Modeling of Financial Distress Probability for Vietnamese Listed Companies

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Abstract

To date, an in-depth discussion of the factors influencing financial distress in Vietnam is still lacking. This paper explores the determinants of corporate financial distress of Vietnamese firms listed on the Hochiminh Stock Exchange using a dynamic logit model. We find that financially distressed enterprises have highly leveraged capital structures with low liquidity and low profitability. The financial distress probability is more pronounced for firms with small capitalization as well as those newly established and less profitable. With the hope of improving market efficiency, we finally come up with a simple, convenient model which helps investors estimate a firm's financial distress probability without information cost.

Keywords: Financial distress; emerging market; logit regression.

1. Introduction

Over recent years, the topic of "financial distress estimation" has developed a major research domain in corporate finance. Many academic studies have been dedicated to the search for the best corporate failure prediction model. Moreover, from their point of view, economists around the world have tried to define "financial distress" in different ways. Beaver (1966) defines this economic term as the "inability of a firm to pay its financial obligations as they mature". This definition is similar to those found in the later studies of Andrade and Kaplan (1998) and Brown et al. (1993). On the other hand, Whitaker (1999) believes that financial distress can be realized when the firm's cash flow is less than the long term debts' expenses. Alternatively, by making the comparison between liabilities and asset value, Gestel et al. (2006) analyze financial distress and failure as the result of chronic losses causing a disproportionate increase in liabilities accompanied by shrinkage in the asset value.

Currently, Vietnam is facing a huge number of distressed cases each year. Specifically, on average, there were around 55,000 Vietnamese firms falling into financial distress or bankruptcy from 2008 to 2013. Such a high degree of corporate failure has caused severe financial consequences for the whole market. Despite that fact, few studies have been carried out regarding Vietnamese firms' financial distress and bankruptcy. Realizing the problem, this paper is presented with the hope of enriching the market knowledge in this field by analyzing the determinants of financial distress in Vietnam through establishing a distress-estimating model, using the sample of firms listed on the Hochiminh Stock Exchange.

Correct assessment of credit condition and financial distress probability is important to facilitate the efficient investment decisions of economic entities. Currently, there are only two sources of public credit ratings in Vietnam: CIC (Credit Information Center) and CRV (Credit Rating of Vietnam Index), both of which are very costly for individual investors to access. Additionally, CIC provides information for institutional investors only. Nevertheless, different measures give different conclusions about a firm's financial condition. Individual investors usually do not have time and expertise to scrutinize financial ratios thoroughly. Thus, the model established in this paper can be used to assist individual investors in their decision making, at the same time improving the market information efficiency.

2. Literature review

In order to evaluate financial distress conditions of listed enterprises, academic researchers from all over the world have been using different modeling techniques and estimation procedures, with different underlying assumptions and computational complexity.

Beaver (1966) was the first economist to apply univariate analysis in predicting the failure of industrial and publicly owned corporations. For its deficiency, this is currently not a common method in the field of financial distress and bankruptcy (Zmijewski, 1984).

Multiple discriminant analysis (MDA) is one of the common statistical techniques that are used. As a typical example, Altman (1968) first used this analysis in establishing the Z-score model which shows the impact of some statistically significant financial ratios on corporate

bankruptcy risk. The Z-score model was first set up in America and has been continuously tested in many other countries, including emerging markets (Ohlson, 1980; Narayanan, 1999). Up to the present, the Z-score model has been widely used in both academic and practical studies worldwide (Balcaen and Ooghe, 2004). Despite its common use, some serious drawbacks still exist in this approach. The MDA model follows the assumption that all independent variables are normally distributed. In reality, it is difficult or impossible for all the predictors to have normal distribution. Descriptive comparison is another criticism of the MDA model. The MDA model's users can only identify whether a company is "safe" or "unsafe", instead of an exact distressed level (Ohlson, 1980).

Logit analysis and probit analysis are also among the common methods. Ohlson (1980) pioneered using logit analysis on financial ratios in order to predict company failure, while Zmijewski (1984) was the pioneer in applying probit analysis. In more recent times, the logit model was used by Sarlija and Jeger (2011) in order to design three separate financial distress prediction models that will track the changes in the relative importance of financial ratios throughout three consecutive years (from 2006 to 2009) in Croatia. After the tracking, Sarlija and Jeger (2011) found that predicting financial distress using financial ratios is more significant during the time of economic downturn. Different from the MDA model, the logit model requires no assumption regarding the probabilities of bankruptcy and/or the distribution of predictors (Maddala, 1977). More flexible assumptions make the logit model a common choice for research regarding financial distress in developing nations. As an example, Polsiri and Sookhanaphibarn (2009) employed logit regression in testing the impact of governance variables on corporate distress in Thailand. According to this research, firms with excessive use of debt, poor operating performance, and small market capitalization tend to experience financial distress.

Testing the statistical impact of some specific financial ratios on the probability of financial distress is still a fresh topic in Vietnam. Instead, Vietnamese economists focus on testing the utility of Altman's Z-score in reducing credit risk for the banking system. Being a pioneer in the field, the author follows Ohlson (1980) in using logit regression to evaluate the statistical impact of some measures calculated from the listed firms' financial statements. The author identifies some ratios that have significant influence on the financial health of Vietnamese listed firms, which come from different financial groups. These ratios include: liquidity ratios, solvency ratios, profitability ratios, sales ratios and cash flow ratios.

Size is an important financial measure indicating a firm's operating and financial strength. According to Ohlson (1980), larger-sized firms have better financial conditions. As companies increase in size, they have less difficulty in getting access to credit for investment, have broader pools of qualified human capital, and may achieve greater strategic diversification (Pervan, 2012). Big firms are more flexible in raising capital due to the availability of several financing resources. Therefore, a shortage of funds for those firms is easier to be solved. Moreover, large firms are often provided with

more favored terms from suppliers and have more power when dealing with customers.

In terms of liquidity, WC/TA (Working Capital to Total Assets) and CASH/TA (Cash to Total Assets) are often included in distress models. WC/TA has been proven to have negative movement against the risk of financial distress in several academic studies, including Beaver (1966), Altman (1968), and Ohlson (1980). The higher the WC/TA, the better is the firm's liquidity position. Beaver (1966) and Sarlija and Jeger (2011) also identified the importance of CASH/TA. Opler and Titman (1994) indicated that liquidity ratios and leverage ratios play an important role in analyzing the financial health of corporations during recessions. According to Hendel (1996), non-liquid assets are unnecessary in recessions, since demand is low relative to inventories held. Thus, liquidity is more important during market downturns.

With regard to profitability, NI/TA (Net Income to Total Assets) shows a company's overall efficiency and performance. This ratio is proven to have a positive influence on the firm's financial health according to Beaver (1966) and Ohlson (1980). RE/TA (Retained Earnings to Total Assets) is also used to analyze the firm's profitability and establishment period. A firm can retain more earnings only if it can generate more profit over the years. Moreover, young companies have a smaller amount of retained earnings than perennial ones. It is statistically and practically proven that enterprises face more chance of being bankrupt in the initial years after establishment (Dun and Bradstreet, 2004). This measure also shows the extent to which a company relies on debt. The lower the ratio, the more a company is funding assets by borrowing instead of through retained earnings which, again, increases the risk of bankruptcy if the firm cannot meet its debt obligations.RE/TA has a positive coefficient in the research of Altman (1968), which means the firm's financial health will improve with the increase in the value of this ratio.

Realizing the importance of cash flow and sales, many economists have included cash flow ratios in their model testing. One of them is Bilderbeek (1979) with the CF/S (Cash flow to Sales) ratio. This ratio is identified as having negative movement against corporate financial distress. The CF/S ratio shows the company's ability to turn sales into cash. The high CF/S ratio illustrates a good firm's financial position. The S/TA (Sales to Total Assets) also carries a positive coefficient in the Z-score model of Altman (1968). This ratio shows the efficiency with which a firm is using its assets to generate sales.

Concerning leverage, while TL/TA (Total Liabilities to Total Assets) indicates the company's ability to meet its long-term obligations and keep its head above water, MC/TL (Market Capitalization to Total Liabilities) shows the market expectations against the firm's ability to satisfy its long-term obligations. According to Ohlson (1980), Beaver (1966) and Zmijewsk (1984), the financial health of a firm will deteriorate substantially when its total liabilities increase against total assets. In terms of MC/TL, it is included in the model of Altman (1968) with a positive-signed coefficient.

3. Methodology

3.1. Data

This paper uses a sample of firms listed on the Hochiminh Stock Exchange from 2009 to

2012, except those operating in the Banking, Insurance and Security fields. Up to 2008, the Vietnamese stock market faced large fluctuations. Furthermore, high market growth rates made many financially distressed companies unidentified over a long period of time. This resulted in an extreme shock for the market when the global crisis hit the country in 2008. From 2009 to 2012, the Vietnamese market entered the post-crisis period. Studying this period will give a clearer picture about distressed situations in Vietnam in the aftermath of the crisis.

After being processed, there are 304 HOSE listed enterprises included in the data set. This data set is unbalanced due to some missing delisted firm-years. The authors base their study on the CRV Index annual reports, which summarize the credit ratings of HOSE's listed firms from 2009 to 2012, to identify distressed cases.

3.2. Model

3.2.1. The logistic model

For its advantages, as indicated in the literature review, this paper applies the logit model to establish a model that can illustrate the impact of some financial ratios on the chance of being distressed of listed firms on HOSE. The Logit model estimates the probability that an event will occur by a set of independent variables.

$$Z_{ij} = \beta_0 + \beta_k \sum_{k=1}^{n} X_{kij} + e_{ij}$$

Where:

$$Z_{ij} = Logit\left(P_{ij}\right) = \log\left(\frac{P_{ij}}{1-P_{ij}}\right)$$

Where P_{ij} is the probability of firm *i* falling into financial distress in year *j*.

We can get back to our estimated probability of occurrence:

$$P_{ij} = \frac{e^{\beta_0+\beta_k \sum_{k=1}^{n} X_{kij}}}{1+e^{\beta_0+\beta_k \sum_{k=1}^{n} X_{kij}}}$$

The value of β_k illustrates how the log odds of probability of occurrence changes when X_k changes by a single unit. Because the relation between X_k and P is nonlinear, β_k does not have

Table 1: Summary of CRV credit rating for sampled HOSE listed firms from 2009 to 2012

	2009	2010	2011	2012	Total
AAA	21	67	66	62	216
AA	23	68	64	57	212
A	35	59	55	58	207
BBB	39	34	32	31	136
BB	31	9	17	19	76
B	19	3	6	10	38
CCC	3	2	2	4	11
CC	2	3	4	2	11
C	0	5	2	1	8

Source: CRV's annual reports

Table 2: List of independent variables

Variables	Calculation	Expected sign	Meaning	Economic models
Size	Size = Log(Market Capitalization)	-	Size	Ohlson (1980)
WC/TA	$WC/TA = \frac{\text{Working Capital}}{\text{Total Assets}}$ Working Capital = Current Assets – Current Liabilities	-	Liquidity	Ohlson (1980), Beaver (1966), Altman (1968)
CASH/TA	$CASH/TA = \frac{\text{Cash}}{\text{Total Assets}}$	-	Liquidity	Beaver (1966), Sarlija and Jeger (2011)
NI/TA	$NI/TA = \frac{\text{Net Income}}{\text{Total Assets}}$	-	Profitability	Ohlson (1980), Beaver (1966), Zmijewsk (1984)
RE/TA	$RE/TA = \frac{\text{Retained Earnings}}{\text{Total Assets}}$	-	Profitability and period of establishment	Altman (1968)
CF/S	$CF/S = \frac{\text{Net Cash Flow}}{\text{Total Assets}}$	-	Cash flow generated from sales	Bilderbeek (1979)
TL/TA	$TL/TA = \frac{\text{Total Liabilities}}{\text{Total Assets}}$	+	Book leverage	Ohlson (1980), Beaver (1966), Zmijewsk (1984)
MC/TL	$MC/TL = \frac{\text{Market Capitalization}}{\text{Total Liabilities}}$	-	Market expectation about the firm's ability to satisfy debts	Altman (1968)
S/TA	$S/TA = \frac{\text{Sales}}{\text{Total Assets}}$	-	Sales generated from available assets	Altman (1968), Sarlija and Jeger (2011)

a straightforward interpretation in this model as it does in ordinary linear regression. P<0.5 indicates that occurrence is less likely and P>=0.5 indicates the high probability of occurrence.

3.2.2. Dependent variable

The dependent variable has two values, "1" for distressed firm-years and "0" for wealthy firm-years. From 2009 to 2012, financially distressed firms are classified according to their credit ratings published on CRV Index's annual reports. Distressed firms are those with at least one year during the period having a credit rating lower than "B". However, not all distressed firms' years are assigned with 1. Instead, 1 is just allocated to the distressed years of distressed firms (years with rating of "CCC", "CC" and "C"). All the remaining firm-years with other ratings are numbered with "0". In the total of 1030 firm-year observations, there are 915 firm-years rated by CRV, and 30 firm-years being assigned with "1" (85 firm-years are not rated). In other words, from 2009 to 2012, 30/1030 firm-years are classified as "financially distressed". These 30 firm-years belong to 14 HOSE's listed firms. Table 1 shows the number of firms belonging to each ranking over a 4-year period (from 2009 to 2012).

3.2.3. Independent variables

Nine independent variables in the initial regression are chosen based on both their popularity and their degree of statistical significance in preceding researches. They are from different ratio groups including size, profitability ratios, liquidity ratios, solvency ratios, cash flow ratios, and sales ratios. Table 2 shows the variables used in this model with their meaning, expected sign in the regressions' results, and the economic models previously using them.

4. Results

4.1. Descriptive statistics

Panel A, B and C of Table 3 summarize descriptive statistics for each independent variable included in the initial regression of the model. Panel A, Panel B, and Panel C respectively describe the distributions of the variables in 1,030 firm-years overall – 1000 non-distressed firm-years, and 30 financially distressed firm-years. In interpreting these distributions, it is important to keep in mind that every firm-year is weighted equally. Therefore, the effects of small companies increase relative to the effect of large companies, making the distributions dominated by the behavior of relatively small companies. Moreover, through weighting all firm-years equally, the level of importance of both past and current data are the same when analyzing the impact of independent variables on the probability of financial distress of listed firms.

From Table 3, the variables that have higher means for wealthy firm-years and lower ones for distressed firm-years compared to the overall average are: Size, WC/TA, CASH/TA, NI/TA, RE/TA, CF/S, MC/TA and S/TA. This indicates their negative relationship with the dependent variable. However, as the standard deviation of MC/TL (at 26.07) is extremely high, it is uncertain that this variable will have a negative sign in the regression's result. In contrast, TL/TA has lower means for sound firm-years and higher ones for distressed firm-years compared to the overall average. This means that the ratio increases with the probability of financial distress.

As WC (Working capital), CF (Net Cash Flow), NI (Net income) and RE (Retained

Table 3: Descriptive statistics of ten independent variables

Variable	Size	WC/TA	CASH/TA	NI/TA	RE/TA	CF/SALES	TL/TA	MC/TL	S/TA
Panel A: Entire data set									
Mean	11.514	0.209	0.092	0.063	0.065	0.004	0.498	3.163	1.021
Median	11.473	0.200	0.052	0.045	0.053	0.003	0.529	0.770	0.678
Standard deviation	0.581	0.221	0.105	0.116	0.304	0.503	0.218	26.07	1.980
Min	9.778	-1.052	0.000	-0.994	-1.48	-7.969	0.001	0.009	0.001
Max	13.865	0.885	0.840	2.247	8.64	7.131	1.563	767.682	52.984
Observations	1030	1030	1030	1030	1030	1030	1030	1030	1030
Panel B: Data set of non-distressed firms									
Mean	11.534	0.220	0.094	0.068	0.08	0.007	0.491	3.249	1.032
Median	11.489	0.208	0.055	0.047	0.055	0.003	0.523	0.805	0.691
Standard deviation	0.570	0.210	0.105	0.107	0.289	0.509	0.213	26.45	2.003
Min	9.778	-0.837	0.000	-0.646	-0.98	-7.969	0.001	0.009	0.001
Max	13.865	0.885	0.840	2.247	8.636	7.131	1.117	767.682	52.984
Observations	1000	1000	1000	1000	1000	1000	1000	1000	1000
Panel C: Data set of distressed firms									
Mean	10.834	-0.165	0.026	-0.130	-0.37	-0.090	0.758	0.3	0.683
Median	10.820	-0.156	0.013	-0.066	-0.23	-0.010	0.739	0.178	0.399
Standard deviation	0.549	0.255	0.032	0.210	0.45	0.224	0.229	0.317	0.861
Min	9.845	-1.052	0.001	-0.994	-1.48	-0.996	0.411	0.023	0.016
Max	12.226	0.288	0.119	0.024	0.047	0.101	1.563	1.273	3.566
Observations	30	30	30	30	25	30	30	30	30

Table 4: The correlation among independent variables

	Size	WC/TA	CASH/TA	NI/TA	RE/TA	CF/S	TL/TA	MC/TL	S/TA
Size	1								
WC/TA	0.21	1							
CASH/TA	0.17	0.40	1						
NI/TA	0.28	0.36	0.30	1					
RE/TA	0.14	0.25	0.12	0.77	1				
CF/S	0.04	0.01	0.09	0.04	0.01	1			
TL/TA	-0.18	-0.58	-0.36	-0.38	-0.17	-0.016	1		
MC/TL	0.02	0.03	0.02	0.13	0.12	0.135	-0.173	1	
S/TA	-0.06	0.06	0.13	0.54	0.73	0.005	0.007	0.081	1

Source: Synthesis by STATA

Earnings) can have both positive and negative values, so do their ratios, including WC/TA, NI/TA, CF/S and RE/TA. Comparing the mean and median of the overall population, except TL/TA, all the variables have positively skewed distributions, in which the mean values are higher than the median values. The greatest positive skew is illustrated in the MC/TL's distribution. Specifically, the mean of MC/TL is significantly higher than its median (3.16 vs. 0.77). This ratio also takes the highest standard deviation (at 26.07) among all the variables, regarding figures of the overall population. Meanwhile, the smallest skew is seen in the figures of CF/S where mean and median are 0.004 and 0.003 respectively. Following different distribution, a negatively skewed one, TL/TA shows a very small difference between its mean (0.5) and median (0.53).

Table 4 shows the correlation among the independent variables included in the model's testing. As a high degree of multicollinearity can increase the variance of the coefficient estimates, and make the estimates very sensitive to minor changes in the model, the check for multicollinearity helps to ensure the result of the logit model.

According to Table 4, the highest correlation is showed in the relationship between NI/TA and RE/TA (at 0.77). This is due to the fact that net income and retained earnings are closely related to each other. Specifically, retained earnings is the remaining proportion if net income which has not been delivered to the shareholders. Thus, these two measures often move in the same direction. The second highest correlation is seen in the figures of S/TA and RE/TA (at 0.73). More noticeably, S/TA is also closely related with NI/TA (at 0.54). These high correlations are partly explained by the close connection between NI/TA and RE/TA mentioned previously. Next, WC/TA and TL/TA also have a considerably high relationship with each other. With the correlation of nearly 0.6, the existence of both of them in the model's testing will lead to biased results.

4.2. Regression results

Table 5 illustrates the multivariate regression results of nine independent variables included in the model's testing. Each model shows different results for each multi regression between the remaining financial ratios and the probability of financial distress. The initial regression of 9 independent variables is not shown due to high multicollinearity among the variables, which will certainly lead to biased results. The elimination of independent variables in Model 1, Model 2, Model 3, Model 4 and Model 5 is based on the concern of multicollinearity. According to Table 4, S/TA has extremely high correlation with NI/TA and RE/TA (at 0.54 and 0.73), which imply that multicollinearity is likely to exist. As the removal of S/TA does not cause significant changes in the model, the author decided to exclude this ratio from all the remaining multivariate regressions.

As analyzed previously, the close relationship between NI/TA and RE/TA as well as between WC/TA and TL/TA requires the elimination of one in two variables from model. According to Table 5, the removal of NI/TA and WC/TA does not cause any significant change in the sign and magnitude of the remaining variables. Hence, these two variables are excluded from our final model.

After all, Model 7 is the final model with only 4 significant variables; namely, Size, CASH/TA, RE/TA and TL/TA. While the likelihood ratio and chi-square test the model's validity, R-square measures the percentage of the response variable variation that is explained by a linear model. The final model has relatively reliable estimates with the likelihood ratio, Chi-square and R-square at 121.6, 0.000 and 0.4482 respectively.

According to Table 5, we can reach an empirical conclusion about the determining effects of each independent variable on the Vietnamese listed firm's financial distress probability. As explained in the following, we conclude that CASH/TA (liquidity) has the highest effect in determining a firm's financial distress probability. RE/TA (as a measure of time of establishment and profitability) is second in the order, then Size and TL/TA (leverage).

CASH/TA (Cash/Total Assets), as a measure of liquidity, also has negative coefficients in the regression models. Such a negative sign illustrates opposite movements between this ratio and the dependent variable. In other words, the chance of being financially distressed for firms will decrease when CASH/TA increases. This also follows the result by Beaver (1966). Through the highest negative coefficient (-15.23), CASH/TA is the variable that has the greatest influence on the model's dependent variable. For interpretation, the log odds of financial distress will decrease over -15.23 when the value of CASH/TA ratio increases by 1 unit. Saying this in a different way, for a 1% increase in CASH/TA, the firm will less likely face financial distress by 0.26%. The opposite movement between the value of CASH/TA and the probability of financial distress follows the economy's actual situation. In Vietnam, the need for cash is especially important due to economic downturns in the market. The role of cash was significantly more important during the crisis period from 2009 to 2012. At this time, many Vietnamese enterprises, in spite of stable profitability, fell into an illiquid or insolvent position, just due to the lack of cash

Table 5: The coefficients of different combinations of independent variables from the multivariable regressions

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Size	-0.76 (-1.27)	-1.03 (-1.74)*	-0.91 (-1.62)	-1.11 (-1.86)*	-1.06 (-1.84)*	-1.45 (-2.8)**	-1.40 (-2.73)**
WC/TA	-3.49 (-2.09)**	-3.43 (-2.08)**	-4.89 (-3.1)**		-3.27 (-2.16)**		
CASH/TA	-8.90 (-1.07)	-11.81 (-1.43)	-7.27 (-0.93)	-13.98 (-1.68)*	-12 (-1.45)	-14.97 (-1.79)*	-15.23 (-1.82)*
NI/TA	-9.10 (-2.42)**		-13.17 (-3.88)***				
RE/TA	-3.33 (-2.74)**	-4.86 (-3.84)***		-6.15 (-5.1)***	-4.81 (-3.87)***	-5.65 (-5.29)***	-5.62 (-5.27)***
CF/S	-0.54 (-1.62)	-0.59 (-1.76)*	-0.51 (-1.55)	-0.54 (-1.47)	-0.59 (-1.75)*	-0.51 (-1.44)	
TL/TA	-0.17 (-0.08)	-0.53 (-0.25)	0.40 (0.19)	1.31 (0.67)		2.97 (2.09)**	2.91 (2.03)**
MC/TL	-1.23 (-1.04)	-1.42 (-1.21)	-0.57 (-0.66)	-1.21 (-1)	-1.24 (-1.39)		
Const	6.14	9.47	7.24	9.01	7.37	11.20	10.73
Observations	915	915	915	915	915	915	915
LR chi2	135.77	129.35	127.9	124.42	127.87	122.69	121.6
Chi-square	0	0	0	0	0	0	0
R-square	0.5005	0.4768	0.4715	0.4586	0.4713	0.4523	0.4482

*Note: The absolute value of z-statistics is reported in parentheses. *denotes significant at 10%, ** denotes significant at 5% and *** denoted significant at 1%.*
Source: Synthesis by STATA.

on hand. Specifically, the higher is this ratio, the higher the level of cash held by a firm. An insufficient amount of cash forces firms to use their external financial resources, which may have been very limited after 2008, or even have to liquidate their assets, which may have been substantially deteriorated in value in such a hard period of the economy.

The next significant variable in our final regression is RE/TA. Except Model 1, this ratio is significant at a 1% significance level in all regressions. Its coefficients in all multivariate regressions are consistently negative, which means that this ratio has negative movement with the probability of being in financial distress. This result matches the conclusion of Altman (1968). In the final model, RE/TA has the second largest impact on the dependent variable with a coefficient of -5.62. The sign and magnitude carried by RE/TA also follow what actually appears in the reality. Regarding the marginal effect, a 1% increase in RE/TA will lead to a 0.098% decrease in financial distress probability. RE (retained earnings) is a part of net income that was not paid out to the shareholders in the form of dividends. Thus, RE/TA measures cumulative profitability over time as a proportion of total assets. Through high correlation with NI/TA (at 0.77), RE/TA partly shows the company's ability to make profit over time. Moreover, this ratio can also indicate a firm's size and its establishment period. In the 1990s, 25% of the newly established enterprises were going in to bankruptcy within three years after their establishment (Dun and Bradstreet, 2004). In terms of retained earnings, small and newly established enterprises cannot retain much of their income. Thus, a higher RE/TA implies better profitability, longer establishment and a higher market reputation for firms.

From Model 7, Size has a negative coefficient which is statistically significant at a significance level of 5%. This finding is consistent with the previous study of Ohlson (1980). The author concludes that size affect the probability of financial distress in Vietnamese listed firms, especially those on the HOSE. In reality, large-cap companies often have more power in its trading position with counterparties as well as more approaches to financing resources. Therefore, it is easier for them to weather unexpected downturns. The coefficient of -1.4 in the final regression implies that the log odds of financial distress decreases by 1.4 for every one unit change in Size. In terms of marginal effect, for 1% increase in size, the probability at which a firm falling into financial distress decreases by nearly 0.025%. Size is also the ratio that has the smallest influence (smallest coefficient) on financial distress of HOSE listed firms.

TL/TA is the only variable that has a positive coefficient in our regression models. In the final model, this ratio coefficient is 2.91. For interpretation, a 1 unit increase in TL/TA will increase the log odds of corporate financial distress by 2.91. In terms of marginal effect, an increase in the TL/TA by 1% results in a 0.05% increase in financial distress for listed enterprises. This ratio is significant in Model 6 and Model 7. The positive sign is consistent in all regressions, which also follows the research of Ohlson (1980), Beaver (1966) and Zmijewsk (1984). TL/TA measures the proportion of an enterprise's assets financed with debts. Theoretically, financial risk increases when the firm uses more leverage in its capital structure. Thus, an increase in TL/TA stands as a bad indicator for the firm' financial position as it will create more financial pressure. However, if the firm maintains this ratio at a very low level, it cannot take advantage of tax shields brought by using debts. Therefore, firms need to seek to

balance the costs of financial distress with the tax shield benefits from using debts.

Applying Model 7's results, the authors build a model showing the determinants of financial distress of Vietnamese listed firms, especially those on the HOSE. Because all the inputs (explanatory variables) can be easily acquired from public sources, this model can assist individual investors or any interested party in measuring the probability of a firm falling into financial distress at virtually no cost, which, the authors expect, encourage fund allocation, investment decision and market efficiency.

$$Z = 10.73 - 1.4X_1 - 15.23X_2 - 5.62X_3 + 2.91X_4 + e$$

• Z: Log-odd of the probability of financial distress for a firm.

• X_1: The firm's Size (log of the firm's market capitalization).

• X_2: Cash/Total Assets (CASH/TA).

• X_3: Retained Earnings/Total Assets (RE/TA).

• X_4: Total Liabilities/Total Assets (TL/TA).

5. Conclusion

The above regressions and subsequent testing give us a fairly reliable model for estimating the financial distress of Vietnamese firms. This model will be a useful tool for investors and other concerned parties in evaluating the financial position of Vietnamese listed firms. Among the determinants of financial distress, CASH/TA has the most significant impact on Vietnamese enterprises' financial conditions, due to its higher coefficient. Firms with a low or negative cash balance over years are considered to be in an extremely bad position and have a high chance of being bankrupt, which is proven both in theory and in reality. The role of cash is extremely important in the time of crisis due to the lack of liquidity in the overall market. Even profitable companies can go into financial distress or bankruptcy if they do not have sufficient cash to deal with their outstanding payments.

Next, RE/TA is also a significant determinant of listed firms' profitability and establishment period. Firms which have an increasing amount of retained earnings over time are expected to have stable operating conditions with many profitable investing opportunities. In terms of Size, larger firms are expected to have a stronger financial position compared to smaller firms, thanks to several advantages in dealing with customers, suppliers and other stakeholders. Larger-sized firms can also take advantage of economies of scale in order to increase their productivity and decrease production costs. Regarding the capital structure of Vietnamese firms, the model shows that those firms' financial strength will increase with the decrease in TL/TA.

As the Vietnamese market is young with insufficient transparency in the information-disclosure system, the data used in this paper, although acquired from official reliable sources, should be used with care. Nevertheless, the writer hopes that this study can partly enhance the distress evaluating ability of Vietnamese enterprises. Better evaluation of financial distress helps mitigate potential harmful effects caused by this economic catastrophe. Moreover, this research will add a reference to the topic regarding the forecast of firms' failure, which is still a fresh and insufficiently-covered topic in Vietnam. This paper's logit model can be further researched to identify the appropriate thresholds distinguishing different distressed levels for Vietnamese listed firms. Those thresholds can provide clearer views for the market's parties when it comes to the forecast of a firm's financial position.

References

Altman, E.I (1968), 'Financial Ratios, Discriminant Analysis, and Prediction of Corporate Bankruptcy', *Journal of Finance*, Vol. 23, No. 4, pp. 589-610.

Andrade, G., and Kaplan, S. (1998), 'How Costly is Financial (Not Economic) Distress? Evidence from Highly Leveraged Transactions that Became Distressed', *Journal of Finance,* Vol. 53, No. 5, pp. 1443-1493.

Balcaen, S. and Ooghe H. (2004), '35 Years of Studies on Business Failure: an Overview of the Classical Statistical Methodologies and Their Related Problems', *Working paper*, Universiteit Gent.

Beaver, W.H. (1966), 'Financial Ratios as Predictors of Failure', *Journal of Accounting Research*, Vol. 4, Supplement, pp. 71-111.

Bilderbeek, J. (1979), 'An Empirical Study of the predictive Ability of Financial Ratios in the Netherlands', *Zeitschrift Fur Betriebswirtschaft,* Vol.5, pp. 388-407.

Brown, D., James, C., and Mooradian, R. (1993), 'The Information Content of Distressed Restructurings Involving Public and Private Debt Claims', *Journal of Financial Economics*, Vol. 33, No. 1, pp. 93-118.

Dun and Bradstreet (2004), *Small Business: Preventing Failure – Promoting Success*, Lewis A Paul, Jr., the Wichita State University, Small Business Development Center.

Gestel, T., Baesens, B., Suykens, J., Van den Poel, D., Baestaens, D., Willekens, M. (2006), 'Bayesian Kernel Based Classification for Financial Distress Detection', *European Journal of Operational Research*, Vol. 172, No. 3, pp. 979-1003.

Hendel, I. (1996), 'Competition under Financial Distress', *Journal of Industrial Economics*, Vol. 44, No. 3, pp. 309-324.

Maddala, G. S. (1977), *Econometrics*, McGraw-Hill, New York.

Narayanan, P. (1999), 'Business Failure Classification Models in Emerging Markets', *International Journal of Banking*, Vol. 23, pp. 29-54.

Ohlson, J. A. (1980), 'Financial Ratios and the Probabilistic Prediction of Bankruptcy', *Journal of Accounting Research*, Vol. 18 No. 1, pp.109-131.

Opler, T. C., and S. Titman (1994), 'Financial Distress and Corporate Performance', *Journal of Finance,* Vol. 49, No. 3, pp. 1015-1040.

Pervan, M. (2012), 'Influence of Firm Size on Its Business Success', *Croatian Operational Research Review*, Vol.3, pp. 213-223.

Polsiri, P. and K. Sookhanaphibarn (2009), 'Corporate Distress Prediction Models Using Governance and Financial Variables: Evidence from Thai Listed Firms during the East Asian Economic Crisis', *Journal of Economics and Management*, Vol.5, No.2, pp. 273-304.

Sarlija, N. and M. Jeger (2011), 'Comparing Financial Distress Prediction Models Before And During Recession', *Croatian Operational Research Review (CRORR)*, Vol.2, pp.133-142.

Whitaker, R. B. (1999), 'The Early Stages of Financial Distress', *Journal of Economics and Finance*, Vol. 23, No. 2, pp.123-133.

Zmijewski, M.E. (1984), 'Methodological Issues Related to the Estimation of Financial Distress Prediction Models', *Journal of Accounting Research*, Vol. 22, No. 1, pp.59-82.