The Singapore Economic Review, Vol. 56, No. 3 (2011) 327–347

DOI: 10.1142/S0217590811004353

World Scientific
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UNEMPLOYMENT AND SPEED OF ADJUSTMENT IN ASEAN-3 ECONOMIES: A COINTEGRATION ANALYSIS

THIRUNAUKARASU SUBRAMANIAM[*,‡]
and AHMAD ZUBAIDI BAHARUMSHAH[†]

[*]*Department of Southeast Asian Studies*
University of Malaya, Malaysia

[†]*Graduate School of Management*
University Putra Malaysia, Malaysia
[‡]*stkarasu@um.edu.my*

This paper investigates the existence of long-run relationship between unemployment and several key macroeconomic variables in Malaysia, Singapore, and the Philippines. The Johansen–Juselius cointegration method confirms the existence of a stationary long-run cointegration relationship between unemployment and its determinants in all three countries. Exports and foreign direct investment are important determinants of unemployment in Malaysia. In the Philippines, government spending and exports are inversely related to unemployment. In Singapore, only exports appeared as a significant factor in determining unemployment. The results show that the speed of adjustment following a shock is more rapid in Singapore compared to the other two ASEAN countries.

Keywords: Unemployment; speed of adjustment; Malaysia; Singapore; the Philippines.

JEL Classification: E24

1. Introduction

One of the main macroeconomic objectives is achieving low unemployment or full employment. It is the major source of concern among policymakers and society alike. High levels of unemployment is detrimental for economy as it may bring negative impacts such as wastage of resources, high crime rate, health problems (Linn *et al.*, 1985; Bacikova-Sleskova *et al.*, 2007) and skills acquired may become obsolete. It is well known that unemployment reduces productivity and income and thereby adversely affects accumulation of physical and human capital via spending on education and learning-by-doing. Thus, maintaining low unemployment is vital and is dependent on the ability of the economy to recover from negative economic shocks. In the past four decades, there are several episodes in the Southeast Asian countries where economic recession caused unemployment to rise sharply. One such shock is the 1984–1985 economic crisis that caused unemployment rate to rise due to low output growth in Malaysia, Singapore and the Philippines. The other during the 1997–1998 Asian financial crisis, falling national output

‡Corresponding author.

caused unemployment rate to rise (Tan, 1999; Ngiam, 2000; Tongzon, 2002). More recently, the economic slowdown in the United States in 2001–2002 due to the bursting of dot-com bubble caused unemployment to rise sharply, especially in Singapore which is very much dependent on US market for its exports.

Figure 1 below shows the annual unemployment trend of the three countries in Association of Southeast Asian Nations (ASEAN) over the period from 1975 to 2004. It is evident that unemployment rate in the countries under review behaved in an erratic fashion. In Malaysia, unemployment was more than 4% from 1975 to 1991. After that unemployment rate fell below 4%. In the aftermath of the 1985 economic crisis, unemployment rate reached a peak of 8.3% in 1986. Malaysia was able to contain the unemployment rate of 3% during the period of strong economic growth from early 1990s to mid-1990s. Rising unemployment rates were observed in the post-crisis period despite strong Gross Domestic Product (GDP) growth and export growth rates experience in the post-crisis period.[1] Singapore, with output growth that is driven largely by exports recorded unemployment rate as low as 1.7% in 1990. As may be seen in Figure 1, the economy was also affected by the two landmark events mentioned earlier. The economy went through an economic slowdown in mid-1980s due to the 1985 economic crisis. This event was accompanied by an unemployment rate of 6.8% in 1986 (compared to unemployment below 3% in 1984). Like the other neighboring ASEAN countries, unemployment rate rose again during the historic

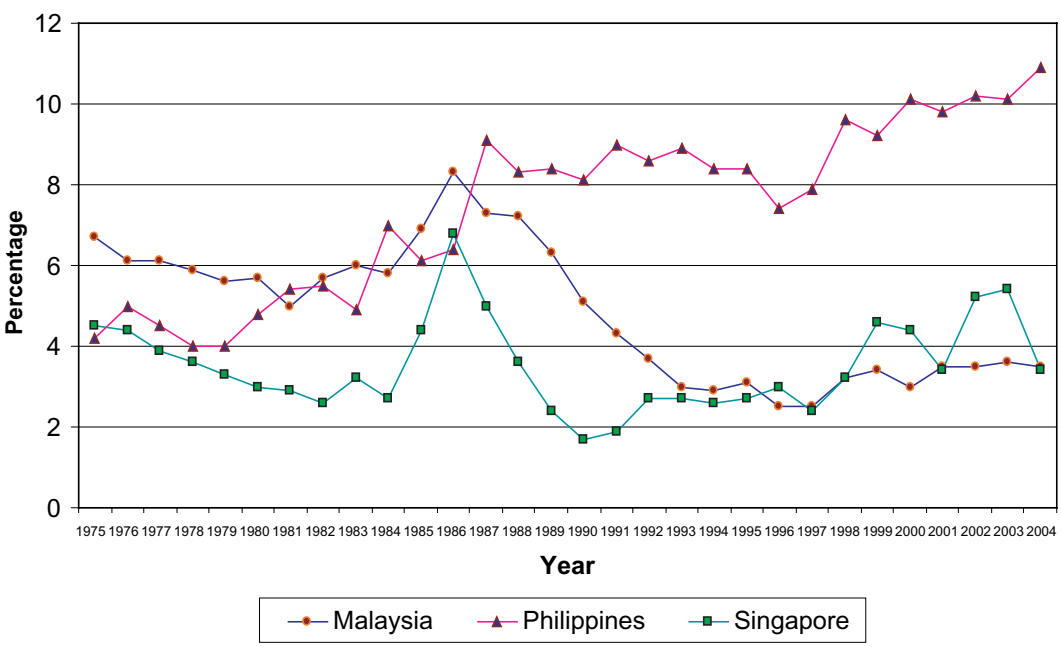

Figure 1. Unemployment in Malaysia, Singapore and the Philippines, 1975–2004

[1] The crisis struck the three ASEAN countries in late 1997. The negative impact of the crisis on real GDP growth, FDI, exports and other macroeconomic variables was only felt in the following year.

events of the 1997 economic crisis and following the economic slowdown of the United States in 2001 where unemployment rate was recorded as high as 5.4% in 2003. High unemployment observed during this period was the result of major external and demand shocks. In terms of the trend of unemployment rates in the Philippines, it is rather distinctive compared to the other two countries, as it displayed an increasing trend in unemployment for most of the period under investigation. In recent years, the unemployment rates in the Philippines have reached double digit figures.

The strong GDP and export growth rates experienced by these ASEAN countries in the post-crisis period were accompanied by rising government deficits (spending) and unemployment rates. The recovery following the crisis is an important aspect in ensuring the stability in the labor market. How fast did the labor markets in these countries adjust following the crisis? In the Southeast Asian context, as research on speed of convergence in relation to unemployment is limited or nonexistent, this paper intends to fill this gap. Thus, the first objective of this paper is to determine the speed of adjustment in the labor market following a shock. Second, this paper attempts to identify the major determinants of unemployment in Malaysia, Singapore and the Philippines.

The rest of this paper is organized as follows. Section 2 briefly looks at the related literature review. Section 3 presents the data source and Section 4 discusses the model specification as well as the methodology used in the empirical analysis. Section 5 reviews the empirical results and the final section concludes.

2. Literature Review

2.1. *Determinants of unemployment*

The role of foreign direct investment (FDI) in determination of employment is highlighted in several studies (Ruane and Gorg, 1999; Driffield and Taylor, 2000; Seyf, 2000). Driffield and Taylor (2000) analyzed the relationship between FDI and labor market and found that FDI has the potential to increase wage inequality and relies on relatively more skilled labor in the host country. On the other hand, Ruane and Gorg (1999) showed that in the case of the Republic of Ireland, FDI contributes positively to aggregate employment and gains in high-technology sectors. In a study by Seyf (2000) on unemployment issues in the European Union (EU), the author concluded that the same volume of FDI appears to be creating more jobs in Germany than in any other EU member countries under study. The author also claimed that encouraging FDI may not reduce unemployment in the EU countries.

Gordon (1997) argued that time series evidence shows a causal link running from unemployment to economic growth. A number of studies have singled out economic growth as a major determinant of unemployment. Downes (1998) conducted an economic analysis of unemployment in Trinidad and Tobago, and found that economic growth plays a dominant role in reducing unemployment in this developing economy. Similarly, Kooros (2006) in his study on unemployment in the United States found an inverse relationship of unemployment with Gross National Product (GNP). A negative relationship

in the unemployment–economic growth nexus was also reported by Walterskirchen (1999) for a set of EU countries.

Several studies also discussed the role of wages and taxes in the determination of unemployment rate. These include studies by Huay and Groenewold (1992) and Downes and Bernie (1999), among others. The former study revealed that real wages, tax effects and replacement rate are important in explaining the unemployment rate in Australia. Specifically, they showed that these variables raised the level of unemployment rates. Downes and Bernie (1999) found that there was an increase in the responsiveness of employment to GDP shocks with an increase in nonaccelerating rate of unemployment (NAIRU). An increase in the responsiveness of employment to real wage movements from mid-1970s onward was also observed by them in Australia. This issue is also discussed in Trivedi and Baker (1985), where the authors reported that increase in unemployment in Australia is related to increase in real unit labor costs, lagged unemployment and real unemployment benefits (prior to 1975) and decrease in rate of capacity utilization. Similarly, Valentine (1993) argued that the main cause of increase in unemployment in Australia is due to growth in real unit labor costs.

The unemployment–vacancy (U–V) relationship or also referred to as the Beveridge Curve postulates an inverse relationship between unemployment and job vacancy. This ratio is commonly used as a measure of labor market tightness. Jackman *et al.* (1990) looked at the Beveridge Curve for 14 OECD countries and concluded that labor market policies in these countries tend to shift the U–V curve toward the origin and makes the curve flatter as well. Bodman (1999) studied the Beveridge Curve using data from Australia and concluded that there is no trend in the efficiency of matching and an increase in output and size of labor force improves matching efficiency. Stegman and Stegman (2000) concluded that an increase in proportion of long-term unemployment increases structural mismatch in Australia. Recently, Teo *et al.* (2005) examined the Beveridge Curve for four major East Asian countries (Singapore, Japan, Hong Kong and Taiwan) and found that these fast-growing economies are experiencing greater unemployment and low vacancies. The higher negative coefficient obtained for vacancy rate in Singapore compared to Japan and Korea, according to them suggests that Singapore's labor market is experiencing higher matching efficiency compared to the other two East Asian countries. They also added that the improvement of the matching efficiency has somewhat declined in the post-1997 Asian crisis.

Focusing on China, Fu and Balasubramanyam (2005) found a positive impact of exports on employment. Meanwhile, Athukorala and Menon (1996) also showed how export-led industrialization in Malaysia contributed to employment creation and subsequently rising living standard and improvement in the distribution of income of the country. This phenomenon is also evident in Indonesia where growth of manufactured exports, particularly in labor-intensive light industries helped to create large employment gains especially between 1985 and 1990 (see Fujita and James, 1997).

The role of government spending is not excluded in the determination of unemployment. An increase in government spending is expected to stimulate growth and this in turn would reduce the level of unemployment rates. In recent years, governments including

those in the countries under review responded to the global financial crisis by introducing stimulus packages. These fiscal stimuli were introduced in order to cushion the economy from aggregate demand shocks and to put back the economy on its pre-crisis level and this indirectly lowers the unemployment rates. The paper by Abrams (1999), however, appears to be at odds with such a claim. Abrams reported a positive relationship between unemployment and government size (government spending). Likewise, Christopoulus and Tsionas (2002) suggested that the reduction of government sector (cut in government spending) can be considered as an additional channel through which employment growth could grow faster. The role of government has also been studied by Barro (1991) and Scully (1989). Both authors support the notion that there is an inverse relationship between government size and economic growth. On the other hand, Farmer (2009) assured that fiscal policy can reduce unemployment.

The role of monetary policy in determination of unemployment is also highlighted in several empirical studies. Pitchford (1983) highlighted that an increase in unemployment in Australia in 1974 is associated with the rise in real wage rate and decrease in real money supply. Increase in the rate of unemployment thereafter is mainly due to effects of real money supply. Canlas (1997) analyzed the impact of activist monetary policy on unemployment level in the Philippines and reported that monetary policy is ineffective in reducing unemployment.

2.2. *Speed of adjustment*

The speed of adjustment in the labor market following a shock is less emphasized in the studies of East Asian countries. It is crucial to estimate the speed of convergence as it shows how fast the labor market can adjust following a shock. It is widely acknowledged that labor market rigidities can reduce the pace of adjustment of the labor market following a shock. Some of the rigidities in the labor market include membership of trade union and minimum wage. Masso and Heshmati (2003), for example, highlighted that the adjustment speed in the labor market is decreasing over time (from 20% to 18%) in transition economy of Estonia. The adjustment determinants in Estonian labor market according to them are credit market and inflow of FDI (i.e., supply of foreign capital). On the other hand, implementation of labor market reforms[2] in Germany through Hartz I/II and Hartz III programs accelerated the outflows from unemployment to employment suggesting a positive effect on the speed of unemployment outflows (Fahr and Sunde, 2009).

Lamo *et al.* (2007) pointed out that the requirement of specific skills in certain sectors of the economy can be an obstacle to labor market adjustment process as shortages of workers with adequate skills may lead to high and persistent unemployment. In Australia, Debelle and Vickery (1998) found that the adjustment speed of around 0.5 for labor demand and the speed of adjustment is invariant to the state of business cycle. According to

[2] The aim of the reforms (Hartz I, II and III) were to accelerate labor market flows and reduce unemployment duration, and thereby reduce the number of people detached from the labor market. Further information on these reforms can be obtained from Fahr and Sunde (2009).

Blanchard and Wolfers (2000), Layard *et al.* (1991) and Phelps (1994), the speed of adjustment of unemployment to shocks is determined by institutional factors. On the other hand, Smith and Zoega (2007) found that institutional variables do not determine the convergence speed. Gahan and Harcourt (2002) also highlighted that there is no evidence that Australia's labor market institutions have had adverse effects on labor market efficiency. In Southeast Asian context, there are very limited studies focused on the pace of adjustment. Recently, Montalvo (2006) found that in the Philippines, where the minimum wages are high, the recovery of the unemployment takes very long. Canlas (1997) also proposed that the slow reallocation of labor from agriculture to industry and service sectors cause persistent and high aggregate unemployment rate in the Philippines.

3. Data

Table 1 presents the descriptive statistics of the dependent variable namely unemployment rate for all three countries. It can be observed from Table 1 that the unemployment rate for the Philippines is the most volatile. The data for this study is obtained mainly from World Development Indicators 2006 CD-ROM published by the World Bank. Data used in this study is annual data that covers a period from 1975 to 2004 in the case of Malaysia and Singapore. But in the case of the Philippines, annual data used covers a period from 1974 to 2003. Data on job vacancy rate[3] is obtained from the respective country's annual statistical report. In the case of Philippines, job vacancy rate was obtained from Yearbook of Labor Statistics, published by Department of Labor and Employment Philippines. For Malaysia, job vacancy rate is obtained from Social Statistics Bulletin, published by Department of Statistics Malaysia. For Singapore, the job vacancy rate is calculated from data obtained from Singapore Yearbook of Labour Statistics and Labour Market, published by Manpower Research and Statistics Department, Ministry of Manpower Singapore.

Table 1. Descriptive Statistics for the Dependent Variable (Unemployment Rate)

	Malaysia (1975–2004)	Singapore (1975–2004)	Philippines (1975–2003)
Mean	4.8466	3.5200	7.3551
Median	5.0500	3.2500	8.1000
Maximum	8.3000	6.8000	10.2000
Minimum	2.5000	1.7000	4.0000
Std. Dev.	1.6602	1.1439	2.0778
Skewness	0.2046	0.8614	−0.3027
Kurtosis	1.8156	3.5346	1.6662
Jarque-Bera	1.9626	4.0674	2.5925

[3] This data is freely available to the scientific community.

4. Model Specification and Methodology

The following specification is used to explain the unemployment model as suggested by Phelps (1994).

$$\mathrm{LUE}_t = \beta_0 + \beta_1 \mathrm{LVAC}_t + \beta_2 \mathrm{LGDP}_t + \beta_3 \mathrm{LLPROD}_t + \beta_4 \mathrm{LIFDI}_t + \beta_5 \mathrm{LEX}_t + \varepsilon_{t1}, \quad (1)$$

where LUE is a log of total unemployment, LVAC is a log of total job vacancies, LGDP is a log of total GDP, LLPROD is a log of labor productivity, LIFDI is a log of total inflow of FDI and LEX is a log of total export and LGOV is a log of total government expenditure and ε_{t1} is the error term, t represents the time period and β_1, β_2 , β_3, β_4 and β_5 are the coefficients to be estimated.

4.1. *Short run dynamics with error correction models*

When the cointegrating vector is obtained from the Johansen–Juselius procedure, the short-run vector autoregression in error correction model (ECM) can be written as follows (following Engle and Granger, 1987):

$$\begin{aligned}\Delta \mathrm{LUE}_t = {} & b_0 + \sum_{i=1}^{m} b_{1i} \Delta \mathrm{LVAC}_{t-i} + \sum_{i=1}^{m} b_{2i} \Delta \mathrm{LGDP}_{t-i} + \sum_{i=1}^{m} b_{3i} \Delta \mathrm{LLPROD}_{t-1} \\ & + \sum_{i=1}^{m} b_{4i} \Delta \mathrm{LIFDI}_{t-i} + \sum_{i=1}^{m} b_{5i} \Delta \mathrm{LEX}_{t-i} + \sum_{i=1}^{m} b_{6i} \Delta \mathrm{LUE}_{t-i} \\ & + b \mathrm{ECT}_{t-1} + v_{1t}, \end{aligned} \quad (2)$$

where b_0 is the constants indicating intercepts; Δ is a difference operator; ECT_{t-1} is the error correction term (ECT) obtained from cointegration relationship that is normalized with respect to each variable; b is the coefficient that shows the speed of adjustment back to long-run equilibrium relationship and v_{1t} is the serially uncorrelated random error terms with zero mean.

5. Empirical Results

5.1. *Unit root tests*

This section examines the existence of the unit root problem in the time series data of the three countries namely Malaysia, Singapore and the Philippines by employing Augmented Dickey–Fuller (ADF) unit root test. The unit root test is performed in order to differentiate stationary and nonstationary series and at the same time to determine whether the variable under investigation is I(0) or I(1) processes. Determination of the order of integration is important in order to determine the use of appropriate cointegration techniques. Lag length selection for ADF test is based on Schwarz Information Criteria (SIC). Table 2 summarizes the results of the ADF unit root test for Malaysia, Singapore and the Philippines. All series namely LUE, LVAC, LGOV, LIFDI, LGDP, LPROD and LEX are found to be integrated at most of order one or I(1). This gives us a good justification to employ Johansen cointegration test.

Table 2. ADF Unit Root Test for Malaysia, Singapore and the Philippines, Constant without Trend

Countries	LUE	LVAC	LGOV	LIFDI	LGDP	LEX	LLPROD
				Panel I: Level			
Malaysia	−3.188**	−1.001	−1.521	−1.663	−2.167	−1.980	−2.192
Singapore	−0.792	−2.649	−2.465	−1.782	−2.947*	−1.719	−1.495
Philippines	−2.246	0.121	−0.823	−1.295	−1.362	−0.964	−2.401
				Panel II: 1st Difference			
Malaysia	−3.857***	−3.881***	−4.495***	−2.913*	−3.781***	−4.063***	−3.924***
Singapore	−4.537***	−5.842***	−4.218***	−5.676***	−3.498**	−2.927*	−2.653*
Philippines	−5.143***	−3.489**	−3.326**	−5.648***	−4.024***	−3.554**	−4.131***

Note: *, ** and *** denote statistical significance at 10%, 5% and 1%, respectively.

5.2. *Johansen contegration test*

In applying the cointegration analysis, we first determine the order of lag length of the vector autoregressive (VAR) model. To this end, we follow Juselius (1996) and begin with one lag and make sure that the residual are free from autocorrelation. Otherwise, we increase the lag length. Since the data is annual, we find that in most cases, one lag is sufficient to yield a VAR model with residuals free of autocorrelation. The popular Johansen multivariate cointegration test is performed to confirm the existence of long-run relationship. Two log-likelihood ratios (LR), namely, the trace test and the maximal eigenvalue (λ-max) test is used in the test. More elaborate discussion on this method can be found in Johansen (1988) and Johansen and Juselius (1990). As the variables under study for all three countries are integrated at most of order one, this gives us a good justification to proceed with Johansen procedure of testing for the presence of multiple cointegrating vectors as suggested by Masih and Masih (1999) and Worthington *et al.* (2003).[4]

The results of the cointegration test are reported in Table 3. The results of the Johansen cointegration test below rejects the null hypothesis of no cointegrating vector $(r = 0)$ for all three countries at 1% significance level based on the trace test. The outcome from the maximal eigenvalue (λ- max) test is found to be consistent with the trace test, where both statistics are greater than the critical values. Hence, there is at least one unique cointegrating relationship in each of the three countries. This allows us to conclude that at least one stochastic trend is shared by all the six variables in the long run.

The results indicate that a long-run cointegration equilibrium relationship exist among LUE, LVAC, LGDP, LLPROD, LIFDI and LEX in the case of Malaysia and among LUE, LVAC, LGDP, LGOV, LIFDI, LEX and LLPROD in the case of Singapore. In the case of the Philippines, the results also indicate that a long-run cointegration equilibrium relationship exists among LUE, LVAC, LGDP, LGOV, LEX and LPROD.

[4] The method can admit only I(1) or a mixture of I(1) and I(0) processes in the system, given that the dependent variable is I(0) while at least two independent variables are integrated of I(1) (see also Chan and Baharumshah, 2003; Masron and Yusop, 2009).

Table 3. Cointegration Tests

Null	Alternative	Trace		λ_{max}	
		Value	99% C.V.	Value	99% C.V.
		Malaysia $(k = 1, r = 1)$			
$r = 0$	$r = 1$	119.133***	104.961	51.081***	45.869
$r \leq 1$	$r = 2$	68.052	77.818	29.594	39.370
$r \leq 2$	$r = 3$	38.457	54.681	20.049	32.715
$r \leq 3$	$r = 4$	18.408	35.458	13.498	25.861
$r \leq 4$	$r = 5$	4.910	19.937	4.311	18.520
$r \leq 5$	$r = 6$	0.598	6.634	0.598	6.634
		Singapore $(k = 1, r = 1)$			
$r = 0$	$r = 1$	175.812***	135.973	59.814***	52.308
$r \leq 1$	$r = 2$	115.997***	104.961	41.955	45.869
$r \leq 2$	$r = 3$	74.0421	77.818	31.004	39.370
$r \leq 3$	$r = 4$	43.037	54.681	24.106	32.715
$r \leq 4$	$r = 5$	18.931	35.458	13.398	25.861
$r \leq 5$	$r = 6$	5.532	19.937	5.353	18.520
$r \leq 6$	$r = 7$	0.179	6.634	0.179	6.634
		Philippines $(k = 1, r = 2)$			
$r = 0$	$r = 1$	149.360***	104.961	56.585***	45.869
$r \leq 1$	$r = 2$	92.774***	77.818	42.916***	39.370
$r \leq 2$	$r = 3$	49.858	54.681	22.756	32.715
$r \leq 3$	$r = 4$	27.101	35.458	19.689	25.861
$r \leq 4$	$r = 5$	7.411	19.937	6.437	18.520
$r \leq 5$	$r = 6$	0.974	6.634	0.974	6.634

Note: ***denotes significance at 1% critical value, k is the lag length and r is the cointegrating vector(s).

5.3. *Short-run dynamics with ECT*

Further, the analysis is extended to obtain the ECM. Application of correction factor for the cointegration procedure in small sample reduces the tendency of the test to falsely reject the null hypothesis of no cointegration in relatively short span of data (Baharumshah *et al.*, 2006). It is important to examine the short-run relationship in order to understand the speed of adjustment to equilibrium following a shock. At the same time, Granger (1986) highlighted that a significant ECT indicates evidence of causality at least in one direction.

Table 4 displays the ECM for all the three countries. In unemployment model for Malaysia (ΔLog UE_t), the ECT is found to be significant only at 10% level of significance. The magnitude of ECT value of -0.21 for Malaysia suggests that the deviation from the long-run unemployment is corrected by 0.21 by the coming year. For Singapore, the coefficient of ECT is found to be significant at 1% level of significance with the correct sign. The highly significant ECT confirms the existence of a stable long-run relationship in the model as purported by Banerjee *et al.* (1998). The high magnitude of the ECT (-0.69) for Singapore indicates that the deviation from the long-run unemployment is corrected by

Table 4. Error Correction Model Results

Variables	Malaysia (1975–2004)	Singapore (1975–2004)	Philippines (1974–2003)
	Dependent Variable: ΔLog UE_t		
Intercept	−0.1646	0.3042***	0.1087*
	[−1.5464]	[5.0845]	[1.7427]
ΔLog UE_{t-1}	0.2893	0.1263	−0.3500
	[1.1665]	[0.9490]	[−1.4982]
ΔLog VAC_{t-1}	−0.1926	0.0438	−0.1254
	[−1.4596]	[0.5015]	[−1.1203]
ΔLog GDP_{t-1}	1.8926*	−6.5889***	−0.3305
	[1.9561]	[−4.9726]	[−0.3042]
ΔLog GOV_{t-1}	—	0.5287	−0.3981
		[1.3444]	[−0.8227]
ΔLog $IFDI_{t-1}$	0.0131	0.1286**	—
	[0.2617]	[2.0462]	
ΔLog EX_{t-1}	0.4445	0.7059	0.2764
	[0.8931]	[1.3019]	[0.7035]
ΔLog $LPROD_{t-1}$	−1.2338*	3.4616***	−0.0016
	[−1.8823]	[3.4574]	[−0.0017]
ECT	−0.2137*	−0.6923***	−0.0257**
	[−1.8046]	[−5.5716]	[−2.1947]
Adjusted R-squared	0.1018	0.7161	0.2670
	Diagnostic Checking		
Serial Correlation	2.5283	3.8594	0.4478
	(0.1118)	(0.0495)	(0.5033)
Normality	0.2927	0.2307	8.5827
	(0.8638)	(0.8910)	(0.0136)
Heterogeneity	0.8846	0.0450	0.2112
	(0.3469)	(0.8319)	(0.6458)

Note: *, ** and *** denote statistical significance at 10%, 5 % and 1%, respectively. Figures in ( ) denotes *p*-value.

69% by the coming year. In other words, the speeed at which unemployment adjusts to other macroeconomic variables is very high (69% in a year). For the Philippines, the coefficient of the ECT is found to be significant at the usual significance levels and carries the correct sign. Like the other two countries, the adjustments in the other macroeconomic variables cause induced adjustments in unemployment but the speed of adjustment, however, appears to be very slow (2% in a year).

Obviously, the speed of adjustment varies across the countries. The high coefficient of adjustment for Singapore indicates that convergence to equilibrium is rapid in Singapore. Implementation of flexible wage system is one of the ways how Singapore was able to come out of the 1997 economic crisis speedily besides strong fundamentals, flexible

exchange rate system and discouraging internationalization of the Singapore dollar (Ngiam, 2000). Flexible wage system allows for wage reduction during crisis in the public sector. On the other hand, a lower coefficient of adjustment for the Philippines suggests that the convergence to equilibrium is less rapid. This could be due to the existence of labor market rigidities such as minimum wage, maternity leave and trade union as suggests by Calderon *et al.* (2007) causing the adjustment to be much slower. Another reason for the slow convergence to equilibrium for the Philippines is that the economy relies heavily on agriculture. As labor in agriculture sector requires more specific skills, the process of retraining or reskilling may require longer time.

The battery of diagnostic check is used to check if the estimation models constructed has the desirable statistical properties. The ARCH (Autoregressive Conditional Heteroskedasticity) test reveals that the errors fulfill the homoskedastic condition and is independent of regressors. The Breusch–Godfrey serial correlation test reveals that there is no significant serial correlation in the disturbances of the error terms. Jarque–Bera statistic suggests that the disturbances of the regressions are normally distributed. Finally, the regression coefficients are evaluated for structural stability using the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMSQ) of the recursive residual test. Both the CUSUM and CUSUMSQ test statistics are found not to exceed the bounds of the 5% level of significance, thus indicating that the regression equations are stable (see Appendix 1).

5.4. *Long-run equation*

Table 5 shows the long-run equation for Malaysia, Singapore and the Philippines. For Malaysia, with Log UE_t as the dependent variable, all variables are found to be significant at

Table 5. Long-Run Equation

Variables	Malaysia (1975–2004)	Singapore (1975–2004)	Philippines (1974–2003)
	Dependent Variable: ΔLog UE_t		
Intercept	−4.9482	+18.8538	+18.1723
Log UE	—	—	—
Log VAC	+0.8316***	−0.0693	+1.4120***
	[−4.3190]	[−0.5414]	[−2.6392]
Log GDP	+3.2828***	−1.7716	+5.7503
	[−9.6185]	[−1.2323]	[−1.2172]
Log GOV	—	+0.4390	−7.3444***
		[1.1026]	[2.1650]
Log IFDI	−0.3502***	+0.1760*	—
	[4.8532]	[1.7574]	
Log EX	−3.1766***	−1.1767***	−10.0147***
	[7.2890]	[−3.4670]	[4.2431]
Log LPROD	+1.1950**	+2.9539**	+30.9140***
	[−2.2971]	[2.4397]	[−6.6504]

Note: *, ** and *** denote statistical significance at 10%, 5 % and 1%, respectively.

1% level of significance except for LPROD which is found to be significant at 5% level of significance. FDI and EX have the correct expected sign, indicating an inverse relationship with unemployment. The positive sign of LPROD shows a positive relationship between productivity and unemployment. This may be due to increase in labor productivity and is contributed more by technological factor and not due to increase in labor. This finding is similar to that of De Francesco (1999) who found that there is a positive relationship between unemployment and labor productivity in Australia. Technological advancement with more efficient output/capital ratio can also replace workers and reduce the demand for labor (Kooros, 2006).

A positive relationship between VAC and UE may suggest that the theory of Beveridge Curve does not hold in the Malaysian labor market. It is also an indication that the country's labor market may suffer due mismatch problem (Zulkifly, 2001; Kanapathy, 2004; Muzafarshah and Woon, 2004; Thangavelu and Guangzhou, 2005). The inverse relationship between FDI with UE suggests that FDI inflow may solve the unemployment problem in the country. Wood (1994) and Suryahadi *et al.* (2001), among others found that FDI raises demand for unskilled labor in developing countries. The same goes with variable EX, which has the ability to create more employment opportunities. The role of export expansion in increasing relative demand for skilled labor in developed countries was highlighted by Bernard and Jensen (1995, 1997). In the case of Indonesia, export expansion increased the relative demand for the unskilled labor (Suryahadi *et al.*, 2001). Kooros and Halpet (2000) also found that in an open economy, initially unemployment may rise, but eventually it will decline. The economic slowdown in the United States in 2001, for example, triggered a negative impact on employment in Malaysia where unemployment increased by 0.5 percentage point in 2001 as the export to the United States declined.

For Singapore, with Log UE_t as the dependent variable, only FDI, EX and LPROD are found to be significant. EX is the main determinant of unemployment in Singapore. A positive sign for FDI may indicate that FDI into Singapore are very much capital intensive and less labor intensive. For the Philippines, with Log UE_t as the dependent variable, only GOV, VAC and EX are found to be significant at 1% level of significance. VAC is found to have a positive sign in the model indicating that there could be a problem of structural unemployment in the Philippines labor market. Also, GOV is inversely related to unemployment in the Philippines.

5.5. *The dynamic analysis: Generalized variance decomposition*

As the conventional variance decomposition based on Choleski's decomposition are sensitive to the ordering of the variables, this shortcoming can be dealt with by constructing generalized variance decomposition (GVDs) as proposed by Lee *et al.* (1992). The variance decompositions represent the proportion of total variance that is attributable to each of the orthogonalized innovations which measures the overall relative importance of an individual variable in generating variations due to its own shock as well as shocks due to other variables in the system (Baharumshah, 2001).

The GVDs for LUE in Malaysia suggests that its movements at short-forecasting horizons are driven mainly by the historical innovation in LUE itself (Table 6). Other

Table 6. Generalized Variance Decomposition for Malaysia

Horizon	ΔLUE	ΔLVAC	ΔLGDP	ΔLEX	ΔLIFDI	ΔLLPROD
			Variance Decomposition of ΔLUE			
1	**100.0000**	0.000000	0.000000	0.000000	0.000000	0.000000
6	**70.79150**	3.007723	15.83380	2.610258	1.085442	6.671274
12	**71.57030**	1.869388	16.96383	2.373420	1.123986	6.099076
24	**71.98981**	1.073673	17.81003	2.041883	1.163425	5.921179
			Variance Decomposition of ΔLVAC			
1	2.495565	**97.50443**	0.000000	0.000000	0.000000	0.000000
6	1.498917	**92.37696**	0.629378	0.099884	4.833670	0.561195
12	1.277963	**92.69764**	0.682199	0.059380	4.713584	0.569239
24	1.133534	**92.87833**	0.688474	0.037097	4.693288	0.569276
			Variance Decomposition of ΔLGDP			
1	15.27892	0.008608	**84.71247**	0.000000	0.000000	0.000000
6	6.023652	1.149101	**88.70887**	2.514358	0.448159	1.155863
12	5.254108	1.284146	**89.66858**	2.568583	0.425264	0.799324
24	4.756552	1.225155	**90.39661**	2.582483	0.410363	0.628833
			Variance Decomposition of ΔLEX			
1	12.60260	2.689506	67.63449	**17.07341**	0.000000	0.000000
6	6.915683	5.886011	67.25105	**19.60922**	0.015941	0.322101
12	6.501211	6.124776	67.27624	**19.72347**	0.008806	0.365493
24	6.217359	6.241704	67.33557	**19.84022**	0.004709	0.360435
			Variance Decomposition of ΔLIFDI			
1	13.92818	1.995937	5.403830	0.198360	**78.47369**	0.000000
6	10.39986	12.08902	4.017935	0.944228	**71.70840**	0.840554
12	8.603669	12.95442	3.585390	0.756890	**73.50020**	0.599435
24	7.292404	13.58773	3.422311	0.619961	**74.61992**	0.457672
			Variance Decomposition of ΔLLPROD			
1	12.80572	0.100081	86.34566	0.039869	0.121814	**0.586855**
6	5.582106	1.166296	89.96021	1.566905	0.550362	**1.174120**
12	4.800237	1.296732	90.88019	1.569848	0.543695	**0.909301**
24	4.289359	1.282956	91.54229	1.564410	0.530113	**0.790870**

variables (job vacancy, GDP, FDI, export and labor productivity) contribute around 28% of the innovation in unemployment. Innovations in LUE explains about 1% of Malaysia's LVAC variance at the 24-month horizon. As the forecast horizon increases, the importance of historical shocks related to LGDP and LEX increases. After the 24-month horizon, economic growth emerged as the leading variable, being the most exogenous of all. About 90% of the variation in economic growth is explained by its own shock in Malaysia. Job vacancy explains about 6% and 14% of variance forecast errors of export and FDI, respectively at 24-month horizon.

The GVDs for LUE for Singapore suggests that its movements at short-forecasting horizons are driven mainly by the historical innovation in LUE itself (Table 7). Other variables namely job vacancy, government spending, GDP, FDI, exports and labor productivity contribute only around 25% of the innovation in unemployment. About 80% of

Table 7. Generalized Variance Decomposition for Singapore

Horizon	ΔLUE	ΔLVAC	ΔLGDP	ΔLGOV	ΔLEX	ΔLIFDI	ΔLLPROD
			Variance Decomposition of ΔLUE				
1	**100.0000**	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
6	**73.34107**	1.829728	20.71736	1.565174	0.419401	0.126003	2.001272
12	**74.34010**	1.308010	21.35744	1.576312	0.230771	0.134105	1.053266
24	**74.81402**	1.018167	21.85135	1.521426	0.118360	0.131887	0.544791
			Variance Decomposition of ΔLVAC				
1	0.020444	**99.97956**	0.000000	0.000000	0.000000	0.000000	0.000000
6	3.351036	**56.96053**	3.519795	4.501452	22.36988	4.087048	5.210260
12	4.187157	**55.74462**	2.764519	5.116676	23.42569	4.771675	3.989663
24	4.646180	**54.95037**	2.290072	5.476521	24.22755	5.165938	3.243371
			Variance Decomposition of ΔLGDP				
1	15.58383	18.00178	**66.41439**	0.000000	0.000000	0.000000	0.000000
6	8.383998	6.328562	**78.37762**	0.106742	3.347032	0.035069	3.4209780
12	7.992158	5.102880	**79.95509**	0.070314	3.513937	0.020960	3.344659
24	7.769347	4.498473	**80.79626**	0.051491	3.591271	0.011549	3.281611
			Variance Decomposition of ΔLGOV				
1	7.181743	53.70039	0.602997	**38.51487**	0.000000	0.000000	0.000000
6	3.331378	49.93384	19.60811	**22.08339**	2.290244	1.470805	1.282229
12	2.442958	48.89106	22.60190	**21.07023**	2.748384	1.329821	0.915648
24	1.942139	48.83357	24.05855	**20.35358**	2.886897	1.260657	0.664604
			Variance Decomposition of ΔLEX				
1	14.34406	5.395018	62.58085	0.387933	**17.29214**	0.000000	0.000000
6	8.745339	1.259072	59.09240	0.431025	**28.30283**	0.426438	1.742894
12	8.341589	0.664542	58.95407	0.358162	**29.63726**	0.481103	1.563270
24	8.120602	0.341819	58.87930	0.315667	**30.36289**	0.501426	1.478302
			Variance Decomposition of ΔLIFDI				
1	15.05701	1.592343	15.69730	1.298023	52.59652	**13.75881**	0.000000
6	5.940872	2.032498	15.93763	2.165453	57.61796	**13.00603**	3.299551
12	3.858131	2.091594	15.18172	2.472577	60.12541	**13.41069**	2.859877
24	2.533529	2.047966	14.71977	2.573668	61.84173	**13.66524**	2.618100
			Variance Decomposition of ΔLLPROD				
1	8.259324	14.72976	60.75977	0.207773	0.935450	0.060771	**15.04716**
6	4.426196	3.158678	70.43808	0.108084	2.453027	0.050683	**19.36525**
12	4.263836	2.049780	71.55035	0.063646	2.229778	0.033014	**19.80960**
24	4.170728	1.485453	72.20505	0.041753	2.091847	0.024468	**19.98070**

the variance in GDP of Singapore is explained by its own shock at the 24-month horizon. We noticed that as the forecast horizon increases, the importance of historical shocks related to LGDP and LEX increases. Innovations in LUE explains around 4% of Singapore's LVAC variance at the 24-month horizon. After the 24-month horizon, economic growth emerges as the leading variable, being the most exogenous of all the variables considered. About 81% of the variation in economic growth is explained by its own shock in Singapore. Export explains about 61% of variance forecast errors of FDI at 24-month horizon. Economic growth explains about 72% of variance forecast errors of labor productivity at 24-month horizon.

Table 8 presents the GVDs for LUE for the Philippines. Like the other two ASEAN countries, the GVDs suggest that its movements at short-forecasting horizons are driven mainly by the historical innovation in LUE itself. Meanwhile, the other variables contribute only about 4% of the innovation in unemployment. Innovations in LUE explains around

Table 8. Generalized Variance Decomposition for the Philippines

Horizon	ΔLUE	ΔLVAC	ΔLGDP	ΔLGOV	ΔLEX	ΔLLPROD
			Variance Decomposition of ΔLUE			
1	**100.0000**	0.000000	0.000000	0.000000	0.000000	0.000000
6	**94.71937**	0.006134	0.357815	2.824803	2.027141	0.064740
12	**95.47015**	0.005691	0.206495	2.480429	1.766095	0.071135
24	**95.89081**	0.003543	0.111050	2.296956	1.623751	0.073889
			Variance Decomposition of ΔLVAC			
1	2.881880	**97.11812**	0.000000	0.000000	0.000000	0.000000
6	5.701507	**86.88674**	5.632853	0.394334	0.296438	1.088127
12	5.671025	**86.65106**	5.826126	0.409246	0.290196	1.152349
24	5.636621	**86.50253**	5.959517	0.421267	0.290482	1.189578
			Variance Decomposition of ΔLGDP			
1	17.70559	10.17961	**72.11479**	0.000000	0.000000	0.000000
6	23.54364	12.37455	**59.15692**	4.525615	0.379961	0.019317
12	24.44477	13.14041	**57.33528**	4.673786	0.394776	0.010978
24	24.94358	13.58391	**56.29882**	4.758383	0.409068	0.006244
			Variance Decomposition of ΔLGOV			
1	5.562066	22.43547	57.38969	**14.61277**	0.000000	0.000000
6	9.203932	23.54960	57.18148	**9.920435**	0.060189	0.084365
12	9.594680	23.95211	57.13295	**9.190824**	0.047893	0.081543
24	9.805726	24.18177	57.08047	**8.809084**	0.042411	0.080543
			Variance Decomposition of ΔLEX			
1	31.96850	2.631884	36.07221	3.171216	**26.15619**	0.000000
6	50.79866	1.829127	25.19231	1.150002	**19.43328**	1.596620
12	52.80746	1.599092	24.07800	0.685158	**19.06909**	1.761197
24	54.11663	1.480201	23.24484	0.416201	**18.87892**	1.863219

Table 8. (*Continued*)

Horizon	ΔLUE	ΔLVAC	ΔLGDP	ΔLGOV	ΔLEX	ΔLLPROD
			Variance Decomposition of ΔLLPROD			
1	4.064464	13.51329	81.33252	0.053596	0.023034	**1.013098**
6	14.86657	17.44624	63.61976	2.930625	0.627355	**0.509446**
12	16.18435	18.75234	61.64807	2.492070	0.631360	**0.291809**
24	16.94309	19.62189	60.42831	2.200801	0.648049	**0.157863**

6% of the Philippines' LVAC variance at the 24-month horizon. As the forecast horizon increases, the importance of historical shocks related to LGDP decreases. After the 24-month horizon, unemployment emerges as the leading variable, being the most exogenous of all. About 95% of the variation in unemployment is explained by its own shock in the Philippines. Unemployment explains about 61% of variance forecast errors of exports at 24-month horizon. Job vacancy explains about 20% of variance forecast errors of labor productivity at 24-month horizon.

6. Conclusions and Policy Implications

This study is concerned with the relationship between unemployment and its major determinants in three ASEAN countries. The results reveal that a stable long-run cointegration equilibrium relationship exists among the variables under study. Exports and FDI inflows are found to be important determinants in reducing unemployment in Malaysia. In order to maintain low unemployment, the Malaysian government should focus on exports and FDI as employment-creating sectors. In Singapore, export sector is also found to be the main determinant of unemployment whereas in the Philippines, government spending appears as the main determinant of unemployment. This study also proves that the speed of adjustment following a shock is more rapid in Singapore compared to the other two countries — Malaysia and the Philippines. Higher matching efficiency as pointed out by Teo *et al.* (2005) could possibly explain this finding. The slow convergence to equilibrium, especially for the Philippines could be explained by the economy's heavy reliance on agriculture sector, as labor in agriculture sector requires more specific skills. Consequentially the process of retraining or reskilling requires longer time. Thus, it is vital for the Philippines to be involved especially in active labor market policies. Some measures that can be taken include improvement in the matching process of public employment services, and retraining and reskilling to increase the chances of employability. The variance decompositions experiment suggests that income is the leading and the most exogenous variable in Malaysia and Singapore while the vacancy rate appears to be the case for the Philippines. The findings appear to support the notion that low output growth in recent years is the reason for the rise in unemployment rate. Finally, the results show that an increase in labor productivity and the level of unemployment are positively correlated in all the three emerging economies. High growth rates experienced in these countries over the past few

decades seem to have marginal, or even no effect on the level of unemployment rates. Together, these two observations suggest that job creation especially for tertiary educated job-seekers (in Malaysia and the Philippines) is low over the sample period under study.

Acknowledgments

The authors wish to thank the Institute of Southeast Asian Studies (ISEAS), Singapore, for assistance rendered during data collection process. They also wish to thank two anonymous referees for their thoughtful comments and suggestions on an earlier draft of this paper. Financial assistance provided by University of Malaya (Grant No. FO320/2007B) is graetfully acknowledged. Any remaining errors are our own.

Appendix I

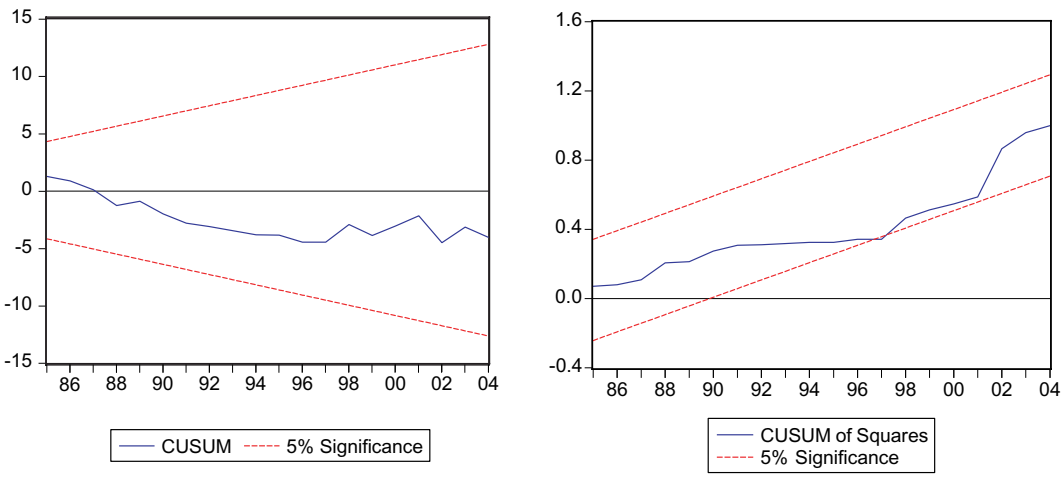

Figure A1. CUSUM and CUSUMSQ Stability Test for Malaysia

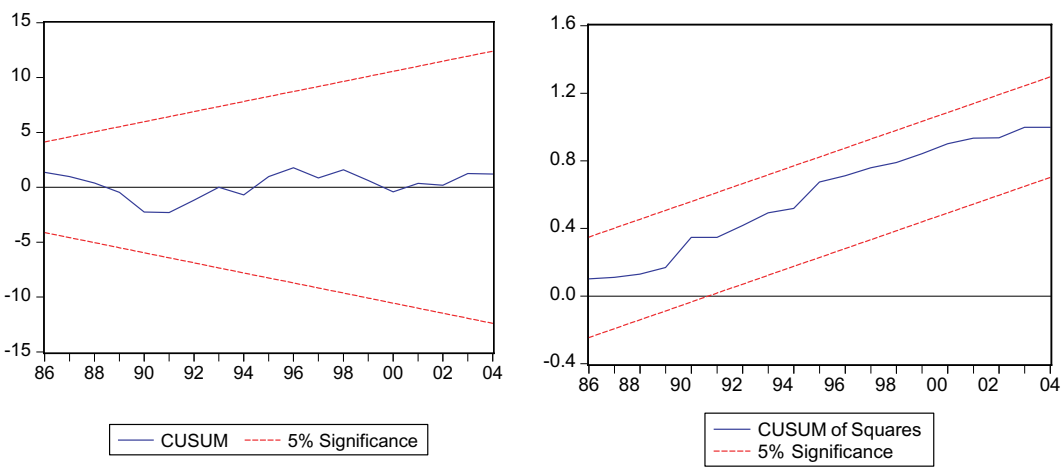

Figure A2. CUSUM and CUSUMSQ Stability Test for Singapore

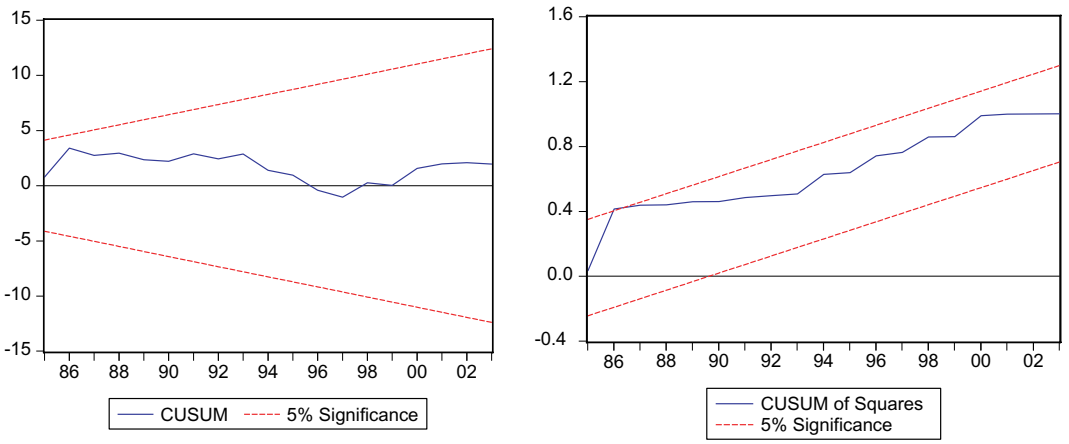

Figure A3. CUSUM and CUSUMSQ Stability Test for the Philippines

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