Multiple Discriminant Analysis (MDA) in Micro Enterprise Financial Distress Evaluation

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Abstract

This study aims to assess the usefulness of Multiple Discriminant Analysis (MDA) and financial ratios in evaluating financial distress in micro-enterprises, addressing a gap in the literature. Using Signaling Theory, this research examines how information provided by management or business owners can influence external parties' perceptions, potentially impacting the enterprise's value. The study employed a quantitative research method, utilizing primary data from questionnaires completed by micro-entrepreneurs in Tanjungpinang City, Indonesia. Financial information provided by these micro-enterprises formed the basis of the analysis. A positivist paradigm with a deterministic philosophy guided this research, where multiple linear regression analysis was used to predict how changes in independent variables impact financial distress. The results indicate that MDA is effective in assessing financial distress among micro-enterprises. Specifically, profitability ratios (EBIT/Total Assets, ROA, ROE, and NPM) and leverage (Debt Equity Ratio - DER) significantly influence financial distress. However, liquidity (Working Capital/Total Assets) and activity ratios (Total Assets Turnover) do not have a significant effect. This study contributes to the literature on financial distress, particularly in micro-enterprises, and provides valuable insights for government efforts to develop financial transaction recording applications for micro-enterprises. The findings highlight that adequate and reliable financial data are crucial for evaluating the condition and prospects of micro-businesses. The absence of such data can hinder internal and external stakeholders from assessing the business's condition. Therefore, a simple application for financial transaction recording is necessary to help micro-business units track their financial obligations effectively, as the DER ratio can indicate their ability to meet both long-term and short-term liabilities, and its insufficiency may lead to financial distress.

Keywords: Multiple Discriminant Analysis, Financial Distress, Financial Ratios, Micro Enterprises.

Bambang Sambodo, Djoko Suhardjanto, Setianingtyas Honggowati, Agung Nur Probohudono, Supriyono, Kusumaningdiah Retno Setiorini

1. Introduction

The growth rate of Micro, Small, and Medium Enterprises (MSMEs) during the 2015-2019 period amounted to 1,549,490 business units, or 2.52%. When compared to large enterprises, the national trend indicates that the growth of entrepreneurs in MSMEs is significantly more pronounced in terms of numbers. In 2019, MSMEs had a much higher percentage of employment than large enterprises, employing 96.92% of the total workforce compared to just 3.08% employed by large businesses. This is based on the total workforce of 123,368,672 people (see Table 1) [1]. According to the Ministry of Cooperatives and Small and Medium Enterprises of the Republic of Indonesia, the contribution of MSMEs to Gross Domestic Product (GDP) in 2019 reached 60.51%. However, this figure does not correspond with the fact that over 90% of all business actors in Indonesia are MSMEs. The challenges faced by MSMEs include issues in management, organization, technology, capital, operations, market access, licensing, and unavoidable field costs.

Table 1. Development of MSMEs and Large Enterprises Period 2015 – 2019

No	INDICATOR	UNIT	YEAR 2015		YEAR 2016		YEAR 2017	
			AMOUNT	%	AMOUNT	%	AMOUNT	%
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	BUSINESS UNITS (A+B)	Unit	59.267.759	100,00	61.656.546	100,00	62.928.077	100,00
	A. Micro, Small and Medium Enterprises (MSMEs)	Unit	59.262.772	99,99	61.651.176	99,99	62.922.617	99,99
	- Micro Enterprises	Unit	58.521.987	98,74	60.863.578	98,71	62.106.900	98,70
	- Small Enterprises	Unit	681.522	1,15	731.047	1,19	757.090	1,20
	- Medium Enterprises	Unit	59.263	0,10	56.551	0,09	58.627	0,09
	B. Big Enterprises (BEs)	Unit	4.987	0,01	5.370	0,01	5.460	0,01
2	WORKFORCE (A+B)	People	127.423.438	100,00	116.273.356	100,00	120.260.185	100,00
	A. Micro, Small and Medium Enterprises (MSMEs)	People	123.229.387	96,71	112.828.610	97,04	116.673.416	97,02
	- Micro Enterprises	People	110.807.864	86,96	103.839.015	89,31	107.232.992	89,17
	- Small Enterprises	People	7.307.503	5,73	5.402.073	4,65	5.704.321	4,74
	- Medium Enterprises	People	5.114.020	4,01	3.587.522	3,09	3.736.103	3,11
	B. Big Enterprises (BEs)	People	4.194.051	3,29	3.444.746	2,96	3.586.769	2,98

Source: Kemenkopukm RI 2020 [1]

A notable 72.47% of MSMEs experience difficulties in business management, which are identified as challenges in the following areas: (1) capital, (2) marketing, (3) raw materials, (4) labor, and (5) transportation and distribution. These difficulties have a significant impact on the cash flow of MSMEs. Minimal cash inflows or cash outflows without corresponding inflows place MSMEs in a position of financial strain, making them highly vulnerable to financial distress. If not anticipated or managed properly, MSMEs face a high risk of bankruptcy [2], [3], [4]). Additionally, sustainable financial development is necessary, as it not only attracts investment from leading global economies but also positively affects weaker and less sustainable economies [5]. CNBC Indonesia reported on March 26, 2021, that 30 million MSMEs had closed due to the COVID-19 pandemic [6]. The chairman of the Indonesian MSME Association (Akumindo), Ikhsan Ingratubun, stated that nearly 50% of MSMEs were affected by the pandemic in 2020, leading to bankruptcy and closure. The financial difficulties faced by MSMEs are often described as 'financial distress'. Baldwin and Mason [7], defined financial distress as

a situation where a business unit is unable to meet its obligations. According to [8], explained that financial distress occurs when an entity cannot settle its debt obligations due to insufficient financial resources. Similarly, [9] described financial distress as the inability of an entity to fulfill its financial commitments. Based on these perspectives, financial distress can be defined as the inability of an entity to meet its financial obligations due to limited or insufficient income and other financial resources. To prevent and anticipate bankruptcy, it is essential to evaluate MSMEs' financial condition to detect financial distress or early-stage financial problems. In Indonesia, micro-enterprises typically consist of small businesses owned and managed by individuals or small groups with minimal human resources. These businesses generally have relatively small capital, below IDR 50,000,000 (fifty million rupiah), and annual turnover not exceeding IDR 300,000,000 (three hundred million rupiah). Another limitation of micro-enterprises is the lack of proper documentation of operating activities and financial reporting. Furthermore, most micro-businesses do not follow the entity principle, which requires a separation between personal and business finances.

In his research, [10] developed Multiple Discriminant Analysis (MDA), a discriminant analysis model to assess the financial condition of a business unit using financial ratios. This research was conducted on manufacturing companies in the United States. The MDA model is used to classify a business unit into specific categories based on its financial condition, determined through financial ratio calculations. Moreover, finance enables business actors to develop economic systems, make productive investments, and acquire modern technology to enhance competitiveness and foster innovation. Another study by [11] highlighted the significance of millennial entrepreneurs (aged 19 to 42 years), who are increasingly engaging in business through online platforms.

Based on previous studies focused on small and medium enterprises (SMEs) that already had financial reports and, in some cases, were publicly listed companies, making it easier for researchers to use financial ratios to assess financial distress. Although research on financial distress is extensive, studies focusing on micro-businesses are rare, particularly those that address the unique challenges of these enterprises, such as the absence of financial reports. This research thus presents novelty by focusing on micro-businesses with the characteristics described. Research by [12], [13] revealed that small and medium-scale businesses are most vulnerable to financial distress. Financial distress analysis of large, medium, and small businesses has been extensively studied, but research on micro-businesses remains limited. This makes the current study both unique and interesting, as it emphasizes the specific characteristics of micro-enterprises, which are markedly different from larger businesses. A study using the MDA model, concluding that six variables could accurately describe financial problems in SMEs and predict bankruptcy within one to three years: short-term debt to total assets, short- and long-term debt to total assets, changes in total assets from the previous year, company size, cost to total debt, and return on assets. Meanwhile, [14] highlighted the predictive power of financial ratios in assessing financial distress in SMEs. Karas et al. [15], demonstrated the importance of the operating cash flow ratio in predicting financial distress, particularly when combined with short-term debt for SMEs in the Czech Republic. This research aims to develop a prediction model for financial distress in micro-businesses in Tanjungpinang City, based on the analytical models used in previous research. The key research questions are:

Bambang Sambodo, Djoko Suhardjanto, Setianingtyas Honggowati, Agung Nur Probohudono, Supriyono, Kusumaningdiah Retno
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1. Can Multiple Discriminant Analysis (MDA) be used to assess financial distress in micro-businesses?
2. What financial ratios influence financial distress in micro-businesses?

2. Literature Review and Hypothesis Development

2.1 Signal Theory (Signaling Theory)

Signaling theory, developed by [16], explains how the behavior of information recipients is influenced by the information giver. Management or business owners provide signals, such as financial information disclosure, through various media accessible to external parties, which are interpreted as signals. These signals are intended by management to convey positive impressions to external parties, with the goal of enhancing the company's perceived value. Management possesses more comprehensive information about the company compared to external parties. This condition, where one party holds more information than another, is referred to as information asymmetry. In such situations, it becomes challenging for external parties to differentiate between well-performing and poorly-performing companies, while management typically portrays the company in a favorable light, regardless of its actual performance.

2.2 Financial Distress

Financial distress occurs when a business entity faces a shortage of financial resources, rendering it unable to meet its financial obligations. According to [17] , financial distress occurs when cash inflows from business activities are lower than cash outflows, leading to a deteriorating financial structure. This can be observed through the solvency ratio, where the net worth relative to total debt tends to decline.

2.3 Finansial Ratio Analysis

This study aims to classify micro-enterprises into problematic or non-problematic financial conditions, a task complicated by the lack of reliable financial reports among such businesses. In Indonesia, micro-enterprises face significant challenges in identifying financial problems that could lead to bankruptcy. This research employs a literature review to map the variables used in previous studies utilizing the Multiple Discriminant Analysis (MDA) model. Factor analysis will then be conducted to reduce the number of variables and ensure the research focuses on specific aspects relevant to financial distress among micro-businesses in Tanjungpinang City. This section describes previous research on financial distress using the MDA model across various countries.

1. United States

In 1968, Altman examined 66 manufacturing companies in the United States, categorizing them into two groups: those that had gone bankrupt and those that had not [10]. He introduced the discriminant function as follows:

$$Z = 0,012X1 + 0,014X2 + 0,033X3 + 0,006X4 + 0,999X5 \quad (2.1)$$

Descriptions: X1 = Working Capital / Total Assets Rasio; X2 = Retained Earnings / Total Assets Rasio; X3 = EBIT / Total Assets Rasio; X4 = Ratio of Market Value of Equity / Book Value of Total Debt; X5 = Sales / Total Assets Rasio; Z = Overall Indeks

Companies with a Z score greater than 2.99 are classified as non-bankrupt. Companies with Z scores between 1.81 and 2.99 fall into the grey area. Those with Z scores below 1.81 are classified as bankrupt. Altman's research highlights the utility of combining financial ratios in discriminant analysis for predicting financial distress. When using multivariate analysis, the statistical significance of the results improves.

2. Brazil

In 1979, [18] conducted a study in Brazil, testing two groups: companies facing serious problems and those without. The model was modified to account for the specific conditions of Brazilian companies. In the Z1 model, the X1 variable was removed because its coefficient did not explain the model. Additionally, the X2 variable was redefined as (Total Equity - Share Capital) / Total Assets, and the X4 variable was modified to the book value of equity divided by total debt.

$$Z1 = 1,44 + 4,03X2 + 2,25X3 + 0,14X4 + 0,42X5 \quad (2.2)$$

Descriptions: X1 = Ratio of Working Capital / Total Assets = Removed from model; X2 = Ratio of Retained Earnings / Total Assets; X3 = EBIT / Total Assets Rasio; X4 = Ratio of Book Value of Equity / Book Value of Total Debt; X5 = Sales / Total Assets Rasio; Z1 = Overall Indeks.

Further adjustments led to the Z2 model, where the X2 variable was also excluded due to the challenge of deriving it from only one set of financial statements. Additionally, the X2 variable was found to be similar to X4. Thus, the Z2 model can be applied without additional data.

$$Z2 = 1,84 - 0,51X1 + 6,23X3 + 0,71X4 + 0,56X5 \quad (2.3)$$

Descriptions: X1 = Working Capital / Total Assets Rasio; X2 = Retained Earnings Ratio / Total Assets = Excluded from the model; X3 = EBIT Ratio / Total Assets; X4 = Ratio of Book Value of Equity / Book Value of Total Debt; X5 = Sales / Total Assets Rasio; Z2 = Overall Indeks.

3. Bangladesh

A study on financial distress in 20 textile and clothing companies in Bangladesh by [19]. The MDA function used is as follows:

$$Z = 13.1146X5 + 0.2323X6 + 0.0156X8 + 0.2183X9 \quad (2.4)$$

Descriptions: X5 = Net Profit / Total Assets Rasio; X6 = EBIT / Interest Expense Rasio; X8 = Net Profit / Total Shares Rasio; X9 = Net Sales / Average Inventory Rasio; Z = Overall Indeks.

Companies with a Z value or discriminant value less than 1.99186 are categorized as financially distressed, while those with a Z value greater than 1.99186 are classified as non-financially distressed.

4. Malaysia

Research on the application of MDA and financial ratios to assess financial distress among SMEs in Malaysia was conducted by [20]. Their study examined 172 SMEs over the period 2002-2012.

$$D = \alpha + \beta 1 CONT + \beta 2 FRGN + \beta 3 NDIR + \beta 4 GENDER \qquad (2.5)$$
$$+ \beta 5 TLA + \beta 6 SLA + \beta 7 LQT + \beta 8 STA + \beta 9 EBIT$$
$$+ \beta 10 NIS + \beta 11 LogTA + \beta 12 LogCAP + \beta 13 AGE$$

Descriptions: D = Discriminant score; α = Constant Estimation; CONT = Controlling Shareholders (dummy variable) FRGN = Foreign Ownership (dummy variable); NDIR = Total Board of Directors; GENDER = Gender of Main Director (dummy variable); TLA = Ratio of Total Liabilities to Total Assets; SLA = Ratio of short term Liabilities to Total Assets; LQT = Ratio of Current Assets to Current Liabilities; STA = Ratio of Sales to Total Assets; EBIT = Ratio of Gross Profit to Total Assets; NIS = Ratio of Net Profit to Share Capital; LogTA = Logarithm of Total Assets; LogCAP = Logarithm of Share Capital; AGE = Length of Operation of the Company.

This study found that, based on the results of the Multiple Discriminant Analysis (MDA), there were no significant differences between SMEs experiencing financial distress and those that did not, when viewed from the 13 variables used in the study.

5. India

Research conducted by [21], highlighted the application of the MDA model in developing countries, specifically India, where [22] in 1988 developed the MDA model to assess business units in healthy and unhealthy conditions. In this context, "unhealthy" refers to business units that, although experiencing losses, can still continue their operations. Unhealthy business units are those that have experienced cash flow reductions for two consecutive years. The financial ratios used in this study include: X1 = Ratiocurent asset / current liabilities; X2 = Ratiostock of finish goods /Sale; X3 = Ratio of EAT / Total assets; X4 = Ratiointerest / Value of Output; X5 = Ratiocash flows / Total Amoun of debt; X6 = Working capital / Total assets rasio; X7 = Sales / Total assets rasio. By examining the standardized coefficient, the accuracy of these financial ratios is 87.1%, while the unstandardized coefficient shows an accuracy of 86.6%. MDA is a statistical technique used to classify and predict financial outcomes, particularly to assess whether a business unit is at risk of bankruptcy or financial distress, along with later works by [10], [18], [23], [24] indicated that MDA is effective in assessing and categorizing business units into financial distress or non-distress conditions. This study applies a modified Altman Z-Score method to evaluate financial distress in micro-enterprises in Tanjungpinang City. The model developed by [18] in Brazil used the following formula:

$$Z = 1.84 - 0.51X1 + 6.23X3 + 0.71X4 + 0.56\,X5 \qquad (2.6)$$

Descriptions: X1 = Working Capital / Total Assets Rasio; X2 = Retained Earnings Ratio / Total Assets = Excluded from the model; X3 = EBIT Ratio / Total Assets; X4 = Ratio of Book Value of Equity / Book Value of Total Debt; X5 = Sales / Total Assets Rasio; Z = Overall Indeks.

2.4 Conceptual framework

The conceptual framework presented delineates the essential financial ratios that aid in forecasting financial distress via the Altman Z-Score model [10]. These ratios are classified into four primary categories: Profitability Ratio, Liquidity Ratio, Leverage Ratio, and Activity Ratio. All these ratios ultimately influence the assessment of Financial Distress, which is quantified using the Altman Z-Score, a renowned model for forecasting bankruptcy and financial instability in corporations. The correlations between these ratios and financial distress are delineated by hypotheses H1 to H7, as illustrated in Figure 1.
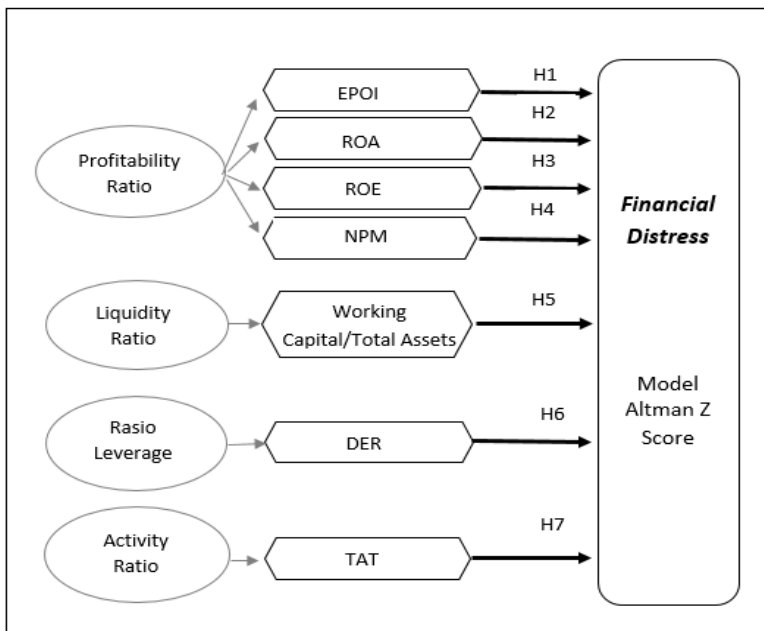

Figure 1. Research Model

2.4.1 Relationship of Financial Ratios to financial distress

Financial ratios have been widely used in previous studies to describe a company's current and future conditions [17], [25]. These ratios serve as tools for analyzing business performance, offering insight into the development and financial health of a business unit by utilizing available financial data. The financial ratios used in earlier research to explain the relationship with financial distress are:

Descriptions: X1 Working Capital /Total Assets Rasio; X2 Retained Earnings / Total Assets Rasio; X3 Ratio of EBIT / Total Assets; X4 Ratio of Market Value of Equity / Book Value of Total Debt; X5 Ratio of Sales / Total Assets; X6 Ratio of Book Value of Equity / Book Value of Total Debt; X7 Ratio Net Profit / Total Assets; X8 Ratio of EBIT / Interest Expense; X9 Ratio

Net Profit / Total Shares; X10 Net Sales / Average Inventory Rasio; X11 Ratio of Total Liabilities / Total Assets; X12 Ratio of Short Term Liabilities / Total Assets; X13 Ratio of Current Assets / Current Liabilities; X14 Ratio of Gross Profit / Total Assets; X15 Ratiostock of finish goods / Sale; X16 Ratiointerest / Value of Output ; X17 Ratiocash flows / Total Amoun of debt.

Seventeen financial ratios have been identified from previous studies concerning financial distress. The study conducted factor analysis to determine which ratios could be used in this study based on the financial data of micro-enterprises in Tanjungpinang City, as obtained through a preliminary survey.

2.4.2   Profitability Ratio to financial distress

Profitability ratios measure the success of a business unit in generating profits. A high profitability ratio signals that the business is well-managed and likely not experiencing financial difficulties. Research by [26], [27] suggests that profitability ratios, represented by Earning Power of Total Investment (EBIT/Total Assets), Return on Assets (ROA), and Return on Equity (ROE), significantly affect financial distress. Similarly, research by [19] indicates that the profitability ratio, proxied by Net Profit Margin (NPM), has a significant negative effect on financial distress. Based on these findings, the following hypotheses are proposed:

H1: Earning Power of Total Investment affects financial distress in micro-enterprises.

H2: Return on Assets affects financial distress in micro-enterprises.

H3: Return on Equity affects financial distress in micro-enterprises.

H4: Net Profit Margin affects financial distress in micro-enterprises.

2.4.3   Liquidity Ratio to financial distress

The ability of a business unit to meet its obligations as they become due reflects its financial health. A failure to fulfill these obligations indicates the onset of financial distress. Liquidity ratios assess a business unit's ability to pay current debts using current assets. Research by [28] found that the Working Capital to Total Assets ratio does not significantly affect financial distress. Based on this, the hypothesis for this ratio is:

H5: The ratio of Total Capital to Total Assets does not affect financial distress in micro-enterprises.

2.5.4   Leverage Ratio to financial distress

Leverage ratios measure the business unit's ability to meet both long-term and short-term obligations by analyzing its assets. A lack of sufficient assets can lead to financial distress. Research by [29], [30], [31] demonstrates that leverage ratios influence financial distress. Thus, the following hypothesis is proposed:

H6: The Debt to Equity Ratio affects financial distress in micro-enterprises.

2.4.5   Activity to financial distress

This ratio evaluates how efficiently a business unit manages its resources to generate income. It examines the relationship between sales and assets, as well as the impact of investments on income generation. The hypothesis for activity ratios is:

H7: Total Asset Turnover affects financial distress in micro-enterprises.

3. Methodology

3.1   Population, Sample and Sampling Technique

The population for this study consists of 411 micro-enterprises in Tanjungpinang City. The sample includes micro-enterprises that responded by completing 30 financial information questionnaires, which provided data over a three-year observation period. The questionnaire includes questions about the financial information required to assess financial distress by calculating financial ratios. This approach allows the research to proceed, even in cases where the micro-enterprises do not have formal financial reports, by utilizing the financial information obtained from the distributed questionnaires.

3.2   Data and Data Collection Methods

This study employs a quantitative research method, utilizing primary data collected through questionnaires distributed to micro-enterprises. The primary data consist of financial information provided by these micro-enterprises, and the study is not limited to those with formal financial reports. The research follows a positivism paradigm with a deterministic philosophy, suggesting that causative factors significantly determine the research outcomes. According to the positivism paradigm, scientific truth is obtained through observation, experience, and perception, as proposed by (Sekaran & Bougie, (2016).

3.3   Data analysis technique

3.3.1   Multiple Regression Analysis

Multiple linear regression analysis is used to predict changes in the dependent variable as the independent variables increase or decrease, as well as to determine the direction of the relationship (positive or negative) between the independent and dependent variables. The multiple linear regression equation is as follows:

$$Y = a + b1x1 + b2x2 + b3x3 + b4x4 + b5x5 + b6x6 + b7x7 + e \tag{3.1}$$

Descriptions: $Y = Financial\ Distress$; $X1 = EPOI\ (Profitability\ Ratio)$; $X2 = ROA\ (Profitability\ Ratio)$; $X3 = ROE\ (Profitability\ Ratio)$; $X4 = NPM\ (Profitability\ Ratio)$; $X5 = Working\ Capital\ /\ Total\ Assets\ (Liquidity\ Ratio)$; $X6 = DER\ (Leverage\ Ratio)$; $X7 =$

TAT (*Activity Ratio*); $b = regression\ coefficient$; $a = Constant$; $e = Residual\ error$ (*error*).

3.3.2 Hypothesis testing

Hypothesis testing includes the partial test (t-test), simultaneous test (F-test), and the coefficient of determination (R²), which are used to verify the stated hypotheses. The tests are conducted at a significance level of 0.05. The criteria for accepting or rejecting the hypothesis are as follows:

1.   If the significance value is greater than 0.05, the hypothesis is rejected, indicating that the independent variable does not significantly influence the dependent variable.
2.   If the significance value is less than 0.05, the hypothesis is accepted, suggesting that the independent variable significantly affects the dependent variable [32].

The F-test is used to examine whether the independent variables, as a whole, have a significant effect on the dependent variable. The coefficient of determination (R²) indicates the percentage of the dependent variable's variation explained by the independent variables in the model. An R² value of 0 means that the independent variables do not explain any of the variation in the dependent variable, while an R² value of 1 indicates that the independent variables perfectly explain the variation.

4. Findings

The analysis presents the results of the financial distress (Y) assessment using Multiple Discriminant Analysis (MDA) and examines the effects of the independent variables on the dependent variable. The results for the Financial Distress assessment using the Altman Z-Score method are shown below.

Table 2. Assessment Financial Distress with Altman Z-Score Year 2018 – 2020

No.	Micro Business Name	Z-Score Pertahun					
		2018	Condition	2019	Condition	2020	Condition
1	Mitra Taylor	1,368	Non-FD	5,543	Non-FD	-0,033	FD
2	Penjahit Trio	7,155	Non-FD	1,808	Non-FD	1,266	Non-FD
3	Penjahit Rapi	5,966	Non-FD	8,003	Non-FD	6,853	Non-FD
4	Keripik Kentang Bu Rosnidar	7,191	Non-FD	5,904	Non-FD	5,491	Non-FD
5	Komariah	5,440	Non-FD	2,009	Non-FD	2,151	Non-FD
6	Singkom	5,827	Non-FD	5,827	Non-FD	5,251	Non-FD
7	Kue Basah Zelima Wati	41,242	Non-FD	32,665	Non-FD	29,330	Non-FD
8	Bawang Goreng Anugerah	3,800	Non-FD	3,800	Non-FD	3,566	Non-FD
9	Marmun	18,771	Non-FD	12,434	Non-FD	8,738	Non-FD
10	Kube Rasa Bersatu	13,425	Non-FD	5,037	Non-FD	4,090	Non-FD
11	SDJ	3,639	Non-FD	-0,196	FD	-0,315	FD
12	Bapak Novriman (Keripik Usu)	2,699	Non-FD	-0,468	FD	-0,468	FD
13	Bu Asamah (Wajik Bandung)	57,816	Non-FD	22,486	Non-FD	22,486	Non-FD
14	Bu Masinem (Rempeyek)	3,395	Non-FD	1,710	Non-FD	2,774	Non-FD
15	Bu Inda Yanti (Kacang Kedelai Jagung)	3,918	Non-FD	4,365	Non-FD	5,563	Non-FD
16	Ibu Arpah Diana (Cakar Ayam)	2,143	Non-FD	4,078	Non-FD	1,658	Non-FD
17	Ibu Agustiar (Cakar Ayam)	1,519	Non-FD	-0,074	FD	-0,731	FD
18	Ibu Novy Puspasari (Aneka Snack)	6,537	Non-FD	1,790	Non-FD	-0,363	FD
19	Henny Jh Snack	4,993	Non-FD	1,172	Non-FD	-0,311	FD
20	Mandiri Taylor	3,638	Non-FD	-0,710	FD	-0,873	FD

21	Hantaran Pernikahan	2,898	Non-FD	-0,017	FD	3,987	Non-FD
22	Luti Gendang	23,881	Non-FD	21,115	Non-FD	17,865	Non-FD
23	Sukini	2,639	Non-FD	3,574	Non-FD	-0,051	FD
24	Suprihatin	2,394	Non-FD	1,687	Non-FD	2,033	Non-FD
25	Harma Yeni	1,971	Non-FD	1,329	Non-FD	1,764	Non-FD
26	Novela	8,964	Non-FD	2,332	Non-FD	2,332	Non-FD
27	Nurhayati	13,482	Non-FD	13,482	Non-FD	13,482	Non-FD
28	Afit	13,983	Non-FD	4,679	Non-FD	4,679	Non-FD
29	Kaos Kacel	2,986	Non-FD	2,552	Non-FD	2,193	Non-FD
30	Siti Zulaiha	7,193	Non-FD	7,193	Non-FD	7,193	Non-FD
Notes	: FD : Financial Distress; Non-FD : Non-Financial Distress; Z-Score > 0 (non-FD); Z-Score < 0 (FD)						

In 2018, no instances of financial distress were observed among micro businesses, indicating that all micro businesses were in good health during that year. However, in 2019, financial distress occurred in 16% of micro business units, equating to 5 units. By 2020, the percentage of micro businesses experiencing financial distress increased to 26%, representing a total of 8 business units (see Table 3). Descriptive statistical analysis was carried out in order to provide an overview of the variables used in this study.

Table 3. Descriptive statistics

	Y	X1	X2	X3	X4	X5	X6	X7
Mean	0.144444	1.280252	1.806126	1.299512	0.712398	0.936288	0.114092	1.891730
Median	0.000000	0.852892	1.097465	0.874619	0.767857	1.000000	0.000000	1.807868
Maximum	1.000000	8.780488	9.756098	8.699187	0.933333	1.000000	2.476190	2.691656
Minimum	0.000000	0.140351	0.210526	0.213144	0.162222	0.287671	0.000000	1.650681
Std. Dev.	0.353509	1.375869	1.755534	1.340267	0.171088	0.142754	0.329246	0.217661
Skewness	2.022847	2.948977	2.061995	2.997636	-1.809976	-2.448367	4.791950	1.494588
Kurtosis	5.091908	13.59406	7.643249	14.07223	6.024498	8.545235	31.51087	4.671571
Jarque-Bera	77.78892	551.3247	144.6264	594.5159	83.44365	205.2287	3392.704	43.98495
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Sum	13.00000	115.2226	162.5513	116.9561	64.11578	84.26594	10.26826	170.2557
Sum Sq. Dev.	11.12222	168.4783	274.2890	159.8721	2.605117	1.813698	9.647881	4.216488
Observations	90	90	90	90	90	90	90	90

Source: Output Eviews 12

For the variable Y (Financial Distress) with n=90n=90, the mean value is 0.1444 and the standard deviation is 0.3535. Variable X1 (EPOI) with n=90n=90 has a mean value of 1.2803 and a standard deviation of 1.3759. Variable X2 (ROA) has a mean of 1.8061 and a standard deviation of 1.7555. Similarly, variable X3 (ROE) has a mean of 1.2995 and a standard deviation of 1.3403. For X4 (NPM), the mean is 0.7124 with a standard deviation of 0.1711. X5 (Working Capital/Total Assets) has a mean of 0.9363 and a standard deviation of 0.1427. X6 (DER) has a mean of 0.1141 and a standard deviation of 0.3292. Finally, X7 (TAT) has a mean of 1.8917 and a standard deviation of 0.2176.

4.1   Regression Model Selection Test Results

To determine the best regression model, EViews requires selecting the most suitable model among the Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM), with the following steps:

1.   Chow Test. The Chow test is used to select the best model between the CEM and FEM (see Table 4). The criteria are:

H0: Common Effect Model (CEM) accepted if the probability value is greater than 0.05.

Ha: Fixed Effect Model (FEM) accepted if the probability value is less than 0.05.

Table 4 Chow Test Results

Redundant Fixed Effects Tests

Equation: Untitled

Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	2.056066	(29,53)	0.0113
Cross-section Chi-square	67.840203	29	0.0001

Source: EViews Output 12

The results of the Chow test indicate that the null hypothesis (H0) is rejected, and the alternative hypothesis (Ha) is accepted. This suggests that the Fixed Effects Model (FEM) is a better fit, as evidenced by the cross-section probability values for both the F-test and Chi-Square being less than 0.05.

2. Hausman's test. Test this to choose the best model between Fixed Effect Model (FEM) and Random Effect Model (REM), with the following criteria:

H0: Random Effect Model (REM), accepted if Probability > 0.05

Ha: Fixed Effect Model (FEM), accepted if Probability < 0.05

Table 5 Hausman Test Results

Correlated Random Effects - Hausman Test			
Equation: Untitled			
Test cross-section random effects			
Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	12.946480	7	0.0734

The results of the Hausman test indicate that the alternative hypothesis (Ha) is rejected, while the null hypothesis (H0) is accepted. This suggests that the Random Effects Model (REM) is the best model among the Common Effects Model (CEM), Fixed Effects Model (FEM) and REM, as evidenced by the random cross-section probability value being greater than 0.05.

4.2 Panel Data Regression Test

This test was conducted to obtain the panel data regression equation which will be used to answer the hypothesis in this study

Table 6. Panel Data Regression Test Results

Dependent Variable: Y

Method: Panel EGLS (Cross-section random effects)

Date: 11/03/22   Time: 22:54

Sample: 2018 2020

Periods included: 3

Cross-sections included: 30

Total panel (balanced) observations: 90

Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.156740	1.490702	3.459269	0.0009
X1	2.981136	0.484477	6.153308	0.0000
X2	-0.419562	0.177600	-2.362401	0.0205
X3	-2.296906	0.442783	-5.187432	0.0000
X4	-2.172334	0.302139	-7.189849	0.0000
X5	-0.405602	0.512369	-0.791621	0.4309
X6	1.138362	0.364106	3.126460	0.0024
X7	-1.738521	0.971471	-1.789576	0.0772

Effects Specification		S.D.	Rho
Cross-section random		0.102986	0.2460
Idiosyncratic random		0.180307	0.7540

Weighted Statistics			
Root MSE	0.178238	R-squared	0.667098
Mean dependent var	0.102686	Adjusted R-squared	0.638680
S.D. dependent var	0.310648	S.E. of regression	0.186730
Sum squared resid	2.859181	F-statistic	23.47416
Durbin-Watson stat	1.903034	Prob(F-statistic)	0.000000

Unweighted Statistics			
R-squared	0.666388	Mean dependent var	0.144444
Sum squared resid	3.710506	Durbin-Watson stat	1.466409

Source: Eviews output 12

Based on table 6, it is known that the resulting multiple linear regression equation is:

$$Y = 5,16 + 2,98(X1) - 0,42(X2) - 2,30(X3) - 2,17(X4) - 0,41(X5) + 1,14(X6) - 1.74(X7)$$

4.3   Hypothesis testing

The following section outlines the results of the partial test (probability) for the relationship between each independent variable and the dependent variable:

1.   Partial Test (Probability)

Table 7. Probability Test Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.156740	1.490702	3.459269	0.0009
X1	2.981136	0.484477	6.153308	0.0000
X2	-0.419562	0.177600	-2.362401	0.0205
X3	-2.296906	0.442783	-5.187432	0.0000
X4	-2.172334	0.302139	-7.189849	0.0000
X5	-0.405602	0.512369	-0.791621	0.4309
X6	1.138362	0.364106	3.126460	0.0024
X7	-1.738521	0.971471	-1.789576	0.0772

Source: Eviews output 12

1.   EPOI's effect on Financial Distress: The significance test showed a probability value of 0.000 (<0.05) and a regression coefficient of 2.981, indicating a positive and significant effect. Therefore, Hypothesis 1 is accepted.

2.   ROA's effect on Financial Distress: A negative effect is supported by a probability value of 0.021 (<0.05) and a regression coefficient of -0.419, leading to the acceptance of Hypothesis 2.

3.   ROE's effect on Financial Distress: The probability value of 0.000 (<0.05) and a regression coefficient of -2.297 indicate a significant negative effect. Thus, Hypothesis 3 is accepted.

4.   NPM's effect on Financial Distress: The results show a probability value of 0.000 (<0.05) with a regression coefficient of -2.172, indicating a significant negative effect, and Hypothesis 4 is accepted.

5.   Working Capital/Total Assets' effect on Financial Distress: A probability value of 0.431 (>0.05) suggests no significant effect, and therefore, Hypothesis 5 is accepted, indicating no effect of Working Capital/Total Assets on Financial Distress.

6.   DER's effect on Financial Distress: With a probability value of 0.002 (<0.05) and a regression coefficient of 1.138, DER is found to have a significant positive effect, and Hypothesis 6 is accepted.

7.   TAT's effect on Financial Distress: A significance level of 0.077 (>0.05) suggests that TAT does not have a significant effect on Financial Distress, leading to the rejection of Hypothesis 7.

The R-square value of 0.666 indicates that 66.6% of the variance in the dependent variable (Financial Distress) is explained by the independent variables, while 33.4% is influenced by other factors. From the test results presented in Table 8, this study reveals that the equation model has a statistical F value of 23.474, with a Prob (F Statistics) value of 0.000. This indicates that the research model can effectively predict the simultaneous effects of the independent variables on the dependent variable.

Table 8 Simultaneous Test (F)

Weighted Statistics

Root MSE	0.178238	R-squared	0.667098
Mean dependent var	0.102686	Adjusted R-squared	0.638680
S.D. dependent var	0.310648	S.E. of regression	0.186730
Sum squared resid	2.859181	F-statistic	23.47416
Durbin-Watson stat	1.903034	Prob(F-statistic)	0.000000

Source: Eviews output 12

Therefore, we conclude that the independent variables collectively influence the dependent variable. The R-square value of 0.666, or 66.6%, indicates that this research model can explain 66.6% of the effect of the independent variables on the dependent variable, while the remaining 33.4% is influenced by other independent variables (See Table 9).

Table 9 R-square Test

Unweighted Statistics

R-squared	0.666388	Mean dependent var	0.144444
Sum squared resid	3.710506	Durbin-Watson stat	1.466409

Source: Eviews output 12

5.   Discussion

5.1   Assessment of Financial Distress using the Multiple Discriminant Analysis (MDA)

In this study, the MDA method, utilizing the modified Altman Z-score model, was employed to categorize micro business units into those experiencing financial distress and those not facing such challenges. The results indicate that financial distress was identified in 5 micro business units in 2019 and 8 in 2020, characterized by a trend of decreasing revenue and rising operational costs. These findings align with previous research by [18], [21], [24], [20], [33], which

demonstrated that MDA can effectively assess and classify a business unit's condition into categories of financial distress or non-distress.

5.2 The Effect of Financial Ratios on Financial Distress

The Earnings Power of Investments (EPOI) ratio demonstrates that micro businesses effectively manage their assets to generate sufficient funds to meet financial obligations. This ratio reflects the ability of micro businesses to generate profits from their resources. A lower EPOI value indicates that asset utilization is unproductive, placing micro businesses at risk of financial distress due to insufficient profitability. Return on Assets (ROA) assesses the performance of micro businesses in generating profits from asset utilization. A higher ROA suggests better performance and positions the business in a healthier state, while a lower ROA increases the likelihood of financial distress. An increase or decrease in the Return on Equity (ROE) affects a micro business's capacity to avoid financial distress. ROE represents the return provided to the business owner and can signal impending financial distress. The results indicate that ROE changes can predict the occurrence of financial distress in micro businesses. The Net Profit Margin (NPM) value reflects efficiency in reducing costs and increasing net profit. A higher NPM is associated with lower financial distress, suggesting that a business's ability to generate income correlates with reduced financial distress risks. This study supports research by [26], [27] showing that profitability ratios—EPOI, ROA, ROE, and NPM—significantly impact financial distress. These variables are strong predictors of financial distress in micro businesses. However, in this study, the Working Capital/Total Assets ratio does not impact financial distress, indicating that liquidity (the ability to pay current debt with current assets) does not affect financial distress in micro businesses. These micro businesses, instead, fund their operations using equity or capital rather than relying on liabilities. This finding is consistent with the study by [28] which also found no relationship between the working capital/total assets ratio and financial distress. The Debt-to-Equity Ratio (DER) captures the ability of micro businesses to meet both long-term and short-term obligations by leveraging their assets. A lack of sufficient assets can lead to financial distress. In this study, DER is assumed to be a cause of financial distress, as high debt obligations expose businesses to financial vulnerability. These findings are consistent with research by [29], [30], [31] and [34], which confirm that leverage impacts financial distress conditions. Conversely, the Total Asset Turnover ratio does not affect financial distress in micro businesses, suggesting that asset turnover does not contribute to the risk of financial distress in the context of this study.

6. CONCLUSION

The MDA method, specifically utilizing the Altman Z-Score model, proves effective in assessing the financial health of micro businesses and identifying instances of financial distress. The analysis reveals that profitability ratios (EPOI, ROA, ROE, and NPM) and the leverage ratio (DER) significantly influence financial distress, serving as reliable predictors. In contrast, liquidity (Working Capital/Total Assets) and activity ratios (Total Asset Turnover) do not demonstrate a predictive capability regarding financial distress. This research underscores the relevance of signaling theory in the context of micro businesses in Tanjungpinang, suggesting

that management actions significantly inform external stakeholders about the business's condition and future potential. The necessity of well-prepared financial reports becomes evident, as they provide crucial insights for evaluating future prospects. To enhance financial transparency and decision-making, it is imperative for micro businesses to maintain accurate and reliable financial records. Given the reliance on interviews and respondent recall for data collection, the need for a simple application to aid in recording financial transactions is highlighted. Future research should focus on developing formal financial reporting mechanisms to improve data validity and accuracy, while also considering additional financial ratios and macroeconomic factors to enrich the understanding of financial distress in micro businesses.

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