

“Determining the impact of financial performance factors on bankruptcy risk: an empirical study of listed real estate companies in Vietnam”

AUTHORS

Van Cong Nguyen  <https://orcid.org/0000-0002-0400-7475>

Thi Nga Nguyen  <https://orcid.org/0000-0003-3147-771X>

Thi Tu Oanh Le  <https://orcid.org/0000-0002-2823-2204>

Trong Than Nguyen

ARTICLE INFO

Van Cong Nguyen, Thi Nga Nguyen, Thi Tu Oanh Le and Trong Than Nguyen (2019). Determining the impact of financial performance factors on bankruptcy risk: an empirical study of listed real estate companies in Vietnam. *Investment Management and Financial Innovations*, 16(3), 307-318.
doi:[10.21511/imfi.16\(3\).2019.27](https://doi.org/10.21511/imfi.16(3).2019.27)

DOI

[http://dx.doi.org/10.21511/imfi.16\(3\).2019.27](http://dx.doi.org/10.21511/imfi.16(3).2019.27)

RELEASED ON

Monday, 07 October 2019

RECEIVED ON

Wednesday, 07 August 2019

ACCEPTED ON

Friday, 27 September 2019

LICENSE



This work is licensed under a [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/)

JOURNAL

"Investment Management and Financial Innovations"

ISSN PRINT

1810-4967

ISSN ONLINE

1812-9358

PUBLISHER

LLC “Consulting Publishing Company “Business Perspectives”

FOUNDER

LLC “Consulting Publishing Company “Business Perspectives”



NUMBER OF REFERENCES

23



NUMBER OF FIGURES

2



NUMBER OF TABLES

7

© The author(s) 2026. This publication is an open access article.



BUSINESS PERSPECTIVES



LLC "CPC "Business Perspectives"
Hryhorii Skovoroda lane, 10,
Sumy, 40022, Ukraine

www.businessperspectives.org

Received on: 7th of August, 2019

Accepted on: 27th of September, 2019

© Van Cong Nguyen, Thi Nga
Nguyen, Thi Tu Oanh Le, Trong Than
Nguyen, 2019

Van Cong Nguyen, corresponding
author, Ph.D., Professor, School of
Accounting and Auditing, National
Economics University (NEU),
Vietnam.

Thi Nga Nguyen, Ph.D., Accounting
Department, University of Labor and
Social Affairs (ULSA), Vietnam.

Thi Tu Oanh Le, Ph.D., Accounting
Department, University of Labor and
Social Affairs (ULSA), Vietnam.

Trong Than Nguyen, Ph.D., Associate
Professor, Faculty of Graduate and
Postgraduate Studies, Academy of
Finance, Vietnam.



This is an Open Access article,
distributed under the terms of the
[Creative Commons Attribution 4.0
International license](https://creativecommons.org/licenses/by/4.0/), which permits
unrestricted re-use, distribution,
and reproduction in any medium,
provided the original work is properly
cited.

Van Cong Nguyen (Vietnam), Thi Nga Nguyen (Vietnam), Thi Tu Oanh Le (Vietnam),
Trong Than Nguyen (Vietnam)

DETERMINING THE IMPACT OF FINANCIAL PERFORMANCE FACTORS ON BANKRUPTCY RISK: AN EMPIRICAL STUDY OF LISTED REAL ESTATE COMPANIES IN VIETNAM

Abstract

The risk of bankruptcy is affected by many different factors. Therefore, identifying the groups of factors affecting bankruptcy risks, especially financial performance factors, are important and necessary. The study focused on the impact of financial performance on the bankruptcy risk of real estate companies listed on Vietnam's stock exchange. Research data were collected from 44 real estate companies listed on Vietnam's stock exchange from 2011 to 2017 with 308 observations. The study was conducted by the quantitative method based on the logistic regression model with the help of SPSS 25 specialized software. The research results show that Return on Assets (ROA), Return on Equity (ROE) and Total Asset Turnover (TAT) have significant reverse effects on bankruptcy risk, while Operating Profit Margin (OPM) is not a relevant factor. The accuracy rate of the overall predictive model is 90.9%. This study extends the scope of literature on the impact of financial performance on the bankruptcy risk of real estate companies. Moreover, this study offers the model of bankruptcy risk prediction of the listed real estate companies in Vietnam and recommends effective solutions to improve business efficiency, limit and prevent financial risks for listed real estate companies in Vietnam.

Keywords

bankruptcy risk, financial performance, Operating Profit Margin (OPM), Return on Equity (ROE), Return on Assets (ROA), TAT (Total Asset Turnover)

JEL Classification

G32, G33, L25

INTRODUCTION

Bankruptcy risk is a negative and unpleasant factor for any business. Once an enterprise goes bankrupt, it affects not only the company directly, but also many other related industries. This is particularly evident in industries that play an important role in the national economy like the real estate industry in Vietnam. Under the impact of the global crisis, the real estate market has become quiet, less vibrant; the number of sluggish goods caused the drop profit for a long time. The business operation of real estate companies has been facing many difficulties, leading to bankruptcy risks. According to VOV.VN (2018), in the first 7 months of 2018, the number of dissolved real estate businesses increased by 75% compared to the same period of 2017.

In order to prevent and mitigate the bankruptcy risk of real estate enterprises in general and listed companies in particular, apart from general management measures, the financial analysis should be conducted with the stress on financial performance analysis. Therefore,

investigating the impact of financial performance on the bankruptcy risk of the listed real estate companies in Vietnam is theoretically and practically imperative, which has attracted interest from a large number of managers and investors.

Using a quantitative research method to analyze the influence of financial performance factors on bankruptcy risk, financial data was collected from 44 listed real estate companies in Vietnam.

Authors believe that this research has met the full, representative and comprehensive aspects of the research sample, ensuring the reliability of research results for the following reasons:

First, the selected business sector is real estate. This is a business sector that requires large capital, long payback period and investment capital mainly from loans. The industry is also at high risk of bankruptcy.

Second, sampled objects are real estate companies listed on Vietnam's official stock exchanges (HOSE, HNX). These are large-scale companies and play a decisive role in the real estate market in Vietnam. Of 54 listed real estate companies on both exchanges, we selected 44 companies to survey (after eliminating companies with insufficient data or missing data). Sample rate accounts for 81.5%.

Third, companies are categorized into two groups based on the regression results: group 1 consists of 12 companies at risk of bankruptcy (the probability of occurrence of events through observation results has value of 1) and group 2 consists of 32 companies that are not at risk of bankruptcy (the probability of occurrence of the event through observation results with value of 0).

Fourth, about the research data. Authors use secondary data sources collected from different sections of financial statements of real estate companies listed on HNX, HOSE and Vietnam Securities Commission (Hanoi Stock Exchange, 2018; HoChiMinh Stock Exchange, 2018; State Securities Commission of Vietnam, 2018). This is a highly transparent, audited and publicly available dataset.

Finally, the study period is from 2011 to 2017. This is the period of real estate business in Vietnam from the bottom (2011–2013) to recovery (2013–2015) and growing (2015–2017).

1. AIM AND SCOPE

The main purpose of this study is to examine the impact of financial performance on bankruptcy risk of listed real estate companies. In order to achieve the research objectives, this study proposed a logit model that demonstrated the relationship between financial performance and the risk of bankruptcy. Furthermore, the study will examine the impact of ROA, ROE, TAT, OPM to the bankruptcy risk of listed real estate companies in Vietnam's stock exchange. Consequently, the study proposed some recommendations and solutions to improve financial performance and reduce the risk of bankruptcy of listed real estate companies in the stock exchange in Vietnam. The research questions are:

- 1) Is the probability of a bankruptcy risk affected by financial performance indicators?

- 2) How does the trend of these indicators affect the probability of bankruptcy?

From the results obtained, the study proposed some recommendations and solutions to improve financial performance and reduce the risk of bankruptcy of listed real estate companies in the stock exchange in Vietnam.

2. LITERATURE REVIEW

Bankruptcy risk is one of the issues, which have received substantial attention from many researchers worldwide. In particular, the indicators reflecting the operational financial performance of enterprises are always essential and statistically significant in research results. Many authors have studied bankruptcy risks such as Ohlson (1980),

Eljelly et al. (2001) and Bandyopadhyay (2006). They developed models of bankruptcy probability prediction. These authors all use logistic models with financial indicators such as net profit/total assets, after-tax profit/total assets, total debt on total assets, etc. Many authors study the relationship between financial index and bankruptcy risks (Fulmer et al., 1984; Altman et al., 2007) in which ROA, ROE, TAT were statistically significant in predicting the bankruptcy risk. Nguyen (2009) investigated and developed a credit rating model for Vietnamese enterprises in the transitional economy to provide a model in which ratios of profit before interest and taxes to total assets; profits after taxes to shareholders' equity are statistically significant. Hoang (2011) used seven indicators and a sample of 463 listed companies to provide a forecasting model in which asset turnover ratio (revenue to total assets), profit margin (net profits to revenue), ROA – Return on Assets (net income on total assets), ROE – Return on Equity (net income to shareholders' equity) are significant indicators. Beaver (1966) analyzed 30 financial ratios between bankrupt and non-bankrupt companies. Through analysis, Beaver (1966) pointed out that the three important indicators in determining financial crisis in a company are the total debt to total assets ratio, return on assets, and cash flow to total debt ratio. Ohlson (1980) used the logit model for financial ratios with a sample size of 2,163 companies, including 105 bankrupt companies and 2,058 non-bankrupt companies between 1970 and 1976. The results of the study showed that four statistically significant factors affecting the probability of bankruptcy in a year are: financial scale, financial structure (measured by the leverage ratio, which is total debt to total assets), performance (measured by return on assets ratio and operating cash flows to average total liabilities), current solvency (measured by net working capital to total assets ratio and current liabilities to current assets ratio). Kolar (2002) used the logit model to identify factors that caused the collapse of the US banking system from 1980 to 1990. He collected and analyzed samples of 55 major bankrupt banks and about 1,000 banks without major failures between 1989 and 1992. The study found that net profit/total assets, profit after tax/total assets, total equity/total assets and interest/net assets are statistically significant in determining breaks debt of the US banks.

According to Altman et al. (1968), Altman et al. (1977), Zhang et al. (2007) and Hoang (2011), financial performance is a very important factor that directly affects the risk of bankruptcy and is often considered through indicators of profitability and operational capacity. Indicators of profitability are used to evaluate the effectiveness of using the resources in making profits. It means when business gets more value or profits, it is more likely to pay off its debts and thus reduce the bankruptcy risk. Depending on the purpose and analytical materials, the profit used to determine profitability can be profit after taxes, profit before taxes and interest. In particular, profit after taxes is a commonly used indicator. When applying this indicator to analyze the real estate industry, it is possible to calculate the profitability of each specific resource element such as revenue, total average assets.

According to Tatsiana (2006), there are three levels of bankruptcy risk:

- primary level of risk (the risk is not high enough and valuable because managers are not ready to face risk events);
- estimated level of risk (the risk is analyzed and reduced to a lower level as managers have prepared for the occurrence of a risk event);
- final level of risk (measures to reduce risk are mainly built and implemented).

Gu (2002) argued that companies with high liabilities and low EBIT (Earnings Before Interest and Taxes) are less likely to survive and vice versa.

Altman et al. (2007) pointed out that companies in financial crisis are those subjected to special control when the following conditions occur: a company has negative cumulative incomes in two consecutive years, or the net asset value per share is lower than the book value, the company has negative income in one year and share capital in that year is lower than charter capital, or the company receives continuous notices of auditors. According to Altman et al. (1968), Altman et al. (1977), Altman et al. (2007) and Hoang (2011), financial performance is a very important factor that directly affects the risk of bankruptcy and is

often considered through indicators of profitability and operational capacity.

Beaver (1966) analyzed financial ratios between bankrupt and non-bankrupt companies. The results showed that the ratio of net income to total assets is one of three important indicators (total debt/total assets, net income/total assets and cash flow/total debt) in determining financial crisis of a company. Altman (1968) used Multiple Discriminant Analysis (MDA) to analyze 66 manufacturing companies (33 bankrupt companies and 33 non-bankrupt companies). The results showed that the forecasting model with a prediction accuracy of 96% can predict accurately up to two years before bankruptcy occurs with an accuracy of 83%. In this model, three indicators of financial performance, namely retained earnings to total assets, earnings before interest and taxes to total assets, revenue to total assets, are statistically significant. In addition to studies in the United States, Altman et al. (2007) conducted a study on predicting the financial risk of companies on China's stock exchange. The study provided a model for predicting the bankruptcy risk of Chinese companies with a distinction of 0.5 and ratios of net income to total assets, retained earnings to total assets are statistically significant. Fulmer et al. (1984) investigated a sample of 60 companies in the United States, which are divided into two groups of 30 failed companies and 30 successful companies. In this study, the model can identify companies one year before failing with an accuracy of 98% and identify companies one year before bankruptcy with an accuracy of 81%, especially indicators of performance efficiency, including retained earnings to total assets; revenue to total assets; profit before interest and taxes to shareholders' equity are statistically significant

In 1980, Ohlson applied logit model for financial ratios of a sample of 2,163 companies, including 105 bankrupt companies and 2,058 non-bankrupt companies during the period from 1970 to 1976 (Ohlson, 1980). He succeeded in developing O-score model in which the basic statistical factors that affect the probability of bankruptcy in a year are: net income on total assets, size, total debt on total assets, and operating cash flow on total debt, net operating capital on total assets and short-term liabilities on short-term assets. Accuracy of

Ohlson's models is 96.12%, 95.55% and 92.84%, respective to models predicting year 1, 2, and 1 or 2 years. Jame (2002) used the logit model to identify factors causing the collapse of the US banking system during the period from 1980 to 1990. He collected and analyzed a sample of 55 major bankrupt banks and about 1,000 banks, which did not fail significantly during the period from 1989 to 1992. The study showed that ratios of net income to total assets, profit after tax to total assets are statistically significant in determining the bankruptcy of the US banks. Eljelly et al. (2001) developed a three-variable model to predict the bankruptcy of private companies in Sudan. The research shows that profitability (operating profit on total assets) and liquidity (short-term assets/short-term liabilities) are the components that make businesses successful. Bandyopadhyay (2006) used a logistic approach and z-index to develop a model with a high distinction of 91% to predict the bankruptcy of Indian companies. In the model, the ratios of profit to total assets and total revenue to total assets are two statistically significant financial indicators.

This review shows that the financial performance indicators have been used in many studies on bankruptcy risks. However, most studies only mention the trend of impact and the degree of influence of indicators reflecting financial performance on the risk of bankruptcy in businesses in general without going into a field-specific business area. Moreover, the studies do not take into account the characteristics of each economy, each stage of development, as well as the characteristics of each sector, especially real estate business – a sensitive business sector – directly affected by the macro-management policies of the state. In addition, so far, no research has predicted bankruptcy risk for listed construction companies in Vietnam, where “real estate bubbles” often occur.

3. RESEARCH METHODS

In fact, there are some basic models suitable for dependent variables that are binary variables that only receive values of 0 or 1 (with or without bankruptcy risk), such as: multi-factor analysis model (MDA), probit model, logit model in which the MDA model was widely used be-

fore the 1980s according to the studies of Beaver (1966), Altman (1968). The disadvantages of the model are that the independent variables must follow assumptions: normal distribution, low correlation or no correlation, equal covariance matrix between the groups, but the independent variables are sometimes difficult to satisfy this requirement. From these limitations, after the 1980s, logit and probit models were more widely used with higher effectiveness by Puagwatana and Gunawardana (2005), Kim (2007) and Erdogan (2008). There are many similarities between logit and probit model such as no normal distribution of independent variables, noncomplicated statistical tests, qualitative independent variables can be quantified. The difference in the assumption between probit and logit model is that the logit model assumes a standard logistic distribution noise, while the probit assumes a normal distribution noise. Press and Wilson (1978) chose between logit and discriminant analysis, argued that the logit model gave better results than discriminant analysis. Therefore, the logit model is used in this study to analyze the relationship between bankruptcy risk (dependent variable) and financial performance.

In this study, the following four indicators were used to measure the financial performance of real estate companies. These indicators are inherited from Altman (1968), Eljelly et al. (2001) and Nguyen (2009), including:

- X_1 : Operating Profit Margin – OPM: This indicator measures how much profit a company makes on sales before paying interest or tax (Eljelly et al., 2001).

- X_2 : Return on Assets – ROA: This index indicates the effectiveness of using the assets to generate income. The higher the value of ROA, the higher the efficiency of asset use and therefore the lower the risk of bankruptcy risk (Altman, 1968).
- X_3 : Return on Equity – ROE: The indicator measures how many profits after - tax a company generates with shareholders' equity. The higher the ROE number, the higher the business financial performance and vice versa (Nguyen, 2009).
- X_4 : Total Asset Turnover – TAT: This indicator is a financial performance ratio that measures a company's ability to generate sales from its assets. This variable also contributes to the explanation of the industry factor for the research model as each industry has a different total asset turnover (Altman, 1968).

After variables are determined, a regression model is developed with dependent variables and independent variables as follows:

$$\text{Probability (bankruptcy risk)} = f(\text{OPM}, \text{ROA}, \text{TAT}, \text{ROE}),$$

where dependent variable: bankruptcy risk; independent variables include four variables, which are OPM, ROA, ROE, and TAT.

A conceptual framework is shown in Figure 1.

As the dependent variable in the study is bankruptcy or non-bankruptcy of companies (binary varia-

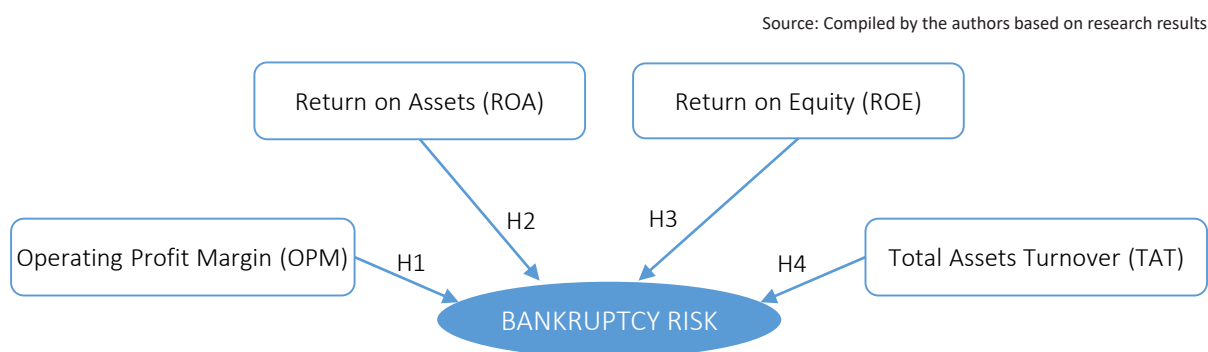


Figure 1. Conceptual framework

bles can only take values of either 0 or 1), the logit model was used to study the relationship between bankruptcy risk (dependent variable) and indicators of financial performance affecting the risk of bankruptcy (independent variable). In accordance with this study, companies with the value of binary variable ≥ 0.5 would be at risk of bankruptcy and the firms with values < 0.5 are classified as companies with not at risk of bankruptcy (healthy companies).

From these analysis, the authors propose the following research hypotheses:

H1: OPM has a negative relationship with bankruptcy risk.

The ratio measures the operational efficiency of a company and its pricing strategy. A higher ratio reflects the efficiency of the business in procuring raw materials and converting them into finished products. The higher the OPM, the lower the risk of bankruptcy risk and vice versa.

H2: ROA has a negative relationship with bankruptcy risk.

ROA indicates the efficiency of using the company's assets to generate income. The higher the ROA, the better the management, creating favorable conditions to improve business efficiency, resulting in a lower risk of bankruptcy and vice versa.

H3: ROE has a negative relationship with bankruptcy risk.

ROE is the objective of any investment. ROE measures the percentage return on the shareholder's fund from the business undertaking and also

the overall earnings performance of the company. ROE also emphasized that the company's management capabilities. The higher the ROE, the lower the risk of bankruptcy risk and vice versa.

H4: TAT has a negative relationship with bankruptcy risk.

TAT shows the management efficiency of the company using the available assets. The higher the TAT rate, the more revenue will be generated, the lower the risk of bankruptcy.

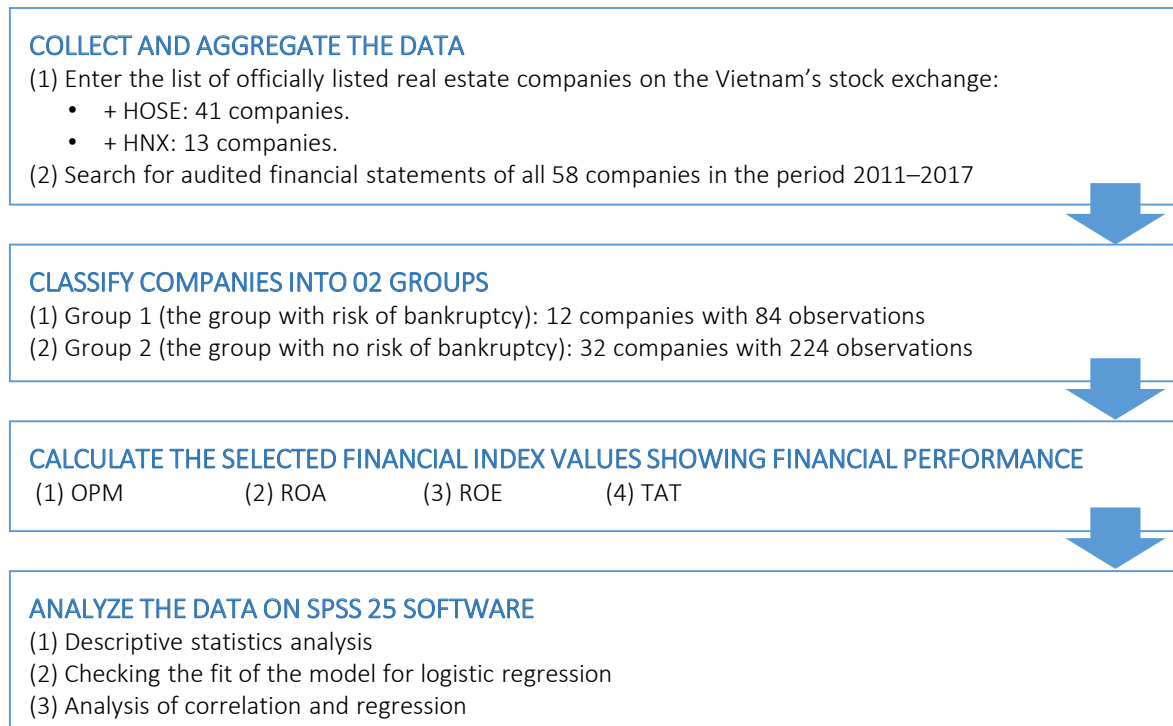
The selected research sample is the listed real estate companies on the Vietnamese stock exchange. The total number of real estate companies listed on HOSE and HNX is 54 companies. With the data for 7 years (from 2011 to 2017), 44 companies out of 54 listed real estate companies were selected (10 companies were excluded due to insufficient data and lack a lot of data). To identify a company at risk of bankruptcy, we base on one of the following assumptions: (i) The company has negative operating capital and liabilities over market capitalization value; (ii) The company has a negative ROA and liabilities over market capitalization value; (iii) Negative operating capital, liabilities over market capitalization value and negative ROA and liabilities over market capitalization value; and (iiii) Negative operating capital, liabilities over market capitalization value or negative ROA and liabilities over market capitalization value. Due to the low observations, in order to ensure the best estimation results, the fourth sign of bankruptcy risk (negative operating capital, liabilities over market capitalization value or negative ROA and liabilities over market capitalization value) was chosen. With this criterion, 44 companies with 308 observations are divided into 2 groups: group

Table 1. Signs of bankruptcy risk observation

Source: Compiled by the authors based on research results.

Signs of bankruptcy risk	Observations		
	Risk of bankruptcy	Non-risk of bankruptcy	Total
Negative operating capital and liabilities over market capitalization value	47 (15.26%)	261 (84.74%)	308 (100%)
Negative ROA and liabilities over market capitalization value	58 (18.83%)	250 (81.17%)	308 (100%)
Negative operating capital, liabilities over market capitalization value and negative ROA and liabilities over market capitalization value	14 (4.55%)	294 (95.45%)	308 (100%)
Negative operating capital, liabilities over market capitalization value or negative ROA and liabilities over market capitalization value	84 (27.3%)	284 (72.7%)	308 (100%)

Source: Completed by the authors based on research results.

**Figure 2.** The research process

1 (group with risk of bankruptcy) has 12 companies with 84 observations (27.3%), group 2 (group with no risk of bankruptcy) consists of 32 companies with 224 observations (72.7%) to conduct the analysis and perform necessary tests based on SPSS dedicated software. Table 1 presents the signs of bankruptcy risks observations.

The research process can be summarized in Figure 2.

4. RESULTS AND DISCUSSIONS

4.1. Research results

4.1.1. Descriptive statistics

The statistical results based on the sample of 44 listed real estate firms showed that the number of real estate companies classified as being at risk of bankruptcy varied from year to year. During the period from 2011 to 2013, the number of companies at risk of bankruptcy was the highest.

Table 2. Statistic description

Source: Compiled by the authors based on research results.

Bankruptcy risk	Year							Total
	2011	2012	2013	2014	2015	2016	2017	
Companies at no risk of bankruptcy	31	29	28	33	32	36	35	224
Companies at risk of bankruptcy	13	15	16	11	12	8	9	84
Total	44	44	44	44	44	44	44	308

The results in Table 2 reflect the difficult situation of the real estate market in this period when the Government issued the monetary policy in 2011 to reduce money inflow into the real estate sector. Hence, it had a strong impact on the market and made the real estate market gloomy. Especially in 2012 and 2013, it was the year of fierce competition and real estate companies strived to survive, resulting in a large number of bankruptcies.

Research results show that the average ROA and ROE of real estate companies is quite low, ROA is approximately 2.5% and the ROE is approximately 6.5%. With companies at risk of bankruptcy, the average value of ROA is -2.45%, ROE is -4.5%. The average sample value of the TAT variable is 0.2443,

Table 3. Descriptive statistics

Source: Compiled by the authors based on research results.

Variables	N	Minimum	Maximum	Mean	Std. deviation
OPM	308	-.571867	.643866	.17824898	.256922380
ROA	308	-.369748	.186120	.02568909	.053943687
ROE	308	-.607837	.702873	.06596194	.132448857
TAT	308	-.018618	1.394065	.24432890	.224491126

which indicates that the total asset turnover of real estate companies is not high. This is also consistent with the fact that the real estate market is in the gloomy period with high levels of inventory and a small number of transactions. Furthermore, the standard deviation of 0.2244 means that there is not much difference among companies in terms of total asset turnover, which also reflects the common situation of the whole market when almost all companies cannot sell products, leading to an increase in inventories, and sales are low.

In general, the statistical results showed that the efficiency of listed real estate companies in general and real estate companies at risk of bankruptcy in particular are not high, the business situation is difficult.

4.1.2. Regression analysis

As the dependent variable in the study is a binary variable, which can only take values of either 0 or 1 (1 = there is bankruptcy risk, 0 = there is no bankruptcy risk), the author used the logit model and analyzed the data on SPSS 25. The results are shown in Table 4.

In Table 4, the Wald test used to task significance of the overall regression coefficients shows that the significance values of variables X_2 (ROA), X_3 (ROE), X_4 (TAT) are less than 0.05, so hypothesis $H_0: \beta_i = 0$ is rejected. Based on the results in Table 4, the regression equation is as follows:

$$Z = \ln = \left(\frac{p}{1-p} \right) = 3.170 - 157.043X_2 - 42.642X_3 - 11.483X_4,$$

or

$$P = \frac{\text{Exp} \cdot (3.170 - 157.043X_2 - 42.642X_3 - 11.483X_4)}{1 + \text{exp} \cdot (3.170 - 157.043X_2 - 42.642X_3 - 11.483X_4)}.$$

Table 4. Regression results

Source: Compiled by the authors based on research results.

Notations	Variables	Coefficients	S.E.	Wald	df	Sig.	Exp(B)
X_1	OPM	-0.34300	1.585	.047	1	.829	0.710
X_2	ROA	-349.585	91.256	14.675	1	.000	0.000
X_3	ROE	35.278	24.651	2.048	1	.152	2.0945
X_4	TAT	-1.3860	1.644	.711	1	.399	0.250
Constant		1.5190	0.473	10.307	1	.000	4.567

From the regression equation, the variable X_2 – ROA (Return on Assets), an indicator of companies' efficiency has a negative impact on bankruptcy risk, which means the higher the value of ROA, the lower the bankruptcy risk and vice versa.

4.1.3. Checking model fit for logistic regression

In order to assess the model fit for logistic regression, in addition to testing the multicollinearity among independent variables through the correlation matrix, the following tests were conducted to assess the degree of fit of the model.

Testing the overall fit of the model

Table 5 illustrates the results of testing the overall fit of the model with the hypothesis $H_0: \beta_k = 0$ and alternative hypothesis H_1 : there is at least one coefficient, which is non-zero. This test examines the ability to explain the dependent variable of the set of independent variables.

Table 5. Assessing the fit of the regression model

Source: Compiled by the authors based on research results.

		Chi-square	df	Sig.
Step 1	Step	233.291	4	.000
	Block	233.291	4	.000
	Model	233.291	4	.000

The results in this table show that overall fit has a sig. = 0.000 so H_0 is rejected. This means that the linear combination of all coefficients in the model is statistically significant in explaining the dependent variable.

Testing the fit of the model

Table 6. Testing the fit of the model

Source: Compiled by the authors based on research results.

Step	-2 Log likelihood	Cox & Snell R-square	Nagelkerke R-square
1	127.656 ^a	.531	.770

Table 6 shows the results of the test of model fit. Unlike normal linear regression that the larger the coefficient R^2 , the more appropriate the model, the logistic regression used an indicator -2LL (-2 Log likelihood) to evaluate the fit of the model. The smaller the value of -2LL, the higher the model fit. The smallest value of -2LL is 0 (which means no error), indicating the model is perfectly fit.

This table shows that -2LL = 127.656, which is relatively low, indicating a good fit of the overall model.

Testing the predictive power of the model

The test of the predictive power of the model is used to measure the accuracy of the prediction model regarding the bankruptcy risk of companies relative to actual results.

Table 7 presents the results of the comparison between the actual results and the prediction of the model. The results show that among 224 cases predicted to be not at risk of bankruptcy, the model correctly predicted 208 cases, with the accuracy rate of 92.9%. For 84 cases at bankruptcy risk, the model has 12 cases of false predictions and accuracy rate was 85.7%. Therefore, the prediction of

the number of companies not at bankruptcy risk was slightly more accurate (92.9%) compared with those companies at risk of bankruptcy (85.7%). The accuracy rate of the overall predictive model is 90.9%. This outstanding accuracy implies that the model has the potential for practical application when studying the impact of performance efficiency to the bankruptcy risk of listed real estate companies.

4.2. Discussions

The regression results show that there are three variables X_2 (ROA), X_3 (ROE) and X_4 (TAT) that affect bankruptcy risks in out of 4 indicators of financial performance. This shows the importance of these indicators in assessing the bankruptcy risks in real estate companies.

The X_2 (ROA) variable has a regression coefficient in the overall model of -157,043, indicating that ROA has the opposite relationship with the probability of bankruptcy risks. That means the higher the ROA, the lower of the probability of bankruptcy risks and vice versa. This result is a suite with the original hypothetical expectation and is also consistent with the research results of the authors such as Beaver (1966), Hoang (2011), Ohlson (1980). This is considered an important indicator, because it shows how much profit an enterprise earns from investing in total assets. This criterion is also consistent with the credit institution's point of view, they are interested in the profitability of recovering capital and repaying the debt. Moreover, this is one of the criteria to classify the company of the stock exchange.

The X_3 (ROE) variable is similar to ROA that investors will be the most interested in investing money into any company. This shows that how much profit an enterprise earns from owners capital. With the regression result of -42,642, ROE has a neg-

Table 7. Testing the predictive power of the model

Source: Compiled by the authors based on research results.

Bankruptcy risk	Prediction (intersection point is 0.5)			
	If there is bankruptcy risk	If there is no bankruptcy risk	Total	Percentage of accurate prediction (%)
If there is no bankruptcy risk	16	208	224	92.9
If there is bankruptcy risk	72	12	84	85.7
Total	86	220	308	90.9

ative effect on the probability of listed real estate companies bankruptcy on Vietnam's stock exchange. That means the higher ROE the company gets, the lower the probability of bankruptcy occurs and vice versa. This result is consistent with the research results of Nguyen (2009) and Nguyen (2012). However, compared to the impact level of ROA and ROE, the impact of ROE is smaller. This can be explained that both ROA and ROE reflect efficiency, but ROE shows clearly the impact of the tax shield and financial leverage.

The $X_4 - TAT$ variable: According to the regression results, the X_4 variable regression coefficient is -11.483 and shows that it has the opposite effect to the risk of bankruptcy, the higher the turnover of the asset gets, the lower the probability of bankruptcy risk returns and vice versa. This result

is also consistent with Altman (1968), Fulmer et al. (1984), Bandyopadhyay (2006), Hoang (2011), Nguyen (2012) and in accordance with the expectation of the research hypothesis. This variable is of great significance for industry characteristics. For a long time, real estate companies in Vietnam face crisis due to high inventory levels, while they operate mainly from borrowing. When goods are not sold, the real estate companies can not pay due debts and are in danger of falling into bankruptcy. Therefore, increasing the turnover of assets, accelerating the volume of goods sold will help companies recover capital quickly and profitably.

In addition to the statistically significant variables, the results showed that OPM as some other studies deemed statistically significant did not affect bankruptcy of Vietnamese real estate companies.

CONCLUSION

The research results proposed a logistic model with the dependent variable as the risk of bankruptcy and ROA as the independent variable is predicted with the accuracy rate of 90.9%. The research has shown that a logistic model is a useful tool for risk prediction. Based on research results, ROA, ROE, and TAT have significant adverse effects on the bankruptcy risk of enterprises. Therefore, in order to limit bankruptcy risks, real estate companies can find solutions to increase profits, reduce inventory. Specific measures can be proposed as follows:

- Restructuring products to suit the practical needs of the market:

The fact of the current market is that there is a difference in supply and demand, specifically, there is a shortage of small apartments but an excess of large apartments and luxury apartments. Therefore, enterprises can change their strategy to split apartments, invest in small-sized apartments with reasonable prices to attract customers who have low income, but have real needs, which can help to improve the liquidity of projects.

- Flexible payment options for customers:

Instead of traditional payment methods, enterprises can provide more flexible payment methods for customers such as installment payment, partial prepayment and pay the remaining amount within certain years at a reasonable interest rate. With luxury apartments, companies can provide policies that allow customers to enjoy an annual interest rate of 10%, 12% within 10 years, 15 years on the value of the houses, and provide high discounts for those who pay immediately, pay 90%, 95% of the value of the apartment.

- Reduce inventory in order to accelerate asset turnover:

In fact, the demand of housing is relatively high, however, the real estate market is still in a gloomy situation, because the supply does not meet the demand, particularly, prices of houses and lands are considerably high compared to incomes of most people. Therefore, in order to improve the real estate market and increase operational efficiency, companies must lower selling prices to match people's incomes.

In addition, to develop the real estate market, the government should create transparency in the real estate market by developing and issuing a system of documents relating to real estate business, creating a legal business environment, clearly defining the rights and obligations of the real estate business. At the same time, the government should provide capital support to enterprises with certain criteria; develop real estate financial channels; appropriately implement the interest rate policies, land policies, real estate transfer policies. For real estate associations and real estate companies, it is necessary to proactively submit proposals to management agencies to simplify administrative procedures and provide preferential policies for businesses, investment in medium and low real estate.

For credit institutions and currencies, it is necessary to review interest rate policies, prioritize lending to feasible and appropriate projects, serve poor workers, and consider real estate companies, restructuring their old debts incurred high-interest rates.

Thus, in order to promote the market to overcome difficult periods, increasing performance efficiency and preventing real estate companies from the financial crisis are the responsibilities of stakeholders. Solutions need to be deployed synchronously and resources must be exploited. Especially, cash should flow through the real estate market. Only when these solutions are implemented simultaneously, the real estate market has the impetus for positive changes. As prevention is always better than cure, enterprises should place emphasis on performance efficiency indicators and take timely measures to improve these indicators to reduce the risk of bankruptcy.

REFERENCES

- Altman, E. I. (1968). Financial ratios, discriminant analysis and the prediction of corporate bankrupt. *The Journal of Finance*, 23(4), 589-609. <https://doi.org/10.1111/j.1540-6261.1968.tb00843.x>
- Altman, E. I., Haldeman, R. G., & Narayanan, P. (1977). ZETA Analysis: New Model to Identify Bankruptcy Risk of Corporations. *Journal of Banking and Finance*, 1(1), 29-54. [https://doi.org/10.1016/0378-4266\(77\)90017-6](https://doi.org/10.1016/0378-4266(77)90017-6)
- Altman, E. I., Heine, L. M., Zhang, L., & Yen, J. (2007). *Corporate Financial Distress Diagnosis in China* (Working paper). New York: New York University Salomon Center.
- Bandyopadhyay, A. (2006). Predicting Probability of Default of Indian Corporate Bonds: Logistic and Z-Score Model Approaches. *Journal of Risk Finance*, 7(3), 255-272. <https://doi.org/10.1108/15265940610664942>
- Beaver, W. H. (1966). Financial ratios as predictors of failure. *Journal of Accounting Research*, 4, 71-111. Retrieved from <https://www.jstor.org/stable/2490171>
- Eljelly, M. A. A., & Mansour, H. F. I. (2001). Predicting private companies failure in the Sudan. *Journal of African Business*, 2(2), 23-43. https://doi.org/10.1300/J156v02n02_03
- Erdogan, E. B. (2008). Bankruptcy Prediction of Turkish Commercial Banks Using Financial Ratios. *Applied Mathematical Sciences*, 2(60), 2973-2982. Retrieved from <http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.465.517>
- Fulmer, J. G., Moon, J. E., Gavin, T. A., & Erwin, M. J. (1984). A bankruptcy classification model for small firms. *Journal of Commercial Bank Lending*, 66(11), 25-37.
- Gu, Z. (2002). Analyzing bankruptcy in the restaurant industry: a multiple discriminant model. *International Journal of Hospitality Management*, 21(1), 25-42. [https://doi.org/10.1016/S0278-4319\(01\)00013-5](https://doi.org/10.1016/S0278-4319(01)00013-5)
- Hanoi Stock Exchange. (2018, September 25). *Information Disclosure*. Retrieved from <https://www.hnx.vn/thong-tin-cong-bo-ny-tcph.html>
- Hoang, T. (2011). Analysis the Corporate Credit Risk by Logistic Model. *Journal of Science and Technology*. University of Da Nang.
- HoChiMinh Stock Exchange. (2018). *Annual Report 2018*. Retrieved from <https://www.hsx.vn/Areas/Desktop/Web/AnnualReportView?fid=53b3300db569458d93ae9899e2c87d08>
- Kim, B. J. (2007). Bankruptcy Prediction: Book Value or Market Value? *Korean Insurance Journal*, 7, 55-97. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1579929
- Kolari, J., Glennon, D., Shin, H., & Caputo, M. (2002). Predicting large US commercial bank failures. *Journal of Economics and Business*, 54(4), 361-387. [https://doi.org/10.1016/S0148-6195\(02\)00089-9](https://doi.org/10.1016/S0148-6195(02)00089-9)
- Nguyen, H. T. (2009). *Establishing a credit scoring model for enterprises in Vietnam during the period of economic transformation*

- (Doctoral Thesis). Hanoi, Vietnam: National Economics University.
16. Nguyen, K. B. (2012). *Factors affecting bankruptcy in enterprises in Dong Nai province* (Master Thesis). University of Economics Ho Chi Minh City.
 17. Ohlson, J. (1980). Financial ratios and the probabilistic prediction of bankruptcy. *Journal of Accounting Research*, 18(1), 109-131. <https://doi.org/10.2307/2490395>
 18. Press, S. J., & Wilson, S. (1978). Choosing Between Logistic Regression and Discriminant Analysis. *Journal of the American Statistical Association*, 73(364), 699-705. Retrieved from <https://www.math.arizona.edu/~h Zhang/math574m/Read/LogitOrLDA.pdf>
 19. Puagwatana, S., & Gunawardana, K. D. (2005). Logistic Regression Model for Business Failure Predictions of the Technology Industry in Thailand. *International Journal of the Computer, the Internet and Management (IJCIM)*, 13, 181-184. Retrieved from https://www.researchgate.net/publication/237353979_Logistic_Regression_Model_for_Business_Failures_Prediction_of_Technology_Industry_in_Thailand
 20. State Securities Commission of Vietnam. (2018, August 14). *Company listed companies?* Retrieved from http://ssc.gov.vn/ssc/faces/en/enmenu/enpages_compdatabase/company_listed_companies
 21. Tatsiana, N. R. (2006). *Analysis and Estimate of the Enterprises Bankruptcy Risk*. Republic of Belarus: State Economic university.
 22. VOV.VN. (2018). *The dissolved real estate business increased the highest*. Retrieved from <https://vov.vn/kinh-te/doanh-nghiep-kinh-doanh-bat-dong-san-giai-the-tang-nhieu-nhat-793377.vov>
 23. Zhang, L., Chen, S., Yen, J., Altman, I. A., & Heine, M. L. (2007). *Corporate Financial Distress Diagnosis in China* (Salomon Center Working Paper). Natural Science Foundation of China (NSFC). Retrieved from <http://people.stern.nyu.edu/ealtman/WP-China.pdf>