International Journal of Business and Applied Economics (IJBAE)
Vol. 3, No. 5, September 2024: 921-936

The Altman's Z-Score Model as a Financial Distress Prediction Tool During Covid-19 Pandemic (Case Study of IDX Manufacturing Companies Period 2017-2022)

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A R T I C L E I N F O

Keywords: Altman Z-score, Financial Distress, Financial Ratios

Received : 29, July
Revised : 25, August
Accepted: 27, September

A B S T R A K

This study aims to analyze financial distress manufacturing industry on IDX for the period 2017-2022 which experiencing performance pressure due to Covid-19 pandemic with Altman Z-Score model. Potential financial distress is analyzed using financial ratios of productivity (EBIT to Total Assets), liquidity (Working Capital to Total Assets), activity (Sales to Total Assets), solvency (Market Value of Equity to Total Liabilities), and profitability (Retained Earnings to Total Assets). A quantitative descriptive research method using purposive sampling technique in determining 31 listed companies as a sample. The analysis results show the Altman Z-score model is able to predict financial distress conditions on IDX listed companies manufacturing industry sector before and during the Covid-19 pandemic for the 2017-2022 period, by using its five financial ratios formulation as a tool.

DOI: https://doi.org/10.55927/ijbae.v3i5.11819
E-ISSN: **2963-6124**
https://journal.formosapublisher.org/index.php/ijbae

INTRODUCTION

In carrying out its business operations, sometimes companies have to face the risk of financial distress which is characterized by a reflection of financial conditions through several ratio indicators in their financial statements. This needs to be anticipated by the company to maintain its survival by analyzing financial predictions to provide early warning signals to avoid the risk of bankruptcy.

In 2019, almost all parts of the world were hit by the Corona Virus Disease (Covid-19) pandemic outbreak which was first detected in December 2019 at the city of Wuhan China. Indonesia was among those affected and the first case was found in March 2020. The massive spread of the virus that occured greatly impacted the instability conditions in various business sectors so the government took countermeasures by enforcing various policies, the one was the restriction of community activities. The implementation of this policy has a very significant impact on the country's economy which is marked by slowing economic growth which fell from 5.02 percent in 2019 to 2.97 percent in 2020 (djkn.kemenkeu.go.id).

The limitation of activities in the community has disrupted the economic supply chain cycle in the manufacturing industry, starting from activities in the production, distribution, and marketing processes, marked by the weakening of the manufacturing Purchasing Managers Index/PMI as an indicator of national industrial performance from 51.9 in February 2020 to 45.3 in March 2020, and a sharp drop to 27.5 in April 2020 (Figure 1). This condition was strengthened by the government's official statement through the Ministry of Industry, which stated that several manufacturing industry sectors experienced a decrease in production capacity of up to 50 percent (CNN Indonesia, 2020).

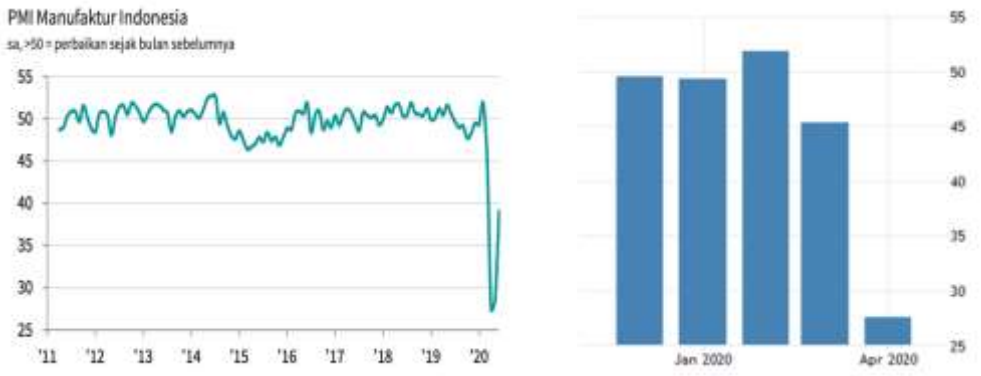
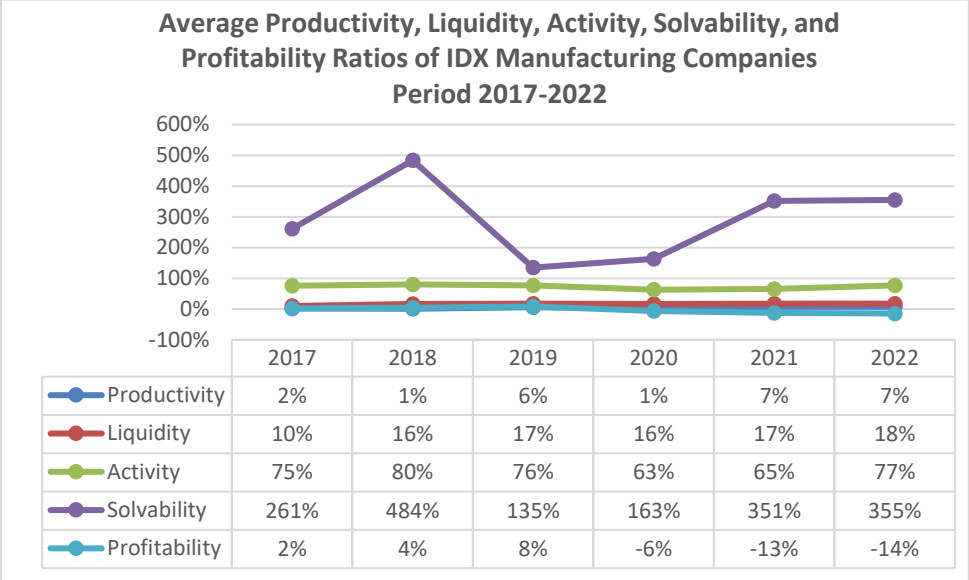


Figure 1. Indeks PMI Manufaktur Indonesia masa Covid-19
Source: IHS Markit (2020)

Indirectly, the reflection of financial ratios formed as an indicator of the positive or negative results of the company's financial performance could impact on the existence of companies in Indonesia, especially in the manufacturing industry sector companies before and during the Covid-19 pandemic as shown in the following five financial ratio charts, including productivity, liquidity, activity, solvency, and profitability (Figure 2). The five

ratios show that during the research period, there was a phenomenon of fluctuating financial performance in several manufacturing companies affected by the pandemic.



	2017	2018	2019	2020	2021	2022
Productivity	2%	1%	6%	1%	7%	7%
Liquidity	10%	16%	17%	16%	17%	18%
Activity	75%	80%	76%	63%	65%	77%
Solvability	261%	484%	135%	163%	351%	355%
Profitability	2%	4%	8%	-6%	-13%	-14%

Figure 2. Average Productivity, Liquidity, Activity, Solvability, and Profitability Ratios of IDX Manufacturing Companies Period 2017-2022
Source : Data processed (2024)

A number of empirical studies to predict company financial distress have been conducted using several models including Altman Z-Score, Zmijewski X-Score, and Springate S-Score (Sumarni, 2022). However, until now the Altman Z-Score model is the most popular and reliably applied because it has a certain level of accuracy research results with 94% in various types of industries. The Z-score model pioneered by Altman as a formula tool based on five standard financial ratio categories, like productivity, liquidity, activity, solvency, and profitability, has been used in many companies industry research like manufacturing (Kelen et al., 2022); (Aplugi et al., 2024), nursing home (Lord et al., 2020); automotive (Sareen & Sharma, 2022); retail (Marginingsih, 2022); and cement (Susilawati, 2019).

Based on the phenomena and background that have been described, this study analyzes and discusses the financial condition of issuers of manufacturing companies listed on the IDX during the 2017-2022 period of the Covid-19 pandemic using the Altman Z-Score method.

LITERATURE REVIEW

Financial Distress

Financial distress is a familiar term in the business world interpreted as a continuous decline in the company's financial performance within a certain period of time which is usually characterized by uncertainty about future profitability which will lead to bankruptcy. The prediction of the financial

distress is important information for stakeholders including creditors, investors, regulatory authorities, auditors, and company management to make policies or decisions. Categorizations in financial distress (Sihombing, 2018) include,

(1) **Economic Failure,** is a financial difficulty that occurs due to the failure of the economic system of a country or region, or the income earned cannot cover thecosts incurred, so leading an inflation, monetary crisis or bubble economy;
(2) **Business Failure,** occurs due to business failure from various sectors ranging from marketing, production, and even finance in achieving predetermined targets;
(3) **Financial Failure,** the occurrence of financial difficulties due to the inability of cash flow which is categorized into (3a) Technical Insolvency, caused by the company failed to meet the liquidity of its short-term obligations, and (3b) Bankruptcy Insolvency, is an ongoing technical insolvency if the company persistently fails to pay its short-term obligations and impacts its long-term obligations;
(4) **Legal Bankruptcy,** is a type of financial distress which officially declared in court that the company is bankrupt based on legal laws.

Financial distress conditions can be influenced by many factors which are divided into 3 main categories (Sihombing, 2018):

(1) **General Factors,** including **(a). The economic sector** in connection with economic policies, including those related to finance, changes in interest rates, foreign currency revaluation, provisions for changes in foreign trade volume; **(b). The social sector** in the form of changes in people's lifestyle behavior, and the occurrence of conflicts can have an impact on financial difficulties; **(c). The technology sector** can cause costs borne by companies to swell due to unplanned maintenance and implementation, including the lack of professional use of production equipment; **(d). The government sector** is related to changes in government policy or the implementation of new laws and regulations.
(2) **External Company Factors**, including **(a). The consumer sector** in the form of identifying changes in consumer desires that result in the consumption of goods and or services; **(b). The creditor sector** which has an impact on credit acquisition due to decreased trust; **(c). The competitor sector** when other companies have the ability to provide more competitive products which leads consumers switching to competing companies.
(3) **Internal Company Factors**, usually the result of inappropriate decisions and policies in the past as well as management's failure to act deciding when necessary.

The measurement of bankruptcy risk as a result of financial distress has a long history in financial literature. There are several indicators that predict both by internally using the company's cash flow conditions, and by externally from macroeconomic conditions, financial market rating agencies, and the information from suppliers, dealers, and others.

As an important analyzing tools whether the company financial distress are in the healthy category or not, the Z-score model (Equation 1) created by a finance professor from New York University (NYU) Stern School of Business, Edward I. Altman, who developed a multiple discriminant analysis (MDA) model using financial ratio formula and analyzed it to obtain the accuracy results to 94% (Altman, 1968). The latest findings of Z-score plus refine the existing model so that it can be used to analyze the financials of manufacturing and non-manufacturing companies (Altman et al., 2017).

$$Z - Score = 3{,}3\ EBIT/TA + 1{,}2\ NWC/TA + 1\ Sales/TA + 0{,}6\ MVE/BVD + 1{,}4\ Accum\ RE/TA \quad (1)$$

Financial Statements

To determine the internal condition of the company, the financial reports are used as a summary of the activities and results of the company's operations for a period of time which presents financial performance in the form of reports that are prepared in accordance with standard provisions, including the Statement of Financial Position (Balance Sheet), Income Statement, and Statement of Cash Flow.

In presenting systematic, relevant, reliable and complete financial reports, the aim is to make the analysis easier to understand the condition of the company, and in analyzing, measurements are needed as a basis for making interpretations. Generally the measurement used is financial ratio.

Ratio Analysis

Ratio analysis is a systematic ratio to describe the company's financial performance expressed in percentage form. These financial ratios are analyzed based on the data and the components contained in the company's financial reports using the method:

(1) Common size, which analyzes by comparing each item in the financial statements with total assets or sales to evaluate performance over time and compare it with competitors in the same industry;
(2) Time series and forecasting, carrying out analysis by comparing financial data at certain time intervals with the aim projecting future financial conditions, involving government regulatory factors, changes in the level of competition, and others that affected the company's financial structure.

The beginning process of determining the financial ratios that will be used in the formulation of bankruptcy predictions is, after the data in balance sheet and income statement were collected, a list of potential variables (ratios) that are useful for evaluation are then compiled, and classified into five standard ratio categories, namely liquidity, profitability, leverage, solvency, and activity ratio. These ratios were selected based on 1) literature popularity, 2) potential relevance to research, and several new ratios initiated in writing articles. Overall from the list of existing variables, five variables were selected

as the best results in predicting company bankruptcy with a description of the financial ratio formula used as follows (Altman, 1968).

Productivity ratio shows the actual productivity measure of the assets owned by the company by ignoring tax factors, where the main existence of the company is based on obtaining profits from its assets.

$$\textbf{Productivity} = \frac{\textbf{Earning Before Interest and Tax (EBIT)}}{\textbf{Total Asset}}$$

Liquidity ratio shows the company's ability to meet short-term obligations that matured. Working capital is defined as the difference between current assets and current liabilities. Explicitly, liquidity characteristics and company size are considered because companies that experience consistent operating losses generally will have shrinking current assets in relation to total assets. The use of variables in this ratio is considered the best indicator of termination operations.

$$\textbf{Liquidity} = \frac{\textbf{Net Working Capital}}{\textbf{Total Asset}}$$

Activity ratio shows the company's effectiveness in using assets by looking at the level of asset activity. The capital turnover ratio is a standard financial ratio that describes the ability to generate sales from company assets. It is considered quite important because individually it is the least significant ratio, in fact statistical significance does not appear at all. However, due to its unique relationship with other variables in the model, this ratio ranks second in the contribution of the overall bankruptcy prediction model.

$$\textbf{Activity} = \frac{\textbf{Sales}}{\textbf{Total Asset}}$$

Solvency ratio measures the company's ability to fulfill its long-term obligations, where equity is measured by the combined market value of all shares (preferred shares and common shares), while debt includes short-term and long-term debt. This measure indicates how much a company's assets can decline in value (measured by the market value of equity plus debt) before liabilities exceed assets and the company becomes insolvent. This ratio adds a dimension of market value that is not considered by other empirical studies of failure and is a more effective predictor of bankruptcy than the more commonly used similar ratio, namely Net Worth/Total Debt (book values).

$$\textbf{Solvability} = \frac{\textbf{Market to Value Equity}}{\textbf{Book Value Debt}}$$

Profitability ratio measures a company's ability to generate profits, are also a measure of cumulative profitability over time which was previously mentioned as one of the "new" ratios. Company age is implicitly considered in this ratio.

$$\textbf{Profitability} = \frac{\textbf{Retained Earnings}}{\textbf{Total Asset}}$$

Hypothesis dan Research Framework

Based on the phenomena described previously, the following research framework is presented to support the hypothesis of the Altman Z-Score model as a prediction tool for company financial distress before and during the Covid-19 pandemic (Figure 3).

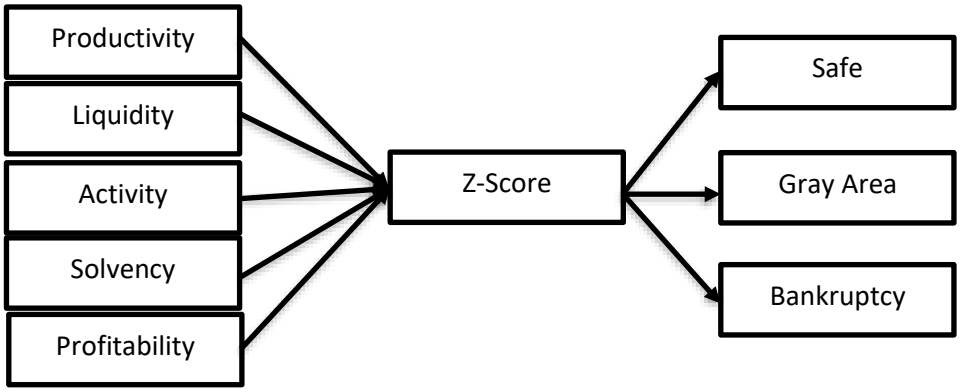


Figure 3. Framework Research
Source: Data processed (2024)

METHODOLOGY

This research uses a descriptive method with secondary data taken from 31 samples of issuers in manufacturing companies listed on the Indonesia Stock Exchange (Table 1) during the 2017-2022 period, which were selected using a purposive sampling technique based on the following criteria,

1. Issuer companies in the manufacturing industry category.
2. Never been delisted or relisted during the research period.
3. Annual financial reports are published in local currency (Rupiah) and present complete data.

The analysis was carried out using the Altman Z-Score method for manufacturing companies by calculating financial ratio figures sourced from the company's balance sheet and income statements, then the calculation results of each financial ratio were entered into the following formula.

$$\mathbf{Z = 3{,}3\ X_1 + 1{,}2\ X_2 + 1\ X_3 + 0{,}6\ X_4 + 1{,}4\ X_5}$$

where,

X_1 : Productivity (EBITTA) = Earnings Before Interest Tax/Total Asset
X_2 : Liquidity (WCTA) = Net Working Capital/Total Assets
X_3 : Activity (STA) = Sales/Total Assets
X_4 : Solvability (MVETL) = Market Value Equity/Book Value of Total Debt
X_5 : Profitability (RETA) = Retained Earnings/Total Assets
Z : Z-Score (Overall Index)

Table 1. Sample BEI Manufacturing Company (Tbk) Period 2017-2022

No	Code	Emiten	No	Code	Emiten
1	AMFG	Asahimas Flat Glass	17	KBLI	KMI Wire and Cable
2	APII	Arita Prima Indonesia	18	KBLM	Kabelindo Murni
3	ARNA	Arwana Citramulia	19	KIAS	Keramika Indonesia Asosiasi
4	ASGR	Astra Graphia	20	KOIN	Kokoh Inti Arebama
5	ASII	Astra International	21	KONI	Perdana Bangun Pusaka
6	BHIT	MNC Asia Holding	22	LION	Lion Metal Works
7	BMTR	Global Mediacom	23	MDRN	Modern Internasional
8	BNBR	Bakrie & Brothers	24	MFMI	Multifiling Mitra Indonesia
9	CTTH	Citatah	25	MLIA	Mulia Industrindo
10	DYAN	Dyandra Media Internasional	26	MLPL	Multipolar
11	EMTK	Elang Mahkota Teknologi	27	SCCO	Supreme Cable Manufacture
12	ICON	Island Concepts Indonesia	28	TIRA	Tira Austenite
13	IMPC	Impack Pratama Industri	29	TOTO	Surya Toto Indonesia
14	INDX	Tanah Laut	30	UNTR	Unilever Indonesia
15	JECC	Jembo Cable Company	31	VOKS	Voksel Electric
16	JTPE	Jasuindo Tiga Perkasa			

Source: Data processed (2024)

The Z value obtained from each sample is classified into 3 categories including safe, gray area, and distress (Table 2), to conclude the results based on the hypothesis formulated.

Table 2. Altman Z-Score Category

Score	Category
Z >= 2.99	Safe
1.81 < Z < 2.99	Grey Area
Z <= 1.81	Bankruptcy

Source : Fundamentals of Corporate Finance (Jordan, Bradford D., Ross, Stephen A., Westerfield, 2022)

RESEARCH RESULT

The analysis carried out in this research is divided into 2 stages. The first is to calculate the five financial ratios of the Altman model from 31 research sample companies, they are : profitability ratio of Earnings Before Interest Tax to Total Assets/EBITTA (X1), the liquidity ratio of Net Working Capital to Total Assets/WCTA (X2), activity ratio of Sales to Total Assets/STA (X3), solvency ratio of Market Value Equity to Book Value of Total Debt/MVETL (X4), and profitability ratio of Retained Earnings to Total Assets/RETA (X5). Next, the results of each financial ratio variable for the samples are entered into the Z-Score model to determine the extent of the company's financial distress (Table 3).

Table 3. Altman Z-Score Analysis BEI Manufacturing Company Period 2017-2022

No	Issuer	Year	X1	X2	X3	X4	X5	Z-Score
1	AMFG	2017	0,01489	0,16057	0,61996	0,96172	0,50525	2,1462
		2018	0,02095	0,05574	0,52691	0,33116	0,38121	1,3953

No	Issuer	Year	X1	X2	X3	X4	X5	Z-Score
		2019	-0,01677	0,00705	0,49093	0,27939	0,34651	1,0968
		2020	-0,02789	-0,05923	0,47324	0,23288	0,32000	0,8979
		2021	0,06577	-0,00281	0,64134	0,46883	0,39323	1,6868
		2022	0,10988	0,05447	0,74623	0,64295	0,44707	2,1859
2	APII	2017	0,04537	0,19317	0,39715	1,22392	0,25046	1,8637
		2018	0,09028	0,23331	0,48081	1,14527	0,29785	2,1629
		2019	0,06978	0,21362	0,49456	1,04456	0,32571	2,0639
		2020	0,10701	0,24964	0,48598	0,92552	0,37030	2,2124
		2021	0,07287	0,26111	0,46549	1,30856	0,39239	2,3538
		2022	0,07321	0,24350	0,52273	1,13504	0,39914	2,2963
3	ARNA	2017	0,11661	0,17800	1,08221	4,38987	0,57526	**5,1199**
		2018	0,13444	0,21232	1,19273	5,54260	0,59916	**6,0556**
		2019	0,16089	0,23003	1,19602	5,14315	0,59556	**5,9227**
		2020	0,21850	0,29467	1,12252	7,50250	0,62120	7,5684
		2021	0,26865	0,37731	1,13878	8,81603	0,65847	8,6896
		2022	0,33066	0,40821	1,15295	9,79586	0,77247	9,6929
4	ASGR	2017	0,14857	0,36203	1,62464	1,61999	0,46592	**4,1736**
		2018	0,16290	0,45766	1,79188	2,27906	0,56653	**5,0392**
		2019	0,12209	0,39817	0,81168	1,00827	0,49314	**2,9877**
		2020	0,03495	0,49316	0,76149	1,48615	0,59652	3,1954
		2021	0,03976	0,48397	0,83870	1,08939	0,53863	2,9584
		2022	0,05062	0,48861	0,83145	1,30161	0,55861	3,1478
5	ASII	2017	0,09875	0,07634	0,69697	2,41186	0,38366	**3,0987**
		2018	0,11053	0,04268	0,69393	1,95469	0,37055	2,8015
		2019	0,10921	0,08267	0,67385	1,69708	0,39916	2,7105
		2020	0,07436	0,13770	0,51758	1,70869	0,44076	2,5705
		2021	0,08184	0,15378	0,63566	1,51450	0,44594	2,6233
		2022	0,12702	0,14668	0,72921	1,36078	0,39633	2,6957
6	BHIT	2017	0,04239	-0,00878	0,24026	0,13334	0,01350	0,4685
		2018	0,05052	0,03568	0,26099	0,09436	0,01505	0,5482
		2019	0,07270	0,02632	0,27715	0,15069	0,02222	0,6702
		2020	0,05874	0,01578	0,24873	0,17344	0,02384	0,5990
		2021	0,02938	0,04035	0,26652	0,18291	0,03178	0,5661
		2022	0,06541	0,04670	0,26170	0,16536	0,04047	0,6895
7	BMTR	2017	0,10067	0,18385	0,39103	0,61741	0,23789	1,6473
		2018	0,09346	0,08372	0,40373	0,23429	0,25392	1,3087
		2019	0,13056	-0,18418	0,42900	0,41745	0,29038	1,2958
		2020	0,09780	0,14207	0,37395	0,38746	0,30004	1,5197
		2021	0,06409	0,08782	0,40168	0,00000	0,31773	1,1634
		2022	0,08758	0,16598	0,34065	0,00000	0,30785	1,2598
8	BNBR	2017	-0,01452	-1,24955	0,33819	0,44856	-2,56215	-4,5270
		2018	0,00587	-0,01970	0,23303	0,08910	-1,38792	-1,6609
		2019	0,00958	0,01002	0,22525	0,08686	0,78382	1,4184
		2020	-0,05457	-0,08961	0,17546	0,08314	0,75756	0,9983
		2021	-0,00205	-0,08951	0,15636	0,07601	-1,31367	-1,7514
		2022	0,01328	-0,05950	0,20768	0,10357	-1,14667	-1,3631
9	CTTH	2017	0,03327	0,28073	0,33276	0,32165	-0,59630	0,1376
		2018	0,04420	0,28143	0,38411	0,35879	-0,56638	0,2900

No	Issuer	Year	X1	X2	X3	X4	X5	Z-Score
		2019	-0,01167	0,25652	0,20399	0,19358	-0,59506	-0,2436
		2020	-0,02372	0,16874	0,14834	0,14591	-0,73427	-0,6679
		2021	-0,01957	0,13924	0,03577	0,12679	-0,77457	-0,8700
		2022	-0,00256	0,09969	0,16162	0,11408	-0,75027	-0,7091
10	DYAN	2017	-0,00328	(0,01656)	0,59283	0,36180	-0,03208	0,7343
		2018	0,08188	0,10644	0,84193	0,78971	0,02449	1,7480
		2019	0,03562	0,11687	0,80668	1,29262	0,03314	1,8864
		2020	-0,22406	-0,02070	0,27238	0,50406	-0,16873	-0,4256
		2021	-0,11183	-0,06075	0,58758	0,67897	-0,25857	0,1910
		2022	0,08663	0,04884	1,11223	0,72495	-0,22799	1,5725
11	EMTK	2017	0,02724	0,38875	0,34188	1,22913	0,05004	1,7058
		2018	0,01646	0,38645	0,45887	1,16659	-0,08313	1,5605
		2019	-0,10739	0,33735	0,63282	0,59628	-0,17896	0,7905
		2020	0,02724	0,24969	0,66743	1,44054	-0,06044	2,4393
		2021	0,16597	0,25538	0,33642	31,03160	0,12245	19,9810
		2022	0,01612	0,30076	0,34911	13,79549	0,22076	9,3496
12	ICON	2017	0,04609	0,35161	0,35558	0,66580	0,01713	1,3531
		2018	0,09160	0,42336	0,50095	0,55875	0,06965	1,7440
		2019	0,10652	0,55100	0,55069	0,57023	0,14185	2,1041
		2020	0,02316	0,31791	0,38747	0,64147	0,14664	1,4356
		2021	0,00579	0,34387	0,37897	0,85659	0,13979	1,5204
		2022	-0,05864	-0,02488	0,46313	0,43548	0,09002	0,6271
13	IMPC	2017	0,08246	0,37812	0,51992	5,23888	0,33317	**4,8556**
		2018	0,08086	0,37035	0,58868	4,55271	0,34877	**4,5199**
		2019	0,08250	0,27812	0,59803	4,64400	0,34970	**4,4800**
		2020	0,08968	0,24233	0,66646	5,20178	0,34825	4,8618
		2021	0,07905	0,25989	0,77839	10,40164	0,40342	8,1569
		2022	0,13412	0,30219	0,81756	14,05243	0,33602	10,5247
14	INDX	2017	-0,16519	0,48085	0,10189	26,47246	0,05438	**16,0934**
		2018	-1,83593	0,55522	0,05555	100,6943	-0,91271	**53,8020**
		2019	0,01956	0,29730	0,07853	3,44528	-0,79082	1,4599
		2020	0,00117	0,19693	0,07660	2,98234	-0,77065	1,0273
		2021	-0,01600	0,19870	0,07366	4,71966	-0,75718	2,0310
		2022	-0,16783	0,06756	0,08206	8,08218	-0,84356	3,2776
15	JECC	2017	0,08222	0,03850	1,13306	0,51472	0,08627	1,8802
		2018	0,08515	0,07665	1,52586	0,72126	0,15655	2,5508
		2019	0,10260	0,13724	1,54922	0,82433	0,20303	2,8313
		2020	0,03219	0,16326	1,04033	1,08707	-0,23978	1,6590
		2021	-0,04243	0,10176	0,99103	0,85716	0,18182	1,7420
		2022	0,05168	0,10064	1,28033	0,51457	0,16976	2,1181
16	JTPE	2017	0,14444	0,07920	1,21490	0,27359	0,35687	2,4504
		2018	0,17044	0,15995	1,16795	0,48304	0,38518	2,7514
		2019	0,22676	0,21915	1,24767	1,03151	0,43595	**3,4882**
		2020	0,10839	0,25377	0,94271	1,61586	0,50546	3,2821
		2021	0,09397	0,27675	0,88731	1,49729	0,48353	3,1048
		2022	0,12573	0,22742	0,91015	0,83504	0,42957	2,7004
17	KBLI	2017	0,14986	0,30182	1,05738	1,39125	0,33743	**3,2212**
		2018	0,10498	0,39799	1,30668	0,99699	0,38080	**3,2620**
		2019	0,14808	0,47203	1,26545	1,79197	0,45594	**4,0341**
		2020	-0,01517	0,67486	0,65417	2,33304	0,51766	3,5385

No	Issuer	Year	X1	X2	X3	X4	X5	Z-Score
		2021	0,03863	0,62190	0,64645	4,12119	0,60609	4,8414
		2022	0,03250	0,63107	0,79410	4,16650	0,60803	5,0098
18	KBLM	2017	0,03973	0,09263	0,98403	0,71172	0,11372	1,8125
		2018	0,05196	0,10842	0,95772	0,58714	0,13112	1,7952
		2019	0,04514	0,11959	0,89465	0,78090	0,15874	1,8779
		2020	0,01387	0,14845	0,86079	1,30662	0,19406	2,1404
		2021	-0,01512	0,09734	0,81099	0,89995	0,12020	1,5862
		2022	0,03011	0,12798	1,00418	1,03537	0,13951	2,0737
19	KIAS	2017	-0,05358	0,20237	0,45828	4,37966	-0,25106	2,8006
		2018	-0,05498	0,21600	0,51393	4,27049	-0,29989	2,7341
		2019	-0,41021	0,11655	0,59680	2,92985	-0,79673	0,0255
		2020	-0,05658	0,08415	0,42802	4,41357	-1,01550	1,5687
		2021	0,00229	0,15649	0,55245	4,85989	-1,04364	2,2027
		2022	0,00162	0,14847	0,60790	3,50649	-0,97309	1,5330
20	KOIN	2017	-0,00974	0,12245	2,15830	0,46232	0,01363	2,5696
		2018	-0,00849	0,08011	2,04617	0,30240	0,00193	2,2984
		2019	-0,02307	0,05899	2,48035	0,19052	-0,02360	2,5563
		2020	0,07921	0,11436	2,14019	0,18036	0,03724	2,6992
		2021	-0,02473	-0,00995	2,42065	0,16006	-0,00293	2,4190
		2022	-0,06034	-0,11681	2,83439	0,11621	-0,06886	2,4684
21	KONI	2017	0,01098	-0,01956	0,97893	0,50666	-0,26614	0,9231
		2018	-0,02564	-0,06503	1,14758	0,62978	0,09655	1,4980
		2019	0,04867	-0,03417	1,17067	0,97743	0,14351	2,0776
		2020	0,02053	0,40184	0,84313	1,49138	-0,31584	1,8458
		2021	0,07155	0,71515	1,03929	16,96290	-0,23253	11,9858
		2022	0,10740	0,69185	1,25633	31,70086	-0,19726	21,1853
22	LION	2017	0,02208	0,51229	0,51279	1,73288	0,58412	**3,0579**
		2018	0,02031	0,53044	0,60921	1,60033	0,60500	3,1200
		2019	0,00839	0,53972	0,54139	1,10996	0,60279	2,7266
		2020	-0,00749	0,60224	0,46085	0,87927	0,60073	2,5274
		2021	-0,00751	0,47317	0,43357	0,71952	0,56509	2,1994
		2022	0,00606	0,49391	0,59724	2,09619	0,57177	3,2681
23	MDRN	2017	-0,96358	(1,22547)	0,25711	0,17812	-1,76224	-6,7535
		2018	-0,03103	-0,79563	0,10299	0,20592	-1,92693	-3,5283
		2019	0,08235	-0,64766	0,20385	0,40351	-2,65189	-3,7721
		2020	-0,56067	-1,24023	0,28525	0,45224	-6,01371	-11,2011
		2021	0,67041	-1,13946	0,31688	0,58032	-6,76304	-7,9582
		2022	0,35168	-0,49038	0,28942	0,69445	-7,42312	-9,1142
24	MFMI	2017	0,12209	0,07278	0,45330	13,73573	0,41073	**9,7600**
		2018	0,12042	0,08612	0,44480	11,78042	0,44651	**8,6389**
		2019	0,33178	0,35150	0,33212	3,15389	0,32439	4,1953
		2020	0,12441	0,04864	0,41572	2,53607	0,04120	2,4640
		2021	0,16507	0,24960	0,42478	3,24689	0,04401	3,2788
		2022	0,14195	0,21074	0,43378	2,44515	0,04120	2,6799
25	MLIA	2017	0,07495	(0,03642)	1,21024	0,05011	-0,30260	1,0203
		2018	0,23516	-0,01522	1,05951	0,10549	-0,26345	1,5118
		2019	0,09335	0,05039	0,67489	0,05743	-0,21772	0,7731
		2020	0,05043	0,01048	0,65030	0,04788	-0,20862	0,5659

No	Issuer	Year	X1	X2	X3	X4	X5	Z-Score
		2021	0,11062	0,08220	0,72683	0,21564	-0,09004	1,1939
		2022	0,17680	0,17193	0,74539	0,29890	-0,08099	1,6011
26	MLPL	2017	-0,06728	0,07032	0,85285	0,16764	0,11183	0,9724
		2018	-0,00728	0,04608	0,87305	0,09933	0,13049	1,1466
		2019	-0,01935	0,00377	0,82066	0,12903	0,09212	0,9677
		2020	-0,00166	-0,06422	0,65535	0,08869	0,04924	0,6949
		2021	-0,03034	0,04653	0,69847	0,52936	0,06594	1,0641
		2022	0,03302	0,00072	0,84549	0,19619	0,07579	1,1791
27	SCCO	2017	0,09241	0,23037	1,10616	1,43874	0,30357	**2,9758**
		2018	0,09015	0,26395	1,23888	1,42579	0,33872	**3,1828**
		2019	0,10650	0,30236	1,29551	1,49744	0,37588	**3,4345**
		2020	0,08675	0,38290	1,23428	4,59570	0,47832	5,4071
		2021	0,03742	0,31828	1,06855	7,20178	0,40639	6,4640
		2022	0,02711	0,30172	1,06651	4,47402	0,38645	4,7435
28	TIRA	2017	-0,00425	0,13646	0,71211	0,83362	0,03867	1,4162
		2018	0,03442	0,16729	0,83561	0,69559	0,04104	1,6247
		2019	0,04203	0,17729	0,82662	0,84743	0,04514	1,7497
		2020	0,02440	0,13196	0,72801	0,83641	0,02014	1,4969
		2021	-0,03911	0,09475	0,68237	1,40020	0,01013	1,5213
		2022	0,04527	0,09252	0,81219	1,27404	0,01646	1,8601
29	TOTO	2017	0,13223	0,26289	0,76973	3,71728	0,55726	**4,5321**
		2018	0,15486	0,30571	0,76913	3,71145	0,59923	**4,7128**
		2019	0,05453	0,33359	0,70451	3,03101	0,60412	**3,9491**
		2020	0,00685	0,33316	0,52208	2,07473	0,55100	2,9607
		2021	0,06608	0,32987	0,56606	2,04819	0,58525	3,2282
		2022	0,11900	0,33304	0,63119	2,78025	0,61484	3,9525
30	UNTR	2017	0,13855	0,27747	0,78480	3,80273	0,40084	**4,4178**
		2018	0,14746	0,05905	0,72776	1,72241	0,34848	2,8065
		2019	0,15943	0,16329	0,75578	1,58668	0,42126	**3,0196**
		2020	0,08568	0,23298	0,60467	2,70699	0,49591	3,4855
		2021	0,12074	0,26754	0,70593	2,00522	0,50349	3,3334
		2022	0,21131	0,26262	0,87990	1,90846	0,50772	3,7482
31	VOKS	2017	0,12973	0,19278	1,07021	1,00039	0,18930	2,5949
		2018	0,07743	0,16618	1,08008	0,79775	0,20362	2,2987
		2019	0,10452	0,32896	0,88168	0,87084	0,22905	2,4645
		2020	0,04116	0,34038	0,62908	0,54378	0,23882	1,8340
		2021	0,04910	0,12901	0,59108	0,38683	0,16781	1,3750
		2022	-0,04613	0,02720	0,98597	0,29670	0,11045	1,1990
Before Covid-19			0,03	0,14	0,77	2,93	0,05	
During Covid-19			0,05	0,17	0,68	2,90	-0,11	

Source: Data processed (2024)

Secondly, after obtaining the Z-Score value for each company, the following stage is to determine the average value over the 6 years research period to determine the company's position in the safe, gray area or distress classification (Table 4). The third is the final stage that analyzes the categorization of financial distress conditions based on the periods of time before and during the Covid-19 pandemic.

Table 4. Z-Score Classification

No	Issuer	Year						Avg	Classify
		2017	2018	2019	2020	2021	2022		
1	AMFG	2,1462	1,3953	1,0968	0,8979	1,6868	2,1859	1,5681	grey area
2	APII	1,8637	2,1629	2,0639	2,2124	2,3538	2,2963	2,1588	grey area
3	ARNA	5,1199	6,0556	5,9227	7,5684	8,6896	9,6929	7,1748	safe
4	ASGR	4,1736	5,0392	2,9877	3,1954	2,9584	3,1478	3,5837	safe
5	ASII	3,0987	2,8015	2,7105	2,5705	2,6233	2,6957	2,7500	grey area
6	BHIT	0,4685	0,5482	0,6702	0,5990	0,5661	0,6895	0,5902	distress
7	BMTR	1,6473	1,3087	1,2958	1,5197	1,1634	1,2598	1,3658	grey area
8	BNBR	-4,5270	-1,6609	1,4184	0,9983	-1,7514	-1,3631	-1,1476	distress
9	CTTH	0,1376	0,2900	-0,2436	-0,6679	-0,8700	-0,7091	-0,3438	distress
10	DYAN	0,7343	1,7480	1,8864	-0,4256	0,1910	1,5725	0,9511	distress
11	EMTK	1,7058	1,5605	0,7905	2,4393	19,9810	9,3496	5,9711	safe
12	ICON	1,3531	1,7440	2,1041	1,4356	1,5204	0,6271	1,4640	grey area
13	IMPC	4,8556	4,5199	4,4800	4,8618	8,1569	10,5247	6,2331	safe
14	INDX	16,0934	53,8020	1,4599	1,0273	2,0310	3,2776	12,9485	safe
15	JECC	1,8802	2,5508	2,8313	1,6590	1,7420	2,1181	2,1302	grey area
16	JTPE	2,4504	2,7514	3,4882	3,2821	3,1048	2,7004	2,9629	safe
17	KBLI	3,2212	3,2620	4,0341	3,5385	4,8414	5,0098	3,9845	safe
18	KBLM	1,8125	1,7952	1,8779	2,1404	1,5862	2,0737	1,8810	grey area
19	KIAS	2,8006	2,7341	0,0255	1,5687	2,2027	1,5330	1,8108	grey area
20	KOIN	2,5696	2,2984	2,5563	2,6992	2,4190	2,4684	2,5018	grey area
21	KONI	0,9231	1,4980	2,0776	1,8458	11,9858	21,1853	6,5859	safe
22	LION	3,0579	3,1200	2,7266	2,5274	2,1994	3,2681	2,8166	grey area
23	MDRN	-6,7535	-3,5283	-3,7721	-11,2011	-7,9582	-9,1142	-7,0546	distress
24	MFMI	9,7600	8,6389	4,1953	2,4640	3,2788	2,6799	5,1695	safe
25	MLIA	1,0203	1,5118	0,7731	0,5659	1,1939	1,6011	1,1110	distress
26	MLPL	0,9724	1,1466	0,9677	0,6949	1,0641	1,1791	1,0041	distress
27	SCCO	2,9758	3,1828	3,4345	5,4071	6,4640	4,7435	4,3679	safe
28	TIRA	1,4162	1,6247	1,7497	1,4969	1,5213	1,8601	1,6115	grey area
29	TOTO	4,5321	4,7128	3,9491	2,9607	3,2282	3,9525	3,8892	safe
30	UNTR	4,4178	2,8065	3,0196	3,4855	3,3334	3,7482	3,4685	safe
31	VOKS	2,5949	2,2987	2,4645	1,8340	1,3750	1,1990	1,9610	grey area
Period		**Before Covid-19**			**During Covid-19**				
Safe		**11**	**8**	**8**	**0**	**0**	**0**		
Grey Area		**12**	**18**	**15**	**22**	**23**	**24**		
Distress		**8**	**5**	**8**	**9**	**8**	**7**		

Source: Data processed (2024)

DISCUSSION

Based on the analysis stage, description of the five financial ratios of the 31 samples of listed companies in manufacturing sector during the 2019-2022 period shows that the solvency ratio most dominantly represents the condition of financial difficulties, followed by the activity, liquidity, profitability, and productivity ratios (Table 3).

Predictions of company financial distress analysed from the time period of the pandemic before and during Covid-19, the financial ratios found by

Altman were able to provide signs, among others: (1) a decrease in the company's ability to cover its short and long term debt from its equity by 0.03%; (2) a drop in sales figures from a number of company assets by 0.09%; (3) an increase in the use of net working capital by 0.03% in order to operate assets owned as an effort for issuers to continue operating during the pandemic; (4) a drastic decrease in the determination of the retained earnings policy against the company's assets by 11% to the point of minus; and (5) the acquisition of profit before tax and interest increased by 0.02% of total assets owned, where the increase was not too significant which could possibly result from the company's efforts to print profit performance during the pandemic.

Thus the analysis of the average category conditions of the 31 issuer samples studied before the Covid-19 pandemic during the 2017-2019 period, including 9 issuers in safe conditions (ARNA, ASGR, IMPC, INDX, KBLI, MFMI, SCCO, TOTO, UNTR); 15 issuers in gray area conditions (AMFG, APII, ASII, BMTR, EMTK, ICON, JECC, JTPE, KBLM, KIAS, KOIN, KONI, LION, TIRA, VOKS); and 7 issuers in distress conditions (BHIT, BNBR, CTTH, DYAN, MDRN, MLIA, MLPL). This condition becomes different when the Covid-19 pandemic takes place during the 2020-2022 period, where on average there are no issuers of the companies studied in that period in a safe condition so that the whole switches to a gray area condition of 23 issuers (AMFG, APII, ARNA, ASGR, ASII, EMTK, ICON, IMPC, INDX, JECC, JTPE, KBLI, KBLM, KIAS, KOIN, KONI, LION, MFMI, SCCO, TIRA, TOTO, UNTR, VOKS), and the remaining 8 issuers are in distress (BHIT, BMTR, BNBR, CTTH, DYAN, MDRN, MLIA, MLPL) as shown in Table 4.

CONCLUSIONS DAN RECOMMENDATIONS

Based on the results of the analysis and discussion that has been carried out, it can be concluded that the Altman Z-score model is able to predict the occurrence of financial distress in manufacturing industry sector company issuers on the IDX before and during the Covid-19 pandemic for the 2017-2022 period by using the financial ratio formulation as a tool.

1. The condition of the company's financial difficulties in this research is analyzed based on selected financial ratios which represent predictive tools, starting sequentially with the solvency, activity, liquidity, profitability and productivity ratios.
2. During the Covid-19 pandemic period 2019-2022, of the 31 issuers selected as research samples, 8 issuers were in distress, and almost no issuers were in safe condition, so the remaining 23 issuers were in gray area. Thus, compared to before the Covid-19 pandemic for the 2017-2019 period, there was an increase in the number of issuers in distress conditions by 0.03% and 26% of issuers in gray area conditions, whereas there was a quite sharp decline in issuers in safe conditions of 29%.

ADVANCED RESEARCH

To enrich the body of knowledge, further research that can be recommended includes, (1) using other financial distress measurement models

with alternative formulas and different financial ratios; (2) research objects on issuers or companies operating in other industrial sectors; (3) selection of the research periods of time; (4) using statistical methods that are linked to other measurement variables.

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