

# B2.2\_2021 Climate Change Disclosure Impact on Indonesian Corporate Financial Performance

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## Climate Change Disclosure Impact on Indonesian Corporate Financial Performance

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### ABSTRACT

This paper aims to observe the impact of climate change disclosure (CCD) towards corporate financial performance (CFP) proxied by returns on assets (ROA), return on sales (ROS), and sales growth. Linear and non-linear approaches are employed for this research. Recommendation from Task Force on Climate-Related Financial Disclosures (TCFD) are applied for content analysis to obtain CCD scores. The target population in this study is 45 best performing companies (LQ45) listed on the Indonesia Stock Exchange (IDX) that disclosed sustainability report from 2014 to 2018. The number of observations is 72 year-companies. The findings show that CCD in large companies decreases ROS and improves ROA, yet in general, the improvement occurs in the long term for ROA and sales growth after a certain level is met (U-curve). In general, providing climate-related information will eventually pay. Financial performance of the companies has increased despite of low quality of CCD and an indication of positive customer reaction to CCD is noticeable.

### *Dampak Pengungkapan Perubahan Iklim terhadap Kinerja Keuangan Perusahaan Indonesia*

#### ABSTRAK

Penelitian ini bertujuan untuk menguji dampak pengungkapan perubahan iklim (Climate Change Disclosure/CCD) terhadap kinerja keuangan perusahaan (CFP) yang diprosikan dengan return on assets (ROA), return on sales (ROS), dan pertumbuhan penjualan. Pendekatan linier dan non-linier digunakan untuk penelitian ini. Rekomendasi Task Force on Climate-Related Financial Disclosures (TCFD) digunakan untuk analisis konten untuk mendapatkan skor CCD. Populasi sasaran dalam penelitian ini terdiri dari 45 perusahaan dengan kinerja terbaik (LQ45) di Bursa Efek Indonesia (BEI), yang menerbitkan laporan keberlanjutan selama tahun 2014 s.d. 2018 secara berurutan. Jumlah pengamatan penelitian adalah 72 tahun-perusahaan. Hasil penelitian menunjukkan bahwa CCD di perusahaan besar mampu menurunkan ROS dan meningkatkan ROA, namun secara umum, peningkatan kinerja keuangan terjadi dalam jangka panjang untuk ROA dan setelah tingkat tertentu (U-curve) pertumbuhan penjualan terpenuhi. Secara umum, pengungkapan perubahan iklim pada akhirnya akan menunjukkan hasil. Studi ini menemukan bahwa peningkatan kinerja keuangan diakibatkan karena adanya CCD meskipun dengan kualitas yang tidak baik dan reaksi positif dari investor.

## 1. Introduction

Climate change affects businesses, hence mitigating and adapting to climate change needs to be streamlined into business process. It impacts corporate finance, affecting various kinds of assets, sales, and costs (Stechemesser et al., 2015). One adaptation example is disclosing climate-related information through sustainability report (SR) (Wittneben & Kiyar, 2009). SR is a practice to report an organization's impacts and contributions on economic, social, and environmental aspects towards the goal of sustainable development (GRI, 2018). Global Reporting Initiative (GRI) standards encourages organizations to disclose emissions-related information. Reporting on GHG emissions and carbon is a newer area of environmental reporting (Bebbington and Larrinaga-González 2008/2010 as cited in Gray et al., 2014), and this requires an accountant role since it is accounting's domain to measure, communicate, regulate, and establish metrics of corporate environmental performance (Ilinitch et al., 1998). Investors view climate risk reporting to be as crucial as traditional reporting (Ilhan, et. al 2020).

Recent years have seen increasing development of CCD globally, encompassing North America, Europe, Asia Pacific, and emerging economies (DiSalvio and Dorata, 2014; Kolk et al., 2008). The increase particularly is driven from the support of the Task Force on Climate-related Financial Disclosures (TCFD), Sustainability Accounting Standards Board (Global Commission on Adaptation, 2019), CDP (formerly the Carbon Disclosure Project) (Kolk, Levy, & Pinkse, 2008), and Securities and Exchange Commission (SEC) (DiSalvio & Dorata, 2014). One of the successful institutions that managed to use institutional investors to urge companies disclosing their climate change activities is CDP, a non-profit organization (Kolk et al., 2008). This practice thus becomes research interest whether it pays by disclosing such information. Some authors argue that incorporating climate change considerations in business can lead to economic advantage and

competitive advantage as a first mover (Wittneben & Kiyar, 2009; Lash & Wellington, 2007).

Various economic measures are employed to observe the influence of CCD on CFP, with the most employed are ROA, ROS, returns on equity (ROE), and Tobin's  $q$  (Lewandowski, 2015). Unfortunately, until nowadays there is no firm answer due to mixed evidence, and methods differ substantially (Lewandowski, 2015) that results are considered far from conclusive enough to be considered satisfactory (Günther et al., 2011: 279 as cited in Lewandowski, 2015). There is a possibility that CCD and CED effect on CFP might be a non-linear form (Broadstock, et al, 2018; Lewandowski, 2015). Han et al. (2016) find U-shaped curve for environmental performances and ROE relationships, which means a negative relation might occur at the early stage that will take a positive turn at the latter stage. According to Lewandowski (2015), mixed results from market and accounting measures can be explained by the non-linear relationship between carbon emission abatement and CFP, in which emission abatement might pay off in the beginning then after reaching a certain abatement level, the effect might become negative. Thus observing the CCD effect on CFP from this perspective might obtain a broader picture than observing from a linear approach only.

Climate change also impacts companies' sales (Stechemesser et al., 2015), yet this area is still under-researched. More GHG emission disclosure can produce better sales due to better transparency (Daromes & Monica, 2020). Deloitte's (2020) survey shows millennials and Gen Z preference towards buying products from companies with environmental stewardship. Climate change and environmental issues are the top concerns for millennials and Gen Z generations, prior to and after the Covid-19 pandemic hit (Deloitte, 2020). Thus, improving climate change initiatives will ensure business sustainability against climate-related risks, and attract more customers through better corporate value.

This paper aims to fulfill some existing research gaps. First, prior research on CCD affecting CFP is limited in developing countries. Research on CED in Indonesia is growing, although investigation on CCD effect on CFP is still limited. Most research investigates factors influencing CED (Nasih, et. al, 2019; Nurdiawansyah, et. al 2018; Hanifah, 2017; Akhiroh & Kiswanto, 2016; Cahya, 2016; Irwhantoko & Basuki, 2016; Jannah, 2014). Others investigate CED effects on corporate value, including CFP (Salbiah & Mukhibad, 2018; Soewarno, et. al 2018; Hanifah, 2017; Kelvin, et. al 2017; Anggraeni, 2015). Research on Indonesian companies generates mixed results, although mostly finds positive effects (Soewarno et al., 2018; Hanifah, 2017; Kelvin et al., 2017; Anggraeni, 2015).

Second, current research has yet to establish a conclusive relationship between CCD with CFP. Combining linear and non-linear approaches might generate a more robust explanation since there's a possibility that the effect is non-linear (Broadstock et al., 2018; Lewandowski, 2015). Most research in Indonesia employs a linear approach. This paper aims to examine whether sustainability reporting in Indonesian companies provides climate change-related information that improves CFP using linear and non-linear approaches.

Third, this study employs sales growth and ROS in addition to ROA, to observe for CCD effect based on a possible sales and profit increase from improving climate reputation. Daromes and Monica (2019) find that CED improves corporate reputation in publicly listed Indonesian companies and argue the increased reputation can contribute to better sales. This paper thus contributes to fulfilling the gap whether CCD can improve sales growth and ROS or not.

Fourth, this paper uses indicators from TCFD's recommendations instead of CDP checklist due to more climate adaptation indicators. Both emission mitigation and climate adaptation are important for business (Okereke, 2007 as cited in Wittneben and

Kiyar, 2009; Wittneben and Kiyar, 2009). Prior research in Indonesia mostly uses the CDP checklist as their indicators (Daromes & Monica, 2020; Nurdiawansyah et al., 2018; Soewarno et al., 2018; Kelvin et al., 2017; Cahya, 2016; Irwhantoko & Basuki, 2016; Jannah, 2014). This is reasonable since TCFD's recommendations were published in 2017. To the authors' knowledge, this is the first study to employ a non-linear approach and TCFD's recommendations to assess CCD in Indonesia. Additionally, this study provides overview of current CCD quality if companies were to implement TCFD's recommendations.

The current study uses purposive sampling which results in 18 companies listed in Indonesia Stock Exchange (IDX) 2019 top performers (LQ45). The eligible companies comprise 13 carbon-intensive and five carbon non-intensive companies. The analysis is conducted on SR disclosed for the period 2014-2018. Multiple regression analysis consists of linear and non-linear multiple regression. Due to panel data, heteroskedasticity and collinearity tests are conducted beforehand. From the descriptive analysis, CCD scores show a low number with only a mean of 2 disclosures aligned with TCFD out of a total of 11 disclosures.

The findings expectedly generate mixed results, but in general, CCD is able to enhance CFP. This paper manages to obtain significant results through a non-linear approach. In the beginning, CCD reduces sales growth and ROA, but boosts both proxies in the long-term. Only CCD in large companies improves ROA immediately but reduces ROS. The current reporting provides more information on corporate mitigation practices, rather than adaptation measures, with the quality being unsatisfactory. Low reporting quality might hinder customers' support to companies as they perceive the companies only claiming to be environmental stewards without actual deed. Partially, the findings indicate an optimistic public reaction to current corporate climate change activities that can be

further improved through government intervention and better reporting quality.

This study eventually contributes to climate change accounting literature in Indonesia and provides an overview of Indonesian companies' reporting readiness if they were to adopt TCFD's recommendations. Despite having a low number of disclosures aligned with TCFD, observed companies have shown their efforts in climate change reporting despite no mandatory requirements. Generally, companies report on their mitigation efforts rather than adaptation measures.

The remainder of this paper is as follows: section two explains literature review and hypothesis development; section three explains data, samples and methodology; section four provides statistical results; section five discusses the results, and the last section concludes this research.

## 2. Theoretical framework and hypotheses development

### Climate change disclosure

Climate change disclosure is an outcome of climate change accounting. As mentioned by Schaltegger et al. (2015), corporate climate accounting collects climate-related information relevant to the organization, associated society, and the environment. It includes the accounts of GHG and carbon as an initial stage to prepare mitigation and adaptation practices. Schaltegger and Csutora (2012) differentiate climate change accounting from carbon accounting in the reported GHG emissions, which include all GHG emissions, not only carbon dioxide (CO<sub>2</sub>) emission. Carbon accounting focuses on companies' generated CO<sub>2</sub>-equivalent emissions, whereas climate change accounting focuses on climate change and adaptation impact on companies (Schaltegger, et. al 2015).

CCD should cover the most pertinent risks and opportunities the businesses facing. Thus, TCFD (2017) classifies each of the risks and opportunities companies might have, summarized in Table 1. These risks and opportunities might impact the revenue and expenditure in the income statement,

and assets, liabilities, capital and financing in the balance sheet (TCFD, 2017).

Table 1. Climate-related Risk and Opportinities

Climate-related risks	Climate-related opportunities
Transition Risks	- Resource Efficiency
- policy and legal risks	- Energy Source
- technology risk	- Products and Services
- market risk	- Markets
- reputation risk	- Resilience
Physical Risks	
- acute risk	
- chronic risk	

Source: TCFD (2017)

TCFD's recommendations consist of four core elements: (1) Governance, (2) Strategy, (3) Risk Management, and (4) Metrics and Targets. Disclosure on governance regards the board and management's role in handling climate-related risks and opportunities. Disclosure on strategy refers to actual and potential climate-related impacts from risks and opportunities on the business, strategy, and financial planning where such information is material. Risk management discloses how the organization identifies, assesses, and manages climate-related risks. Metrics and targets consist of metrics and targets used to assess and manage material information on climate-related risks and opportunities (TCFD, 2017).

The relationship between CCD and CFP can be explained by the legitimacy theory. When corporations are unable to perform according to certain values within society, their going-concern might be threatened, and so they conduct certain acts to attain to the society's value—legitimize, as to eliminate the threat (Gray et al., 2014: 87). Some research confirms increasing environmental disclosures following environmental incidents to be a legitimacy act (Lim, Wilmshurst, & Shimeld, 2010; Cho, 2009; Islam, 2009; Patten, 1992). Furthermore, companies disclose sustainability information to increase transparency, reputation, brand value, and competitiveness (Herzig and Schaltegger, 2006 as cited in Hahn & Kühnen, 2013).

### CCD and CFP Linkage

Research on CED and accounting-based CFP mainly employs ROA, ROS, and ROE (Lewandowski, 2015). Accounting measures can be considered a backward-looking conceptualization of CFP (Delmas and Nairn-Birch, 2010 as cited in Lewandowski, 2015). Neoclassical microeconomics view devoting resources to environmental management detracts from the goal of maximizing shareholders' wealth (Friedman 1970 as cited in Delmas & Nairn-Birch, 2011). They view investing in the environment results in additional costs. Recent scholars find the effect to be contrary, in which investing in environmental reporting (CED/CCD) leads to economic advantage as evidenced in (Soewarno et al., 2018; Saka & Oshika, 2014; He et al., 2013; Ziegler, Busch, & Hoffmann, 2011). Reporting carbon performance can improve companies' carbon reputation, which leads to improving CFP (Daromes & Monica, 2020; Rohani, 2016). Soewarno et al. (2018) find that Indonesian listed companies are having greater ROA when disclosing more carbon emissions. Management effort in emission reduction gives a signal to stakeholders that the company cares about the environment, and eventually raises ROA, ROE, and firm's value (Kelvin et al., 2017).

However, literature investigating CCD/CED relationship with CFP have yet to reach satisfactory conclusions. Some researchers argue that the disclosure may serve as an economic advantage for companies (e.g. CDP, 2019; Soewarno et al., 2018; Lewandowski, 2015; OECD & CDSB, 2015; He et al., 2013; Ziegler, Busch, & Hoffmann, 2011). In the short-term, GHG emission reduction reveals higher sales profitability, indicating competitive advantage from product differentiation and brand value (Russo & Pogutz, 2009). Broadstock et al. (2018) has observed a non-linear relationship (inverted U-shape) between emissions reported and CFP.

The mixed findings motivate this paper to employ a non-linear approach since most prior studies use a linear approach in investigating CCD

effect on CFP. Following prior studies and legitimacy perspective, CCD relation with CFP occurs in a positive way. Higher disclosure will result in better economic performance from stakeholders' positive reaction towards climate change activity and better corporate communication. Thus the hypothesis constructed are as follows:

H1a: There is a positive and linear effect of Climate Change Disclosure on ROA.

H1b: There is a positive and linear effect of Climate Change Disclosure on ROS.

H1c: There is a positive and linear effect of Climate Change Disclosure on SALES.

H2a: There is a positive and non-linear effect of Climate Change Disclosure on ROA.

H2b: There is a positive and non-linear effect of Climate Change Disclosure on ROS.

H2C: There is a positive and non-linear effect of Climate Change Disclosure on SALES.

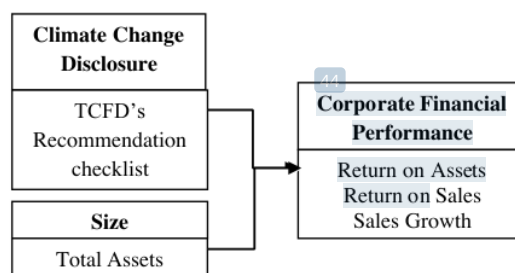


Figure 1 describes the contextual framework of this research.

### 3. Reserch methods

#### Data collection

The data for this research uses annual report and SR available publicly from companies' websites for reporting period 2014-2018. CCD data is derived from SR, while CFP data is derived from annual reports. The assessment uses SR since the issuance keeps growing, and as of 2020, it will be mandatory for all listed companies through the issuance of Financial Services Authority POJK No.51/POJK.03/2017. The population for this research is IDX's top 45 performers based on liquidity and market capitalization (known as LQ45)

for the current year 2019. Companies with good financial performance tend to disclose more information, including carbon emission information (Nurdiawansyah et al., 2018; Akhiroh & Kiswanto, 2016) and climate change information (Eleftheriadis, et. al, 2012). The IDX discloses the LQ45 list twice a year, therefore there are two periods: February 2019-July 2019 (period I) and August 2019 - January 2020 (period II).

For consistency purposes, 18 companies representing 40% of LQ45 are chosen through purposive sampling with the criteria: (1) included as LQ45 for the two periods in 2019, and (2) disclose SR for the period 2014-2018. From 18 companies, 13 companies belong to the climate-sensitive sector with six companies in the Materials and Buildings sector and five companies in the Energy sector. Companies in the climate non-sensitive sector are banks and one communication company.

Table 2. Purposive Sampling Result

LQ45 companies for year 2019	LQ45 company belong to period I and II (criteria 1)	Companies disclosed SR for 2014-2018 (criteria 2)	Number of company eligible for the study
48	42	18	18

### Data measurement

This research employs content analysis for calculating CCD score since it is often employed to measure environmental disclosure quality (e.g. Gnanaweera & Kunori, 2018; Yu, et al, 2017; Choi, et. al 2013; Eleftheriadis et al., 2012; Bouten, et. al, 2011; Hrasky, 2011). Content analysis method belongs to the environmental reporting measurement technique focusing on the disclosure quality (Rohani, 2016) by codifying texts into groups based on certain criteria (Weber, 1990 as cited in (Bouten et al., 2011). The proxy for CCD uses disclosures aligned with TCFD's recommendations checklist. For CFP, this paper employs ROA, ROS, and sales growth as proxies. Additionally, this paper employs firm size as control and moderating variable for CCD effects towards CFP. Eleftheriadis et al. (2012)

find that large firms and firms achieving better financial results tend to disclose information on climate change practices. Similar to sales growth, size uses growth (change) between years rather than absolute value to provide fit figures for statistical data processing. Three companies' annual reports with the main currency in USD are translated to IDR based on Bank Indonesia's middle rate of December each reporting year.

Multiple regression analysis with panel data is conducted on EViews 11. The independent variable CCD and SIZE hypothesis testing on the dependent variable ROA, ROS, and SALES, respectively, use testing with linear and non-linear (quadratic) regression models. All regression models have been tested with classical assumptions, using the multicollinearity test and the heteroscedasticity test. The linear model is as follows:

$$CFP_{it} = \beta_0 + \beta_1 CCD_{it} + \beta_2 SIZE_{it}$$

Where  $CFP_{it}$  is the financial performance measure using ROA, ROS, and SALES as the proxies for company  $i$  at time  $n$ .  $CCD_{it}$  is the score of climate change disclosure, and  $SIZE_{it}$  is the control variable and moderating variable measuring companies' size. Finally, for the non-linear model, the regression changes to quadratic regression below, where  $CCD\_SQ_{it}$  and  $SIZE\_SQ_{it}$  are the square root of  $CCD_{it}$  and  $SIZE_{it}$  for company  $i$  at time  $n$ .

$$CFP_{it} = \beta_0 + \beta_1 CCD_{it} + \beta_2 SIZE_{it} + \beta_3 CCD\_SQ_{it} + \beta_4 SIZE\_SQ_{it}$$

### CCD checklist

TCFD's recommendations are used as a guideline for assessing CCD scores. Eccles and Krzus (2017) find the disclosure aligned with TCFD's recommendations are mostly present within voluntary SR. TCFD's recommendations consist of four core elements with sub-areas to be reported within climate change disclosure: Governance, Strategy, Risk Management, and Metrics and Targets. Table 3 provides the CCD checklist. A coding score of 1 is given for each disclosed criteria and 0 for no disclosure. Full disclosure will result in a total of 11 points. Using binary coding can reduce

subjectivity bias in the weighting process, but unable to fully capture the reporting quality (Leitoniene & Sapkauskiene, 2015). This study does not aim to fully examine the reporting quality, rather the focus lies on the disclosure-CFP nexus. Prior studies have employed TCFD's recommendations as a measurement tool, for example, Demaria and Rigot (2018); Williams (2018); Eccles and Krzus (2017).

Table 3 Climate change disclosure checklist

Governance	a) Describe the board's oversight of climate-related risks and opportunities.
	b) Describe management's role in assessing and managing climate-related risks and opportunities.
Strategy	a) Describe the climate-related risks and opportunities the organization has identified over the short, medium, and long term.
	b) Describe the impact of climate-related risks and opportunities on the organization's business, strategy, and financial planning.
	c) Describe the resilience of the organization's strategy, taking into consideration different climate-related scenarios, including a 2°C or lower scenario.
Risk Management	a) Describe the organization's processes for identifying and assessing climate-related risks.
	b) Describe the organization's processes for managing climate-related risks.
	c) Describe how processes for identifying, assessing, and managing climate-related risks are integrated into the organization's overall risk management.
Metrics and Targets	a) Disclose the metrics used by the organization to assess climate-related risks and opportunities in line with its strategy and risk management process.
	b) Disclose Scope 1, Scope 2, and, if appropriate, Scope 3 greenhouse gas (GHG) emissions, and the related risks.
	c) Describe the targets used by the organization to manage climate-related risks and opportunities and performance against targets.

Source : TCFD (2017)

#### Return on assets

ROA is used to measure companies' performance in generating profit relative to their total assets. It indicates how efficient a company uses its assets to generate profit. ROA measurement includes liability and equity. ROA has been used in numerous studies researching climate-related performance or disclosure, and CFP nexus (e.g. ; Rohani, 2016; Lewandowski, 2015; Fujii, Iwata, Kaneko, & Managi, 2013; Eleftheriadis et al., 2012; Iwata & Okada, 2011). ROA can be calculated as follows:

$$ROA = Profit/Assets$$

#### Return on sales

ROS is a measure of a company's efficiency in generating profit per sales. It also can indicate market evaluation by consumers and trading partners (Iwata and Okada, 2010). Along with ROA, ROS is a common CFP proxy employed in prior research (e.g. Ganda & Milondzo, 2018; Rokhmawati et al., 2017; Lewandowski, 2015; Fuji et al., 2013; Iwata & Okada, 2011). ROS is calculated as follows:

$$ROS = Profit/Sales$$

#### Sales growth

Sales growth (SALES) is a measure of a company's ability to increase the revenue over time which essential to ensure business growth and competitiveness. There is a limited study observing disclosure effect on sales growth despite its importance to boost business growth. When a company attracts customers from the established value as climate steward, concurrently, aside from the absolute sales numbers, sales growth between period is of the same importance, since it indicates a sustaining effect. SALES use sales retrieved from annual reports and calculated as follows:

$$SALES_t = (Sales_t - Sales_{t-1}) / Sales_{t-1}$$

#### Size

Control variable used in this paper is company size (SIZE). It is one of the most commonly employed control variables in prior research (e.g. Ganda, 2018; Kumar and Firoz, 2018; Eleftheriadis et al., 2012; Iwata and Okada, 2010; Stanny and Ely,



2008). Total asset (TA) retrieved from annual reports is used as a proxy for SIZE. Thus, SIZE is calculated as follows:

$$SIZE_t = (TA_t - TA_{t-1}) / TA_{t-1}$$

#### 4. Results and discussion

##### Descriptive test result

Control variable used in this paper is company size (SIZE). It is one of the most commonly employed control variables in prior research (e.g. Ganda, 2018; Kumar and Firoz, 2018; Eleftheriadis et al., 2012; Iwata and Okada, 2010; Stanny and Ely, 2008). Total asset (TA) retrieved from annual reports is used as a proxy for SIZE. Thus, SIZE is calculated as follows:

$$SIZE_t = (TA_t - TA_{t-1}) / TA_{t-1}$$

SR disclosed in the observed companies generate low CCD scores, which on average only two disclosures aligned with TCFD out of total 11 disclosures. The highest CCD score of 6 was found in companies doing business in the energy, oil, gas & consumable fuels sectors, both according to the Global Industry Classification Standard and TCFD classifications. While the lowest CCD score with a score of 0 was found in the Communication Services, Financial, or Bank industry sectors as well as Oil, Gas, and Consumable Fuels. The descriptive test results also show that the company with the largest total asset size is in the energy sector in the oil, gas & consumable fuels industry.

Table 4 Descriptive Statistic

	ROA	ROS	SALES	CCD	SIZE
Mean	7.9064	0.1989	0.1457	2.4028	0.1378
Median	4.1500	0.1548	0.0863	2.5000	0.1084
Maximum	47.4000	0.5921	1.8824	6.0000	1.0117
Minimum	-6.0000	-0.1917	-0.3119	0.0000	-0.1746
Std. Dev.	9.8537	0.1826	0.3152	1.4502	0.1739
Obs.	72	72	72	72	72

Generally, companies report on their mitigation efforts rather than adaptation measures represented in risk management disclosure, as this is to be expected. The highest disclosure is in Metrics and

Targets, with a total of 133 items disclosed (representing 61% of total items disclosed), followed by Strategy (73 items disclosed or 34%). Disclosure on Governance is low; only 11 items disclosed in Governance (b) (5%) and no disclosure regarding Risk Management.

##### Hypothesis test results

Table 5 Statistical Result (Simplified)

Dependent Variable	ROA		ROS		SALES	
	L (FEM)	NL (FEM)	L (REM)	NL (REM)	L (REM)	NL (CEM)
Climate Change Disclosure (CCD)	ns	sig	ns	ns	ns	sig
Size (SIZE)	ns	ns	sig	ns	ns	sig
Interaction (CCD_SIZE)	sig	x	sig	x	ns	x
N	72	72	72	72	72	72
Adjusted-R <sup>2</sup>	0.95	0.91	0.16	0.09	0.18	0.22

Notes: sig is statistically significant at  $\alpha = 5\%$ ; ns = not significant; L = Linear; NL = Non-Linear; FEM = Fixed Effect Model; REM = Random Effect Model; CEM = Common Effect Model

Table 5 provides the simplified version; the detailed version is available in the Table 6. The results are, as expected, generating mixed findings.

##### CCD Impact on return on assets (ROA)

*H1a: There is a positive and linear effect of Climate Change Disclosure on ROA.*

The panel data model used to test the effect of CCD and SIZE on ROA is FEM with the Generalized Least Squares (GLS) method with cross-section weights to overcome heteroscedasticity. As shown in Table 6, the statistical test for ROA with linear (FEM) shows the p-value on the t-test of the CCD is 0.1954, greater than 0.05. This test result concludes that H0 is accepted, which empirically proves that there is no linear and positive CCD effect on ROA. However, the interaction between CCD and SIZE on ROA shows a p-value of 0.0000 which indicates that ROA is influenced linearly and positively by the interaction of CCD with SIZE. The regression model is:

$$ROA = 8.0257 - 0.2402 CCD + 1.3525 CCD\_SIZE \quad (4.1)$$

The coefficient of determination of this regression model shows the R-square = 0.9673, while adjusted R-square = 0.9553. The literature suggests, for regression models with more than two variables and comparing several models, the coefficient of determination used is adjusted R-square. Thus, with an adjusted R-square is of 95.53%, the ROA can be explained 95.53% by the CCD and SIZE, while 4.47% is explained by other independent variables outside the model. A possible explanation for the high coefficient of determination is due to the calculation of the FEM model using dummy variables to accommodate the variation or heterogeneity of the dependent variable.

*H2a: There is a positive and non-linear effect of Climate Change Disclosure on ROA.*

In Table 6 the non-linear column of ROA, the p-value on the t-test for CCD and CCD\_SQ shows that it is 0.0000 lower than 0.05 (significant), so that H0 is rejected and H2a is accepted, which concludes empirically that there is a non-linear and positive effect of CCD on ROA. Similar to the linear model, for the non-linear regression model, the panel data model uses FEM with White cross-section method to overcome heteroscedasticity. The regression model is:

$$ROA = 9.8745 - 2.2903 CCD + 7.8396 SIZE + 0.3675 CCD\_SQ - 8.7855 SIZE\_SQ \quad (4.2)$$

The coefficient of determination (adjusted R-square) is 0.9075, which means that the independent variables in this non-linear regression model can explain their effect on ROA by 90.75%, while 9.25% is explained by other independent variables outside the model.

#### **CCD impact on return on sales (ROS)**

*H1b: There is a positive and linear effect of Climate Change Disclosure on ROS.*

As shown in Table 6 linear column of ROS, the p-value on the t-test for the CCD is greater than 0.05,

thus H0 is accepted which concludes that there is no linear and positive CCD effect on ROS. However, the variables that had a significant effect on ROS were SIZE (0.0008 < 0.05) and CCD\_SIZE (0.0402 < 0.05). The regression model is:

$$ROS = 0.1742 + 0.0043 CCD + 0.28182 SIZE - 0.072015 CCD\_SIZE \quad (4.3)$$

The coefficient of determination R-square = 0.1954, while adjusted R-square = 0.1599. This indicates that the independent variables in this model together can explain 15.99%, of ROS, while 84.01% is explained by other independent variables outside the model.

*H2b: There is a positive and non-linear effect of Climate Change Disclosure on ROS.*

In Table 6, the non-linear column, the p-value on the t-test for the CCD\_SQ variable is greater than 0.05, thus H0 is accepted indicating no non-linear and positive effect of CCD on ROS.

#### **CCD Impact on sales growth**

*H1c: There is a positive and linear effect of Climate Change Disclosure on SALES.*

In Table 6 linear column of SALES, the p-value of CCD t-test is greater than 0.05 thus H0 is accepted, indicating no linear and positive effect of CCD on SALES. All other independent variables are also not significant.

*H2C: There is a positive and non-linear effect of Climate Change Disclosure on SALES.*

In Table 6, the non-linear column, the p-value on the t-test for CCD is 0.0000 and CCD\_SQ is 0.0382 which indicates a non-linear and positive effect of CCD on SALES. The regression model is:

$$SALES = 0.1331 - 0.1467 CCD + 1.6134 SIZE + 0.0260 CCD\_SQ - 1.2587 SIZE\_SQ \quad (4.4)$$

The adjusted R-square is 0.2169, meaning the independent variables in this model can explain SALES by 21.69%, while 88.31% is explained by other independent variables.

Table 6. Statistical Results

Dependent Variable	ROA			ROS			SALES				
	L (FEM)	NL (FEM)	L (REM)	NL (REM)	L (REM)	NL (REM)	L (REM)	NL (REM)	L (REM)	NL (REM)	
Independent Variable	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p	
Climate Change Disclosure (CCD)	-0.2292	0.1954	-2.2903	<b>0.0000*</b>	0.0043	0.7308	-0.0112	0.7071	-0.02981	0.3026	<b>0.0382*</b>
Size (SIZE)	0.0122	0.9916	7.8396	0.0707	0.2818	<b>0.0008*</b>	0.0589	0.6680	0.426642	0.1461	<b>0.0002*</b>
Interaction (CCD_SIZE)	1.3146	<b>0.0444*</b>			-0.0720	<b>0.0402*</b>			0.187553	0.1026	
CCD											
Quadratic (CCD_SQ)			0.3675	<b>0.0000*</b>			-0.0001	0.9778			<b>0.0463*</b>
SIZE											
Quadratic (SIZE_SQ)			-8.7855	0.0680			0.1746	0.3104			<b>0.0212*</b>
Constant	8.0106	0.0000*	9.8745	0.0000*	0.1742	0.0000*	0.2103	0.0003*	0.095015	0.2269	0.1193
N	72		72		72		72		72		72
R <sup>2</sup>	0.9670		0.9349		0.1954		0.1401		0.21398		0.2610
Adjusted-R <sup>2</sup>	0.9541		0.9075		0.1599		0.0888		0.179302		0.2169
Prob(F-statistic)	0.0000*		0.0000*		0.0019*		0.0363*		0.0009*		0.0004*

Notes: (\*) statistically significant at  $\alpha = 5\%$ ; ROA = Return on Assets; ROS = Return on Sales; SALES = Sales Growth;

Linear (FEM) = linear model with fixed effect model, GLS with cross-section weights;

Non-linear (FEM) = non-linear model (quadratic) with fixed effect model, GLS with cross-section weights

Linear (REM) = linear model with random effect model

Non-linear (REM) = non-linear model (quadratic) with random effect model; Non-linear (CEM) = non-linear model (quadratic) with common effect model

## 5. Discussion

Based on the non-linear findings, CCD effect on ROA and sales growth occurs in U-curve. CCD initially reduces ROA and sales growth but increases after a certain threshold. The precursor for this negative relationship can be caused by large mitigation projects resulting in a substantial increase in capital expenditures (Lewandowski, 2015) The decrease in ROA and sales growth can be linked to the finding on ROS where the finding indicates a negative relationship in larger companies. CCD does not impact ROS, possibly due to companies picking 'low hanging fruit' where the underlying carbon reduction initiatives occurred with negligible investment costs or no cost at all (Lewandowski, 2015). ROS can indicate a market appreciation towards climate stewardship; therefore, a negative finding indicates that Indonesian customers are unlikely to value current company's climate-related practices (in this case through sustainability reporting) thus diminishing the sales and profit eventually. This can be explained by the findings of Rokhmawati et al. (2017), which indicate that Indonesian customers' buying preferences are not dependent on green products, but rather on the product price.

The absence of financial improvement from disclosing climate-related information can be explained by low appreciation from investors and other stakeholders to CCD due to insufficient information (Rohani, 2016) observed. Content analysis results in low CCD scores with the highest disclosure occurred in Metrics and Targets, and no disclosure in Risk Management. These findings signal low corporate awareness on integrating climate change (especially adaptation) risks within corporate policy. The observed companies show efforts in mitigating GHG emissions notably disclosure in the emission metrics. It is reasonable since presently CED is more developed than CCD. Mediocre reporting on emission reporting indicates that companies are able to integrate climate change measures if willing. Observation of low CCD quality is also found in prior research on Malaysian

companies (Ahmad & Hossain, 2015). In the absence of mandatory reporting and emission restriction, CCD in developing countries such as Indonesia and Malaysia is bound to be at the introductory stage to maintain impression and legitimacy (Ahmad & Hossain, 2015). At this point, mandatory influence is needed to further improve current practices. After a certain level, CCD increases ROA and sales growth with immediate improvement for larger firms. Therefore, companies need to raise the reporting quality.

The underlying assumption in which CCD improves CFP can be related to real climate strategy employed along with the reporting. Qian and Schaltegger (2017) demonstrate that carbon disclosure can improve carbon performance. Since ROA indicates a company's efficiency in managing operations, carbon reduction initiatives such as energy efficiency can result in lower energy costs leading to higher revenue (Fujii et al., 2013). Regarding sales growth, as the companies more mature, their sales growth is bound to be slower, indicated by the finding of an inverted U-curve between size and sales growth. CCD can moderate the sales growth thus indicating a competitive advantage for having better CCD. A positive relationship aligns with theoretical arguments on the existence of a business case for sustainability (Lewandowski, 2015) Despite low CCD quality, the results show customers' appreciation of companies' climate change activities through increasing sales. The results also emphasize the importance of sustaining corporate climate change mitigation and adaptation practices in the long run, as the effect has the potential to spur sales growth for the following periods.

This study eventually contributes to climate change accounting literature in Indonesia. This paper also provides an overview of current sustainability reporting aligned with TCFD's recommendations. Despite having a low number of disclosures aligned with TCFD, observed companies have shown their efforts in climate change reporting despite no

mandatory requirements. If TCFD's recommendations were to be implemented in Indonesian companies, companies need to enhance their understanding on disclosing climate-related information. Since, generally, companies report on their mitigation efforts rather than adaptation measures. The importance of corporate climate adaptation has just been highlighted recently, therefore it is reasonable that adaptation information is very limited. In this case, government intervention is needed to increase climate change awareness at the corporate level and to improve reporting quality.

## 6. Conclusions

This paper provides an empirical study observing climate change disclosure impact on corporate financial performances proxied by ROA, ROS, and sales growth with company size as a control variable and additionally as moderating variable. This research employs content analysis using TCFD's recommendations as the indicators for measuring CCD scores. Motivated by prior research observing CCD-CFP nexus that has yet to gain a satisfactory conclusion, this research employs linear and non-linear approaches as conducted in Han et al. (2016) to examine for a possible non-linear effect of CCD impact. Both SALES and SIZE use growth (change) between years rather than absolute value to provide fit figures for statistical data processing. Purposive sampling results in a sample consists of 18 companies belonging to IDX's top 45 performers based on liquidity and market capitalization (known as LQ45). SR disclosed in 2014-2018 from each companies' website are used for observation, since CCD is more likely to be available in SR (Eccles & Krzus, 2019).

The results generate mixed findings. From the linear models, only CCD in larger firms significantly affects ROA and ROS. From the non-linear results, CCD significantly affects sales growth and ROA, which occurs in U-curve meaning in the long term the effect is bound to increase. The downturn is ameliorated by a negative impact on ROS. Despite the initial decrease, improving CCD

quality might increase stakeholders' perception over corporate value leading to higher sales in the long term. The findings partially support Daromes and Monica (2019), Soewarno et al. (2018), and Kelvin et al. (2017) by showing that CCD is able to portray the company as an environmental steward thus improving corporate reputation and value. Overall, the results are in line with legitimacy theory in which (1) companies disclose climate-related information to obtain approval from society as indicated by increasing sales growth, (2) the disclosure improves financial performance despite the insufficient quality.

Some limitations in this paper occur in the number of companies observed in which only 18 companies are eligible, and methods apply. First, the weighting process for the content analysis is only conducted by one person thus it is subject to subjectivity bias. Second, binary coding is applied to reduce subjectivity bias yet it is unable to capture CCD quality fully, therefore our research is only able to provide CCD scores based on the availability of information, rather than its comprehensiveness. Another limitation occurs on proxy applied, where CFP proxy data is obtained from annual reports, thus there might be different formulas applied to obtain each proxy. These limitations will be the subject of future research.

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