

## **CHAPTER 5 – EMPIRICAL RESULTS**

### **5.0 Introduction**

In this section, we discuss the results of descriptive statistics, univariate logistic regression, multivariate logistic regression model and its accuracy.

### **5.1 Descriptive statistics**

The first step for descriptive analysis of the data is to identify any significant differences between the two groups of companies, namely failed and non-failed companies. In addition to the analysis of financial ratios, this paper also includes tabulation and cross tabulation of non-financial ratios such as development mix, family ownership, Bumiputera managed and firm size, to assess the differences in terms of characteristics of failed and non-failed firms. The distinct differences between the two groups show an early sign of weakness of business operations, hence, leading to weaker financial ratios and higher probability of failure.

Table 5.1 provides descriptive statistics for a median of 5 variables (financial ratios) from year 1995 to 1997. Panel A shows summary statistics for all firms in our sample. Panel B shows summary statistics for firms that did not fail and Panel C shows summary statistics for firms that failed.

**Table 5.1 - Median comparison of financial ratios (1995-1997)**

<b>Year</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>
<b>Full sample (n=78)</b>			
Working capital/ total assets	0.1284	0.1004	0.0770
Retained earnings/ total assets	0.0971	0.1026	0.0940
EBIT/ total assets	0.0554	0.0534	0.0402
Total debt (RMm)	76.1065	125.4680	197.5365
Sales/total assets	0.3834	0.3623	0.3252
<b>Non-failed Sample (n=56)</b>			
Working capital/ total assets	0.1130	0.1029	0.0823
Retained earnings/ total assets	0.1062	0.1196	0.1223
EBIT/ total assets	0.0620	0.0622	0.0517
Total debt (RMm)	67.7545	113.5860	157.2245
Sales/total assets	0.3552	0.3554	0.3038
<b>Failed Sample (n = 22)</b>			
Working capital/ total assets	0.1530	0.0587	0.0607
Retained earnings/ total assets	0.0620	0.0622	0.0517
EBIT/ total assets	0.0458	0.0404	0.0325
Total debt (RMm)	150.9275	268.9320	373.9650
Sales/total assets	0.5232	0.4412	0.4527

*EBIT : Earnings before interest and tax*

Three points were noted from the simple median calculation. Firstly, median of all variables differ between the groups of failed and non-failed firms. Second, EBIT/ total sales for the failed group presents a decreasing trend as the year of failure (year 1998) approaches. This observation is consistent with the expectation that cashflow is negatively related to the probability of failure. Third, total debt is positively related to the probability of failure.

As shown in Table 5.2, the average 3-year growth of "Total liabilities" is higher for the "failed" group at 62.5 percent as compared to 52.2 percent for "non-failed" group. Sales or total turnover for failed companies registered a 3-year average growth of only 18.2 percent as compared to 36.4 percent for non-failed companies. Failed companies also showed weaker EBIT, retained earnings and working capital.

**Table 5.2 - Summary of 3-year average growth (1995-1997)**

	<b>Total</b>	<b>Non-failed</b>	<b>Failed</b>
Total liabilities	59.23%	52.24%	62.51%
Sales	34.14%	36.44%	18.17%
EBIT	30.40%	39.13%	12.43%
Retained earnings	49.83%	55.51%	37.47%
Total assets	36.22%	34.43%	37.25%
Working capital	9.55%	9.35%	3.47%

A cross tabulation of the non-financial data as presented in Table 5.3 shows that 23.1 percent of companies in the sample are family-owned, and out of the failed companies, only 9.1 percent are family owned. Companies that have significant commercial property development exposure comprise 32.1 percent of the sample size. Among the failed companies, 45.5 percent of them have significant commercial development exposure, in line with expectation. Also, 11.5 percent of the sample companies are involved in hotel development, while 29.5 percent of companies are Bumiputera managed. Among the failed sample, 36.4 percent of the companies are Bumiputera-owned. Small firms i.e. those that have paid-up capital of less than RM200 million comprise 44.9 percent of the sample. Also, 68.2 percent of failed companies are small firms, implying that large firms are less likely to fail. On the other hand, firms with assets of less than RM500 million comprise only 25.6 percent of the sample given that most property companies are asset rich. Out of the failed companies, only 31.8 percent of them have assets below RM500 million, implying that asset size is not a predictor of failure, conforming to previous studies.

**Table 5.3 Non- financial descriptive statistics**

	<b>Total (n = 78)</b>	<b>Healthy (n = 56)</b>	<b>Failed (n = 22)</b>
Family owned	23.1%	28.6%	9.1%
More than 40% commercial development	32.1%	26.8%	45.5%
Involved in hotel development	11.5%	12.5%	9.1%
Owned and managed by Bumiputera	29.5%	26.8%	36.4%
Firm size : paid-up capital < RM200m	44.9%	35.7%	68.2%
Firm size : Total asset < RM500m	25.6%	23.2%	31.8%

## 5.2 Univariate logistic regression

Univariate logistic regression was performed for twelve variables (including three dummy variables) to identify the statistically significant ratios, based on a priori findings. The twelve variables and the expected signs are summarised in Table 5.4 below.

**Table 5.4 – Variables tested under univariate logistic regression and the expected sign of coefficient**

Variables	Expected sign of coefficient
Working capital/ total assets	Negative
Retained earnings/ total assets	Negative
EBIT/ total assets	Negative
Total debt	Positive
Sales/total assets	Positive
Cash/ total assets	Negative
Working capital/ equity	Negative
Current assets/ net sales	Negative
Working capital / sales	Negative
Exposure to hotel development	Positive (dummy)
Exposure to commercial sector (> 50% of total development mix)	Positive (dummy)
Bumiputera ownership	Positive (dummy)

Univariate logistic regression shows that operating efficiency ratio (measured by working capital/total assets, working capital/equity and working capital/sales) and operating leverage (measured by sales/total assets and current assets/ net sales), profitability ratio (retained earnings/total assets), cashflow (measured by EBIT/total asset and cash/total assets ) and gearing (measured by total debts) can be used to predict failure. The higher the Sales/total asset and Total debt, the higher the probability of failure. This is because failed companies have over expanded which resulted in high Sales /Total assets. Failed companies also often geared up rapidly to finance the expansion. When demand weakened and property prices declined during the 1997 financial crisis, companies with higher

gearing due to over expansion were more likely to fail. EBIT/total sales and cash/total assets are negatively associated with the probability of failure as companies with strong cashflow are less likely to default on loan repayment. Similarly, companies with strong operating efficiency and operating leverage as indicated by working capital/total assets, working capital to equity and sales/ total assets are less likely to fail.

The sign for commercial exposure is positive, indicating that companies with commercial exposure exceeding 50 per cent of their total development are more likely to fail. This is also in accordance with a priori expectation as commercial properties suffered more than the residential property segment due to oversupply problems and lack of buying interest. All the variables have classification accuracy of at least 60 percent one year prior to failure.

Using data for the period 1995-1997 to test the variables, Table 5.5 shows the financial ratios that were found to be statistically significant at the 10 percent level in univariate logistic regression. Note that all variables are found to be insignificant at the 5 percent level, except for Sales/ Total Assets.

**Table 5.5 - Summary of univariate logistic regression**

<b>Coefficient</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>
Working capital/ total assets	0.7399	-1.1519	-2.0863
Retained earnings/ total assets	-0.1129	-1.5267	-2.1171
EBIT/ total assets	0.4601	-8.4050	-5.6657
Total debt	0.0005	0.0026	0.0016
Sales/total assets	2.4659	2.7575	3.0498
<b>Z-statistics</b>			
Working capital/ total assets	0.6413	-1.0320	-1.7159
Retained earnings/ total assets	-0.1225	-1.2038	-2.0891
EBIT/ total assets	0.4228	-1.8965	-1.6675
Total debt	2.4250	2.4217	2.0207
Sales/total assets	2.6281	2.4628	2.7172
<b>Classification accuracy</b>			
Working capital/ total assets	59.71%	59.73%	61.09%
Retained earnings/ total assets	59.51%	59.96%	62.09%
EBIT/ total assets	59.59%	60.64%	60.85%
Total debt	62.48%	63.37%	61.75%
Sales/total assets	64.41%	63.22%	64.60%

### 5.3 The Multivariate Logit Model

Table 5.6 presents multivariate logistic regression result for one, two and three year prior to failure using data for the period 1995-1997. The results show that the statistically significant predictor variables that entered the multivariate model are: EBIT/ total assets, total debt, and sales/total assets. These three variables in this model represent cashflow, gearing, and operating leverage. Several dummy variables (such as exposure to hotel development, exposure to commercial sector and Bumiputera ownership) were tested and only one is included – firm’s exposure to commercial property development (Commercial Exposure). Results show that EBIT/ total sales is negatively associated with the probability of failure while total debt and sales/ total assets are positively related with the probability

of failure, consistent with expectations. The dummy variable 'Commercial Exposure' is positively related to the probability of failure, consistent with expectations. Moreover, consistent with univariate findings, sales/ total asset ratio is the most significant variable.

All the slope coefficients are significant at 10 percent and are in accordance with priori expectations. Thus, the higher the Sales/Total asset and Total debt, the higher the probability of failure. This is because failed companies have over expanded which resulted in high Sales /Total assets. Failed companies also often gear up rapidly to finance the expansion. When demand weakened and property prices declined during the 1997 financial crisis, companies that have higher gearing due to over expansion are more likely to fail. EBIT/total sales is negatively associated with the probability of failure as companies with strong cashflow are less like to default on loan repayments. The sign for commercial exposure is positive, indicating that companies with commercial exposure exceeding 50% of their total development are more likely to fail. This is also in accordance with a priori expectation as the commercial property sector suffered more than the residential property sector due to oversupply problems and lack of buying interest.

**Table 5.6 - Summary of Multivariate Analysis**

<b>Coefficient</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>
<b>C</b>	-3.230488	-2.956664	-3.027031
EBIT/ total assets	-0.342493	-15.08157	-9.3027
Total debt	0.00333	0.003199	0.001601
Sales/total assets	2.953278	4.49595	4.256716
Commercial exposure	1.010459	0.771364	0.863169
<b>Z-statistics</b>			
<b>C</b>	-4.297228	-3.80208	-3.979931
EBIT/ total assets	-0.339066	-2.55420	-2.110963
Total debt	2.024779	2.34909	1.742117
Sales/total assets	2.815276	3.10754	3.010699
Commercial Exposure *	1.672498	1.16750	1.351951
<b>Classification accuracy</b>	<b>69.49%</b>	<b>73.15%</b>	<b>70.78%</b>
<b>Log Likelihood Ratio</b>	<b>18.6066</b>	<b>26.4261</b>	<b>21.5507</b>

\* Commercial Exposure: Dummy variable for firms that have more than 50 percent exposure to commercial sector

For comparison equivalent to the R-square in linear regression, a more widely used statistic for logistic regression models is the Likelihood Ratio test. This test check if the null model (i.e. the model that only includes the constant term) fits the data as well as the fuller (final) model. In other words, it tests if the variables included in the final model are significant in explaining some of the variability in the data. The test is significant at the 1 percent level, indicating that the variables included can explain a significantly large proportion of the data variability.

The logit model ensures that 1) probability estimated from the logit model will always lies within the logical bound of 0 and 1, and 2) the probability of failure does not increase linearly with a unit change in value of the explanatory variable. Rather, the probability approaches zero at a slower and slower rate as the value of an explanatory variables gets smaller and smaller and the probability approaches 1 at a slower and slower rate as the value of explanatory variable gets larger and larger.



There are two methods to estimate the logit model. Method of Maximum Likelihood is used to estimate data on individual observations, while Ordinary Least Squares is used for group observations. Since the data gathered is on a company by company basis, this paper uses Maximum Likelihood computation to estimate the parameters of the model.

The interpretation of this model is as follows. Holding all other variables constant, if EBIT/Total Asset goes up by one percent, on the average, the probability of failure reduces by 9.3 percent. Similarly, the probability of failure goes up by 0.0016 percent, on average, if Total Debt increases by one percent. If Sales/Total assets goes up by one percent, on the average, the probability of failure increases by 4.3 percent. The probability of failure is also positively related to Commercial Exposure.

Next we proceed with the computation of the actual probability of failure of a company using the model. The computation of the actual probability of failure for company No.1 (non-failed company as per Appendix B) in year 1997 is as follows. Given that EBIT/Total asset = -4.18 percent, Total Debt = RM377 million, Sales/Total assets = 13.2 percent and Commercial exposure = 0, the estimated probability can be computed as 18.7 percent. For the next example using a failed company – company No. 57, given that EBIT/Total asset = -13.7 percent, Total Debt = RM71.4 million, Sales/Total assets = 56.5 percent and Commercial exposure = 1, the estimated probability can be computed as 85.3 percent.

#### 5.4 Testing the accuracy of the model

The model's accuracy will also be tested based on its expected predictive ability. For prediction rule  $p$  that lies between zero and one, a cut-off value of 0.5 was selected. A discrete classification using the predicted probability:

$$\hat{p} = 1 - F(-X' \hat{b})$$

is performed, where  $F$  is a continuous, strictly increasing function that takes a real value and returns a value ranging from zero to one. Observations are classified as having predictive probabilities that are above or below the cut off value. The expectation prediction table is sometimes referred to as the classification table. The fraction of  $y=1$  (failed) observations that are correctly predicted is termed the sensitivity, while the fraction of  $y=0$  (non-failed) observations that are correctly predicted is known as specificity. These two values are expressed in percentage terms (of total observations).

The overall correct classification for the first year prior to insolvency is 70.78 percent. Type I error is at 14.6 percent. Multivariate results for the logit model two years prior to insolvency indicate that the model correctly classifies 73.15 percent of firms. Type I error is at 13.4 percent. Lastly, multivariate logistic results three years prior to failure show that the model classifies correctly 69.49 percent of firms. Type I error is at 15.3 percent. In summary, in contrast with prior empirical evidence, the highest correct classification rate is achieved in the second year prior to failure rather than the first, as in most studies in other countries show.

A comparison with the study by Neophytou (2000), using a similar logistic model based on 102 public industrial companies in the United Kingdom, and three financial variables that are:- 1) a profitability, 2) operating cashflow, and 3) financial leverage ratio, the study yields an overall classification accuracy of 83% one year prior to failure. For further comparisons on the ratios used in other similar studies, please refer to Appendix A.