CHAPTER TWO

DATA AND METHODOLOGY

2.1 SOURCES OF DATA

The data used in this study are obtained directly from the company financial statement such as balance sheet, consolidated balance sheet, profit and loss account and consolidated profit and loss account in the annual reports, where only primary data are being extracted. Those primary data are current assets, current liabilities, inventories, profit before interest and tax, total assets, shareholders' fund, total liabilities, working capital, turnover, fixed assets, accounts receivables, cash, creditors, net profit and issued shares. Thus, the ratios will be calculated based on these primary data. The formulas for the ratios are given in Chapter Three.

2.2 DATA COVERAGE AND PERIOD OF STUDY

The companies used in this study are selected randomly and only the counters that are listed on the Kuala Lumpur Stock Exchange (KLSE) Main Board during the period of study are considered in the sample selection. The sample consists of 54 counters (see Appendix I) selected randomly by using Simple Random Sampling (SRS) method and the study period covered from 1 January 1988 to 31 December 1999 (12-year period). In addition, only companies with

December financial year-end are considered in the sample selection due to the seasonal effect on companies with different financial year-end. Furthermore, finance companies are excluded in this study due to the different layout in their financial statements compared to other companies.

2.3 METHODOLOGY

The analysis will be based on some statistical methods with the help of software packages, such as Econometric Views (E-Views), Statistical Package for Social Sciences (SPSS) and Microsoft Excel. Some of the statistical techniques that are used in this study include: -

(1) Regression Analysis (Ordinary Least Squares),

(2) White's General Heteroscedasticity Test (1980),

(3) The Jarque-Bera (JB) Test of Normality.

This study will be divided into two parts. Part One concentrates on the testing of the proportionality of financial items in different ratios, whereas Part Two of the analysis will involve the testing of the applicability of financial ratios in predicting the company's performance.

It is important to test the proportionality assumption of financial ratios. If proportionality assumption of financial ratios does not hold in this study, it would be meaningless to compare ratios across firms of different sizes. Furthermore, our analysis in company performance prediction will not be meaningful.

To test the proportionality of financial items in different ratios, the ratios are grouped into four categories, namely: -

(1) Liquidity

(2) Return on invested capital/profitability/operating performance

(3) Financial leverage and solvency

(4) Asset utilization and efficiency

The basic ratio method implies that a financial ratio for a firm is compared to some standard deemed to be applicable as given below: -

$$P_i/Q_i = AVE_i + E_i$$

where P_i and Q_i are the variables of interest for firm i (P and Q are primary data), AVE_i is the norm for the industry, and E_i is the difference from that norm. As discussed above, this implies that the relationship between the two variables (a) has no intercept, (b) is linear and (c) given (a) and (b), the ratio is proportional.

In Part One, the Ordinary Least Squares (OLS) regression (REG) is estimated by using the items of financial ratio Y_i/X_i (Y and X are primary data) as follows: -

$$\text{REG:} \quad Y_i = \beta_0 + \beta_1 X_i + \varepsilon_i$$

In regression analysis, OLS regression analysis assumes that the error terms, ε_i (residuals) in the equation are normally distributed about the fitted line and are homoscedastic. However, this model (REG model) may be highly heteroscedastic. Therefore, the problem of heteroscedasticity will be tested using White's approach.

If heteroscedasticity does not occur, t-test will be used to test the proportionality assumption of the financial ratio. However, if heteroscedasticity occurs, the REG model will be transformed into homoscedastic model (PRO) first before t-test is carried out to test the proportionality assumption of the financial ratio. Last but not least, the normality of the error terms of the models will be tested using Jarque-Bera test.

It should perhaps be pointed out that although one of the variables is classified as dependent and the other independent, there is no contention that there is any casual relationship. The statistical test employed here is simply an attempt to elicit the form of any statistical connection between the variables.

In Part Two, we test the applicability of financial ratios in predicting the company performance. Two ratios will be used in this study to measure the company performance, which are earnings per share (EPS) and revenue per share (RPS). The linear regression analysis will be used here to measure the validity of financial ratios in predicting the company performance as follows: -

$$\text{LR: } W_i = \gamma_1 V_{1i} + \gamma_2 V_{2i} + \gamma_3 V_{3i} + \ldots\ldots + \varepsilon_i$$

where the dependent variable (W) is company performance measured by EPS or RPS and the independent variables (V) are estimated by using various financial ratios as specified in Chapter Three.

In addition, enter-all-variables and stepwise methods in linear regression will be used to obtain the useful and relevant financial ratios in predicting the company performance for stocks in the KLSE. In enter-all-variables method, all the regressors are included in running the linear regression. But stepwise method consists of the selection of variables proceeding by steps. At each step, variables already in the equation are evaluated according to the selection criteria for removal; then variables not in the equation are evaluated for entry. This process is repeated until no variable is eligible for entry or removal.

2.4 STATISTICAL TEST

2.4.1 T-TEST FOR PROPORTIONALITY ASSUMPTION

Given the regression model as follows: -

REG: $Y_i = \beta_0 + \beta_1 X_i + \varepsilon_i$

The null and alternative hypotheses are

H_0: $\beta_0 = 0$

H_1: $\beta_0 \neq 0$

Test Statistic: $t = \dfrac{\hat{\beta}_0 - \beta_0}{se(\hat{\beta}_0)}$

where $\hat{\beta}_0$ is the estimator of β_0 and $se(\hat{\beta}_0)$ is the standard error of $\hat{\beta}_0$.

Critical Region: $t > t_{\alpha/2,\, n-2}$ or $t < -t_{\alpha/2,\, n-2}$

Rejecting H_0 means proportionality assumption of the financial ratio is rejected.

And,

H_0: $\beta_1 = 0$

H_1: $\beta_1 \neq 0$

Test Statistic: $t = \dfrac{\hat{\beta}_1 - \beta_1}{se(\hat{\beta}_1)}$

where $\hat{\beta}_1$ is the estimator of β_1 and $se(\hat{\beta}_1)$ is the standard error of $\hat{\beta}_1$.

Critical region: $t > t_{\alpha/2, n-2}$ or $t < -t_{\alpha/2, n-2}$

Rejecting H_0 means proportionality assumption of the financial ratio is not rejected.

However, if heteroscedasticity occurs, we assume that the heteroscedasticity of the REG model takes the form of Var $(\varepsilon_i) = (X_i\sigma)^2$. The model can be transformed into homoscedastic model (PRO) as follows:

PRO: $\mathbf{Y_i/X_i = \beta_1' + (\beta_0'/X_i) + \varepsilon_i'}$

Then, the t-test will be used to test the proportionality assumption of the financial ratio as follows: -

H_0: $\beta_0' = 0$

H_1: $\beta_0' \neq 0$

Test Statistic: $$t = \frac{\hat{\beta}_0' - \beta_0'}{se(\hat{\beta}_0')}$$

where $\hat{\beta}_0'$ is the estimator of β_0' and $se(\hat{\beta}_0')$ is the standard error of $\hat{\beta}_0'$.

Critical region: $t > t_{\alpha/2, n-2}$ or $t < -t_{\alpha/2, n-2}$

Rejecting H_0 means the proportionality assumption of the financial ratio is rejected.

And,

H_0: $\beta_1' = 0$

H_1: $\beta_1' \neq 0$

Test Statistic: $t = \dfrac{\hat{\beta}_1' - \beta_1'}{se(\hat{\beta}_1')}$

where $\hat{\beta}_1'$ is the estimator of β_1' and $se(\hat{\beta}_1')$ is the standard error of $\hat{\beta}_1'$.

Critical region: $t > t_{\alpha/2, n-2}$ or $t < -t_{\alpha/2, n-2}$

Rejecting H_0 means the proportionality assumption of the financial ratio is not rejected.

2.4.2 WHITE'S GENERAL HETEROSCEDASTICITY TEST (1980)

Heteroscedasticity can be divided into pure and impure versions. Pure heteroscedasticity is caused by the error term of the correctly specified estimation; impure heteroscedasticity is caused by specification error.

Heteroscedasticity often occurs in data sets in which there is a wide disparity between the largest and smallest observed values. In cross-sectional data sets, it is easy to get such a large range between the highest and lowest values of the variables.

The general test of heteroscedasticity proposed by White does not rely on the normality assumption and is easy to implement. The White test proceeds as follows: -

(1) Given the data, we estimate the REG regression and obtain the residuals, ε_i.

(2) Use these residuals (squared) as the values of the dependent variable in a second equation that includes as explanatory variables each X from the original equation, the square of each X, and the product of each X times every other X. For example,

$$\varepsilon_i^2 = \lambda_1 + \lambda_2 X_{1i} + \lambda_3 X^2_{1i} + \lambda_4 X_{2i} + \lambda_5 X^2_{2i} + \lambda_6 X_{1i} X_{2i} + v_i$$

for 2 independent variables, X_1 and X_2.

Note that there is a constant term (λ_1) in this equation even though the original regression may or may not contain it. Obtain the coefficient of determination (R^2) from this regression.

(3) Test the overall significance of the equation with the chi-square test under the null hypothesis that there is no heteroscedasticity.

H_0: $\lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = \lambda_5 = \lambda_6 = 0$

H_1: At least one λ_i not equal to zero ($i = 1, 2, 3, 4, 5, 6$)

Test Statistic: $n * R^2$

where n is the sample size, R^2 is the coefficient of determination (the unadjusted R^2) of the equation.

Critical Region: $n * R^2 > \chi^2_{\alpha, df}$

This test statistic has a chi-square distribution with degrees of freedom (df) equal to the number of slope coefficients in the equation.

(4) If n^*R^2 is large, we reject the null hypothesis and conclude that there is heteroscedasticity.

2.4.3 THE JARQUE-BERA (JB) TEST OF NORMALITY

The Jarque-Bera statistic tests whether a series is normally distributed. The JB test statistic effectively aggregates the information in the data about both skewness and kurtosis to produce a normality test. It is also based on the OLS residuals.

H_0: Residuals are normally distributed

H_1: Residuals are not normally distributed

Test Statistic: $$JB = \frac{n}{6}[S^2 + \frac{(K-3)^2}{4}]$$

where n represents the number of observations, S represents skewness and K represents kurtosis.

Critical Region: $JB > \chi^2_{\alpha,\, 2df}$

If the p-value is low, reject H_0.

If the p-value is high, do not reject normality assumption.

Since for a normal distribution the value of skewness is zero and the value of kurtosis is 3, in the formula above, (K-3) represents kurtosis. Under the null hypothesis that the residuals are normally distributed, Jarque and Bera showed that asymptotically (i.e., in large sample) the JB statistic is distributed as a chi-squared random variable with two (2) degrees of freedom. If the p-value of the computed chi-square statistic in an application is sufficiently low, one can reject the hypothesis that the residuals are normally distributed. But if the p-value is reasonably high, one does not reject the normality assumption.