Journal of Global Business and Social Entrepreneurship (GBSE)
Vol. 3: no. 5 (2017) page 36–45 | gbse.com.my | eISSN 24621714|

EXCHANGE RATE VOLATILITY ON MACROECONOMIC DETERMINANTS IN MALAYSIA: VECTOR ERROR CORRECTION METHOD (VECM) MODEL

Aye Aye Khin [1], Chiow Yet Yee [2], Ler Su Seng [3], Chan Mei Wan [4], Goh Qi Xian [5]

[1, 2, 3, 4 & 5] Faculty of Accountancy & Management (FAM), Universiti Tunku Abdul Rahman (UTAR), Jalan Sungai Long, Bandar Sungai Long, Cheras, 43000 Kajang, Selangor, Malaysia.

ayeaye5@yahoo.com [1], chiowyetyee@gmail.com [2], vincent_ler1314@hotmail.com [3], meiwan97@gmail.com [4], kennygoh2008@hotmail.com [5]

Abstract

This paper investigates the exchange rate volatility on macroeconomic determinants in Malaysia using time series data from January 2010 to August 2016. The study employed the econometric analysis such as Vector Error Correction Method (VECM), Johansen Cointegration Rank test and Granger Causality test to derive the long-run and short-run relationships among the variables. The VECM model results indicated a significant and positive short-run relationship between exchange rate, consumer price index (CPI), and the lagged of the exchange rate. Besides, there is also a significant and negative short-run relationship between exchange rate and money supply. However, interest rate is negatively and statistically insignificant related to exchange rate. Johansen Cointegration Rank test revealed the presence of cointegration and long-run relationship among the variables. The outcome of Granger causality test confirmed a bidirectional causal relationship between exchange rate and money supply. Both CPI and interest rate pointed their unidirectional causalities toward exchange rate. In addition, efforts on structural and institutional reforms are needed for financial sectors in order to deal with the changes caused by exchange rate volatility.

Keywords: Exchange rate, volatility, Macroeconomic, Malaysia

GBSE Journal 2017

1. Introduction

Malaysia exchange rate system was developed from the earliest-Bretton Woods system, and then switched to floating until the latest-managed floating system. Some may hold that the pegging was not necessary in solving the volatilities. Moreover, there are few studies that found no evidence of connection between exchange rate and macroeconomic fundamentals such as (Flood & Rose 1995; Baxter & Stockman 1989). Besides, large numbers of study's findings were pointed to the negative effects or relationships imposed by exchange rate volatility. For instance, exchange rate volatility gives negative pressure on the inflationary rate (Danmola, 2013; Ramasamy & Abar, 2015). The effect of volatility is negative and significant on growth. There are negative linkages among real GDP per capita, money supply, output, interest rate and FDI (Alagidede & Ibrahim, 2016). Adekunle (2010) pointed out that high exchange rate will cause rises on the cost of living in Malaysia due to the parallel relationship of exchange rate and consumer price index.

The relationship between exchange rate and macroeconomics variables were widely investigated in lots of research. However, the empirical evidence might differ due to the target country and availability of data. Therefore, this research is conducted in order to obtain clearer understanding on the impact of exchange rate volatility in Malaysia as the dependent variable and consumer price index, interest rate, and money supply are selected as the independent variables using the most recent data in Figure 1. The continuous depreciation of Ringgit has put Malaysia economy in a risky condition. Entering 2016, ringgit remains vulnerable to external pressures. Figure 1 shows that ringgit has slowly appreciated during January 2010 to July 2011, and recorded the lowest rate which is RM2.95/USD within six years. It was fluctuated during the remaining period but maintained at a rate of less than RM3.40/USD. In December 2011, the trend went up higher and higher as ringgit started to depreciate. Entering July 2015, the exchange rate had no longer maintained below RM3.80/USD and even reached a peak at RM4.45 against USD in September 2015, which is the worst currency crash over the years. Although it has slightly returned to lower rates, but still considered unhealthy for Malaysia economy. However, the consumer price index (CPI), money supply and interest rate are increasing trend during the estimating period from January 2010 to December 2016 (BNM, 2017).

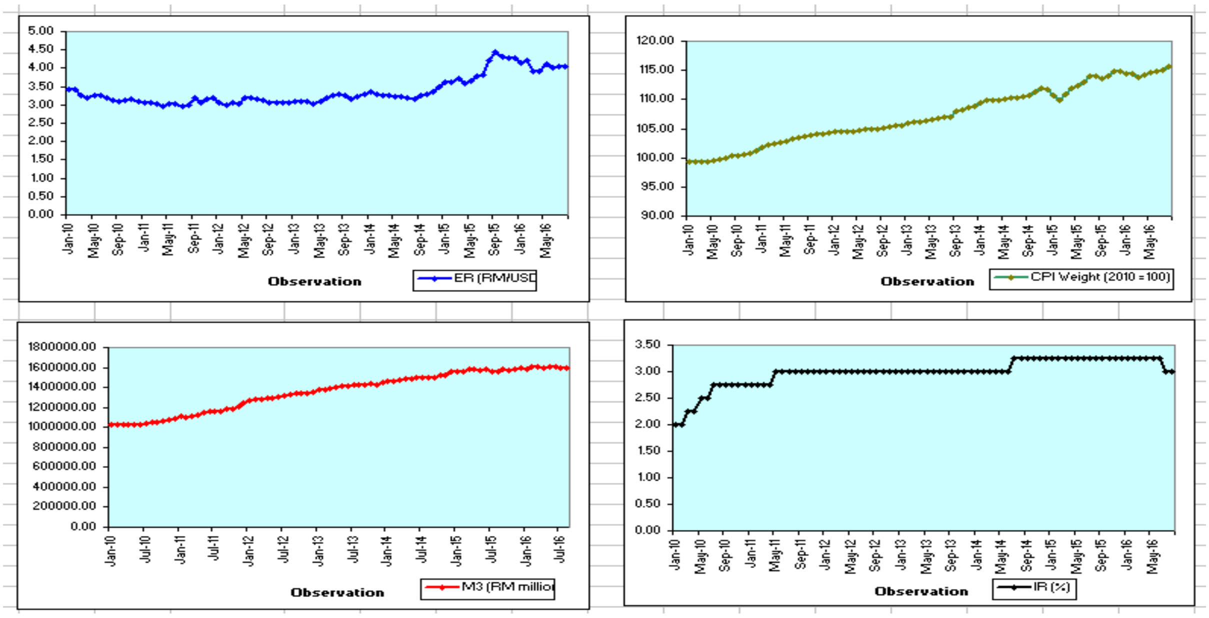

Figure 1: Exchange Rate, Consumer Price Index, Money Supply and Interest Rate from January 2010 to Jun 2016
Adapted from: Bank Negara Malaysia, 2017

2. Literature Reviews

The main objective of this study is to analyse the impact of exchange rate volatility towards the macroeconomic variables in Malaysia from 2010 to 2016. We are intended to evaluate the empirically the relationship between the exchange rate volatility and consumer price index, interest rate and money supply.

Exchange Rate (ER) is defined as the value of a country's currency in exchange with another country's currency. It represents the national currency's quotation related to foreign countries (Azid *et al*., 2005). Exchange Rates has been applied as a strategic policy vehicle that determined the direction of economic resources flow namely the skilled labour, managerial know-how, capital and foreign exchange in import and export sectors (Ebiringa *et al*., 2014). Generally, Real exchange rate (RER) is acknowledged as a crucial macroeconomic variable as compared to the nominal rate. It shows the international competence of a country and the price changes that have been adjusted due to the inflation within a country related to those trading partners.

Ashok & Vikram (2016) analyzed the impact of macroeconomic factors and exchange rate volatility on Indian economy covering the period from 1996 to 2014. The result from linear regression analysis proved that inflation and GDP were statistically insignificant and negatively related to exchange rate. Meanwhile, interest rate was found statistically significant as opposed to FDI. Both interest rate and FDI were positively related to exchange rate. Ali *et al* (2015) studied the impact of interest rate, inflation and money supply on exchange rate volatility in Pakistan by using monthly data from July 2000 until June

2009. Evidence from VECM showed that money supply and interest rate were negative factors in affecting exchange rate volatility. The cointegration analysis revealed that there is no variable in the sample that has no cointegration. Granger causality test showed that interest rate granger caused exchange rate, whereas inflation and exchange rate granger caused each other. However, money supply did not granger cause exchange rate. Hence, the study provided evidences that high money supply and rise in interest rate raises the inflation. Eventually, this will increase the exchange rate volatility. The exchange rate and inflation are highly connected in long run and short run.

Katusiime *et al* (2015) developed an Autoregressive Distributed Lag (ARDL) model to estimate the effect of exchange rate volatility on economic growth in Uganda using annually data form 1960 to 2011. The cointegration relationship between these variables is confirmed via Pesaran Bound test. They found that inflation generated negative and statistically significant effect on economic growth, the effect is reflected on the price instability in the country. However, the insignificant result for trade openness revealed that it has no effect on the economic growth. Besides, private sector credit and trade openness are positively associated with economic growth in the long and short run. One effect is statistically significant and another one is statistically insignificant. The key findings revealed that exchange rate volatility positively influenced economic growth in long and short term. Sekantsi (2011) investigated the effects of real exchange rate volatility South Africa's exports to U.S from January 1995 to February 2007 with the application of a Bounds test approach. Similar to (Katusiime *et al.*, 2015), the paper used GARCH as a measuring instrument for volatility, Unit Root, Cointegration and ARDL Bounds tests. The results showed a significant negative relationship between exports and the variables such as real foreign income and exchange rate volatility which included in the export function. Hence, the findings called for an improvement for competitive exchange rate and more robust macroeconomic fundamentals.

3. Methodology

3.1 Conceptual Framework

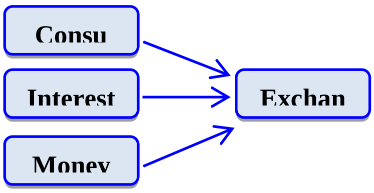

Figure 2: Conceptual Framework for Impact of Exchange Rate Volatility towards the Macroeconomic Variables in Malaysia

Figure 2 illustrates the model of the exchange rate volatility towards the consumer price index, interest rate and money supply in Malaysia.

3.2 Model Specification

The functional form:

$ER = f(CPI, IR, M3)$ (1)

The original form:

$ER_t = \beta_0 + \beta_1 CPI_{t-1} + \beta_2 IR_{t-1} + \beta_3 M3_{t-1} + \varepsilon_t$

where:
- ER = Exchange rate (RM/USD)
- CPI = Consumer price index (2010=100)
- IR = BNM Overnight Policy Rate (% p.a.)
- M3 = Broad money/Money supply M3 (RM million)
- β_0 = Constant coefficient
- $\beta_1, \beta_2, \beta_3$ = Coefficients of independent variables
- ε_t = Error term

3.3 Research Hypothesis

Hypothesis 1

H_0: There is no significant relationship between exchange rate volatility and consumer price index.

H_A: There is a significant relationship between exchange rate volatility and consumer price index.

Hypothesis 2

H_0: There is no significant relationship between exchange rate volatility and interest rate.

H_A: There is a significant relationship between exchange rate volatility and interest rate.

Hypothesis 3

H_0: There is no significant relationship between exchange rate volatility and money supply.

H_A: There is a significant relationship between exchange rate volatility and money supply.

3.4 Research Methods

The monthly time series secondary data for exchange rate (ER); consumer price index (CPI); interest rate (IR); and money supply (M3) are collected from the national summary data page of Bank Negara Malaysia (BNM). The data estimation period covers from January 2010 to June 2016, which has total 80 observations. The time series data are then fetched into the analysis tool, Eviews. The research methods for this study are: firstly the preliminary analyses such as correlation, and unit root test, secondly, the Vector Error Correction Method (VECM), co-integration rank test and granger causality test and finally the diagnostic checking involves the application of four tests: i) multicollinearity test (Variance inflation factor), ii) heteroscedasticity (White) test, iii) serial autocorrelation (LM) test, and iv) normality (Jarque- Bera) test.

The preliminary analysis such as correlation analysis, it is to measure the strength of a linear or nonlinear relationship between two variables (William, 2006). The coefficient correlation is known as "r" which depicts how strong or how weak pairs of variables are connected. Then, the unit root test is also important to ensure every single variable to be integrated at the same order to prevent any spurious regression. Hence, Augmented Dickey Fuller (ADF) test and Phillips-Perron (PP) test are used to determine whether a time series variable has a unit root. The general equation of ADF test is denoted as:

$$\Delta Y_t = \beta_1 + \beta_{2t} + \delta Y_{t-1} \sum_{i=1}^{n} \alpha \Delta Y_{t-i} + \varepsilon_t \quad (2)$$

where: Δ = difference operator; t = linear time trend; n = number of lags; ε_t = pure white noise error term; and $Y_{t-1} = (\Delta Y_{t-1} - Y_{t-2}), (\Delta Y_{t-2} - Y_{t-3})$, etc. The error term, u_t is assumed to be correlated. Moreover, granger causality test is carried out to determine the causality and direction of causality between variables (Gujarati & Porter, 2009). Assume that both ε_t are non- correlated. The causal relationship can be explained with the aid of the following pair of equations:

$$X_t = \sum_{i=1}^{n} \alpha_i Y_{t-i} + \sum_{i=1}^{n} \beta_j X_{t-j} + \varepsilon_t \quad (3)$$

$$Yt = \sum_{i=1}^{n} \lambda_i X_{t-i} + \sum_{i=1}^{n} \delta_j Y_{t-j} + \varepsilon_t \quad (4)$$

Vector Error Correction Method (VECM) is from the unrestricted vector autoregressive (VAR) model that used to estimate non-stationary time series that were identified to be cointegrated. Each variable is a linear function of past lags of itself and past lags of the other variables (Gujarati & Porter, 2009). VECM model can be expressed as:

$$\Delta Y_t = \sum_{i=1}^{p} \phi Y_{t-1} + \mu_t \quad (5)$$

where: Y_t is the vector of endogenous variables; p is the order of lag; Y_{t-1} is the lagged variable; ϕ is the coefficient to be estimated; and μ_t is a stochastic error term, which also known as impulse or innovation. Co-integration Rank Test assumes that the variables are integrated of same order, the co-integration analysis which recommended by Johansen & Joselius (1990) is applied to estimate the long run equilibrium relationship in the exchange rate volatility function. The trace and Max-Eigen value test statistics are estimated as the following equations:

$$\lambda_{trace}(r) = -T\sum_{i=r+1}^{N}\ln(1 - \hat{\lambda}_i) \quad (6)$$
$$\lambda_{max}(r, r + 1) = -T\ln(1 - \hat{\lambda}_{r+1}) \quad (7)$$

where: λ_{trace} trace test the null hypothesis r = 0 against the alternative of r > 0
T = number of usable observations
λ_i = Eigen values or estimated characteristics root
λ_{max} test the null hypothesis r = 0 against the alternative of r =1

4. Results and Discussion

4.1 Preliminary Analysis (Correlation Analysis)

The correlation among variables was shown in Table 1. The strength of the correlation is rearranged as CPI > M3> IR, by an order from the strongest to the weakest. The variables namely consumer price index (CPI), interest rate (IR) and money supply (M3), are having moderate positive correlation with exchange rate (ER), r = 0.77, 0.42 and 0.66, respectively.

Table 1: Correlation Matrix

	ER	CPI	IR	M3
ER	1.000000	0.771326	0.423454	0.663974
CPI	**0.771326**	1.000000	0.799556	0.970244
IR	**0.423454**	0.799556	1.000000	0.823394
M3	**0.663974**	0.970244	0.823394	1.000000

Source: Eviews Output

4.2 Unit Root Tests

Table 2 shows the results of unit root test. IR is stationary at I(0), while ER, CPI and M3 are non-stationary at their level but turned stationary as a result of transforming into first differencing. The p-value of ER, CPI and M3 after first differencing reveals that H_0 of nonstationary time series is rejected. It also implies that these variables do not have unit root and integrated of order 1. Both Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests suggested that the selected variables are integrated at I(1).

Table 2: ADF and PP Statistics

Variable	ADF Statistics			PP Statistics		
	Level	Δ^1	Δ^2	Level	Δ^1	Δ^2
ER	-0.4095	-8.5853 ***	-12.087 ***	-0.4805	-8.5891 ***	-22.6847 ***
CPI	-0.1886	-7.5008 ***	-7.0249 ***	0.0530	-6.4758 ***	-18.8589 ***
IR	-4.6475 **	-9.0320 ***	-9.4766 ***	-4.8803**	-9.0945 ***	-38.0912 ***
M3	-1.8869	-9.5890 ***	-14.131 ***	-1.9430	-9.5622 ***	-22.8587 ***

Adapted from: Eviews Output
Notes: ***, **, * indicates that H_0 is rejected at 0.01, 0.05 and 0.10 significant level. The number of lags shows in parentheses. Lag lengths for the ADF unit root test are based on the Akaike's information criterion.

4.3 Vector Error Correction Method (VECM)

The co-integration equation for long-term relationship between variables is below:

	ΔlnER	**ΔlnCPI**	**ΔlnIR**	**ΔlnM3**		
CointEquation	0.0146	0.0228	-0.0357	0.0169	= 0	(8)
	(0.0058)	(0.7005)	(0.0047)	(0.0019)		
	[2.5179**]	[0.3282]	[-7.5186***]	[0.0883]		

In the ER cointegration equation, the variables of ER and IR are cointegrated between the variables. There is also a long-term relationship between ER and IR variables statistically significant at α 0.05 and 0.1 level, respectively.

The VECM model generated four equations as stated below:

$$\mathbf{lnER_t = -1.940 + 0.972\, lnCPI_{t-1} - 0.078\, lnIR_{t-1} - 0.169\, lnM3_{t-1} + 0.835\, lnER_{t-1} + 0.776\varepsilon_t} \quad (9)$$

t= [2.4961**] [-0.1418^{ns}] [-1.8436*] [14.8009***]

R^2=0.7102 Adj R^2= 0.7075

$$\mathbf{lnCPI_t = 0.085 + 0.039\, lnER_{t-1} + 0.050\, lnIR_{t-1} + 0.012\, lnM3_{t-1} + 0.949\, lnCPI_{t-1} + 0.094\varepsilon_t} \quad (10)$$

t= [0.5840^{ns}] [0.7555^{ns}] [0.9238^{ns}] [20.1444***]

R^2=0.6655 Adj R^2= 0.6543

$$\mathbf{lnIR_t = -0.858 - 0.043\, lnER_{t-1} + 0.306\, lnCPI_{t-1} - 0.021\, lnM3_{t-1} + 0.802\, lnIR_{t-1} + 0.679\varepsilon_t} \quad (11)$$

t= [-0.8807^{ns}] [0.8977^{ns}] [-0.2609^{ns}] [16.5276***]

R^2= 0.6410 Adj R^2= 0.6379s

$$\mathbf{lnM3_t = 0.247 - 0.019\, lnER_{t-1} + 0.078\, lnCPI_{t-1} + 0.028\, lnIR_{t-1} - 0.957\, lnM3_{t-1} + 0.226\varepsilon_t} \quad (12)$$

t= [-1.1828^{ns}] [0.6875^{ns}] [1.7152^{ns}] [35.7385***]

R^2=0.6976 Adj R^2= 0.6874

Note: t-statistics in [ ], * statistically significant at the 0.01 level, ** at the 0.05 level, * at the 0.10 level and ^{ns} means not significant.**

Based on the VECM model of ER equation (9), 71 percent of the variation in the explanatory variables is explained by the Exchange Rate equation. The result pointed out that the explanatory variables, namely the consumer price (lnCPI), money supply (lnM3) and the lagged period of the exchange rate ($lnER_{t-1}$) variables were the most influential and decisive factors with statistically significance at the 0.05, 0.10 and 0.01 level, respectively. Next, based on the VECM model of CPI equation (10), 67 percent of the variation in the explanatory variables is explained by the Consumer Price Index equation. The result pointed out that the explanatory variables, namely the lagged period of the consumer price index ($lnCPI_{t-1}$) variable only was the most influential and decisive factors with statistically significance at the 0.01 level.

Furthermore, based on the VECM model of IR equation (11), 64 percent of the variation in the explanatory variables is explained by the Interest Rate equation. The result pointed out that the explanatory variables, namely the lagged period of the interest rate ($lnIR_{t-1}$) variable only was the most influential and decisive factors with statistically significance at the 0.01 level. Moreover, based on the VECM model of M3 equation (12), 69 percent of the variation in the explanatory variables is explained by the Money Supply M3 equation. The result pointed out that the explanatory variables, namely the lagged period of the money supply M3 ($lnM3_{t-1}$) variable only was the most influential and decisive factors with statistically significance at the 0.01 level.

4.4 Cointegration Rank Test

Table 3: Trace test- intercept (no trend) in Cointegration Rank Test

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.01 Critical Value	Prob.**
None *	0.396804	207.3608	77.81884	0.0000
At most 1 *	0.187467	85.02649	54.68150	0.0000
At most 2	0.083571	34.78749	35.45817	0.0122
At most 3	0.046650	13.66795	19.93711	0.0925
At most 4	0.008668	2.106827	6.634897	0.1466

Trace test indicates 2 cointegrating eqn(s) at the 0.01 level
* denotes rejection of the hypothesis at the 0.01 level
**MacKinnon-Haug-Michelis (1999) p-values

According to Table 3 and 4, the first trace statistic 207.3608 is greater than its critical value 77.8188 at 0.01 level, so the H_0 of r = 0 is rejected. The second trace statistic 85.02649 also being greater than its critical value 54.68150 at 0.01 level. Therefore, the H_0 of $r \leq 1$ is also rejected. As a result, trace test had indicated 2 co-integrating equations at 1% significance level. Moreover, the Max-Eigen value test also indicated 2 co-integrating equations at 1% significance level. The Max-Eigen statistic 122.3343 is greater than its critical value 39.37013. Consequently, only the H_0 of r = 0 is rejected in Max-Eigen value test. The second Max-Eigen statistic is 50.23900 also being greater than its critical value 32.71527 at 0.01 level. Therefore, the H_0 of $r \leq 1$ is also rejected. The co-integration test result for both trace test and Max-Eigen tests indicate 2 co-integrating equations at the 1% significance level. It showed the existence of long-run relationship among the variables.

Table 4: Maximum Eigenvalue test- intercept (no trend) in Cointegration Rank Test

Unrestricted Cointegration Rank Test (Maximum Eigen value)				
Hypothesized No. of CE(s)	Eigen value	Max-Eigen Statistic	0.01 Critical Value	Prob.**
None *	0.396804	122.3343	39.37013	0.0000
At most 1 *	0.187467	50.23900	32.71527	0.0000
At most 2	0.083571	21.11954	25.86121	0.0502
At most 3	0.046650	11.56112	18.52001	0.1282
At most 4	0.008668	2.106827	6.634897	0.1466
Max-eigen value test indicates 2 cointegrating eqn(s) at the 0.01 level * denotes rejection of the hypothesis at the 0.01 level **MacKinnon-Haug-Michelis (1999) p-values				

Source: Eviews Output

4.5 Granger Causality Tests

Table 5: Result of Granger Causality Test

CPI → ER*** ER → CPI^{ns}	CPI granger caused ER ER does not granger caused CPI
IR → ER** ER → IR^{ns}	IR granger caused ER ER does not granger caused IR
M3 → ER** **ER → M3***	M3 granger caused ER ER granger caused M3

Adapted from: Eviews Output

Notes : ***, **, * represents the significance levels at 0.01, 0.05 and 0.10 in order to reject null hypothesis. The number of lags included is equals to 1.

In Table 5, the first column indicates the direction of causality, while the second column indicates the causal relationship of two variables. From the result above, there are two pairs of variables with unidirectional causality. The F statistic of CPI to ER is significant at α 0.01 level, and IR to ER is significant at α 0.05 level. As a result, we rejected their null hypothesis of which CPI does not Granger Cause ER and IR does not Granger Cause ER. Therefore, both CPI and IR are found to "Granger Caused" ER, (CPI → ER) and (IR → ER). This proved the presence of unidirectional causality. Otherwise, M3 and ER "Granger Caused" each other due to the fact that their F statistics of M3 to ER and ER to M3 are significant at α 0.05 and 0.10 level. Hence, the direction of causality between M3 and ER is bi-direction (M3 ←→ ER) at α 0.05 and 0.10 level.

4.6 Summary of Residual Diagnosis

Regarding to the summary of residual diagnosis Table 6, residual diagnosis analysis of normality test, heteroscedasticity test, serial correlation (LM) test and multicollinearity test results shows that alternative hypothesis H_A are rejected and H_0 are accepted. Therefore, the exchange rate volatility model's residuals are normally distributed, no heteroscedasticity, no serial correlation and no multicollinearity in the residual diagnosis tests.

Table 6: Summary of Residual Diagnosis

Diagnostic Tests	Results	Hypothesis	Decision
Normality test (Jarque-Bera)	JB statistics: 0.5056; Prob. value: 0.8731	Normality test H_0: error term is normally distributed. H_A: error term is not normally distributed.	P-value >0.05 H_0 is accepted. H_A is rejected.
Heteroscedasticity test (White)	F(3,76) statistics: 0.0342; Prob. value: 0.9756	H_0: The variance is homoscedasticity. H_A: The variance is heteroscedasticity.	P-value >0.01 H_0 is accepted. H_A is rejected.
Serial Correlation test (LM)	F(1,74) statistics: 0.4177; Prob. value: 0.4019	H_0: There is no autocorrelation among the residuals. H_A: There is autocorrelation among the residuals.	P-value >0.05 H_0 is accepted. H_A is rejected
Multicollinearity test (Variance Inflation Factor) (VIF)	VIF = 1/(1-R^2) VIF = 1/(1-0.71) (0.71 = ER equation R^2 value) VIF = 3.4483	H_0: No multicollinearity among the variables. H_A: There is multicollinearity among the variables.	VIF<5 H_0 is accepted. H_A is rejected.

5. Conclusion

The major contribution of this research is that it provided evidence in proving the significant relationship between exchange rate volatility and macroeconomic variables in Malaysia with the support from VECM, Cointegration, and Granger Causality outcomes. VECM model presented the short term significant relationship between exchange rate and macroeconomic variables which are CPI and money supply. This outcome is similar to the findings of (Ali *et al*., 2015; Kamali & Neysi, 2015). Johansen cointegration test revealed the presence of cointegration and long run relationship among the all of the variables. This finding is consistent with the previous research of (Onyekachi & Onyebuchi, 2016; Abbas *et al*., 2011; Ali *et al*., 2015; Kamali & Neysi, 2015, Rehman & Aftab, 2015, Sarac & Karagoz, 2016). The outcome of Granger causality test showed a bidirectional causal relationship between exchange rate and money supply, as similar to the paper of (Zamanian *et al*., 2013). Next, CPI pointed a unidirectional causal relationship towards exchange rate, matching the studies of (Ali *et al.*, 2015; Rehman & Aftab, 2015). Finally, interest rate also delivered a unidirectional causal relationship towards exchange rate (Ali *et al.*, 2015; Rehman & Aftab, 2015). The empirical findings reaffirmed the need to revise current economic practices adopted by the government. Otherwise, it could lead to a series of adverse chain reactions in future.

As an illustration for the negative relationship between interest rate and exchange rate found in this study, when domestic interest rate reduces, it will discourage foreign direct investment. Reduction in home currency demand will increase the exchange rate, which in turn increase the domestic inflation and decrease consumer spending. The evidences that CPI is positively related to exchange rate suggested that people will expect inflation rise up higher in the future. Likewise, money supply will be predicted to decrease when exchange rate increases due to its negative relationship. People may not will to hold more domestic currency at this moment because they expect the currency is going to devalue in the future. Therefore, Malaysia government could pursue macroeconomic policies to control CPI and money supply in order to alleviate such fears and expectations. It could be contractionary monetary policy that allow the money stock to decline, and lead to rise in interest rate. The rise of interest rate will attract more investments, thus leading to appreciation of currency point exchange rate. In addition, efforts on structural and institutional reforms are needed for financial sectors in order to deal with the changes caused by exchange rate volatility. The central bank could incorporate the likely impact of exchange rate volatility in the implementation of monetary policy and interest rate policy for more transparency in the foreign exchange market.

6. References

Azid, T., Jamil, M., Kousar, A., & Kemal, M. A. (2005). Impact of exchange rate volatility on growth and economic performance: A case study of Pakistan, 1973-2003 [with Comments]. *The Pakistan development review*, 749-775.

Adekunle, A. K. (2010). Exchange rates and the consumer price index in Nigeria: A causality approach. *Journal of Emerging Trends in Economics and Management Sciences (JETEMS)*, 1(2), 114 -120.

Abbas, Z., Khan, S., & Rizvi, S. T. H. (2011). Exchange Rates and Macroeconomic Fundamentals: Linear Regression and Cointegration Analysis on Emerging Asian Economies. *International Review of Business Research Papers*, 7(3), 250-263.

Alagidede, P., & Ibrahim, M. (2016). On the causes and effects of exchange rate volatility on economic growth: Evidence from Ghana. *International Growth Centre (IGC)*, 1-27. Retrieved from http://www.theigc.org/project/on-the-causes-and-effect-of-exchange-rate-volatility-on-economic-growth-evidence-from-ghana/

Akinbobola, T. O. (2012). The dynamics of money supply, exchange rate and inflation in Nigeria. *Journal of Applied Finance & Banking*, 2 (4), 117-141. ISSN 1792-6580.

Ashok, M. A., & Vikram, K. A. (2016). Exchange Rate Volatility & its Impact on Macro economic Factors with respect to Indian Economy. *International Journal of Social Science & Management*, 4(6), 1-21. ISSN: 2319-300X.

Ali, T. M., Mahmood, M. T. & Bashir, T. (2015). Impact of Interest Rate, Inflation and Money Supply on Exchange Rate Volatility in Pakistan. *World Applied Sciences Journal*,33 (4): 620-630, ISSN 1818-4952. doi: 10.5829/idosi.wasj.2015.33.04.82

Baxter, M, & Stockman, A, C. (1989). Business Cycles and The Exchnage-Rate Regime. *Journal of Monetary Economics*, 23, 377-400.

Bank Negara Malaysia. (2017). Monthly Statistical Bulletin January 2017, http://www.bnm.gov.my.

Danmola, R. A. (2013). The Impact of Exchange Rate Volatility on The Macroeconomic Variable in Nigeria. *European Scientific Journal*, 9(7), 1-14. ISSN: 1857 – 7881.

Ebiringa, O. T., Chi-Chi, O. A., & Obi, H. K. (2014). Behavioral Pattern of Monetary Policy Variables and Effects on Economic Growth: An Econometric Investigation of Nigeria. *Journal of Economics and Sustainable Development*, *5*(1), 11-20.

Franses, P. H. (1998). *Time Series Models for Business and Economic Forecasting*. New York: NY, Cambridge University Press.

Flood, R, P. & Rose, A, K. (1995). Fixing Exchange Rates a Virtual Quest for Fundamentals. Journal of Monetary Economics, 36(1), 1-37.

Gujarati, D.N., and Porter, D.C. (2009). *Basic econometrics*, 5th ed. New York: McGraw-Hill. ISBN: 978-007-127625-2

Katusiime, L., Agbola, F. W., & Shamsuddin, A. (2015). Exchange rate volatility–economic growth nexus in Uganda. *Applied Economics*, 48(26), 2428-2442. doi: 10.1080/00036846.2015.1122732

Kamali, P. & Neysi, S. H. N. (2015). Examining the Dynamic Effects of Money Supply, Exchange Rate and Inflation in Iran. *Management and Administrative Sciences Review*, 4(2), 349-358. ISSN: 2308-1368.

Khodeir, A. N. (2012). Towards inflation targeting in Egypt: The relationship between exchange rate and inflation. *South African Journal of Economic and Management Sciences*, 15(3), 325-332.

Khin, A. A. & Thambiah, S. (2015). An illustration of modelling analysis pocess of VECM model for rubber industry in Malaysia: A conceptual framework. *6th International Conference on Business and Economics Research*. ISBN: 978-967-5705-17-5.

Onyekachi, O. J., & Onyebuchi, E. M. (2016). An Econometric Analysis of the Relationship between Exchange Rate Depreciation and Inflation in Nigeria. *International Journal of Economics, Commerce and Management*, 4(9). 52-75. ISSN 2348-0386.

Ramasamy, R. & Abar, S. K. (2015). Influence of Macroeconomic Variables on Exchange Rate. *Journal of Economics, Business and Management*, 3(2): 276-281, ISSN 2301-3567. doi: 10.7763/JOEBM.2015.V3.194

Rehman, I. U., & Aftab, M. (2015). On the Linkages between Exchange Rate, Inflation and Interest Rate in Malaysia: Evidence from Autoregressive Distributed Lag Modelling. *Pakistan Journal of Statistics*, 31(5), 609-622.

Sarac, T. B. & Karagoz, K. (2016). Impact of Short-term Interest Rate on Exchange Rate: The Case of Turkey. *Procedia Economics and Finance*, 38, 195-202. doi: 10.1016/S2212-5671(16)30190-3.

Sekantsi, L. (2011). The impact of real exchange rate volatility on South African exports to the United States: A bounds test approach. *Review of Economic and Business Studies*, 8, 119-139.

Tafa, J. (2015). Relationship between exchange rates and interest rates: Case of Albania. *Mediterranean Journal of Social Sciences*, 6(4), 163-170. doi:10.5901/mjss.2015.v6n4p163

Zamanian, G., Pahlavani, M. & Ranjbarnouri, F. (2013). Causal Relation between Money Stock and Exchange Rate under the Fixed and Floating Regimes. *International Journal of Academic Research in Progressive Education and Development*, 2(1). ISSN: 2226-6348.