Explaining the Beneish model and providing a comprehensive model of fraudulent financial reporting(FFR)

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Abstract

In this study, the aim is to provide a comprehensive model for the prediction, prevention and detection of financial reporting fraud using the modified benchmarking model.

To achieve the research goal, the necessary data were collected for 161 companies listed on the Tehran Stock Exchange during a 10-year period (2009-2018). The results of estimating the research model have been examined by the binomial logit method. The results of testing the hypotheses of this study indicate that Beneish model is successful in separating companies involved in fraudulent financial reporting and healthy companies, based on McFadden's detection coefficient, with 73% confidence, and among the independent variables, day's sales in receivable index (DSRI), gross margin index (GMI), asset quality index (AQI), sales growth index (SGI), depreciation index (DEPI) and total accrual to total assets index (TATAI), have a direct and significant effect on fraudulent financial reporting, but sales, general, and administrative expenses index (SGAI) and leverage index (LEVI) have had a significant inverse effect on fraudulent financial reporting (FFR).

Keywords: Beneish Model, fraudulent financial reporting (FFR), Fraud, M-Score Model

1. Introduction

Financial statement fraud is considered to be a serious threat to market participants' confidence in financial information, which entails heavy costs for various segments, and is an unacceptable, illegal,

and immoral behavior. The opportunity and possibility of committing fraud increases when the internal controls of the units are weak, its management elements are ineffective and the quality of audit work is low (Khajavi and Mansouri, 2015).

In general, fraud in financial statements is divided into two categories: detected and undetected. Only a small portion of fraud in financial statements is detected and other cases are not reported until they are detected. In many cases, fraud was discovered by senior managers years after it was committed (Khajavi and Ebrahimi, 2017).

Due to the increasing competition of companies and institutions, the achievement of the expected income is also limited. Therefore, the incidence of fraud in financial statements is increasing day by day and the prevention and detection of fraud in these statements haves become more important than the past (Vahidi Elizaei and Hamedian, 2009).

Giant companies such as WorldCom, Enron and GlobalCrossing have also fallen sharply due to financial statement fraud, destroying confidence in financial markets, financial information and the accounting profession around the world. The failure of these companies has raised doubts in the minds of various shareholders about the validity and reliability of financial statements (Asyiqin, 2014). The collapse of Enron, Worldcom, and Parmalat in recent years bears little resemblance to that of 1929, as "financial reporting fraud" is considered a major threat to the capital market, despite the global economic crisis. Such cases, which used to be rare, have become a common complication in the global capital market, which, unfortunately, is also followed by large auditing firms in these violations and frauds. Clearly, it is seen that despite extensive research on fraud and related factors, the financial statements and reports are still not of high quality and the Iranian stock market may be in an optimistic state, at a low level of performance and even some researchers believe that it is not at the level of poor performance. The main problem, then, is that there are probably other factors in the field of fraudulent financial reporting that have been less studied by researchers. Fraudulent methods of financial reporting are becoming newer day by day, so the models and patterns for dealing with it must also be updated. It seems that the studies that have been done so far in the field of fraud in financial statements have a more postmortem perspective and were conducted after the occurrence of fraud and the purpose was to identify fraudulent financial reporting. There is no suitable solution for forecasting and thus preventing fraud in financial statements. Therefore, in the present study, the main purpose is to provide a model using the Beneish model based on the indigenous conditions of Iran, which initially predicts fraudulent financial reporting and, as a result, increases the ability to prevent and finally, in the event of fraud, it is possible to identify at least the companies and financial statements that are involved in fraudulent financial reporting, so as not to deprive the public of the profession and financial reporting, which can affect all users to improve their financial statements and build relative confidence in them, and reduce the heavy costs of auditing. In view of the above, in this study, it has been investigated whether the application of the adjusted accounting model, in addition to detecting fraud in financial reporting, has the ability to predict and prevent it or not. In fact, the more accurate the prediction of fraud detection in financial reporting, the greater the ability to prevent fraud, which is one of the strengths of this study.

In view of the above, the question that arises is:
What effect does explaining the adjusted Beneish model have on fraudulent financial reporting?

2. Theoretical foundations and research background

Beneish (1999), to examine companies involved in fraudulent financial reporting and companies involved in non-fraudulent financial reporting, 74 companies manipulating financial statements from

1982 to 1992, in his model, he used the explanatory variables of both groups of manipulative and non-manipulative companies using probit analysis.

He assigned the number 1 to the manipulative companies and the number zero to the non-manipulative companies and calculated the coefficients of the independent variables. The breaking point of Beneish model was -2.22. Therefore, if the calculated score (M-Score) is greater than -2.22, it is likely that the company is manipulating profits. The model for profit manipulation is as follows:

M-Score = -4/84 + 0/920DSRI + 0/528GMI + 0/404AQI + 0/829SGI + 0/115DEPI – 0/172SGAI + 4/679TATAI – 0/327 LVGI

where in:

Financial reporting fraud rate is equal to M-Score, DSRI is equal to daily sales receivables index, GMI is equal to gross profit margin index, AQI is equal to asset quality index, SGI is equal to sales growth index, DEPI is equal to depreciation cost index, SGAI is equal to sales cost index, general and administrative, LEVI is equal to leverage index and TATAI is equal to total accruals to total assets index.

Fraudulent financial reporting is the misrepresentation, omission of items, and under-disclosure of information to deceive users of financial statements, especially investors and creditors, often with exaggerated assets. And incomes are either accompanied by a decrease in debts and expenses or vice versa (Sedighi Kamal, 2013).

In general, financial statement fraudulent schemes are typically as follows:

1. Excess of assets or income

2. Decrease in debts or expenses (Khajavi and Ebrahimi, 2017).

Fraudulent financial reporting is the intentional misrepresentation or omission of amounts or disclosures in financial statements to deceive users of financial statements, which includes playing with financial numbers. The game of financial numbers is the use of fictitious accounting methods to transform the perception of users of financial statements of the company's business performance. Fictitious accounting methods, ie using one or more methods to play with financial numbers, including the selection and application of accounting procedures, is boldly (Pourheidari and Samieinejad, 2015).

In this study, since fraudulent financial reporting has detrimental effects on companies themselves and the confidence of users of financial statements, the main purpose is to provide a model for predicting fraudulent financial reporting. To be able to increase the power of prevention. Also, based on the model derived from this study, it is possible to identify companies that are already involved in fraudulent financial reporting, in order to avoid further irreparable losses.

Asgari Alouj et al. (2019), developed the Beneish model by combining artificial neural networks and a particle cumulative motion optimization algorithm to predict profit manipulation. The results of their study showed that the Beneish model and the modified Beneish model, in separating the two groups of companies manipulating profit and non-manipulating, is more or less a random model and believe that both models, They are incapable of separating the two groups of profit-manipulating and non-profit-manipulating companies.

Sony et al. (2019), investigated fraudulent financial reporting based on the Beneish model. The results of this study indicate that financial stability and the nature of the industry have a significant effect on fraudulent financial reporting, but the audit opinion does not have a significant effect on fraudulent financial reporting. Also, financial stability and the nature of the industry affect the actual management of profits, but the audit opinion does not have a significant impact on the actual management of profits. According to the study, actual earnings management has a positive effect

on fraudulent financial reporting and can play a mediating role in the relationship between financial stability and the nature of the industry. It does not have a mediating role.

Kasumasanti et al. (2018), examined manufacturing companies using the Beneish model. The results of this study indicate that 1) there are still companies that are potentially able to provide fraudulent financial reporting (fraudulent companies) and approximately 7.81 of the statistical population Constitute 2) of the sample companies, 3.13% are considered as vague companies (gray companies), and 3) 89.1% of the companies, Are considered as non-fraudulent companies.

Darzi Ramandi (2018), examined the impact of fraudulent financial reporting on the risk of falling stock prices by emphasizing managerial ownership in companies listed on the Tehran Stock Exchange. The results showed that fraudulent financial reporting has no statistically significant effect on the relationship between fraudulent financial reporting and the risk of stock price fall as well as managerial ownership.

Zhi and Zheng (2017), showed that increasing management skills reduces financial statement fraud. Second, corporate political connections undermine the impact of management ability on fraud in financial statements. Further analysis showed that this was shifting from NGOs to state-owned companies.

Khajavi and Ebrahimi (2017), investigated whether it is possible to find a model for detecting fraud in the financial statements of the company by identifying the factors related to fraud in the financial statements and by using data mining methods listed on the Tehran Stock Exchange? The research findings indicate that there is evidence of good performance of the proposed models for predicting fraud in financial statements.

Shaari Anaghiz et al. (2017), examined and applied the accuracy of the results obtained from the Beneish model and the modified model based on the Iranian economic environment in detecting and exposing fraudulent financial reporting. The results indicate that the modified model of the bank more accurately shows the amount of fraud in the financial statements of companies.

Rahimian and Haji Heydari (2016), examined the detection of fraud using a modified model of cash and financial ratios. The results of their study show that the ratio of sales to total assets and the ratio of equity to Total assets are two fraudulent financial ratios.

Sajjadi and Kazemi (2016), sought to provide a comprehensive model of fraudulent financial reporting in Iran, using the underlying theory. The results of this study show that the motivation of managers to be rewarded, misuse of assets, political expenses, tax purposes and the acquisition of the company by managers also affect fraudulent financial reporting.

Reposis (2016), examines the use of the Beneish model to detect fraud in the financial statements of joint stock companies. The results of using F statistic show that the debt sales sales index, asset quality index, depreciation index, administrative and general expenses index, total liabilities index of total assets and leverage index 99% is effective on Beneish pattern. Most of all, accounts receivable sales with 92.95% explain the difference in the Beneish pattern.

Aris et al. (2015), used Beneish model (1999), Altman model and financial ratios to identify financial reporting fraud and their results showed that using Beneish model, it is possible to identify the company. There are fraudsters.

Farajzadeh Dehkordi and Aghaei (2015), examined the relationship between financial reporting fraud and corporate profit-sharing policies. The results show that companies that distribute profits are less likely to commit fraudulent financial reporting. Dividend income levels also have a negative relationship with fraudulent financial reporting.

Moradi et al. (2014), identified the factors affecting the likelihood of fraud in the reporting of financial statements from the perspective of auditors and managers. Findings indicate that between the characteristics of management, management compliance with internal controls and applicable

standards, risk factors related to market and industry conditions, operational characteristics, liquidity and financial stability with the possibility of fraud, there is a significant relationship.

Etemadi and Zalaghi (2013), investigated the fraud of financial statements in companies listed on the Tehran Stock Exchange, using some related financial ratios. The results of this study indicate that the output model has an effective role in detecting financial statement fraud and can help investors, chartered accountants, internal auditors, tax authorities, government agencies and banking systems.

In the previous research, the emphasis has generally been on the detection of fraud in financial reporting and no appropriate and comprehensive solution has been provided to prevent and predict fraudulent financial reporting. However, in the present study, the aim was to provide a model for forecasting, prevention and finally detection of financial reporting fraud, which is one of the strengths of the present study.

3. Research Hypotheses

Beneish model includes the following 8 important indicators that have been presented with fraudulent financial reporting, in the form of the following hypothesis:

The Beneish model has a significant effect on predicting financial reporting fraud in companies listed on the Tehran Stock Exchange.

Sub-hypotheses:

1. Day's sales in receivable index (DSRI), has a significant effect on fraudulent financial reporting.

2. Gross margin index (GMI), has a significant effect on fraudulent financial reporting.

3. Asset quality index (AQI), has a significant effect on fraudulent financial reporting.

4. Sales growth index (SGI), has a significant effect on fraudulent financial reporting.

5. Depreciation index (DEPI), has a significant effect on fraudulent financial reporting.

6. Sales, general, and administrative expenses index (SGAI), has a significant effect on fraudulent financial reporting.

7. Leverage index (LEVI), has a significant effect on fraudulent financial reporting.

8. Total accrual to total assets (TATAI), has a significant effect on fraudulent financial reporting.

Research method The present study is an applied descriptive-analytical study. The data collection tool is the library-e-documentation method. The statistical data of the research are taken from the financial statements of the companies listed on the Tehran Stock Exchange. The statistical population of the study is the companies listed on the Tehran Stock Exchange during the years 2009 to 1397. From the above statistical population, based on the following restrictions by systematic elimination method, only 161 companies from different industries were selected. This example includes companies that meet the following requirements:

1. Companies that had been accepted before 2009.

2. In order to match the reporting date and eliminate the seasonal effects, the financial period should end on March 29, and they should not change the financial year during the period under review.

3. Due to the specific type of activity of investment and financial companies, the company in question should not belong to this type of companies.

4. The companies in question should have continuous activity during the research period and should not stop operating symbols for more than 6 months.

5. The required information is available from them. The model used in this study, taken from Beneish model (1999), is as follows:

M-Score= $\beta_0 + \beta_1$ DSR I_{it} + β_2 GMI_{it} + β_3 AQ I_{it} + β_4 SG I_{it} + β_5 DEP I_{it} + β_6 SGA I_{it} + β_7 TATAI$_{it}$ + β_8 LVG I_{it} + ϵ_{it}

In this regard, i and t represent the company and time, respectively.

4. Model variables The dependent variable

The dependent variable of this research is fraudulent financial reporting which has a qualitative nature and has a nominal scale. In measuring this variable, the number one has been assigned to companies with fraudulent financial reporting and the number zero to healthy companies.

Independent variable

The independent variable of this research is Beneish model, which includes 8 indicators, as follows (Beneish, 1999):

Day's sales in receivable 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 (LEVI), and total accrual to total assets index (TATAI).

Sentence disorder () includes a set of factors that, in addition to the independent variables in the model, can affect fraudulent financial reporting.

Since the dependent variable of this study is virtual and has two values of one (for companies with fraudulent financial reporting) and zero (for companies with non-fraudulent financial reporting), the two-sentence logit regression is used to test hypotheses.

In logistic regression, the calculated Z statistic value of the estimated coefficients, the McFadden detection coefficient, and the likelihood statistic (LR) statistic are the criteria used for statistical analysis.

Research Findings table 1 shows the descriptive statistics of the explanatory variables used in this study, including mean, minimum, maximum and standard deviation.

Table 1: Descriptive statistics of research variables

Variable symbol	Minimum	Maximum	Average	Standard deviation
DSRI	0.017	61.071	1.411	2.489
GMI	-91.283	120.948	1.122	4.756
AQI	0.005	83.677	1.344	3.623
SGI	0.155	10.468	1.217	0.499
DEPI	0.036	35.785	1.215	1.493
SGAI	0.114	9.649	1.095	0.539
LEVI	0.116	3.028	1.015	0.213
TATAI	-0.780	-0.600	-0.012	0.123

Source: Research Findings

Beltaji (2013) believes that the usual methods of econometrics in experimental work are based on the assumptions of the reliability of the studied variables, because it is possible that the estimation is fictitious with unstable variables and citing the results of such estimates leads to misleading results. Therefore, in this study, the root tests of Levin Lin Cho, Fisher ADF and Fisher PP units have been used.

Table 2:   The results of the unit root test at the data level

Variable symbol	Test	Test at the level of variables		Test result
		Statistics value value	Probability level level	
DSRI	LLC	-127.947*	0.0000	Stable on the surface I(0)
	Fisher-ADF	720.916*	0.0000	
	Fisher-pp	1298.88*	0.0000	
GMI	LLC	-151.447*	0.0000	Stable on the surface I(0)
	Fisher-ADF	739.264*	0.0000	
	Fisher-pp	1325.85*	0.0000	
AQI	LLC	-170.404*	0.0000	Stable on the surface I(0)
	Fisher-ADF	668.928*	0.0000	
	Fisher-pp	1236.85*	0.0000	
SGI	LLC	-9.91077*	0.0000	Stable on the surface I(0)
	Fisher-ADF	568.129*	0.0000	
	Fisher-pp	988.964*	0.0000	
DEPI	LLC	-12.0237*	0.0000	Stable on the surface I(0)
	Fisher-ADF	585.518*	0.0000	
	Fisher-pp	1195.95*	0.0000	
SGAI	LLC	-23.6753*	0.0000	Stable on the surface I(0)
	Fisher-ADF	733.515*	0.0000	
	Fisher-pp	1447.62*	0.0000	
LEVI	LLC	-12.8419*	0.0000	Stable on the surface I(0)
	Fisher-ADF	618.098*	0.0000	
	Fisher-pp	1249.99*	0.0000	
TATAI	LLC	-12.2777*	0.0000	Stable on the surface I(0)
	Fisher-ADF	671.131*	0.0000	
	Fisher-pp	1337.37*	0.0000	

*Is significant at the 5% level

Source: Research Findings

According to table 2, all variables studied in this study, based on three tests, are at a stable level.

Before making the estimate, first, using the Beneish model, fraudulent financial reporting companies were identified and separated from non-fraudulent companies. In this study, the variables of Beneish model were calculated using financial statement information, and then Beneish score for 1610 companies-years was measured using the calculated variables. The measurement result showed that 500 companies of the year have a score of more than -1.78, and as a result, companies with fraudulent financial reporting and 1110 companies of the year have a score of less than -1.78, whereas companies with financial reporting were found to be non-fraudulent.

The results of estimating the research model by two-sentence logit method and using annual data from 2009 to 1397 of companies listed on the Tehran Stock Exchange are shown in table 3:

Table 3:   Model estimation results

Dependent variable: The virtual variable of fraudulent financial reporting					
Method: Logit binomial pattern					
Volume: 2009-2018					
Number of sections: 161 companies					
Total number of observations: 1610					
Variable symbol		Coefficient	standard error	Statistics value Z	Probability value
The explanatory variables	Constant	-20.42584*	1.644223	-12.42279	0.0000
	DSRI	6.696443*	0.451430	14.83384	0.0000
	GMI	3.335502*	0.271908	12.26703	0.0000
	AQI	2.701114*	0.226037	11.94990	0.0000
	SGI	6.010995*	0.526609	11.41452	0.0000
	DEPI	0.849257*	0.126110	6.734266	0.0000
	SGAI	-1.315193*	0.4152162	-3.167621	0.0015
	LEVI	-2.924618*	0.760282	-3.846752	0.0001
	TATAI	32.82708*	2.319555	14.15232	0.0000
Verification statistics or LR		1592.688	-	-	0.0000
McFadden detection coefficient or R^2		0.728996			

*Is significant at the 5% level

Source: Research Findings

M-Score-20.42584+6.696443 DSR I_{it} +3.335502 GMI$_{it}$ + 2.701114 AQI$_{it}$ + 6.010995 SGI$_{it}$+0.849257 DEPI_{it}-1.315193 SGAI_{it}-2.924618 LVGI_{it}+32.82708 TATAI$_{it}$+ ϵ_{it}

The results of model estimation show that the coefficients of the variables are all statistically valid. The probability value of the likelihood statistic or LR indicates that the null hypothesis that all coefficients of the independent variables are zero at the 95% confidence level is rejected and the total estimated regression is statistically valid.

With the R2 McFadden statistic, the value of which varies between zero and one, the fit of the model is well measured. The closer this index is to one, the more the model conforms to reality, in other words, the better the fit. The R2 suffix statistic in the estimated model is about 73%, which indicates that the independent and control variables in the model were able to explain 73% of the dependent variable changes.

According to table 3, the eight variables used, in specifying the model, are significant at the 95% confidence level. Among the independent variables, 6 indices of receivables from day's sales in receivable index (DSRI), gross margin index (GMI), asset quality index (AQI), sales growth index (SGI), depreciation index (DEPI) and total accrual to total assets index (TATAI), have a direct and significant effect on fraudulent financial reporting, but two indices of sales, general, and administrative expenses index (SGAI) and leverage index (LEVI) have a significant inverse effect on fraudulent financial reporting (FFR).

5. Conclusions and suggestions

Beneish (1999) developed a model based on eight financial variables that identifies companies involved in fraudulent financial reporting and sound companies with 76% accuracy. In this research, using the logit approach, the coefficient of variables in the day's sales in receivable 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 (LEVI), and total accrual to total assets index (TATAI) was estimated.

The proposed model, based on the Logit approach, with 73% overall accuracy, was able to identify the number of companies involved in fraudulent financial reporting. This study has one main hypothesis and 8 sub-hypotheses in that the sub-hypotheses have been developed in line with the main hypothesis and based on the results of statistical tests, the eight variables used are significant at 95% confidence level.

The fixed value (width from origin) of this model is -20.42584 for which out of 8 variables studied, 2 indicators of sales, general, and administrative expenses index (SGAI) and leverage index (LEVI) have a significant inverse effect on fraudulent financial reporting, and others have a positive and significant effect on fraudulent financial reporting.

The extracted model of this research, along with other criteria for detecting manipulation of financial statements, can be used for Iranian capital market research. In general, the results of this study are similar to those of studies such as Kusumasanthi et al. (2018), Reposis (2016), Aris et al. (2015) and Rahimiyan and Haji Heydari (2015) and in terms of segregation of fraudulent and healthy companies, it is different from the study of Asgari Alouj et al. (2018). It is suggested that in future research, the proposed model be developed by adding non-financial variables, in addition to financial variables, and other criteria that affect fraudulent financial reporting, as well as non-statistical methods, such as company size, number of shareholders, composition of board members in terms of duty and non-duty, growth opportunities, number of times the base volume is filled, free float, artificial intelligence techniques such as genetic algorithm, bird algorithm or learning methods of neural network, and considering that with the advancement of technology, deceiving methods also change, so new deceiving methods are reviewed and compared with the results of this research and new methods to predict and detect financial reporting fraud.

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