FORCING VARIABLES OF PURCHASING POWER PARITY ON ASEAN-4 REAL EFFECTIVE EXCHANGE RATE: AN APPLICATION OF AUTOREGRESSIVE DISTRIBUTED LAG (ARDL)

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Abstract
This paper presents the empirical study on long-run and short-run forcing variables of purchasing power parity (PPP) for ASEAN-4 currencies vis-a-vis the U.S. dollar, i.e., their real effective exchange rate (REER). This study uses a recently developed autoregressive distributed lag (ARDL) approach to co-integration (Pesaran et al., 2001) over the period 1991:Q1 – 2006:Q2. Our empirical results suggest that the domestic money supply (M1) for Malaysia is in long-run only, while for Indonesia, Philippines, and Singapore are in long and short run is a significant forcing variable of PPP for countries' REER. The findings can derive policy implication for the monetary authorities in these ASEAN-4 countries.

Keywords**:** Purchasing Power Parity (PPP); Real Effective Exchange Rate (REER); ASEAN-4 (Malaysia, Indonesia, Philippines, and Singapore economies); ARDL.

JEL Classification Codes**:** F31; F32.

1. Introduction

Purchasing power parity (PPP) is the oldest theory of exchange rate, also it is an important theory of exchange rate determination in international finance. Purchasing power parity is an economic technique used when attempting to determine the relative values of two currencies. It is useful because often the amount of goods a currency can purchase within two nations varies drastically; based on availability of goods, demand for the goods, and a number of other, difficult to determine factors.

The 1997 Asian Financial Crisis (AFC) plunged some of the most successful economies in the world particularly ASEAN-4 countries namely: Malaysia, Indonesia, Philippines, and Singapore into financial chaos. This crisis caused collapse in these economies, i.e. the impact of the financial crisis was very severe not only on the financial sectors but also on the real sectors in these countries. Thus, the 1997 financial crisis was a critical point in the Asian economic history. It was empirically and theoretically argued that the AFC caused the ASEAN-4 economies to become more sensitive to changes and fluctuations in the world economy- particularly the economy of USA. Therefore, the issue of the degree of sensitivity of ASEAN-4 to USA economy would be measured in this study since USA dollar is the dominant world reserve currency and the value of most countries' currencies were directly linked with the value of the U.S. dollar.

The objective of this study is: to determine the long-run and short-run forcing variables of PPP on ASEAN-4 REER over the study period. The Autoregressive Distributed Lag (ARDL) approach is employed here because it has several advantages such as avoiding the classification of variable into I (0) or I (1), free from problems of endogeneity and yielding consistent estimates of the long-run coefficients. In this study also, the emphasis will be on the behavior of the (REER)[1]. The REER indicates how the weighted average purchasing power of a currency has changed relative to some arbitrarily selected base period.

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[1] The term real effective exchange rate (REER) is defined as the real price in the domestic currency of one real unit of another (foreign) currency. Hence, the nominal exchange rate is part of the REER. It is a relative price that responds to the law of supply and demand. Being a price REER, according to a simple economic theory, is determined within the economic system.

2. Overview of Purchasing Power Parity (PPP)

The PPP theory was originally developed by a Swedish economist Cassel (1919), stating that the exchange rate of currencies between two countries would move proportionally to the ratio of the price level in the currencies concerned. According to MacDonald (2001), Sarno and Taylor (2002), Cheung et. al. (2004), and Che and Mansure e (2006) point that there are an array of approaches and related methodological frameworks available in the PPP literature, However, there are at least four (4) major competing PPP models that demand special attention (Cheung et. al., 2004). They are: Absolute PPP and Relative PPP, Monetary Model of PPP, Portfolio Balance of PPP, and Uncovered Interest Parity (UIP) of PPP.

Absolute PPP and Relative PPP

In literature, there are two versions of PPP theory namely absolute PPP and relative PPP. While absolute PPP refers to the equity of price levels across countries, relative PPP refers to the equity of the rates of change in these price levels. The Law of Comparative Advantage (LCA) theorem of equilibrium exchange rate or the Law of One Price (LOP) of the capitalist system suggests that same basket of goods and services must sell the same price in different capitalist countries Cassel (1919), and Sarno and Taylor (2002). This measure the price of the basket of goods and service is essentially known as absolute PPP and has been repeatedly expressed in the literature Sarno and Taylor (2002), and Che and Mansure e (2006) as:

$$S_t = \mathrm{P}_t - \mathrm{P}_t^* \tag{1}$$

Where, s_t is the spot REER expressed as the domestic price of the foreign currency, p_t is the domestic price level, while p_t^* is foreign price level and t denotes the time period. MacDonald (2001) and Sarno and Taylor (2002) asserted that Equation 1, which represented the absolute PPP theoretical framework, should be specified as a testable regression equation expressed as:

$$s_t = \beta_0 + \beta_t(p_t - p_t^*) + \varepsilon \tag{2}$$

Where β is constant variable and ε is noise error term.

Sarno and Taylor (2002) and Che and Mansure e (2006) had transformed equation (2) as:

$$s_t = \beta_0 + \beta_1 v_t - \beta_2 p_t + \beta_3 p_t^* + \varepsilon \tag{3}$$

Where υ_t is the *ex- post* nominal exchange rate at time *t*.

They argued that if υ_t p_t and p^*_t are nonstationary integrated process of I(1), the weak form (or random walk) PPP prevail, implying that the residual term: ε is I(0). Adding symmetry, strong and absolute version of PPP prevails, if $\beta_2 =$ 1 and $\beta_3 =$ -1 where "*homogeneity*" condition exist, theoretically.

Similar to absolute PPP, relative PPP looks at the relationship between exchange rates and prices in terms of growth rates. Relative PPP may still hold i.e. even if the exchange rate is not equal to the exact ratio of the price indices, it may at least be comparable to it. The Dornbusch (1976) and Frankel (1976) who pioneered the *relative* PPP suggested that the actual price levels must be considered under the new relative PPP theoretical framework instead of the price. The essence of their suggestions is that some of the actual domestic prices, i.e., commodity goods and services do not necessarily change in accordance to foreign prices. In simple, economics terms, the relative PPP points out that the changes in the foreign exchange rates must equal to the changes in relative domestic prices and Che and Mansure e (2006). These changes may be due not only to exchange rate but also money supply (m), real gross domestic products (RGDP), the level of interest rate (i,), and inflation rate (π), respectively (Sarno and Taylor, 2002; Brissmis, et. al., 2005).

Monetary Models

Monetary models are considered standard exchange rate determination models. They are based on the view that the exchange rate is the relative price of foreign and domestic money so it should be determined by the relative supply and demand for these moneys. Money market equilibrium condition resides on purchasing power parity, which explains the monetary models with the assumption of flexible prices.

Within the monetary models, there the sticky-price monetary model with sluggish adjustment of prices in the goods markets. As deviations strictly from PPP appeared in the short run, one of the major pillars of the flexible-price monetary model would be called into question. In response, Dornbusch (1976) constructed a sticky-price monetary model that allowed for short run PPP deviations, thus, the underpinning of Dornbusch-Frankel Sticky Price Monetary Model (DFSP) model.

The sticky price monetary model assume that the PPP hold in the long run[2] but not in the short run due to the price stickiness. The DFSP is generally re-expressed[3] as:

$$s_t = \alpha_0 + \alpha_1 m_t + \alpha_2 G_t + \alpha_3 i + \alpha_4 \pi_i + ... + \varepsilon \tag{4}$$

The monetary models of exchange rate determination are concentrated in terms of expected future value and the current exogenous variables. Taylor (1995) stated that exchange rate was a function of expectation of discounted future value of exogenous variables. There are different processes involved for exogenous variables to follow different paths of exchange rates. According to Baillie and MacMahon (1990), Taylor (1995), and Che and Mansure e (2006), equation 4 can be reformulated for this study as follows:

$$S_t = \alpha_0 + \alpha_1 R + \alpha_2 R^* + \alpha_3 M + \alpha_4 G + \alpha_5 \pi + \alpha_6 NFA + \alpha_7 TOT + U_t \tag{5}$$

Where S_t is real effective exchange rate in the ASEAN-4 countries with U.S, R is the domestic interest rate in the ASEAN-4 countries, R^* is the foreign interest rate, M is money supply in the ASEAN-4 countries, π is the inflation rate, NFA is the net foreign asset in the ASEAN-4 countries, **G** is the real gross domestic product in the ASEAN-4 countries, and TOT is the term of trade in the ASEAN-4 countries.

Portfolio Balance Model

Portfolio balance model is one of the major models based on PPP. According to the portfolio balance model, exchange rates are determined by the demand and supply of all domestic and foreign assets not just by the supply and demand of money as in the monetary model. The portfolio balance model is therefore a dynamic model of exchange rate determination based on the interaction of goods and service markets, current account balance, prices and the rate of asset accumulation.

The composite IS-LM model of Edwards (1989) had empirically observed that the key factors that could significantly influence the exchange rate of a country's currency were related to the country's stage of development and the state of openness of the economy. Earlier researchers, such as Clerk and MacDonald (1999), Stein (1999), Cavallo and Ghironi (2002) and Che and Mansure e (2006), had attempted to integrate the earlier models together. These researchers further integrated the various theoretical effects upon PPP based on the Portfolio Balance Model and had also included the effects via interest rate, money supply (M), inflation rates and the portfolio balance effects via economic growth rates, terms of trade (tot) and net foreign assets (nfa), which had measured the openness of the economy. According to and Che and Mansure e (2006), the Portfolio Balance equation for this study could be reformulated as:

$$S_t = \alpha_0 + \alpha_1 R + \alpha_2 R^* + \alpha_3 M + \alpha_4 G + \alpha_5 \pi + \alpha_6 NFA + \alpha_7 TOT + U_t \tag{6}$$

Uncovered Interest Parity Model

The Uncovered Interest Parity (UIP) model theory states that differences between interest rates across countries are explained by the expected change in currencies. In more recent empirical literature on exchange rates, a lot of effort has been devoted to testing international parity conditions, such as PPP and UIP, which have played an essential role in asset market models of the exchange rate MacDonald and Taylor (1990), Chaboud and Wright (2005). Such conditions are normally thought of as arbitrage relationships, which are held continuously especially in the case of UIP.

[2]Baillie and MacMahon (1990), Kanas (1997), Husted and Kelbergen (1998), Dutt and Gosh (1999), Francis et al. (2001) Rapach and Wohar (2002), and Groen and Kelbergen (2003)

[3] Taylor (1995), and Che and Mansure e (2006)

UIP equation is written[4] as:

$$S_{t+k} = S_t + i_{t,k} \quad (7)$$

Where S is the log exchange rate, *i* is the interest rate of maturity *k* and *t* is time to maturity. Bjorland and Hungnes (2002), and Che and Mansure e (2006) transformed the equation ($s_t = p_t - p_t^*$ -θ ($i_t - i_t^*$)) into a testable co-integration model yielding:

$$s_t = \beta_0 + \gamma_1 p_t + \gamma_2 p_t^* + \beta_3 \theta (i_t - i_t^*) + \varepsilon_t \quad (8)$$

Where β and γ are the coefficient parameters, and θ is the speed of adjustment of interest rate differential and θ = 1/λ suggesting that the real exchange rate is a function of both the price level and interest rates differentials. Equation 8 suggests that all real shocks that force real exchange rate away from PPP have to be captured by the long-run market interest rates, where the rates appear to predict PPP and exchange rates level (MacDonald and Nagayasu, 2000; Caporalea, et. al., 2001; Bjornland and Hungnes, 2002; Jin 2003, Wang, 2004; and Che and Mansure e 2006).

3. Methodology of the Study

Source of Data

Our estimates on this study were based on the most up to date quarter data for the sample period 1991:1q - 2006:2q for Malaysia, Indonesia, The Philippines, Thailand and Singapore. The published quantitative financial and economic data were extracted from three main sources: the International Monetary Fund (IMF, various issues and home page), central banks of ASEAN-4 countries, various issues of reports published. The data acquired from the above sources compared with the data extracted from DataStream (UUM online library software).

All value entities are defined in terms of national currencies. The models' variables are generating to a percentage quarter data. Che and Mansure e (2006) believed that the span of selected period is long enough to empirically test the long run forcing variables influencing the co-integration PPP relationship in economies under review

Model Specification

In this paper, the exchange rate model applied to explore the forcing factors that determine REER to the ASEAN-4 countries. However, Goh Soo and Mithani (2000), Taylor (2002), Sarno and Taylor (2002), Chaboud and Wright (2005) and Che and Mansure e (2006) found that many empirical and earlier researchers on exchange rate adopted co-integration techniques. Using the existing theoretical frameworks discussed earlier in Section 2. We can write PPP of equilibrium exchange rates based on the earlier empirical frameworks (models) as follows:

$$S_t = \alpha_0 + \alpha_1 R + \alpha_2 R^* + \alpha_3 M + \alpha_4 G + \alpha_5 \pi + \alpha_6 NFA + \alpha_7 TOT + \varepsilon_t \quad (9)$$

where, S_t denotes real effective exchange rate in ASEAN-4 countries Via U.S[5], R denotes domestic interest rate in ASEAN-4 countries, R* denotes foreign Interest rate, M denotes money supply in

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[4] According to Bjorland and Hungnes (2002), and Che and Mansure e (2006)

$s_{t+1} - s_t = i_t - i^*_t$

$\therefore \Delta s^e_{t+1} = i_t - i^*_t$

Assuming that Δs^e_{t+1} is a function of deviation of S_t from its equilibrium value S_t, the above equation can be rewritten as:

$\Delta s^e_{t+1} = i_t - i^*_t = -\lambda(s_t - s_t)$

In the long run, the equilibrium exchange rate will be given by relative price according to PPP. Hence, substituting equation 1 ($s_t = p_t - p_t^*$) for the equilibrium exchange rate will result in the following equation: $s_t = p_t - p_t^*$ -θ ($i_t - i_t^*$)

ASEAN-4 countries, π denotes inflation rate, NFA denotes net foreign asset, G denotes Real gross domestic product, and TOT denotes term of trade. The disturbance term ε is to capture the unobserved effects and is assumed to have zero mean and constant variance.

Econometric Method

Unit Root Test: Test for Stationary

The recent economic developments in econometrics warrant to examining the characteristics of time series. The researchers (Nelson and Plosser, 1982) stated that the application of standard methods of conventional non-stationarity data, contain any Unit Root problem, may lead to spurious correlation in the regression analysis. The stationary test commonly known as the unit root test, is conducted to check the order of the integration of each of the variable that is the number of times they must be differenced before attaining stationary. In order to avoid the problem of spurious correlation in the regression analysis, the time series properties of the variables will use in the regression analysis of this study are investigated using the two most popular unit root tests proposed to examine the stationary, which are the Augmented Dickey-Fuller (ADF) and the Phillips Perron tests.

Autoregressive Distributed Lag (ARDL)

Pesaran et al. (1999 and 2001) developed a procedure, called Autoregressive Distributed Lag (ARDL). The ARDL approach also allows us to identify long-run and short-run dynamics explanatory variables on a dependent variable. It can be applied regardless of the stationary properties of the variables in the sample and it allows for inferences on long-run estimates, which is not possible under alternative co-integration procedures.

The first step in the ARDL procedure outlined by Pesaran and Shin (1999) is to test the long-run significance of the dependent variables, by computing the *F*-statistic test the significance of the lagged levels of the variables in the error correction form of the underlying ARDL model. This is similar to testing the significance of the error correction term in an error correction model. It involves the testing of the joint long-run significance of all explanatory variables including the constant.

We apply the ARDL approach proposed by Pesaran *et al*. (2001) to estimate equation 9 The following ARDL model is estimated to examine the long-run relationship:

$$\Delta S = \alpha_0 + \alpha_1 R_{t-1} + \alpha_2 R^*_{t-1} + \alpha_3 M_{t-1} + \alpha_4 G_{t-1} + \alpha_5 \pi_{t-1} + \alpha_6 NFA_{t-1} + \alpha_7 TOT_{t-1} +$$

$$\beta_1 \sum_{i=1}^{n} \Delta S_{t-i} + \beta_2 \sum_{i=0}^{n} \Delta R_{t-i} + \beta_3 \sum_{i=0}^{n} \Delta R^*_{t-i} + \beta_4 \sum_{i=0}^{n} \Delta M_{i=0} + \beta_6 \sum_{i=0}^{n} G_{t-i} + \beta_7 \sum_{i=0}^{n} \Delta \pi_{t-i} + \beta_8 \sum_{i=0}^{n} \Delta NFA_{t-i} + \beta_9 \sum_{i=1}^{n} \Delta TOT_{t-i} + \varepsilon \quad (10)$$

where S is the real effective exchange rate (REER), R and R^* are domestic Interest rate and foreign Interest rate,respectively. M money supply, π inflation rate, NFA net foreign assets, G is growth rate of real gross domestic product in ASEAN-4 and TOT term of trade. Δ is the first difference, n is the lag number in the independent variables $\sum_{i=1}^{n}$ and ε is the error term.

4. Empirical Result

Unit Root Test

In this study, we utilized the two most popular unit root tests, the Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) tests, to check if the variables under consideration were integrated of I (0), I (1) or mutually integrated. It is widely known that if any variable in the model integrated of an order higher than I (1), the ARDL technique could not used to provide reliable estimates of the parameters of the model.

[5] According to Dufrenot and Yehoue (2005), Che and Mansure (2006), and Che and Marouane (2006), REER was defined as the ratio of the domestic CPI to the foreign CPI. The deflator employ by researchers are varies: some employ Trade Weighted Average (TWA), GNP deflator and so on.

ADF and PP tests suggest that most of our variables for ASEAN-4 economies are integrated in order I(0) or I(1) which means that the null hypothesis of unit root rejected for all series in both ADF and PP tests. Thus, we relied on the ARDL approach to estimate and interpret the parameters of the models used in the present study.

Long-Run Equilibrium Estimation

Given the existence of a long-run relationship, the next step is to use the ARDL approach to estimate the parameters of this long run relationship. This method has the additional advantage of yielding consistent estimates of the long-run coefficients that are asymptotically normal irrespective of whether the variables under consideration are I (0), I (1) or factionary integrated, (Pesaran and Shin, 1999; Pesaran *et al.* 2001).

The results of an ARDL models are reported in table 1. As we can see from the table, most of the variables under consideration are significant and the signs are consistent with a priori expectations. Clearly, for ASEAN-4 (Malaysia, Indonesia, Philippines, and Singapore) the key long- run forcing variables of PPP of REER against U.S dollar throughout of the whole period is observed to be the domestic money supply (M1).

According to Che and Mansure (2006) this can be explained as follow. Malaysia historically earned its monetary policy independent in June 1967. Prior to the date, it began to develop its own financial system, diversify its economy and began to export more of its products to other countries, particularly United States, United Kingdom, Japan, and Europe, it thus began to accumulate a large amount foreign reserve, particularly, USD besides other currencies as its foreign reserves to stabilized its economy. Its dependent over US dollar was further manifested when its peg it Ringgit (MR) to US dollar, MR3.8 to US dollar, between September 1998 to May 2005. Malaysia has partecally no PPP or exchange rate of its own since it fully depends on USD until it unpaged the MR to USD in May 2005, Che and Mansure e (2006). The table also indicates AFC has left a notable negative impact upon Indonesia's long-term PPP, as well as its economy. The crisis has brought a sharp increase in Indonesia's inflation Che and Mansure (2006).The result in table 1 seems to suggest Philippines has too much money in circulation in the market, during the study as well as whole period, this due to unstable socio-and political economic condition over long period Che and Mansure (2006). Singapore strategic geographical location provides an opportunity to be an international wholesale intermediary with many economies Che and Mansure e (2006).

Table 1: The selected ARDL model: long-run coefficient estimation for ASEAN-4 REER via U.S dollar.

Regressors	***Dependent Variable is REER (S)***			
	Malaysia	**Indonesia**	**Philippines**	**Singapore**
	Coefficient [T-ratio]			
R		.8658 [1.821]*	.0543 [2.311]**	-.1610 [-4.323]***
R*		.5717 [1.922]*	-.1648 [-3.186]**	
M1	-.3872[-3.223]**	-.7635[-3.643]**	.9494 [4.972]***	-.7631[-2.712]**
G	.5939 [3.117]**	.6814 [8.456]***		.8105 [7.884]***
π			.0985 [1.825]*	
NFA			-.2244 [-2.433]**	
TOT	-.6879 [-3.261]**		.2282 [2.471]**	.2856 [1.835]*
C	-.9618 [-1.707]*	-.1138[-5.030]***	.2067 [3.036]**	.2101 [2.828]**
The period	1991:Q2-06:Q2	1991:Q2-06:Q2	1991:Q2-06:Q2	1991:Q2-2006:Q2
No.of Obs	(61)	(61)	(61)	(61)

Notes: Asterisks ***, **, * represent 1%, 5%, 10% significant levels, respectively. The t-ratios are reported in square brackets. The following notation applies: domestic interest rate (R), foreign interest rate (R*), domestic money supply (M), real gross domestic product (G), inflation rate (π), net foreign assets (NFA) and terms of trade (TOT).

Error correction Model (ECM)

We estimated the short-run dynamic of the REER model for ASEAN-4 using the ARDL approach to co-integration proposed by Pesaran *et al. (*2001).The explanatory statistics in ASEAN-4 indicated that the REER equations were well specified. None of the statistics in the table (2) were significant at the 5% significance level. Thus the explanatory statistics test results obtained revealed that all equations passed the tests successfully, i.e. the $\overline{R}^2$ showed that all the REER equations obtained best goodness of fits and the variation on the selected variables explained almost all the variations of the dependent variables for Malaysia, Indonesia, the Philippines, and Singapore against U.S under consideration. The Standard Error (S.E) obtained best goodness of fits of the data, while D.W showed normal distribution of the data for all ASEN-4 REER equations.

In general, the results of the REER models for each of the ASEAN-4 as shown in table 2 indicate that the lagged error correction term ECM_{-1} carries the expected negative signs and is highly significant, which is supportive of the inference of a unique co-integration and stable long run REER relationship. Moreover, the result show the key short-run forcing variables of PPP of ASEAN-4 REER against U.S dollar throughout of the whole period are observed to be, the domestic money supply (M1) for Indonesia, Philippines, and Singapore , domestic interest rate (R) for Malaysia, Philippines, and Singapore , and net foreign assets (NFA) for the Malaysia, Indonesia ,and Philippines. The long-run and short-run forcing variables of PPP for ASEAN-4 differ due the their different economics environments and this tandem with Che and Mansure e (2006).

Table 2: Error correction representation based on the ARDL model: Short-Run estimation for ASEAN-4 REER via U.S dollar.

Regressors	***Dependent Variable is ΔREER (S)***			
	Countries			
	Malaysia	**Indonesia**	**Philippines**	**Singapore**
	Coefficient [T-ratio]			
ECM(-1)	-.0529[-2.197]**	-.2878[-2.563]**	-.1907 [-2.098]**	-.2323[-3.250]**
ΔR	.0620 [4.170]***		.0425 [3.087]**	-.7733 [-1.750]*
Δ R*		.2233 [1.828]*		.0765 [1.979]*
ΔM1		-.2610 [-2.887]**	.1660 [2.047]**	-.1789 [-3.603]**
ΔG	.0620 [4.170]***	.1777 [3.443]**		
$\Delta\pi$				
ΔNFA	-.0705 [-3.477]**	.1586 [3.0691]**	-.0433[-1.825]*	
ΔTOT			06352 [1.805]*	
C	-.0193 [-1.110]	-.2337 [-2.205]**	.0557 [1.758]*	.1942 [2.232]**
$\overline{R}^2$	.7439	.84673	.7510	.7634
S.E.	.0135	.0915	.0167	.0372
S.squared resid	.0102	.4522	.01487	.0762
F-statistic	5.840	7.569	2.945	6.077
DW-statistic	1.732	2.045	2.276	1.733
The period	1991:Q2-06:Q2	1991:Q2-06:Q2	1991:Q2-06:Q2	1991:Q2-006:Q2
No.of Obs.	(61)	(61)	(61)	(61)

Notes: The *t*-ratios are represented in squire brackets. Asterisks ***, **, * represent 1%, 5%, 10% significance levels, respectively. Δ denotes the first difference of each variable. The following notation applies: domestic interest rate (R), foreign interest rate (R^*), domestic money supply (M), real gross domestic product (G), inflation rate (π), net foreign assets (NFA) and terms of trade (TOT). $\overline{R}^2$ is Adjusted R-squared, (S.E) is the standard Error of regression, and Sum squared residual.

5. Summary and Conclusions

In this paper, we examined the long-run and short-run forcing variables of domestic interest rate, foreign interest rate, inflation rate, domestic money supply, net foreign assets, terms of trade (TOT) and real gross domestic product (RGDP) upon REER in ASEAN-4 countries**.** The long-run and short-run forcing variables of PPP for ASEAN-4 differ due their different economics environments and this tandem with Che and Mansure e (2006). The estimated of the long-run and short-run parameters of ASEAN-4 exchange rate model show that most of the variables carried the correct expected signs and their coefficients are statistically different from zero at conventional significant levels.

The results suggested that domestic money supply (M1) for Malaysia is in long-run only, while for Indonesia, Philippines, and Singapore are in long and short run , is the greatest forcing variable of PPP on countries' REER for full period. The impact of the M1 on Malaysia's PPP long runs due to develop its own financial system, open, and small. The impact of M1 upon Indonesia's PPP is due to major export natural resources. While, Singapore result suggested that domestic money supply (M1) is significant influence on Singapore's PPP in the full period. The impact of M1 upon Singapore's PPP is due to open, small, and the financial sector in Singapore is well developed followed by Malaysia financial compared to other ASEAN-4 financial markets.

Finally, our empirical results are also in line with the World Bank researchers who found that the developing economies, in general, are heterogeneous. Thus, the long run and short run forcing variable of PPP should be differ accordingly to countries' economics environments. The results are also similar to the empirical findings of Frenkel (1976,1978,), MacDonald and Taylor (1994), Chinn and Meese (1995), Kanas (1997), Husted and MacDonald (1998), Dutt and Gosh (1999), Francis et aI. (2001), Caporalea, et. al. (2001), Rapach and Wohar (2002), Groen and Kelbergen (2003), and Chaboud and Wright (2005). Thus, the policy makers in the respective ASEAN-4 economies need to keep constantly identifying the long-run forcing variables from time to time. The long run forcing variables are essential to the policy makers to assess, to mange and develop financial sector in order to play more vital role in promote their respective economies growth.

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