Chapter 4 : Research Results

4.1 Introduction

This chapter presents the findings and results of the research. As exchange rate (Malaysia Ringgit to USD) floated in July 2005, and the changes of this rate supposed as sources of the risk in this study, the two graphs based on daily and monthly data has clarified the situation at the begining. As explained in detail in previous chapter, the methodology includes three steps of regression models that starts from the step1 for finding the coefficient of foreign exchange rate exposure (β_{2i}) and then this coefficient enters (as dependent variable) into the equations of step 2 that in turn included three cross-sectional regressions with dummy variables (FCD and FDD) as well. The step1 regression (Equation1.1) run for all the 91 securities in the sample, whether they used FCD and FDD or not and after finding β_{2i} for all 91 companies, the absolute value of this coefficient realized and was used as independent variable in the step2 cross-sectional regressions (Equation 2.1, 2.2, and 2.3). So, the most important things from the step1 (Equation1.1) is estimating the coefficient (β_{2i}). After finding the absolute value of β_{2i} , the three cross-sectional regressions including step2 run for all the companies of the sample, and the aim of this step is to realize the relationship between the use of these two techniques (FCD and FDD) and the exchange rate exposure and related risk. Finally, by using the two other regression equations in the step3 (Equation 3.1, and 3.2), the linkage of using these two strategies with each other has been specified. Before and after running the equations of all three steps model, the most prominent tests that has done through many

previous investigations, has implemented for robustness of the research and the outcome of each test has clarified and discussed within this chapter as well.

4.2 Exchange Rate Fluctuations

Although the main purpose of this research was to study the effectiveness of two external hedging strategies (FCDand FDD) for reducing the exchange rate exposure, the exchange rate changes that could provide the risk of the exposure has been specified for the Daily and Monthly data based on MYR to USD for the selected period (2005-2009)as seen in Figure 4.2.1(a) and 4.2.1 (b).

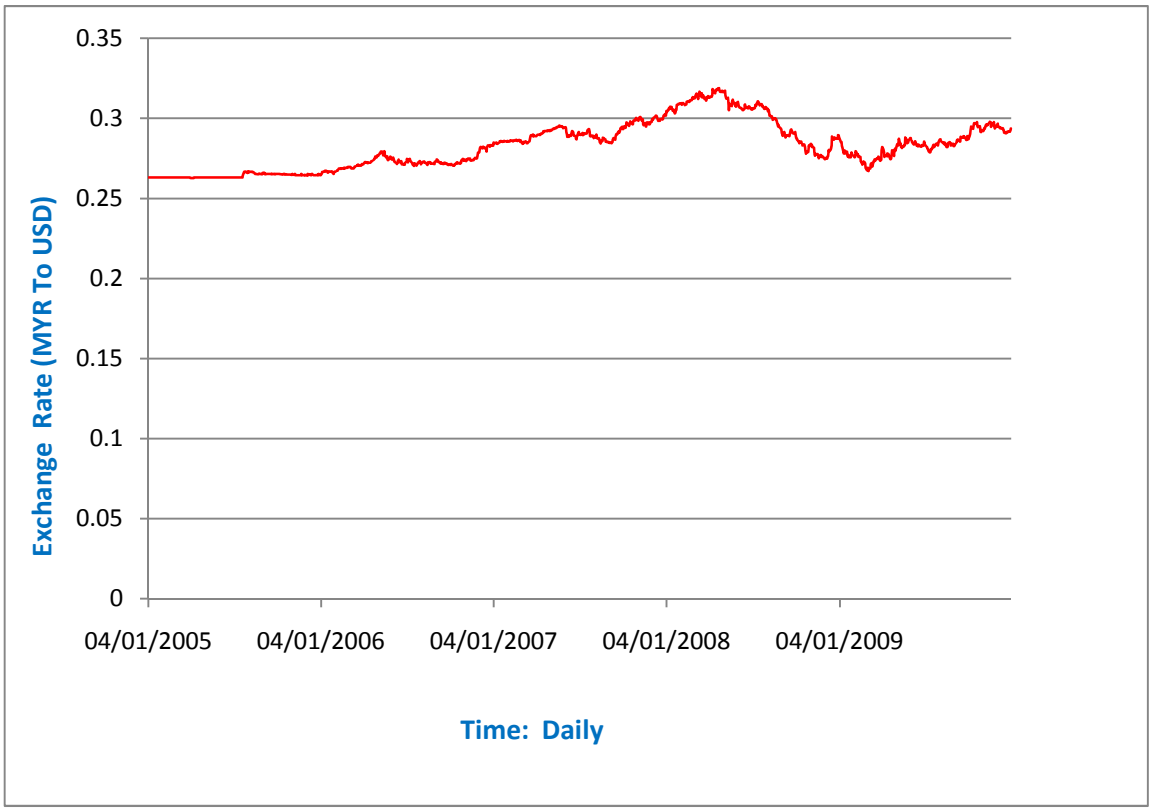

Figure 4.2.1(a): Histogram on the Exchange Rate (Based on Daily Data)

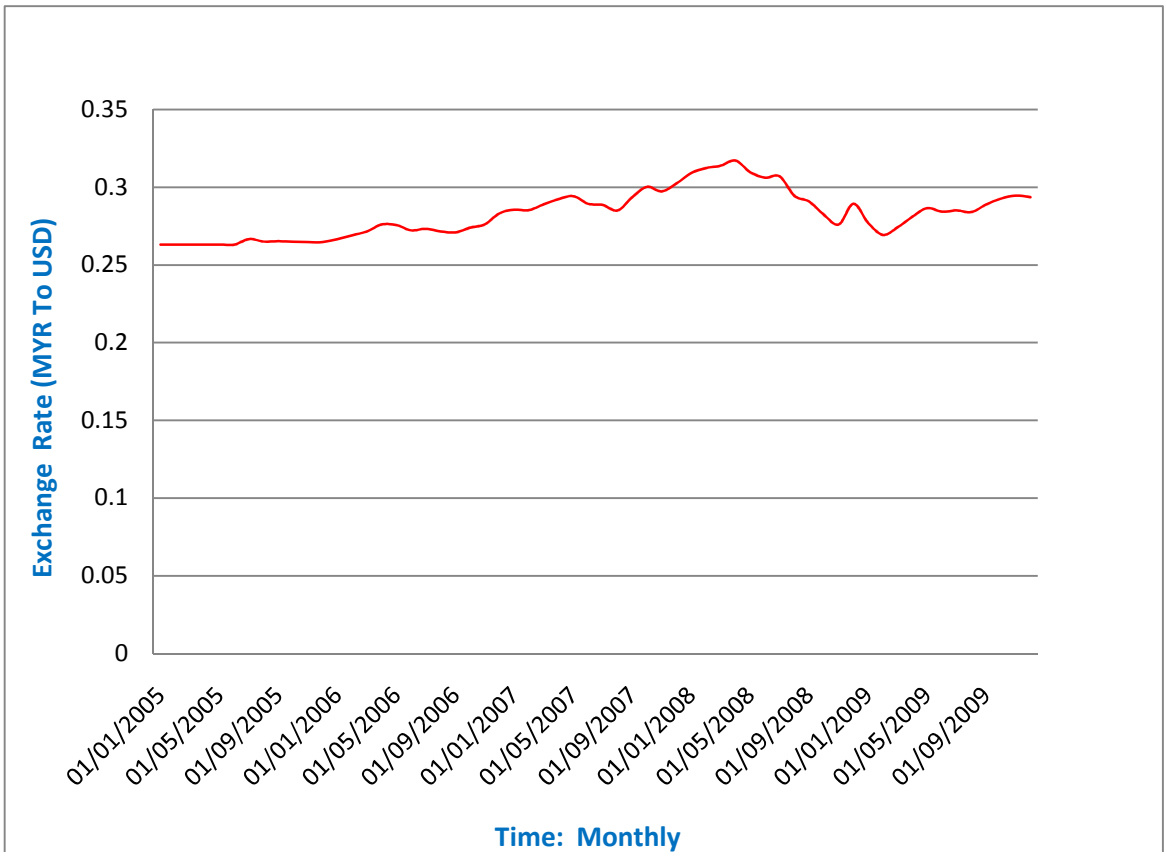

Figure 4.2.1(b): Histogram on the Exchange Rate (Based on Monthly Data)
Source: Bloomberg

As obviously clarified, the exchange rate fluctuations started from the time that the government officially announced to float the exchange rate (from the July 2005). Moreover, the graphs show that although the government announced to float the exchange rate officially, the exchange rate has not have high fluctuations after the time of floatation especially during the latest five years (2005-2009), so it could remind the subject of controling and managing the exchange rate changes by the government and specifically by the BNM (Bank Negara Malaysia) as the Central Bank for stabilizing the condition. Furthermore, the other two histograms that have clarified the changes in volume of the international reserves (based on Ringgit) and the frequency of BNM intervention to the exchange market that has illustrated within the next chapter under the explanation of DCI (Direct Currency Intervention), can cover and robust the subject of the intervention by the BNM for preventing against high exchange rate fluctuations. On the other hand, as the high economic and financial risk provide the condition of motivating the companies to use hedging strategies (Bartram, Brown, and Fehle, 2009), so with considering to the stable economical condition of Malaysia, it seems that the companies have been used the strategies (especially FCDs) for the other purposes (like considering about the opportunities cost) rather than just hedging like mentioning about the opportunities costs (Chen and Raymond, 2002).

4.3 Descriptive statistics and Correlation Matrices

Based on the normality test function, the statistics criteria of all non-dummy variables (including both dependent and independent variables) for all three steps equations, calculated as in Table 4.1:

Table 4.1: Dependent Variable's Criteria

Variables	R_{it}	R_{mt}	R_{st}	β_{2i}	FS/TS	Size	Debt
Mean	-0.44862	8.25268	0.18217	1.1351	40.850	19.6151	0.2009
Median	-0.95694	4.96785	0.05659	0.8678	37.711	19.2118	0.1855
Maximum	73.7598	49.9054	4.70467	6.6546	80.554	24.2907	0.5702
Minimum	-139.624	-37.9200	-4.34313	0.0006	15.424	16.6533	0.0000
Std.Dev.	13.3575	20.0513	1.61500	1.2264	18.128	1.54401	0.1522
Skewness	-0.14532	-0.10711	-0.39904	2.0582	0.5638	0.80632	0.4939
Kurtosis	9.60832	2.93357	4.09653	8.2075	2.2733	3.40966	2.5454
Jarque-Bera	8883.97	11.4444	418.446	167.07	6.8238	10.4971	4.4845
Probability	0.00000	0.00327	0.00000	0.0000	0.0329	0.00525	0.1062
Sum	-2186.14	45059.6	994.667	103.29	3717.4	1784.97	18.289
Sum Sq.Dev.	869283	219481	14238.3	135.37	29579	214.558	2.0858
Observations	4873	5460	5460	91	91	91	91

Based on Table 4.1, as the absolute value (Euclidean) of the Skewness for all mentioned variables are below 2.35 (a general limitation based on the rule of thumb), so all the related histograms would be symmetric and normal. Moreover, since the amount of Kurtosis for some of the variables exceeds 2.35, there have been peaked data compared with their normal distributions. In addition, the Jarque-Bera test shows whether the samples are drawn from a normal distribution or not, based on the related amounts for the 5% and 1%

levels of significance, the critical values are respectively 5.991 and 9.21, so most of the variables could have normal distribution.

Tables 4.2: Correlation Matrices for Dependent Variables and Explanatory Non-Dummy Variables

Step1: Equation 1.1
Sample (adjusted): 5456
Included observations: 4873 after adjustments

Correlation	Ri	Rm	Rs
Ri	1		
Rm	0.154393	1	
Rs	0.121599	0.284677	1

Step2: Equation 2.1, 2.2, and 2.3
Sample: 91
Included observations: 91

Correlation	β_{2i}	FSTS	SIZE
β_{2i}	1		
FSTS	0.014079	1	
SIZE	0.115484	-0.132160	1

Step3: Equation 3.1, and 3.2
Sample: 91
Included observations: 91

Correlation	FSTS	DEBT	SIZE
FSTS	1		
DEBT	0.032423	1	
SIZE	-0.132160	0.318832	1

As clarified by the correlation matrices separately for each step equations, there is not any considerable correlation between the independent explanatory variables within most of the equations.

4.4 Test of Multicollinearity

Multicollinearity tests have been done for all the variables of all the equations in all three steps, and the outcome is shown in Table 4.3 to Table 4.8.

Table 4.3: Multicollinearity, Step 1, Equation 1.1

Variables	R-Squared	VIF
Rm : Return on market portfolio	0.077406	1.08390039
Rs : exchange rate changes	0.077406	1.08390039

Table 4.4: Multicollinearity, Step 2, Equation 2.1

Variables	R-Squared	VIF
FS/TS : Foreign sales to total sales	0.018267	1.01860689
FCD : use of Foreign Currency Derivatives (Dummy: 0 or 1)	0.001422	1.00142402
Size : Size of the company (Ln TA)	0.018249	1.01858821

Table 4.5: Multicollinearity, Step 2, Equation 2.2

Variables	R-Squared	VIF
FS/TS : Foreign sales to total sales	0.018267	1.01860689
FDD : use of Foreign Denominated Debt (Dummy: 0 or 1)	0.001422	1.00142402
Size : Size of the company (Ln TA)	0.018249	1.01858821

Table 4.6: Multicollinearity, Step 2, Equation 2.3

Variables	R-Squared	VIF
FS/TS : Foreign sales to total sales	0.076530	1.08287221
FCD : use of Foreign Currency Derivatives (Dummy: 0 or 1)	0.067478	1.07236075
FDD : use of Foreign Denominated Debt (Dummy: 0 or 1)	0.255070	1.34240801
Size : Size of the company (Ln TA)	0.212165	1.26930131

Table 4.7: Multicollinearity, Step 3, Equation 3.1

Variables	R-Squared	VIF
FDD : use of Foreign Denominated Debt (Dummy: 0 or 1)	0.206229	1.25980918
FS/TS : Foreign sales to total sales	0.072603	1.07828686
Debt : Total debt to total asset	0.111707	1.12575467
Size : Size of the company (Ln TA)	0.256148	1.34435344

Table 4.8: Multicollinearity, Step 3, Equation 3.2

Variables	R-Squared	VIF
FCD : use of Foreign Currency Derivatives (Dummy: 0 or 1)	0.001423	1.00142502
FS/TS : Foreign sales to total sales	0.024449	1.02506173
Debt : Total debt to total asset	0.107313	1.12021346
Size : Size of the company (Ln TA)	0.122620	1.13975700

As clarified from the tables, there is no any R-Squared near to 1 in all the equations from all three steps, so the VIF become less than 5 for all of them. Hence, there is no any Multicollinearity problem in the equations of all three steps.

4.5 Findings and Results

As the equation1.1 from the step1(Time-series regression model) could estimate the foreign exchange rate exposure that specified as β_{2i} in this equation:

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

So, this regression was run for all 91 Malaysian non-financial companies including in the sample and the amount of the coefficient (β_{2i}) estimated for all securities.

After Finding the exposure of exchange rate (β_{2i}), the absolute value of that (Euclidean Norm; $|\beta_{2i}|$) has entered into the all three equations (Cross-sectional regressions) in step 2 as dependent variable, and the outcome of this step is shown in Table 4.9:

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

Equation2.3: $|\beta_{2i}| = \theta_0 + \theta_1(FS/TS)_i + \theta_2(FCD)_i + \theta_3(FDD)_i + \theta_4(Size)_i + \varepsilon_i$

Table 4.9: Cross-sectional Regressions with Financial Hedge Strategies

Equations	Equation 2.1	Equation 2.2	Equation 2.3
Intercept	- 0.775793	- 1.22200	- 1.085770
FS/TS	0.001980	0.002695	0.002632
Size	0.094403	0.110767	0.109520
FCD	- 0.050601		- 0.025651
FDD		- 0.154607	- 0.144762
R-Squared	0.014634	0.015977	0.016078
F-value	0.430681	0.470866	0.351333

Although the sign of the coefficients of both FCD and FDD in all three regression equations is negative, and this subject can be interpreated as a relationship for reducing the exposure and in turn the related risk by these two strategies, the result is not significant for using FCD and FDD as effective hedging strategies for reducing foreign exchange rate exposure in Malaysia during the latest five years (2005-2009). So, this result could be justified with governmental intervention (as the most probable reason) in this situation, and clarified that as long as the government and BNM (Bank Negara Malaysia) specifically have managed and controlled the foreign exchange rate fluctuations, the usages of the two external hedging strategies by the non-financial firms in the country could not be effective for hedging purposes. So, this subject on the other hand could remined the usages of FCD by the companies for the other purposes like considering about the opportunity cost, trading and making profit rather than hedging. Therefore, the first and the second null hypotheses have not been rejected for the case of Malaysia.

Finally, by the run of step 3 (Logistic regressions), the outputs have been provided in Table 4.10.

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

Table 4.10: The Relationship between the use of FCD and FDD

Dependent Variable	Intercept	FCD	FDD	FS/TS	Debt	Size
FCD	4.0174		1.66024**	- 0.01086	- 0.2527	- 0.20858
FDD	- 20.184**	1.95431**		0.03712**	3.1317	0.75268**

Note. ** $p < 5\%$

Obviousely, the outcome shows that there is a significant relationship between the use of two external hedging strategies (FCD and FDD) by the Malaysian non-financial firms that have interaction with outsiders, so the third null hypothese has been rejected within the research. In addition, the positive signs of the coefficients for FCD and FDD advocated that these two techniques can cover and complete their effects mutually during the exploitation by Malaysian corporations.

4.6 Test of Heteroskedasticity

Based on Eviews (Breusch-Pagan-Godfrey method) for Heteroskedasticity test:

1- P-value of F-statstic and LM (Obs*R-squared of the auxiliary regression; following a chi-square with k degrees of freedom) must be considered at first.

2- The method assumed homoskedasticity as null hypotheses at the begining.

3- If reject the null hypotheses (based on *p*-value less than 5% for *F*-statistic and Obs*R-squared), there will be heteroskedasticity problem, otherwise the null hypotheses will be supported and heteroskedasticity will not be existed anymore.

Table 4.11: Heteroskedasticity, Step 2, Equation 2.1,2.2, and 2.3

Equations	*p*-Value for *F*-statistic	Prob Chi-Square
Equation 2.1	0.5918	0.5803
Equation 2.2	0.5806	0.5690
Equation 2.3	0.7385	0.7260

Table 4.12: Heteroskedasticity, Step 3, Equation 3.1, and 3.3

Equations	*p*-Value for F-statistic	Prob Chi-Square
Equation 3.1	0.7116	0.6986
Equation 3.2	0.0004	0.0007
Equation 3.2 (After WLS)	0.7718	0.7632

Since the fact that the *p*-Value for *F*-statistic and Obs*R-Squared are more than 5% for all equations except the latest one (Equation3.2), there is no heteroskedasticity problem within the models.

As Table 4.12 clarified, for the Equation 3.2 of step3, the *p*-value and Chi-Square are both below 5%; that means there is heteroskedasticity problem at first. For removing this problem, the WLS (Weighted Least Squared) method could be helpful for implementation in this situation, so after generating the new variable (uhatsqr in Eview's file) and running the weighted least squared function, the variables in the equation 3.2 of step3 have found significant as well; hence, the heteroskedasticity problem has not existed afterwards.

4.7 Summary and Discussion

This chapter started with clarification of exchange rate fluctuations based on Malaysia Ringgit to USD during the latest five years (2005-2009) and the related graphs (based on daily and monthly data) specified that the exchange rate has not fluctuated much during the selected period. Different criteria of all variables were specified through descriptive statistics and correlation matrices as well. One of the most prominent pre-tests for regression models, specially for the cross-sectional regressions which is famous as Multicollinearity test has implemented thereafter. Fortunately, no any multicollinearity problem within all equations has been realized. After finding the exchange rate exposures from the time series regression (from Equation 1.1 from step 1), the run of step 2 equations (Cross-sectional regressions) clarified that although the use of FCD and FDD as external hedging strategies could reduce the risk of exposure (as the sign of both coefficients became negative) generally, they are not significant for Malaysian non-financial firms in this situation. So, this could reinforce the subject of intervention by the government for managing and controlling the foreign exchange rate especially by the BNM (Bank Negara Malaysia) during the selected period of time as well as the relatively low fluctuations of exchange rate discussed at the beginning can make this subject robust.

The run of the step 3 equations clarify that FCD and FDD can significantly be used as complementary techniques to each other for hedging against foreign exchange rate fluctuations in Malaysia. Finally, heteroskedasticity test has been run for all three steps equations, and the result has shown that except for equation 3.2 that seemed to have heteroskedasticity problem at the first,

by using WLS (Weighted Least Squared) method, all the variables for this equation became significant as well, so there is no any heteroskedasticity problem within all the equations hereafter.