Chapter 3: Research Methodology

This chapter started with the description and formulation of the hypotheses and then theoretical and empirical framework that illustrates all the assumptions, variables and their relations. The methodology that already has been used within the research is explained completely afterwards. The method of data collection, sources of data and information, analytical tools and statistical methods implemented for analyzing the gathered data, will also be discussed and explained in details in this chapter.

3.1 Hypotheses Development

Since this investigation has focused on the exchange rate exposure and the using of two prominent external strategies for hedging against this exposure, these three main Null hypotheses can be mentioned for testing about Malaysian non-financial companies including all sectors in this situation.

H1: There is no relationship between exposure to foreign exchange rate changes and FDD (Foreign Denominated Debts).

H2: There is no relationship between exposure to foreign exchange rate changes and FCD (Foreign Currency Derivatives).

H3: There is no relationship between the use of FDD (Foreign Denominated Debts) and FCD (Foreign Currency Derivatives)

As these three hypotheses considered as null, the alternative hypothesis means that there will be relationship(s) between each of two items that have specified within each hyphothesis.

3.2 Empirical Framework

The framework was divided into three main steps in this study. At step 1, the exposure to exchange rate fluctuations were measured through a time series regression (Equation 1.1) that consistent with the Jorion's (1990) model. In fact, the exposure could be mentioned as the slopes of the coefficient of currency volatilities to the corporation's value based on the same currency. As most of the prominent scholars used this model as a base for their researches about the exposure, this study was not excluded from the model. The model considered the return on common stock for each company based on monthly data and enters this item as dependent variable. The exchange rate fluctuation provides an independent variable that is calculated as the percentage changes of the exchange rate during the specific period of time. Because of the fact that market volatilities could have effective influence in this situation, the model mentioned about the return on market portfolio as the other independent variable. Hence, market portfolio return has been controlled by this action.

Step 2 of the empirical framework has included the three equations known as Cross-sectional regressions (Equations 2.1, 2.2, and 2.3). In fact, after estimating the exposure via the equation 1.1 (the coefficient that advocated as the exposure), the Euclidean norm of this coefficient ($|\beta_{2i}|$) can be used as a dependent variable through the cross-sectional regressions.

The third step of the framework encompasses the other two cross-sectional regressions (Equations 3.1 and 3.2) that will show the relationship between two strategies (FCD and FDD) exploitations.

The three kinds of equations and their components are classified in this situation:

Step 1: Time series regression for estimating the value of the exposure

Equation 1.1: $R_{it} = \beta_{0i} + \beta_{1i} R_{mt} + \beta_{2i} R_{st} + e_{it}$

Where:

R_{it} : Return on the share i (common stock) in period t

R_{mt} : Return on the portfolio of the market in period t

R_{st} : Percentage changes of the exchange rate in period t

β_{0i} : Constant

β_{1i} : Coefficient of market portfolio return

β_{2i} : Coefficient of the exposure

e_{it} : Error term

As explained, after specification the amount of β_{2i} (Appendix 1), the Euclidean norm of this coefficient (the positive sign) have interred into the other equations as an independent variable, so the next regression equations could be as follow:

Step 2: Cross-Sectional regressions for finding the linkage between two strategies (FCD and FDD) and the exchange rate volatilities

Equation 2.1: $|\beta_{2i}| = \theta_0 + \theta_1(FS/TS)_i + \theta_2(FCD)_i + \theta_3(Size)_i + \varepsilon_i$

Equation 2.2: $|\beta_{2i}| = \theta_0 + \theta_1(FS/TS)_i + \theta_2(FDD)_i + \theta_3(Size)_i + \varepsilon_i$

Equation 2.2: $|\beta_{2i}| = \theta_0 + \theta_1(FS/TS)_i + \theta_2(FCD)_i + \theta_3(FDD)_i + \theta_4(Size)_i + \varepsilon_i$

Where:

$|\beta_{2i}|$: The absolute value of exchange rate exposure

FS/TS : Foreign sales to total sales

FCD : Foreign Currency Derivatives (exploitation)

FCD : Foreign Denominated Debts (exploitation)

Size : Size of the corporation

As an illustration, the value of the exposure absolutely can use within the step 2 regressions as independent variables so that the relationship between the two strategies (FDD and FCD) and the exposure of the exchange rate fluctuations can be specified separately and together, and the proxy of FCD and FDD clarifies the use of these techniques that in turn have the value of 0 or 1 in this situation; 0 for when the techniques have been used and 1 for when they have not used, and considered as dummy variables. Hence, if the coefficient of dummy variables meet the negative value, it means that the exposure and the techniques (FCD and FDD) have negative effects to each other, so FCD and FDD can reduce the exposure and vice versa. The ratio of FS/TS shows the degree of foreign involvement during the period that is at least 0.1, and the size of the companies that advocated the effect of this criterion can be estimated based on the exponential log (Ln TA) of total assets of them during the period of time.

Step 3: Logistic regressions for realizing the relationship between using of two techniques (FCD and FDD)

Equation3.1: $(\mathrm{FCD})_i = \theta_0 + \theta_1(\mathrm{FDD})_i + \theta_2(\mathrm{FS/TS})_i + \theta_3(\mathrm{Debt})_i + \theta_4(\mathrm{Size})_i + \varepsilon_i$

Equation3.2: $(\mathrm{FDD})_i = \theta_0 + \theta_1(\mathrm{FCD})_i + \theta_2(\mathrm{FS/TS})_i + \theta_3(\mathrm{Debt})_i + \theta_4(\mathrm{Size})_i + \varepsilon_i$

Like the previous models, the FCD and FDD here just indicated the using of these strategies, and not related to their volume. So, they are considered as dummy variables. The ratio of FS/TS shows the proportion of foreign engagement of the companies via foreign sales and the Size of the firm calculated like the same as previous model by the exponential log of total asset of the companies. The Debt here is the ratio of total debts to total assets.

As aroused from the equations obviously, the relationship between the two strategies can be specified within the equations of step 3, so that if the coefficients of both are found to have positive value, it shows that the two strategies can be used as complementary to one another, and if one coefficient of one technique is found with negative value and the other with positive value, it clarifies that the two techniques are substitutes for each other.

Table 3.1 briefly defined the variables and their predicted signs:

Table 3.1: Variable definition and predicted sign

Variables (Dependent and Independent)	Signs (based on prediction)
R_{it} : Return on common stock (DV)	+ / –
R_{mt} : Return on market portfolio (IV)	+ / –
R_{st} : Exchange rate changes (IV)	+ / –
$\lvert\beta_{2i}\rvert$: Absolute value of the exchange rate exposure (DV)	+
FS/TS : Foreign sales to total sales (IV)	+
FCD : use of Foreign Currency Derivatives (Dummy, DV, and IV)	+
FDD : use of Foreign Denominated Debt (Dummy, DV, and IV)	+
$Size$: Size of the company (Ln TA)(IV)	+
$Debt$: Total debt to total asset (IV)	+

3.3 Selection of Measures

This research is based on all Malaysian non-financial corporations that have had relatively considerable foreign involvement during latest five years (2005-2009) as the specific period of time. Based on many previous researches like He and Lilian (1998), and Nguyen and Faff (2003), ISA (International Standard of Accounting), and GAAP (Generally Accepted Accounting Principles), frequently the amount of at least 10% foreign sales mentioned as a base for effective foreign involvement. Hence, this criterion was selected for restricting the population, and all Malaysian non-financial firms that have had equal or more than 10% foreign sales during each of the years 2005 to 2009 have

been selected. As advocated by Bondar and Wong (2003), and the other previous researchers, stretching the magnitude of the time horizon for cash inflows of the company that were considered as return on the common stock, can provide the condition for the exposure to be more significant. So, the monthly data for a period of latest five years (from the beginning of the year 2005 to end of the year 2009) has been chosen for this investigation. The year 2010 has not selected for the study, since the related data and information for the year has not been completed yet. The non-financial corporations are included in this study, as the financial firms may use the two mentioned strategies (FCD and FDD) for the other purposes that are not related to the issue of hedging.

3.4 Population and Sampling Design

The Population defined as all Malaysian non-financial firms that have had any foreign involvements through foreign sales for the latest five years (2005-2009), and included 517, 714, 733, 669, and 715 securities for the years 2005 to 2009 separately. After population specification, we had to restrict the lists of the securities for providing the sample. So, based on the criterion of at least 10% for foreign sales (FS ≥ 10%), the new lists provided with 179, 248, 279, 257, and 281 securities for the years 2005 to 2009 and considered as fundamental lists for providing the sample. As the final list of our sample should not have any missing data, by using a function of “Count if” in Excel file and matching the five separate fundamental lists to each other, the list of sample provided with contains exactly 100 securities that repeated in each five years, and the recent list has mentioned as a base sample for this investigation. Finally, as the needed data (especially primary data that is

explained in the next part) could not be found for 9 companies of recent list, these securities were droped from the list and the final list of the sample includes 91 companies. With considering to illustration, the sampling in this study provided based on non-probability method that each element of the population does not have any probabilities for choosing in the sample. In more detail, quota sampling method that belongs to the category of non-probability sampling, have been selected for providing the sample; since the criteria (non-financial firms and at least 10% foreign sales) clarified the necessity of obtaining the information from a specific group of companies as the target group. In fact, it could be mentioned as a kind of proportionate stratified method in which a predetermined proportion of companies via allocating some criteria for restricting the population with convenience basis, has been selected (Sekaran, 2002). The necessity of implementing this method was clarified when a subgroup could be mentioned as a representative for the group efficiently. So, if the subgroup was small in number, it would not be neglected to be selected through the sample. Moreover, this method is the only way that could be more effective to gather the needed data earlier and with lower expenses compare with the other methods, so it has been chosen for this research.

3.5 Data Collection Procedure

The process of gathering data started from the January 2011 within all accessible resources. Both kinds of secondary and primary data and information were needed during this research. For providing the secondary data, we used Bloomberg network mainly, Datastream, and any other valid

resources like Bank Negara Malaysia and Bursa Malaysia websites. Moreover, financial statements of the companies included the sample list could be helpful for finding some additional and complementary information. Except one company, sufficient data has been found for the list of 100 securities for the return on its common stock. The return on market portfolio has been extracted from the KLCI indices based on monthly data. After extracting the relavent data of exchange rates from the Bloomberg network, the exchange rate monthly changes (Malaysia Ringgit to USD) were calculated by the Ln function through an Excel file. For the step 2 and step 3 that includes cross-sectional regressions model, as we needed some primary data about using the two strategies (FCD and FDD) by the companies during the latest five years period, after finding the e-mail addresses of the corporations via their websites, at first just two simple Yes/No questions was sent to these addresses through Siswa-mail of University of Malaya. After passing around one month, only 7 companies answered the questions via specified e-mail address, so the necessity of implementing the other effective ways for gathering primary data was emphasized. Hence, connecting directly with the financial department (financial managers, controllers, treasurers or any other related workers that could answer to the questions) of the firms through their contact numbers in addition to ask indirectly by some local friends that could have any relations with the companies as well, altogether 100 corporations were surveyed. At the end of the day, 39 companies advocated positive answers for FCD exploitations during the 5 year period and 15 companies out of 100 used FDD (issuing foreign bonds or any other kinds of foreign debt) within the length of the period. As explained before, the survey

is based on the information and questionnaire of just two Yes or No questions that has been sent to Malaysian non-financial firms that listed on the Bursa Malaysia website in February 2011. All in all, from the total number of 100 companies that were chosen for telephone interviews, 3 corporations strongly refused to answer the questions, one company asked for official applications, one of them taking the contact number, but has not answered later, one left voice message, two firms have not answered, and the line of one of them was wrong, so after continuous survey during two weeks, finally the number of 92 companies answered to our two Yes/No questions. In addition to contact the companies directly, the situation of using FCD and FDD for 7 companies has asked by some of local friends that had linkage with the companies, so this recent answers have found indirectly as well. At the end of the day as the 8 companies have not specified the use of two strategies (FDD and FCD) and one firm did not have other sufficient data; hence, the finalized sample includes 91 companies for including the tests and investigation with enough data.

3.6 Analytical tools and Data Analysis Techniques

The data analysis process in this research includes sorting, editing, analyzing, summarizing and interpreting the outcomes. Because of the fact that our data and information characteristics are more matches with time series data (in step 1) and then using the value of the coefficient (extracted from the step1) through the step 2 and step 3, the most appropriate methods for modeling seemed to be regression. After sorting the gathered data, the package Eviews Enterprise Edition7.1 has been selected as a main analytical instrument for

this study. It combines the technology of the best modern software with the cutting edge features for data handling. As this software is a powerful and innovative statistical tool for modeling, analyzing, and forecasting on the one hand, and it is more user friendly and flexible on the other hand, it was candidate to be chosen. Moreover, it can estimate and show the amount of coefficients, their probabilities, and the outcome of some important tests (*F*-Test and *t*-Test) at the same time in the tables. Moreover, the other prominent tests like Multicollinearity and Heteroskedasticity could be run easily through this software as well.

1. *F*-test

This test shows whether or not the relationship between selected independent variables and dependent variable is significant. In other words, based on analyze of variance (ANOVA) this test usually use for clarification of how the explanatory variables that defined as independent variables within the regression model related to the independent variables and can explain the variability of resent variable significantly.

2. *t* -test

This test that known as *t*-value as well, is used for testing the hypotheses and could be effective when there is no linear relationship between dependent and independent variables. The significance of the parameters themselves can be aroused from the test in this situation. By estimation of the coefficients of the regression equations (β and θ) it will clarify whether or not the independent variables statistically significant to define the dependent variable, so the necessity of them will be specified.

3. Test of Multicollinearity

When the two or more independent variables within the regression model considerably correlate with each other, the Mulicollinearity problem is being created. In fact, in this situation (multicollinearity problem), the estimation of how one independent variable can influence the dependent variable (while it is controlled by the other independent variables) is not accurate and in other words, the pure impact of independent variable to dependent variable cannot be specified accurately. In this case, the standard error usually is high so that if an independent variable completely correlated with the other independent variable(s), the standard error will be infinity and vice versa. Moreover, The bigger the amount of R-squared of dependent variable and a set of independent variables provides the smaller standard error while the R-squared of an independent variable with a set of independent variables except itself, shows the more correlation between that variable and the other independent variables, so the standard error is relatively high. Furthermore, large sample size can reduce the standard error, since it provides the condition for estimation of the coefficients more presisely. Besides, adding more independent variables to the equation can increase the standard error, specially when this action cannot increase in R-squared of dependent variable.

Statistically the problem of multicollinearity can be realized by the tolerance of independent variable (Xi) that specified as (1- R^2_{Xi}), or the reciprocal of this amount that has known as VIF (Variance Inflation Factor). The amount of tolerant near to 1 advocated that there is not considerable multicolinearity problem and if this amount reach to around 0, it means that the threat of

muticollinearity is serious. The VIF clarifies how much the mulicollinearity exist for estimation of the specific coefficient and the index shows the amount of increase in variance of this coefficient by the collinearity problem.

VIF index can be calculated within 3 stages:

If the regression model would be as follow:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n + e$$

A. At first, calculate VIF for all independent variables (X1 to Xn) by running the regression equation for all the independent variables via OLS (Ordinary Least Squar) method, with consideration that X is the function of all the other IVs.

B. Secondly, by using the formula of VIF , calculate the index for all coefficients (β_n) in the the above regression model:

$VIF(\beta_i) = \frac{1}{1-R_i^2}$

C. Thirdly, after calculating the VIF, we can analyze the magnitude of multicollinearity. So, in the condition that VIF > 5 , it means that the multicollinearity problem exist.

4. Test of Heteroskedasticity

When the standard deviation of a variable is not constant over the specific period of time, it provides heteroskedasticity problem. Whithin the regression model, when the condition created that the variance of the error term to be constant, it makes homoskedastisity. In simple regression line, when the amount of X bar changes, and the vertical spread of data around the predicted line to be relatively constant, it famused as homoskedastisity. On the other

hand, in the case that the vertical dispersion of data will not be constant as the X value changes, the condition creates heteroskedastisity problem.

Breusch-Pagan-Godfrey test is designed to detect any linear form of heteroskedasticity, and it is an option built in to Eviews version 7.1. This method can test the null hypothesis when the error variances are all the same contradicted to the alternative hypothesis that the error variances are a multiplicative function of one or more variable. As a case in point, in the condition that the alternative hypothesis states the error variances increase (or decrease) as the predicted values of independent variable increase, the bigger the predicted value provides the bigger the error variance.

3.7 Chapter Summary

As arises from the title, the methodology and its appurtenances have been explained widely in this chapter. At first, by expanding the hypotheses, the theoretical and empirical framework were illustrated in detail so that all equations and their variables have specified completely. The important criteria used for clarifying the population, the selected time period for investigating, and the sampling method and its design has explained afterwards. The ways for data gathering and the outcome of the process has been illustrated as well in this part. The analytical tools and the reasons of its selection and some regarded statistical measurements have been brought in the rest of this chapter.