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# The Misalignment of Exchange Rates in Malaysia: Evidence Using FEERs Model

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**Abstract**

The misalignment of exchange rate is the normal phenomenon in currency's behaviour for a country. The traditional theory of exchange rates in determining the misalignment of the currency is the Law of One Price (henceforth LOP), where the price levels would be the same between two countries after converting their price into a common currency. However, this model does not take into account the economically interesting question of whether a particular exchange rate is driven by macroeconomics fundamentals. Therefore, the aim of this paper is to investigates the behaviour of exchange rate movement in Malaysia and identify the determinants of macroeconomics fundamentals on the exchange rates for this country. By using fundamental equilibrium exchange rates (FEERs) model, this study adopts the autoregressive distributed lag (ARDL) to examine the long run relationships (or cointegration) among the variables and the dynamic effect within variables in the short run.

*Keywords:* Fundamental Equilibrium Exchange Rates (FEERs); Bound Testing; Exchange Rates Misalignment; Autoregressive Distributed Lag (ARDL)

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## 1.0 Introduction

The misalignment of exchange rates among ASEAN countries shows dramatic changes over the past four decades. Even though the misalignment of these regions shows variations among individual countries, but most of these regions have experienced greater overvaluation and undervaluation of currency against the US dollar. As one of the member ASEAN's countries, Malaysia is believed to experience the same phenomenon thus created with the Ringgit to be depreciate and appreciate.

The impact of misalignment of currency to the economy is quite huge. For instance, the overvaluation of the currency for most ASEAN countries including Malaysia during the Asian currency crisis 1997/1998 implies that the national currency for these regions experience a depreciation and thereby reduce economic growth. Depreciation of the currency increases foreign debt during that crisis due to most of the ASEAN countries depend on foreign trade especially to meet the needs of the intermediate goods. On the other hand, the undervaluation of the currency implies that national currency tend to appreciate thus make the currency expensive against foreign currency. This will increase imports and decrease exports demand, and creating deficit in trade balance. Therefore, it is important to study the behaviour of exchange rates due to the impact of exchange rates on the economy.

The traditional model to estimate the misalignment of exchange rates is based on Law of One Price (LOP) and Purchasing Power Parity (PPP) popularized by Gustaz Cassel in 1918. The LOP explain that the price levels would be the same between two countries after converting their price into a common currency. However, this concept does not address all factors which may account for deviations from PPP levels in terms of a time-varying equilibrium path of the exchange rate.

Many studies have conducted to determine the other factors which can influence the movement of exchange rates thus investigate its misalignment. Most of previous studies suggested that the net foreign assets and terms of trade are important fundamentals to determine the long-term real exchange rate (MacDonald, 1998; Clark & MacDonald, 1999; Berger & Kempa, 2012). A study by Koske (2008) indicates that openness is the main cause of real exchange rate movements in the past, whilst the tradable productivity, government consumption and net foreign assets also had a large impact.

Based on the above premises, the aim of this study is to investigate the behaviour of exchange rate movement in Malaysia by identifying the determinants of macroeconomics fundamentals on the real exchange rate for this country. This paper is organized as follows. The overview of the determination of equilibrium exchange rate in Malaysia is summarized in the first section. While the second section will discuss the published empirical and theoretical literature on equilibrium exchange rates in emerging as well as in developing countries. Section three is the briefly discussion of the theoretical framework of equilibrium exchange rates, the research design and methodology to estimate the equilibrium exchange rates in Malaysia by applying the FEERs model. The output estimations and research findings are discussed in section four. Section five is the discussion of the misalignment of currency in Malaysia and finally, section six will summarize the main findings and conclude with some policy implications.

## 2.0 Literature Review

The estimation equlibrium exchange rate plays an important role to determine a suitable policy approaches. For instance, the policy makers can determine the shocks element which is can affect the changes in the value of exchange rates thereby it can determine the best policy response (Driver & Westaway, 2004).

Some studies found that exchange rates in developing countries, such as ASEAN, are easily prone to misalignment and volatility due to weak management of economic policies (Sekkat & Varoudakis, 2000). This situation will affect international trade amongst trading partners thus creating uncertainty to traders due to fluctuating prices in exports and imports. Hence, the imbalances of trade balance will occur if traders find it difficult to make decisions on what to export or import and finally it would affect the equilibrium exchange rate.

Lim (2000) used managed equilibrium exchange rates (MEER) to assess the misalignment for the Thai *baht* prior to the 1997 crisis. The results suggest that the *baht* was overvalued during the study period due to mismanagement of economic policies in Thailand, which caused the Thai currency to depreciate against U.S. dollar.

The study conducted by Chin and Azali (2005) estimated exchange rate misalignments among five ASEAN countries before the financial crisis in 1997-1998. They were using the sticky-price monetary exchange rate model within the environment of vector error-correction model (VECM) to run the estimation. This study found that Thailand currency was undervalued while Indonesian, Malaysian, Philippine and Singaporean currencies were overvalued against the U.S. dollar during the relevant period. However, they suggested that the degree of misalignment in the exchange rate[1] was not the actual cause for ASEAN's financial crisis.

Sahminan (2005) estimated equlibrium real exchange rate and examined the misalignments of Indonesian's currency from 1993 until 2005. The results depict the significance between the equilibrium real exchange rate and three independents variables[2] in the long run, while five independents variables[3] in short run. Based on that, he found that the *rupiah* was overvalued shortly before the 1997 crisis and continued to be undervalued until 2003 before being overvalued in 2004.

By using behavior equilibrium exchange rate (BEER), Nuryadin (2006) adopted the Johansen method and VECM to examine long run co-integration between variables and the dynamic effect within variables in the short run. The result showed that there is significance relationship between real effective exchange rates with net foreign assets, terms of trade and total trade to GDP. The estimation showed that the Indonesian *rupiah* has been undervalued post-1997 with equilibrium in 1998 and 1999.

There was undervaluation of Ringgit after Malaysia exited from the peg with the U.S. dollar in July 2005 (Koske, 2008). By comparing between two approaches, BEER and FEER, the study assesses the equilibrium value of real effective exchange rate of the Ringgit over the past 25 years. Additionally, the study determined that real GDP per capita as well as Openness were the main causes of real exchange rate movements in the past, whilst tradable productivity, government consumption and net foreign assets have also had a sizable impact.

In the other case of ASEAN countries, there are previous studies that look at the exchange rate behaviour of individual countries in the ASEAN region. Sidek and Yusoff (2009) analysized the equilibrium exchange rate for the Ringgit. They find that the Ringgit was volatile around its long run equilibrium and misalignments occured for short periods. They also agreed that the Ringgit was overvalued before the financial crisis in 1997.

## 3.0 Model, Methodology and Data

As mention in the first section of this paper, the LOP and PPP are traditional concepts to explain the exchange rates behaviour. Without excluding the knowledge of traditional concepts, therefore, this paper will use the FEERs model in order to understand deeper the misalignment of exchange rates and its macroeconomic fundamental.

### 3.1 Model (Theoretical Framework)

The fundamental equilibrium exchange rate (FEERs) model is introduced by Williamson on 1983. It is an estimation of macro-econometric model by using time series analysis, imposing external and internal balance, and solving for the equilibrium real exchange rate in medium-term (for a comprehensive discussion see Driver & Westaway, 2004; Egert & Lahreche-Revil, 2003; Rubaszek, 2008; Holtemöller & Mallick, 2012). The model can be written as follows:

$$ER_t = \alpha_0 + \alpha_1 TOT_t + \alpha_2 OPENNESS_t + \alpha_3 CA_t + \alpha_4 YGAP_t + \varepsilon_t \quad (1)$$

where $ER_t$, $\alpha$ and $\varepsilon$ denotes as real effective exchange rate, vectors of coefficient and disturbances term, respectively. Any deviation from equilibrium is reflected in the $\varepsilon_t$ term, which includes both short-term influences

[1]Indonesia, Malaysia, Philippines and Singapore currencies were overvalued about 1 to 4 percent against US dollar, while the Thai currency was undervalued at 2 percent against U.S. *dollar*.
[2]Productivity differential, terms of trade, and net foreign assets.
[3]Terms of trade, productivity differentials, net foreign assets, inflation differentials, and interest rate differentials.

and random disturbances; $TOT$ and $OPENNESS$ are terms of trade and trade policy (openness), respectively; $CA$ denote current account balance (current US$, millions); and $YGAP$ is output gaps[4]. All variables are in Logarithm.

### 3.2 Methodology

The ARDL approach proposed by Pesaran, Shin and Smith (2001) is used to estimate equilibrium exchange rate model. The advantage of using ARDL test is that it is applicable regardless of the stationary properties or irrespective of whether the regressors are purely $I(0)$ or $I(1)$, or mutually co-integrated. This is a useful approach that by passes the need for pre-testing the integration order of variables which the potential biased associated in the unit root test can be avoided. Indeed, the ARDL approach is robust for co-integration analyses with small sample study (Pesaran et al. 2001).

A specified 'restricted error correction model' (RECM) of the ARDL model than given to determine the long-run relationships. Further analysis for FEERs model can be conducted to examine whether $TOT_t$, $OPENNESS_t$, $CA_t$ and $YGAP_t$ is a *long-run forcing* variables for $ER_t$. Therefore, Equations (1) can be rewritten as following equations:

$$\Delta ER_t = \alpha_0 + \sum_{i=1}^{k} \alpha_{1i} \Delta ER_{t-i} + \sum_{i=0}^{n} \alpha_{2i} \Delta TOT_{t-i} + \sum_{i=0}^{n} \alpha_{3i} \Delta OPENNESS_{t-i} + \sum_{i=0}^{n} \alpha_{4i} CA_{t-i} + \sum_{i=0}^{n} \alpha_{5i} \Delta YGAP_{t-i} + \beta_1 ER_{t-1} + \beta_2 TOT_{t-1} + \beta_3 OPENNESS_{t-1} + \beta_4 CA_{t-1} + \beta_5 YGAP_{t-1} + v_t \quad (2)$$

where $v$ is disturbance term. By using the *F*-test, the null hypothesis of non-existence of the long-run relationship for FEERs model is defined as: $H_o: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$ against $H_a: \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq 0$. According to Pesaran et al. (2001), the bounds *F*-test must be valid to ensure that there is no serial correlation by employing LM statistics for testing the hypothesis of no serial correlation against orders 1 and 2. Meanwhile, the Schwartz-Bayesian information criterion (SBC) is used to determine the optimal lag length and was automatic selected.

In order to estimate the short-run coefficients and to estimate the speed of adjustment, the following ARDL-Restricted Error Correction Model (RECM) equation can be specified by rewritten Equations (1) as following equations:

$$\Delta ER_t = \alpha_0 + \sum_{i=1}^{k} \alpha_{1i} \Delta ER_{t-i} + \sum_{i=0}^{n} \alpha_{2i} \Delta TOT_{t-i} + \sum_{i=0}^{n} \alpha_{3i} \Delta OPENNESS_{t-i} + \sum_{i=0}^{n} \alpha_{4i} CA_{t-i} + \sum_{i=0}^{n} \alpha_{5i} \Delta YGAP_{t-i} + \lambda EC_{t-1} + w_{1t} \quad (3)$$

where $EC_{t-1}$ is the lagged residual from co-integration (the long-run equation) between dependent and independent variables in level derived from ARDL model. The null hypothesis for $EC_{t-1}$ for different numbers of regressors ($k$) can be expressed as $H_o: \lambda = 0$, against of $H_a: \lambda \neq 0$. All the above explain that the significance of the error correction ($EC_{t-1}$) indicates cointegration, and $\lambda$ measures the speed of adjustment and the deviation from equilibrium. However, the negative value for $\lambda$'s suggest that the model is stable and any deviation from equilibrium will be corrected in the long-run. According to Pesaran et al. (2001), the existence of an error correction model implies cointegration of the variables. Therefore, the long-run relationship is valid and free from spurious regression problem.

### 3.3 Data

This studies using annually data for Malaysia starting from 1970 until 2012. The exchange rates ($REER$) are annually averages in terms of Ringgit/USD. The $TOT$ is the ratio of domestic export unit value (export price in US

[4] (Holtemöller & Mallick, 2012); and (Rubaszek, 2008)

Dollars) to import value (import price in US Dollars) as a proportion of the equivalent effective foreign ratio. The larger revenues from exports will affect to the increasing in terms of trade (income effect), thereby results in shifting away foreign demand for domestic exports (substitution effect). If income effects of the terms of trade dominate its substitution effects, an improvement in terms of trade results in exchange rate appreciation, and *vice versa*. Meanwhile, $OPENNESS$ is the ratio of the sum of exports and imports relative to real GDP. This variable is a proxy of trade policies of the country. The reduction of tariff increases the level of trade in the current account (and *vice versa*), therefore exchange rate will appreciate (and *vice versa*). $TOT$ and $OPENNESS$ are expected to have ambiguous sign.

This study considers $CA$ balance based on Egert and Lahreche-Revil (2003). They explained the $CA$ variable to describe the external balance in FEER model. The external balance is reached when the current account is sustainable. Therefore, the role of terms of trade and openness are important to ensure the sustainability in the current account. $YGAP$ is the different between real national income (real GDP in US$ million) and potential national income (potential GDP in US$ million). The C$A$ and $YGAP$ are expected positively related to exchange rate.

All the data series were obtained from various sources such as the International Monetary Fund's International Financial Statistics (IMF/IFS), United Nations Statistics Department (UNSD), United Nations Conference on Trade and Development (UNCTAD), Asian Development Bank (ADB), Worldbank's World Development Indicators (WDI), Penn World Table (PWT) and www.bruegel.org.

## 4.0 Empirical Results and Discussion

This section discusses the empirical results of the analysis of macroeconomics variables on the exchange rates in Malaysia by using FEERs model. The discussions begin with analysis of empirical results of unit root tests using Augmented Dickey-Fuller (ADF), Phillips-perron (PP) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS). The purpose of employing the unit root tests is to examine the existence of stochastic non-stationary in the series. The next discussion would be the cointegration tests using ARDL bounding testing popularized by Pesaran et al. (2001). This is followed by discussion of short run and long run relationship between the exchange rates and macroeconomics variables through the Autoregressive Distributive Lad (ARDL).

Table 1 below is the empirical results of unit root test. All the variables in this study such as $REER$, $TOT$, $OPENNESS$, $CA$ and $YGAP$ are tested based on "no trend and constant", and "trend and constant". Thus, conclusion can be made whether the variables are cointegrated at level, first difference or second difference. Based on table, the outcomes from the unit root tests of ADF, PP and KPSS explain that the data are stationary mixture *I(0)* and *I(1)*, and no *I(2)*. Therefore, the ARDL modelling approach can be used in the estimation of FEERs model.

Table 1: Unit root test for stationarity.

| Variable | | ADF | | PP | | KPSS | |
|---|---|---|---|---|---|---|---|
| | | No Trend | Trend | No Trend | Trend | No Trend | Trend |
| | | | | FEERs | | | |
| LREER | Level | -0.940 | -2.708 | -1.008 | -2.026 | 0.109 (3)<br>0.347 | 0.071 (3)<br>0.119 |
| | 1st Diff. | -4.645***(0)<br>-3.601 | -4.600***(0)<br>-4.199 | -4.340***(8)<br>-3.601 | -4.361***(9)<br>-4.199 | - | - |
| | *I* | *I(1)* | *I(1)* | *I(1)* | *I(1)* | *I(0)* | *I(0)* |
| LTOT | Level | -3.267**(1)<br>-2.935 | -3.231*(1)<br>-3.193 | -3.136**(1)<br>-2.933 | -3.120 | 0.801***(5)<br>0.739 | 0.111 (3)<br>0.119 |
| | 1st Diff. | - | - | - | -6.220***(3)<br>-4.199 | 0.301 (12)<br>0.347 | - |
| | *I* | *I(0)* | *I(0)* | *I(0)* | *I(1)* | *I(1)* | *I(0)* |
| LOPEN | Level | -0.961 | -0.930 | -0.960 | -1.042 | 0.805***(5)<br>0.739 | 0.086 (3)<br>0.119 |
| | 1st Diff. | -5.801***(0)<br>-3.601 | -5.797***(0)<br>-4.199 | -5.805***(1)<br>-3.601 | -5.771***(2)<br>-4.199 | 0.086 (3)<br>0.347 | - |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | *I* | *I(1)* | *I(1)* | *I(1)* | *I(1)* | *I(1)* | *I(0)* |
| LCA | Level | -1.237 | -2.141 | -1.244 | -2.170 | 0.778***(5) | 0.101 (4) |
| | | | | | | 0.739 | 0.119 |
| | 1st Diff. | -6.929***(0) | -6.893***(0) | -6.941***(2) | -6.895***(1) | 0.219 (17) | - |
| | | -3.601 | -4.199 | -3.601 | -4.199 | 0.347 | |
| | *I* | *I(1)* | *I(1)* | *I(1)* | *I(1)* | *I(1)* | *I(0)* |
| LYGAP | Level | -3.417**(0) | -3.419*(0) | -3.572**(2) | -3.578**(2) | 0.080 (3) | 0.057 (2) |
| | | -2.933 | -3.191 | -2.933 | -3.521 | 0.347 | 0.119 |
| | 1st Diff. | - | - | - | - | - | - |
| | *I* | *I(0)* | *I(0)* | *I(0)* | *I(0)* | *I(0)* | *I(0)* |

Note: ***, **, * indicate the statistically significant level at 1%, 5% and 10%. First line of variable is t-statistic value and the second line of variable is critical value.

The next analysis is to determine the existence of a long-term cointegrating relationship between the exchange rates and macroeconomics variables in Malaysia by using ARDL bound test. Table 2 below presents the empirical result of bound test for FEERs model and the lag length for these regressions was automatically selected based on Schwarz Bayesian Criterion (SBC).

Table 2: Cointegration bound test analysis.

| **F-Statistic** | | **FEERs** | |
|---|---|---|---|
| | | **Lower Bound** | **Upper Bound** |
| F-Statistic | | | |
| | 90% | 2.262 | 3.367 |
| (Pesaran and Pesaran 2009) | | | |
| | 95% | 2.649 | 3.805 |
| F-Statistic | | | |
| | 90% | 2.306 | 3.353 |
| (Narayan 2004) | 95% | 2.734 | 3.920 |
| **Computed F-Statistic** | | **F = 3.6918*** | |

Note: ** and * indicate the statistically significant level at 5% and 10%. Narayan (2004) critical values are tabulated for a sample size ranging from 30 to 80 observations.

The result of bound test shows that the F-statistics for FEERs model fall above the upper bound critical value at 10 percent significance level and this result suggest that cointegration exists among the variables in the model under investigation.

Table 3: Results of ARDL Model and Long-run Equation.

| **Variable** | **FEERs (Dependent: REER)** | | | **Exp. Sign** |
|---|---|---|---|---|
| | **Coeff.** | **S.E.** | ***t*-stat** | |
| | | **ARDL (2, 0, 0, 0, 0)** | | |
| LREER(-1) | 0.699 | 0.148 | 4.712*** | |
| LREER(-2) | -0.281 | 0.156 | -1.800* | |
| LTOT | -0.023 | 0.108 | -0.214 | |
| LOPEN | -0.336 | 0.099 | -3.390*** | |
| LCA | -0.351 | 0.021 | -0.017 | |
| LYGAP | 0.970 | 0.214 | 4.526*** | |
| C | 3.015 | 0.645 | 4.676*** | |
| | $R^2$=0.98 | *AR(1)=0.956* | | |
| | | *Reset(1)=0.009* | | |
| | | *Norm(2)=0.385* | | |
| | | *ARCH(1)=0.747* | | |
| **Long-run equation:** | | | | |
| LTOT | -0.040 | 0.190 | -0.210 | +/- |

| | | | | |
|---|---|---|---|---|
| LOPEN | -0.577 | 0.111 | -5.184*** | +/- |
| LCA | -.603 | 0.035 | -0.017 | - |
| LYGAP | 1.668 | 0.462 | 3.610*** | + |
| C | 5.184 | 0.693 | 7.486*** | |
| **Short-run equation:** | | | | |
| dLREER | 0.281 | 0.156 | 1.800* | |
| dLTOT | -0.023 | 0.108 | -0.214 | |
| dLOPEN | -0.336 | 0.099 | -3.390*** | |
| dLCA | 0.351 | 0.021 | -0.017 | |
| dLYGAP | 0.970 | 0.214 | 4.526*** | |
| dC | 3.015 | 0.645 | 4.676*** | |
| Ecm(-1) | -0.582 | 0.132 | -4.414*** | |
| | *$R^2$=0.59* | *SER=0.042* | | |

Notes: Asterisk ***, ** and * denotes statistically significance at 1%, 5% and 10%. Numerical values for AR(1), Reset(1), Norm(2) and ARCH(1) are *p*-values. *AR*(1) is Lagrange multiplier test for non-serial correlation. Reset(1) is Ramsey's RESET test for functional form. Norm(2) denotes the test for non-normality of the residuals based on the test of kurtosis and skewness of residuals. ARCH(1) is Autoregressive Conditional Heterocedasticity test of residuals. C is intercept. Lag Length was automatic selected based on Schwarz Bayesian Criterion (SBC).

The next step is the output estimation based on restricted error correction model (RECM-ARDL) approach is employ in order to estimate the long-run equation for the equilibrium exchange rates equation. Using the information from the estimated ARDL equation and the long-run equation, we can then compute the error correction term based on the error correction model and Table 3 shows the result. The result shows that the estimated orders for FEERs approach is ARDL(2, 0, 0, 0, 0). The $R^2$ for FEERs model are 98 percent. This indicated that the large proportion of the variations in the exchange rates can be explained by the explanatory variables.

The estimation of long-term cointegration between exchange rate and its explanatory variables in the FEERs model reveals that the $OPENNESS$ and $YGAP$ are statistically significant at the 1 percent significance level. Generally, the long run in FEERs model explain that a 1 percent increase in the $OPENNESS$ could lead to a depreciate in exchange rate at 0.58 percent, whilst a 1 percent increase in the $YGAP$ could lead to an appreciate in exchange rate at 1.67 percent. The negative sign for the $OPENNESS$ coefficient and the positive sign for $YGAP$ coefficient in the model is compatible with the explanation of economics theory where $OPENNESS$ is expected to be ambiguous (Egert & Lahreche-Revil, 2003; and Coulibaly & Gnimassoun, 2013), whilst $YGAP$ is expected to be positive (Rubaszek, 2008). Traditionally, the $OPENNESS$ is the proxy for the trade liberalization for a country. Reducing the tariff and non-tariff protection should worsen the current account due to increase in the imports especially for the small and open country such as Malaysia. Meanwhile, the positive sign for the $YGAP$ coefficient in the model can be explained based on Rubaszek (2008), where a strong external price competitiveness can lead to the positive output gap and surplus in current account, thus the exchange rates will appreciate.

The error correction term for FEERs is significant at 1 percent significance level. It also carries the expected negative sign. This indicates that the model is stable and any deviation from equilibrium will be corrected in the long run (Habibullah, Din & Abdullah, 2012). The coefficient of error correction term implies the speed of adjustment process. Based on the result, the coefficient of the error correction term for FEERs is 0.58. This indicates that 58 percent of the previous year's shock adjusts back to long-term equilibrium in the current year. This result also provides further evidence of the existence of a stable long-term level cointegration among the variables in the exchange rates.

Another characteristic of ARDL model is that the dependent variables not only can be explained by the independent variables in the model, but it can also be explained by the value of itself in the past. Based on table above, the result for short-run relationship in FEERs model shows that an increase in lagged variable of past exchange rate value is statistically significant at 10 percent level of significance. This explain that a 1 percent increase in past exchange rate value lead to appreciation in exchange rate at 0.28 percent in current year. The coefficients of the short-term also shows that the lagged variables of $OPENNESS$ and $YGAP$ are statistically significant at the 1 percent level of significant. The estimation explain that a 1 percent increase in $OPENNESS$ lead to depreciation in exchange rate at 0.34 percent, whilst a 1 percent increase in $YGAP$ lead to appreciation in exchange rate at 0.97 percent.

## 5.0 Misalignment

This section is going to present the misalignment of Ringgit in terms of US dollar. Generally, the misalignment of exchange rate is the deviation of the actual exchange rate from an estimate of its equilibrium values (Frait, Komarek & Melecký, 2004).

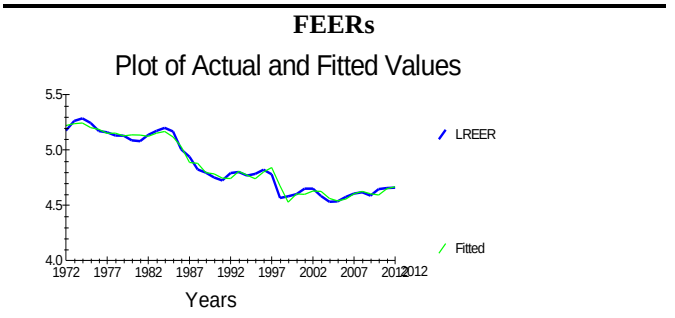


Figure 1: Actual Values and Fitted Values for Malaysia.

According to Holtemöller and Mallick (2012), Chin and Azali (2005) and Sahminan (2005), the misalignment of exchange rate is the residual between actual values and fitted values of exchange rate. The residual between actual and fitted values can be shows graphically in Figure 1 above. The positive value for residual denotes an undervaluation of domestic exchange rate, whilst the negative value for residual denotes an overvaluation of the currency.

Based on Table 4 below, the FEERs model shows that the misalignment of Ringgit in this country are overvalued in 1986, 1988-1991, 1993-1994, 1997-1998, 2000, 2003-2005, 2008-2009 and 2012, whilst it is undervalued 1983-1985, 1987, 1992, 1995-1996, 1999, 2001-2002, 2006-2007 and 2010-2011. Based on the results, there are 16 years that Ringgit is experience an overvalued and 14 years its experience an undervalued during the period from 1983 until 2012.

Table 4: Exchange Rate Misalignments (%) in Malaysia, 1983-2012.

| | FEERs | | |
|---|---|---|---|
| **1983** | 0.02 | **1998** | -0.11 |
| **1984** | 0.03 | **1999** | 0.05 |
| **1985** | 0.05 | **2000** | -0.01 |
| **1986** | -0.02 | **2001** | 0.05 |
| **1987** | 0.05 | **2002** | 0.02 |
| **1988** | -0.06 | **2003** | -0.04 |
| **1989** | -0.40 | **2004** | -0.03 |
| **1990** | -0.03 | **2005** | -0.01 |
| **1991** | -0.02 | **2006** | 0.02 |
| **1992** | 0.05 | **2007** | 0.01 |
| **1993** | -0.01 | **2008** | -0.01 |
| **1994** | -0.01 | **2009** | -0.02 |
| **1995** | 0.04 | **2010** | 0.05 |
| **1996** | 0.02 | **2011** | 0.01 |
| **1997** | -0.06 | **2012** | -0.01 |

Notes: Figures are exchange rate misalignments in percentage (%). A misalignment is the residual between actual and fitted values of exchange rate. Positive (negative) value for residual denotes an undervaluation (overvaluation).

## 6.0 Conclusion

This study investigated the exchange rates behavior by estimating equilibrium exchange rates in Malaysia. The starting point of this study is regarding the LOP theory, which is not address all factors which may account for deviations from PPP levels in terms of a time-varying equilibrium path of the exchange rate. In order to understand deeper the misalignment of exchange rates and its macroeconomic fundamental in Malaysia, therefore, the FEERs model is used without excluding the important of the LOP theory. By adopting the ARDL model, this study able to make analyzing the short-run and long-run relationships between exchange rates and its macroeconomic fundamental, namely, the terms of trade ($TOT$), trade policy ($OPENNESS$), current account ($CA$) and output gaps ($YGAP$). The analysis used annual data from 1970-2012.

The investigating of the misalignment was done by examining the residuals between real exchange rate and estimate exchange rate. The result shows that the misalignment of exchange rate for Ringgit is quite small. The overvalued of Ringgit in FEERs model lie in the range 0.01-0.40 percent, whilst the undervalued lie in the range 0.01-0.05 percent. One possible explanation of the smallest misalignment of exchange rates is that the flexibility of currency regime, where the higher the flexibility of the currency regime, the lower is the misalignment (Holtemöller & Mallick, 2012). This result is consistent with Chin and Azali (2005) and agrees that the misalignment was not the cause of the ASEAN's financial crisis 1997/1998, which involved this country.

The policy implications of this study are suggested as follow. Firstly, the long-run and short-run relationship between exchange rates and its macroeconomic variables in FEERs model shows that there are statistically significant between dependent and independent variables for both model. This evidence suggests that the exchange rates in Malaysia are driven by its macroeconomic variables.

Secondly, based on long-run equation for FEERs model, the $OPENNESS$ shows it statistically significant to explain the relationship between exchange rates and $OPENNESS$. The negative sign for the $OPENNESS$ coefficient explains that the trade liberalization is not suitable in Malaysia as it will worsen the current account thus depreciate the currency. The possible explanation for this is due to Malaysia is a small and open economy and is believed to have sensitivity in its current account. However, this variable can be used as a stabilization policy of Malaysia.

Thirdly, although this study not excludes the traditional theory of LOP, the policy makers need to take the macroeconomic indicators into account in order to achieve economic goals for this country. In this case, the trade liberalization and output gaps play important role to achieve the goals. Finally, the policy makers can monitor whether the real exchange rates would be undervalued or overvalued in the future. For instance, the surplus in current account and increasing in output gap might be the signal for real exchange rates to be undervalued.

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