustainability Reporting

The results showed that in Malaysia, a company's size has a significant negative effect on investor reactions via its sustainability report disclosure. The research results in Indonesia, however, showed that the company's size does not affect investor reactions via the level of disclosure in the sustainability report.

4.2.20. Effect of Leverage on Investor Reaction via Sustainability Reporting

Disclosure in sustainability reports has no significant effect on investor reaction. So, if the leverage level is high, the company's sustainability report is considered to increase the burden of the company to reduce its income.

4.2.21. Effect of Profitability on Investor Reaction via Sustainability Reporting

Profitability has a substantial impact on investor reactions via the level of disclosure in the sustainability report. Before making an investment, investors should be aware of the information in a company's financial statements, which includes company profitability data.

4.2.22. Effect of Company Age on Investor Reaction via Sustainability Reporting

The results for Indonesia showed that company age has a significant effect on investor reactions via sustainability report disclosure, while in Malaysia, the age of the company has no significant impact on investor reactions via the sustainability report.

5. CONCLUSIONS AND SUGGESTIONS

5.1. Conclusions

1. Company size has a positive effect on companies' carbon emissions disclosure in Indonesia and Malaysia.
2. The leverage level has a positive effect on companies' carbon emissions disclosure in Indonesia and Malaysia.
3. Profitability has no effect on companies' carbon emissions disclosure in Indonesia, whereas, in Malaysia, profitability has a significant positive effect on companies' disclosure of carbon emissions.
4. Company age has no effect on carbon emissions disclosure in Indonesia, while in Malaysia, company age has a significant positive effect on the disclosure of carbon emissions.
5. Firm size does not affect companies' sustainability reporting in Indonesia, while in Malaysia, the size of the company does affect the sustainability report.
6. Leverage has a significant positive effect on companies' sustainability reports in Indonesia, while in Malaysia, leverage has no effect on sustainability reporting.
7. Profitability has a significant negative effect on companies' sustainability reporting in Indonesia, while in Malaysia, profitability has a significant positive effect on the sustainability report.
8. Company age has a significant positive effect on sustainability reporting in Indonesia, while in Malaysia, company age has no effect on sustainability reporting.
9. Firm size does not affect investors' reactions to companies in Indonesia, whereas it does have a significant negative effect on investor reactions in Malaysia.
10. The leverage level does not affect investors' reactions to companies in Indonesia or Malaysia.
11. Profitability has no significant effect on investor reactions to companies in Indonesia or Malaysia.
12. Company age does not affect investors' reactions to companies in Indonesia or Malaysia.
13. Carbon emissions disclosure has a significant positive effect on investor reactions to companies in Indonesia, while in Malaysia, the disclosure of carbon emissions does not affect investor response.
14. Sustainability reporting significantly affects investors' reactions to companies in Indonesia and Malaysia. Sustainability reporting sends a positive signal to investors that the company's prospects are good, which can attract investors' attention.
15. Company size significantly affects investors' reactions via the disclosure of carbon emissions in Indonesia, while in Malaysia, the company's size does not affect investors' responses via carbon emissions disclosure.
16. Leverage has a significant effect on investors' reactions via carbon emissions disclosure in Indonesia. In Malaysia, leverage does not affect investors' response via the disclosure of carbon emissions.
17. Profitability does not affect investors' reactions via carbon emissions disclosure in Indonesia or Malaysia. A company's profitability and carbon emissions disclosure do not attract investments.
18. Company age does not affect investors' reactions via carbon emissions disclosure in Indonesia or Malaysia.
19. Firm size does not affect investor reactions via sustainability reporting in Indonesia. In Malaysia, firm size negatively affects investor reactions via the sustainability report.
20. The level of leverage significantly influences investors' reactions via sustainability reporting in Indonesia, while in Malaysia, the leverage level does not affect investors' responses via the sustainability report.
21. Profitability significantly affects investor reactions via sustainability reporting in Indonesia and Malaysia.
22. Company age significantly affects investors' reactions via sustainability reporting in Indonesia, while in Malaysia, company age does not influence investors' responses via the sustainability report.

5.2. Suggestions

1. Companies should be more aware of the importance of disclosing carbon emissions and the long-term benefits that they will obtain so that they can increase their business.
2. Companies should be more aware of the importance of sustainability reports and the long-term benefits they offer for the sustainability of the company's business.
3. Investors should consider the information content of carbon emissions disclosures and sustainability reports before investing.

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