# Monetary Policy Synchronization in the ASEAN-5 Region: An Exchange Rate Perspective

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# Common Features Analysis of ASEAN-5 Exchange Rates and Its Economic Implications

## Abstract

In light of the longstanding vision of economic and monetary integration in the ASEAN region and the importance of coordinating monetary policies to achieve it, the objective of this paper is to the assess the monetary policy synchronization among the founding members of the ASEAN, i.e., Indonesia, Malaysia, Philippines, Singapore and Thailand. Due to the importance of exchange rate movements to the coordination of monetary policies, we approach this issue from a currency exchange rate perspective. Specifically, multivariate trend-cycle decomposition is employed to investigate common trends and common cycles among the exchange rates of these countries during the period 1976 to 2012. Our analysis reveals that the real exchange rates of Malaysia, Philippines, Singapore and Thailand share common cycles in the short term and have common trends in the long term, but the Indonesian currency does not share these relationships. Thus, our results augur well for the synchronization of monetary policies among Malaysia, Philippines, Singapore and Thailand. In contrast, the relatively turbulent dynamics of the Indonesian Rupiah evident in frequent bouts of stark depreciation separated by periods of steady depreciation over the past three decades raise questions regarding the readiness of Indonesia for participating in a monetary alliance with the ASEAN-4 nations.

# Common Features Analysis of ASEAN-5 Exchange Rates and Its Economic Implications

## I. Introduction

The ASEAN-5 economies[1] have attracted a considerable amount of attention from investors, policy makers and researchers over the past two decades. This region has experienced outstanding economic growth which has been referred to as the 'East Asian Miracle', and is of interest to both researchers and policymakers. The ASEAN-5 economies rely heavily on trade. They trade extensively among themselves as well as with countries outside the ASEAN region. The trade-to-GDP ratios illustrate the degree of openness of these economies. In 1996 - one year before the Asian financial crisis - Indonesia, Malaysia, Philippines, Singapore and Thailand had trade-to-GDP ratios of 0.52, 1.82, 0.90, 2.78 and 0.85 respectively[2] . Also, the intra-ASEAN foreign direct investment (FDI) flows have experienced astonishing growth. According to the ASEAN Investment Report 2011, FDI inflows grew approximately by 105% in 2010, and expected to grow as the region continues to thrive like in recent years. In 2010, each of the five countries recorded an economic growth of 6%. It is believed that the stability of intra-regional exchange rate will help promote trade, investment and growth among countries with similar trade composition (Kawai, 2008; Bhandari and Upadhyaya, 2010)

To complement the fusion of trade and finance, political harmony is also brewing in the ASEAN region. Encouraged by these developments, the ASEAN leaders are considering the possibility of an ASEAN Monetary Union. Significant steps have been taken towards a greater integration in the past two decades. At ASEAN summit 1998, the heads of the state agreed to form a task force to conduct a study on the feasibility of an ASEAN currency union. Subsequently, several breakthroughs such as the

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[1] ASEAN-5 economies refer to the economies of the founding members of the Association of Southeast Asian Nations-Indonesia, Malaysia, Philippines, Singapore and Thailand.

[2] The trade-to-GDP ratios have been calculated by dividing the sum of exports and imports by GDP.

establishment of the Chiang Mai Initiative[3] (CMI) in East Asia's efforts towards monetary cooperation took place (Sun and Simons, 2011). Additionally, the ASEAN nations are steadily progressing towards the formation of the ASEAN Economic Community (AEC) which envisions enhanced intra-regional economic integration and seeks to establish the ASEAN region as a single market, thus making it more competitive and efficient. In fact, the establishment of the ASEAN Free Trade Area (AFTA) is well on its way. The signing of the ASEAN Comprehensive Investment Agreement (ACIA) in February 2009 was a big leap forward towards the creation of an open and a desegregated investment zone. Such intra-regional agreements manifest the desire of the ASEAN countries to form a comprehensive economic alliance, which upon completion is likely to make the ASEAN region an economic force to reckon with on the global economic platform.

The surge in intra-regional trade has been an important source of economic growth for the ASEAN-5 nations. These countries also cater to the import demands of developed countries such as Japan, the US, and members of the European Union. The existence of common trading partners fosters a competitive environment among the ASEAN-5 nations. The desire to attract both intra-regional and extra-regional foreign direct investment - another engine for economic growth - from common destinations, most notably Japan, the US, the UK and the Netherlands only elevates the degree of competition among the ASEAN-5 nations. Thus, resorting to the so-called beggar-thy-neighbor policies is not entirely inconceivable in such circumstances. For instance, these policies may take the form of driving the value of the domestic currency downwards to stimulate exports which in turn may hurt the export sector of a competing nation. Maintaining low rates of inflation is another way to keep a country's exports competitive. Whereas this is entirely consistent with the fundamental monetary policy objectives of the ASEAN-5 nations i.e. maintaining price level stability, this often involves currency appreciation.

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[3] For the elaborative task assigned to CMI, please see Sun and Simons (2011).

With a large proportion of intra-ASEAN trade taking place in the manufacturing sector, the appreciation of a currency may transfer cost-inflation to the trading partners, thereby making their export sector less competitive. Such economic spillovers not only weaken the cause of forming an economic alliance, but also necessitate synchronization and coordination of monetary policies.

In light of the ongoing efforts towards monetary integration, this study intends to investigate the two common features i.e. long term trends and short term cycles among the real exchange rates of the founding members of ASEAN— Indonesia, Malaysia, Philippines, Singapore and Thailand—in an effort to infer the feasibility of monetary integration. In this effort, the present study particularly aims to identify i) the number of common trends , ii) the number of common cycles, iii) decomposes the original series into its trend and cyclical components, and finally analyze whether or not there is a comovement in the trend and cyclical components. The central question of this study is, Is the exchange rate behavior among the ASEAN countries over time similar enough to support forging an alliance for monetary union? Some studies suggest that countries should not create a monetary union in the presence of large asymmetric (country specific) shocks as the cost of having a monetary union would significantly outweigh the benefits from it (Bayoumi, Eichengreen and Mauro, 2000; Sato and Zhang, 2006; Ahn, Kim and, Chang, 2006; Cortinhas, 2009; Basnet and Sharma, 2013).The chief implication of this study is that if the exchange rates of the ASEAN-5 countries have both common trend in the long term and share common cycles in the short term then these countries can make the case for monetary integration. Equivalently, if the exchange rates of these countries are subject to asynchronous trends and cycles then forging a monetary union would be undesirable. The rationale for using exchange rates as the indicator of the feasibility of a monetary union is that for decades, the exchange rates dynamics has been in the core of monetary policy discussion in emerging market economies as it is a crucial transmission channel of monetary policy. In an open economy, a central bank utilizes the exchange rate as a shock absorber (through appreciation/depreciation). Furthermore, exchange rate movements are central to international

trade and finance as they directly impact the relative price of goods and services in domestic and foreign markets. Fluctuations in exchange rates can have a significant bearing on the terms of trade and the value of foreign asset holdings since they can potentially transmit economic shocks across countries. Wilson and Choy (2007) note that the long and short-term dynamics of exchange rate play a decisive role in making the decision for a monetary union or optimum currency area.

The growth of economic integration means that policymakers need to be more attentive to the implications of foreign policies as the transmission of economic disturbances via exchange rates (among other media) from one country to another may compromise the monetary autonomy of an economy. Thus, an examination of exchange rate co-movements can provide useful insights into the issue of economic and financial spillovers. Also, the investigation of the long-term and the short-term co-movements among the ASEAN-5 currency exchange rates is important due to the prospects of monetary integration in the ASEAN region and the creation of an Optimum Currency Area to facilitate trade and development. To the best of our knowledge, no study has explicitly addressed the common trend and common cycles in the exchange rates of ASEAN countries in conjunction with monetary integration. Note that the effect of exchange rates on macroeconomic stability is linked to interest rates, and other important macroeconomic variables such as output and inflation. While testing the dynamics behavior of exchange rate constitutes a different aspect of investigation in assessing the appropriateness of a monetary union, we are aware that an issue of this important (i.e. monetary union) should be evaluated thoroughly utilizing other macroeconomic fundamentals that include business cycle similarities, labor mobility, price and wage flexibility and finally political agreements. To that extent, this study does not provide a thorough evaluation for that possibility.

Half a century ago, Mundell (1961) introduced the optimum currency area theory (OCA). Mundell and the proponents of monetary union claim that a common currency facilitates trade, reduce both the risks associated with exchange rate uncertainty, and foreign exchange rates related transaction costs. It also eliminates the need for reserves for foreign transaction. On the other hand, the opponents of

common currency argue that a country joining a monetary union loses its monetary policy sovereignty that is, the country cannot change the price of its currency at the time of need, especially to counter country specific macroeconomic shocks.

The main findings of this paper are as follows. The real exchange rates of Malaysia, Philippines, Singapore and Thailand have at least two common trends in the long term and do share the same number of common cycles in the short term. However, the Indonesian currency does not share this relationship. The decomposed series (i.e. trend part and cyclical part) demonstrate a high degree of comovement with a positive relationship both in the long and the short run. Likewise, the correlation coefficients of both trend and cyclical components are strongly positively related; none of the countries (excluding Indonesia) share a negative relationship.

The organization of this paper is as follows. In section II, relevant literature is presented, section III includes the data and methodology used in this study. The empirical findings are discussed in section IV and Section V concludes this article with the main findings and policy implications.

## II. Brief Literature review:

There is a growing literature that empirically investigates the prospect of monetary union or optimum currency area (OCA) in East Asian countries in general or ASEAN-5 in particular. In a recent paper, Rhee (2012) tests for the possibility of a monetary union in the ASEAN +3 (South Korea, China and Japan) by utilizing the GARCH-M model and concludes that the prospect of monetary union is not in place. In contrary, Binner et *al.* (2011) find the favorable condition for optimum currency area in ASEAN plus Taiwan. Their results assert that these countries meet necessary conditions for forming a common currency area. Chin and Azali (2010) examine the linkages among the ASEAN-5 currencies during pre and post crisis. Their results show that there was no cointegrating relationship during the pre-crisis period, but a meaningful cointegration exists during the post crisis period suggesting a low financial integration among the ASEAN-5 before the crisis.

Sun and Simons (2011) investigate the feasibility of monetary union in eleven East Asian countries that include ASEAN-5. Their cointegration and the Granger causality test results do not support a uniform monetary union incorporating all eleven countries. The study, however, finds some supportive evidence for a sub-group union such as between South Korea, the Philippines, Thailand, Indonesia, and Malaysia. Cortinhas (2009) investigates the suitability of monetary integration in the ASEAN-5 by examining the exchange rate pass through into domestic prices. The result supports a monetary union between Singapore, Thailand and Malaysia. Indonesia and Philippines seem to be a weak candidate to join the union. Tawadros (2008) tests the endogeneity of the optimum currency areas for ASEAN and concludes that these countries are not yet synchronized enough to enjoy the benefits of monetary unification. Similarly, Kim (2007) does not see any prospect of monetary union in East Asia except a feeble possibility between Hong Kong and China. Strobel (2007) also does not find any supporting evidence for the readiness of monetary union among the ASEAN group. By using the theory of Generalized Purchasing Power Parity (G-PPP), Wilson and Choy (2007) do not find supportive evidence for an OCA for ASEAN-5. Ahn, Kim and Chang (2006), on the other hand, provide evidence that ASEAN-4 (excluding Philippines) and four Northeast Asian economies (Hong Kong, Japan, South Korea and Taiwan) may form an optimum currency area. Sato and Zhang (2006) test real output variables to assess the suitability of monetary union in East Asia and find evidences for a pair of countries union but not for the whole region.

The existing evidence is mixed and inconclusive regarding whether the ASEAN countries are ready for a coherent monetary union. Many studies (see e.g. Binner et al. 2011; Tawadros, 2008; Kim, 2007) have investigated the feasibility of a monetary union in ASEAN countries by utilizing either G-PPP, VAR or the cointegration framework. This study differs methodologically because it utilizes the serial correlation common features test proposed by Vahid and Engle (1993). The test develops a multi country framework to identify common trends and common cycles. Additionally, the common feature test decomposes the original series into two parts (trend and cyclical components) and analyze their

relationship[4]. The trend part explains the long run relationship while the cyclical part shows the relationship in the short run.

An examination of the long-term and short-term exchange rate dynamics will reveal the following information for the benefit of the monetary authorities in ASEAN-5. First, the study will provide the ASEAN-5 nations important insights about their exchange rates movement both in the long and short run, which may enhance further dialogue in the region for monetary union. Second, it will shed light on the extent of the autonomy and the degree of insulation of monetary policies to economic shocks occurring in foreign nations. Third, the transition period—the period in which a country is in the process of giving up the use of its currency in favor of the common currency—can be relatively smooth if their exchange rate markets have exhibited co-movements historically, both in the long-run and in the short-run.  In other words, it is relatively easy to integrate markets that have exhibited integration in the past.  As Grimes (2005) points out that the monetary autonomy of countries will not be compromised much as a result of monetary integration if they have synchronous cycles.

In addition to benefiting to the policy dialogue, our results also benefits the investors. For instance, if two or more exchange rates share common trends, then long-run benefits arising from diversifying a foreign investment portfolio among the corresponding currencies will be mitigated. The short-term cycles have implications on gains from diversifying foreign investment portfolios over shorter investment horizons. Investors seeking short-term investment gains can benefit from monitoring transitory or short-term responses of exchange rates to various economic and financial shocks.  For

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[4] Initially, Vahid and Engle (1993) examined the presence of common trends and common cycles among per capita consumption and income, and Engle and Issler (1993) investigated trend-cycle decomposition among per capita GDP of Argentina, Brazil and Mexico, and later Engle and Issler (1995) examined the presence of trend and cyclical components among the outputs of various sectors of the U.S.  Recently a number of researchers (e.g. Bein, Candelon and Hecq (2000), Sharma and Wongbangpo (2002), Sato and Zhang (2006), Sato, Allen and Zhang (2007), Abu-Qarn and Abu-Bader (2008) and Adom et al. (2010), Basnet and Sharma (2013b) among others) have used the common trend and common cycle approach among a set of macro variables to investigate the feasibility of a monetary/economic union in a group of countries. Adom et al. (2010) have given a detailed justification as to how this methodology is superior to the one proposed by Blanchard and Quah (1989) and used by researchers earlier.

instance, *ceteris paribus*, the depreciation of a currency causes the value of the assets denominated in that currency to decline as well.

### III. Data and Methodology

*Data*

We use monthly data on nominal exchange rates expressed in terms of the domestic currencies of Indonesia, Malaysia, Philippines, Singapore and Thailand - per US Dollar from January 1976 to April 2012. The data are obtained from the International Financial Statistics CD-ROM. The real exchange series are constructed as follows: $r_t^i = e_{i,t} \times \dfrac{p_t^*}{p_t}$ , where $e_{i,t}$ is the US Dollar price of the currency of country $i$, $p_t^*$ and $p_t$ are the consumer price index of the US and home country respectively. There was a financial turmoil in the exchange rates of the ASEAN-5 nations beginning from July 1997 until September 1998. We have specifically included the turmoil because the inclusion of this period allows us to study the sample period in its entirety, and also can be used to demonstrate the financial contagion during the Asian financial crisis[5].

*Methodology*

First, all the exchange rate series are tested for stationarity and their order of integration is determined. We employ the Dickey-Fuller (1979) and the augmented Dickey-Fuller (1981) tests, the Phillips-Perron tests [Phillips and Perron (1988), Perron (1988)] and the KPSS test [Kwiatkowski, Phillips, Schmidt and Shin (1992)] to test for unit roots in the individual time series. After determining their order of

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[5] In the context of the 1997/98 financial crisis in East Asia, researchers have utilized a variety of ways (such as providing pre and post crisis estimations (Wilson and Choy, 2007), or using a dummy variable (Sun and Simons, 2011) or using entire period without any breakdown or so (Rhee, 2012) etc.) to deal with a structural change issue caused by the crisis. In an attempt to take care of this issue, we re-estimated the model B by excluding the fifteen month (July 1997 to September 1998) of the crisis period. However, we did not find any qualitative differences in the results. One of the goals of this study is to investigate whether or not the ASEAN countries demonstrate the comovement in their trend and cyclical components during the crisis period. Therefore, only the results of whole period are reported; the results of the excluding period are not reported in the paper, are available upon request though.

integration, the optimum lag-length to be used in the cointegration model is identified by conducting the

sequential likelihood ratio tests on the unrestricted vector autoregression models consisting of the levels

of the natural logarithmic transformations of the five exchange rate series. We use the maximum-

likelihood based $\lambda$-max and $\lambda$-trace statistics proposed by Johansen (1988, 1991) to test for the number of

cointegrating vectors among the spot exchange rates of the ASEAN-5 countries. Johansen demonstrated

that given an $(n \times 1)$ vector $x_t$, there can exist $r < n$ linearly independent cointegrating vectors implying

the presence of $(n - r)$ common trends. The $(r \times n)$ matrix $\beta$ is the matrix of the cointegrating

coefficients and $\beta' x_t$ is $I(0)$. We consider the following model:

Model A:   $x_t = \left( e_t^{IDR}, e_t^{MYR}, e_t^{PHP}, e_t^{SGD}, e_t^{THB} \right)'$

where $x_t$ is a $(5 \times 1)$ vector and $e_t^{IDR}, e_t^{MYR}, e_t^{PHP}, e_t^{SGD}$ and $e_t^{THB}$ are the natural logarithmic

transformations of the real exchange rates of the Indonesian Rupiah, the Malaysian Ringgit, the Philippine

Peso, the Singapore Dollar and the Thailand Baht respectively. The likelihood ratio tests proposed by

Johansen (1988, 1991) are also used to test the statistical significance of each of the cointegrating

coefficients by imposing restrictions within the estimated cointegrating vector.

According to Vahid and Engle (1993), the number of common cycles can be determined by

testing the significance of the co-feature vectors ( i. e. canonical correlations) among

$\Delta x_t$ and $\left[ \beta' x_{t-1}, \Delta x_{t-1}, \Delta x_{t-2}, \ldots, \Delta x_{t-m+1} \right]$ where $m$ is the chosen lag-length of the vector autoregression

model. Vahid and Engle (1993) proposed a $\chi^2$ statistics to test for the number of significant co-feature

vectors. However, following Engle and Issler (1995), here we use an F-test approximation discussed in

Rao(1973), since this F-test has better small sample properties than the $\chi^2$ statistics.

Vahid and Engle (1993) noted that "with $r$ linearly independent cointegrating vectors, if $x_t$ has

common cycles, there can, at most, exist $(n - r)$ linearly independent cofeature vectors that eliminate

common cycles." In other words, if there exists r (< n) linearly independent co-integrating vectors, there

can exist at most $s = (n - r)$ linearly independent cofeature vectors and $(n - s)$ common cycles. The range of the $(n \times s)$ matrix $\tilde{\beta}$ is referred to as the cofeature space. Also, there exists linear independence among the $r$ cointegrating vectors and the $s$ cofeature vectors. They demonstrated that the necessary condition to recover the trend and cyclical components of the series is that the sum of the linearly independent cointegrating vectors and the linearly independent cofeature vectors is exactly equal to the number of variables, i.e. $r + s = n$. If $r + s = n$ then a $(n \times n)$ matrix $B = \begin{bmatrix} \tilde{\beta}' \\ \beta' \end{bmatrix}$ is of full rank and thus $B^{-1}$ exists. Upon partitioning the columns of $B^{-1}$ i.e., $B^{-1} = [\tilde{\beta}^- \mid \beta^-]$, the trend and cyclical components can be recovered in the following way[6]:

$$x_t = B^{-1} B x_t = \tilde{\beta}^- \tilde{\beta}' x_t + \beta^- \beta' x_t = Trend + Cycle \tag{1}$$

We know that $\beta' x_t$ is serially correlated and $I(0)$. Therefore $\beta^- \beta' x_t$ represents the cyclical component. On the other hand, $\tilde{\beta}' x_t$ is a random walk and does not contain any cycles. Therefore, $\tilde{\beta}^- \tilde{\beta}' x_t$ represents the trend component.

## IV. Empirical Results

Following the literature, all the exchange rate series are transformed into their natural logarithmic forms. The unit root tests discussed in the earlier section are used and these test statistics are presented in Table 1. The unit root test statistics reveal that each of the five real exchange rate series is $I(1)$.

[Table 1 here]

*Trend-Cycle Decomposition*

Based on the sequential likelihood ratio test, six lags are identified as the optimum for the co-integration model. In order to determine the model specification, we test the null hypothesis of a model with no

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[6] This decomposition is explained in details in Vahid and Engle (1993, pp. 346 – 347).

intercept and no trend against the alternative hypothesis of a model with an intercept and no trend. We reject the null hypothesis at the 5 % significance level as the likelihood ratio, $\chi^2(1) = 6.92 > 3.84$. Thus, a model with an intercept term and no trend is chosen for the analysis. Both the $\lambda$-trace and the $\lambda$-max statistics reveal (Table 2) the presence of one cointegrating vector. The Lagrange multiplier (LM) $\chi^2$ statistics to test for no-autocorrelation among the residuals (with 25 d.f.) is 26.68 with a p-value of 0.37. Thus, the residuals of model A are white noise. Next, the statistical significance of each of the five variables is tested using the likelihood ratio statistics by imposing restrictions $H_o : \beta_k = 0$ where $k = 1$, 2…5 within the cointegrating vectors. The test statistics in Table 3indicate that the Indoneisan Rupiah is not significant *(p = 0.49)* and therefore, can be excluded from the model.

[Table 2 here]

The overwhelming statistical evidence to the exclusion of the Indonesian Rupiah can be explained in large part by its rather unique dynamic behavior - within the context of ASEAN-5 exchange rates - before, during and after the Asian financial crisis in 1997. Although, the Indonesian Rupiah was officially pegged to an undisclosed basket of currencies between 1978 and 1997 (Reinhart and Rogoff, 2002), Indonesia did not possess the macroeconomic fundamentals that play a key role in maintaining a currency peg. It was plagued by several banking, financial and political crises. Also, among the ASEAN-5 currencies, the Indonesian Rupiah experienced the most severe devaluations during and before the Asian financial crisis. Not only were these instances of devaluation relatively more severe, the frequency of such instances of stark devaluations was relatively high. Moreover, during the periods separating such instances, the Indonesian Rupiah continued to depreciate at a gradual rate. Such behavior was not exhibited by any of the other four currencies during the pre-crisis period. The Rupiah depreciated by approximately 50% in November 1978 when it severed its link to the US Dollar. The Indonesian financial sector had operated under strict regulatory laws during the 1970s. In the wake of financial reforms undertaken to deregulate the financial sector, the Rupiah depreciated by 37.8% in April 1983. Following this period, the Rupiah gradually depreciated against the US Dollar until September 1986. The

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Rupiah was devalued by another 44.26% in September 1986. As mentioned above, during the Asian financial crisis - from June 1997 to January 1999 - the Indonesian Rupiah suffered a devaluation of 265%. In the post-crisis period, the Indonesian Rupiah is the only currency among the ASEAN-5 currencies that has not exhibited a clear appreciating trend against the US Dollar. The currencies of Thailand and Singapore have steadily appreciated against the US Dollar since 2003 and the currencies of Philippines and Malaysia have done the same since 2005.

[Table 3 here]

Such dynamics coupled with the overwhelming statistical evidence warrant the exclusion of the Indonesian Rupiah from the model. Therefore, we estimate the following restricted model, Model B to determine the presence of common trends and cycles among the remaining four exchange rates:

Model B: $x_t = \left( e_t^{MYR}, e_t^{PHP}, e_t^{SGD}, e_t^{THB} \right)'$

The identical methodology is employed to the restricted Model B as was employed to the unrestricted Model A in order to determine the optimum lag-length and the number of co-integrating vectors. The likelihood ratio test reveals a lag-length of six. A model with an intercept and no trend is utilized as the $\chi^2$ statistics (i.e. 5.84) rejects the null hypothesis of a model with no intercept and no trend at the 5% significance level. The results of the cointegration test for model B are reported in lower panel of Table 2. We cannot reject the null hypothesis of two cointegrating vectors at the 5% significance level. While the $\lambda$-trace indicates only one cointegrating vector (i.e. $r = 1$), the $\lambda - max$ statistics reveal the presence of two co-integrating vectors among the ASEAN-4 exchange rates. We use the test results from $\lambda - max$ as it has a more definitive alternative hypothesis (Enders 1995, p393). The existence of two cointegrating vectors (i.e. $r = 2$) implies that there exists two ($n - r$: $4 - 2 = 2$) common trends. The presence of common stochastic trends among exchange rates has long-run implications on the behavior of these rates, i.e., while they may drift apart temporarily they will eventually be brought together by their

common stochastic trends[7]. The LM $\chi^2$ statistics to test for no-autocorrelation among residuals is 8.32 (with 16 d. f.) with a p-value of 0.93 and thus reveals that the residuals are white noise.

[Table 4 here]

Once the long term co-integrating relationship is established the next step is to test for the number of common cycles. For that, we conduct the serial correlation common feature test proposed by the Vahid and Engle (1993), which has been discussed in section 3.2. The test results are reported in Table 4. The null hypothesis that the rank of the cofeature vectors (s) is four is reject at the 5% significance level. The test statistics presented in Table 4 suggest that the real exchange rates of ASEAN-4 has two cofeature vectors (i.e. s =2), implying that they share at least two common cycles. Note that the number of cointegrating vectors (r) determine the number of common trends and the number of cofeature vectors (s) determine the number of common cycles. In this study, the common feature test identifies two cointegrating vectors (r =2) and two cofeature vectors (s =2), which leads to our final quest of trend-cycle decomposition. Since we have r + s = n (i.e. r =2, s= 2 & n =4), the special condition suggested by the Vahid and Engle (1993), is satisfied and therefore we decompose the exchange rate series into their trend and cyclical components using equation (1). The decomposed series are utilized to measure the degree of comovements both in the long and short run.

*Cofeature Analysis*

The results assert that the four ASEAN countries have two common trends and share the same number of common cycles in their exchange rates. To further analyze the dynamics of the long and short term commonalities, each series is decomposed into its trend and cyclical components by using equation (1). The long-term trends of all four countries are plotted in Figure 1. The cyclical components are plotted in Figures 2. We observe that the trend components of all four countries exhibit a greater degree of co-

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[7] However, the existence of co-integrating relationship does not imply that the countries under consideration does not differ in their policy implementation over time. At best, it simply means that any deviation in the short run will be corrected by internal dynamics that pushes these economies back towards equilibrium path in the long run (Darrat and Al-shamsi, 2005).

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movement (Fig 1). The evolution of trend components with respect to timing and impact is strongly similar among all four countries. Table 5, lower triangle, reports the correlation coefficients among the trend components. The idea of estimating the correlation coefficients is to measure the strength of the association between two variables. The estimated magnitude and the direction of the coefficients suggest that the trend components of the ASEAN countries are highly positively correlated (Table 5, lower triangle). Note that the trend components are obtained by subtracting the cyclical components from the original series. The graphical presentation further asserts the strong correlation. The correlation between Malaysia and Thailand, between Singapore and Philippines, and between Thailand and Philippines is 0.90 or more. While the correlation between Malaysia and Singapore, and between Thailand and Singapore is 0.45 and 0.72 respectively, none of the countries share a negative relationship in their components. The standard deviation of the trend and cyclical components presented in lower panel of Table 5 indicates that there is no noticeable cross country differences in volatility. The standard deviation of trend component is very low; it is less than 1 for all four countries. In fact, it is only 0.10 for the most volatile country (Malaysia).

[Table 5 here]

In figure 1, we observe some noticeable instances. First, there is a sharp increase in trend components of four countries during the 1980s and the late 1990s, which coincides with the Latin American crisis, and the Asian financial crisis respectively. In1982, Mexico along with other Latin American countries, faced a profound financial crisis, defaulted on its foreign debt. Foreign investors viewed the Latin American crisis as a general phenomenon in emerging markets that hit the financial sector of the ASEAN nations as well. The shaded area in the 1980s in Fig 1 shows that all four countries suffer a large devaluation in their real exchange rates.  The second one is the big spike in the late 1990s, which can be attributed to the Asian financial crisis. During the late 1980s and early 1990s the South East (SE) Asian countries (that includes the sample countries in this study) grew at an unprecedented level, which is often termed 'The Asian Miracle.' The SE Asian countries experienced an investment boom in

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commercial and residential property, among others. Capital flows, mostly short term investment, from abroad increased significantly. However, foreign creditors and investors began to sense the vulnerability of banking sectors when the banks, in many instances, failed to meet their short term obligations. A creditor's panic erupted; the creditor became reluctant to roll over their short term loan and investors began to further speculate that these countries may plunge into a deep financial crisis. They pulled out their investments abruptly. First, Thailand's domestic institutions failed to meet their external short-term obligation. Eventually, the whole episode ended up being a complete financial meltdown. The financial collapse caused the Thai currency to depreciate sharply. The meltdown was so contagious and quickly spilled over the rest of the countries. All four countries suffered almost the same level of currency depreciation, which has been captured by a large spike in the trend components during the time of 1997 - 1998. All major events seem to be impacting ASEAN-4 countries in a very similar way that suggests that the region is prone to contagious effects. Figure 1 asserts that the long term behavior of the ASEAN-4 exchange rates shows strong similarities in term of macroeconomic responses to internal and external shocks.

[Figure 1 here]

Now turn to the behavior of the cyclical components, plotted in Figure 2. We note that the cyclical components of the Thai Baht, the Malaysian Ringgit, the Philippines Peso, and the Singapore Dollar exhibit a strong co-movement and share a positive relationship, i.e., they move together in the same direction. All four countries demonstrate very similar response to the major two instances mentioned above in the short run as well. However, the amplitude of the Thai Baht is less pronounced compared to the rest of the three countries. The correlation for cyclical components reveals that the cyclical behavior of the four countries is highly correlated (Table 5 upper triangular). The correlation among them is above 0.80 for any pair of countries. In fact, the test results reveal that the short run behavior of the real exchange rate between Malaysia and Singapore, between Malaysia and Thailand, and between Thailand and Singapore is perfectly correlated (Table 5 upper triangular). The standard deviation

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of cyclical components corroborates the perfect correlation. The standard deviation for all countries is extremely low (Table 5 lower panel), suggesting a synchronized short run movement. This study does not find any inverse relationship between the trend and cyclical behavior. For instance, in a study of seven Latin American countries Basnet and Sharma (2013) report that Argentina and Venezuela behave totally opposite than that of the other five countries—Brazil, Chile, Colombia, Mexico and Peru. Therefore, the quite similar trend and cyclical behavior among the real exchange rates of ASEAN-4 countries suggest a synchronous policy response to the shocks. The similar response of both trend and cyclical components to the exchange rate fluctuations suggest a very similar macroeconomic fundamentals among the ASEAN -4 countries.

[Figure 2 here]

According to conventional literature highly correlated business cycles are considered to be, among others, a necessary condition for a higher level of economic or monetary integration. The idea behind this logic is that if the business cycle fluctuations are not synchronized, then harmonized fiscal or monetary policies could be undesirable. In that case, each member requires differing set of policy prescriptions to cope with such asynchronous cycles. In light of synchronized long term movement among the real exchange rates of the ASEAN-4, it is worth mentioning some of the forcing variables (i.e. fundamentals) that may have driven the real exchange rates to a synchronized path. The OCA theory emphasizes the role of real exchange rate as a stabilization instrument. The link between exchange rates and macroeconomic stability is derived from interest rate, and other important variables such as output and inflation. Enders and Hum (1994) argue that if the forcing variables share common stochastic trends then the real exchange rates that are influenced by these variables also share common trends. Thus, it is fair to say that the macroeconomic fundamentals in the ASEAN-4 share commonalities in responding to internal and external shocks in the long term.

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Exchange rates in the short-run may be influenced by currency flows initiated by investors, political policies and interest rate differentials arising due to fiscal and monetary shocks. However, significant foreign exchange interventions by monetary authorities in order to preserve or alter the value of the currency may considerably impact the path of the exchange rate. In recent years, the ASEAN nations have conducted monetary policies with the primary objective of maintaining price level stability.  In fact, Philippines (since January 2002) and Thailand (since May 2000) have adopted inflation targeting monetary policy frameworks.  Despite the establishment of inflation targeting as the cornerstone of monetary policy, the central banks of these countries continue to manage its currency exchange rates through intervention in the foreign exchange rate market (Pontines and Siregar, 2009) [8].  While Malaysia and Singapore do not target explicitly stated rate of inflation, price level stability is indeed the overarching goal of their monetary policy.  However, exchange rate management has been and continues to be important to the conduct of monetary policy in both Malaysia and Singapore. The existence of long term common trend and short term common cycles in a set of variables respectively indicates that those variables do not swing for long time, they ultimately move together, and share similar cyclical fluctuations in the short run.

Also, the short-term responses to shocks cannot be separated from macroeconomic conditions that prevail in the countries. Within the economies of the ASEAN nations, the economies of Malaysia, Philippines, Singapore and Thailand have relatively sound economic fundamentals. These economies have well developed capital markets, have maintained low rates of inflation and have successfully implemented financial and economic reforms leading to macroeconomic stability. The relatively stable and investor friendly financial and economic systems may have

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[8] We are not suggesting that the objective of exchange rate stability is necessarily inconsistent with that of price level stability.

provided a safe and secure environment for foreign investments. Thus, the strong similarity in

the long run behavior might have linked to a common factor that may have caused the

synchronous movement in the long run. A plausible common factor that might have tied all

countries together could be monetary policy target and macroeconomic condition outlined above.

Likewise, the quite similar cycles suggest that the countries may have policy coordination

through the channel of market forces in the short run. Therefore, our results support for a

coherent monetary union at least from the exchange rates movement perspective.

## V. Conclusions

The ASEAN nations are keenly pursuing the goal of economic and monetary integration.
Their intent is evident in the enactment of various economic and political agreements that seek to
enhance intra-regional policy coordination. Our study explores an important aspect of monetary
policy synchronization, i.e., currency exchange rate co-movements. We find that the currency
exchange rates of the ASEAN-5 nations - with the exception of Indonesia - exhibit co-movement
in the long-run and in the short-run. This result bodes well for monetary policy coordination
among these countries.

We isolate and identify the trend and the cyclical components of the Malaysian Ringgit,
the Philippine Peso, the Thailand Baht and the Singapore Dollar in a multivariate modeling
framework introduced by Vahid and Engle (1993). This allows us to examine the responsiveness
of the ASEAN-4 exchange rates to transitory and permanent shocks. It also allows us to
examine the degree of short-term as well as long-term co-movements among the ASEAN-4
exchange rates. Our analysis reveals that the exchange rates of Malaysia, Philippines, Singapore
and Thailand have shared common trends and do share at least two common cycles but the
exchange rate of Indonesian Rupiah is not the part of long term trend. The relatively turbulent
dynamics of the Indonesian Rupiah evident in frequent bouts of stark depreciation separated by
periods of steady depreciation over the past three decades raise questions regarding the readiness
of Indonesia for participating in a monetary alliance. Our results suggest that the real exchange
rate of ASEAN-4 cannot deviate from the long run equilibrium for a long time, they ultimately
move together and they share similar cyclical movement in the short run.

The trend-cycle decomposition results display some interesting facts. Comparing response behavior generated by the permanent (trend) and transitory (cycle) components we find that the trend behavior of the ASEAN-4 real exchange rates exhibits a high degree of co-movements both in the long and short term. The correlation coefficients of the trend and cyclical components are also positively correlated. We do not find any asynchronous behavior in their long and short run movements; we find a high degree of comovement among all countries with respect to timing, duration and intensity of effect. This suggests that the responses to the shocks and the speed of adjustment were symmetric. Taking both common trend and common cycles into account this study suggests that the ASEAN countries may expedite their ongoing efforts for monetary integration in the region. Of course, factors beyond exchange rates and economics must also be examined. We do not pretend to provide a comprehensive evaluation of this possibility, but rather present evidence from different angles that may contribute to increase our understanding of the economic dynamic of the region. Hence, a cautionary move is recommended during the process of creating such an alliance.

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Table 1
Unit root test Statistics.

|  | IND | MYS | PHL | SGP | THA |
|---|---|---|---|---|---|
| $\tau_{\alpha*}$ | -2.05 | -1.30 | -1.67 | -0.25 | -1.59 |
| $\tau_{\alpha\sim}$ | -2.07 | -2.15 | -1.48 | -1.73 | -1.25 |
| $\phi_1$ | -0.43 | 0.24 | -1.35 | 0.94 | -018 |
| $\phi_2$ | -1.85 | -2.21 | -1.65 | -1.57 | -1.28 |
| $z(\tau_{\alpha*})$ | -1.61 | 1.75 | -2.28 | -0.24 | -1.60 |
| $z(\tau_{\alpha\sim})$ | -2.13 | -1.91 | -0.72 | -1.76 | -1.28 |
| $z(\alpha_*)$ | -1.08 | -2.54 | -1.10 | -2.34 | -2.04 |
| $z(\alpha\sim)$ | -14.83 | -12.58 | -3.69 | -5.48 | -7.06 |
| KPSS | 2.26* | 1.81* | 2.07* | 1.78* | 1.66* |

* indicates the rejection of the null hypothesis at 5% significance level.

The null hypothesis for the ADF tests [ $\tau_{\alpha*}$ and $\tau_{\alpha\sim}$ ] the DF tests ( $\phi_1$ and $\phi_2$ ) and the Phillips-Perron tests [ $z(\tau_{\alpha*})$, $z(\tau_{\alpha\sim})$, $z(\alpha_*)$ and $z(\alpha\sim)$ ] is that the series is non-stationary. For the KPSS test, the null hypothesis is that the series is stationary. The lag-length for the ADF tests is chosen by minimizing the AIC criteria. The DF tests assume that each series is an AR(1) process. The lag-length for the Phillips Perron tests is determined by using the Schwert (1986) formula $Int\{4(T/100)^{0.25}\}$.

Table 2
Test Statistics for the number of co-integrating vectors.

| Eigenvalue | Lags | $H_0$ | $H_A$ | $\lambda-trace$ | $H_0$ | $H_A$ | $\lambda-\max$ |
|---|---|---|---|---|---|---|---|
| | | | | Model A | | | |
| 0.077 | 6 | $r=0$ | $r>0$ | 62.05* | $r=0$ | $r=1$ | 31.15* |
| 0.034 | 6 | $r\leq1$ | $r>1$ | 26.90 | $r=1$ | $r=2$ | 15.02 |
| 0.017 | 6 | $r\leq2$ | $r>2$ | 11.87 | $r=2$ | $r=3$ | 7.60 |
| 0.009 | 6 | $r\leq3$ | $r>3$ | 4.26 | $r=3$ | $r=4$ | 4.25 |
| 0.001 | 6 | $r\leq4$ | $r>4$ | 0.01 | $r=4$ | $r=5$ | 0.01 |
| | | | | Model B | | | |
| 0.080 | 6 | $r=0$ | $r>0$ | 62.81* | $r=0$ | $r=1$ | 38.07* |
| 0.046 | 6 | $r\leq1$ | $r>1$ | 24.72 | $r=1$ | $r=2$ | 20.53* |
| 0.001 | 6 | $r\leq2$ | $r>2$ | 4.19 | $r=2$ | $r=3$ | 4.02 |
| 0.000 | 6 | $r\leq3$ | $r>3$ | 0.16 | $r=3$ | $r=4$ | 0.16 |

*indicates rejection of the null hypothesis at 5% significance level.

Table 3
Likelihood Ratio Statistics to test for individual Coefficients.

| Country | $\chi^2(1)$ | p-value |
|---|---|---|
| IDN | 0.45 | 0.49 |
| MYS | 9.27 | 0.00 |
| PHL | 6.21 | 0.01 |
| SGP | 4.13 | 0.04 |
| THA | 3.80 | 0.05 |

Table 4
F-Statistics to test for the number of common cycles in Model B.

| Null | $\rho_i^2$ | DFs | F-stat | p-value |
|---|---|---|---|---|
| s>0 | 0.02 | 14 | 0.76 | 0.71 |
| s>1 | 0.06 | 30 | 1.35 | 0.10 |
| s>2 | 0.09 | 48 | 1.76** | 0.00 |
| s>3 | 0.13 | 68 | 2.21** | 0.00 |

**indicates rejection of the null hypothesis at 1% significance level.

Table 5

Correlations among trend and cyclical components of real exchange rates

|        | MAL  | PHL  | SGP  | THA  |
|--------|------|------|------|------|
| MAL    | 1    | 0.80 | 0.99 | 0.99 |
| PHL    | 0.79 | 1    | 0.79 | 0.84 |
| SGP    | 0.45 | 0.90 | 1    | 0.99 |
| THA    | 0.94 | 0.95 | 0.72 | 1    |

| | Standard Deviation | | | |
|--------|------|------|------|------|
|        | MAL  | PHL  | SGP  | THA  |
| Trends | 0.10 | 0.08 | 0.05 | 0.08 |
| Cycles | 0.03 | 0.04 | 0.02 | 0.01 |

*MAL=Malaysia, PHL=Philippines, SGP=Singapore, and THA=Thailand ( in table 1: IND = Indonesia)*
Lower triangular: coefficients of trend components.
Upper triangular: coefficients of cyclical components.

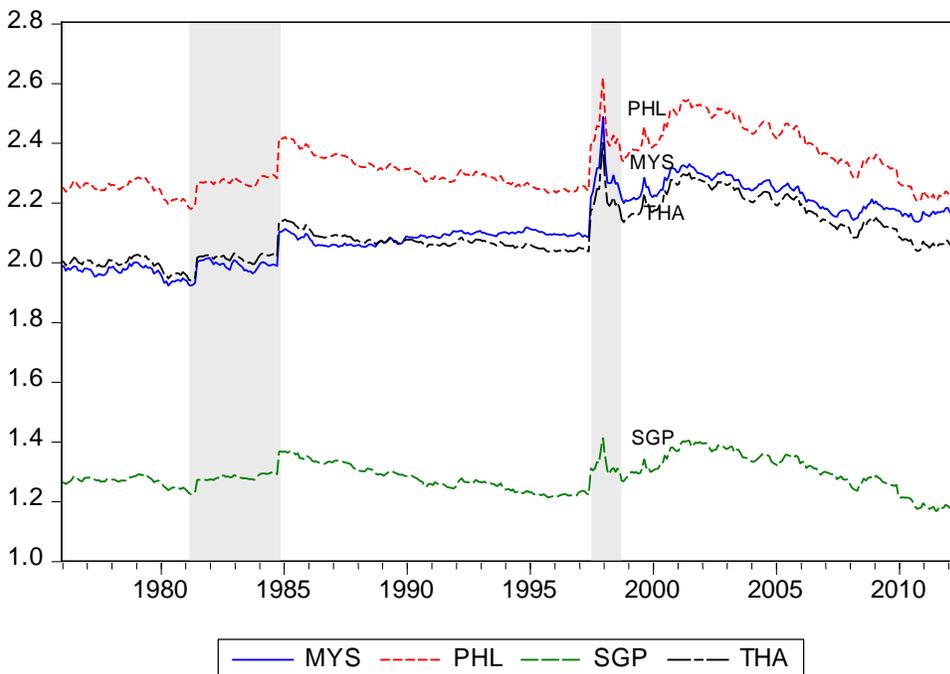Fig 1: Trend components of the ASEAN-4 real exchange rates.

Fig 2: Cyclical components of the ASEAN-4 real exchange rates.