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The Impact of Exchange Rate Fluctuations on International Trade Between Malaysia and China

KE-CHYN NG[a] AND MUI-YIN CHIN[a*]

[a]*Faculty of Accountancy, Finance, and Business Tunku Abdul Rahman University College Kuala Lumpur, Malaysia*

ABSTRACT

This study examined the impact of exchange rate fluctuations on the level of international trade between Malaysia and China using 45 observations spanning from 2010 quarter 1 to 2021 quarter 1. The Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model was adopted to compute the exchange rate fluctuations. International trade between Malaysia and China was selected in this study as, since 2009, China has consistently been Malaysia's top trading partner. Besides, to produce precise output, this study employed two models: the export and import models. The empirical results, derived from Autoregressive Distributed Lag (ARDL) modelling, suggested that exchange rate fluctuations had a negative but statistically insignificant impact on exports. In contrast, exchange rate fluctuations had a positive and statistically significant impact on imports. This result implied that importers from Malaysia were generally risk-takers, as they tended to trade significantly during periods of high exchange rate fluctuation. However, to avoid losses for both exporters and importers due to exchange rate fluctuations, policymakers from both countries should ensure that facilities for exchange rate hedging become more convenient and straightforward for traders so that international trade continues to bloom for both countries.

JEL Classification: F14, F31

Keywords: ARDL Model; China; Exchange Rate Fluctuation; GARCH Model; Malaysia

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[*] Corresponding author: Email: chinmy@tarc.edu.my

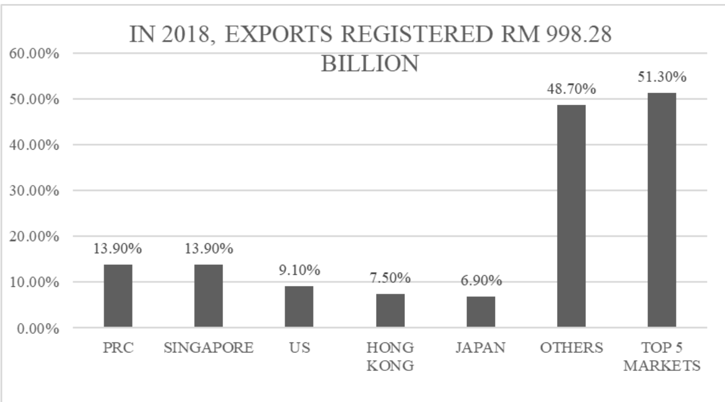
INTRODUCTION

Over time, Malaysia has realised that international trade is crucial for an open economy. In 2018, Malaysia experienced steady growth in its international trade performance after accomplishing double-digit growth in 2017. The World Trade Organisation (WTO) ranked Malaysia as the world's 25th largest exporter and the 26th largest importer (WTO, 2019). As Malaysia's total trade growth was higher than expected, which was attributable to the higher contribution of both exports and imports, in 2018, total trade increased by 5.9% to RM1.88 trillion, as compared to RM1.77 trillion in 2017. Although Malaysia, like many countries in 2018, suffered from the effects of global economic uncertainty, its exports reached nearly RM1 trillion as they rose by 6.7%, reaching RM998.01 billion. At the same time, Malaysia's imports increased by 4.9%, reaching RM877.74 billion.

Source: MITI Report (2018)

Figure 1 Malaysia’s Total Trade in 2018, by Country

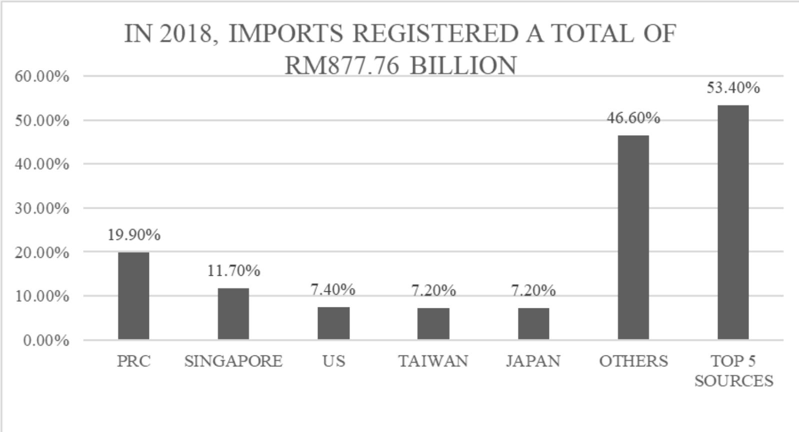
Based on Figure 1, Malaysia's top five major trading partners in 2018 were; China, Singapore, the United States (US), Japan and Thailand. These five countries accounted for 50.6% of Malaysia's total trade. China has been the top trading partner of Malaysia since 2009. On the other hand, from Figure 2, Malaysia's largest export markets were; Singapore and China, which contributed 13.9% to Malaysia's total exports, respectively, followed by the United States, Hong Kong and Japan. These five countries contributed to 51.3% of Malaysia's total exports.



Source: MITI Report (2018)

Figure 2 Malaysia’s Total Exports in 2018, by Country

Meanwhile, referring to Figure 3, Malaysia's primary sources of imports were China, Singapore, the United States, Taiwan, and Japan, where imports from China to Malaysia comprised the most significant percentage, accounting for 19.9% of Malaysia's total imports. Collectively, these five countries accounted for 53.4% of Malaysia's total imports. Based on these figures, China has been playing a pivotal role in Malaysia's trade.



Source: MITI Report (2018)

Figure 3: Malaysia's Total Imports in 2018, by Country

According to Ewubare and Merenini (2019), the exchange rate is a significant macroeconomic variable determining international competitiveness. It is viewed as an indicator of the competitiveness of the currency of any given economy. Exchange rate fluctuations are relatively more important for developing countries since such countries typically have a lack of information regarding future exchange rates (Ohr, 1991). This situation is more critical for those countries that are highly dependent on international trade, such as the developing countries of East Asia (Soleymani and Chua, 2013). Besides, the lack of advanced technology, low industrialisation, and poor infrastructure for development all have highly adverse effects on international trade. Brodsky (1984) argued a direct impact between exchange rate fluctuations and trade through risk, uncertainty and adjustment costs. However, international trade can be affected indirectly through the different frameworks of output, investment and government policies. Yet some studies, for instance, those of; Morgenroht (2000), Todani and Munyama (2005) and Rey (2006), have shown different results, wherein exchange rate fluctuations have had positive effects on the level of international trade. According to Pickard (2003), who found that exchange rate fluctuations had a positive relationship with international trade, it was noted that this was mainly due to risk-portfolio diversification.

Exchange rate fluctuations will create risks for both countries and international traders in terms of uncertainty. Changes in exchange rates will directly affect their future returns, trade and investment decisions (Hooper and Kohlhagen, 1978). However, currency hedging arrangements can easily prevent the creation of risk, but the development of hedging instruments is relatively low in developing markets. Even when well-developed hedging instruments are available, the costs are high, making it an unaffordable option for smaller firms or industries (Levich et al., 1999). Theoretically, the level of risk is ambiguous with trade, as different traders have different attitudes towards risk. Risk-loving traders will increase their level of trade during periods of exchange rate fluctuation to compensate for their anticipated losses. Therefore, this will result in a positive effect on the exchange rate and the level of international trade (Franke, 1991).

On the other hand, according to Mukherjee and Pozo (2011), risk-averse traders will do the opposite of risk-loving traders, as they will avoid losses due to exchange rate risk. Based on the arguments above, there are two contradictory views of the positive and negative relationships between exchange rate fluctuations and the level of international trade. Hence, how exchange rate fluctuations affect the level of international trade is highly dependent on a country's condition and the behaviour of traders. As a result, the primary purpose of this paper is to examine the impact of exchange rate fluctuations on trade flows between Malaysia and China since external trade plays a pivotal role in the Malaysian economy. The scope of this paper is different from previous studies, such as Bahmani-Oskooee and Aftab (2018). They adopted disaggregated data to investigate the asymmetric effects of exchange rate changes on Malaysian Chinese commodity trade and Bahmani-Oskooee and Aftab (2017) for Malaysian-US trade. This study aimed to examine the impact of exchange rate fluctuations on Malaysia and China's export and import performance. Therefore, the macro picture of the overall effect of exchange rate fluctuations on the trade performance between Malaysia and China can be gauged by Malaysian policymakers.

The remainder of this study is organised in the following manner: Section 2 conducts a literature review, while Section 3 focuses on the methodology and data used in this analysis. Section 4 exhibits the empirical results and discusses the findings of the study. Finally, Section 5 covers the concluding remarks and policy implications raised by the study.

LITERATURE REVIEW

Hooper and Kohlhagen (1978) were the first researchers to study the relationship between fluctuations in exchange rates and the volume of international trade (Mustafa and Nishat, 2004). A theoretical model was applied to inspect the connection between currency exchange rate fluctuations and the trade balance. It was tested empirically on various trade flow cases regarding the United States and Germany between 1965-1975. The researchers adopted an equilibrium model by including import demand and export supply functions to examine the price and volume of trade between the United States and Germany. Besides, the authors calculated the standard deviation of the nominal exchange rate to calculate the variable of exchange rate fluctuation. The authors found that fluctuations in the exchange rate had a neutral relationship with both exports and imports, while this relied on the behaviour of importers and exporters, either; risk-averse or risk-loving. If importers or exporters had risk-averse behaviour, then the level of international trade would be negatively affected by fluctuations in the exchange rate. However, exchange rate fluctuations showed a positive impact on the level of international trade when importers or exporters were risk loving. In other words, it could be concluded that exchange rate fluctuations were ambiguous to the level of international trade.

On the other hand, Thorbecke (2011) assessed the level of trade that would be affected due to changes in the exchange rate in East Asia. The author noticed that fluctuations in exchange rates would lead to a decline in exports, in terms of capital and intermediate goods, from developed countries to developing countries in Asia. The study used panel data, which was sourced from 30 countries from 1982 to 2003, with 21 observations. The study found that an appreciation in the exchange rate of developing countries, relative to other country's exchange rates, would cause the exports of finished goods from developing countries, such as Malaysia, Thailand and Indonesia, to decline. Generally, the study concluded that developing and developed economies in Asia were strongly linked by the prevailing exchange rates"Likewise, Soleymani and Saboori (2012) researched the effect of Malaysia's currency (Ringgit Malaysia (RM)) depreciating against the Japanese Yen on the balance of trade of the two country's by utilising annual data from 1974 to 2009. The study investigated 67 industries and obtained a linkage between foreign exchange and the balance of payments by employing a J-curve[1] to examine the short-term effects. At the same time, the Autoregressive Distributed Lag (ARDL) model and Error Correction Model (ECM) were used to analyse the long-term relationship between the manipulated and explained variables. The study's findings showed that if there were a real depreciation of the RM against the Yen, then the balance of payments in most industries would be affected negatively. Besides, only 24 of the 67 industries exhibited a move from short-run effects to long-run effects."

Besides, Nishimura and Hirayama (2013) explored the effects of fluctuations in the Chinese Renminbi and Japanese Yen exchange rate on the level of trade between Japan and China. The study employed two exchange rate fluctuation measurements: the Exponential Generalised Autoregressive Conditional Heteroskedasticity (EGARCH) approach and a computation of the standard deviation of the real growth of the daily currency rate. Both the short- and long-term impacts of foreign exchange uncertainty on the trade performance between China and Japan were obtained by using the ARDL approach. The empirical results showed that the exchange rate level did not influence Japanese exports but that the exchange rate significantly explained the level of Chinese exports. Moreover, foreign exchange uncertainty responded neutrally to the volume of Japanese exports to China, but the fluctuation negatively affected exports from China to Japan.

[1] The J Curve is an economic theory which states that, under certain assumptions, a country's trade deficit will initially worsen after the depreciation of its currency—mainly because thehigher prices onf imports will be greater than the reduced volume of imports.

Moreover, Jordaan and Netshitenzhe (2015) adopted the Ordinary Least Squares (OLS) regression technique to analyse the relationship between the exchange rate and level of trade in South Africa on data from 1988 to 2014. Their findings uncovered that the Real Effective Exchange Rate (REER) had a long-run relationship with trade volume. An increase in the value of the exchange rate (depreciation) positively affected export performance. Meanwhile, based on the ECM result, a depreciation of the REER also resulted in a positive relationship with exports in the short run.

Lastly, Vinh and Duong (2019) analysed the impact of currency exchange fluctuations on Vietnam's exports using quarterly data from 2000 to 2014 and employing the Autoregressive Distributed Lag (ARDL) model. Their empirical findings proved that currency fluctuations had a positive short-run impact on the level of exports. However, export performance was negatively influenced by exchange rate fluctuations at the 1% significance level in the long run. Based on the coefficient, when the foreign exchange rate increased by 1%, the export volume in Vietnam would be reduced by approximately 0.11%.

Based on this review of past literature, the impacts of exchange rate fluctuations on international trade remain inconclusive and depend on the attitudes of the international traders.

METHODOLOGY

Theoretical Framework

According to the Purchasing Power Parity (PPP) and Standard Trade theories, fluctuations of the exchange rate and the real exchange rate should have an expected negative sign with the endogenous variable, exports and imports.

Based on the theory of relative PPP, when a price change occurs in one country, relative to the price in another country, the exchange rate will respond in the opposite direction for a similar basket of goods. The rationale of the theory is that when one country experiences a relatively higher price than its trading partners, imports will become more attractive due to relatively lower prices. At the same time, exports will lose their competitiveness in the international market. Besides, the exchange rate will change as citizens purchase a country's currency with falling prices while selling a country's currency with rising prices (Gallagher, 2000).

While the standard trade theory is a simple approach that links trade performance with fluctuations in the real currency exchange rate, the theory mentions that the international trade volume will be affected by fluctuations in the exchange rate, ceteris paribus. If there is an increase in the real foreign exchange rate in the home country, also known as real currency depreciation, this would indicate that domestic households would purchase fewer imported goods and export relatively more goods, as foreign households would purchase more goods from the domestic country. (Zhang, 2010).

Empirical Model

The objective of this study was to examine the impact of exchange rate fluctuations on the level of international trade between Malaysia and China. This study employed quarterly time series data regarding international trade, which comprised the level of exports and imports from 2010 quarter 1 to 2021 quarter 1. In line with the previous literature review, three leading economic indicators were taken on board as independent variables: the real exchange rate, exchange rate fluctuation, and real GDP (Appuhamilage and Alhayky, 2010; Serenis and Tsounis, 2014). The three independent variables were included to estimate their effects on Malaysia's exports to China and imports from China to Malaysia, respectively. The time-series data model, in a functional form, is shown as follows:

$$\mathrm{EX} = f\,(\mathrm{REXR, VOL, RGDP}) \tag{1}$$
$$\mathrm{IM} = f\,(\mathrm{REXR\ VOL, RGDP}) \tag{2}$$

Where EX denotes Malaysia's exports to China and IM represents Malaysia's imports from China. REXR indicates the real exchange rate, VOL represents exchange rate fluctuation, and RGDP (real gross domestic product) refers to the country's income. However, the variables had different sets of characteristics. Therefore, the variables were transformed into log form to minimise the value of their standard deviations before estimation. Thus, the study employed the following equation:

$$REX_{mt} = \alpha_0 + \alpha_1 REXR_t + \alpha_2 VOL_t + \alpha_3 RGDP_t + \varepsilon_t \quad (3)$$
$$RIM_{mt} = \beta_0 + \beta_1 REXR_t + \beta_2 VOL_t + \beta_3 RGDP_t + \mu_t \quad (4)$$

Meanwhile, the proxy for each of the variable is:

REXmt	=	Malaysia real export to China (RM Billion);
RIMmt	=	Malaysia real import from China (RM Billion);
REXRt	=	Real Exchange Rate (RM-RMB);
VOLt	=	Exchange Rate Fluctuation;
RGDPt	=	Real Gross Domestic Product;
εt, µt	=	Residual; and
t	=	Time Period from 2010; Q1 to 2021; Q1.

According to the relative price effect, as there was an increase in the real exchange rate (depreciation) which may have led Malaysia's export volume to increase, therefore, it was expected that $\alpha_1 > 0$, and vice-versa for Malaysia's imports, where it was expected that $\beta_1 < 0$. Besides, the predicted value was that α_2, $\beta_2 > 0$ or α_2, $\beta_2 < 0$, when the rate of currency exchange fluctuation was experiencing an ambiguous relationship with the level of international trade. Besides, the gravity theory of international trade indicates that if the real GDP were increasing, an increase in exports from Malaysia would be expected. Thus, it was anticipated that $\alpha_3 > 0$. Similarly, an increase in real GDP would result in a higher level of imports from China and, therefore, it was expected that $\beta_3 > 0$.

Test and Procedure

The real exchange rate (REXR), which was used as one of the exogenous variables was computed using the ratio of a foreign price level, which is China's consumer price index (CPI) and the domestic price level, which was denoted by Malaysia's CPI, multiplied by the nominal exchange rate (NEX) (Ewubare and Merenini, 2019). Formally:

$$REXR = (NEX * CPI_{china}) / CPI_{Malaysia} \quad (5)$$

Measurement of Exchange Rate Fluctuations

$VOLt$ depicts the measurement of real exchange rate fluctuations or fluctuations using the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) approach.

The Bahmani-Oskooee and Aftab (2017) GARCH model assumes that REX is random, and it follows a first-order auto-regressive process as follows:

$$REXR_t = a_0 + a_1 REX_{t-1} + \varepsilon_t \quad (6)$$

where ε_t is white noise, while $E(\varepsilon) = 0$ and $V(\varepsilon) = h^2$, respectively.

The following theoretical specification of the GARCH (p, q) model was adopted to estimate the conditional variance of ε_t:

$$h_t^2 = \beta_0 + \beta_1 h_{t-1}^2 + \cdots + \beta_p h_{t-p}^2 + \delta_1 \varepsilon_{t-1}^2 + \cdots + \delta_q \varepsilon_{t-q}^2 \quad (7)$$

h_t^2 denotes the conditional variance. Meanwhile, the predicted value of h_t^2 was the measurement of the fluctuation of $REXR_t$. The order of the GARCH model in this study was determined by the significance of parameters βs and δs in Equation (7). Table 1 below shows the Estimated GARCH (1,1)-in-mean model. Based on the estimation, the dependent and GARCH variables were significant at the 1% significance level. This outcome signified the suitability of using the GARCH approach to estimate exchange rate fluctuations.

Table 1 Estimated GARCH (1,1) in-mean model

	Coefficient	Standard Error
Conditional Mean Equation		
@SQRT(GARCH)	-0.1134	0.3413
C	0.0117	0.008
RERE(-1)	0.9817	0.0147
Conditional Variance Equation		
C	8.73E-06	5.94E-06
RESID(-1)^2	0.1971	0.0873
GARCH(-1)	0.7529	0.081

Note : Dependent Variable: Real Exchange Rate for End of Period (RERE); Method: ML ARCH - Normal distribution (BFGS / Marquardt steps); Coefficient covariance computed using outer product of gradients; Presample variance: backcast (parameter = 0.7); and GARCH = C(4) + C(5)*RESID(-1)^2 + C(6)*GARCH(-1).

Nonetheless, Figure 4 below shows the fluctuation of the exchange rate between Malaysia and China between 2010 quarter 1 to 2021 quarter 4, which aims to provide insight into the measurement of the fluctuations.

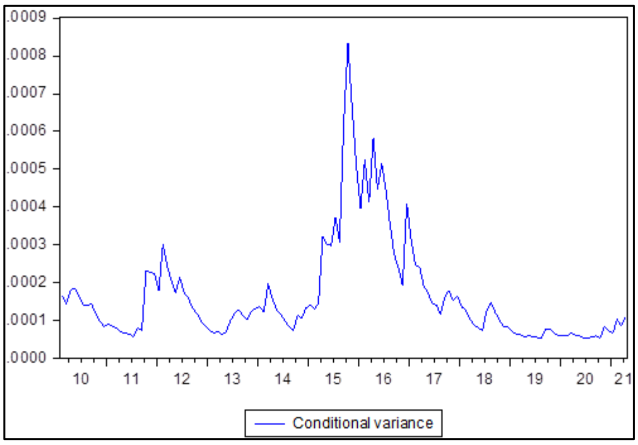


Figure 4 The Fluctuation of Malaysia-China's Exchange Rate

Augmented Dickey-Fuller (ADF) Test

After the exchange rate fluctuation for each year was computed, stationarity testing was carried out. The Augmented Dickey-Fuller (ADF) Test is one of the most commonly used tests to examine whether a series contains stationary or nonstationary data. Dickey and Fuller (1979) introduced the test, better known as the ADF test, with the lagged differenced dependent variable, ΔYt, to overcome the serial correlation problem.

$$\Delta Y_t = \beta_1 + \alpha t + \delta Y_{t-1} + \sum_{i=1}^{m} \theta_i \Delta Y_{t-i} + \varepsilon_t \tag{8}$$

Phillips-Perron (PP) Test

The Phillips-Perron **(**PP) test was also applied in this study, as this test also controls serial correlation when testing for a unit root. The PP test conducts the error term and tests the serial correlation by applying a non-parametric statistical method. Besides, the PP test also respects and overcomes the problems of autocorrelation and heteroscedasticity. The equation of the PP test used in this study was:

$$\Delta Yt \ = \ \alpha 0 \ + \ \beta \ Yt - 1 \ + \ \varepsilon t \tag{9}$$

Autoregressive distributed lag (ARDL) modelling Approach

The ARDL approach was adopted in this study to estimate the long-run coefficients of the independent variables. According to Pesaran and Shin (1999) and Pesaran et al. (2001), the ARDL approach has advantages over conventional cointegration testing. In particular, this approach was suitable for use with the small sample size of 45 observations adopted for this study, making ARDL the best modelling approach to treat the data. In addition, Sarmidi and Salleh (2011) noted that the ARDL approach was applicable, regardless of whether the regressors were trend and/or first-difference stationary. This modelling approach avoids the problems attributable to nonstationary data.

Nevertheless, the suitability of the ARDL approach for the export and import models of this study was first examined using bounds testing. After confirming the long-run relationship among the variables in both models, the long-run coefficients for the variables of both models were estimated, respectively.

Pairwise Granger Causality Tests

Lastly, the Pairwise Granger causality test was applied to determine whether the endogenous and exogenous variables under study had a causal relationship between themselves in the short run. This study determined the Granger causality between the endogenous variables (REXm and RIMm) and the exogenous variables (REXR, VOL and RGDP). The equation of the Granger causality model to test the relationship between the variables was written as follows:

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \ldots + \alpha_i Y_{t-i} + \beta_1 X_{t-1} + \ldots + \beta_i X_{t-i} + \varepsilon_t \quad (10)$$
$$X_t = \alpha_0 + \alpha_1 X_{t-1} + \ldots + \alpha_i X_{t-i} + \beta_1 Y_{t-1} + \ldots + \beta_i Y_{t-i} + \varepsilon_t \quad (11)$$

Diagnostic Testing

In this study, the diagnostic testing carried out included the Jarque-Bera Test, the CUSUM Test, the CUSUM of Squares Test, the Serial Correlation LM Test, the Ramsey RESET Test and the Heteroscedasticity Test. The testing ensured that the model was considered to be the Best Linear Unbiased Estimator (BLUE).

Source of Data

The data of the dependent variables, which were; Malaysian real exports and imports, in RM billions, were obtained from Malaysia's Economic Planning Unit (EPU). The data used to compute the real exchange rate, comprising the nominal exchange rate, was extracted from Bank Negara Malaysia, Malaysia's central bank. While the CPI, the real GDP was derived from the Department of Statistics, Malaysia, dataset. The data collected were quarterly time-series data, comprising 45 observations from 2010 quarter 1 to 2021 quarter 1.

EMPIRICAL RESULT AND DISCUSSION

Unit Root Tests Results

Table 2 Unit Root Tests Results

ADF Unit Root Test					
Level	**Constant**	**Constant & Trend**	**First Difference**	**Constant**	**Constant & Trend**
LEX	0.2666(3)	-4.2707(0)***	d(LEX)	-4.4275(4)***	-4.5977(4)***
LIM	-3.0383(3)**	-0.7203(3)	d(LIM)	-7.6862(2)***	-8.9268(2)***
LREXR	0.1354(3)	-4.3025(0)***	d(LREXR)	-4.3188(4)***	-4.5473(4)***
LRIM	-2.476(3)	-0.5565(3)	d(LRIM)	-8.0497(2)***	-8.8862(2)***
LREXR	-1.2529(0)	-1.5421(0)	d(LREXR)	-5.3747(0)***	-5.2582(1)***
LVOL	-0.9685(0)	-1.3552(0)	d(LVOL)	-5.1628(0)***	-5.1261(0)***
LRGDP	-2.1606(3)	-4.0811(0)**	d(LRGDP)	-6.9128(2)***	-7.5999(2)***
PP Unit Root Test					
Level	**Constant**	**Constant & Trend**	**First Difference**	**Constant**	**Constant & Trend**
LEX	-1.005(43)	-4.2967(8)***	d(LEX)	-13.8582(15)***	-14.4247(14)***
LIM	-2.1167(13)	-3.2075(9)*	d(LIM)	-11.9834(23)***	-15.7956(17)***
LREXR	-2.3963(14)	-4.328(8)**	d(LREXR)	-13.2989(14)***	-15.3831(14)***
LRIM	-1.7696(14)	-3.3809(7)*	d(LRIM)	-12.9546(21)***	-15.5341(18)***
LREXR	-1.2009(5)	-1.6898(2)	d(LREXR)	-5.2573(7)***	-5.1756(8)***
LVOL	-1.0598(1)	-1.5416(1)	d(LOV)	-5.0473(5)***	-4.9962(5)***
LRGDP	-1.6979(22)	-4.0811(0)**	d(LRGDP)	-11.4134(18)***	-14.9798(15)***

Notes: Figures in (…) for ADF tests are the lag lengths while figures in (…) for PP tests are Figures in (…) for PP test is bandwith. The value refers to T-statistic while Asterisks (***) denote significant at 1% levels.

Table 2 exhibits the results of the ADF and PP unit root tests. Based on the estimation, some variables were stationary at level, and some were stationary at order one. The mixed results of $I(0)$ *and* $I(1)$ confirmed that ARDL was the most appropriate approach to treat the data.

Estimation Results Using ARDL Approach

Exports Model

Table 3 Bounds Test for Long-run Cointegration Analysis (Exports Model)

Model	F-statistics	
Export Model : $EX_{mt} = \alpha_0 + \alpha_1 REX_t + \alpha_2 VOL_t + \alpha_3 RGDP_t + \varepsilon_t$	5.0463***	
Nayaran (2005)	K=3, n= 45 (refer to 41)	
Critical value	Lower bound	Upper bound
1%	3.65	4.66
5%	2.79	3.67

Notes: **, and *** denote significant at 5%, and 1% levels, respectively. Critical values are obtained from Narayan (2005).

From Table 3, the F-statistic was greater than the critical upper bound value at the 1% significance level. Thus, it signified a long-run cointegration relationship between real exports from Malaysia to China and its determinants.

Table 4 Long-Run Coefficient Estimates Using ARDL Approach (Exports Model)

Variable	Coefficient	Standard Error	t-Statistic	Probability
LREXR	2.9753	2.1027	1.415	0.1667
LV	-2.9819	2.0908	-1.4262	0.1635
LRGDP	0.9041*	0.4661	1.9398	0.0613
C	-1.0746	6.1139	-0.1758	0.8616

Note: *, ** and *** denote significant at 10%, 5% and 1% respectively.

The result shown in Table 4 indicates a negative long-run relationship between Exchange Rate Fluctuation (LVOL) and Malaysia's exports to China (LEX). Although the negative sign indicated that when there was an increase in exchange rate fluctuation, it would decrease Malaysia's exports to China, the statistic was insignificant. This outcome was in line with the findings of Mustafa and Nishat (2004), which indicated no significant relationship between exports and exchange rate fluctuations between Malaysia and New Zealand. In a nutshell, the estimated result indicated that exchange rate fluctuations did not significantly impact exports from Malaysia to China.

Likewise, the estimated result for the real exchange rate (LREXR) was statistically insignificant, implying that the real exchange rate did not significantly impact Malaysia's exports to China. This finding was in line with the results of Nishimura and Hirayama (2013), as the authors revealed that Japanese exports were not affected significantly by the level of the exchange rate.

On the other hand, there was a positive and significant long-run relationship between real GDP (LRGDP) and Malaysia's exports to China. The empirical result indicated that when there was an increase in real GDP, it would increase Malaysia's exports to China and vice-versa. The result was consistent with the expected sign, as suggested by the studies conducted by Gnoufougou (2013) and Kalaitzi (2018) and was also compatible with the standard trade theory.

Imports Model

Table 5 Bounds Test for Long-run Cointegration Analysis (Imports Model)

Model	F-statistics	
Import Model: $EX_{mt} = IM_{mt} = \beta_0 + \beta_1 REX_t + \beta_2 VOL_t + \beta_3 RGDP_t + \mu_t$	6.2812***	
Nayaran (2005)	K=3, n= 45 (refer to 41)	
Critical value	Lower bound	Upper bound
1%	3.65	4.66
5%	2.79	3.67

Notes: **, and *** denote significant at 5%, and 1% levels, respectively. Critical values are obtained from Narayan (2005).

From Table 5, the F-statistic was greater than the critical upper bound value at the 1% significance level. Thus, it signified a long-run cointegration relationship between real imports from China to Malaysia and its determinants.

Table 6 Long-Run Coefficient Estimates Using ARDL Approach (Imports Model)

Variable	Coefficient	Standard Error	t-Statistic	Probability
LREXR	-2.9162	1.879	-1.552	0.1289
LV	3.4236*	1.8806	1.8205	0.0766
LRGDP	1.3227***	0.1887	7.0107	0.0000
C	-5.9648***	2.474	-2.411	0.0209

Note: *, ** and *** denote significant at 10%, 5% and 1% respectively

From Table 6, it was interesting to discover a positive and significant long-run relationship between Exchange Rate Fluctuation (LVOL) and Malaysia's imports from China (LIMm). The result suggested that a 1% increase in exchange rate fluctuation would result in a 3.4236% increase in Malaysia's imports from China and vice-versa. The result supported the argument of Franke (1991), who postulated that risk-loving traders would increase their level of trade during periods of exchange rate fluctuation to compensate for anticipated losses.

On the other hand, the real exchange rate (LREXR) had a negative but insignificant long-run relationship with Malaysia's imports from China (LIMm). This result was similar to that of the export model.

Besides, there was a positive long-run relationship between real GDP (LRGDP) and Malaysia's imports from China (LIMm). An increase in Malaysia's real GDP by 1% caused Malaysia's imports from China to increase by 0.549% and vice-versa. The result was consistent with the expected sign, as suggested in the studies of Gnoufougou (2013) and Kalaitzi (2018), and compatible with international trade theory.

Diagnostic Check Results

Table 7 Diagnostic Tests Results

Diagnostic Tests	F-Statistics (p-value)
Exports Model	
JB	1.3133(0.5186)
AR (2)	0.1528 (0.6986)
ARCH(1)	0.4045 (0.5286)
RESET (1)	0.2131(0.6476)
CUSUM	Stable
$CUSUM^2$	Stable
Imports Model	
Diagnostic Tests	**F-Statistics (p-value)**
JB	2.263 (0.3226)
AR (2)	0.0172 (0.8963)
ARCH(1)	1.1027 (0.2999)
RESET (1)	1.4558(0.2353)
CUSUM	Stable
$CUSUM^2$	Stable

Notes: JB is the Jarque-Bera statistic for testing normality. AR [2] and ARCH [1] are the Lagrange Multiplier tests of 2nd order serial correlation and 1st order ARCH effects. RESET [1] refers to the 1st order Ramsey RESET specification test. CUSUM is the cumulative sum of recursive residual stability test and CUSUM¬2 is the cumulative sum of the squares of recursive residual stability test.

The diagnostic test results for both the export and import models are shown in Table 7. While each diagnostic test showed no significance in both models, indicating a lack of evidence to reject the null hypothesis of non-specification error. According to the results from; the Jarque-Bera, LM, ARCH and Ramsey RESET tests, both of the models were normally distributed, free from auto serial correlation problems, free from any heteroscedasticity errors and were correctly fitted.

The results of the CUSUM and CUSUM of squares for the export and import models are shown in Figures 5, 6, 7 and 8, respectively. The results implied that the parameters of both models were stable. In short, based on the evidence from all of the diagnostic tests, both models can be concluded as the best models, as they fulfilled the criteria of being the Best Linear Unbiased Estimators (BLUE).

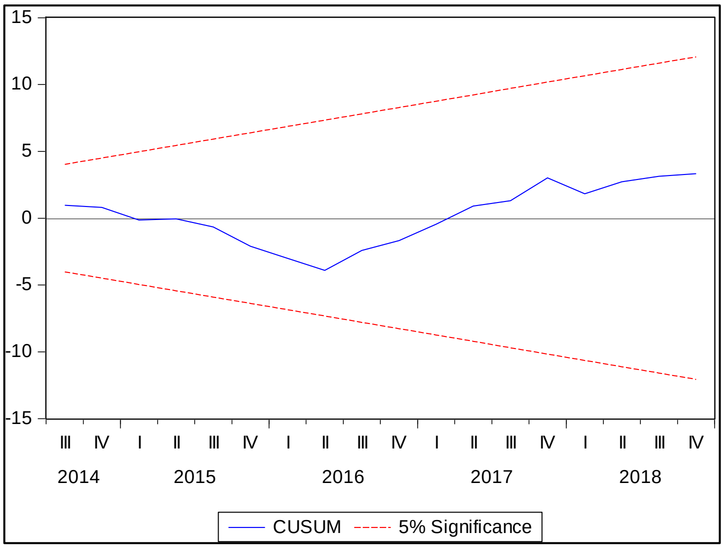


Figure 5 CUSUM Test for Exports Model

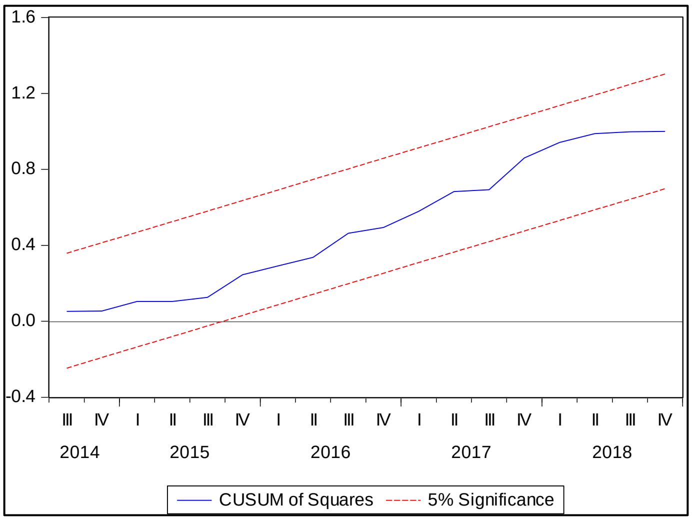


Figure 6 CUSUM^2 Test for Exports Model

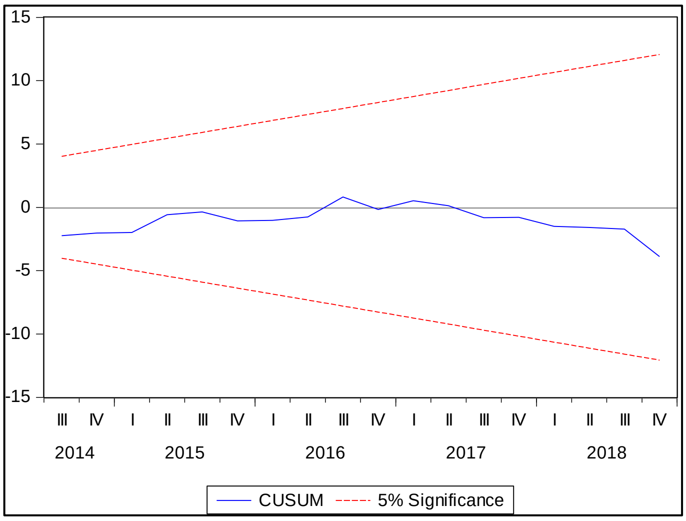


Figure 7 CUSUM Test for Imports Model

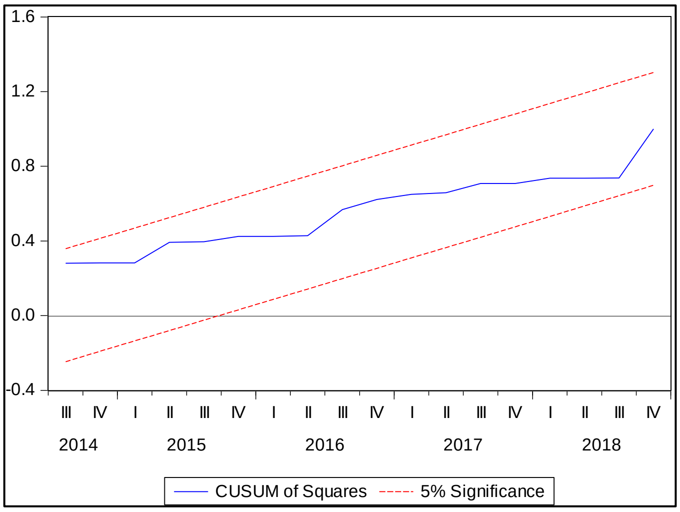


Figure 8 CUSUM^2 Test for Imports Model

Pairwise Granger Causality Tests

Exports Model

Table 8 Pairwise Granger Causality Tests for Exports Model

Null Hypothesis:	No of observation	F-Statistic	Probability
LREXR does not Granger Cause LREXm	44	1.44265	0.2366
LREXm does not Granger Cause LREXR		0.89014	0.3510
LVOL does not Granger Cause LREX	44	1.34837	0.2523
LREX does not Granger Cause LVOL		0.21413	0.6460
LRGDP does not Granger Cause LREX	44	3.74627	0.0598
LREX does not Granger Cause LRGDP		0.77075	0.3851
LVOL does not Granger Cause LREX	44	1.51947	0.2247
LREX does not Granger Cause LOV		26.8536	6.E-06
LRGDP does not Granger Cause LREXR	44	0.31647	0.5768
LREXR does not Granger Cause LRGDP		2.69825	0.1081
LRGDP does not Granger Cause LVOL	44	0.62393	0.4341
LVOL does not Granger Cause LRGDP		3.25639	0.0785

The Pairwise Granger causality relationships between the variables in the export model were estimated using lag 1. The estimated results are shown in Table 8. There was a unidirectional Granger causality relationship from LRGDP to LREXm at the 10% significance level. Meanwhile, a unidirectional Granger causality ran from LREXm and LV to LV and LRGDP, respectively. In a nutshell, there was only unidirectional Granger causality in the short run.

Imports Model

Table 9 Pairwise Granger Causality Tests for Imports Model

Null Hypothesis:	No of observation	F-Statistic	Probability
LREXR does not Granger Cause LRIMm	44	0.84759	0.3626
LRIMm does not Granger Cause LREXR		1.3148	0.2582
LVOL does not Granger Cause LRIMm	44	1.3371	0.2542
LRIMm does not Granger Cause LVOL		2.513	0.1206
LRGDP does not Granger Cause LRIMm	44	0.3682	0.5473
LRIMm does not Granger Cause LRGDP		14.5069	0.0005
LVOL does not Granger Cause LREXR	44	1.5198	0.2247
LREXR does not Granger Cause LVOL		26.8536	6.E-06
LRGDP does not Granger Cause LREXR	44	0.3165	0.5768
LREXR does not Granger Cause LRGDP		2.6982	0.1081
LRGDP does not Granger Cause LVOL	44	0.6239	0.4341
LVOL does not Granger Cause LRGDP		3.2564	0.0785

Meanwhile, the Granger causality relationship between the variables in the import model is shown in Table 9. Like the exports model, lag 1 was adopted, and a unidirectional Granger causality was only detected in the short run. Based on Table 9, a unidirectional Granger causality ran from LRIM and LVOL to LGDP at the 1%

significance level, respectively. Besides, the LREXR Granger caused LVOL in the short run at the 1% significance level too. Apart from the above, the results showed no significant Granger causality relationships for other variables.

CONCLUSION

The purpose of conducting this study was to analyse the impact of exchange rate fluctuations on international trade between Malaysia and China. The study had a concrete focus on the real exchange rate fluctuations using the GARCH model. By employing unit root tests and the ARDL approach, this study analysed quarterly data between 2010: Q1 to 2021: Q1. Based on prior literature and economic theory, three independent variables were taken on board during the estimation: the real GDP (RGDP), the real exchange rate ($REXR_t$) and most importantly, Exchange Rate Fluctuation (VOL_t) on two models, which were Malaysia's exports to China and Malaysia's imports from China, respectively.

The empirical results indicated that, in the long run, exchange rate fluctuations did not significantly impact the exports of Malaysia to China. On the other hand, exchange rate fluctuations positively and significantly impacted Malaysia's imports from China. These findings implied that Malaysia's international traders were risk-takers.

In contrast, in the long- and short-run, the motion of the real exchange rate may lead to changes in relative prices but may not affect trade flows in the international market. This outcome might be attributable to specific elements of the economy, which may involve the currency in which the home producers account for their products and the trade structure. In short, from an empirical viewpoint, numerous studies have yielded mixed findings on the relationship between exchange rate uncertainty and trade. They have stated that the relationship is both complex and complicated. For example, an undervalued currency has often been found to have a positive impact on trade. However, such effects have not been reported to be of a consistent persistence or size across the various studies (See, Morgenroht (2000), Todani and Munyama (2005) and Rey (2006)).

This study aimed to provide an understandable empirical analysis on the impact of exchange rate fluctuations on the level of international trade between Malaysia and China. Based on the results of positive and significant relationships between exchange rate fluctuations in the imports model, it is suggested that exporters in Malaysia are generally risk-takers, as they tend to increase their trade activities during periods of exchange rate fluctuation. Therefore, policymakers in Malaysia should ensure that hedging facilities for the exchange rate are more convenient for traders to assist the volume of international trade to continue to blossom and contribute to the country's GDP.

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