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ON THE MALAYSIAN RINGGIT EXCHANGE RATE DETERMINATION AND RECENT DEPRECIATION

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ABSTRACT

The Ringgit (MYR) has recently, since October 2015, suffered a large decline against most world currencies. In this study, based on the theory of exchange rate determination, we tested for a long run relationship between both MYRUSD and MYRGBP against the differential interest rate, differential money supply, price of world crude oil and Goods and Services Tax (GST, as dummy variable). We ran an Autoregressive Distributive Lag (ARDL) model on monthly data from January 2010 to January 2017. We found a negative long run relationship between MYRGBP and differential money supply and a positive long run relationship against the world crude oil price. As the Ringgit (MYR) supply increased relative to the British Pound, the Ringgit depreciated, and as the crude oil price strengthened, the Ringgit appreciated. A high dependency of the Ringgit on world crude oil implies a bad sign. In our view, Malaysia needs to work harder to attract foreign direct investment to maintain the value of the Ringgit at a healthy level.

JEL Classification: E40, F31

Key words: Exchange rate determination, Foreign exchange, Ringgit, Malaysia

1. INTRODUCTION

Following the Asian crisis of 1997, the Malaysian Ringgit suffered a very hard knock that led to its value being priced at RM4.72 per US Dollar (USD), and this resulted in the Malaysia policy makers pegging the currency at RM3.80 per USD. The Ringgit was unpegged later in July 2005 - the decision to float the national currency was made by the Malaysia monetary policy makers to enable the currency value to be determined by market forces (Ahmad, Yusop and Masron, 2010). The Ringgit appreciated slightly after it was officially unpegged from the USD; for example, in early 2012 the Ringgit was quoted at RM3.00 per USD. Ten years after the unpegging, on July 29th 2015, however, the Ringgit was slowly depreciating; it was trading at RM3.80 per USD[1]. Then on October 20th 2015 came a major blow with the Ringgit dipping to a low of RM4.2460 per USD (Bank Negara, 2015). The big question asked by the financial community now is: will the Ringgit sink further to RM4.72 per USD (its lowest low during the 1997 crisis)?

International finance researchers have produced countless documents on exchange rate determinants with the adoption of different models on macroeconomic fundamentals, economic expectations and speculative factors (Kanamori, 2006). For instance, Mundell (1962) and Fleming (1962) in the Keynesian paradigm reflected that the exchange rate is determined by the supply and demand of foreign currency for the purchase of foreign goods (Mussa, 1976), which implies a market flow of funds. However, Bashir and Luqman (2014) on the Pakistani economy found that the terms of trade and inflation were identified as determinants of the real exchange rate (Fida et al., 2012).

Depreciation in value of the Malaysian Ringgit is of great concern to participants, such as policy makers, multinational firms, investors, importers, exporters, foreign students and, lastly, tourists, due to the off and balance effect on their respective sides, which suggests there is a duty on academic researchers to probe and investigate the determining forces behind the depreciation of the Malaysian Ringgit for reasons of academic interest and market regulatory advice among others. The majority of foreign investors in Malaysia are from the UK and the US, so these findings will be of great concern to them in understanding how changes in macroeconomic fundamentals influence their returns. In addition, this study will enhance importers` and exporters` understanding of which trends exchange rates will follow for any changes in macroeconomic variables.

The Keynesian school of thought has been the paradigm in macroeconomics for the last five decades, and it still holds a niche area today. Many nations have adopted Keynesian models in every facet of their economy. The exchange rate era entered into a new regime (floating regime) following the dissolution of the Bretton Woods system, known as the fixed exchange rate regime, in 1971. After its collapse, nations could choose either a floating or fixed exchange rate system, which led to ups and downs in the exchange rates. This prospect of exchange rate valuation calls for ~~a~~ variation of monetary models of exchange rate determination.

Monetary models assumed that a strong relationship exists between the nominal exchange rates and the macroeconomic fundamentals where the price of a nation's currency was at least determined by the demand and supply of the currency. This simple assumption has formed monetary models of exchange rate determination into two classes (Mussa, 1984). Firstly, the monetary model has illustrated that the exchange rate depends on the current domestic and foreign monies as well as current determinants for these monies demand, such as domestic and foreign income and interest rates. While this class of monetary model has been widely used in empirical studies, the second has been more practical in theoretical work. The latter class of monetary models highlights the influence of not only current but the expected future path of money supplies and factors affecting money demands on the current exchange rate. Given these monetary influences, it is essential for the policy maker, i.e., the Central Bank that formulates monetary policy, to understand how the policy influences the exchanges rates as well as their economic performance.

The vast majority of existing studies on exchange rate determinants are based on developed countries. International researchers such as Wilson (2009), Egert (2010), Ghosh (2011), Aftab (2012), and Pancaro and Sabarowski (2016) have focused their studies on the US, South Africa, India, Pakistan and Europe respectively. The lack of current research for developing countries has motivated us to undertake this research, to examine the determinants of the Malaysian Ringgit and its recent performance against the USD and GBP.

Our findings offer an understanding of the exchange rate determinants, which were contrary to previous studies in terms of the scope by adopting data until January 2017, and this makes it relatively more recent compared to other studies, undertaken by Khan (2007), Aftab (2012) and Ajao (2013). The second contribution of this study is its support of the fundamental theory known as the Purchasing Power Parity and monetary approach of the exchange rate. The higher money supply would result in an increase in money circulation that could lead to higher inflation. As a consequence, high inflation will subsequently lead to currency depreciation according to the

Purchasing Power Parity theory. Lastly, to the best of our knowledge, this study will be the first of its kind to conduct an extensive comparative study on the Malaysian exchange rate determinants within the context of the British Pound and the USD.

The rest of this paper is arranged in the following order: the next facet entails prior relevant studies on exchange rate determinants. The third section contains the theories of exchange rate determination, while the fourth section presents the data, methodology and model. The fifth and sixth sections give the empirical results and conclusion (along with policy implications), respectively.

2. LITERATURE REVIEW

The review of existing literature is designed to create better understanding of factors determining exchange rate movements as documented by earlier researchers. This review will cover nine strands and discussion on each variable in relation to exchange rate movements. The first exposes the dynamics of exchange rate movement with respect to the interest rate. Hsieh (2009) probed the determining factors for the Indonesian Rupiah against the USD. Results from an extended Mundell-Fleming model of exchange rate determination indicated that a relatively greater real money aggregate, a relatively higher domestic interest rate or a relatively more expected inflation rate caused real depreciation of the Indonesian Rupiah. Junttila and Korhonen (2011) further investigated the nonlinear relationship between the exchange rate and macroeconomic fundamentals using the error correction model and quarterly data between 1974:1 to 2001:3 for Canada, France, Germany, Italy and the UK. They found that the interest rate differential was the major force influencing the exchange rate.

Frommel et al. (2005) used a real interest differential model by adopting the Markov regime switches for three exchange rates within the period 1973 to 2000. The result revealed the real interest rate differential as the determining force of the exchange rate model, as supported by Basurto (2001), Dekle (2002), Agbola (2005) and Zada (2010). Frankel (2007) contributed to the existing study by focusing on the South African Rand and adopted data between 1981 Q1 to 2006 Q4, while the ordinary least square (OLS) method was used for analysing the relationships. It was reported that the real interest rate differential influenced the real exchange rate. Lastly, Sun (2011) investigated the exchange rate for three advanced countries, including Australia, and noted that the interest rate differential was the most important explanatory variable that determined the exchange rate for all the countries.

The second facet has an emphasis on the impact of inflation on exchange rate dynamic movements. Khan et al. (2007) noted the influence of purchasing power parity (inflation) for the Pakistani Rupee and USD by adopting an ARDL approach to cointegration over the period of 1982 Q2 to 2005 Q4. Chang and Tzeng (2011) examined the inflation differential between the currency value of Russia, Poland, Latvia, Lithuania, Romania, the Czech Republic, Hungary and Estonia against the USD, which provided evidence of an inflation rate differential as the determining factor of the exchange rates for all the countries. Husain et al. (2005) found that limited access to international capital was available for the weaker and less developed countries, so a low inflation rate and higher level of durability was associated with the fixed exchange rate regime in those countries. In addition to the existing findings, Junttila and Korhonen (2011) investigated the non-linear relationship between exchange rate and macro fundamentals for Canada, France, Germany, Italy and the UK; their findings revealed that the inflation differential, with respect to the US inflation, was the determining factor influencing the non-linear relationship between the exchange rate and monetary fundamentals.

The third facet of this section focuses on the impact of money supply on the exchange rate. Karfakis (2006) probed the determining factor for the Romanian Lei exchange rate determinate against the USD using the monetary model, and noted that money supply positively influenced the exchange rate. Increases in money supply led to a depreciation in value of the domestic currency. Wilson’s (2009) findings supported Karfakis (2006) by concentrating on the effective exchange rate of the USD and noted that money supply was positively related to the effective exchange rate, whereby increased money supply led to currency value depreciation, as supported by Taylor (2001); the findings of Insah (2013), however, contradicted this result. Omotor (2010) analysed the relationship between money demand and foreign exchange risk in Nigeria. He found that the demand for money in the long run is co-integrated with real income, exchange rate variability, interest rate and inflation.

Pazarlioglu and Guloglu (2007) contributed to the existing findings by concentrating on the Turkish economy; they found a long running relationship between money supply and the nominal exchange rate. This view supports the notion of Wong (2004) that the relative money supply between the US and the UK predicted the nominal exchange rate of the USD/GBP. Groen (2000) added to this by focusing on fourteen industrialized nations, and found that money supply influenced the exchange rate movements for all the countries. Ibrahim and Wan Yusoff (2001) found that money supply responds positively to currency appreciation and vice versa.

The fourth strand involves a review of the existing literature on the gross domestic product relative to the exchange rate movement. Harberger (1986) studied the effect of economic growth rate on the real exchange rate and noted that no systematic relationship existed between the economic growth rate and nominal exchange rate. In line with Harberger's (1986) study, Husain et al. (2005) found no robust relationship between economic performance and exchange rate regime in developing economies. However, Garton (2012) investigated the determining factors for the Australian Dollar exchange rate and noted that strong economic performance caused the Australia Dollar to appreciate.

Markrydakis et al. (2000) used real GDP per employee and reported a positive impact of GDP on exchange rate movements by adopting quarterly data between 1980 Q1 to 1999 Q2. Maeso-Fernandez et al. (2002) also supported the positive results of the GDP differential and real exchange rate in the Euro by employing a BEER/PEER methodology, and this view was consistent with Parveen et al. (2012). Hyder and Mehboob (2006) noted the positive impact of GDP on exchange rate movement; however, this contradicted the positions of Bahmani and Kara (2000), Amuedo-Dorantes and Pozo (2001), Zada (2010) and Saeed et al. (2012) that GDP did not determine the exchange rate movements in their respective studies.

Net export is the fifth section of the review in relation to the exchange rate determinants. Rahman and Barua (2006) investigated the commanding factor of the Bangladeshi exchange rate movement. They noted a strong negative correlation between currency depreciation and net exports. They asserted that a high demand for foreign currency following an increased import bill leads to a withdrawal of excess liquidity, which subsequently leads to depreciation in the nominal exchange rate. Aftab (2012) explored the effect of monetary fundamentals on the exchange rate of Pakistan over the period Q1 2003 to Q4 2010. The results showed that net exports were negatively influenced by the exchange rate of the Pakistani Rupee against the USD.

Furthermore, the sixth feature of the literature is related to the crude oil price changes on the exporting country's nominal exchange rate. Zalduendo (2006) emphasized the importance of crude oil as a significant determinant of real exchange rate movements in the

Argentinian currency against the USD. In a vector cointegration (VEC) model, they noted that an increase in crude oil price led to the Argentinian currency appreciating, and when the crude oil price reduced, the currency value depreciated. Egert (2010) investigated the South African Rand against the USD with relation to this factor using monthly data between January 2001 and July 2007, and noted that gold price volatility influenced South Africa's exchange rate value against the USD and Euro.

Zalduendo (2006) focused on the impact of crude oil price changes compared to other factors underlying Venezuela's real exchange rate against the USD. He noted that the real exchange rate of Venezuela appreciated when the UK Brent oil price fell. The large increase in oil prices since the beginning of the new millennium, for instance, impacted the behavior of the nominal exchange rate of many oil exporting countries. A positive oil shock tends to generate an appreciation of the currency over the long run and vice versa. Koranchelian (2005), Zalduendo (2006), Chen (2007), Habib et al. (2007) and Korhonen et al. (2009) noted that an increase in the crude oil price led to an increase in the nominal exchange rate for oil exporting countries.

Joyce and Kamas (2003) further contributed to the finding that crude oil price contributed to the nominal exchange rate of Colombia and Mexico against the USD, whereby a rise in the oil price led to a depreciation of the nominal exchange rate of the countries. This finding contradicted the work of Olomola and Adejumo (2006) who found that increases in the crude oil price positively influenced the value of the Nigerian Naira against the USD; thus, increases in the crude oil price led to an appreciation in the nominal exchange rate of the Naira. However, Joyce and Kamas (2003) supported the report of Ghosh (2011) that a rise in the crude oil price led to a fall in the Indian Rupee upon the adoption of the Narayan et al. (2008) model.

Lastly, government policy implementation entails factors, such as, in the case of Malaysia, a goods and services tax (GST) implementation that has a tendency to contribute negatively to the exchange rate. This is because the goods and services can be purchased at a tax-free rate outside the country by a rational consumer, which will result in an increase in the demand for the other currency, and automatically upward pressure will be imposed, putting downward pressure on the Malaysian Ringgit. In a recent survey by the Associated Chinese Chambers of Commerce and Industry of Malaysia (ACCCIM), 43 percent of respondents felt that the GST has affected their businesses negatively, compared to 30 percent who felt it had a positive effect[2]. The industries suffering the highest negative impact were logistics at 59 percent, property development (51 percent), and imports and exports (50 percent). In addition, 58 percent of traders said the GST has affected their company's cash flow, with half of the respondents having trouble claiming a refund on the input tax. We believe that this GST policy has the potential to affect future Malaysian Ringgit exchange rates.

3. THEORIES OF EXCHANGE RATE DETERMINATION

No single model of exchange rate determination has provided an adequate answer to the movement in the exchange rates under a floating rate regime. This study briefly highlights some well-known theories of exchange rate determination that induce the study to come out with relevant exchange rate factors that will be discussed further in the next section.

First, Purchasing Power Parity, or PPP, has become a prominent theory of exchange rate determination for explaining the relationship between exchange rate and inflation level. Based on the law of one price, it states that identical goods should have an equal price in any market or country. As the exchange rate is defined as the price of one currency into another currency, the purchasing power of currencies in both countries would be the same as the exchange rate, which is equal to the relative price between the two countries. This is the absolute PPP approach (perfect market assumption), but the relative PPP approach (market imperfection) assumes that the exchange rate depends on a constant ratio of the price of goods between two countries. The relative PPP implies an inflation differential as the exchange rate determinant:

$$e_t = \frac{1 + \pi_t}{1 + \pi_t^*} - 1 \tag{1}$$

where π_t and π_t^* represent domestic inflation and foreign inflation, respectively. This equation predicts that a higher inflation differential over a foreign price would reduce the purchasing power in the domestic country, hence lowering the value of its national currency. Intuitively, the cheaper price of foreign goods would increase the demand for foreign goods and foreign currency, resulting in an appreciation of the foreign currency and depreciation of the domestic currency. Therefore, the change in the exchange rate is similar to the difference between the relative inflation between the two countries.

Next, Fisher's hypothesis (developed by Irving Fisher) explains the relationship between the interest rate and the inflation rate. It states that in the long run, there will be a one for one adjustment of the nominal rate to the expected inflation as the real rate is assumed to be constant. The Fisher Effect (1930) has encouraged the derivation of another close theory called the International Fisher Effect (IFE). The latter theory postulates the relationship between the current exchange rate and the difference between the two countries' nominal interest rates at a particular time. It has applied the Fisher Effect's assumption that the real returns are equal in any country due to arbitration. In this case, the inflation rate differential might be a factor for the differential in the nominal interest rate as the real return is similar for every investor. The underlying Fisher's Effect is the assumption that the effective return on foreign investment should be equal to that of the domestic, and is supported by the PPP theory that suggests exchange rate movements are caused by inflation rate differentials; the IFE equation is derived as follows:[3]

(2) $$r^* = r_h = i_h(1 + i^*)(1 + e) - 1$$

where r, i and e are the real return and nominal return in a foreign country and the exchange rate accordingly. An asterisk (*) represents a foreign country while h refers to the home country. The currency of a country with a higher interest rate will lose value as propounded by the International Fisher Effect theory. A higher interest rate relative to the other country results in a higher than expected inflation (Fisher Effect) with later consequences of an increase in the general price level. This results in a high demand for foreign products (i.e., increased imports and decreased exports). This action will enhance the upward pressure on the universal trading currency and place downward pressure on the local currency due to the high demand for the trading currency, as supported by the Purchasing Power Parity theory. Another theory that explains the exchange rate changes is the monetary approach. Various monetary models explain the changes in exchange rates, which have been developed in previous studies (Dornsbuch, 1976; Mussa, 1977; Bilson, 1978). Despite these, conventional models of the monetary approach hold the PPP theory and assume a stable money demand function for each country. The basic monetary approach has resulted in the equation of the exchange rate as the function of the money supply differential, income differential and interest rate differential in the following way (Hakkio, 1982; Mussa, 1984; Boyko, 2002):

(3) $$e = (m_h - m^*) + a_1(y_h - y^*) + \alpha_2(i_h - i^*) + \varepsilon_t$$

The income differential is expected to have a negative influence on the exchange rate. The larger the income, the higher the demand for money will be to finance the larger transaction. The domestic currency rises to reflect the higher price level of goods, or in other words, the exchange rate would be devalued, which implies a less expensive price for foreign goods. Meanwhile, the interest rate differential may affect the exchange rate either in a positive or negative way. According to Frankel (1982), the positive influence of the interest rates as presumed in the flexible-price model predicts that the demand for domestic money reduces to reflect a higher than expected rate of inflation due to an interest rate increase. As a result, the domestic currency would be depreciated (cited in Boyko, 2002). This view is consistent with the IFE theory. On the other hand, an interest rate increase may attract capital inflows to a domestic country bringing a larger supply of foreign currency into the market. As a consequence, the exchange rates would decline.

4. DATA AND METHODOLOGY

This study used monthly data spanning from January 2010 to January 2017 with a total of 85 data points for each variable. The monthly data for exchange rates, interest rates and money supply for Malaysia were adopted from Bloomberg (2015), Bank Negara and the Asia Development Center. The data for the USA interest rates and money supply were collected from the Federal Reserve Economic Data and OECD Data Bank. Lastly, the data on UK interest rates and money supply were retrieved from Bloomberg (2015) and the OECD Data Bank.

4.1 MODEL ESTIMATION

An Autoregressive Distributive lag, known as an ARDL model, was adopted for this study, based on the nature of our data. This test involved a series of steps to conduct an empirical analysis of the data. The first part of the methodology was lag selection criteria, followed by a unit root test, followed by examining the long run relationship between the series data known as the bound cointegration test; the second facet of the test involved examining the short-run relationship between the variables. Later, we added diagnostic analysis to examine the residuals for the autocorrelation and stability test.

4.2 REGRESSION FRAMEWORK

It has been of great importance to find the macro determinant of the nominal exchange rate, and countless studies have been documented. However, this current research is unique compared to previous studies because it combines the traditional monetary fundamentals of exchange rate determinants with government policy. Chin (2007) investigated the gap between foreign and domestic measures, such as output, inflation, interest rate and money supply, as the major driving factors of the exchange rate as adopted by Meerza (2012). This research, however, added two additional factors: the crude oil price and government policy on implementation of a goods and service tax in Malaysia combined with money supply and interest rate. These four indices were deployed to measure the dissimilarity in the Malaysian Ringgit (MYR) exchange rate against the USD ($) and British Pound (£), and are contained in the following model function:

$$e_t = (m_h - m^*) + \alpha_1(i_h - i^*) + \alpha_2 COIL_t + d_1 GST_t \tag{4}$$

where e_t is the exchange rate measured in MYR per USD/British Pound over a period of time; $(i_h - i^*)$ measures the difference between the Malaysian and foreign country nominal interest rate (%) (i.e., $INT_{MY,t} - INT_{US,t}$), which was adopted as a factor for the control measure of funds in the economy. For further discussion, we used the abbreviations of MYRUSD and MYRGBP to indicate the Malaysian Ringgit denominated in USD and British Pound, respectively.

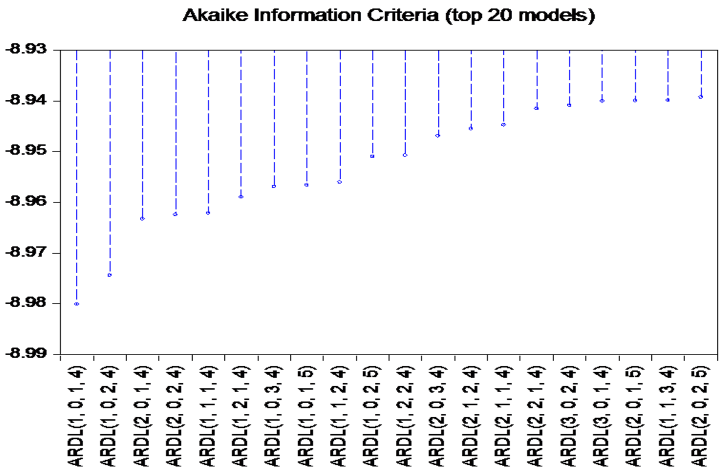
All other indicators were measured as follows: $m_h - m^* = M2_{MY,t} - M2_{US,t}$ money supply (M2) in billion USD over period of time t; $M2_{MY,t} - M2_{UK,t}$ money supply (M2) in billion British Pound over period of time t. $COIL_t$ = West Texas Crude Oil (for MYRUSD) and Brent Crude Oil (for MYRGBP) monthly closing price. GST = dummy variable for government policy. 0 if no GST implemented, 1 if GST implemented.

4.3 LAG SELECTION CRITERIA

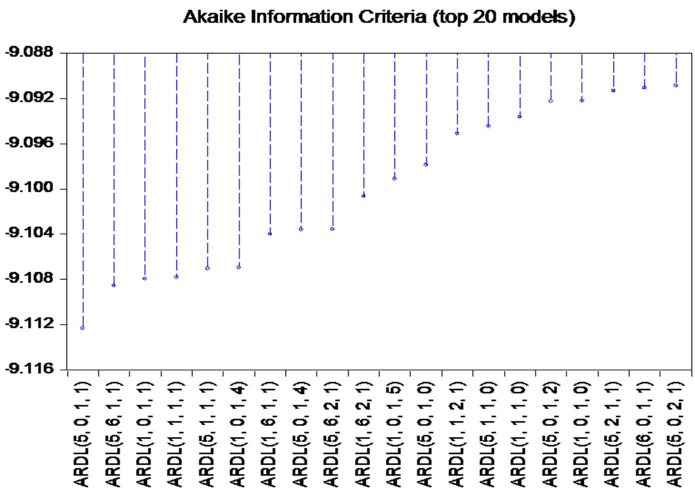
This test is used to examine the best and most adequate model that will provide the most accurate estimates, which involves the adoption of Akaike information. The rationale behind the adoption of the best model is the estimation of the regression that provides the lowest AIC and SIC values estimator (Gujarati, 2009). Figure 1 provides the lag selection output for the MYRUSD model followed by the MYRGBP in the following table.

FIGURE 1
Lag Selection Criteria for MYRUSD and MYRGBP

MYRUSD



MYRGBP



Note: This figure shows the lag selection criteria model that was obtained based on automatic selection, which has shown the lowest Akaike information criteria for MYRUSD and MYRGBP.

From Figure 1, it can be deduced that the best model for the MYRUSD estimates is the model with the lowest AIC. Therefore, the ARDL (1, 0, 1, 4) was selected as the best model where the first sequence of the variable in the brackets is the exchange rate followed by the interest rate differential, money supply differential and crude oil price. As for the MYRGBP case, the ARDL (5, 0, 1, 1) was selected as the best model while the sequence of variables in the bracket is similar to the MYRUSD case.

4.4 TEST FOR UNIT ROOT

Based on the nature of the data used, which is a time series, spurious regression is a threat if non-stationary data is regressed for the analysis. The essence of conducting a unit root test is to understand the order of integration of the series data. An augmented Dickey Fuller test was adopted with a null hypothesis of ADF of the unit root in the series. Data were examined by augmenting the lagged value of the exogenous variable based on the ADF model, as adopted by Atif et al. (2012). Based on the autoregressive process, the series is generated as follows:

$$\Delta Z_t = \delta Z_{t-1} + \sum_i \beta_i \Delta Z_{t-i+1} + \varepsilon_t \quad (5)$$

where $\delta = (\alpha - 1)$, the null hypothesis is H_0: $\delta = 0$ and the alternative hypothesis is H_1: $\delta < 0$. If the null hypothesis of $\delta = 0$ is not rejected, then Z_t follows a pure random walk model and has a unit root. Otherwise, the process is stationary as the null hypothesis is rejected. The result of the ADF test on the series data is shown in Table 1. This table reports the unit root test analysis conducted by adopting the Augmented Dickey Fuller and Phillip-Perron Test on each of the variables, where EXC_t is the Malaysian Ringgit denominated in USD and GBP. $M2_t$ is the differential money supply 2, INT_t is the differential nominal interest rate and $COILt$ is the West Texas intermediate and Brent crude oil closing price for the Malaysian Ringgit against the USD and GBP.

From the unit root analysis for the MYRUSD and MYRGBP data, it can be concluded that all the variables of EXC_t $M2_t$, INT_t ($INT_{MY,t}$ – $INT_{UK,t}$,) and $COIL_t$, except the interest rate differential between Malaysia and USD ($INT_{MY,t}$ – $INT_{US,t}$), contain the unit root at the level, but at the first difference, the series data becomes stationary. Therefore, it can be confirmed that the exchange rate, relative money supply, relative interest rate between Malaysia and UK and crude oil price are in an order of integration of one, i.e., I(1); while, the relative interest rate in the case of the MYRUSD analysis is in an order of zero, i.e., I(0). Since none of the variables are in an order of integration of two, i.e., I(2), we can proceed with the ARDL.

TABLE 1
Unit Root Analysis for MYRUSD and MYRGBP

	MYRUSD			
	ADF		Phillips-Perron	
	Level	1st Diff	Level	1st Diff
EXC_t	-0.2557	-10.9122***	-0.2389	-10.9136***
INT_t	-3.2595***	-7.5756***	-3.0256**	-7.6354***
$M2_t$	-0.7135	-9.5834***	-0.9614	-9.5850***
$COIL_t$	-2.002	-7.7899***	-2.1086	-7.8337***
	MYRGBP			
	ADF		Phillips-Perron	
	Level	1st Diff	Level	1st Diff
EXC_t	-2.0486	-10.6792***	-2.1488	-10.7351***
INT_t	-2.0657	-7.9012***	-2.0566	-7.6459***
$M2_t$	-1.3804	-11.0858***	-1.3823	-11.0917***
$COIL_t$	-1.9761	-7.8670***	-1.9689	-7.9175***

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

5. EMPIRICAL RESULTS

5.1 BOUNDS TESTS FOR COINTEGRATION

Based on the ARDL model, the first step is to investigate the long run relationship between the macroeconomic variables. The Pesaran et al. (2001) methodology of computing the Wald *F*-statistics was adopted and compared with the upper and lower bound critical value[4]. The cointegration regression model is as follows:

$$\Delta e_t = \delta_1 e_{t-1} + \delta_2 (m_h - m^*)_{t-1} + \delta_3 (i_h - i^*)_{t-1} + \delta_4 COIL_{t-1} + \textstyle\sum_i \beta_1 \Delta e_{t-i+1} + \sum_i \beta_i \Delta X_{i(t-i+1)} + d_1 GST_t \quad (6)$$

where X_i refers to the explanatory variables. The null hypothesis for the Wald test is where H_0: $\delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$.

Table 2 represents the bound test for cointegration for MYRUSD and MYRGBP with GST as a dummy variable included in the model. This table reports the bound test for the long run relationship between the variables, where EXC_t is the exchange rate of the Malaysian Ringgit against USD and GBP. INT_t is the difference in the nominal interest rate between home and foreign countries, $M2_t$ is the difference in money supply 2 between home and foreign countries, and $COIL_t$ is the West Texas intermediate and Brent crude oil closing price for the Malaysian Ringgit against the USD and GBP, while GST is the goods and service tax policy implemented by the Malaysian Government. In the case of the Malaysian Ringgit against USD, the estimated F-statistic is 1.8264, which is less than the lower bound critical value of Pesaran et al. (2001). It can thus be concluded that the null hypothesis of no long run relationship among the variables fails to be rejected, which implies there is no presence of a long run relationship between the MYRUSD exchange rate, relative money supply, relative interest rate, crude oil price and Government policy of GST. However, the reverse position holds for MYRGBP, whereby the estimated F-statistics is 7.2208 that is above the upper bound critical value, from which it can be concluded that there is a long run relationship between the MYRGBP exchange rate, relative money supply, relative interest rate, crude oil price and Government policy of GST. Table 2 presents the ARDL model and the estimates of the calculated F-statistics, with changes in the EXC_t as the dependent variable and with the lower and upper bounds contained below for both MYRUSD and MYRGBP.

TABLE 2
Bound Testing for Cointegration (No Specification)

Critical Value	Lower Bound	Upper Bound
1%	3.42	4.84
5%	2.45	3.63
10%	2.01	3.1
Variables $F(EXC_t, INT_t, M2_t, COIL_t, GST)$	F-statistics	Cointegration
Panel A: MYRUSD	1.8264	No
Panel B: MYRGBP	7.2208	Yes

5.2 LONG RUN ANALYSIS

Upon confirmation, the long run relationship between the macro-variables is reported in Table 3 for the MYRGBP. We do not report the long run coefficient for the MYRUSD as there is no cointegration found from the earlier ARDL bound cointegration test. Based on Table 3, with regard to MYRGBP, it can be concluded that the money supply differential and crude oil price have significant influence on the Malaysian Ringgit against the British Pound. Meanwhile, the other two variables of the interest rate differential and dummy variable of the GST are not significant to affect the exchange rate in the long run.

TABLE 3
Long run Relationships between Dependent and Independent Variables (MYRGBP)

Variable	Coefficient	Std. Error	t-statistic
INT_t	-0.0118	0.0121	-0.9766
$M2_t$	-0.0519	0.0198	-2.6230***
$COIL_t$	0.0238	0.0083	2.8458***
GST	0.0382	0.0301	1.2707

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

The relative money supply of Malaysia to the UK has a negative impact on the MYRGBP exchange rate. This implies that one unit increase in the relative money supply would result in a 0.0519 unit depreciation in the value of the Malaysian Ringgit against the British Pound. This position is consistent with the theory of the exchange rate determinant. The significant negative effect of the money supply differential to the exchange rate is consistent with the monetary theory on the exchange rate stating that an increase in the money in circulation would result in inflation, which afterwards has a negative impact on the currency value of the country. The higher inflation rate, which is constituent with the relative purchasing power parity theory, also lends support to the indirect impact of money supply on the exchange rate.

With regard to the crude oil price, there is a positive effect from the crude oil price on the MYRGBP exchange rate. This means that an increase in the oil price by one unit leads to an appreciation in the value of the Malaysia ringgit against the British Pound by 0.0238 units. This is consistent with the conventional belief that a boom in the crude oil price for the exporting country will positively reflect an appreciation in the domestic currency value; likewise, a fall in the price leads to a depreciation in the currency value. Crude oil revenue has been the backbone of the Malaysian Government’s financing, which accounts for about 30 to 40 percent of the national budget. This position supports the forecast by Kim-Hwa (2015) that the Malaysia Government’s revenue will drop by 13 percent from 19 percent following the fall in the crude oil market. This finding supports the existing reports by Koranchelian (2005), Chen et al. (2007), Habib (2007) and Korhonen (2009) that a crude oil price increase leads to increase in the nominal exchange rate of the oil exporting countries, but in another way, contradicts the findings of Zalduendo (2006) that the Argentina Peso was negatively affected by a fall in the crude oil price.

5.3 SHORT-RUN ANALYSIS AND ERROR CORRECTION TERM

Table 4 reports the Error Correction Model for both MYRUSD and MYRGBP. The Error Correction Model is to provide estimates of the speed of respective exchange rate response from shock in the short term. The estimates of the Lag ECT are -0.0322 and -0.0974 for MYRUSD and MYRGBP, respectively, as shown in Table 4. It shows the expected but significant progression toward equilibrium from disequilibrium. Approximately, the speed of adjustment for the exchange rate to return to the equilibrium from lagged period error shocks is about 3.22% for MYRUSD and 9.74% for MYRGBP.

TABLE 4
Short-run and Error Correction Model Estimation

	Panel A: MYRUSD			Panel B: MYRGB		
Variable	Coefficient	Std. Error	*t*-statistic	Coefficient	Std. Error	*t*-statistic
Int_t	-0.000001	0.0001	-0.0077	-0.000001	0.0001	0.0122
$\Delta M2_t$	0.2676	0.0115	23.1960***	0.148	0.0087	17.0068***
$\Delta COIL_t$	0.0088	0.0035	2.5035***	-0.003	0.0031	-0.9709
$\Delta COIL_{t\text{-}1}$	-0.0076	0.0035	-2.1746**	-0.0076	0.0035	-2.1746**
$\Delta COIL_{t\text{-}2}$	-0.0015	0.0033	-0.4499	-0.0015	0.0033	-0.4499
$\Delta COIL_{t\text{-}3}$	0.0098	0.0033	2.9294***	0.0098	0.0033	2.9294***
$\Delta EXC_{t\text{-}1}$				0.0454	0.0487	0.9308
$\Delta EXC_{t\text{-}2}$				0.0125	0.0489	0.2572
$\Delta EXC_{t\text{-}3}$				0.0833	0.0519	1.6046
$\Delta EXC_{t\text{-}4}$				0.1468	0.0521	2.8152***
GST	0.0017	0.0019	0.8869	0.0029	0.0017	1.6519*
$ECM_{t\text{-}1}$	-0.0322	0.012	-2.6789***	-0.0975	0.0209	-4.6485***

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

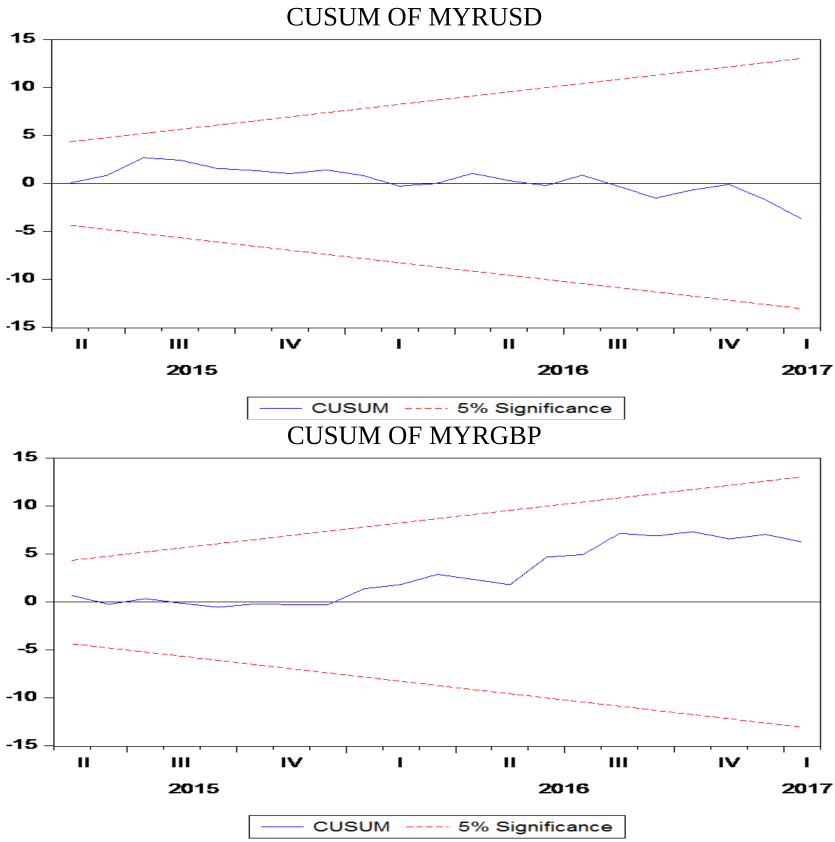
5.4 DIAGNOSTIC ANALYSIS

The aim of subjecting the residual to a diagnostic test is to enhance the validity of the estimators so that they are the best linear unbiased estimators (BLUE) and do not violate the assumption of the classical linear model as contained in Table 5. The residual for each model was subjected to the serial correlation test, by adopting the Breusch-Godfrey Serial Correlation LM Test, so it can be confirmed that both the model residual have *F*-stat: 1.5800 and 0.3499 for the MYRUSD and MYRGBP models, respectively, with *p*-value > 0.05. Therefore, the null hypothesis of no serial correlation cannot be rejected.

TABLE 5
Breusch-Godfrey Serial Correlation LM test

Diagnostic Test	Null Hypothesis	*F*-statistics (*p*-value)
MYRUSD	No Serial Correlation	1.580031 (0.2129)
MYRGBP	No Serial Correlation	0.349967 (0.8808)

FIGURE 2
CUSUM of MYRUSD and MYRGBP



The stability test for the long run model was estimated by adopting the CUSUM test as shown in Figure 2. This figure shows the CUSUM analysis of MYRUSD and MYRGBP to confirm the stability in the long and short run relationship between EXC and other variables of relative difference in money supply 2, relative difference in nominal interest rate and crude oil closing price. From the figure, we can see that the tests were concentrated between the critical bound at the 5 % significance level.

6. CONCLUSION AND POLICY IMPLICATIONS

In this study, we tested for the presence of long run relationships between economic time series – between MYRUSD and MYRGBP against potential determinants of exchange rates, such as interest rate differential (Malaysia and USA; Malaysia and UK), money supply differential (Malaysia and USA; Malaysia and UK), price of world crude oil (proxied by West Texas for USA and Brent for UK) and GST (as a dummy variable).

We found no evidence of a long run relationship between the interest rate differentials and both MYRUSD or MYRGBP. This finding is at odds with the findings of Junttila and Korhonen (2011), Basurto (2001), Dekle (2002), Wong (2004), Agbola et al. (2005) and Zada (2010), in which the interest rate differential influenced the exchange rate movements of their respective studies.

Interestingly, although we did not find any long run relationship with MYRUSD and possible determinants, we did find that MYRGBP has a long run relationship with differential money supply and price of Brent crude oil. These findings are generally in line with the findings of Koranchelian (2005), Zalduendo (2006), Chen et al. (2007), Habib (2007), Korhonen (2009) and Olomola and Adejumo (2006) that the crude oil price fall leads to a depreciation in the currency value of oil exporting countries. In their respective studies, the researchers noted that a rise in the crude oil price led to an appreciation in the currency value for crude oil exporting countries. We conjecture that we could not find any evidence of a long run relationship between MYRUSD and the crude oil (West Texas) price since both Malaysia and USA are oil exporting countries. A positive long run relationship exists between MYRGBP against the Brent crude oil price, which means MYR is appreciating against GBP, when the Brent crude oil price is going up, and this makes sense as Malaysia is an oil exporter, whereas the UK is an oil importing country. A negative long run relationship between MYRGBP and differential money supply means that as Malaysia increases the money supply, MYR depreciates against GBP in the long run – this finding is consistent with Wilson (2009), Karfakis (2006) and Taylor (2001).

They noted that an increase in the home country money supply led to a depreciation in the home currency value. We also found no evidence of a long run relationship for MYRUSD and MYRGBP against the GST policy – this result is understandable since GST has only been imposed in Malaysia since April 2015.

By and large, one of the biggest points that we can infer from this study is that the Ringgit's (MYR) performance against the British Pound (GBP) is very dependent on the price of world crude oil. We believe it is time for the Malaysian government to embark on long term projects to make Malaysia's assets and resources more attractive to foreign investment. We are not talking about selling the nation's strategic assets here, but rather we must strive to attract more foreign direct investment. To achieve that we must make our investment environment more attractive and the nation's political climate must be stable and must be seen as stable. As more foreign direct investment is pouring in, the demand for the Ringgit will increase, and the nation's wealth could be maximized.

ENDNOTES

1. This data was taken from Bank Negara's website, see http://www.bnm.gov.my/index.php?ch=statistic&pg=stats_exchangerates&lang=en&StartMth=2&StartYr=2009&EndMth=7&EndYr=2015&sess_time=1200&pricetype=Sell&unit=rm

2. http://www.acccim.org.my/blog/topic/26/1/237/ACCCIM+Survey+Report+on+the+GST+Implementation+in+Malaysia

3. The details of the derivation of the International Fisher Effect (IFE) equation is explained in Madura (2011).

4. All parameters are considerably co-integrated if the Wald F-statistic falls above the upper critical value but do not co-integrate if the F-statistic is below the lower bound. The results would be inconclusive if the F-statistic falls between the lower bound and upper bound critical value.

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