The effect of financial distress and firm size on carbon emission disclosure

Metya Kartikasary1*, Hubertus Maria Rosariandoko Wijanarko1, Ari Tihar1, and Asri Zaldin1

1 Accounting Department, BINUS Online Learning, Bina Nusantara University, 11480 Jakarta, Indonesia

Abstract. This study aims to examine the effect of financial distress, corporate governance, and firm size on carbon emission disclosure in the Indonesian Energy Sector during the world energy crisis. Using 56 data from energy sector industries in 2021 (during the global energy crisis), this research is analyzed with linear regression method. The results of the study show that financial distress has no effect on the disclosure of carbon emissions, although the world is being hit by an energy crisis. Meanwhile, corporate governance and firm size have a positive and significant effect on carbon emission disclosure. Related to legitimacy theory and stakeholder theory, a firm with good corporate governance has responsible to disclose all information to stakeholders. The larger firm also has wide access to open their information than small firms.

1 Introduction

Recently, Global warming, climate change and carbon emission have become increasingly growing problems all over the world. Climate and environmental issue become the most priorities of all stakeholders. Many stakeholder groups are urging action and proposing several solutions in association with those problems [1].

Since the beginning of the industrial era in 1750, NASA reported that human activities have increased the concentration of CO2 in the atmosphere by about 50%. The industry revolution should be given attention not only to profit but also to people and the planet. One part of the challenge is the need for entities to understand and communicate their contribution to decreasing global warming which results from carbon emissions. This greater awareness will lead to environmental responsibility [2].

This situation led to the new approach, that companies should report their environmental activity through their environmental disclosure. According to Paris Agreement 2015, 195 countries agreed to reduced the emission to keep the world below 1.5°C celcius. From this congress, the drive is towards encouraging the disclosure and effective monitoring of firms’ carbon footprints; developing financial instruments that promote the reduction and mitigation of climate-related risks; and ensuring the efficient channeling of financial flows to low-carbon technologies [3] [4]. This event increased overall awareness on environmental and social issues as well as the attention of the firms committed to improving their ESG performance [4].

Environmental disclosure became more popular over a decade ago in many countries. In the Asia context, there are several studies that investigated environmental disclosure [5–9]. Research from [10] review environmental disclosure in large companies. In Australia, [2] investigated the carbon emission disclosure in the Australian company.

There are several factors that affected carbon emission disclosure. One is a firm size. Research from [11] explained that large firms tend to share more environmental information than small firms as they have enough funds to spend for the welfare of society. Another perspective show that large firm have access and responsible to give information to public and stakeholder. Strong internal governance makes voluntary, detailed carbon emission disclosure are more likely [9].

Contrary with large company that have access to disclose their environmental and carbon emission activity, company with financial distress may not provide high quality of environmental reporting due their limited access and capital [5]. Environmental reporting is related to image, brand, and reputation of the firm. This disclosure also can attract investors and build good reputation to the firm. Ideally, this advantage should be stimulating company to enhance its financial performance, neither good or bad firm performance.

This study will investigate factors that affected carbon emission disclosure, especially in the period of global energy crisis and post Covid-19 pandemic in 2021. Global energy crisis that occurred between 2021 and 2022 was caused by fossil fuel energy shortage. This crisis was triggered by three main factors, (1) the global movement against carbon emission from fossil fuel energy resources which began early 2000s, (2) the global supply disruption caused by a halt of oil production during Covid-19 pandemic and (3) the insufficient fossil fuel energy to meet rising demand as the effect of Ukraine and Russia conflict [12].
situation affected the company’s financial performance and triggered financial problems of companies. This study will examine does the global energy crisis and post covid-19 pandemic affected company action related to reducing carbon emission activities and carbon emission disclosure in Indonesian energy sector companies. The covid-19 pandemic which hit the world at the end of 2019, changes many aspects due to the lockdown era in 2019 and 2020. The adoption of the new normal era brings new systems for company operations and recovers financial performance. This research enriches carbon emission disclosure by adding financial distress variables to analyze other factors that may affect the disclosure due to the global energy crisis and post Covid-19 pandemic.

2 Literature review and hypothesis

2.1 Financial distress and carbon emission disclosure

The covid-19 pandemic hit the world and brings a new normal era. Many companies adopt their systems and change their operations to adjust to the new habit. The company is also still recovering from the financial side and adjusting its systems to optimize its performance. Besides that, the global energy crisis that occurred in 2021 also triggered financial problem in many firms. This adoption may change their environmental performance due to the limited fund that they have. Large firms may have access and capital to participate actively in reducing carbon emissions but other companies with financial distress didn’t. Financial distress period is a critical factor to determine the trend of environmental disclosure [5]. Other research about financial distress, [13] show that there is a negative association between environmental performance and financial distress. Result from [5] found that financially distress firms have lower environmental disclosure quality than non-distressed firm. Contrary with this result, other research [14] found that ESG reporting is one approach that effectively prevents financial distress in Indonesian listed firms. Another study focused on how ESG reporting helps financially distressed firms recovery from distress and are less likely to file from bankruptcy [15]. This different result brings the conclusion that there is a relationship between financial distress and environmental or carbon emission disclosure. Therefore, hypothesis is proposed as follows:

H1: There is a relationship between financial distress and carbon emission disclosure.

2.2 Firm size and carbon emission disclosure

Stakeholder theory states that organizational performance should be reviewed by how effectively managers balance the interest of company stakeholder [16]. Stakeholder involvement in decisions regarding environmental, health, and safety (EHS) issues develops due to a decrease in public trust and the desire of stakeholders to participate more. This raises expectations of transparency and accountability, or interest in demonstrating responsiveness to public concerns [17]. Legitimacy theory state that companies have responsibility to their stakeholder. Due to this theory, large firms should disclose all relevant information to their stakeholder as a corporate responsibility and accountability [18]. Larger firm have enough resources both physical and financial to reduced carbon emission through corporate environmental activity. Firms that are highly leveraged often institute accounting and financial strategies that enable them to make thorough disclosures of their financial or nonfinancial (environment/social) information [19].

Many research explains the relationship between firm size and carbon emission disclosure. Research from [11] explained that large firms tend to share more environmental information than small firms as they have enough funds to spend for the welfare of society. Research from South Korea found that firm size have a strong correlation with voluntary carbon emission disclosure [9]. Larger companies will give more attention to environmental activities and disclosure [20]. Based on the previous explanation, related to legitimacy theory that company have a responsibility to disclose information as accountability and transparency, an especially large firm which has more resources. Therefore, hypothesis proposed as follows:

H2: There is a relationship between firm size and carbon emission disclosure.

3 Research methods

3.1 Research design and analysis

This study using Indonesian Energy Sector companies as research sample. There were 76 companies in energy sector but 20 companies didn’t publish their sustainability report. Thus, 56 companies using for further analysis. The data was taken from Indonesian Stock Exchange during 2021 period related to global energy crisis and post covid-19 pandemic. This research analyze with linear regression method.

3.2 Research variable

The dependent variable of this research is carbon emission disclosure which measured by Global Reporting Initiatives (GRI) sustainability report guidelines [5]. The GRI has been used because research this research commonly used to measure ESG, sustainability and CSR Reporting. This standard also used by companies in Indonesia on their carbon emission disclosure. This research using GRI Standard 305 for carbon disclosure. There is 8 measurement that must be disclose in carbon emission disclosure. Each disclosure component given one score. Companies get a maximum 8 score if they disclose all of carbon emission components related to the checklist. Here is the checklist of the component of carbon emission disclosure:
Disclosure of management approach (this section refers to GRI 103)
2. Disclosure 305-1 Direct GHG emissions
3. Disclosure 305-2 Indirect Energy GHG emissions
4. Disclosure 305-3 Other indirect GHG emissions
5. Disclosure 305-4 GHG emission intensity
6. Disclosure 305-5 Reduction of GHG emissions
7. Disclosure 305-6 Emissions of ozone depleting substances (ODS)
8. Disclosure of 305-7 Nitrogen oxides (NOX), sulfur oxides (SOX), and other significant air emissions

Financial Distress and Firm Size are the independent variable. Financial Distress (X1) is measured by Altman Z-Score [21], see Table 1. This measured give highest accuracy for predicted company bankruptcy. Here is the formula for Altman Z-Score for measuring financial distress below [21]:

\[ Z = \frac{1.200 \times X1 + 1.400 \times X2 + 3.300 \times X3 + 0.600 \times X4 + 0.999 \times X5}{1,200} \]  

**Equation 1**

Table 1. Altman Z-Score.

<table>
<thead>
<tr>
<th>Factors</th>
<th>Definition</th>
<th>Weighting</th>
</tr>
</thead>
<tbody>
<tr>
<td>X1</td>
<td>Working Capital : Total Assets</td>
<td>1,200</td>
</tr>
<tr>
<td>X2</td>
<td>Retained Earnings : Total Assets</td>
<td>1,400</td>
</tr>
<tr>
<td>X3</td>
<td>Earnings before interest and taxes : Total Assets</td>
<td>3,300</td>
</tr>
<tr>
<td>X4</td>
<td>Market value of equity : Book value of liabilities</td>
<td>0,600</td>
</tr>
<tr>
<td>X5</td>
<td>Sales : Total Assets</td>
<td>0,999</td>
</tr>
</tbody>
</table>

The firm size (X2) variable is measured by natural logarithm of total assets [20] [5]. The formula of firm size explained below:

\[ \text{Firm Size} = \ln (\text{Total Assets}) \]  

**Equation 2**

4 Result and discussion

4.1 Descriptive statistics

The first analysis for this study is descriptive analysis to analyze the characteristics of research data. The result of descriptive statistics analytics is shown in Table 2. Based on descriptive statistics table, the mean value of financial distress shows a figure of 3.543 which means that energy sector companies in Indonesia are in a safe area even though there is an energy crisis in the world. Table 2 also show that carbon emission disclosure has mean score 2.59. Compare with maximum value 8, this disclosure should be increasing.

The results of the descriptive statistical analysis above, it shows that the Z-score for measuring financial distress has a maximum value of 23.97 and the smallest -2.87. The results of the descriptive statistical test show that the standard deviation of the firm's age is 4,84747.

Table 2. Descriptive statistics.

<table>
<thead>
<tr>
<th>Var</th>
<th>N</th>
<th>Mean</th>
<th>Maximum</th>
<th>Minimum</th>
<th>Dev. Std</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>56</td>
<td>2.59</td>
<td>8</td>
<td>0</td>
<td>2.395</td>
</tr>
<tr>
<td>X1</td>
<td>56</td>
<td>3.5435</td>
<td>23.97</td>
<td>-2.87</td>
<td>4.84747</td>
</tr>
<tr>
<td>X2</td>
<td>56</td>
<td>72591783</td>
<td>57038828</td>
<td>2917411</td>
<td>12688996144</td>
</tr>
<tr>
<td>X3</td>
<td>73110.37</td>
<td>571429</td>
<td>202</td>
<td>101</td>
<td></td>
</tr>
</tbody>
</table>

Output Sources: SPSS 27

4.2 Regression analysis

This research using linear regression analysis with SPSS 27, to examine the effect of financial distress and firm size on carbon emission disclosure. The test was carried out using the cross-section data regression model formula as follows:

\[ \text{CEDisc} = \alpha + \beta_1 \text{FDisst} + \beta_2 \text{FSize} + e \]  

**Equation 3**

\[ \text{CEDisc} = \text{Carbon Emission Disclosure} \]
\[ \text{FDisst} = \text{Financial Distress} \]
\[ \text{FSize} = \text{Firm Size} \]
\[ \alpha = \text{Constanta} \]
\[ \beta_1 - \beta_2 = \text{Coefficient} \]
\[ e = \text{Error} \]

One sample Kolmogorov Smirnov test was conducted to normality test. The result shown in Table 3. Based on the result, the data used in this study were normally distributed because the value was greater than 0.05, which was shown in the Asymp sig (2-tailed) score of 0.200.

Table 3. Normality test.

<table>
<thead>
<tr>
<th>Unstandardized Residual</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Parameters a,b</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>56</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>,0000000</td>
</tr>
<tr>
<td>Most Extreme Differences</td>
<td></td>
</tr>
<tr>
<td>Absolute</td>
<td>,069</td>
</tr>
<tr>
<td>Positive</td>
<td>,069</td>
</tr>
<tr>
<td>Negative</td>
<td>,061</td>
</tr>
<tr>
<td>Test Statistic</td>
<td>,069</td>
</tr>
<tr>
<td>Asymp. Sig. (2-tailed)</td>
<td>,200</td>
</tr>
</tbody>
</table>

Output Sources: SPSS 27

Table 4 shows the multicollinearity test for this research. Using the variance inflation factor, the multicollinearity test showed that the regression model was free from the multicollinearity issue with a tolerance score > 0.1.

Table 4. Multicollinearity test.

<table>
<thead>
<tr>
<th>Collinearity Statistics</th>
<th>Tolerance</th>
<th>VIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 (Constant)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Financial distress</td>
<td>,968</td>
<td>1,033</td>
</tr>
<tr>
<td>Firm Size</td>
<td>,884</td>
<td>1,131</td>
</tr>
</tbody>
</table>

Output Sources: SPSS 27

The heteroscedasticity test was conducted with Glejser Test. Table 5 shows the result that all variables
in this research didn’t have a heteroscedasticity problem, with a significance test >0.05.

**Table 5. Heteroscedasticity test.**

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficient</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B Std. Error Beta</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Constant)</td>
<td>.794,.719</td>
<td>1.104,.276</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Financial distress</td>
<td>-.066,.029</td>
<td>-.033,.827</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firm Size</td>
<td>1.057,.000</td>
<td>.155,.319</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Output Sources: SPSS 27**

Autocorrelation test using Durbin Watson shown in Table 6 to detect autocorrelation issue. Based on Table 6, there is no autocorrelation problem for this research. This result also can be explain through legitimacy theory. From the legitimacy theory perspective, companies need to have social legitimacy in the sense of a “licence to operate” to access the resources needed to do business successfully [22]. In view of this theory carbon emission disclosure act as a license and responsibility of the company that they use resources to operate its business wisely. This result in line with [13] that there is negative relationship with environmental performance and financial distress. This result also supported by [23–25] which show that financial performance does not have a significant impact on environmental disclosure. Environmental reporting is related to image, brand, and reputation of the firm [26] this disclosure also can attract investors and build good reputation to the firm. Ideally, this advantage should be stimulating company to enhance its financial performance, neither good or bad firm performance.

Hypothesis 2 proposed that there is a relationship between firm size and carbon emission disclosure. Table 2 regression result show the p-value <0.05. Thus, hypothesis 2 is accepted. Larger firm have enough fund and resources to participate actively in environmental and carbon emission reduction. Other reason is larger firm using carbon emission disclosure to perform their image to build a good reputation to investor and stakeholder.

This result consistent with [20] [11] [9] that firm size has strong correlation with carbon emission disclosure. Larger firm have enough resources both physical and financial to reduced carbon emission through corporate environmental activity. This result also related with legitimacy theory. Legitimacy theory state that companies have a responsibility to their stakeholder. Due to this theory, large firms should disclose all relevant information to their stakeholder as corporate responsibility and accountability [18,26].

**5 Conclusion**

Legitimacy theory explained that companies continuously try to ensure that they operate their business activity in accordance with societal boundaries and norms [22]. Carbon emission disclosure is one of the reports that appears in the sustainability report, showing all activities related to reduce emission and protect the environment in order to fulfill the company’s responsibility. Stakeholder theory ensure that there is a connection between company and all stakeholder [16]. Through stakeholder theory, organization should give a value for all stakeholder not just shareholder.

Legitimacy and stakeholder theory as a foundation of company responsibility to society. This research
show the result that there is no relationship between financial distress and carbon emission disclosure. This result can be explained that carbon emission disclosure is important information that should be disclose even though the company is experiencing financial distress. This result in line with [13] [23–25], which show that financial performance does not have a significant impact on environmental disclosure. From the view of legitimacy theory, this carbon emission disclosure is the evidence that company access the resources needed wisely.

Firm size has positive relationship with carbon emission disclosure. Large firm has enough resource to participate actively in carbon emission reduction. Due to stakeholder theory they should disclose all information both financial and non-financial as corporate responsibility and accountability. This result consistent with [20] [11] [9] that firm size has strong correlation with carbon emission disclosure.

This research has limitations regarding the generalizability of the global energy crisis and post covid 19 conditions in the Indonesian energy sector, due to the limited 2021 data sample. Further research can expand the data and add another factor that can be supported carbon emission disclosure for better and deep analysis in Indonesian energy sector, for example financial structure [27,28], corporate governance [1], [9]. Future research also can expand the region, for example Southeast Asia or Asia region to enrich the literature of carbon emission disclosure during the global energy crisis and post covid-19 pandemic.

References

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