
| RESEARCH ARTICLE

Do Leverage and Carbon Risk Affect Financial Distress? Evidence from Asian Countries' Automotive Industry

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| ABSTRACT

This study intends to delve deeper into the effect of leverage and carbon risk on the financial distress of South East Asian, East Asian, and South Asian countries' automotive industries. Quantitative research using logistic regression on Eviews 12 software was selected to achieve the research objectives. The examined data were collected from automotive companies listed in the Indonesia Stock Exchange, Stock Exchange of Thailand, Bursa Malaysia, Tokyo Stock Exchange, and National Stock Exchange of India in 2015-2021, with purposive sampling employed to select the sampled companies, resulting in 36 companies with 252 observation data. The analysis showed that leverage and carbon risk positively affect the automotive industry's financial distress, while control variables consisting of inflation, company size, and company age affect financial distress. These findings bring implications for business owners, especially in the automotive sector, to consider the financial and carbon risk as the internal and external factors that could affect financial distress in running their business. Carbon risk was examined as a unique variable connected to this research context and rarely examined in financial distress studies. Carbon risk was included as the non-financial independent variable to determine whether external factors affect automotive companies' financial distress.

| KEYWORDS

Financial Distress, Leverage, Carbon Risk, Automotive Industries

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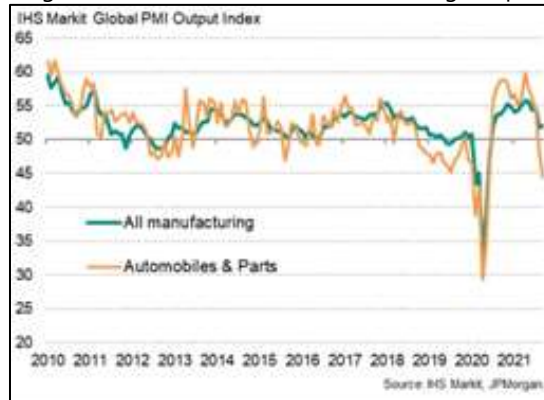
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1. Introduction

A continuous decline in a company's financial performance is an early indication of financial distress (Oktarina, 2017), defined as a condition in which a company's cash generated from operational activities is insufficient to pay off its liabilities (Arifin, 2018 in Safitri & Yuliana, 2021). Financial distress occurs when a company incurs high costs required to pay off liabilities, low operational performance compared to other companies in the same sector, and a declining industrial market (Pan, 2012 in Setyawati & Amelia, 2018).

Large or small companies in various industrial sectors could face financial distress (Gunawan et al., 2020), and the automotive industry is exceptionally vulnerable to financial distress. Purchasing Managers Index (PMI) reveals that the automotive industry is a manufacturing sector experiencing a drastic performance decline. Figure 1 shows the drastic decline in the automotive industry's production compared to other manufacturing sectors, which experienced its peak decline in 2021.

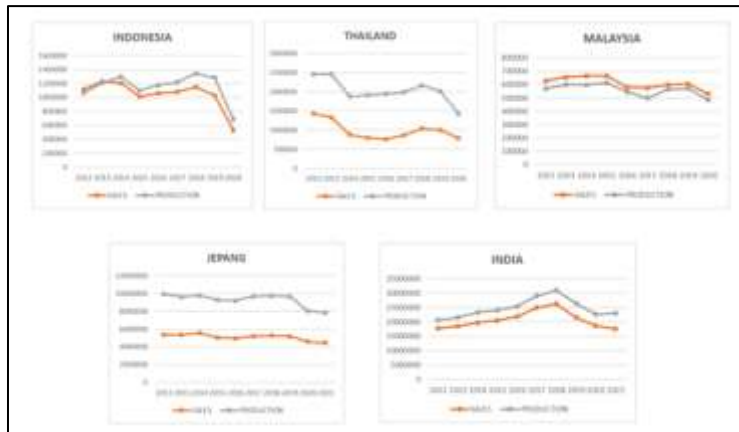
Figure 1 Growth of Global Manufacturing Output



Source: S&P Global Market Intelligence

The automotive industry is facing a demand for zero-emission vehicles, thus increasing the potential for changes in its supply chain. The United Nations Environment Programme (UNEP) states that motorized vehicle emissions contribute to 70% of air pollution. Therefore, using zero-emission vehicles has become a global policy to tackle air pollution. On top of that, the automotive industry has also faced a global semiconductor chip supply crisis since 2021 (Gaikindo, 2021). A semiconductor chip is a vital component in today's motorized vehicle production that supports the electronic functions of today's motorized vehicles. Thus, the global crisis will likely bring down motorized vehicle production optimization and sales.

Figure 2 Motorized Vehicle Production and Sales 2012-2021 in Five Asian Countries



Source: International Organization of Motor Vehicle Manufacturers

Figure 2 shows that the automotive industry in five Asian countries experienced a drastic sales decline in recent years. According to the International Organization of Motor Vehicle Manufacturers, motorized vehicle production and sales fluctuate in Indonesia, Thailand, Malaysia, Japan, and India due to the bottlenecks in the supply chain caused by the semiconductor chip crisis and global demand for zero-emission vehicles. The automotive industry in Indonesia experienced the most profound decline between 2019-2020, with 48.35% due to decreasing purchasing power due to the Covid-19 pandemic and semiconductor chip scarcity that disturbed the motorized vehicle supply in Indonesia (Gaikindo, 2020).

Thailand's automotive industry observed a 33.73% decline in production and sales of motorized vehicles during 2013-2016 due to the expired First-Car-Buyer scheme and the weakened Consumer Confidence Index in Thailand caused by a political crisis (Bangkok Post, 2020). Another South East Asia country that experienced an automotive industry decline was Malaysia in 2016-2017. Production and sales of motorized vehicles were declining due to slow economic growth (The Edge Malaysia, 2016). The automotive industry in the East Asia region is also not exempted from production and sales instability. The automotive industry in Japan recorded a 9.3% decline in 2015 due to increased motorized vehicle tax (Japan Times, 2021). As in South Asia, India's automotive industry experienced extreme production and sales decline in 2019 due to low consumer sentiment and economic growth, resulting in low consumer demands (The Times of India, 2020).

The decline in the automotive industry increases the potential financial distress in automotive companies. Financial distress in a company can be identified from the negative operational income because of the decline in the company's ability to generate profits (Heniwati et al., 2020). Financial and non-financial factors might cause financial distress. Financial factors such as leverage could signal a company's financial condition, affecting investors' perception of company prospects. Non-financial factors, such as carbon risk, also provide signals on the external conditions that might affect a company's performance.

Leverage provides essential information showing the extent of company operational activities funded through borrowed funds (Finishtya, 2019). A company's external condition also plays a crucial role for investors in deciding their investment plan. Climate change poses a risk to the company's value because of the increased cost tied to carbon emission policies. Thus, carbon risk becomes crucial information for investors to make investment decisions. Carbon risk refers to climate change's direct impact on company cash flow.

This study focuses on the company's leverage because there are discrepancies in research findings. Previous studies conducted by Natalia and Rudiawarni (2022), Idawati and Wardhana (2021), Safitri and Yuliana (2021), Isayas (2021), Heniwati et al. (2020), Sumani (2020), and Oktarina (2017) reveals that leverage affects financial distress in companies. In contrast, Finishtya (2019), Dillak and Fitri (2019), Dianova and Nahumury (2019), Mafiroh and Triyono (2018), and Fahlevi and Mukhibad (2018) do not find leverage's effect on financial distress.

This study also adds carbon risk to investigate its effect on financial distress. A limited number of studies have examined the relationship between carbon risk and financial distress. The existing studies on the topic primarily focused on the relationship between carbon risk and financial performance assessed using a company's profitability, as reported by Palea and Santhia (2022), Nguyen and Phan (2020), Trinks et al. (2020), and Lee et al. (2015), who find carbon risk's negative effect on profitability and its ability in increasing the risk of financial distress. These findings contradict those of Zhou et al. (2018) and Busch and Lewandowski (2017), who find no effect of carbon risk on a company's financial performance. Further, these studies explained that carbon performance depends on specific financial performance measures and that certain companies have limited resources to obey carbon policies.

The primary objective of the present study is to comprehend the effect of leverage and carbon risk on the automotive industry's financial distress in Indonesia, Thailand, Malaysia, Japan, and India in 2015-2021. This study contributes to developing research regarding financial distress and bridges the gap between research findings in previous studies. The novelty offered by the current study is the addition of carbon risk in the context of the study that has not been examined in financial distress studies.

2. Literature Review

Signaling theory states that companies could provide a signal in the form of information through their financial report that reflects their companies' financial performance. Poor financial performance will send a negative signal that affects the investment decision. Company financial performance can be assessed from its leverage, which shows the portion of debt used to fund the company's operational activities.

Research conducted by Natalia and Rudiawarni (2022), Idawati and Wardhana (2021), Safitri and Yuliana (2021), Isayas (2021), Heniwati et al. (2020), Sumani (2019), and Oktarina (2017) find positive effect of leverage on financial distress. High leverage shows high liabilities that companies use in funding their business activities and sends negative signals to investors that prevent them from investing in the company due to the high company risk (Dillak & Fitri, 2019). This condition will hinder the company's efforts in securing additional funding to pay off its liabilities and leads to financial distress in the said company. According to this discussion, the current study proposed the following hypothesis:

H_1 : Leverage positively affects financial distress.

The external factors also provide an essential signal for investors in assessing a company's ability to respond to external conditions that may affect the company's performance. Recently, climate change has acted as an external factor that increases risks for companies through the carbon reduction policies that demands companies to incur high capital cost to carry energy transition. Carbon risk is the risk of transition to low-emission products that affect a company's financial performance. Companies with high carbon emissions will incur high costs for this process (Wang et al., 2022) and increase their carbon risks because they need to secure large incomes to offset their carbon emissions.

Studies conducted by Palea and Santhia (2022), Nguyen and Phan (2020), Trinks et al. (2020), and Lee et al. (2015) revealed that carbon risk affects a company's financial performance because high carbon risk might cause low profitability, thus, indicating that the company is experiencing financial distress. Carbon risk occurs because of the company's inability to solve its carbon emissions from the income it generates. High carbon risk sends a negative signal because it increases the probability of difficulties in

accessing sources of capital to fund their zero-emission production process, thus reducing their profitability. Declining profitability might result in negative net profit, which indicates financial distress. Based on the discussion, we proposed the following hypothesis:

H₂: Carbon risk positively affects financial distress.

3. Methodology

3.1 Type of Research, Population, and Sample

This study is a quantitative study to examine the effect of leverage and carbon risk on financial distress. The data needed for the analysis are secondary data collected from the capital market of each studied country and the company's official website. The population in this study is all automotive companies in Indonesia, Thailand, Malaysia, Japan, and India. These countries were selected because they experienced similar sluggish automotive industry performance conditions. The samples in this study were selected according to the purposive sampling technique under the following criteria:

1. An automotive company listed in the Indonesia Stock Exchange, Stock Exchange of Thailand, Bursa Malaysia, Tokyo Stock Exchange, and National Stock Exchange of India, and publishing audited annual reports with complete financial components
2. Reported negative net profit, earning per share, and did not pay dividends for two consecutive years between 2015-2021 (Dillak & Fitri, 2019; Gunawan et al., 2020).

3.2 Measurement Construct

Financial distress is the dependent variable in the current study, measured using the Altman Z-score. This measurement is selected for its high accuracy in predicting financial distress. The Z-score is more optimal in measuring bankruptcy and has a cut-off point to classify the company's condition. The current study applied dummy variables in measuring financial distress by assigning code 1 for companies with financial distress indicated by z-score < 2.99 and code 0 for companies without financial distress indicated by z-score > 2.99 (ElBannan, 2021). The formula for Altman Z-Score :

$$Z\text{-Score} = 1,2 (\text{Working Capital}/\text{Total Assets}) + 1,4 (\text{Retained Earnings}/\text{Total Assets}) + 3,3 (\text{Earnings Before Interest and Taxes}/\text{Total Assets}) + 0,6 (\text{Market Value of Equity}/\text{Book Value of Total Debt}) + 1,0 (\text{Sales}/\text{Total Assets})$$

The independent variables in this study are leverage and carbon risk. Leverage is measured using the debt-to-asset ratio in line with Sumani (2019), Dillak and Fitri (2019), and Dianova and Nuhumury (2019). The second independent variable, carbon risk, is measured using carbon emissions to revenue in line with Trinks et al. (2022), Ehlers et al. (2021), and Busch and Lewandowski (2017).

The control variables used in this study consist of inflation, company size, and company age. Inflation is measured using the consumer price index in Indonesia, Thailand, Malaysia, Japan, and India, collected from the official website of the World Bank (worldbank.org). The measurement of company size involves taking the natural logarithm of total assets, and company age is determined by subtracting the research year from the year the company was established.

3.3 Data Analysis Technique

This study adopted a logistic regression model to test the proposed hypotheses. The model is selected because the dependent variable has non-metric or categorical data. The analysis stages include descriptive statistics, multicollinearity test, model fit test, expectation prediction (classification) test, coefficient of determination test, overall model fit test, and partial test. The formula for logistic regression is as follows:

$$\ln\left(\frac{p}{1-p}\right) FD = \alpha + \beta_1 LEVE + \beta_2 CARISK + \beta_3 INF + \beta_4 SIZE + \beta_5 AGE + e$$

- Notes: $\ln\left(\frac{p}{1-p}\right) FD$ = The probability of the company experiencing financial distress
 α = Constant
 $\beta_1 - \beta_5$ = Coefficient of regression
 LEVE = Leverage
 CARISK = Carbon risk
 INF = Inflation
 SIZE = Company size
 AGE = Company age

4. Results and Discussion

4.1 Sampling

The data collection process was conducted through a purposive sampling method, resulting in 36 samples of automotive companies and 252 observations. Table 1 summarizes the result of the sampling process.

Table 1. Sampling Results

Sampling Criteria	Indonesia	Thailand	Malaysia	Japan	India
Listed in each country's stock exchange and published annual report in 2015-2021.	12	12	11	43	32
Reported negative net profit earning per share and did not pay dividends in two consecutive years between 2015-2021.	(4)	(7)	(5)	(34)	(24)
Total samples	8	5	6	9	8
Total observations (total companies x 7 years)	56	35	42	63	56
Total Observations	252				

Source: Collected data (2023)

4.2 Descriptive Statistics

Table 2 summarizes the descriptive statistics of financial distress with a mean score of 0.79, showing that 79% of the 252 samples show an indication of financial distress. Based on the Altman Z-Score calculation, 201 samples show an indication of financial distress, and 51 are categorized as non-financial distress.

The descriptive statistics of leverage show a mean score of 0.58, indicating that the selected samples in Indonesia, Thailand, Malaysia, Japan, and India have high levels of debt or liabilities. The mean score of carbon risk is 0.36, indicating a 36% carbon risk level in the selected automotive companies. This data also shows that automotive companies in Indonesia, Thailand, Malaysia, Japan, and India have high carbon risk because European Union regulation set 12%-15% as the carbon emission level for motorized vehicles.

The mean score for inflation is 2.09, indicating high inflation in the selected countries. Another control variable, company size, has a mean score of 21.63, showing that the automotive companies in the selected countries are relatively large. The mean score for company age is 54.67 years.

Table 2. Descriptive Statistics

	FD	LEVE	CARISK	INF	SIZE	AGE
Mean	0.797619	0.583199	0.357621	2.096565	21.63780	54.66667
Maximum	1.000000	3.889506	0.874096	6.623437	31.56331	104.0000
Minimum	0.000000	0.066532	0.060730	-1.138702	7.874047	16.00000
Std. Dev.	0.402574	0.391959	0.270687	2.083099	5.772479	22.95848
Observations	252	252	252	252	252	252

Source: Eviews 12 output, collected data (2023)

4.3 Multicollinearity Test

Logistic regression does not require a classical assumption test (Ghozali & Ratmono, 2020), except for multicollinearity, to ensure the correlational independence of the independent variables in the model (Ghozali & Ratmono, 2020). The result of the multicollinearity test shows that the data is free from multicollinearity issues because the independent variables generated a result of < 0.80 .

Table 3. The Result of the Multicollinearity Test

	LEVE	CARISK	INF	SIZE	AGE
LEVE	1.000000	-0.003571	0.328769	-0.414870	0.126891
CARISK	-0.003571	1.000000	-0.603900	0.340012	0.508869
INF	0.328769	-0.603900	1.000000	-0.475705	-0.302271
SIZE	-0.414870	0.340012	-0.475705	1.000000	0.237751
AGE	0.126891	0.508869	-0.302271	0.237751	1.000000

Source: Eviews 12 output, collected data (2023)

4.4 Model Fit Test (Hosmer and Lemeshow)

The model fit test was conducted to examine the best fit between the statistical model and the data used in this study. The result of the Hosmer and Lemeshow test for model fit shows an H-L Statistic of 6.8548 and a chi-square probability of 0.5524 > 0.05, indicating the proposed regression model has the ability to generate a prediction based on the observed data.

Table 4. The Result of the Model Fit Test (Hosmer and Lemeshow)

H-L Statistic	6.8548	Prob. Chi-Sq(8)	0.5524
Andrews Statistic	30.2868	Prob. Chi-Sq(10)	0.0008

Source: Eviews 12 output, collected data (2023)

4.5 Expectation-Prediction (Classification) Test

The accuracy of the proposed regression model was tested to ensure its ability to generate an appropriate prediction based on the collected data. The result of the expectation-prediction test in Table 5 shows that the proposed model can predict the 0 value of the dependent variable in 16 observations and 1 value of the dependent variable in 193 observations. Thus, the proposed model generated 0.8294 or 82.94% of prediction accuracy, computed by summarizing the correct prediction (16+ 193) and dividing it by the total observations (209/252). Therefore, the proposed model possesses the ability to predict the company that will experience financial distress because its prediction accuracy is close to 100%.

Table 5. The Result of Expectation-Prediction (Classification) Test

	Estimated Equation		
	Dep=0	Dep=1	Total
Correct	16	193	209
% Correct	31.37	96.02	82.94
% Incorrect	68.63	3.98	17.06
Total Gain*	31.37	-3.98	3.17
Percent Gain**	31.37	NA	15.69

Source: Eviews 12 output, collected data (2023)

4.6 Coefficient of Determination Test

McFadden R-Square is adopted in the coefficient of determination test, resulting in the R-Square of 0.210881. This result shows that leverage and carbon risk explain 21.09% of the variability in financial distress, while the rest, 78.91%, might be explained by factors outside the proposed model. The result of the coefficient of determination test is summarized in Table 6.

Table 6. The Result of the Coefficient of Determination

McFadden R-squared	0.210881
LR statistic	53.53377
Prob(LR statistic)	0.000000

Source: Eviews 12 output, collected data (2023)

4.7 Overall Model Fit Test

The Overall Model Fit result shows an LR statistic of 53.53377 with a probability of 0.000 < 0.05. Therefore, it can be concluded that leverage, carbon risk, inflation, company size, and company age simultaneously affect financial distress.

Table 7. The Result of the Overall Model Fit Test

LR statistic	53.53377
Prob(LR statistic)	0.000000

Source: Eviews 12 output, collected data (2023)

4.8 Partial Test

The partial test results summarized in Table 8 indicate that leverage and carbon risk positively affect financial distress. Partially, inflation and company age as the control variables negatively affect financial distress, while company size positively affects financial distress. The model of logistic regression based on the partial testing is as follows:

$$FD = -0.358807 + 4.760175LEVE + 1.906540CARISK - 0.252492INF + 0.070746SIZE - 0.039655AGE$$

Table 8. Partial Test Results

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.358807	1.118505	-0.320792	0.7484
LEVE	4.760175	1.028503	4.628254	0.0000
CARISK	1.906540	0.960718	1.984495	0.0472
INF	-0.252492	0.116567	-2.166073	0.0303
SIZE	0.070746	0.042695	1.657026	0.0975
AGE	-0.039655	0.009499	-4.174850	0.0000

Source: Eviews 12 output, collected data (2023)

5. Discussion

5.1 The Effect of Leverage on Financial Distress

The result of partial analysis on the effect of leverage measured using the debt-to-asset ratio shows that automotive company leverage positively affects its financial distress. This finding is supported because the p-value of the finding < 0.05, indicating the finding is significant at a 5% level. Thus, increasing company leverage will increase the possibility of financial distress in automotive companies.

This finding is consistent with those of Natalia and Rudiawarni (2022), Idawati and Wardhana (2021), Safitri and Yuliana (2021), Isayas (2021), Heniwati et al. (2020), Sumani (2019), and Oktarina (2017), that find the positive effect of leverage on financial distress. High leverage indicates a high percentage of debts in the company's capital structure. This condition provides insight into the company's financial risk and its dependency on debt as its funding source. Ineffective management of debts in a company could lead to a risk of default and result in financial distress.

In the implementation of signaling theory, leverage signals how much debt is used in funding a company's assets. High leverage will send a negative signal that a company uses a large number of debts in funding its assets and can lead to financial distress. Companies with high leverage will have a high risk and send negative signals to investors in making their investment decisions. High debts and difficulties securing additional funding to pay off their liabilities will increase a company's financial distress risk.

5.2 The Effect of Carbon Risk on Financial Distress

The result of the partial test on carbon risk as an independent variable, measured using carbon emissions to revenue, shows that the variable has a positive effect on financial distress. This finding supports with p-value < 0.05, which is significant at a 5% level. High carbon risk will bring down the company's profits, indicating financial distress. This descriptive statistics result also supports this finding with a carbon risk average score of 0.36, indicating that the automotive companies in Indonesia, Thailand, Malaysia, Japan, and India have an average carbon emission of 36%. This average carbon emission score is higher than those of European Union regulation at 12%-15%. High carbon risk occurs when a company cannot mitigate its carbon emissions. Increased carbon risk will threaten company performance because companies with high carbon emissions need to set aside a portion of their profit into production transitional efforts to reduce their carbon emissions.

This finding supports Palea and Santhia (2022), Nguyen and Phan (2020), Trinks et al. (2020), and Lee et al. (2015), who found the effect of carbon risk on a company's profitability. High carbon risk could lead to low profitability in companies, increasing the risk of financial distress. Companies with high emissions tend to face a high risk of transitioning to low-emission products because it requires high transition costs. Thus, the company will struggle to generate high profitability in this condition. Eventually, companies experiencing a long-term period of low profitability indicate the presence of financial distress in their operation.

In implementing the signaling theory, carbon risk provides a signal on the company's external factor. Companies and investors also need information outside of the companies that might affect the company's performance. High carbon risk could send a negative signal regarding the risk of transitioning into low-emission products, which incur high costs for the company. This high

cost could decrease profitability and increase the potential for financial distress. The selected samples from several countries showed high levels of carbon emission. Therefore, these sampled companies will need to use some of their earnings to transition into low-emission production processes and products to reduce their carbon emissions because high carbon risk will diminish the company's profitability and increase financial distress risk.

5.3 The Effect of Inflation on Financial Distress

The partial test shows that inflation, measured using the consumer price index in each country, negatively affects financial distress. This empirical finding is consistent with Mashudi et al. (2021), who reveals that high inflation will decrease the possibility of financial distress. This condition is possible because high inflation will increase prices, and companies can increase their selling prices to avoid the probability of financial problems.

5.4 The Effect of Company Size on Financial Distress

The partial analysis of company size shows that company size positively affects financial distress. Large companies have an increased risk of financial distress because their big assets could incur high asset management costs. This finding is consistent with Natalia and Rudiawarni (2022) and Ibrahim (2019), who conclude that large companies have a higher potential to experience financial distress from managing their assets.

5.5 The Effect of Company Age on Financial Distress

The partial analysis shows that company age negatively affects financial distress. Older companies have a lower possibility of experiencing financial distress. This finding is consistent with Natalia and Rudiawarni (2022) and Isayas (2021), who state that companies with long operational histories have richer experiences than younger ones. Therefore, they have better methods for preventing financial distress.

6. Conclusion

The current study finds that leverage and carbon risk simultaneously affect the financial distress of the automotive industry in Indonesia, Thailand, Malaysia, Japan, and India. Partially, leverage and carbon risk are positively affecting financial distress. At the same time, the control variable shows that inflation and company age negatively affect financial distress, and company size positively affects financial distress. Regarding the implementation of signaling theory, leverage and carbon risk signal the possibility of financial distress in a company. Therefore, automotive companies need to pay attention to their company's financial condition and their carbon risk. Carbon emission that exceeds the regulatory limit will incur a transitional process of a production system that brings greater risk to the company's performance.

This study applied the Altman Z-Score in measuring financial distress. Despite its strength, this method has weaknesses, such as limited applicability for manufacturing companies, incompatibility with new companies, and inability to apply quarterly computation. Future studies are suggested to measure financial distress using other methods, such as Springate, Zmijewski, and Grover, as a comparison for the Altman Z-Score method in measuring financial distress.

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References

- [1] Altman, E. I. (1968). American Finance Association Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy. *The Journal of Finance* (Vol. 23, Issue 4). <https://doi.org/https://doi.org/10.2307/2978933>
- [2] Busch, T., & Lewandowski, S. (2018). Corporate Carbon and Financial Performance: a Meta-analysis. *Journal of Industrial Ecology*, 22(4), 745–759. <https://doi.org/10.1111/jiec.12591>
- [3] Dianova, A., & Nahumury, J. (2019). Investigating the Effect of Liquidity, Leverage, Sales Growth and Good Corporate Governance on Financial Distress. *Journal of Accounting and Strategic Finance*, 2(2), 143–156. <https://doi.org/10.33005/jasf.v2i2.49>
- [4] Dillak, V. J., & Fitri, Z. H. (2019). Identifying Financial Distress Firms: A Case Study on Property and Real Estate Companies Listed In Indonesian Stock Exchange. *Jurnal Manajemen Indonesia*, 19(3), 292–297. <https://doi.org/10.25124/jmi.v19i3.2532>
- [5] Ehlers, T., Packer, F., & de Greiff, K. (2022). The Pricing of Carbon Risk in Syndicated Loans: Which risks are priced and why? *Journal of Banking and Finance*, 136. <https://doi.org/10.1016/j.jbankfin.2021.106180>
- [6] ElBannan, M. A. (2021). On The Prediction of Financial Distress in Emerging Markets: What matters more? Empirical evidence from Arab spring countries. *Emerging Markets Review*, 47. <https://doi.org/10.1016/j.ememar.2021.100806>
- [7] Fahlevi, E. D., & Mukhibad, H. (2018). Penggunaan Rasio Keuangan dan Good Corporate Governance untuk Memprediksi Financial Distress. *Jurnal Reviu Akuntansi Dan Keuangan*, 8(2), 147. <https://doi.org/10.22219/jrak.v8i2.34>
- [8] Finishtya, F. C. (2019). The Role of Cash Flow of Operational, Profitability, and Financial Leverage in Predicting Financial Distress on Manufacturing Company in Indonesia. *Jurnal Aplikasi Manajemen*, 17(1), 110–117. <https://doi.org/10.21776/ub.jam.2019.017.01.12>

- [9] Gaikindo. (2021). Krisis Chip Semikonduktor Menghambat Produksi Otomotif di Asia. Retrieved February 13, 2023, from <https://www.gaikindo.or.id/krisis-chipsemikonduktor-menghambat-produksi-otomotif-di-asia/>
- [10] Gaikindo. (2020). Tahun 2020: Wabah, Resesi Ekonomi, dan Turunnya Penjualan Mobil 48 Persen. Retrieved February 13, 2023, from <https://www.gaikindo.or.id/wabah-resesi-ekonomi-dan-turunnya-penjualan-mobil-48-persen-pada-2020/>
- [11] Ghozali, I., & Ratmono, D. (2020). Analisis Multivariat dan Ekonometrika Teori, Konsep, dan Aplikasi dengan EVIEWS 10 (2nd ed.).
- [12] Gunawan, A. W., Assagaf, A., Sayidah, N., & Mulyaningtyas, A. (2020). Financial Distress di BUMN Indonesia dan Faktor-Faktor yang Mempengaruhi Investasi, Leverage, dan Cash Flow Operation terhadap Financial Distress pada Perusahaan BUMN. *EKUITAS (Jurnal Ekonomi Dan Keuangan)*, 3(2), 226–243. <https://doi.org/10.24034/j25485024.y2019.v3.i2.4135>
- [13] Heniwati, E., Essen, E., & Hadari Nawawi, J. H. (2020). Which Retail Firm Characteristics Impact On Financial Distress? *Jurnal Akuntansi Dan Keuangan*, 22(1), 40–46. <https://doi.org/10.9744/jak.22.1.40-46>
- [14] Idawati, Wiwi & Wardhana, Aditya K. (2021). Analysis of Financial Distress with Profitability as Moderation Variable. *Jurnal Akuntansi*, 25(2), 222. <https://doi.org/10.24912/ja.v25i2.807>
- [15] Ibrahim, R. (2019). Corporate Governance Effect on Financial Distress: Evidence from Indonesian Public Listed Companies. *Journal of Economics, Business & Accountancy Ventura*, 21(3), 415. <https://doi.org/10.14414/jebav.v21i3.1626>
- [16] Isayas, Y. N. (2021). Financial Distress and Its Determinants: Evidence from Insurance Companies in Ethiopia. *Cogent Business and Management*, 8(1). <https://doi.org/10.1080/23311975.2021.1951110>
- [17] Kyodo. (2021). Japan auto sales plunged 11.5% last year, in biggest drop since 2011. Japan Times. Retrieved February 13, 2023, from <https://www.japantimes.co.jp/news/2021/01/06/business/japan-auto-sales/>
- [18] Lee, K. H., Min, B., & Yook, K. H. (2015). The impacts of carbon (CO₂) emissions and environmental research and development (R&D) investment on firm performance. *International Journal of Production Economics*, 167, 1–11. <https://doi.org/10.1016/j.ijpe.2015.05.018>
- [19] Mafiroh, A., & Triyono. (2016). Pengaruh Kinerja Keuangan dan Mekanisme Corporate Governance terhadap Financial Distress (Studi Empiris pada Perusahaan Manufaktur yang Terdaftar di Bursa Efek Indonesia Periode 2011-2014). *Riset Akuntansi Dan Keuangan Indonesia*. <https://doi.org/10.23917/reaksi.v1i1.1956>
- [20] Mashudi, M., Himmati, R., Ardillah, I. F. R., & Sarasmita, C. (2021). Financial Distress Prediction in Infrastructure, Utilities, and Transportation Sector Companies 2015-2020. *Jurnal Keuangan Dan Perbankan*, 25(3), 656–670. <https://doi.org/10.26905/jkdp.v25i3.5858>
- [21] Natalia, I., & Arni Rudiawarni, F. (2022). The Effect of Board Size, Institutional Ownership and Insolvency Risk on Financial Distress Before and During Covid-19. *JDA Jurnal Dinamika Akuntansi*, 14(2), 110–125. <https://doi.org/10.15294/jda.v14i2.35466>
- [22] Nguyen, J. H., & Phan, H. V. (2020). Carbon Risk and Corporate Capital Structure. *Journal of Corporate Finance*, 64. <https://doi.org/10.1016/j.jcorpfin.2020.101713>
- [23] OICA. Global Sales and Production Statistics 2012-2021 by International Organization of Motor Vehicle Manufacturers (OICA). Retrieved February 2, 2023, from <https://www.oica.net/>
- [24] Oktarina, D. (2017). Macroeconomic indicators and corporate financial ratios in predicting financial distress. *The Indonesian Accounting Review*, 7(2), 219. <https://doi.org/10.14414/tiar.v7i2.1383>
- [25] Palea, V., & Santhià, C. (2022). The financial impact of carbon risk and mitigation strategies: Insights from the automotive industry. <https://doi.org/10.1016/j.jclepro.2022.131001>
- [26] PTI. (2020). 2019 witnesses worst-ever decline in auto sales: SIAM. The Times of India. Retrieved February 13, 2023, from <https://timesofindia.indiatimes.com/business/india-business/2019-witnessesworst-ever-decline-in-auto-sales-siam/articleshow/73192155.cms>
- [27] Reuters. (2020). Car sales to plunge 30-50% in 2020: FTI. Bangkok Post. Retrieved February 13, 2023, from <https://www.bangkokpost.com/business/1937008/carsales-to-plunge-30-50-in-2020-fti>
- [28] Safitri, M. G., & Yuliana, I. (2021). The Effect of Profitability and Leverage on Financial Distress with Inflation as Moderating. *Jurnal ASET (Akuntansi Riset)*, 13(1), 134–143. <https://doi.org/10.17509/jaset.v13i1.31368>
- [29] Setyawati, I., & Amelia, R. (2018). The Role of Current Ratio, Operating Cash Flow and Inflation Rate in Predicting Financial Distress: Indonesia Stock Exchange. *Jurnal Dinamika Manajemen*, 9(2), 140–148. <https://doi.org/10.15294/jdm.v9i2.14195>
- [30] Sumani, S. (2020). Prediksi Financial Distress: Rasio Keuangan dan Sensitivitas Makroekonomi Perusahaan Sektor Primer. *EKUITAS (Jurnal Ekonomi Dan Keuangan)*, 3(3), 285–305. <https://doi.org/10.24034/j25485024.y2019.v3.i2.4153>
- [31] Surendran, Supriya. Vehicle sales fall 29% in March 2016. The Edge Malaysia. Retrieved February 13, 2023, from <https://theedgemaalaysia.com/article/%E2%80%98vehicle-sales-fall-29-march-2016%E2%80%99>
- [32] S&P Global Market Intelligence. (2021). Global auto makers suffer record underperformance amid supply chain delays. Retrieved January 30, 2023, from <https://www.spglobal.com/marketintelligence/en/mi/research-analysis/globalauto-makers-suffer-record-underperformance-amid-supply-chain-delaysOct21.html>
- [33] Trinks, A., Mulder, M., & Scholtens, B. (2020). An Efficiency Perspective on Carbon Emissions and Financial Performance. *Ecological Economics*, 175. <https://doi.org/10.1016/j.ecolecon.2020.106632>
- [34] Wang, Y., Wu, Z., & Zhang, G. (2022). Firms and climate change: a review of carbon risk in corporate finance. In *Carbon Neutrality (Vol. 1, Issue 1)*. Springer. <https://doi.org/10.1007/s43979-022-00005-9>
- [35] Zhou, Z., Zhang, T., Wen, K., Zeng, H., & Chen, X. (2018). Carbon risk, cost of debt financing and the moderation effect of media attention: Evidence from Chinese companies operating in high-carbon industries. *Business Strategy and the Environment*, 27(8), 1131–1144. <https://doi.org/10.1002/bse.2056>