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CURRENCY LINKAGES AMONG ASEAN

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Abstract

The purpose of this study is to examine the potential linkages among ASEAN-5 currencies, in particular the possibility of Singapore dollar bloc during the pre- and post crisis periods by using Johansen multivariate cointegration test and Granger causality test. Significant non-stationarity, and the presence of unit roots were documented for each currency under both study periods. Using ASEAN-4 exchange rates against Singapore dollar, Johansen cointegration test showed that there was no cointegrating relationship during the pre-crisis period, however there were two statistically significant cointegrating vectors among ASEAN exchange rates for the post-crisis period. These findings imply that there is low financial integration before the crisis, but ASEAN countries are financially more integrated after the crisis. This finding also indicated the increasingly important role of the Singapore dollar in ASEAN. Therefore, Singapore dollar may be a possible candidate as the common currency for ASEAN. The analysis is repeated by adding US dollar to the model. The finding ascertains the influence of US dollar on ASEAN currencies before the crisis.

Keywords: Exchange Rate, Cointegration, Granger-causality, ASEAN

JEL Code: F31, F33

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1. Introduction

The Association of Southeast Asian Nations (ASEAN) was established on 8 August 1967 in Bangkok by the five original member countries, namely, Indonesia, Malaysia, the Philippines, Singapore, and Thailand¹. Brunei Darussalam joined on 8 January 1984, Vietnam on 28 July 1995, Laos and Myanmar on 23 July 1997, and Cambodia on 30 April 1999. ASEAN was, and continues to be, an important foundation for broader regionalism in Asia. The agreement on ASEAN preferential trading arrangements in 1977 was the first ever regional trade arrangement concluded in Asia.² Further attempt to forge closer economic integration among the member countries was made in 1992 when ASEAN reached a milestone agreement to establish a free trade area. ASEAN economies were expected to become more integrated and tightened, following the establishment of the ASEAN Free Trade Area (AFTA). Reflecting this and as shown in Table 1, between 1980 and 2005, intra-ASEAN trade expanded at an average rate of 79% compared with 60% for the extra-ASEAN trade and 63% for the total ASEAN trade. The high level of intra-ASEAN trade implied that AFTA is trade-creating on a net basis. With closer regional economic ties, a currency shock in one nation is likely to be transmitted to neighbouring nations at a rapid speed. This was evident in the rapid pace at which the Asian currency crisis spread following the devaluation of the Thai baht in July 1997. Figure 1 shows the exchange rates of ASEAN countries against Singapore Dollar during 1980 – 2007, which lends support to the idea of exchange rates co-movements.

Table 1

¹ Henceforth called the ASEAN-5.

² Comprising only the founding members: Indonesia, Malaysia, the Philippines, Singapore and Thailand.

Figure 1

As the economies of the ASEAN expand and become more integrated, exchange rate changes are having a significant impact on the region. This study attempts to examine the regional currencies linkages as well as to establish the direction of transmission of exchange rate shocks among ASEAN-5 countries namely Indonesia, Malaysia, The Philippines, Singapore and Thailand. With 40 years of regional cooperation, it is important to appraise the degree of integration among ASEAN-5 countries. However, among those published works which come to our notice, none of the study on exchange rates cointegration had considered to include only ASEAN-5 countries' currencies in the analysis. Most of the literatures assessed the issue in different sub-groups of Asian countries with respect to Japanese yen or US dollar. This paper extends the study of currency cointegration to a set of emerging market ASEAN-5 currencies by considering a possibility of Singapore dollar bloc and uses a longer time horizon which included the years before and after currency crisis³. However, it is well-known that most of these currencies are explicitly or implicitly linked to the US dollar to certain degree. Hence, the analysis will be conducted in two sets of currencies, first ASEAN currencies only, then ASEAN and US currencies⁴. As Figure 1 clearly illustrates that the 1997-08 Asian crisis stands out as one prominent event that will likely have strong impact on the currency co-movements, the analysis of data is separated into pre-crisis and post-crisis periods.

³ Singapore dollar was chosen as the base currency because of its strong economy as well as its financial market is the most developed among ASEAN-5.

⁴ The purpose of repeating the analysis by including US dollar is to ascertain the influence of US dollar on ASEAN currencies and whether the ASEAN monetary union have to include US dollar as an anchor currency.

The outline of the remainder of the paper is as follows. Section 2 briefly presents the concept of exchange rates cointegration and reviews some empirical studies on exchange rates cointegration. Section 3 describes the methodology and data set used. Empirical results are presented in Section 4. Finally, Section 5 provides some implications and the concluding remarks.

2. Exchange Rates in the Context of Cointegration: Theory and Empirical Evidence

A wide range of macroeconomic variables can be characterized as nonstationary processes that have no tendency to return to a deterministic path (Nelson and Plosser, 1982). The theory of cointegration has opened a new door into the estimation of and inference about economic models. If a set of nonstationary variables are said to be cointegrated and a linear combination of them is stationary. Such a linear combination would then posit to the existence of a long-term relationship among the variables (Johansen and Juselius, 1990). If we exploit the idea that there may exists co-movements between ASEAN exchange rates, and taking into consideration the exchange rate time series that we are going to study are macro economic variables, the appropriate econometric method shall be used is cointegration test.

If we consider a set of ASEAN exchange rates, examine whether these exchange rates are cointegrated with each other and find a number of stationary linear combinations among them, they may be interpreted as existing long run equilibrium relationships among the exchange rates. The co-movement between these currencies, have important implications for understanding international financial integration and the important role of the Singapore Dollar in ASEAN. Stochastic processes for such currencies and cointegration among the currencies may provide useful information for assessing public policies for managing

exchange rates and international economic relations, for asset valuation, portfolio management, and other practical decisions.

The issue of exchange rate linkages has received increasing attention in recent literature. However, most of the empirical evidence has focused on the advanced Western industrialized economies, less attention has been devoted to examine the properties of exchange rates for the developing Asian countries and associated tests of potential dependencies between those rates.

A number of researchers have applied tests for cointegration in foreign exchange rates for advanced Western economies, such as, Macdonald and Taylor (1989), Baillie and Bollerslev (1989), Coleman (1990), Copeland (1991), Alexander and Johnson (1992), Bhar (1995), Norrbin (1996), and Lajaunie and Naka (1997). The results are, however, mixed depending on the exchange rates and the period being examined.

The Asian foreign exchange market has been analyzed by a few researchers and most of the studies are intended to examine the existence of yen bloc. By employing the cointegration techniques, Aggarwal and Mougoue (1993, 1996 and 1998), Tse and Ng (1997), Baharumshah and Goh (2005) found evidence of yen bloc for subsets of the Asian currencies. However, Chaudhry (1996) reported no cointegration among five Eastern currencies during the managed-float interval and cointegration is detected only during the target-zone interval.

3. Methodology and Data

Before conducting the analysis of long-run relationships among the ASEAN-5 exchange rates, the standard Augmented Dickey-Fuller (ADF) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) unit root tests are employed to test the stationarity of the exchange rate series. If all series are $I(1)$ processes, the next step is to examine the regional currencies linkages between 1980 and 2007 using Johansen multivariate cointegration test. After testing the long-run relationship, we will proceed to examine the short-run relationship using vector error correction model (VECM). Finally, the Granger causality test in the context of VECM is implemented to determine the direction of transmission of exchange rate shocks among ASEAN countries.

The data are Indonesian Rupiah (IDR), Malaysian Ringgit (MYR), Philippines Peso (PHP), Singapore Dollar (SGD), Thailand Baht (THB) and US Dollar (USD) against the Singapore Dollar from 1980Q1 to 2007Q4. It has been suspected that the 1997-98 Asian financial crisis may have affected the currency co-movement among these countries. Hence, the analysis of data is separated into two sample periods: pre-crisis period, covering the period from 1980Q1 to 1997Q2; and post-crisis period, from 1997Q3 to 2007Q4. All data points are transformed into logarithmic scale.

4. Results and Discussion

The first step is to implement the ADF and KPSS unit root tests. Both unit root tests are carried out by including a linear trend with constant and only a constant, respectively. The results of both ADF and KPSS unit root tests are tabulated in Table 2. The results of ADF test clearly showed that the unit root null cannot be rejected in favour of level stationarity at the 1% level of significance in all cases. But the null of trend stationarity is rejected at the 1%

level of significance when the series is tested in its first difference. For KPSS tests, we can reject uniformly the null-hypothesis of trend-stationarity at 5% significance level for all variables in their levels. But we cannot reject the null-hypothesis of trend-stationarity when they are in their first-differences. Based on the ADF and KPSS unit root test results, we conclude that all of the variables are $I(1)$ under both study periods. The unit root test results suggest the appropriateness of cointegration procedures in testing for the long-run relationship of ASEAN exchange rates.

Table 2

Having identified that all the exchange rate series exhibit $I(1)$ behaviour, we adopt the Johansen (1988) procedure to examine whether the variables are cointegrated. It examined whether there is a long-run relationship that keeps them tied together. The results of the cointegration tests, which allow a constant term, are presented in Table 3. For each period, cointegration tests are conducted on two models: First, model A includes only the ASEAN currencies and in model B, the US dollar is added. In this way, the second model checks for the influence of US dollar in the long-run relationship between the ASEAN currencies before and after financial crisis. The results indicated that the null hypothesis of no cointegrating vector couldn't be rejected for model A in the pre-crisis period. This implies that ASEAN currencies are not cointegrated in the pre-crisis period. This result changed when US dollar is added in model B. Both the trace and the max statistics rejected the null hypothesis of no cointegrating vector among the exchange rates using 1% critical value. This indicates that the ASEAN currencies are cointegrated with one cointegrating vector in the presence of US dollar. These results ascertain the influence of US dollar on ASEAN currencies before the

crisis. In the post-crisis period, both models found that there were two statistically significant cointegrating vectors existed among the exchange rates⁵.

Table 3

In order to determine whether all of the currencies enter the cointegration vectors, we perform the exclusion test by imposing zero restriction on the β coefficient of cointegrating vectors. As can be seen from Table 4, the log-likelihood ratios showed that all rejected the hypothesis null of cointegrating parameter equal to zero. This implied that these currencies couldn't be excluded from the system of exchange rates.

Table 4

As the presence of cointegrating vector had been ascertain, we can estimate the short-run behaviour in error correction form with the cointegration relationships being included. Table 5 reported the results of Granger-causality test in the environment of VECM. For the pre-crisis period, the F-statistics of Granger-causality test clearly indicated that the exchange rates of Indonesia, Malaysia, the Philippines and Thailand are weakly exogenous. Granger-causality tests showed that there is a unidirectional causal effect running from Malaysia ringgit to US dollar during the pre-crisis period. This temporal Granger-causality channel also depicted as Figure 2. For the post-crisis period, the F-statistics of Granger-causality test for the first model showed that the exchange rates of Malaysia and Thailand are weakly exogenous. These results suggested that Thai baht and Malaysia ringgit are determined outside this system. Granger-causality tests also indicated that the Indonesia rupiah was

⁵ To choose the number of cointegrating vectors, we followed the approach taken by McNown and Wallace (1994) where the vectors revealed to be significant in both trace and eigenvalues tests are considered.

Granger-caused by the Ringgit Malaysia and Thai baht; while Philippines peso was Granger-caused by Indonesia rupiah. The results demonstrated the clear dominance of the Thai baht and Malaysia ringgit in influencing Indonesia rupiah. For the model with US dollar, the F-statistics indicated that the exchange rates of Malaysia, the Philippines and Thailand are weakly exogenous. The F-statistics showed that US dollar is Granger-caused by Malaysia ringgit and Thai baht, Indonesia rupiah is Granger-caused by Thai baht, and there is a bidirectional relationship between Indonesia rupiah and US dollar. The findings of Thai baht Granger-caused some of the ASEAN currencies are consistent with the fact that the currency crisis began in Thailand and it quickly grew to engulf the regional economies. Figure 3 and Figure 4 summarized the Granger-causality relationships among the ASEAN exchange rates with and without US dollar for the post-crisis period. Comparing these two figures found that besides there were a few interrelationships between US dollar and Indonesia rupiah, Thai baht and Malaysia ringgit; the relationships between Indonesia rupiah and the Philippines peso, Indonesia rupiah and Malaysia ringgit were weaken in the presence of US dollar.

Table 5

Figure 2

Figure 3

Figure 4

5. Conclusions and Some Implications

With the development of AFTA and the increasing level of intra-regional financial cooperation, this study tried to assess empirically the international financial linkages of ASEAN-5 countries during the pre- and post-crisis periods. The results of Johansen

cointegration test showed that there was no relationship among ASEAN currencies during the pre-crisis period; however one meaningful relationship was detected when US dollar is added in the model. These results confirm the influence of US dollar on ASEAN currencies before the crisis. For post-crisis period, both models found two significant cointegrating relationships among the variables. The number of cointegrating vectors in particular for the model without US dollar increased after crisis, this finding implied that ASEAN countries are financially more integrated after the crisis. This finding also indicated the increasingly important role of the Singapore dollar in ASEAN. Therefore, Singapore dollar may be a possible candidate as the common currency for ASEAN. In addition, the Granger-causality channels indicated that the interrelationships between ASEAN currencies were weakened in the presence of US dollar. Hence, US dollar is not suitable to be the anchor currency for ASEAN monetary union.

Evidence on cointegration among ASEAN-5 exchange rates implied that ASEAN countries are characterized by significant intra-group financial linkages. In view of the increasing level of portfolio investment in ASEAN markets, this finding has important implications for policy makers, fund managers, and others interested in ASEAN financial markets. As an example, the results of cointegrating relationship may be useful in assessing and making country asset allocation and hedging decisions. The markets for many of the ASEAN currencies are not very liquid or well developed, except for Singapore and it is often difficult to engage in forward or even spot transactions in such currencies. The implication of cointegrating relationship among ASEAN currencies suggested that useful cross-hedging policies for investments and cash flows denominated in the other four ASEAN currencies can be implemented by offsetting spot and forward positions in the relatively more liquid Singapore dollar.

The results of Granger-causality test showed that Thai baht Granger-caused some of the ASEAN currencies. One implication of this finding is the presence of crisis in one country may trigger a crisis in another country or makes the crisis more likely in the same geographic area of its integration in international trade and financial markets. Hence, governments in ASEAN economies should try to improve their fundamentals, to proceed carefully with financial liberalization, to remove the capital control according to its own pace and to urge for the establishment of a new global financial architecture to counteract to the increased financial vulnerability consequence of financial liberalization.

In conclusion, this study showed that the ASEAN exchange rate markets are causally related. This financial integration may be viewed as an important ingredient towards a more integrated ASEAN common market and a possible for ASEAN monetary union. However, to forge closer economic integration among the ASEAN countries, these countries have to counteract to one important adverse consequence of financial globalization, that is, the increased financial vulnerability. Hence, proper order of financial liberalization according to the pace of individual countries and design collectively a new global financial architecture are needed.

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Table 1: Intra- and Extra- ASEAN-5 Trade

Year	Intra-ASEAN-5	Extra-ASEAN-5	ASEAN-5 total
1980	18814	110899	129714
1985	22493	109484	131978
1990	47333	249822	297649
1995	119668	535001	654669
2000	165598	581502	747099
2005	284520	859778	1144298
Average growth rate (%)	79	60	63

Source: ASEAN statistical yearbook, various issues.

Notes: ASEAN-5 covers Indonesia, Malaysia, The Philippines, Singapore and Thailand.

Intra- and extra- ASEAN-5 trade values are in millions of USD.

Average growth rate are of five years interval.

Table 2: Unit Root Tests

Series (ln)	Augmented Dickey-Fuller				Kwiatkowski-Phillips-Schmidt-Shin			
	constant without trend		constant with trend		constant without trend		constant with trend	
	Level	First Difference	Level	First Difference	Level	First Difference	Level	First Difference
I. Pre-crisis (1980Q1 – 1997Q2)								
IDR/								
SDG	-0.96 (0)	-6.99 (0) ^a	-1.70 (0)	-6.99 (0) ^a	1.08 (6) ^a	0.13 (5)	0.22 (6) ^a	0.07 (6)
MYR								
/SGD	-0.64 (0)	-6.98 (1) ^a	-1.70 (0)	-6.94 (1) ^a	1.08 (6) ^a	0.11 (3)	0.15 (5) ^b	0.11 (3)
PHP/								
SGD	-2.13 (0)	-6.11 (0) ^a	-0.61 (0)	-6.42 (0) ^a	1.03 (6) ^a	0.30 (4)	0.22 (6) ^a	0.05 (3)
THB/								
SGD	-0.80 (0)	-7.41 (0) ^a	-3.07 (0)	-7.37 (0) ^a	1.10 (6) ^a	0.06 (7)	0.16 (2) ^b	0.06 (7)
USD/								
SGD	0.41 (0)	-7.68 (0) ^a	-1.76 (0)	-7.77 (0) ^a	0.99 (6) ^a	0.32 (4)	0.25 (6) ^a	0.12 (6)
II. Post-crisis (1997Q3 – 2007Q4)								
IDR/								
SDG	-1.37 (3)	-4.94 (0) ^a	-3.05 (4)	-4.92 (0) ^a	0.62 (1) ^b	0.19 (2)	0.15 (16) ^b	0.09 (2)
MYR								
/SGD	-2.72 (1)	-7.35 (0) ^a	-2.97 (1)	-7.00 (0) ^a	0.64 (0) ^b	0.22 (0)	0.16 (2) ^b	0.12 (1)
PHP/								
SGD	-2.85 (0)	-5.14 (0) ^a	-1.41 (0)	-5.85 (1) ^a	0.71 (5) ^b	0.42 (1)	0.19 (4) ^b	0.05 (1)
THB/								
SGD	-2.78 (4)	-7.49 (1) ^a	-2.48 (6)	-7.43 (1) ^a	0.46 (30) ^b	0.14 (8)	0.16 (13) ^b	0.09 (8)
USD/								
SGD	-1.13 (0)	-7.29 (0) ^a	-2.50 (0)	-8.78 (0) ^a	0.55 (2) ^b	0.08 (5)	0.22 (5) ^a	0.08 (5)

Notes: a and b denotes significance at 1% and 5% levels. Figures for ADF are the t-statistics for testing the null hypothesis that the series is nonstationary. For constant with trend, the critical values for rejection are -4.10 and -3.48 at 1% and 5%. For constant without trend, the critical values for rejection are -3.53 and -2.90 at 1% and 5%. Figures for KPSS are the LM-statistics for testing the null hypothesis that the series is stationary. For constant with trend, the critical values for rejection are 0.22 and 0.15 at 1% and 5%. For constant without trend, the critical values for rejection are 0.74 and 0.46 at 1% and 5%. Figures in parenthesis are lag length for ADF and bandwidth for KPSS. All series are log transformed.

Table 3: Johansen-Juselius Likelihood Cointegration Test

Null Hypotheses	Eigenvalue	Trace	Critical Value (1%)	Critical Value (5%)	Max-Eigen	Critical Value (1%)	Critical Value (5%)
<i>I. Pre-crisis (1980Q1 – 1997Q2)</i>							
Model A : ASEAN-5							
(r = 0)	0.232102	38.77920	54.46	47.21	17.16637	32.24	27.07
(r ≤ 1)	0.176573	21.61282	35.65	29.68	12.62826	25.52	20.97
(r ≤ 2)	0.093936	8.984562	20.04	15.41	6.411928	18.63	14.07
(r ≤ 3)	0.038806	2.572634	6.65	3.76	2.572634	6.65	3.76
Model B : ASEAN-5, US							
(r = 0)	0.522248	93.78194 ^a	76.07	68.52	48.75178 ^a	38.77	33.46
(r ≤ 1)	0.278495	45.03016	54.46	47.21	21.54346	32.24	27.07
(r ≤ 2)	0.162313	23.48670	35.65	29.68	11.68934	25.52	20.97
(r ≤ 3)	0.100558	11.79736	20.04	15.41	6.994743	18.63	14.07
(r ≤ 4)	0.070182	4.802614	6.65	3.76	4.802614	6.65	3.76
<i>II. Post-crisis (1997Q3 – 2007Q4)</i>							
Model A : ASEAN-5							
(r = 0)	0.730811	82.01624 ^a	54.46	47.21	51.18137 ^a	32.24	27.07
(r ≤ 1)	0.434002	30.83487 ^b	35.65	29.68	22.19744 ^b	25.52	20.97
(r ≤ 2)	0.138523	8.637430	20.04	15.41	5.815157	18.63	14.07
(r ≤ 3)	0.069810	2.822273	6.65	3.76	2.822273	6.65	3.76
Model B : ASEAN-5, US							
(r = 0)	0.864079	159.7372 ^a	76.07	68.52	77.83149 ^a	38.77	33.46
(r ≤ 1)	0.742337	81.90572 ^a	54.46	47.21	52.88805 ^a	32.24	27.07
(r ≤ 2)	0.455204	29.01766	35.65	29.68	23.68644 ^b	25.52	20.97
(r ≤ 3)	0.126457	5.331225	20.04	15.41	5.272707	18.63	14.07
(r ≤ 4)	0.001499	0.058518	6.65	3.76	0.058518	6.65	3.76

Notes: r indicates the number of cointegrating vectors. Trace and Max-Eigen denote the trace statistic and maximum eigenvalue statistic. The critical values are obtained from Osterwald-Lenum (1992). a and b denotes rejection of the hypothesis at 1% and 5% critical value. Lag selection based on Schwert (1987)'s formula, models included 4 and 3 lags for pre- and post-crisis.

Table 4: Exclusion Tests

Exclusion	Likelihood Ratio	Exclusion	Likelihood Ratio
<i>I. Pre-crisis (1980Q1 – 1997Q2)</i>		<i>II. Post-crisis (1997Q3 – 2007Q4)</i>	
Model A : ASEAN-5		Model A : ASEAN-5	
		IDR/SGD	13.817 ^a
		MYR/SGD	20.059 ^a
		PHP/SGD	26.409 ^a
		THB/SGD	38.688 ^a
Model B : ASEAN-5, US		Model B : ASEAN-5, US	
IDR/SGD	5.956 ^b	IDR/SGD	33.842 ^a
MYR/SGD	2.847 ^c	MYR/SGD	12.415 ^a
PHP/SGD	24.254 ^a	PHP/SGD	40.055 ^a
THB/SGD	23.215 ^a	THB/SGD	44.724 ^a
USD/SGD	10.044 ^a	USD/SGD	38.277 ^a

Note: Figures are the likelihood ratio statistics (asymptotically distributed χ^2) for testing the null hypothesis that each coefficient is statistically equivalent to zero across all vectors. a, b and c denotes significance at 1% 5% and 10% levels, respectively. All series are log transformed.

Table 5: Granger Causality Results

Dependent Variable	Independent Variable (F-stat)				
<i>I. Pre-crisis (1980Q1 – 1997Q2)</i>					
Model B : ASEAN-5, US					
	IDR/SGD	MYR/SGD	PHP/SGD	THB/SGD	USD/SGD
IDR/SGD	-	3.398	0.649	4.395	5.912
MYR/SGD	4.534	-	0.417	1.822	1.403
PHP/SGD	7.245	1.171	-	2.858	1.657
THB/SGD	0.957	3.847	3.882	-	6.949
USD/SGD	0.603	8.004 ^b	4.378	0.451	-
<i>II. Post-crisis (1997Q3 – 2007Q4)</i>					
Model A : ASEAN-5					
	IDR/SGD	MYR/SGD	PHP/SGD	THB/SGD	
IDR/SGD	-	7.784 ^b	0.552	25.747 ^a	
MYR/SGD	2.949	-	4.758	1.295	
PHP/SGD	17.365 ^a	2.753	-	2.281	
THB/SGD	5.590	0.609	0.145	-	
Model B : ASEAN-5, US					
	IDR/SGD	MYR/SGD	PHP/SGD	THB/SGD	USD/SGD
IDR/SGD	-	5.903	0.098	23.673 ^a	30.147 ^a
MYR/SGD	0.567	-	1.201	0.998	4.417
PHP/SGD	2.173	1.296	-	1.165	0.123
THB/SGD	1.348	4.132	1.475	-	2.518
USD/SGD	22.548 ^a	8.803 ^b	2.300	19.519 ^a	-

Notes: Figures are the F-statistics for testing the null hypothesis that the joint significance of the lagged values of the independent variables in the equation of the dependent variable. a and b denotes significance at 1% and, 5% level. . All series are log transformed and in first difference.

Figure 1: Exchange Rates for ASEAN

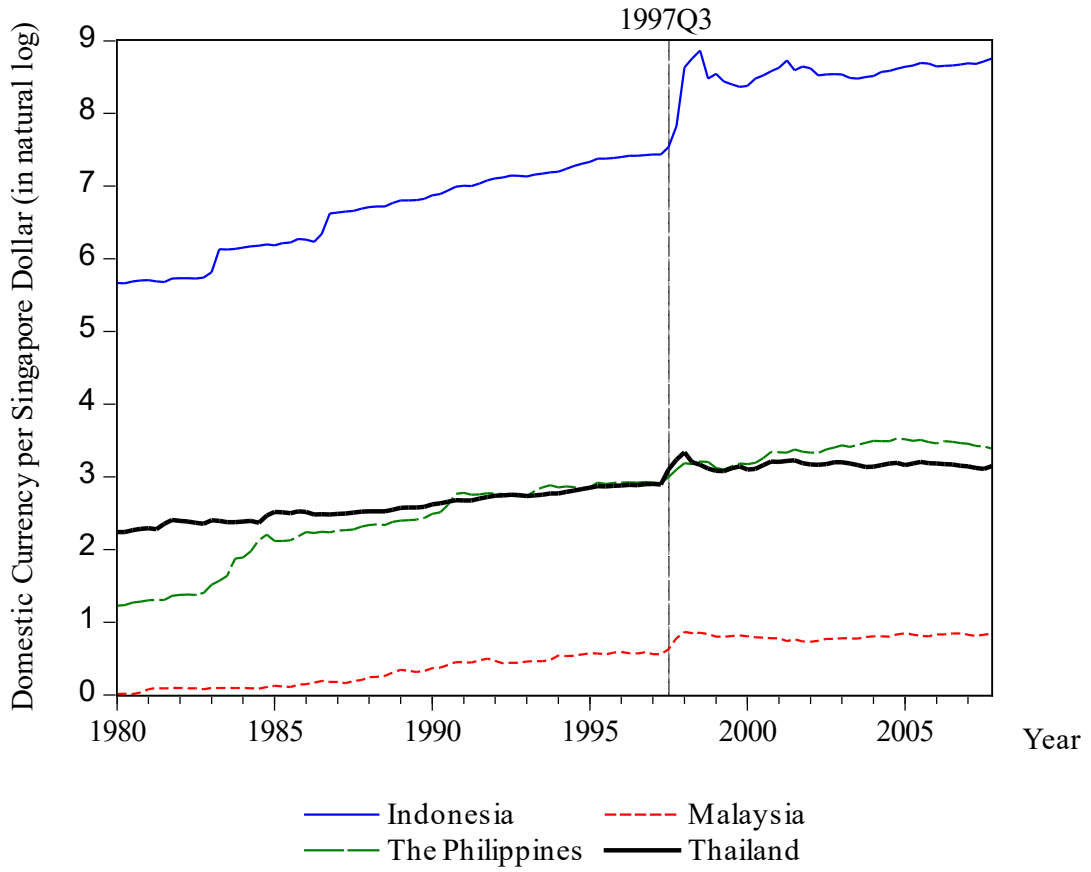


Figure 2: Relationship among ASEAN and US Exchange Rates (against Singapore Dollar) for Pre-crisis Period

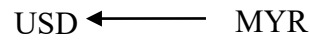


Figure 3: Relationship among ASEAN Exchange Rates (against Singapore Dollar) for Post-crisis Period

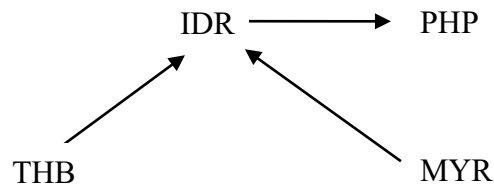


Figure 4: Relationship among ASEAN and US Exchange Rates (against Singapore Dollar) for Post-crisis Period

