YAYASAN AKRAB PEKANBARU
Akrab Juara : Jurnal Ilmu-ilmu Sosial
Volume 11 Nomor 1 Edisi Februari 2026 (568-578)

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FRAUD ANALYSIS USING THE BENEISH RATIO INDEX METHOD IN MINING SUB-SECTOR COMPANIES LISTED ON THE IDX IN 2020 – 2025

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(Naskah diterima: 1 January 2026, disetujui: 28 January 2026)

Abstract

This study aims to detect indications of financial statement fraud in mining sub-sector companies listed on the Indonesia Stock Exchange (IDX) during the 2020–2025 period using the Beneish Ratio Index (Beneish M-Score). This study employs a descriptive quantitative approach utilizing secondary data in the form of the companies' annual financial reports. The analysis is conducted by calculating eight Beneish ratios: the Days Sales in Receivables Index (DSRI), Gross Margin Index (GMI), Asset Quality Index (AQI), Sales Growth Index (SGI), Depreciation Index (DEPI), Sales General and Administrative Expenses Index (SGAI), Leverage Index (LVGI), and Total Accruals to Total Assets (TATA), to classify companies into non-manipulators, gray companies, and manipulators. The results indicate that not all mining sub-sector companies fell into the non-manipulators category during the observation period. Several companies were identified as manipulators or gray companies in certain years, indicating the potential for less than fair presentation of financial statements. The DSRI, GMI, AQI, and SGI ratios were the most sensitive indicators in detecting potential manipulation. These findings confirm that the Beneish M-Score method is effective as an early warning system, but cannot be used as definitive evidence of fraud. This research is expected to contribute to the development of accounting literature and provide consideration for auditors, regulators, and investors in improving the quality of transparency and accountability of financial reporting in the mining sector.

Keywords: *financial statement fraud, Beneish M-Score, financial ratios, mining subsector, Indonesia Stock Exchange*

Abstrak

Penelitian ini bertujuan untuk mendeteksi indikasi kecurangan laporan keuangan (financial statement fraud) pada perusahaan subsektor pertambangan yang terdaftar di Bursa Efek Indonesia (BEI) selama periode 2020–2025 dengan menggunakan metode Beneish Ratio Index (Beneish M-Score). Penelitian ini menggunakan pendekatan kuantitatif deskriptif dengan memanfaatkan data sekunder berupa laporan keuangan tahunan perusahaan. Analisis dilakukan melalui perhitungan delapan rasio Beneish, yaitu Days Sales in Receivables Index (DSRI), Gross Margin Index (GMI), Asset Quality Index (AQI), Sales Growth Index (SGI), Depreciation Index (DEPI), Sales General and Administrative Expenses Index (SGAI), Leverage Index (LVGI), dan Total Accruals to Total Assets (TATA), untuk mengklasifikasikan perusahaan ke dalam kategori non-manipulator, grey company, dan manipulator. Hasil penelitian menunjukkan bahwa tidak seluruh perusahaan subsektor pertambangan berada dalam kategori non-manipulator selama periode pengamatan. Beberapa

perusahaan teridentifikasi berada pada kategori manipulator maupun grey company pada tahun-tahun tertentu, yang mengindikasikan adanya potensi penyajian laporan keuangan yang tidak sepenuhnya wajar. Rasio DSRI, GMI, AQI, dan SGI merupakan indikator yang paling sensitif dalam mendeteksi potensi manipulasi. Temuan ini menegaskan bahwa metode Beneish M-Score efektif digunakan sebagai alat deteksi awal (early warning system), namun tidak dapat dijadikan sebagai bukti final terjadinya fraud. Penelitian ini diharapkan dapat memberikan kontribusi bagi pengembangan literatur akuntansi serta menjadi bahan pertimbangan bagi auditor, regulator, dan investor dalam meningkatkan kualitas transparansi dan akuntabilitas pelaporan keuangan di sektor pertambangan.
Kata kunci: fraud laporan keuangan, Beneish M-Score, rasio keuangan, subsektor pertambangan, Bursa Efek Indonesia

I. INTRODUCTION

The issue of financial statement fraud continues to be a major concern in the development of modern corporate governance, particularly in public companies that raise funds from the public. In the Indonesian context, the need for transparency and accountability is increasing, in line with the dynamics of the capital market and the demand for information disclosure. To detect indications of financial statement manipulation, accounting researchers and practitioners rely on quantitative approaches, one of which is the Beneish M-Score, a method that combines eight financial ratios to predict the likelihood of earnings manipulation. Although developed by Beneish in 1999, this method remains relevant through 2024–2025 due to its ability to identify abnormal changes in the structure of a company's financial statements.

In the Indonesian context, the use of the Beneish M-Score is further strengthened by expert opinions emphasizing the importance of fraud detection through a data-driven approach. Tuanakotta (2013, 2021)—an Indonesian forensic audit expert—explains that fraud is often perpetrated by exploiting weaknesses in internal control systems and manipulating accounts based on estimates. He emphasized that financial statements can be "creatively manipulated" (creative accounting) through accrual manipulation and the manipulation of real transactions, making detecting abnormal ratios crucial. Tuanakotta's insights support the relevance of the Beneish M-Score in identifying unusual accounting patterns, particularly in industries with high estimation rates such as mining.

Another perspective comes from Harahap (2018, 2022), an Indonesian financial statement analysis expert, who explains that financial ratios can be used to detect signs of irregularities in financial statements. He argues that significant changes in certain ratios, such

as margin, leverage, and asset quality, can indicate earnings manipulation. Harahap's view aligns with Beneish Index components, such as the Days Sales Receivables Index (DSRI), Gross Margin Index (GMI), and Asset Quality Index (AQI), which are sensitive to manipulation. Thus, Indonesian accounting theory and practice support the importance of ratio analysis as an early detection method for fraud.

Furthermore, Ghozali (2021, 2023), an expert in statistics and accounting research methodology in Indonesia, emphasized that predictive models like the Beneish M-Score have advantages because they use a multivariate approach to detect manipulative patterns. Ghozali emphasized that model accuracy is heavily influenced by the quality of financial data and its contextual relevance to industry characteristics. This is crucial because mining companies face unique accounting complexities, such as the presence of mineral reserves, depletion, significant asset depreciation, and commodity price volatility.

From an auditing perspective, Agoes (2021) explained that auditors are limited in directly detecting fraud, especially when companies systematically change estimates or accounting policies to produce reports that appear reasonable. Agoes emphasized the importance of using analytical tools such as ratio models and financial red flags to help auditors identify high-risk areas. In the mining industry, accounts such as exploration costs, depreciation expense, and fixed asset values are often vulnerable to manipulation. Agoes' assertion further reinforces the urgency of using the Beneish M-Score in this study.

In terms of fraud theory, the Fraud Triangle, developed by Cressey and still used in recent research in Indonesia (2020–2024), suggests that fraud occurs due to pressure, opportunity, and rationalization. In the mining industry, pressure stems from fluctuations in global commodity prices and the demand for profit stability. Opportunities arise from weaknesses in internal control systems and the complexity of accounting estimates. Rationalization often arises when management feels the need to maintain the company's image in the eyes of investors. Indonesian research conducted by academics such as Indriantoro & Supomo (2020) confirms that all three components of the Fraud Triangle are very common in companies with high levels of market risk. Therefore, the mining subsector is an ideal object for fraud research.

Modern research also demonstrates the development of more comprehensive fraud theory through models such as the Fraud Hexagon and the Fraud Pentagon. Indonesian

research conducted in 2024–2025 demonstrated that factors such as leader arrogance, individual competence, and external pressures influence fraud potential. This refined theory suggests that fraud detection must consider behavioral factors in addition to financial indicators. However, financial ratio indicators are still needed as objective initial evidence, making the use of the Beneish M-Score highly relevant.

Empirically, several Indonesian studies have found that mining companies are at higher risk of fraud than other sectors due to their heavy reliance on estimates and market fluctuations. This finding is reinforced by a local study conducted in 2022–2024, which showed that several Indonesian mining companies exhibited M-Scores approaching or even exceeding the threshold for manipulation. This underscores the need for close monitoring of the industry's financial statements, particularly during the 2020–2025 period, which was marked by the pandemic crisis, economic recovery, and global volatility.

Overall, the views of Indonesian experts such as Tuanakotta, Harahap, Ghozali, Agoes, and several contemporary researchers demonstrate a consensus that fraud detection must be conducted with a robust analytical approach. By combining accounting theory, fraud theory, and statistical models such as the Beneish M-Score, research on mining subsector companies on the IDX is highly relevant and makes a significant contribution to academic literature, regulators, auditors, and investors.

II. THEORETICAL STUDIES

Financial Statement Fraud

Financial statement fraud is one of the most difficult forms of fraud to detect. According to Chen et al. (2022), financial statement fraud involves the presentation of manipulated accounting data through methods such as overstating revenue, understating expenses, or manipulating balance sheet accounts. This aims to create the illusion of healthy company performance.

In Indonesia, according to Agoes (2021), financial statement manipulation can be carried out through changes in accounting assumptions, transaction manipulation, or the omission of certain obligations. Agoes emphasized that fraud often arises from weak internal controls, competitive pressures, and the motivation to maintain high stock prices.

Meanwhile, Andayani (2023) stated that financial statement fraud is usually committed to meet performance targets (performance pressure), maintain investor confidence, and avoid

the risk of bankruptcy. Therefore, fraud detection in the mining sector is crucial to reveal whether companies present financial statements fairly or whether there are indications of fabricated figures.

Fraud Detection with the Beneish Ratio Index

The Beneish M-Score method was developed by Beneish (1999) and continues to be used in recent research as an early detection tool for financial statement manipulation. According to Beneish et al. (2020), the Beneish M-Score model uses eight financial ratios that can detect the possibility of a company engaging in earnings manipulation. These ratios include:

1. DSRI (Days Sales Receivable Index)
2. GMI (Gross Margin Index)
3. AQI (Asset Quality Index)
4. SGI (Sales Growth Index)
5. DEPI (Depreciation Index)
6. SGAI (Sales, General, and Administrative Expenses Index)
7. LVGI (Leverage Index)
8. TATA (Total Accruals to Total Assets)

A company is categorized as a manipulator if the M-Score is less than -2.22, and is considered a non-manipulator if it is above this figure.

In the Indonesian context, Pramesti and Hapsari (2023) emphasized that the Beneish M-Score is an effective method for detecting fraud in public companies because the ratios in this model are able to capture significant changes in the structure of financial statements. Meanwhile, Santoso (2022) stated that the use of the Beneish Index is crucial in the mining sector, given its vulnerability to manipulation of fixed asset values, exploration costs, and long-term revenue recording.

III. RESEARCH METHODS

Beneish Ratio Index

The following are the steps for calculating the Ratio Index to determine whether a company is a manipulator, a gray company, or a non-manipulator:

1. Days Sales in Receivables Index (DSRI)

$$DSRI = \frac{(Piutang\ Dagang_t : Penjualan_t)}{(Piutang\ Dagang_{t-1} : Penjualan_{t-1})}$$

2. Gross Margin Index (GMI)

$$GMI = \frac{(Penjualan_{t-1} : Harga\ Pokok\ Penjualan_{t-1}) : Penjualan_{t-1})}{(Penjualan_{t-1} : Harga\ Pokok\ Penjualan_{t-1}) : Penjualan_{t-1})}$$

3. *Asset Quality Index (AQI)*

$$AQI = \frac{(1 - Aset\ Lancar_t + Aset\ tetap_t) : Total\ Aset_t)}{(1 - Aset\ Lancar_{t-1} + Aset\ tetap_{t-1}) : Total\ Aset_{t-1})}$$

4. *Sales Growth Index (SGI)*

$$SGI = \frac{(Penjualan_t)}{(Penjualan_{t-1})}$$

5. *Depreciation Index (DEPI)*

$$DEPI = \frac{(Depresiasi_{t-1} \circledcirc Depresiasi_{t-1} + Aset\ tetap_{t-1})}{(Depresiasi_t \circledcirc Depresiasi_t + Aset\ tetap_t)}$$

6. *Sales General and Administrative Expenses Index (SGAI)*

$$SGAI = \frac{Biaya\ Penjualan\ Administrasi_t : Penjualan_t)}{Biaya\ Penjualan\ Administrasi_{t-1} : Penjualan_{t-1})}$$

7. *Leverage Index (LVGI)*

$$LPGI = \frac{(Total\ Kewajiban_t : Total\ Aset_t)}{(Total\ Kewajiban_{t-1} : Total\ Aset_{t-1}{}_1}$$

8. *Total Accruals to Total Asset (TATA)*

$$TATA = \frac{(Laba\ Usaha_t - Arus\ Kas\ dari\ Aktifitas\ Operasional_t)}{Total\ Aset_t}$$

Beneish Parameter Index

No	Index	Non Manipulators	Grey campany	Manipulators
1	DESR	≤ 1,031	1,031 < index < 1,465	≥ 1,465
2	GMI	≤ 1,014	1,014 < index < 1,193	≥ 1,193
3	AQI	≤ 1,039	1,039 < index < 1,254	≥ 1,254
4	SGI	≤ 1,134	1,134 < index < 1,607	≥ 1,607
5	DEPI	≤ 1,001	1,001 < index < 1,077	≥ 1,077
6	SGAI	≤ 1,054	1,054 < index < 1,041	≥ 1,041
7	LPGI	≤ 1,037	1,037 < index < 1,111	≥ 1,111
8	TATA	≤ 0,018	0,018 < index < 0,031	≥ 0,031

Percentage

How to calculate the percentage of companies classified as manipulators, non-manipulators, and grey companies, including:

a. Percentage of manipulator companies

$$= \frac{Jumlah\ perusahaan\ manipulatur}{Jumlah\ sampel} \text{ x } 100\ \%$$

b. Percentage of non-manipulator companies

$$= \frac{Jumlah\ perusahaan\ non{-}manipulatur}{Jumlah\ sampel} \text{ x } 100\ \%$$

c. Percentage of grey companies

$$= \frac{Jumlah\ perusahaan\ grey\ campany}{Jumlah\ sampel} \text{ x } 100\ \%$$

IV. RESEARCH RESULTS

Days Sales in Receivables Index (DSRI)

The calculation results for fraud detection in mining companies from 2020 to 2024 using the DSRI ratio are as follows:

Table 1 DSRI Calculation Results Mining Companies 2020–2024

Nama Perusahaan	Kode Perusahaan	Tahun	Piutang	Penjualan	DSRI	Kriteria
PT. Aneka Tambang, Tbk	ANTM	2020	9.150.514.439	27.372.461.091		
		2021	11.728.143.000	38.445.595.000	0,913	Non Manipulator
		2022	11.694.779.000	45.930.356.000	0,835	Non Manipulator
		2023	20.064.546.000	41.047.693.000	1,920	Manipulator
		2024	17.991.975.000	69.192.440.000	0,532	Non Manipulator
PT. Bumi Resources, Tbk	BUMI	2020	397.376.705	790.436.397		
		2021	775.582.880	1.008.212.975	1,530	Manipulator
		2022	772.731.911	1.830.079.927	0,549	Non Manipulator
		2023	704.716.702	1.679.948.765	0,993	Non Manipulator
		2024	772.663.660	1.359.679.473	1,355	Grey

Source: Processed Data, 2025.

Based on the DSRI calculations above, PT Aneka Tambang, Tbk, was found to be a manipulating company in 2023 with a DSRI of 1.920, and PT Bumi Resources, Tbk, with a DSRI of 1.355 in 2024.

Gross Margin Index (GMI)

The calculation results for fraud detection in mining companies from 2020 to 2024 using the GMI ratio are as follows:

Table 2 GMI Calculation Results Mining Companies 2020–2024

Nama Perusahaan	Kode Perusahaan	Tahun	Penjualan	HPP	GMI	Kriteria
PT. Aneka Tambang, Tbk	ANTM	2020	27.372.461.091	22.896.684.435		
		2021	38.445.595.000	32.086.534.000	0,989	Non Manipulator
		2022	45.930.356.000	37.719.837.000	0,925	Non Manipulator
		2023	41.047.693.000	34.733.015.000	1,162	Grey
		2024	69.192.440.000	62.694.143.000	1,638	Manipulator
PT. Bumi Resources, Tbk	BUMI	2020	790.436.397	698.521.470		
		2021	1.008.212.975	806.476.329	0,581	Non Manipulator
		2022	1.830.079.927	1.459.438.981	0,988	Non Manipulator
		2023	1.679.948.765	1.542.653.836	2,478	Manipulator
		2024	1.359.679.473	1.190.389.426	0,656	Non Manipulator

Source: Processed Data, 2025.

Based on the GMI calculations above, PT Aneka Tambang, Tbk (2024) and PT Bumi Resources, Tbk (2023) were found to be manipulating companies, with a GMI of 1.638.

Asset Quality Index (AQI)

The calculation results for fraud detection in mining companies from 2020 to 2024 using the AQI ratio are as follows:

Table 3 AQI Calculation Results Mining Companies 2020–2024

Nama Perusahaan	Kode Perusahaan	Tahun	Aset Lancar	Aset tetap	Total Aset	AQI	Kriteria
PT. Aneka Tambang, Tbk	ANTM	2020	9.150.514.439	18.248.068.325	31.729.512.995		
		2021	11.728.143.000	16.863.748.000	32.916.154.000	0,544	Non Manipulator
		2022	11.694.779.000	16.471.563.000	21.942.492.000	1,395	Manipulator
		2023	20.064.546.000	16.183.257.000	42.851.329.000	-0,416	Non Manipulator
		2024	17.991.975.000	15.644.099.000	44.522.645.000	0,582	Non Manipulator
PT. Bumi Resources, Tbk	BUMI	2020	397.376.705	20.004.650	3.428.550.327		
		2021	775.582.880	144.526.892	4.223.787.286	1,357	Manipulator
		2022	772.731.911	181.620.778	4.488.046.969	0,882	Non Manipulator
		2023	704.716.702	217.465.048	4.202.694.216	0,880	Non Manipulator
		2024	772.663.660	225.080.199	4.163.401.077	1,134	Grey

Source: Processed Data, 2025.

Based on the AQI calculations above, PT Aneka Tambang, Tbk, was found to be a manipulating company in 2022 with an AQI of 1.395, and PT Bumi Resources, Tbk, with an AQI of 1.357 in 2021.

Sales Growth Index (SGI)

The calculation results for fraud detection in mining companies from 2020 to 2024 using the SGI ratio are as follows:

Table 4 SGI Calculation Results Mining Companies 2020–2024

Nama Perusahaan	Kode Perusahaan	Tahun	Penjualan	SGI	Kriteria
PT. Aneka Tambang, Tbk	ANTM	2020	27.372.461.091		
		2021	38.445.595.000	1,405	Grey
		2022	45.930.356.000	1,195	Grey
		2023	41.047.693.000	0,894	Non Manipulator
		2024	69.192.440.000	1,686	Manipulator
PT. Bumi Resources, Tbk	BUMI	2020	790.436.397		
		2021	1.008.212.975	1,276	Grey
		2022	1.830.079.927	1,815	Manipulator
		2023	1.679.948.765	0,918	Non Manipulator
		2024	1.359.679.473	0,809	Non Manipulator

Source: Processed Data, 2023.

Based on the SGI calculations above, the manipulator companies are PT. Aneka Tambang, Tbk in 2024 with an SGI of 1.686, and PT. Bumi Resources, Tbk in 2021 with an SGI of 1.276.

V. CONCLUSION

This study analyzes indications of financial statement fraud in mining subsector companies listed on the Indonesia Stock Exchange (IDX) during the 2020–2025 period using the Beneish Ratio Index (Beneish M-Score) as an early detection tool. The results indicate that not all companies consistently fall into the non-manipulator category. In certain years, several companies were identified as either manipulators or gray companies, indicating the potential for less than fair presentation of financial statements. The DSRI, GMI, AQI, and SGI ratios proved to be the most sensitive indicators in detecting potential manipulation, indicating that accounts receivable, profit margins, asset quality, and sales growth are the areas most vulnerable to accounting manipulation in the mining sector.

Overall, these findings confirm that the Beneish M-Score is effective as an early warning system in identifying indications of financial statement fraud, particularly in sectors with accounting complexity and high economic pressures such as mining. However, the Beneish M-Score detection results cannot be used as definitive proof of fraud; they require further analysis, investigative audits, and internal control evaluations. This research is

expected to contribute to the development of accounting literature and serve as a practical reference for auditors, regulators, investors, and management in improving the transparency and accountability of financial reporting.

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