

# Application of F-Score in Predicting Fraud, Errors: Experimental Research in Vietnam

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## Abstract

This study investigated the situation of frauds and errors on the financial statements of listed companies on the Ho Chi Minh Stock Exchange. Base on the research model by Dechow, Ge, & Sloan (2011), the authors added a variable is the rate of return on assets (ROA). The research data included 214 enterprises from 2014 to 2016, with 624 observations. The study results showed that three variables including accrual accounting (Rsstacc), accounts receivable customers (Chrec), percentage of asset liquidity (Softasset) have affected positively to the possibility of fraud, errors on the financial statements. In addition, the ratio of return on assets (ROA) is variable in the model also has significant influence and statistics. The ability to forecast fraud, errors in the financial statements of this model is 78.21%.

**Keywords:** fraud, errors, financial statements, F-score, predictability

## 1. Introduction

In the market economy, information, especially financial information plays a very important role in making business decisions. Deviation and asymmetry of information lead to mistakes in decision-making, causing great damage to the object using information. Therefore, transparency, the honesty of financial information is always the top concern of managers, investors, credit institutions and other stakeholders. Detecting fraud, errors in information disclosure in the financial statements has always been a difficult problem and never could find an answer accurate even for auditors and related parties. In particular, the level of fraud and error is increasing in very sophisticated ways, as evidenced by a series of cases involving major business scams, frauds in accounting books the world is exposed. For example, the bankruptcy of the Enron Corporation in late 2001 has created a big shock to the US economy. In Vietnam, in recent years there have been many fraudulent reports on financial statements. The most recent mention may be that a series of serious violations of the petroleum business enterprises were found by State audit. These are great challenges not only for the whole society but also for the auditors in detecting frauds, errors on the financial statement. Fraudulent errors on the financial statements a topic that attracts a lot of relevant research. Previous research has focused on whether financial information, non-financial information of listed companies on the stock market can be used to predict fraud, errors on the financial statement. Other studies focus on analyzing factors that help identify fraudulent risks, information errors in the financial statements. Therefore, the study of methods for forecasting fraudulent risks on financial statements is very meaningful. The companies often provide audited financial statements to ensure that the information on the financial statements is true and fair and is certified by a qualified third party. However, this method revealed a major obstacle to investors, the concerned parties or individuals who have an interest in the enterprise's financial statements. Because these methods are very difficult for investors, third parties to approach and in addition require a lot of judgment that even the auditors have difficulty.

The earliest studies on fraud detection in financial reporting were studies using accrual adjustment model (DeAngelo, 1986; Friedlan, 1994; Jones, 1991; M. D. Beneish, 1999 and Dechow et al., 2011) have used statistical techniques to identify violations of financial statements appear and widespread which resulted in high accuracy. In Vietnam, there have been some related studies (Tran T. Gi et al., 2015; Tran T. D. Tram, 2015 and Nguyen N. H. Tran, 2016) to predict the possibility of significant errors due to fraud, error on the financial statements of companies listed on the stock market. However, the limitations of these studies are that the sample size is so small that it can not represent the whole of the companies listed on the Vietnam stock market. At the same time, these studies use regression method not yet appropriate, so the results of the model estimation will not be effective, which will reduce the accuracy of the forecasting process. The purpose of this study is to examine the effectiveness of the model of Dechow et al. (2011) for the Vietnamese stock market. From which the authors suggest a useful tool can be used to detect fraud, errors in the financial statements. The results of this research will help investors choose the right investment portfolio and maximize their investment returns. This study also helps lenders make the right loan decision.

At the same time, this research will help managers and policymakers better look at businesses and solutions to reduce or eliminate fraudulent businesses to protect investors and the stock market in Vietnam.

## **2. Theoretical Background**

### *2.1 Some Concepts*

Fraud is a key factor in verifying the authenticity of accounting information and financial performance. Violations include fraud and error. Cheating is intentional deception, concealment, distortion of the truth for the purpose of self-interest. Errors are unintentional errors, often interpreted as misleading omissions or weaknesses in the ability to cause errors. According to VAS 240, errors on financial statements may arise from fraud or error. To distinguish between fraud and errors, consider the behavior leads to errors on the financial statements is intentional or unintentional. Cheating is an act of deliberate conduct by one or more persons on the board of directors, employees or a third party to commit fraudulent or illegal gain.

Thus, fraud and errors are misconduct; in the field of accounting and finance, these behaviors cause misleading information, reflecting false facts. However, two different behaviors in terms of awareness and the level of significance of violations. On the face of consciousness, errors are involuntary behaviors, the cause of errors may be due to limited capacity or neglect in the work; while cheating is deliberate behavior, deliberately causing another violation to profit. From the differences in consciousness, cheating is very sophisticated and difficult to detect, while errors are easy to detect.

The audit difference is the difference of figures in the audited financial statements compared to the audited financial statements. In other words, it is the deviation of the information on the financial statements that the auditor discovers and corrects. A sufficiently reliable financial statement is a financial statement that contains quality information, non-critical errors, that may represent the financial condition of the business, trusted by the user. The cause of the disparities audit is due to fraud or error in the preparation and presentation of financial statements.

### *2.2 Theoretical Basis for Misconduct on the Financial Statements*

#### **Mandate Theory**

Theory of mandate refers to the relationship between the owners of the business capital and another party is the operator who represents the implementation of business decisions. According to Jensen & Meckling (1976), the distinction between ownership and corporate governance what raises the risks of making the performance not at optimal levels, causing damage to investors. Besides, the operator can make decisions aimed at maximizing their personal interests instead of maximizing corporate value. The manager's self-interest behavior also includes using some of the company's resources in the form of benefits and avoiding risk, meaning that risk-averse operators refuse opportunities. profitable investment for the owner. Meanwhile, owners want to maximize their benefits by increasing the value of the enterprise.

Conflicts personal interests or interests of the two entities is one of the reasons that the operator may perform acts of fraud, errors on the financial statements.

### **The Fraud Triangle**

Cressey (1953) focused on fraudulent analysis from embezzlement side through a survey of more than 200 economic crime cases. He introduced a fraud triangle that identifies the factors that lead to fraud. This triangular fraud model is widely used in fraudulent research and risk assessments in a wide variety of industries, including an audit. According to this model, fraud usually arises when converging three conditions: pressure/motivation, opportunity, attitude/personality.

+ Pressure/engine: Fraud occurs when an employee or an executive or organization to bear a certain pressure. Pressure can be financial losses, economic difficulties, or disagreements in the relationship between employer and employee.

+ Opportunity: When someone has been pressured or has an incentive if he or she has a chance, the fraudulent behavior will be taken.

+ Attitude / Personality: According to this study, fraud is made or not depending on the attitude and personality of each individual. There are people who are under pressure and have the opportunity to commit fraud but they still do not and vice versa.

### **Fraud scale theory**

Albrecht, W. S., Romney, et al., (1986) conducted a study to identify the most important signs of fraud to enable managers to detect and prevent early detection. This study analyzed 212 cases of fraud in the 1980s by using a questionnaire survey. This research set of variables what related to fraud and build a list of 50 red warning signs of fraud. Based on this result, the fraud scale model is composed of three factors: the situation creates pressure, captures opportunity and personal honesty. Under this model, when circumstances create pressure along with the high chance of fraud and low personal honesty, the risk of fraud is very high and vice versa when circumstances create pressure, opportunity to implement low fraud with the highest integrity, the risk of fraud is low. Situations that create pressure may involve financial reasons, opportunities for fraudulent practices that may be personal or due to weaknesses in the internal control system.

## **3. Research Overview**

### *3.1 The Model of Fraud Detection on Financial Statements*

#### **+ M-score model**

This model was developed by M. D. Beneish (1999) and has created an effective method in risk prevention to help auditors, investors identify an enterprise capable of cheating or not? It assumes that any operation on the financial statement is made through the increase of profit. The indicators selected in this model focused on two groups: fraudulent identification variables fraudulent and variables to identify fraudulent motives. They include indicators of leverage, the index of inventories, index periodically collect, index of gross profit, indicators of asset

quality, indicators and revenue growth, the index amortization, management costs. The results show that there is a statistically significant relationship between the probability of fraud and the variables on the financial statements. In this study, the author used a sample of 74 profitable businesses that were dominated by the 1982-1992 period, which indicated that the M-score of a business greater than -2.22 was a sign of dominant behavior profit.

#### **+ Z-score model**

This model was developed by Altman (1968) to predict the possibility of a business going bankrupt in the next two years, as well as a tool to examine the financial health of a business. There have been a number of fraud studies, such as Loebbecke et al., (1989), Persons (1995) and Summers & Sweeney (1998), suggest that financial exhaustion is one of motivating factors which promote fraudulent behavior on financial statements. His research collected a sample of 66 firms divided into two groups: the bankruptcy group consists of businesses that have filed for bankruptcy and the counterpart is the same industry with the same size. He collected 22 variables representing five groups of indicators of liquidity, profitability index, leverage index, liquidity ratio and performance indicators. Then, Z-score was Altman adjust to change some characteristics in 1993, this new model has accurately predicted 66% of businesses go bankrupt and 78% of businesses do not go bankrupt before a year.

#### **+ P-score model**

It was developed by Igor Pustylnick (2011) is based on the Z-score model. The P-score model has the same formula as Z-score but instead of using net income and working capital, in this model used revenue and equity. This study was based on 29 businesses with a history of fraud. In general, the new model of Igor Pustylnick has made changes that are more suited to reality. From the results of the study in 1998, more than 50% of fraud cases based on time of revenue recognition and property fraud, the author dynamically changed the indexes in the Z-score model to increase effectively detect fraud on the financial statements. However, his research is mainly focused on analyzing trends in volatility, which require data to be collected over many years of observation. This is also a limitation of this research model because collecting old data over a long period of time is quite difficult. Besides, the sample size is relatively small only 29 samples, cannot cover much.

### *3.2 F-Score Model*

This model was carried out by Dechow et al., (2011) with the objective to determine the probability of detecting and forecasting material misstatements in the financial statements. The output is an indicator of the probability of financial reporting having material misstatements. This indicator is named F-score, which is calculated with 3 models corresponding to 3 levels. At the same time, the pioneering research in the world in the field of forecasting potentially fraudulent financial statements as works of MD Beneish (1999), Richardson (2005), Skousen, et al., (2008) as well as a foundation for this study. There are three major objectives that the author towards the implementation of research works on the F-score index:

First, they want to build a database of comprehensive, covering all 2,190 companies have alleged misstatement on the financial statements published by the SEC through the AAERs from 1982 to 2005. This study has a much larger sample size than previous studies.

- Second, based on the model of M. D. Beneish (1999), the authors developed and expanded the relevant factors capable of predicting the risk of material misstatement. In addition, the authors further analyzed the groups of variables that represent off-balance sheet, non-financial, and variable data of the stock market.

- Finally, the authors developed a logistic regression model predicting details risks of material misstatement that the output is called F-score with 3 models. The differences between the models are incremental requirements for the data, and also indicate the type I and II error costs that users of these forecasting models will likely encounter. In total, 28 variables representing the five factors were tested for their ability to distinguish between firms reporting misstatements and not misrepresentation. These five factors are cumulative quality, operational efficiency, off-balance sheet activities, non-financial operations, and stock market data.

The correct prediction rate of companies which had misrepresented financial statements of F-score I was 65.59%, F-score II was 64.97% 2 and F-score III was 62.98%. Then, the authors continue to study more about the groups of variables and formulas for calculating these variables in order to further improve the model's predictive ability. They continually reinforce this model in the period of 2007 - 2011 with the predicted results of the model is increasingly improved.

A sample of research was used to build the model of error forecast on the financial statement with 3 different levels. The baseline model examines the relationship between misconduct and the elements of the financial statements including accrual accounting (Rest-acc), change in accounts receivable(Chrec), change in inventories (Chinv), assets average liquidity (Softassets), changes in cash sales (Chcs), changes in return on assets (Chroa) and stock issuance in the year (Issue).

$$\text{Model 1: } \text{MISSATEMENT} = -7.893 + 0.790R_{sst-acc} + 2.518Ch_{rec} + 1.191Ch_{inv} + 1.979Soft_{assets} + 0.171Ch_{cs} - 0.932Ch_{roa} + 1.092Issue + \varepsilon.$$

Next, the authors developed the initial prediction model by adding non-financial information measurement variables (variable number of employees) and activity measurement variables off-balance sheet (variable rental activity).

$$\text{Model 2: } \text{MISSTATEMENT} = -8.252 + 0.665R_{sst-acc} + 2.457Ch_{rec} + 1.393Ch_{inv} + 2.011Soft_{assets} + 0.159Ch_{cs} - 1.029Ch_{roa} + 0.983Issue - 0.15Cha_{emp} + 0.419Leas_{edum} + \varepsilon.$$

$$\text{Model 3: } \text{MISSTATEMENT} = -7.966 + 0.909R_{sst-acc} + 1.731Ch_{rec} + 1.447Ch_{inv} + 2.265Soft_{assets} + 0.160Ch_{cs} - 1.455Ch_{roa} + 0.653Issue - 0.121Cha_{emp} + 0.345Leas_{edum} + 0.082R_{ett} + 0.098R_{ett-1} + \varepsilon.$$

The calculated value is converted to a probability as follows:

$$P\text{-value} = e(\text{VALUE}) / (1 + e(\text{VALUE}))$$

Then this probability is divided by the unconditional probability of the critical error, it is computed by the number of companies with material errors divided by the total number of companies in the sample ( $494 / (132,967 + 494) = 0.0037$ ), to obtain the F-score. Note that the sample is collected by the authors for a long time so this sample can be considered comprehensive, close to the overall reality.  $F\text{-score} = P / 0.0037$ , with an F-score of 1.00 indicates that firms have the same level of unconditional probability of critical error (probability of significant error in random selection a firm in the whole). F-score greater than 1 indicates the higher probability of critical error. F-score users can decide the threshold for classification based on their relative costs for type I and type II errors. Type I error is a misclassification of companies without material misstatement to material misstatement. Type II error is a misclassification of companies with material misstatements to no material misstatement. Costs for these two types of errors are also different, type II error is more expensive than type I error.

For example, in the case of Enron, the F-score in 2000 was calculated according to the model 1 as follows:

$$\text{Value} = -7.893 + 0.790 \times (0.01659) + 2.518 \times (0.17641) + 1.191 \times (0.00718) + 1.979 \times (0.79975) + 0.171 \times (1.33335) - 0.932 \times (-0.01285) + 1.029 \times (1)$$

$$\text{Value} = -4.575$$

$$P\text{-value} = e^{-4.575} / (1 + e^{-4.575})$$

$$P\text{-value} = 0.01020$$

$$F\text{-score} = 0.01020 / 0.0037$$

$$F\text{-score of Enron} = 2.76$$

Table 1. Classification of risk of material misstatement corresponds to F-score levels (Note 1)

Threshold value (cut-off)	Evaluating
F-score > 2.45	Very high risk
F-score > 1.85	High risk
F-score $\geq$ 1	Risk above normal level
F-score < 1	The risk is normal or below no



## 4. Model and Methodology

### 4.1 Research Hypothesis

#### *Accrual accounting (Rsst-acc)*

According to accounting standards, accounting is recorded based on the accrual principle, which means accrual accounting is recognized at the time the economic transaction arises. Therefore, data on income statement including accounting estimates are governed by the judgment of managers. Meanwhile, cash flow statement is prepared on a cash flow basis. Therefore, there will be a difference between profit on the income statement and net cash flow from operating activities on cash flow statement. Thus, in many studies, the sum of the accrual variables can be calculated as:

Total Accruals = Profit after tax - net cash flows from operating activities

Total accrual accounting variables consist of two parts: discretionary accruals (DA), and non-discretionary Accruals (NDA). NDA is determined primarily by the characteristics of the business operations of the business, so-called reasonable accrual variable. By contrast, variable DA may be dominated and depend on the purpose of the management, so-called unreasonable accrual variable. According to research results of M. Beneish (1997) have demonstrated that the sum of accrual accounting divided by total assets is useful in identifying businesses with violations of GAAP, especially for businesses that are actively using the deductions to adjust profits. Francis & Krishnan (1999) pointed out that the analysis of the accrual methods would provide a comprehensive, in-depth view of the rationalization of financial statement by executives. This suggests that accrual accounting is indeed linked to misconduct on the financial statements. Since then, the authors build hypothesis:

*Hypothesis H1: Accrual accounting is positive and statistically significant with fraud, errors on financial statements.*

#### *Inventories (Chinv)*

In addition to using the Rsstacc variable to measure the quality of accrual accounting, Dechow et al., (2011) also rely on two items of receivables and inventory to assess the quality of accruals. Previous studies have concluded that accruals based on subjective estimates relating to these two items are used by managers to influence the financial statements. Accounting standard allows managers to choose the method of inventory pricing. Accounting standards allow managers to choose the method of inventory pricing.

Each method of calculating the different inventory prices will affect the value of inventory at the end of the period, the cost of goods sold and affect the profit in the period. This means that managers can fully profit adjusted as desired through the choice of calculation methods for inventories. In addition, according to the accounting standard, inventories must be recorded lower than the original cost and net realizable value. When the value of the net realizable value is lower than the original requires inventories should be provision for discounts. The provision for inventory devaluation of purely judged so managers often manipulated to adjust the desired profit. Loebbecke et al., (1989) pointed out that more than three-quarters of cases of violation



of The US Securities and Exchange Commission is involved in these two accounts. These statements are also consistent with findings of Persons (1995) and Summers & Sweeney (1998). The commonality of these studies was agreed that fraud is manipulated on inventories, such as inventories that are higher than cost or market value, or incorrect value. Inventory is out of date, damaged.

*Hypothesis H2: Changes in inventories positively and significantly with fraud, errors on the financial statements.*

#### ***Accounts receivable (Chrec)***

Similar to inventories, receivables are stated at a net realizable value in accordance with the accounting standards. This means that for receivables that are overdue, they should be estimated for provision. The firms can fully manipulate the debt age of customers to adjust the provisions to change the profit. For example, the study by Loebbecke et al., (1989) also found out that accounts receivable and inventory accounts related to the majority of samples with cheating have been studied. This conclusion is entirely correct to study by Feroz, Park, & Pastena, (1991). From there, the authors establish the hypothesis:

*Hypothesis H3: Changes in receivables are positive and statistically significant with fraud, errors on financial statements.*

#### ***Percentage of the soft asset is defined as the total assets (Softasset)***

Percentage of the soft asset is defined as the total assets on the balance sheet that does not include cash and the residual value of long-term tangible assets (tangible fixed assets, finance lease fixed assets, construction in progress, investment property) and land use rights. The study by Barton & Simko (2002) provides evidence to conclude that firms with high net operating assets, managers will have more accounting tips to perform the adjusted profit in the short term. The collapse of Worldcom related to billions of dollars in operating costs capitalized for this demonstration. In addition, the selection of a depreciation method will also impact on the expenses accrued expenses related. From there, the authors establish the hypothesis:

*Hypothesis H4: Assets with average liquidity are positive and statistically significant with fraud, errors on financial statements.*

#### ***The change in cash revenue (Chcs)***

Enterprises will try to stimulate demand by loosening the policy of selling businesses, such as changes in limits, payment terms, discount rates. Whether enterprise has sales agreements with related parties, or revenue recognition when not satisfy the conditions of revenue recognition under the provisions. These operations will help to increase capital in the short run, create a growing illusion of business and will inevitably lead to risks later. On that basis, the authors formulates a hypothesis:

*Hypothesis H5: The change in sales revenue in cash have positively and significantly with fraud, errors in the financial statements.*

#### ***Change rate of return on assets (Chroa)***

The rate of return on assets is an indicator which is used to measure the effectiveness of the use of assets. In other words, ROA will help investors to know the return that they will receive from the amount of capital or assets. ROA helps to assess the management capabilities of the managers, thereby affecting the value that they will receive. Therefore, this indicator will affect the deliberate behavior of errors caused by managers. The study by Summers & Sweeney (1998) pointed out that there was a significant difference between fraudulent and non-fraudulent businesses. This conclusion was again demonstrated in the study by Skousen et al., (2008). Because ROA increased mean business is improving so reduced pressure to do acts of errors. Based on this argument, the authors suggest:

*Hypothesis H6: The change rate of return on assets have negative and significantly with fraud, errors on financial statements.*

#### ***Issue additional shares (issue)***

Issuance of additional shares is one of the forms of financing for businesses. However, the question is that there are many channels for a firm to find financing sources such as bank loans, bond issues, stocks. Why does a business with erroneous behavior tend to issue more shares? One of the obvious motive for behavioral errors on the financial statements of the enterprise in order to maintain a high stock price. If a company needs money to maintain the operation, high share prices will help reduce the cost of raising new equity. Also high book value, high stock prices will also reduce the cost of issuing new shares. This is one-way that companies try to make better financial statements through erroneous behavior with the aim of raising stock prices in the market. And over the years have made a mistake, shares were issued more than other years. In addition, according to the pecking order theory, when a business needs capital to finance its operations, the order of financing will be the use of retained earnings. for shareholders, then to borrow and finally to issue shares. The theory is that a business "zealously" issued more shares demonstrates that the business has done well report to find more sources of capital. Research by Dechow et al., (2011) using variable issuance of additional shares to forecast the behavior of errors in the financial statements. Issue variable has value 1 if the enterprise issues share in the year and in contrast with value 0. On that basis, the authors formulates a hypothesis:

*Hypothesis H7: Issuance of additional shares have negative and significantly with fraud, errors on financial statements.*

#### ***4.2 Research Models***

Based on previous research overview and research model by Dechow et al., (2011), the authors use 2 quantitative models to forecast and detect fraud, errors in the financial statements as follows:

##### **Research model 1:**

This model consists of 7 independent variables: Rstacc, Chrec, Chinv, Softassets, Chcs, Chroa and Issue.

$$\begin{aligned} \ln[\text{Prob}(M=1)/(1-\text{Prob}(M=1))] = & \beta_0 + \beta_1 \text{Rsst-acc} + \beta_2 \text{Chrec} + \beta_3 \text{Chinv} + \beta_4 \text{Softassets} + \\ & \beta_5 \text{Chcs} + \beta_6 \text{Chroa} + \beta_7 \text{Issue} + \varepsilon \end{aligned} \quad (1)$$

The variables are measured as follows:

$\text{Rsstacc} = (\Delta \text{WC} + \Delta \text{NCO} + \Delta \text{FIN}) / \text{Average total assets};$

$\text{WC} = [\text{Short-term assets} - \text{Cash and short-term investments}] - [\text{Short-term liabilities} - \text{Current liabilities}];$

$\text{NCO} = [\text{Total Assets} - \text{Short-term Assets} - \text{Investments and Advances}] - [\text{Total Liabilities} - \text{Short-term liabilities} - \text{Long-term liabilities}];$

$\text{FIN} = [\text{Short-term investments} + \text{Long-term investments}] - [\text{Long-term debt} + \text{Debt within short-term debt} + \text{preferred shares}] \text{ (Note 2).}$

$\text{Chrec} = \Delta \text{Accounts receivable} / \text{Average total assets}$

$\text{Chinv} = \Delta \text{Inventory} / \text{Average total assets}$

$\text{Softassets} = [\text{Total Assets} - \text{Tangible fixed assets} - \text{Cash and cash equivalents}] / \text{Total assets.}$

$\text{Chcs} = [\text{Revenue} - \Delta \text{Receivables}]$

$\text{Chroa} = [\text{Net profit (t)} / \text{Average total assets (t)}] - [\text{Net profit (t-1)} / \text{total average assets (t-1)}]$

$\text{Issue} =$  An indicator variable, coded 1 if the company issuing the stock in year t, the opposite is 0.

### Research model 2:

In this model, the authors added 3 variables in research model 1: The rate of return on assets (ROA), the size of enterprises by revenue (Size) and Financial Leverage (LV).

$$\begin{aligned} \ln[\text{Prob}(M=1)/(1-\text{Prob}(M=1))] = & \beta_0 + \beta_1 \text{Rsstacc} + \beta_2 \text{Chrec} + \beta_3 \text{Chinv} + \beta_4 \text{Softassets} + \\ & \beta_5 \text{Chcs} + \beta_6 \text{Chroa} + \beta_7 \text{Issue} + \beta_8 \text{Roa} + \varepsilon \end{aligned} \quad (2)$$

The addition of one variable in research model 2 above to assess the impact of these factors on the ability to identify fraud, errors in the financial statements. Similarly based on the study by Skousen et al., (2008), the authors establish the hypothesis:

*Hypothesis H8: The rate of return on assets (ROA) has an egative relationship and statistically significant with fraud, errors in the financial statements.*

### 4.3 Research Data

To conduct this study, the authors collected data of enterprises listed on the Ho Chi Minh City Stock Exchange in the period 2014 – 2016. As of 2014, there are 306 enterprises, after eliminating financial businesses, the remaining 289 enterprises. Among the businesses was collected, only 214 enterprises have sufficient information to determine the variation in the period 2014-2016. Data was collected from financial statements, the financial consolidated

statements of Q4 in 2014, 2015, 2016 which have not been audited and the financial statement consolidation in 2013, 2014, 2015 and 2016 which was audited. On that basis, the authors collected data on profit after tax and indicators on the financial statements, the financial consolidated statements before and after the audit; and define dependent variables, independent variables, control variables. Then, this research uses STATA software to perform descriptive statistics, regression analysis, forecast analysis, which reflects the trend and level of impact, the impact of each factor on fraud, errors on the financial statements.

The dependent variable is the change in the profit after tax which is calculated as follows:

$$\text{Change in profit after tax} = \frac{\text{Profit after audit} - \text{Profit before audit}}{\text{Profit before audit}} \times 100$$

From this formula, we see change the in profit after tax  $< 0$  means that pre-audit profit is greater than the profit after auditing, it shows a deviation can be to exaggerate profits of the business. Conversely, if the profit after tax  $> 0$  means that the firm can hide profit less than the actual. Under the provisions of Circular 155 (Ministry of Finance, 2015), enterprises have increased or reduce profits above 5% to make explanations. Therefore, in this study, the authors use the change in profit after tax to determine the difference that is considered significant when the change in profit after tax before and after the audit is above 5%.

#### *4.4 Data Analysis Method*

First, the authors determine the type of data, which used in this research is kind of panel data because the data was collected from companies during the three years from 2014 to 2016. The sequence of this study consists of the following steps:

+ Fundamental analyzes were first conducted for the purpose of screening the sample, to eliminate observations that were too large, too small, or too different from the sample size. This basic analysis helps to check the suitability of the sample before performing the logit regression analysis, to ensure the reliability of the quantitative results. Specifically, the authors will perform statistical analysis, correlation analysis to eliminate the phenomenon of multi-collinearity phenomenon between the independent variables.

+ The study will determine whether the independent variables statistically or not affect the dependent variable by examining the index of the multivariate regression model. Data used in this study include all information on financial statements of listed companies on HOSE for three years from 2014 to 2016. The purpose of this study is to identify the independent variables that have a statistically significant relationship to the dependent variable, and thereby to provide appropriate policies that are effective in predicting fraud, errors on the financial statements.

+ Regression model will be rebuilt based on the entire sample data for 3 years from 2014 to 2016, the independent variables do not have a relationship significantly with the dependent

variable (accredited in step above) will be discarded in order to accurately determine the forecasting factors in the model.

## 5. Results and Discussion

### 5.1 Research Results

According to Table 2, there are 151 observations with financial statements that have a material misstatement (Change in profit after tax is over 5%), accounting for 23.5%. The rate of fraud, material misstatement between the years is different, in 2014 only 18.2%, but in 2015 is 26.6% and in 2016 is 25.7%.

Table 2. Change in profit after tax at the misstatement level

Content	2014		2015		2016		Total	
	Quantity	Percentage (%)	Quantity	Percentage (%)	Quantity	Percentage (%)	Quantity	Percentage (%)
No misstatement	175	81.8%	157	73.4%	159	74.3%	491	76.5%
Misstatement	39	18.2%	57	26.6%	55	25.7%	151	23.5%
<b>Total</b>	<b>214</b>	<b>100%</b>	<b>214</b>	<b>100%</b>	<b>214</b>	<b>100%</b>	<b>642</b>	<b>100%</b>

Source: Own edition and calculations

Table 3 show that the rate of financial statements with fraudulent, the errors are at the misstatement level of 23.5% and the indicators of Rsst-acc, Chrec, ChinV, Softassets, Chcs, Chroa are greater than 0. In the three years, the ratio of companies issuing shares is 19.3%, the ratio of profit after tax on assets is 7%.

Table 3. Descriptive analysis

Variables	Number of observations	Mean	Standard deviation	Minimum value	Maximum value
MISS	642	0.235	0.424	0	1
Rsstacc	642	0.034	0.197	-0.868	1.222
Chrec	642	0.030	0.099	-0.408	0.695
Chinv	642	0.015	0.114	-0.728	0.686
Softassets	642	0.679	0.215	0.051	0.996
Chcs	642	0.073	4.878	-24.743	91.931
Chroa	642	0.003	0.097	-1.086	1.156
Issue	642	0.193	0.395	0	1
Roa	642	0.070	0.100	-0.544	1.088

Source: Data from Ho Chi Minh City Stock Exchange and own calculations

Table 4. Autocorrelation matrix

	MISS	Rsstacc	Chrec	Chinv	Softassets	Chcs	Chroa	Issue	Roa
<b>MISS</b>	1								
<b>Rsstacc</b>	0.0081	1							
<b>Chrec</b>	0.0576	-0.1745*	1						
<b>Chinv</b>	-0.0466	-0.2622*	0.0471	1					
<b>Softassets</b>	0.1770*	-0.0588	0.2000*	0.0703	1				
<b>Chcs</b>	-0.0725	-0.033	0.0401	0.1605*	-0.0335	1			
<b>Chroa</b>	-0.0694	0.1218*	0.0663	0.1047*	0.0069	-0.0371	1		
<b>Issue</b>	0.045	0.1699*	0.1834*	0.0786*	0.0398	0.003	-0.0048	1	
<b>Roa</b>	-0.2366*	0.2580*	0.0763	0.0900*	-0.1654*	-0.0004	0.4860*	0.0007	1

Source: Data from Ho Chi Minh City Stock Exchange and own calculations

Table 5. Results of regression model 1

	VIF	OLS	REM	FEM	PA
Rsstacc	<b>1.21</b>	0.191 [0.38]	0.69 [1.10]	<b>1.660**</b> [2.26]	0.566 [1.22]
Chrec	<b>1.14</b>	0.722 [0.75]	0.213 [0.19]	-0.112 [-0.09]	0.185 [0.19]
Chinv	<b>1.16</b>	-0.668 [-0.78]	-0.669 [-0.64]	-0.00968 [-0.01]	-0.429 [-0.46]
Softassets	<b>1.08</b>	<b>2.133***</b> [4.03]	<b>2.453***</b> [3.38]	-2.149 [-1.05]	<b>1.992***</b> [2.84]
Chcs	<b>1.04</b>	-0.0437 [-1.54]	-0.0375 [-1.06]	0.00637 [0.16]	-0.0253 [-1.11]
Chroa	<b>1.06</b>	<b>-1.924*</b> [-1.66]	-2.122 [-1.61]	-1.59 [-1.24]	-1.741 [-1.26]
Issue	<b>1.11</b>	0.215 [0.88]	0.315 [0.99]	0.485 [1.05]	0.243 [1.09]
_cons		-2.758*** [-6.96]	-3.363*** [-6.03]		-2.660*** [-5.07]
N		642	642	261	642

t statistics in brackets \* p<0.1, \*\* p<0.05, \*\*\* p<0.01

Source: Data from Ho Chi Minh City Stock Exchange and own calculations

Table 4 shows the results of correlation coefficients between variables, the purpose of examining the close correlation between independent variables, control variables and dependent variables to eliminate factors that may lead to multi-collinearity phenomenon before running the regression model. The correlation coefficient between the independent variables in the model does not have any pair greater than 0.8, so it is less likely to occur multi-collinearity phenomenon between independent variables.

With panel data, the authors assume that each entity has its unique characteristics can influence the explanatory variables but those factors are not observable. The consideration for whether or not these factors will be achieved with the two models is the random-effects regression model (REM), the fixed-effects regression model (FEM). Besides logit model with fixed effects and random, this research also uses PA models to estimate in case of a data exist which have the correlation structure in the group of panel data (Logit PA).

Table 5 shows the regression results of the factors with fraudulent behavior and errors on the financial statement by 4 regression models. From the analysis of the results of the four models above, PA Logit model is for the most reliable results, because this model has overcome the limitations of the other 3 models. However, to ensure more accurate results, the authors will compare and compare the results of all four methods mentioned above. There are three independent variables, Rsstacc, Chrec and Softassets, which are statistically significant in at least one of the four models, the remaining variables were not statistically significant to be eliminated. In model 2, the authors add the control variable ROA, the regression results are presented in Table 6 under 4 regression models. The results show that control variable ROA is statistically significant in three of the four regression models. Then, the authors remove the independent variables that are not statistically significant and conducting statistical regression by Logit PA method with 3 independent variables is Rsstacc, Chrec, Softassets and control variable ROA. The results in Table 7 indicate that the three independent variables and control variables are statistically significant at 1% and 5% and the Chi-square test of the model is  $0.0005 < 0.05$ , indicating that the model has statistical significance.

Table 6. Results of regression model 2

	<b>VIF</b>	<b>OLS</b>	<b>REM</b>	<b>FEM</b>	<b>PA</b>
Rsstacc	<b>1.32</b>	1.623*** [2.76]	1.799*** [2.68]	1.653** [2.24]	<b>1.601***</b> [2.75]
Chrec	<b>1.17</b>	2.287** [2.20]	2.022* [1.69]	-0.096 [-0.07]	<b>2.022**</b> [1.98]
Chinv	<b>1.18</b>	0.653 [0.71]	0.421 [0.40]	-0.0161 [-0.01]	0.532 [0.58]
Softassets	<b>1.12</b>	1.165** [2.14]	1.391** [2.04]	-2.119 [-1.03]	<b>1.159**</b> [2.03]
Chcs	<b>1.04</b>	-0.0403 [-1.47]	-0.0356 [-1.11]	0.00671 [0.16]	-0.0348 [-1.30]



Chroa		0.562	1.09	-1.353	0.802
	<b>1.33</b>	[0.41]	[0.71]	[-0.50]	[0.58]
Issue		0.0848	0.151	0.489	0.109
	<b>1.11</b>	[0.33]	[0.49]	[1.06]	[0.42]
Roa		<b>-11.49***</b>	<b>-12.04***</b>	-0.381	<b>-11.08***</b>
	<b>1.57</b>	[-5.71]	[-5.11]	[-0.10]	[-5.37]
_cons		-1.553***	-1.909***		-1.561***
_cons		[-3.63]	[-3.49]		[-3.47]
N		642	642	261	642

t statistics in brackets \* p<0.1, \*\* p<0.05, \*\*\* p<0.01

Source: Data from Ho Chi Minh City Stock Exchange and own calculations

Table 7. Results of regression model 1 by PA method

Logistic regression	Number of					
	obs		=			642
	LR chi2(4)		=			73.02
	Prob > chi2		=			0
Log likelihood = -313.69038	Pseudo R2		=			0.1043
	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
Rsstacc	1.567	0.531	2.95	0.003	0.526	2.608
Chrec	2.219	0.996	2.23	0.026	0.267	4.170
Softassets	1.257	0.535	2.35	0.019	0.208	2.306
Roa	-11.148	1.925	-5.79	0.000	-14.920	-7.376
_cons	-1.599	0.421	-3.8	0.000	-2.424	-0.775

Source: Data from Ho Chi Minh City Stock Exchange and own calculations

Table 8. Prediction results of model 1 and model 2

	Model 1			Model 2			
	<i>1</i>	<i>0</i>	<i>Total</i>	<i>1</i>	<i>0</i>	<i>Total</i>	
<i>1</i>	4	1	5	16	12	28	
<i>0</i>	147	490	637	135	479	614	
<i>Total</i>	151	491	642	151	491	642	
The rate of correct prediction of fraud, errors				80.00%			57.14%
Rate of correct forecasts do not cheat, errors				76.92%			78.01%
The rate of average prediction of fraud, errors				76.95%			77.10%
Rate of type I error				20.00%			42.86%
Rate of type II error				23.08%			21.99%

Source: Data from Ho Chi Minh City Stock Exchange and own calculations

The final step will perform the study to test the ability to forecast errors of the selected factors in the model. It aims to answer to the last question of the study is: Can be based on the variables in the model by Dechow et al., (2011) to develop an effective model for predicting fraud, errors on financial statements in Vietnam?. The average of correct prediction in model 1 is 76.92% and in the model 2 is 77.10%.

### *5.2 Discuss the Research Results*

The results of the study show that the model of Dechow et al., (2011) is limited in empirical research in Vietnam. In the 7 variables of model 1, only the Softasset variable is statistically significant. Thus, the results of the study are consistent with the hypothesis H4, which is similar to the research by Barton & Simko (2002).

For model 2, when Roa variable is added in the model, it is statistically significant. The research results indicate that Roa has a negative relationship with the possibility of fraud, errors on the financial statements and the results of the study are consistent with the hypothesis H4. The results of this study are consistent with the results of the study by Summers & Sweeney (1998) and Skousen et al., (2008). At the same time, when adding the Roa, Rsstacc, and Chrec are statistically significant. Beside, Rsstacc is positively and statistically significant at 5% with fraud, errors on financial statements. It is consistent with the hypothesis H1 and the results of the study by M. Beneish (1997) and Francis & Krishnan (1999). Table 7 shows that Chrec is consistent with the H3 hypothesis, which is positive and statistically significant with the fraud and error on the financial statement. The results of this research are consistent with the study by Loebbecke et al., (1989) and Feroz et al., (1991). On the predictability of the two models, model 2 has better predictability than model 1. However, rate of type I error in model 1 and model 2 was significantly different at 20% and 42.86%.

## **6. Conclusions and Recommendations**

Fraud, errors on financial reporting are becoming increasingly popular in Vietnam, in which audits contribute an important part in limiting fraud and errors on the financial statements. Descriptive statistics above showed that 23.5% had profit after tax difference before and after critical audit. Using the model of Dechow et al., (2011) in determining the variables that affect fraud and error on financial statements in Vietnam is suitable, in which there are 3 variables: Rsstacc, Chrec, Softasset and ROA, which are statistically significant. Predictability of fraud, errors on the financial statements of the model is 77.10%.

Based on the results of the study, the authors propose some recommendations as follows:

To determine the pressure factors leading to fraud and errors, auditors may apply analytical and comparative indicators such as Rsstacc, Chrec, Softasset to detect abnormalities. On that basis, the auditors measure more closely examine the signs doubt.

- For investors, credit institutions when considering the truthfulness of the financial statements is not only based on comments in the audit report that investors can use F-score for review financial statements are likely to be fraudulent, errors? In fact, there are many cases where

enterprises have compromise with auditing companies to validate good financial statements for different purposes.

- The after-tax profit margin is partly due to the fraudulent intent of the financial report maker to create. It also has a small part due to subjective reasons such as poor professional accountability, lack of objective honesty, as well as the ability to observe, analyze and judge job. Therefore, to avoid cheating and errors on financial reports, it is necessary to improve the quality of accounting staff.

- Cheating, errors on the financial statement are often hidden and difficult to detect so The Securities and Exchange Commission and the Vietnam Association of Certified Public Accountants (VACPA) should intensify the inspection and handling of violations related to the transparency and truthfulness of financial statements of listed companies. The sanctioning need stricter and more dissuasive, and increase penalties for violations.

- Strengthening the supervision by issuing documents to enhance the role; clearly, define the responsibilities of the Vietnam Securities Commission and stock exchanges in the process of supervising the information disclosure of listed companies. As such, listed companies will have a responsibility and obligation to take seriously.

Although, this study provides evidence of the using the model by Dechow et al., (2011) in identifying factors affecting the fraud, errors on the financial statements as well as a good predictor of potentially fraudulent, errors for listed enterprises on the Ho Chi Minh City Stock Exchange. However, it also has some limitations because of it only certain identified a number of factors, so need some other studies. Firstly, research data is collected for the three years from 2014 to 2016 for listed enterprises on the Ho Chi Minh City Stock Exchange so the next studies should be extended for more years and for Hanoi Stock Exchange. Second, the addition of non-financial variables into the model, to increase the rate of correct prediction of fraud and error, reduce the rate of type I error, type II in the forecast process.

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### Notes

Note 1. Source: (*Dechow et al., 2011*)

Note 2. Source: (*Richardson et al., (2005)*)

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