Fundamentals and Exchange Rates: Evidence from ASEAN-5

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Abstract

Utilizing the combined-form of PPP and UIP we estimate the cointegrating relations for ASEAN-5 economies. The study uses quarterly data over the period from 1980 to 2008. The findings reveal that exchange rate, interest rates and prices are cointegrated, implying that there is co-movement among them in the long run. We also find that the hypothesis – PPP augmented by interest rates forms a cointegrating vector – cannot be rejected. This piece of evidence is consistent with the capital enhanced equilibrium exchange rates (CHEERs) approach, which states that the deviations from PPP can be explained by the interest rates differentials. These evidences defiantly would provide the help in formulating exchange rate policies in ASEAN-5 countries.

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Keywords: *Exchange rate, PPP, UIP, ASEAN-5, Cointegration Analysis*

1. Introduction

Macroeconomic growth in major Southeast Asian countries has been highlighted by the scholars all over the world when they started to follow different trend of exchange rate regimes in order to bring the best sustainable economic growth to their own countries. Before the Asia economic crisis in 1997, the Philippines government has implemented the most flexible exchange rate regime, whereby Indonesia, Malaysia, Singapore and Thailand followed the less flexible crawling-band or managed-floating arrangements. Indonesia, as the biggest region in ASEAN-5 countries, continue to follow crawling-band exchange rate arrangement and Thailand pegged its currency to a currency basket. Malaysia and Singapore followed a managed float exchange rate regime. Since September 1998, the Malaysian government has formally pegged its currency to the U.S. dollar[1].

During the post-crises era, governments in ASEAN-5 start to introduce various economic policy instruments, particularly to the policy regarding exchange rates. Although the issue of the appropriate exchange rate regime is not new, it is continually debated. So far, there is no agreement among economists on which exchange rate regime should be followed by a certain country. For instant, Fischer (2001) and Rogoff (2004) suggested a flexible exchange rates regime is more recommended for developing countries in East Asia. Other economists like McKinnon (2000) argue that fixed exchange rate is a better choice for those countries.

[1] Joseph Stigliz, Economics Nobel Prize winner in 2001, supported Mahathir's plan from its inception. Flexible exchange rates can hurt export and slow growth, whereby pegged provides stability.

A conventional view on the exchange rate regime is that a fixed exchange rate regime can reduce exchange rate volatility and provide a credible anchor for monetary policy. A flexible exchange rate regime, on the other hand, can allow for more independent monetary policy. Accordingly, under a fixed exchange rate regime with perfect capital mobility, domestic interest rates move closely with the interest rate of the country to which domestic currency is pegged. Under a flexible exchange rate regime, by contrast, the monetary authority can set domestic interest rates independently. Other thing being equal, under a flexible exchange rate regime, shocks to international financial markets do not necessary cause domestic interest rates to move. In other words, domestic interest rates under a flexible exchange rate regime can be insulted for shocks to international financial markets.

As claimed by many researchers since the Asian financial crisis and the two subsequent crises in Russia and Brazil, intermediate exchange rate regimes are on their last legs and most of the countries in the world are moving toward corner solutions – at the one end, hard pegs, such as currency boards, currency unions or dollarization, or, at the other end, freely-floating exchange rate regimes[2]. However, some observers have argued that there is relatively more change of speculative attacks and currency crises if countries have either hard pegs or freely-floating exchange rates (for instance, see Goldstein (1999))[3].

[2] For further discussion of these issues, see Frankel et al. (2002).
[3] Calvo and Reinhart (2000) have also claimed that the Asian financial crises countries' exchange rates prior to the 1997 crisis were looked very much like pegs to the U.S. dollar for extended period of time.

A question that comes up about the ASEAN-5 countries is that "is there possibility of a common single currency or dollarization, or fully freely-floating exchange rate regime?" We don't think so. However, we can say that the knowledge of exchange rate determinations is necessary in order to design an effective exchange rate policy, exchange rate based stabilization programs and to prevent the financial market from any financial crisis.

Of particular interest to a central bank is whether interest rate liberalization affects the behavior of the exchange rate market alongside price level that is one other crucial determinant of exchange rate. In thinking about this phenomenon, the reader should recall that there is a natural link between the interest rate differential and exchange rate via the uncovered interest rate parity (UIP) hypothesis and purchasing power parity (PPP) describes exchange rate–price levels association.

However, the empirical findings do not still provide adequate and conclusive answers to simple questions about the determinants of exchange rates. Is the exchange rate determined by the level of prices as the PPP theory suggests or by the spread between the interest rates in the two countries as the UIP theory claims? Answering to this issue becomes more complicated when economic theory assumes that PPP and UIP hold while both are empirically found non stationary in the short and medium-long run as well. Indeed it has been difficult to prove that there was any convergence toward PPP and UIP in the long run.

As said by Johansen and Jueslius (1992), one possible reason is why so many researchers have failed to find evidence in support of the PPP as well as the UIP condition is the fact that researchers have ignored the links between goods and capital markets when modeling the exchange rate. Thus, the failure of the two fundamentals parities, PPP or UIP, may due to the omitting of variables (interest rates and price levels, respectively) from cointegrating vector rather than any inherent deficiency in exchange rate, price levels and interest rates associations. Indeed by modeling the both parities jointly one is better able to capture the interactions between the nominal exchange rate, the price differential and the interest rate differentials, as well as allowing for different short- and long-run dynamics.

The objective of this paper therefore is to examine the two-arbitrage conditions namely PPP and UIP jointly in ASEAN-5 and determine how they behave on the regional macroeconomics. From the theoretical perspective, the both international parity conditions are not independent of each other and the deviations in one of them can be explained by the other one. This view is consistent with the Capital Enhanced Equilibrium Exchange Rates (CHEER), which states that non-stationary deviation from the PPP and UIP forms a stationary relationship consistent with the interdependence of adjustments in the assets and goods markets towards equilibrium.

The paper proceeds in the following manner. In Section 2 we survey some previous empirical studies. In Section 3 we provide some theoretical considerations, describe the methodology employed in the tests and the data. Section 4 presents the empirical results by using econometrics modeling and finally Section 5 concludes.

2. The Existing Empirical Evidence

Mishkin (1984) and Cumby and Obsfeld (1984) both have same outcome, if agents make their forecasts using rational expectations and arbitrage forces are free to act in the goods and assets market, the real interest rates between countries will equalize. Some other authors like Awad and Goodwin (1998), Frankel and Okongwu (1995), Fujii and Chinn (2000), and Goldberg *et al.* (2003) conclude that real interest rate differentials are relatively short-lived and mean reverting but different from zero in the long run.

A large number of empirical studies have investigated the way domestic financial markets in emerging economies respond to international financial market shocks. These studies include Edwards (1998), De Bouwer (1999), Borensztein *et al.* (2001), Habib (2002), Frankel *et al.* (2002), Shambaugh (2004), and Obstfeld *et al.* (2004), investigates the volatility contagion from Mexico to Argentina and Chile when he investigates the behavior of the interest rates in three Latin American countries by using monthly and weekly data during the period of 1990s. He found that there was a spillover from Mexico's financial market volatility into Argentina's financial market volatility, but not into Chile's financial market volatility.

Another analysis by De Bouwer (1999) assesses time varying effects of foreign interest rates on domestic interest rates in a number of East Asian countries including ASEAN-5 countries. Using monthly data during the period from 1980 to 1994, he found that except for Malaysia domestic interest rates of the major Southeast Asian countries are cointegrated with the U.S. interest rates. In addition, he shows that the role of foreign interest rates in explaining innovations to the domestic interest rates in ASEAN-5

excluding Malaysia, increased during the period of his study. He infers that this result is associated with the openness of the capital account of the countries rather than their exchange rate regimes.

Borensztein *et al.* (2001) investigates the implication of the exchange rate regimes on the effects of external factors on domestic interest rates in a number of emerging market economies. As a proxy for external factors, in addition to the U.S. interest rates, they also use risk premium attached to the emerging market debts. The results of their study do not show a clear implication of the exchange rate regimes on the effects of external factors on domestic interest rates. Habib (2002) examines the effect of external shocks on the domestic interest rates and the exchange rates in Czech Republic, Hungary, and Poland during the period from 1997 to 2001.

Using data of more than 100 countries during the period from 1973 to 2000, Shambaugh (2004) finds that domestic interest rates in countries under a pegged exchange rate regime follow the interest rate movements in the country to which the currency is pegged. Obstfeld *et al.* (2004) have extended Shambaugh's (2004) paper, and they test whether the trilemma of open economy existed in a long period of time that spans from Gold Standard until Post-Bretton Wood era. Both Shambaugh's and the Obstfeld *et al.* findings show that, to some extent, a non-pegged exchange rate regime gives more room for monetary policy autonomy.

Bjørnland and Hungnes (2005) examined whether a parsimonious dynamic exchange rate model for Norway that combines the purchasing power parity condition with the interest rate differential in the long run, can outperform a random walk model in

an out-of-sample forecasting exercise. Their results show that the long-run results can be embedded in a parsimonious representation, which outperforms a random walk in an out-of-sample forecasting competition. Ignoring the long run interest differential (that is focusing only on PPP in the long run), however, the fundamental model can no longer outperform a random walk.

Stephen (2004) used Johansen's cointegration method to test combined PPP and UIP, for New Zealand, over the period 1992 to 2003. They were unable to find any significant evidence of combined PPP and UIP. However, their findings are in favor of strict PPP combined with weak form of UIP. Similarly, another study by Jose and Peter (2004) examined the impact of interest rate liberalization on exchange rate expectations in the Dominican Republic by using combined PPP and UIP along with random walk (RW) specification. They found that the most significant driver of exchange rate expectations is the interest rate differential between the Dominican Republic and the United State.

Calvo and Reinhart (2000) analyzed the behavior of exchange rates, foreign exchange reserves, the monetary aggregates, interest rates, and commodities prices across the spectrum of exchange rate arrangements to assess whether the "official labels" provide an adequate representation of actual country practices or not. The study uses monthly data for thirty-nine countries over the period from January 1970 to November 2007.

They divide their analysis into two parts. In first part, they simply find the probability of the deviations in the said variables and compare across the exchange rate

regimes namely peg, limited flexibility, managed floating and free-floating. They reported that exchange rate variability is least for pegs and greatest for floaters and reserve variability is highest for floaters and least for the limited flexibility arrangements. Regarding interest rates, they concluded that interest rates are the most stable for the limited flexibility group and least stable for the managed floating group. Similarly, the results provide evidence that the monetary aggregate show a high degree of variability relative to the more committed floaters. Finally, they said that commodity prices are far more volatile than exchange rate.

Secondly, they estimated a vector autoregressive (VAR) model to examine both temporal and contemporaneous links among the variables. The lag length was chosen on a case-by-case basis using the Schwartz criterion. They reported that in 46 per cent cases, the coefficient on the interest rate change is positive, which is what can be expected when there are credibility problems and interest rate increases signal future depreciations. In the remaining 54 per cent of the cases, the coefficient is negative. This would be the case when tight monetary policies (raising interest rates) lead to a future appreciation.

3. Theoretical Considerations

PPP states that nominal exchange rate between two countries should equal the ratio of the two countries' price level of a fixed basket of goods and service. Relative PPP is formally expressed in the following way:

$$e_t = \alpha + \beta (p_t^d - p_t^f) + \varepsilon_t \qquad t = 1, \ldots, T \qquad (1)$$

where e_t = log nominal exchange rate for domestic country at time t, defined as the number of domestic currency units required to purchase one foreign currency unit.

p_t^d = log domestic price level for domestic country at time t

p_t^f = log foreign price level

ε_t = trade shock with zero mean and finite variance

α is a constant, representing the permanent deviation from absolute PPP due to productivity differentials and other factors. T refers to the number of observations over time.

Of course, there are many factors, which could drive the exchange rate temporarily away from PPP, such as relative growth differentials, commodity prices, speculative price movements, or interest rates. When there is a deviation from PPP, we expect that the exchange rate will drift in the direction of restoring relative PPP, expressed algebraically by:

$$\Delta e_{t+1} = \eta \ (p_t^d - p_t^f - \alpha \ - e_t) \qquad (2)$$

where, the value of η lies between zero and one.

The UIP hypothesis is related to capital market. It states that interest rate differential between domestic and foreign country is equal to the expected change in the nominal spot exchange rate. In simplest form, UIP can be expressed as follows:

$$E_t(e_{t+1}) - e_t = \lambda \ + \delta \ (i_t^d - i_t^f) + u_t \qquad t = 1, \ldots, T \qquad (3)$$

where

i_t^d = log domestic interest rate

i_t^f = log an equivalent foreign interest rate

λ = constant, which capture the fixed effect specific domestic country

$E_t(\cdot)$ = the expectations operator conditional upon information available at time t

u_t is the risk premium associated with holding domestic currency assets (see details, Svensson (1992)). Under the assumption of rational expectations in exchange markets, the future spot exchange rate will equal the value expected at time t plus a random term with zero mean and finite variance that is uncorrelated with all information available at time t, including interest rate differential and spot exchange rate. Thus, equation (3) can be rearranged as follows:

$$\Delta e_{t+1} = \lambda + \delta (i_t^d - i_t^f) + \mu_t \qquad (4)$$

As we reported earlier, the rejection of PPP and UIP, individually, by many studies may be due to a systematic relationship between the two conditions. PPP and UIP are supposed to hold simultaneously, therefore, in this subsection, we proposes a scheme for combining PPP and UIP in a single equation framework, based on Choy (2000).

Since the PPP is a long-run condition, we assume that PPP forms the basis of expectations in the UIP condition. Algebraically, this relationship is obtained by plugging equation (2) into equation (4), yielding:

$$\eta (p_t^d - p_t^f - \alpha - e_t) = \lambda + \delta (i_t^d - i_t^f) + \mu_t$$

Rearranging:

$$e_t - p_t^d + p_t^f + \frac{\delta}{\eta}(i_t^f - i_t^d) + \Psi = 0 \qquad (5)$$

where $\Psi = a + \frac{\lambda}{\eta} + \frac{\mu_t}{\eta}$

In the real world, nominal exchange rates are not, always and everywhere, determined by price levels and interest rates. For example, speculative activity or commodity price movements could lead to a sustained and significant deviation from equation (5). Therefore, we are interesting to know rather equation (5) can be considered as an equilibrium condition towards which exchange rate, price levels, and interest rates tend move in the long run. In other words, whether price levels, interest rates, and the exchange rate are cointegrated. In the next section, we empirically estimate equation (5), using multi-variate cointegration test to test for cointegration.

As said earlier, the study uses the multivariate cointegration procedure to examine the co-movements among exchange rates, price levels and interest rates. The idea of cointegration can be related to the concept of long-run equilibrium between time series when one allows for the possibility of non-stationarity in the underlying series. If a linear combination of non-stationary I(1) variables is stationary I(0), then the variables are said to be cointegrated. The existence of a cointegrating vector implies that the two variables cannot move too far apart. If the real interest rates between two countries are cointegrated, for the real interest rate parity to hold, the cointegrating vector must be [1,-1]. If the cointegrating vector differs from the unit vector then the real rates do not follow each other sufficiently to equalize, but are merely co-moving. Briefly, the idea of cointegration

is based on a vector autoregressive (VAR) model. The five-equation Vector Error Correction (VEC) model counterpart to the VAR model is expressed below:

$$\Delta Y_t = \Gamma_1 \Delta Y_{t-1} + \Gamma_2 \Delta Y_{t-2} + \ldots + \Gamma_{m-1} \Delta Y_{t-m+1} + \Pi Y_{t-m} + \psi_t \quad (6)$$

where $\psi_t \approx Niid_p(0, \Sigma)$, ΔY_t is the first difference of the variables in the Y_t matrix, Γ_m is the short-run adjustment parameters for the variables ΔY_{t-m} for $m = 1,2,\cdots, j-1$and $\Pi = \alpha\beta'$, where β' is the matrix of cointegrating parameters and α represents the speed of adjustment to disequilibrium. According to the Granger representation theorem, if Π has a reduced rank $r < k$, then there exist $r \times k$ matrices such that $\Pi = \alpha\beta'$. Thus, the term $\beta' Y_{t-1}$ is equivalent to the error-correction term. Johansen's test for cointegration centers on estimating the matrix Π in an unrestricted form and then testing whether Π has less than full rank. The number of the independent cointegrating vectors depends on the rank of Π.

The Choice of Variable and Sample Period

As per theoretical discussion, the empirical models contain the following variables:

e_t = domestic exchange rate against US A dollar for country i
pci_{it}^d = the consumer price index for country i
i_{it}^d = market interest rate in country i
i_t^f = market interest rate in USA

All the variables are transformed in natural logarithms. The analysis focuses on ASEN-5 countries namely Malaysia, Singapore, Philippines, Indonesia, and Thailand. Quarterly

data over the range 1980Q1 to 2008Q3 is used for investigating the validity of combined PPP and UIP. All the said variables are taken from International Financial Statistics databases prepared by International Monetary Fund (IMF). The default measure of interest rates is monthly market interest rate. The data has been checked and corrected for errors[4].

4. Empirical Results and Remarks

Prior to testing for cointegration, it is tested for stationarity and the order of the integration of the variables, in the levels as well as in the first differences. More specially, the study tested whether all the said variables are integrated of order one, $I(1)$. This was achieved by estimating the augmented Dickey-Fuller (ADF) unit root tests. The estimated results are presented in Table 1.

Table 1
Results from Augmented Dickey-Fuller (ADF) Test

Countries	e_t		cpi_t		i_t	
	λ_{Levels}	$\lambda_{1st.diff.}$	λ_{Levels}	$\lambda_{1st.diff.}$	λ_{Levels}	$\lambda_{1st.diff.}$
Malaysia	-0.973 (0)	**-9.164** (0)	-0.190 (4)	**-3.892** (3)	-2.448 (6)	**-7.185** (1)
Singapore	-1.487 (0)	**-9.849** (0)	-1.631 (4)	**-4.691** (2)	-2.098 (1)	**-8.660** (0)
Philippines	-2.100 (2)	**-5.347** (1)	-2.878 (5)	**-4.170** (2)	-2.121 (2)	**-9.636** (1)
Indonesia	-0.938 (4)	**-8.056** (0)	-0.385 (3)	**-5.316** (0)	-2.666 (1)	**-9.024** (0)
Thailand	-1.409 (0)	**-9.869** (0)	-0.919 (2)	**-8.912** (0)	-1.687 (5)	**-8.912** (0)
USA	-	-	-1.406 (3)	**-4.394** (2)	-1.910 (1)	**-6.054** (0)

Note: All the test regressions contain a constant term. Bold values indicate the rejection of unit root null hypothesis at the 1% level of significance. Numbers in parentheses are optimal lags selected by AIC and used in the augmentation of the regressions.

All the ADF test regressions are estimated, at levels as well as at first differences, for each country with a constant term. The Akaike Information Criterion (AIC) is used to select an appropriate lag length for ADF tests in order to remove any manifest serial correlation. The results depict that the null hypothesis of non-stationary cannot be rejected at any common level of significance for all the said series at their levels.

[4] See IFS databases for further details.

However, the first differences of the series appear stationary. Thus, each of variables in the estimated system is integrated of order 1, $I(1)$.

The next step to carry on the cointegration testing procedure is to determine the autoregressive order (m) of the corresponding model (equation (6)). The prime objective here is to select the optimal lag-length (m) that eliminates any autocorrelation present in the residuals. In this study, the Akaike Information Criterion (AIC) is used to decide on the number of lags to be included in the empirical models.

The VAR models are first estimated with 8 lags. However, the estimated AIC statistics suggest 1 lag for Malaysia, 2 lags for Singapore, 3 lags for both Philippines and Indonesia and 5 for Thailand in equation (9). Table 2 details the diagnostic tests on the residuals of the VAR models. Autocorrelation of the residuals was examined using the joint F-form of the Lagrange Multiplier (LM) test, which is valid for systems with lagged dependent variables. The null hypothesis of no serial autocorrelation was accepted at the 5 per cent level for all the five countries. Similarly, the estimated VAR systems pass the normality test.

Table 2
Results from LM Tests for System Evaluation

Multivariate Tests:	**Malaysia**	**Singapore**	**Philippines**	**Indonesia**	**Thailand**
Residual Autocorrelation LM ($\chi^2(12)$)	012.98	08.75	14.25	18.65	16.85
Residual Heteroscedasticity	277.45*	441.46*	560.04*	615.14*	802.70*
Normality Test: LM $\chi^2(12)$	177.21*	84.72*	64.75*	146.49	64.26*

Note: * denotes the significant at the 1% level.

Table 3 reports the trace ($\lambda_{trace(r)}$) and the maximum eigenvalue ($\lambda_{\max}$) statistics for all the five countries. The results are obtained using the Johansen cointegration technique, assuming no deterministic trend in the cointegration vector. Both the statistics indicate that there is only one cointegration vector in the system for all the countries apart from Malaysia, where the estimated statistics suggest two cointegrating vectors. Thus, it can be said that there is significant evidences that the exchange rates, domestic and foreign prices levels, and domestic and foreign interest rates have co-movement in the long run in South Asian economies. Thereby, the first cointegration vector is normalized by the nominal exchange rates relating to each country and is recorded in Table 4.

Table 3
Results from Johansen Cointegration Analysis

Null Hypothesis	Malaysia		Singapore		Philippines		Indonesia		Thailand	
	$\lambda_{\max}$	λ_{Trace}	$\lambda_{\max}$	λ_{Trace}	$\lambda_{\max}$	λ_{Trace}	$\lambda_{\max}$	λ_{Trace}	$\lambda_{\max}$	λ_{Trace}
$r = 0$	**35.16**	**79.56**	**50.57**	**81.62**	**36.38**	**75.25**	**53.10**	**107.17**	**33.52**	**108.56**
$r \leq 1$	**31.97**	**44.40**	17.62	31.04	16.96	38.87	21.34	54.07	29.84	75.04
$r \leq 2$	07.37	12.42	08.54	13.42	14.30	21.89	15.91	32.73	26.28	45.19
$r \leq 3$	03.76	05.04	04.87	04.88	06.36	07.59	09.27	16.83	18.67	18.19
$r \leq 4$	01.28	01.28	00.01	00.01	01.23	01.23	07.55	07.55	00.24	00.25

Bold statistics are significant at the 1% or 5% level.

Table 4
Unrestricted Cointegration Vectors Normalized on Exchange Rate Term

	Malaysia	Singapore	Philippines	Indonesia	Thailand
e	1.000	1.000	1.000	1.00	1.00
cpi^d	-0.986	-1.018	-13.100	-1.766	-4.592
cpi^f	0.570	0.923	15.163	1.690	4.000
i^d	0.456	-0.152	0.174	-6.743	0.132
i^f	-0.163	0.382	-2.272	2.205	-0.368

Note: The absolute magnitudes of the coefficients do not represent elasticities (as given by levels) because the model is being tested in first difference. Therefore only relative signs and magnitudes matter.

It can be observed from the table that the cointegrating vectors have signs that match the theory of the combined PPP and UIP for all Malaysia, Philippines, and Thailand. For Singapore and Indonesia, the domestic interest rate, however, appears with negative sign in the cointegration vector while the foreign interest rate with positive sign.

Table 5
Standardized Adjustment Coefficient α

	Malaysia	Singapore	Philippines	Indonesia	Thailand
e	-0.028	0.009	0.001	-0.027	-0.016
cpi^d	-0.001	-0.005	0.000	-0.003	0.007
cpi^f	-0.009	0.009	0.000	-0.000	0.003
i^d	-0.192	-0.071	-0.003	0.022	-0.033
i^f	-0.023	-0.097	0.007	-0.000	0.043

The standardized adjustment coefficients are reported in Table 5. The next is to test the whether the cointegrating vectors match the theoretical restriction postulated by strict PPP and/or UIP or not, as represented in equation (7). This is performed by imposing and testing three types of restriction on the cointegration coefficients as given by the cointegrating vector, which are expressed in Table 6.

Table 6
Theoretical Restriction on Cointegrating Vector

Hypothesis	Economic Interpretation	Implied Restriction β
A	PPP forms a cointegrating vector	$\beta = (1,-1,1,0,0)$
B	PPP augmented by interest differentials form a cointegrating vector	$\beta = (1,-1,1,m,-m)$
C	PPP augmented by unconstrained interest rates forms a cointegrating vector	$\beta = (1,-1,1,m,n)$

The likelihood ratio (LR) test is used to test the validity of the restrictions. The LR statistics are shown in Table 7 with their probability values. The hypotheses, PPP only forms a cointegrating vector and PPP augmented by interest differentials form a cointegrating vector as well, are strongly rejected at 1% level of significance for all the

countries apart from Thailand where only the hypothesis that PPP only forms a cointegrating vector is rejected. However, for all the countries, the hypotheses that PPP augmented by unconstrained interest rates forms a cointegrating vector cannot be rejected at the any common level of significance.

Table 7
Results from LM Tests to Test the Restriction on Cointegration Vectors

Null Hypothesis	Malaysia		Singapore		Philippines		Indonesia		Thailand	
	LM Stat.	p-value	LM Stat.	p-value	LM Stat.	p-value	LM Stat.	p-value	LM Stat.	p-value
A	28.47	0.000	21.54	0.000	14.99	0.000	22.32	0.000	9.49	0.049
B	16.59	0.000	11.95	0.007	8.37	0.045	13.10	0.000	2.06	0.564
C	1.25	0.534	1.84	0.398	4.98	0.080	2.53	0.282	1.18	0.780

Overall, the evidences suggested that the exchange rate versus relative prices configuration would be established only when interest rates are incorporated into the cointegrating set. Thus, the two international parities are not independent of each other and the non-stationary deviations from one of them form a stationary relationship consistent with the interdependent of adjustments in asset and good markets towards equilibrium is ASEAN-5 economies. Accordingly the standardized restricted cointegrating vectors are given in Table 8.

Table 8
Standardized Restricted Cointegrating Vectors

	Malaysia	Singapore	Philippines	Indonesia	Thailand
e	1.000	1.000	1.000	1.000	1.000
cpi^d	-1.000	-1.000	-1.000	-1.000	-1.000
cpi^f	1.000	1.000	1.000	1.000	1.000
i^d	0.634	-0.198	1.223	-7.333	2.409
i^f	-0.012	0.461	-0.332	3.438	-2.409

Note: The absolute magnitudes of the coefficients do not represent elasticities (as given by levels) because the model is being tested in first difference. Therefore only relative signs and magnitudes matter.

5. Conclusions

This paper investigates the interrelations between purchasing power parity (PPP) and uncovered interest rate parity (UIP) in ASEAN-5 economies using Johansen multivariate cointegration analysis. The core objective was to identify whether the determination of the nominal exchange rate is consistent with the UIP-PPP conditional equilibrium or there are some other factors, such as productivity differentials, speculative activities, government intervention, etc., which are deriving the exchange rate away from the conditional equilibrium. The analysis has been performed relatively to the five bilateral cases Malaysia/USA, Singapore/USA, Philippines/USA, Indonesia/USA and Thailand/USA. The data spans quarterly observations and the sample period is 1980Q1 to 2008Q3.

The augmented ADF tests are performed to check the time series properties of the variables. The multivariate Full Information Maximum Likelihood (FIML) cointegration approach developed by Johansen has adopted to investigate the existence of a cointegrating relation. Finally, Lagrange Multiplier (LM) test is used for diagnostic testing of the VAR models specified by the AIC criterion.

The results of the Johansen cointegration analyses suggest the existence of the long-run co-movement among the said variables. Since the first cointegration appears more robust to the economic theory outlined in section 2, it is normalized by the nominal exchange rate for all the countries. The value of the estimated loading coefficients suggests that the adjustments of interest rates to disequilibria are relatively fast. There are strong evidences in support of the hypothesis that the system contains PPP and UIP

relations. However, the hypothesis is strongly rejected when PPP is formulated in isolation. The results are robust to the CHEER approach of exchange rate determination and suggest that the deviations from PPP can be explained by the interest rates differentials

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