



Fraud Detecting Using Beneish M-Score and F-Score: Which is More Effective?

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Abstract

Beneish M-Score and F-Score are methods of identifying fraud in financial statements. The difference in research results between the two methods requires an in-depth study of the effectiveness of the Beneish M-Score and F-Score methods for detecting fraud. The type of research is descriptive and quantitative. The population in this study were companies registered in JII from 2017-2021. Through purposive sampling, ten sample companies were obtained. The results revealed that the Beneish M-Score method is more effective in detecting fraud in JII-registered companies in 2017-2021 than the F-Score. Evidenced by a higher level of accuracy and lower error type than the F-score method. However, the F-Score method has weaknesses in the level of accuracy and type error. Therefore, the Beneish M-Score helps regulators and auditors detect fraud in financial statements, so it is very important for potential investors to be able to make the right investing decisions.

Keywords: *Fraud; Beneish M-Score; F-Score*

INTRODUCTION

A global survey conducted by ACFE (2020) in 2020 Report To The Nation stated that asset misappropriation cases were 86% of cases with the lowest average loss of USD 100,000 per case, and asset abuse cases were the highest percentage of cases. The second highest cases were corruption, which was 43%, with the

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lowest average loss of USD 200,000. These corruption cases include offenses such as bribery, conflicts of interest, and extortion. In contrast, the third-highest case is financial statement fraud, which has a percentage of 10%. However, this case has a huge loss of USD 954,000. According to the Indonesian Fraud Survey (SFI), in Indonesia, there were 239 cases of fraud in 2019. The results of a survey conducted by ACFE Indonesia (2019) stated that the most adverse cases were corruption cases, as many as 167 cases (69.9%). The second-highest case was asset abuse, where this case occurred in as many as 50 cases (20.9%). While the third-highest is financial statement fraud cases, with 22 cases (9.2%). The large number of losses caused by fraud cases in financial statements requires serious and intense resolution so that it is expected to minimize the occurrence of fraud levels. Many things can trigger cheating, such as opportunity, rationalism, pressure, etcetera.

The existence of these various cases of fraud, stakeholders must be given identification tools that can assess the feasibility of a financial statement as a basis for decision making. There are the Beneish M-Score and the F-Score. The Beneish M-Score, according to Hugo (2019) is a method for predicting fraud in financial statements in profit management, where the ratios contained in it have been proven to have the ability to predict financial statement fraud. The higher the Beneish M-Score value in the financial statement, with a cut-off value of -2.22, the greater the likelihood that the financial statements contain fraud. Likewise, the F-Score method is a development of the Beneish M-Score model, specifically designed to allow users to get a score directly without using an index in their calculations, having a cut-off value of 1, the higher the F-Score value, the higher the risk of fraud.

Various studies were developed to detect indications of financial statement fraud. Aghghaleh (2016) showed that the F-score method is claimed to be more comprehensive and effective in detecting financial statement fraud in Malaysia. Ismawati (2019) also pointed out that the F-score method is a good model used in detecting fraud in companies listed on the IDX compared to the Beneish M-score method. Therefore, this study continues previous research to conduct empirical tests on the effectiveness of the Beneish M-Score and F-Score methods in companies listed in the Jakarta Islamic Index (JII) in 2017-2021. So the purpose of this study is to find out more effective methods of Beneish M-Score and F-Score



in detecting fraud. This research can contribute to regulators and auditors in detecting fraud in financial statements. So potential investors need to be able to make the right decisions in investing.

LITERATURE REVIEW

Beneish M-Score Method in Detecting Financial Statement Fraud

Signal theory explains how the company should give signals to users of financial statements. This theory is the basis of the relationship of financial performance with the value of the company so that it largely determines the reputation and success of the company (Mediawati, 2018). Kusumawardhani (2014) defines fraud as an act of fraud or mistake committed by a person or organization. Fraud indicates cheating when there is inaccuracy so that it can harm the company. Santosa (2019) stated that the Beneish M-Score is a mathematical model to detect fraud in the company's financial statements. Beneish M-score is formulated with eight ratios to detect the act of manipulating financial statements, namely: 1) DSRI (receivables index); 2) GMI (sales revenue); 3) AQI (asset quality index); 4) SGI (sales growth index); 5) DEPI (depreciation index); 6) SGAI (selling expenses index, general and administrative), 7) TATA (total asset index); 8) LVGI (debt index). Septiani (2020) revealed that investors must be more careful in investing. So, not only important for high returns but also must attach importance to the quality of company information. The effectiveness of the Beneish M-Score method was shown by Putri (2021) to detect financial statements from 2016-2018. Mardiharjo (2021) stated that the analysis of financial statements using the Beneish M-score is effectively used because it can show three groupings: manipulators, non-manipulators, and gray companies. Based on various studies that have been carried out, the use of the Beneish M-Score is effective in detecting financial statement fraud.

F-Score Method in Detecting Financial Statement Fraud

F-Score, according to Aghghaleh (2016) is a fraud detection method using scaled logistic probability techniques. The F-score is formulated with seven ratios, including: 1) RSST Accrual; 2) Change in receivable; 3) Change in inventory; 4)

Soft assets; 5) Change in cash sales; 6) Return on assets; 7) Actual issuance of stock. Devi (2021) pointed out that pentagon fraud using the F-score method positively analyzes financial statement fraud in state-owned companies listed on the IDX in 2014-2019. Dechow (2011) revealed that the F-score method is effective for identifying and reducing misstatement activities in the future. Based on various studies that have been carried out, the use of the f-score method is effective in detecting financial statement fraud.

Comparison of Beneish M-Score and F-Score

Fraud is a severe problem in the business world. Financial statement fraud proved to be the most worrying because it involved the company's management and harmed investors. Therefore, several methods have been developed to assist regulators and auditors in detecting financial statement fraud. Beneish M-score is a statistical model using financial ratios to evaluate manipulations in financial statements. F-score develops a score from Beneish to predict which companies have material misstatements. Overall, there is a positive and significant relationship between the variables DSRI, SGI, TATA, AQI, RSST Accrual, Δ REC, Δ INV, and Soft assets to misstatements of financial statements related to fraud triangle theory, namely opportunities. Management can take advantage of the flexibility of generally accepted accounting principles to be able to carry out profit management practices, especially on accrual-based accounts. For example, increasing the value of goods sold by making earnings and false sales and increasing the value of assets by changing policies on accounting.

Meanwhile, a significant positive relationship between the GMI and LVGI variables to misstatements of financial statements is related to the fraud triangle theory, namely pressure. The increase in GMI indicates a negative signal because the company's gross profit has decreased. Pressure to realize investor expectations and expectations can encourage management to manipulate financial statements. Meanwhile, the increase in LVGI indicates an increase in the company's burden. Profit management is often carried out during the increase in debt to meet the requirements in the debt covenant contract.

The F-score method is claimed to be better at detecting financial statement fraud than the Beneish M-score method. The F-score method has better



classification accuracy than the Beneish M-score method. The F-score combines variables, *the discretionary accruals* model, and other variables that produce a composite measure of the F-Score. The purpose of building the F-score is to develop a score that can be calculated directly from the financial statements. The variables on the F-Score concern two things that can be seen directly in the financial statements, namely the quality of accruals proxied with RSST and financial performance proxied by RSST Accrual, ΔREC , ΔINV , ΔROA , Soft asset, $\Delta CASHSALES$, and Issuance. (Aghghaleh, Mohamed, and Grace 2016) showed that the F-score is more comprehensive and more effective in detecting financial statement fraud in Malaysia. Ismawati (2019) shows that the F-score is a good method for detecting fraud in companies listed on the IDX compared to the Beneish M-score method. So, this research will compare the Beneish M-score's and F-score's effectiveness for detecting financial statement fraud.

RESEARCH METHOD

This research is a quantitative descriptive study. The population is an issuer listed on the Jakarta Islamic Index (JII) from 2017-2021. The selection of samples by purposive sampling with the following criteria: 1) Companies that are five consecutive years registered in JII. 2) Companies that publish complete financial statements in the rupiah currency. Based on the criteria obtained, 10 sample companies in this study.

The variables contained in the Beneish M-Score consist of days sales receivable index (DSRI), gross margin index (GMI), depreciation index (DEPI), sales growth index (SGI), leverage index (LVGI), total accruals to total assets (TATA), asset quality index (AQI), and sales general administrative index (SGAI), with the formula:

DSRI	$\frac{\text{Receivables}_t / \text{Sales}_t}{\text{Receivables}_{t-1} / \text{Sales}_{t-1}}$
GMI	$\frac{\text{Sales}_{t-1} - \text{Cost of goods Sold}_{t-1} / \text{Sales}_{t-1}}{\text{Sales}_t - \text{Cost of goods Sold}_t / \text{Sales}_t}$
AQI	$\frac{1 - \frac{(\text{Current Assets}_t + \text{PP\&E}_t)}{\text{Total assets}_t}}{1 - \frac{(\text{Current Assets}_{t-1} + \text{PP\&E}_{t-1})}{\text{Total assets}_{t-1}}}$
SGI	$\frac{\text{Sales}_t}{\text{Sales}_{t-1}}$
DEPI	$\frac{\text{Depreciation}_{t-1} / (\text{Depreciation}_{t-1} + \text{PP\&E}_{t-1})}{\text{Depreciation}_t / (\text{Depreciation}_t + \text{PP\&E}_t)}$
SGAI	$\frac{\text{Sales, general and administrative expense}_t / \text{Sales}_t}{\text{Sales, general and administrative expense}_{t-1} / \text{Sales}_{t-1}}$
LVGI	$\frac{\text{LTD}_t + \text{Current Liabilities}_t / \text{Total assets}_t}{\text{LTD}_{t-1} + \text{Current Liabilities}_{t-1} / \text{Total assets}_{t-1}}$
TATA	$\frac{(\Delta \text{Current Assets}_t - \Delta \text{Cash}_t) - (\Delta \text{Current Liabilities}_t - \Delta \text{Current maturities of LTD}_t) - (\Delta \text{Income tax payable}_t - \text{Depreciation and amortization}_t)}{\text{Total Assets}}$

The Beneish M-Score can be calculated using the following formula:

$$M = -4,80 + 0,920DSRI + 0,528GMI + 0,404AQI + 0,892SGI + 0,115DEPI - 0,172SGAI + 4,679TATA - 0,327LVGI$$

The Beneish M-score assessment uses a cut-off value, which is a score higher than -2.22, a probability that the company applied opportunistic earnings management and misleading reporting.

While the variables contained in the F-Score consist of RSST accruals, changes in receivables, changes in inventories, percentages of soft assets, changes in cash sales, changes in return on assets, and issuance, with the formula:



RSST	$\frac{\Delta WWC + \Delta NCO + \Delta FIN}{Average\ Total\ Assets}$
ΔREC	$\frac{\Delta Accounts\ Receivables}{Average\ Total\ Assets}$
ΔINV	$\frac{\Delta Inventory}{Average\ Total\ Assets}$
SOFT ASSETS	$\frac{(Total\ assets - PPE - Cash\ and\ cash\ equivalents)}{Total\ assets}$
$\Delta CASH\ SALES$	Percentage change in cash sales (Sales – Δ Account receivables)
ΔROA	$\frac{Earnings_t / Average\ Total\ Assets_t}{Earnings_{t-1} / Average\ Total\ Assets_{t-1}}$
ISSUE	An indicator variable code 1 if the firm issued securities during year t

F-score can be calculated in the predicted value equation:

$$F = -7,893 + 0,790*RSST + 2,518*\Delta REC + 1,191*\Delta INV + 1,979*SOFT\ ASSET + 0,171*\Delta CASHSALES - 0,932*\Delta ROA + 1,029*ISSUE$$

The predicted value is converted into a probability value, where:

$$Probability\ value = e^{(Predicted\ value)} / (1 + e^{(Predicted\ value)})$$

The result of the probability value will be divided by the unconditional probability of misstatement (probability of unconditional misstatement = 0.0037) to get the f-score value.

$$F-Score = Probability\ Value / Unconditional\ Probability$$

The F-Score uses a cut-off value of 1. if the value obtained is more than 1, it can be indicated that there is fraud in financial statements.

RESULT AND DISCUSSION

Beneish M-Score Method

The Beneish M-Score method is a model that has a cut-off value of -2.22. If a company has a score of less than -2.22, then the company can be indicated as a non-manipulator company. However, if the score is obtained more than -2.22,

the company can be indicated to have manipulated or fraud. The results showed that 32 out of 47 samples showed non-manipulator companies because the result of the calculation value was no more than the cut-off value. Then for the other 15 samples indicated to have manipulators or fraud divided from 2017, there were six samples indicated, namely KLBF with a result of -2.004327, PTBA with a result of -0.87288, SMGR with a result of -2.12849, UNTR with a result of -2.14809, UNVR with a result of -1.73510, and WIKA with a result of -1.87758. In 2018 there were four samples, namely INDF with a result of -2.20586, KLBF with a result of -2.21378, UNTR with a result of -2.16931, and UNVR with a result of -1.35922. In 2019 there were three samples, namely KLBF with a result of -2.21624, PTBA with a result of -2.21299, and UNVR with a result of -0.83049. In 2020 there was 1 sample, namely INDF, with a result of -1.91643, and in 2021 there was 1 sample, namely WIKA, with a result of -1.81579. Overall, the number of companies classified as manipulators has decreased, indicating that the fraud level is decreasing.

F-Score Method

The F-Score method has a cut-off value of 1. Suppose a company has a score of less than 1. In that case, the company can be indicated as a non-manipulator company, but if the score obtained is more than 1, the company can be indicated to have manipulated or committed fraud. The results showed that 31 out of 47 samples showed non-manipulator companies because the calculation value was no more than the cut-off value. Then there were four company samples each for the other 16 samples indicated to have manipulators or fraud divided from 2017-2020. With details, the companies indicated by manipulators in 2017 were KLBF with a result of 2.47410, PTBA with a result of 1.18441, UNTR with a result of 1.01594, and UNVR with a result of 1.04876. In 2018, namely KLBF with a result of 2.30809, PTBA with a result of 1.22106, UNVR with a result of 1.49177, and WIKA with a result of 1.48914. In 2019, KLBF with a result of 2.16061, PTBA with a result of 1.09840, UNTR with a result of 1.26933, and WIKA with a result of 1.40471. In 2020, namely KLBF with a result of 1.93983, UNTR with a result of 1.10616, UNVR with a result of 1.02651, and WIKA with a result of 1.03119. Meanwhile, in 2021, no companies are indicated to have manipulators. Overall, the number of companies classified as manipulators has decreased, indicating that the level of fraud is decreasing.



Tabel 1
Accuracy Results of Beneish M-Score and F-Score

Predictions	M-Score	F-Score
Fraud	15	16
Non-Fraud	32	31
Total	47	47
Accuracy (%)	68,09%	65,96%
Error type (%)	31,91%	34,04%

Source: Data processed in 2022

Based on the results that have been taken into account, it can be seen that there are differences in the results of the beneish m-score and f-score. The error for the beneish m-score was found at 31.91%, or as many as 15 errors, while for the f-score, it was 34.04% or as many as 16 errors. The results confirmed the efficiency of the beneish m-score in detecting fraud by 68.09% or as many as 32 samples, while the f-score was only 65.96% or 31 samples. Thus, it can be concluded that the beneish m-score method is more suitable for detecting fraud in companies listed in the Jakarta Islamic Index in 2017-2021.

Beneish M-Score Method Is Effective in Detecting Financial Statement Fraud

Beneish m-score is a mathematical model that detects fraud in preparing company financial statements. This model involves several financial ratios to obtain a certain score to identify the possibility of financial statement fraud. Based on research that has been carried out on ten samples of companies registered with JII in 2017-2021 with the beneish m-score using the ratios and calculations that have been presented, if the score or cut-off obtained is more than -2.22, it can be said that the company is considered a manipulator. Meanwhile, if the result or cut-off is less than -2.22, the company can be considered a non-manipulator company.

Based on the company's observations in 2017-2021, it is explained that companies indicated to have committed fraud or fraud are INDF, KLBF, PTBA, SMGR, UNTR, UNVR, and WIKA. It can be concluded that the beneish m-score

method is effectively used in detecting financial statement fraud in companies listed on the Jakarta Islamic Index in 2017-2021. Seven out of ten companies classified as manipulators require further detection and prevention of the fraud.

This result is consistent with research by Murdihardjo(2021), which revealed that the beneish m-score method could detect financial statement misstatements effectively by producing three groupings, namely manipulators, non-manipulators, and gray companies. Putri(2021) revealed that the beneish m-score is worthy of being used as a model to analyze financial statements of fraud in manufacturing companies listed on the IDX in 2016-2018. Septiani(2020) revealed that the beneish m-score method is accurate in detecting fraud in the financial statements of banking companies for the period 2016-2018, and the most dominant ratio in the grouping of manipulators and non-manipulators is the DSRI ratio.

F-Score Method is Effective in Detecting Financial Statement Fraud

F-Score is a financial statement fraud detection method developed using scaled logistic probability techniques. This method is a development of the beneish m-score designed so that users can find scores directly without using indices in their calculations. Based on the research of ten samples listed companies on the Jakarta Islamic Index in 2017-2021 using the f-score method with the ratios and calculations that have been presented with value criteria, if the results are less than one company is not indicated to have committed fraud/manipulation, but if the results of calculating the value are more than one, then the company is indicated to have committed fraud/manipulation.

F-Score has seven calculation ratios: 1) RSST Accrual, Accrual basis in financial statements provides an opportunity for managers to manipulate financial statements to make a profit according to their wishes. During 2017-2021, the highest score of RSST Accrual occurred in 2018 at PT Kalbe Farma (KLBF). 2) Change in receivables manipulation can occur through changes in receivables that tend to be too high. During 2017-2021, the highest value of Δ REC occurred in 2021 at PT United Tractors (UNTR). Its shows indications of fraud. 3) Change in inventory, a major change in the company's inventory that can drastically affect gross profit. During 2017-2021, the highest value of Δ INV occurred 2017



at PT Kalbe Farma (KLBF). 4) Soft assets, if this variable has a high value on the balance sheet, then the company has the opportunity to be able to change and regulate assumptions that can affect short-term income. During 2017-2021, the highest value of Soft assets occurred in 2018 at PT Wijaya Karya (WIKA). 5) Change in cash sales, this variable can help evaluate whether there is a decrease in sales that is not in accordance with accrual management. During 2017-2021, the highest value of Δ CASHSALES occurred in 2018 at PT Aneka Tambang (ANTM). It can be monitored when evaluating the possible manipulation of income. 6) Return on assets (Change of Asset Rate of Return Account), manipulation of income can be seen from erratic income. During 2017-2021, the highest value of Δ ROA occurred in 2021 at PT United Tractors (UNTR). 7) Actual issuance of stock (Accrual Shares), issuance of shares can indicate management conducting stock options, this indicates that the manager is trying to sell shares at a time when the price is high.

Based on the results of company observations sampled in 2017-2021, it was explained that the companies indicated to have been manipulated were KLBF, PTBA, UNTR, UNVR, and WIKA. It can be concluded that the f-score method is effectively used in detecting fraud in the financial statements of companies listed in the Jakarta Islamic Index in 2017-2021. Companies that are indicated to be manipulators need further detection and prevention of fraud. Dechow(2011) stated that the f-score method could be used effectively in detecting and reducing misstatement activity in the future. Hung(2017) also stated that the f-score method could be used in determining variables that can affect fraud in financial statements. Skousen(2009) stated that the f-score method can be used by investors as an initial screening tool in investigating fraud in financial statements.

Effective Method Used in Detecting Financial Statement Fraud

Fraud in financial statements proved to be the most worrying because it involved management and was detrimental to investors. Several methods have been developed to petrify in detecting fraud in financial statements. The two methods are beneish m-score and f-score. The beneish m-score method is said to be a manipulator if it has a score of more than -2.22, while the f-score method is considered a manipulator if it has a score of more than 1. It shows that the greater

the beneish m-score or f-score of a financial statement, the greater the likelihood of fraud in financial statements.

Based on the analysis, the beneish m-score and f-score effectively detect financial statement fraud. The beneish m-score shows higher accuracy results compared to the f-score. The results showed that the efficiency of the beneish m-score in detecting fraud was 68.09%, while the f-score was only 65.96%. The result type error showed m-score is lower compared to the f-score. The type error of the beneish m-score method was 31.91%, while the f-score was 34.04%. Thus, the beneish m-score method is more suitable for detecting financial statement fraud in companies listed on the Jakarta Islamic Index in 2017-2021. However, if studied, these two methods have shortcomings, namely failing to detect fraud in *the disclosure*. It is because both methods have dependent on financial statement data, so if there is a qualitative material misstatement contained in the disclosure, it cannot be detected.

Based on the study's results, it is stated that this research is not in line with Ismawati's (2019) research, which reveals that the f-score method is more effectively used in detecting financial statement fraud. Aghghaleh's(2016a) research is also not in line with this study, in Aghghaleh's research states that the f-score method is more effective and more comprehensive than the m-score, while the results of this study prove that the beneish m-score is more effectively used in detecting financial statement fraud in companies listed in the Jakarta Islamic Index in 2017-2021.

CONCLUSION

Based on the results of research and data analysis, it can be concluded:

The scoring model for issuers at JII in 2017-2021 is 32%. Issuers with indications of manipulation in 2017 have 6 issuers (60%), in 2018 there were 4 issuers (40%), in 2019 there were 3 issuers (30%), in 2020 there was 1 issuer (10%) and in 2021 only 1 issuer (14%).

Fraud prediction with the F-Score method for issuers at JII in 2017-2021 is 34%. Issuers with indications of manipulation in 2017 were 4 issuers (40%),



in 2018 there were also 4 issuers (40%), in 2019 there were 4 issuers (40%), in 2020 there were 4 issuers (40%), and in 2021 there are no companies indicated to manipulate.

The Beneish M-Score method is more effective than the F-Score method in detecting fraudulent financial statements on issuers registered with JII in 2017-2021. Effectiveness is stated from the higher accuracy level of the Beneish M-Score method and lower type error than the F-Score method. Therefore, the Beneish M-Score can assist regulators and auditors in detecting fraud in financial statements, so it is very important for potential investors to be able to make the right investment decisions.

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