MODELING THE RELATIONSHIP BETWEEN KLCI AND MONETARY POLICY AFTER THE1997 FINANCIAL CRISIS

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Abstract
Using Autoregressive Distributed Lag (ARDL) and Johansen cointegration with structural break, the long run and short run interactions between stock market (KLCI) and monetary policy (M1, M2 and Interest Rate) are examined in Malaysia with monthly data after 2000 to date. Our results indicate that; a) There is significant long run and short run relationship in the sample period, b) Johansen test with structural break gives more robust result.

Keywords: KLCI; Monetary Policy; Cointegration with structural break; ARDL.

JEL Classification Codes: C22; E44; E52.

1. Introduction

After financial crises the Malaysian economy has been influenced by global factors more than local and government took some capital controls such as pegging Ringgit in order to minimize impact of external shocks on Malaysian Economy. Through pegging exchange rate system, external shocks for instance; Iraq war, the political changes in US, September eleven terrorism attack, Afghanistan war, Tsunami, SARS, Petrol Price hikes have not effected economy as it was expected.

After 2002, the prospect for a global economic recovery affected by recent developments, in particular the war in Iraq and the Severe Acute Respiratory Syndrome (SARS). During the second quarter, consumer and business sentiments in regional economies were particularly affected by the anxiety of a probable prolonged and widespread SARS epidemic that curtailed transport and tourism-related activities besides trade and investment flows. Against this adverse global environment and concerns of further weakening of the already sluggish global economy, the Government has put in place a package of broad-based pro-growth measures in May 2003. The Package of New Strategies, apart from providing immediate relief for the SARS-affected sectors, was to address structural and organizational issues towards sustaining economic growth in the medium and longer term. The strategic measures introduced boosted confidence necessary to stimulate domestic consumption and investment.

The Malaysian economy accelerated its growth momentum in the first half of 2004, after a strong take-off in 2003. The broad-based growth is evident of the effective measures implemented by the Government to develop new sources of growth to reduce the nation's vulnerability to the external environment. The government's macroeconomic policies focus on sustaining the growth momentum of the economy as well improving the nation's capacity to generate growth. During 2005, the economy continues to face greater external challenges, in particular moderation in global growth, revival in inflationary pressures as well as rising trends in tightening of monetary policy, particularly in the US. There were notable shocks to the world economy when oil prices rose sharply to almost USD70 per barrel on 30 august 2005.

Given the weak external environment, monetary policy continues to remain accommodative to support domestic growth and mitigate the adverse impact from the global economic slowdown on the economy. Money supply, M1 or narrow money, an indicator of transaction balances continued to expand during this period and faster pace after 2007. The low inflationary environment as well as global easing of interest

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rates has enabled the Government to ease monetary policy to support its larger fiscal stimulus without putting pressures on prices and wages. Interest rates remain low while ample liquidity continues to prevail in the financial system, reflecting the easier monetary stance.

In tandem with the developments in major world and regional bourses, the performance of the Kuala Lumpur Stock Exchange (KLSE) during the first nine months of 2001 was affected by weaker investor sentiment on concerns of the global economic slowdown. KLSE began the year with a Chinese New Year rally, with the Kuala Lumpur Composite Index (KLCI), closing at 727.73 points at end-January. It trended downwards from April before recovering to close at 659.40 points at end-July, following several optimistic developments in corporate mergers and acquisitions. The September Eleven attack on the US has triggered a fall in share prices worldwide, including the KLCI, which declined to 615.34 points as at end-September. During the period end-2000 to end-September 2001, the KLCI declined by 9.5% against the Philippines Composite Index (-24.6%).

The Kuala Lumpur Composite Index (KLCI) grew at a CAGR of 16.2% over the last five years (2003-07). The year 2007 was an exceptional year for the Malaysian stock market. In 2007, Malaysian stock market achieved an all time high of 1,447 points in December 2007, which surpassed the previous high of 1,315 points recorded in 1994. Over the period of 2003-07, market capitalization of KLCI grew steadily and recorded a CAGR of 16.2%. The Malaysian stock market witnessed bouts of volatility since the beginning of 2008 due to unstable global financial market and fear of US recession due to sub-prime crisis[1] .

2. Literature review

Theoretically, there is negative relationship between money supply and stock prices because, as money growth rate increases, the inflation rate is expected to increase; consequently the stock price decrease. However, an increase in the money supply stimulates the economy and corporate earnings increase. This results in an increase in future cash flows and stock prices. Mukherjee & Naka (1995), Maysami & Koh (2000), and Kwon & Shin (1999) found that there is a positive relationship between money supply and stock returns. Masih & Masih (1996) indicate that money supply (particularly M1) appears to have played the leading role of a policy variable being the most exogenous of all, and the other variables including output, rate of interest, exchange rate, and prices appear to have borne most of the brunt of short-run adjustment endogenously in different proportions in order to re-establish the long-run equilibrium.

Also, an increase in interest rate would increase the required rate of return and the share price would decrease with the increase in the interest rate. An increase in interest rate would raise the opportunity costs of holding cash, and the trades off to holding other interest bearing securities would lead to a decrease in share price as in Rigobon & Sack (2002). They indicate that an increase in short-term interest rates results in a decline in stock prices and in an upward shift in the yield curve that becomes smaller at longer maturities.

Elton & Gruber (1991) indicate that the determinants of share prices are rate of return and expected cash flows. Economic variables which have influence on future cash flows and required returns therefore, impact share prices. French et al. (1987) document stock returns respond negatively to both the long term and short term interest rates. However, Allen & Jagtianti (1997) indicate that the interest rate sensitivity to stock returns has decreased dramatically since the late 1980's and the early 1990's because of the invention of interest rate derivative contracts used for hedging purposes. Furthermore, Bulmash & Trivoli (1991) found that the US current stock price is positively correlated with the previous month's stock price, money supply, recent federal debt, recent tax-exempt government debt, long-term unemployment, the broad money supply and the federal rate. However, there was a negative relationship between stock prices and the Treasury bill rate, the intermediate lagged Treasury bond rate, the longer lagged federal debt, and the recent monetary base.

Many studies in the literature investigate the relationships between stock returns and macroeconomic variables for developed countries such as Mukherjee and Naka (1995) for Japan, Geske & Roll (1983), Fama (1981), Lee (1992) and Bulmash & Trivoli (1991). Darrat (1990) find impact of monetary and fiscal

[1] Economic Reports, Bank Negara Malaysia

policy on share returns for Canada, French et al. (1987), Chen et al. (1986) find that macroeconomic variables do not affect share returns for UK, Leigh (1997) find relationship between stock index and money demand but macroeconomic fundamentals, Mookerjee & Yu (1997) express significant interactions between money supply (M2), foreign exchange reserves and stock prices, Maysami & Koh (2000) indicates significant contribution of interest rate and exchange rate in the long-run relationship between Singapore's stock prices and various macroeconomic variables and Wong at al. (2005) find relationship with interest rate and money supply (M1) for Singapore. Gjerde & Saettem (1999) find relations with interest rate but not real economic activity for Norway,

The studies for developing economies consist of Fung and Lie (1990), Shin (1999), Achsani & Strohe (2002), Gan at al (2006) and Abugri (2006). Fung & Lie (1990) find interaction with money demand in Taiwan. Shin (1999) found the Korean stock markets are cointegrated with the production index, exchange rate, trade balance and money supply. Achsani & Strohe (2002) examine Indonesia and indicate that stock returns respond negatively to changes in interest rate, but real economic activity. Gan at al (2006) find that the New Zealand Stock Index consistently determined by the interest rate, money supply and real GDP and there is no evidence that the New Zealand Stock Index is a leading indicator for changes in macroeconomic variables.

Wongbanpo & Sharma (2002) investigate the role of selected macroeconomic variables (GNP, the consumer price index, the money supply, the interest rate, and the exchange rate) on the stock prices in five ASEAN countries. They find a negative long run relationship between stock prices and interest rates in Philippines, Singapore, and Thailand but, a positive relation in Indonesia and Malaysia. High inflation in Indonesia and Philippines influences the long run negative relation between stock prices and the money supply, while the money growth in Malaysia, Singapore and Thailand provokes the positive effect for their stock markets.

As for Malaysia, there are a few shining studies which are Habibullah & Baharumshah (1996), Ibrahim (1999), Ibrahim & Yusoff (2001), Ibrahim & Aziz (2003), Yusof at al (2006) and Wongbangpo & Sharma (2002), Yusof, Majid & Razali (2006). Habibullah & Baharumshah (1996) employ cointegration analyses to evaluate the informational efficiency of the Malaysian stock market index and sectoral indices using monthly data from January 1978 to September 1992. Considering real output and money supply (M1 and M2) in the cointegrating relation, they find no evidence for cointegration between them. Also they indicate that Malaysian stock market is informationally efficient in the long run. Ibrahim (1999) focused on bivariate relationships and find cointegration between the Malaysian stock prices and three macroeconomic variables – the price level, credit aggregates and official reserves. Ibrahim & Yusoff (2001), analyzes dynamic interactions among three macroeconomic variables (real output, price level, and money supply), exchange rate, and equity prices. They note that money supply exerts a positive effect on the stock prices in the short run. However, money supply and stock prices are negatively associated in the long run. Ibrahim & Aziz (2003) analyze dynamic linkages between stock prices and four macroeconomic variables for the case of Malaysia. Empirical results suggest the presence of a long-run relationship between these variables and the stock prices and substantial short-run interactions among them. In particular, they document positive short-run and long-run relationships between the stock prices and two macroeconomic variables.

For the money supply, documents immediate positive liquidity effects and negative long-run effects of money supply expansion on the stock prices. But, the immediate positive liquidity effects of the money supply shocks fade away over time. Yusof et al. (2006) investigate the extent to which macroeconomic variables affect the stock market behavior in an emerging market Malaysia in the post 1997 financial crisis period employing the autoregressive distributed lag model (ARDL). They suggest that real effective exchange rate, money supply M3, industrial production index and Federal Funds rate seem to be suitable targets for the government to focus on, in order to stabilize the stock market and to encourage more capital flows in to the capital market.

3. Data and methodology

Monthly data of Kuala Lumpur Composite Index (KLCI), Money Supply (M1and M2) and Money Market Interest Rate (MM) are used in this study. Our sample data covers the period between January 1, 2000 and May 30, 2008. The data of KLCI is obtained from Datastream, M1 and M2 are obtained from Bank Negara and MM is obtained from International Financial Statistics. All data are transformed to natural logarithms prior to analysis.

In our three and four variable models we focus on the structural breaks in the series in order to find out the possible impacts of them on the interaction of KLCI and selected Monetary Policy variables. In doing so, Unit Root with structural breaks, Multivariate Cointegration, Cointegration with structural breaks and Autoregressive Distributed Lag (hereafter ARDL) model are used.

First, Stationary tests which are Augmented Dickey–Fuller (ADF) (Dickey & Fuller, 1981), Phillips-Perron (PP) (Phillips & Perron, 1988) and Unit Root test with Structural Breaks are applied to determine the order of integration.

If there is a shift in the time series, it should be taken into account in testing for a unit root because the ADF test may be distorted if the shift is simply ignored. Saikkonen and Lutkepohl (2002) and Lanne et al (2002) have proposed the following model:
A shift function, which is $f_t(\theta)'\gamma$, is added in the equation;

$$y_t = \mu_0 + \mu_1 t + f_t(\theta)'\gamma + e_t$$

Where θ and γ are unknown parameters or parameter vectors and the errors e_t are generated by an AR(p) process.. And shift function is defined as:

$$f_t^{(1)} = d_{1t} = \begin{cases} 0, & t \prec T_B \\ 1, & T \geq T_B \end{cases}$$

The shift function, *ft* (θ)γ is a simple shift dummy variable with shift data $T_{B.}$ Saikkonen and Lutkepohl (2002) and Lanne et al (2002) have proposed unit root tests based on estimating the deterministic term by the generalised least squares (GLS) procedure and subtracting it from the original series. Thereafter an ADF-type test is performed on the adjusted series.

Second, Johansen multivariate cointegration (Johansen, 1988, 1995; Johansen & Juselius, 1990) and VECM is employed to our three-variable models (KLCI-M1-MM and KLCI-M2-MM) and four-variable model (KLCI-M1-M2-MM) to investigate the impact of structural breaks on the interaction between KLCI and Monetary Policy variables. In Johansen's (1995) notation, a p-dimensional Vector Error Correction Model (VECM) can be written as:

$$\Delta y_t = \Pi^* \begin{bmatrix} y_{t-1} \\ 1 \end{bmatrix} + \sum_{j=1}^{p-1} \Gamma_j \Delta y_{t-j} + e_t$$

Where $\Pi^* = \left[\Pi : \quad \nu_0^*\right]$ is $(K \times (K+1))$. The intercept can be absorbed into the cointegrating relations; thus $\Pi^* = \alpha\beta^{*\prime}$ has rank r. The trace test is of the form:

$$LR(r_0) = -T \sum_{j=r_0+1}^{K} \log(1 - \lambda_j)$$

where the λ_j are the eigenvalues obtained by applying reduced rank regression techniques.

If cointegration is confirmed, the Granger-causality test based on VECM is applied to examine the temporal causalities and long run adjustments of our variables. We also examine the cointegrating properties of the estimated equation by utilizing the ARDL cointegration procedure proposed by Pesaran et al. (2001).

4. Empirical results

Stationarity (Unit Root) test with structural break results which is reported in Table 1 indicate that all series are nonstationary in log levels but stationary in log first differences.

Table1: Unit root test with structural break

	Levels			First Differences		
	ADF	PP	UR with SB	ADF	PP	UR with SB
KLCI	-0.511(2)	-0.379(0)	-17906(1)	-6.912(1)*	-8.518(1)*	-6.5911(0)*
M1	2.213(12)	1.028(6)	-0.042(2)	-2.3185(1)	-9.325(6)*	-4.2464(9)*
M2	1.942(1)	2.198(2)	-0.947(2)	-7.98(0)*	-8.133(4)*	-7.922(0)*
MM	-1.167(3)	-0.629(5)	-1.066(2)	-1.843(3)*	-10.297(5)*	-4.1606(2)*

Notes: Critical values for ADF with intercept are 1%, 5%, 10% is -3.503, -2.893 and -2.583. Critical values for Unit Root with Structural Break, and with intercept are 1%, 5%, 10% is -3.48, -2.88 and -2.58.

The estimations are performed using ADF, PP and Unit Root with SB test specifications, which include an intercept. Lag selection is based on Akaike Information Criterion. All series are I(1), stationary in first difference according to PP and Unit Root with SB test.

In Multivariate cointegration analyses we applied two approaches which are;

a. Sub-sample period determined according to the structural breaks in the models.
b. Cointegration with structural breaks

Johansen multivariate cointegration analysis result based on three model and structural breaks represented in Table 2. In all three models, there is significant cointegration relationship in the sub-sample period which is absent in the sample period.

Table 2: Johansen cointegration test result

Models	Lag	Trace	λ_{max}
KLCI-M1-M2-MM			
2000M01 – 2008M05	4	No Coint.	No Coint.
2000M07 – 2005M12	4	1 Coint. Vector	1 Coint. Vector
With structural break (2000M07 based on KLCI)			
2000M01 – 2008M05	2	1 Coint. Vector *	
KLCI-M1-MM			
2000M01 – 2008M05	4	No Coint.	No Coint.
2000M07 – 2005M12	4	1 Coint. Vector	1 Coint. Vector
With structural break (2000M07 based on KLCI)			
2000M01 – 2008M05	2	No Coint.	
KLCI-M2-MM			
2000M01 – 2008M05	4	1 Coint. Vector	No Coint.
2000M07 – 2005M12	4	1 Coint. Vector	1 Coint. Vector
With structural break (2000M07 based on KLCI)			
2000M01 – 2008M05	2	1 Coint. Vector *	

Notes: Trace and Max-eigenvalue test indicates 1 cointegrating equation at the 0.05 level. * LR test indicates 1 cointegrating vector at the 0.01 level

Second step include cointegration with structural break analyses. There is significant cointegration in our four-variable model and result from three-variable models show that the model which includes M2 is the correct model in examining the relationship between monetary policy and KLCI.

Once we obtained positive result from Johansen cointegration technique, we proceed to VECM in order to gauge out short run relationship in our model. The estimated coefficient of the error correction term (-0.044) is statistically significant at the 5 % level and negative sign indicating existence of long–run relationship.

Once we capture cointegration in our model, the Granger-causality test based on VECM is applied to examine the temporal causalities of our variables. The existence of a cointegrating relationship suggests that there must be Granger causality in at least one direction, but it does not indicate the direction of temporal causality between the variables. Table 4 examines short run Granger causality within the Error-Correction Mechanism (ECM). The *F* statistics on the explanatory variables in the equation indicates the statistical significance of the short-run causal effects.

The dynamic relationship between KLCI and selected Monetary Policy variables are presented in Table 3 and summarized below. Empirical result shows that M1 and M2 influence KLCI through MM in the short run.

Table 3: Granger causality based on VECM

D. Var.	Independent Variable								ECT	
	KLCI		M1		M2		MM			
	Chi-Sq.	Prob.	Chi-Sq.	Prob.	Chi-Sq.	Prob.	Chi-Sq.	Prob.	Coef.	t
KLCI			2.587	0.274	4.503	0.105	13.42	0.0012*	-0.0162	-1.54*
M1	0.094	0.953			0.645	0.724	0.216	0.8975	-0.0003	-0.005
M2	0.016	0.991	0.578	0.748			0.223	0.8944	0.0002	0.074
MM	1.370	0.503	9.461	0.008*	6.364	0.041*			0.0184	5.238*

Notes: Asterisk (*) and (**) denote 95% and 99% significance level respectively. Chi square (X^2) tests the joint-significance of the lagged values of the independent variables while t-statistics tests the significance of the error correction term (ECT).

ARDL Model

Table 4 presents the error correction estimations for the model. Based on the results, the lagged error-correction term carries its expected negative sign and is highly significant. Kramers et al. (1992) have shown that a significant error-correction term is a relatively more efficient way to establish cointegration. The coefficient of (-0.16) reveals that approximately 16% of the previous monthly's divergence between the actual and equilibrium value of stock prices is corrected each month. A significant error correction term implies causality from selected monetary variables which are money supply (M1 and M2) and interest rate (MM). The error correction term represents the potential effects of departures from the long-run equilibrium. The size and the significance of the error correction term in the equation shows the tendency of each variable to restore equilibrium in the stock market. Using the procedure as outlined in Pesaran & Shin (1999), we obtained the level long-run parameter estimates of the model. As shown in Table 4, the effect of M1 on stock prices is negative unlike M2.

Table 4: Error correction representation for the selected ARDL model

$\Delta M1_t$	$\Delta M1_{t-1}$	$\Delta M2_t$	ΔMM_t	ΔMM_{t-1}	ΔMM_{t-2}	C	ECM_{t-1}
0.21	0.43	0.071	0.075	-0.14	-0.75	-0.55	-0.162
(0.27)	(0.031)*	(0.474)	(0.78)	(0.579)	(0.005)*	(0.047)*	(0.000)*

Note: the numbers in parenthesis are p values.

Table 5: Normalized equation

KLCI	M1	M2	MM
1	-2.61	3.04	-27.57
	(-2.29)	(-2.20)	(-6.69)

Diagnostic Testing

Table 6 summarizes the results of the diagnostic tests performed on the residuals. These diagnostic tests proved that the error terms are normally distributed, homoscedastic and not autocorrelated.

Table 6: Diagnostic testing result

Test Performed for	Test	Test Stat.	Conclusion
Normality	Jarque-Bera	1.427	Residuals normally distr.
Heteroscedasticity	ARCH	0.0712	Residuals are Homosc.
	White	0.473	
	Breusch-Pagan-God.	1.367	
Serial Correlation	Breusch-Godfrey	0.866	No Serial Correlation
	Durbin Watson		No Serial Correlation

Table 7: Exclusion test (LR) result

	M1	M2	MM
KLCI-M1-M2-MM	0.287	11.399	7.485

Notes: Testing the null hypothesis that each coefficient is statistically equivalent to zero in single cointegrating vector. The exclusion test is a likelihood ratio test (Johansen, 1991) examining the null hypothesis that the relevant variable does not belong to the cointegration relationship.

5. Conclusion

We investigate the relationship between Monetary Policy and KLCI applying the usual cointegration, cointegration with structural breaks and ARDL models. In order to eliminate the impact of structural breaks in our usual cointegration analyses, we defined sub-sample period excluding structural breaks in addition to whole sample period which is between January 2000 and May 2008.

In our sample period, usual cointegration analyses test results indicate no cointegration while sub-sample analyses gives significant cointegration meaning that any shocks in one variable doesn't impact the others in our three models. Cointegration with structural break analyses implies strong cointegration relationship in our four-variable model and three-variable model which include M2. The model with M1 doesn't show any cointegration relationship.

Cointegration with structural breaks gives more robust result consistent with the usual cointegration without structural breaks meaning that if there is structural break in variables it needs either to be included or excluded in the analyses. To ignore structural breaks may give spurious results.

In our four-variable system, negative long run relationship between KLCI and selected monetary variables (M1, MM), positive relationship with M2 found. In our three variable models, we found negative relationship between KLCI and Monetary variables (M1, M2, MM)

Based on Johansen approach, KLCI respond to deviation in the long run and about 1% of previous deviation is being corrected by KLCI whilst based on ARDL approach yields greater speed of adjustment which is about 16%. Granger causality within VECM result shows that Money Market Interest Rate (MM) Granger cause KLCI and the other monetary variables (M1, M2) influence KLCI through Money Market

Interest rate. Hence, there is sufficient empirical evidence which shows that KLCI respond to changes in Monetary Policy in the short run. The result from ADRL in general supports the findings given by VECM.

CUSUM test gives stability unlike CUSUM of Squares test which result from the high volatility of Money Market Interest Rate.

Future studies may focus on interaction between KLCI and Monetary Policy including the volatility issue in the analyses.

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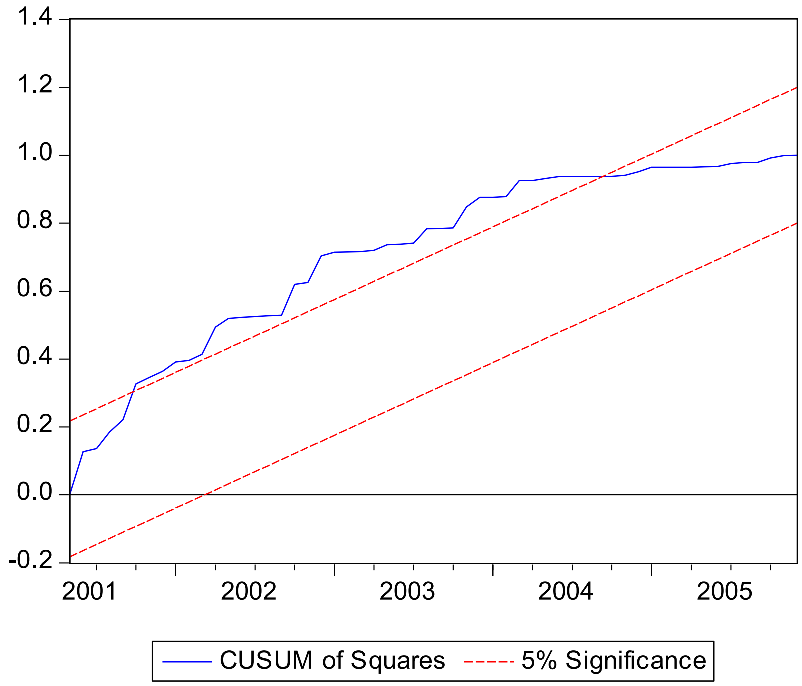
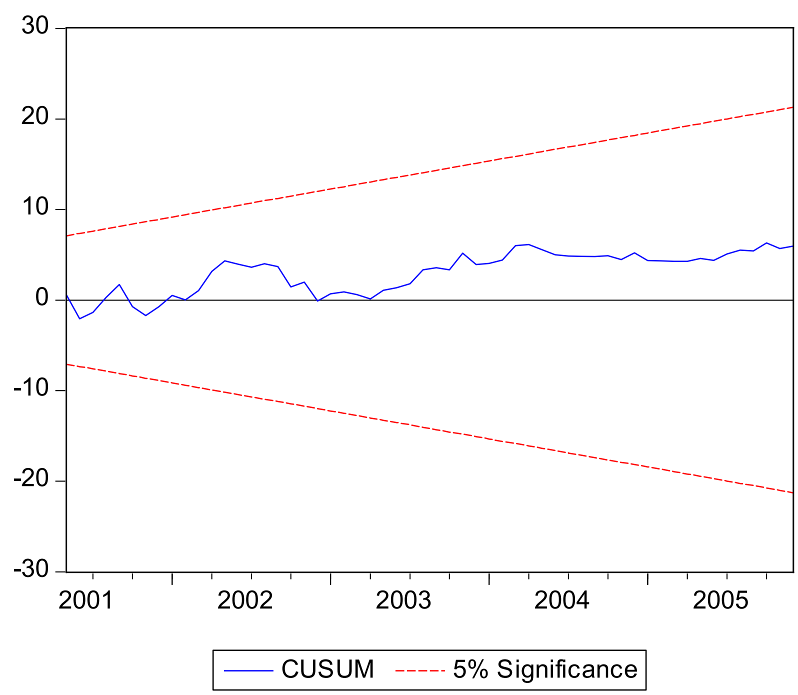
Appendix


1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
2001
2002
2003
2004
2005
CUSUM of Squares
5% Significance


30
20
10
0
-10
-20
-30
2001
2002
2003
2004
2005
CUSUM
5% Significance