Stock Market and Real Interest Rate of ASEAN Countries: Are they Cointegrated?

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Abstract

The objective of this research is to investigate the new linkage pattern of financial market among the ASEAN countries. The research is eager to answer and explain the effect changes of ASEAN stock prices and real interest rate from particular ASEAN country to others countries. Using monthly data over study period 1991-2011 and apply the Cointegration and Vector Error Correction Model (VECM), we found that there were some the linkage of financial market activities among countries in short run and long run. But the level of integration occurs between two countries definitely depends on financial infrastructure of each ASEAN country members like the degree of financial liberalization. Implication of the results could be used to manage the government's monetary policy and applicable to investment decision maker for investors that interested in the region.

Keywords: Financial Integration, Stock Price Index, Real Interest Rate, ASEAN Countries.

Introduction

The basic idea of globalization is to provide the economic infrastructure among countries (regions) over the world in regard with increase the mobility of economic and financial resources. We believe that when the economy integrated the flow and utilize of resources among countries will smoothly and usage alternative of resource will be efficient. In the financial market sector as example, some investors have high liquidity; they need to diversify their portfolio in regards to risk and return of international investment and portfolio formation. The successful investors in investment and financing as well as government in managing economy and resources both are depending on information that they have got. One of information that could help them is the degree of financial market integration information.

Currently, financial integration especially on money and capital market in various regions of the world is increasing significantly. Some factors that lead to this integration is infrastructure world economy, particularly in the financial markets, which provided funds flow freely between a country due to reduced structural obstacles as well as encouragement for investors to profit and manage risk in international portfolio formation. This development has been motivated to academicians and practitioners to encourage themselves in exploring and studying economic and financial integrations.

Most studies in the issue focuses on money and capital markets to assess the financial integration with different variable to present financial integration. Emmza and Losq (1985), Jorion and Schwartz (1986), Wheatley (1988), Ernmza et al. (1992), Bekaert and Harvey (1994) using the standard CAPM model to solve the issue but the result are mixed between accepted and rejected on integration hypothesis. In the same issue, Cho et al. (1986), Gultekin et al. (1989), Korajczyk and Viallet (1989) and Mittoo (1992) tried to assess the integration but using the different model namely APT. They argued APT model more stable compare with CAPM because it can capture some benchmarks, where CAPM based on the single benchmark. Unfortunately they also found the mixed result.

Chen and Knez (1995) came out with the SDF model to test the financial integration hypothesis and their result was strongly rejecting the hypothesis.

Similarly, Click and Plammer (2003) and Baharumshah et al (2005) tested the financial integration looked from money market with different perspective and the study took account the long run relationship between two countries. Both results accepted the integration hypothesis. However, we argue that the short run relationship is importance due to practical reason. Furthermore, the long run and short run studies is hardly rare in this issue.

In this study we focus on financial market integration in the ASEAN Countries (Malaysia, Indonesia, Singapore, Thailand and Philippine). Currently this region represents 35% of capitalization capital market in Asia region, and economic growth stable with average 5% for last 10 year. Besides that, the design of capital market integration ASEAN countries and declared the establishment of the ASEAN economic community by 2015. The purposes of the research are 1) to study the integration of financial activities among ASEAN countries 2) To study the short run and long run relationships among ASEAN countries in financial activities. 3) To provide information in regards with financial market integration to support the decision makers like investors as well as government of ASEAN countries.

For this research, we analyze the financial integration of ASEAN Countries related to money and capital markets integration. The method used are the cointegration dynamic using panel data to capture the relationship in short run and long run financial indicators among ASEAN countries. As we know the VECM was introduced by Engle and Granger (1987). The advantage of VECM are 1) to know the short run and long run effects from particular economic or financial shock, 2) To solve the time series data that it's not stationary and spurious regression, (Kostov and Lingard; 2000). Even though this model has a lot advantage but it also got some limitations. Gujarati (2003) stated that VECM is more concern to forecasting from econometric model and needed some restriction like co integration condition among variable.

The study on integration is importance due to give some implication in international investment and monetary policy decision. Investors and policy makers are interested to economy integration because when financial markets integrated, investors could easy to diversify the investment to get the best portfolio formation in term of expected return and risk. The other hand if financial market integrated there is possibility investors will get zero profit cause the movement of price or value of the asset will similarly. Regards to monetary policy, economy integration would give signal for monetary policy maker to manage the economy especially in term of fund flow management, interest rate policy and money supply policy. Opposite with that, if financial market is not integrated would give advantage to investment diversification due to investor would get profit through arbitrage mechanism.

The rest of this paper is organized as follows. Section 2 will discuss the basic to extended theory in economy integration as well as financial market integration. Section 3 will discuss data and methodology that will be employed to support the objective of the research with some consideration regards with weaknesses and leading of the particular method. Section 4 will discuss empirical finding throughout descriptive and inference statistical analysis. Finally section 5 is conclusion for the finding and implication.

1. Literature Review

Study the economy integration usually employs some basic concept. First, the law of one price state that any financial instrument with the same level of risks should be equally in price. Based on this idea, every country should be focused on production their own advantages. In a goods market context, according to LoOP the identical asset trade in different country and the same time should coated in the same price. An idea of the law of one price is the foundation for PPP which state the relationship the exchange rate and price level in two countries. Cassel (1918) PPP, the purchasing power of one unit of a currency should be the same in the two countries due to spot exchange rate will equate the national price level in the two countries.

Second, the term structure of interest rate depicts the short run, medium and long run interest rate. There are three basic theories; liquidity preference, market segmentation and unbiased expectation that underlying the term structure of interest rate. Two key variables in term structure are inflation and Treasury bill. Interest rate parity (IRP) state that expected return of domestic financial asset should equate with expected return of foreign financial asset if there is no arbitrage process and exchange currency market in equilibrium.

Third, the CAPM introduced by Markowitz (1952), and continued by Sharpe (1964) and Lintner (1965). It explains the relationship between risky asset and their expected return to determine the asset's price. The theory state that an investor should take account two risk in investment decision: risk free rate and assets premium. In line with the price, the higher risk will take higher expected return than the price will counted the lower price, vice versa. In an international finance contact, if PPP is hold, a financial asset with the same risk characteristic should be stated with the same price. Ross (1976) extended the asset pricing theory by CAPM with introducing the APT (arbitrage pricing theory). If CAPM priced the asset based on asset risk premium that generated from the best one portfolio asset in the market than we call a single index, APT extended this idea with priced an asset with multiple index. Usually the multiple indexes are generated from macroeconomic variables or factors.

Fourth, the option pricing model, Black and Scholes (1973) introduced the financial modeling, how to price the derivative financial assets like option. Now the model we call as Black Scholes equation. The basic idea of the theory is to hedge the particular asset by buying and selling the underlying asset in just the right way and definitely to eliminate risk. Merton (1973) continued this work to derive the option pricing model from basic idea Black Schole equation.

Meanwhile associated with the measurement techniques used to see and test the process and the level of integration of an economy it is no simple, complex and very spacious. Some authors suggest several methods according to the objectives they want to find in their research. Naranjo and Protopapadakis (1997), Baele et al (2007), they used the asset pricing model. Bartram et al (2004) Kim et al (2005), Chambet and Gibson (2008), Yong Fu et al (2011) they used GARCH and its variance. Others researchers used VECM and co integration model Baharumshah et al (2007), Raj and Dhal (2008), Phuan et al (2009) and, Bernholz and Kugler (2011).

In USA financial market there are some researchers concern on the financial integration issue. Naranjo and Protopapadakis (1997), they used multy factor asset pricing model (APT) to asses the financial integration at fixed and time varying model and sample three major capital market (NYSE, NASDAQ and AMEX). They created the contradictive issue in previous integration result, their argument is the previous study didn't apply the benchmark to compare the level of integration, the result of just stated a statistic significancy of the model. They found is reject the integration of NYSE, NASDAQ and AMEX both fixed and time varying at interval confidence standard.

Similarly, Ayuso and Roberto (2001) analysed whether there has been an increase in the degree of financial market integration during the nineties. But they analysed by using the stochastic discount factor to mesure the market integration and arbitrage. They look at the financial market integration through the composit index, the evidence found suggests that during the nineties there has been an increase of the degree of market integration between stock markets.

Conversely, Alexakis et al (1997), examined the financial market integration look at from real interest rate of EMS and non EMS. Using the standart model of IRP the found that real interest rate integrated within amoung nice EMS countries and non EMS country that participate in the long run. The presence of the EMS along with the associated lower exchange rate volatility, has strengthened the real interest rate parity as compared to the non-EMS case.

Remain in Euro financial market, Kleimeier and Harald Sander (2000), their study was motivated by recent regulatory changes in EU in term of EMS. Using the the same standart theory of UIP, the study investigated the degree of integration in retail lending in six core European Union (EU) countries using co-integration approach and the corresponding error correction model (ECM) methodology. In the pre-break period they could detect integration to a limited level, the evidence for integration weakened in the post-1992 period. This could however reflect a convergence process, particularly with respect to spreads. As European lending rates are not yet fully integrated, the still segmented financial markets pose a challenge for a united monetary policy.

Futhermore, Bartram et al (2004) used a time-varying copula model to investigate the impact of the introduction of the Euro on the dependence between seventeen European stock markets. The model is implemented with a GJR-GARCH-t model for the marginal distributions and the Gaussian copula for the joint distribution, which allows capturing time-varying, non-linear relationships. The results showed that within the euro area, market dependence increased after the introduction of the common currency only for large equity markets and transaction costs remain important barriers to investment in and thus integration of smaller markets.

Continued by Kim et al (2005) examined the influence of the european Monetary Union (EMU) on the dynamic process of stock market integration over the period 1989–2003 using a bivariate EGARCH framework with time-varying conditional correlations. Their found that there has been a clear regime shift in European stock market integration with the introduction of the EMU. Linear systems regression analysis showed that the increase in both regional and global stock market integration over this period was significantly driven in part, by macroeconomic convergence associated with the introduction of the EMU and financial development levels.

Outside of both European and American regions, Phylaktis and Ravazzolo (2002) examined the economic and financial integration simultaneously at the regional and global level for group of Pacific Basin countries by analyzing the covariance excess return on national stock market. They found evidence that economic integration spurred financial integration. Interesting evidence was economic and financial integration were not need free foreign exchange market infrastructure. Their result also explained the transmission shock between PBC's with two block economy, Japan and USA.

There are some issues in regards with effect of financial integration towards macroeconomic volatility and home bias. Using panel data regression models Neaime (2005) examined empirically the impact of regional and international financial integration on macroeconomic volatility in the developing economies of the MENA region over the period 1980–2002. Empirical results indicated that financial openness is associated with an increase in consumption volatility, contrary to the notions of improved international risk-sharing opportunities through financial integration. Baele et al (2007) investigated, what is a financial integration eroded the equity home bias? They set up and compare the observed foreign asset holdings of 25 markets with optimal portfolio weights obtained from five benchmark models. The International CAPM optimal weights equaled the relative world market capitalization shares. Alternative models that allowed for various degrees of mistrust in the I-CAPM and involve returns data in computing optimal weights indicate a substantially lower yet positive home bias. For many countries, home bias decreased sharply at the end of the 1990s, a development which they link to time-varying globalization and regional integration. We can synthesis from the above two researhers that the financial integration need friendly fund flow mobilization policy to support the sound fiscal and monetary policies.

Opposite with other researchers, Claessens and Schmukler (2007) look at from the firm perspective and their participition to support financial Integration. They analyzed firms from various countries raising capital, trading equity, and/or cross-listing in major financial markets. Using a large sample of 39,517 firms from 111 countries covering the period 1989-2000, they found that, although integration increases substantially over this period, only relatively few countries and firms actively participate. Nevertheless, a structural reforms, the development of the domestic financial sector is concern factor, since of the high degree of financial integration is significantly affected towards lower macroeconomic volatility. Besides that the number of financial firms and volume of trading involed and has a importance rule to increase the international financial integration.

Chambet and Gibson (2008) proposed the multivariate GARCH(1,1)-M return generating model due to the previous study on financial integration is not allowing for partial market integration as well as for the pricing of systematic emerging market risk. They found that emerging markets still remain to a large extent segmented and that financial integration has decreased during the financial crises of the 1990s. They found that countries with an undiversified trade structure have more integrated financial markets. Finally, their results suggested that countries less open to trade are more segmented.

In the ASEAN region, Baharumshah et al (2007) examined the dynamic linkage of real interest rate among ASEAN countries using the VECM and co-integration testing. They found that real interest rate among ASEAN countries integrated in the long run and there was a dynamic causality in the short run. It implied that there was inter dependent in monetary policy among ASEAN countries. Beside that they also found that real interest rate parity hold between ASEAN countries and Japan, nor between ASEAN and US. Furthermore, Phuan et al (2009) almost using the same method, argued this integration is result from financial liberalization policy of ASEAN countries. However long run established different stages depend on when the liberalization adopted. Interestingly of the results, the country adopted liberation at the first stage unaffected by others. Even it will have greater influent on other financial markets.

I-W. Yu et al, (2010) broadly state that financial integration has strong implications for financial stability. In fact, financial integration among economies helps to improve their capacity to absorb shocks and increase the development. Thus intensified financial linkages in a world of increasing capital mobility may also stations the risk of cross-border financial contagion. The equity market integration process fluctuated depend on intensity of economic activity. Nevertheless, the process will continue and the degrees of integration between developed and emerging equity markets are different. The divergence may be characterized to the characteristic in the political, economic and institutional aspects across jurisdictions.

The latest investigation on the issues, Bernholz and Kugler (2011) investigated the financial integration in the early modern period in Spain using threshold error correction. They argued that the silver and gold currencies offered arbitrage opportunities between the market for silver and gold as well as foreign exchange. However, transaction cost, which may have been rather substantial in the past, hindered arbitrage and led to a band of "arbitrage inactivity" for the exchange rate around its par value. They found that there was little deviation between two market places in the early modern and larger deviation in Medina del Compo. Furthermore, Yong Fu et al (2011) analyzed volatility transmission and asymmetric linkages between the stock and foreign exchange markets. In contrast with the existing literature by using industrial level data and applied the trivariate Baba, Kraft and Kroner-generalized autoregressive conditional heteroscedasticity (BEKK-GARCH) model. Both results of these research gave the same view that modern financial market has a small deviation due to the transaction costs are small, the barriers on the market was decreasing, the faster the flow of assets and liquidity high. Finally that news shock in of a financial market affect for volatility of other market but asymmetric effects.

2. Methodology and data

2.1 Research Model

In this section, the time series estimations are utilized to measure the long run integration between return and interest rate for each country. Therefore in order to determine the financial market integration in the ASEAN Countries, the OLS regression equations can be shown through estimation model as follows:

$$R_{it} = \beta_j + \beta_j R^*_{it} + \beta_j I^*_{it} + e_t \quad (1a)$$

$$I_{it} = \beta_j + \beta_j R^*_{it} + \beta_j I^*_{it} + u_t \quad (1b)$$

Which R refer to return of country i at time t, R* is return of other country, I is interest rate of country i at time t, I* is interest rate of other country, e is an error term for return equation and u is an error term for interest rate equation.

2.2 Unit Root Test

Normally, unit root test is used to determine stationarity and this test can be explained using following equation:

$$Y_t = \rho Y_{t-1} + \mu_t \quad (2)$$

where, μ_t is error variable and fulfil all Ordinary Least Square (OLS) assumption that is zero min, constant variances (σ^2) and non auto-colerated. This type of error normally is known as white noise error term. Then, OLS is run on equation (2) above. If value ρ=1, we can say that stochastic variable Y_t has nonstationary problem. To solve this problem, differentiation on the variable must be done until it become stationary.

Hypothesis involved in this test is H_0: $\rho = 1$ (*nonstationary*) and H_1: $\rho \neq 1$ (*stationary*). According to this hypothesis, statistic value used is known as τ. While critical value is the same with what being prepared by Fuller (1976). It is also known as MacKinnon critical value. If statistical τ value is bigger than MacKinnon critical value, H_0 will be rejected. This means that the time series is stationary. Otherwise, if statistical τ value is smaller than MacKinnon critical value, then H_0 will not be substracted. This means that time series is non-stationary and first order differentiation should be done.

In order to determine integrated degree for each time series, we applied two sets of unit root tests to the data; the Augmented Dickey-Fuller test and the semi nonparametric Phillips-Perron test**.**

The Augmented Dickey Fuller Test (ADF) which was introduced by Said and Dickey (1984) can be shown by the following equations:

$$\Delta Y_t = \beta_0 + \beta_1 Y_{t-1} + \sum_{i=1}^{L} \delta_i \Delta Y_{t-i} + \nu_t \quad (3a)$$

$$\Delta Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 T + \sum_{i=1}^{L} \delta_i \Delta Y_{t-i} + \varepsilon_t \quad (3b)$$

Whereas, ΔY_t is first differentiation for time series Y_t which is $(Y_t - Y_{t-1})$. β_0 is intercept, ν_t and ε_t are errors term. T is time flow trend and *i* refer to lag period from 1 to L. To ensure that the error term for each of the above equation is only white noise; optimum lag length period should be fixed. Optimum lag length can be fixed using Akaike Information Criteria (AIC) proposed by Akaike (1997). The formula for AIC is as follows:

$$AIC = \sigma^2 \exp\left[2S/N\right] \quad (4)$$

where, σ^2 is variance for residual sum of square. S is number of variables in the right hand side of the equation including intercept and N is sample size. Null hypothesis that involved to test equations (3a) and (3b) is Y_t series that include non-stationary unit factor that is H_0: $Y_t = 1$ and alternative hypothesis is Y_t series that does not includes stationary factor unit, that is H_1: $Y_t \neq 1$. Null hypothesis will be rejected if β_1 is negative and significant. Acceptance or rejection of H_0 is based on tau statistical value as previously mentioned in current study. Critical value for this test is used from Fuller (1976).

Second, the Philip-Perron Test (PP) can also confirm integration degree for each time series. Introduced by Philips and Perron (1988), PP test involves the following equations:

$$\Delta Y_t = u_1 + \alpha_1 Y_{t-1} + \varepsilon_t \quad (5a)$$

$$\Delta Y_t = u_1 + \alpha_1 Y_{t-1} + \alpha_2 t + \varepsilon_t \quad (5b)$$

where, ΔY_t is Y series first differentiation and t is time trend. In equation (5a), to be stationary the tau statistical value ($\tau_{\alpha\mu}$) must be negative and significant and differs from zero. For Y_t to be stationary in equation (5b), tau statistic ($\tau_{\alpha\tau}$) must be negative and significant and differ from zero. For this PP test, critical value is obtained from MacKinnon (1991).

2.3 Co integration Tests

After the stationary test, the next step is to determine cointegration or long run integration between variables involved – stock return and interest rate for each country. Cointegration test was introduced by Johansen and Juselis (1990) to study long run relation between variables. Gonzalo (1994) viewed this Johansen method as the best.

Based on Nur Azura et al. (2009), the result from Johansen test is obtained with respect of special characteristic of time series for data involved. This method also gives estimation for all cointegration vectors that exist in a time series system and suitable statistic test. Beside, Johansen method also enables a hypothesis test to be done on coefficient in cointegration vector. The equation drawn will be as follows:

$$\Delta Y_t = \prod Y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta Y_{t-i} + BX_t + \varepsilon_t \quad (6)$$

Where, $\prod = \sum_{i=1}^{p} A_i - I, \Gamma_i = -\sum_{j=i+1}^{p} A_j$, Y_t is a k-vector of non-stationary I(1) variables, X_t is a d-vector of deterministic variables, and ε_t is vector of white noises with zero mean and finite variance. The number of cointegrating vectors is represented by the rank of the coefficient matrix Π. Johansen's method is to estimate the Π matrix in an unrestricted form, then test whether one can reject the restrictions implied by the reduced rank of Π. The likelihood ratio (LR) test for the hypothesis that there are at most r cointegration vectors is called the trace test statistic. It is to be noted that the variables under consideration should have identical orders, and in particular are integrated of order one (Engle and Granger, 1987). Testing for cointegration of the type CI(d,b) for b<d are not of primary interest, since for b<d the cointegrating vector is not stationary and does not have a straightforward economic interpretation (Charemza and Deadman, 1997).

2.4 Description of Data

Time series monthly data were collected for a period of December 1991 to November 2011 from Thomson Data Stream. The variables for the raw data are Composite Indexes, CPI and interest rate (interbank interest rate). From the raw data then we defined the real interest rate and stock return. The frequency of time series is in monthly. All time series data covered ASEAN Countries that consists of Malaysia, Singapore, Indonesia, Thailand and Philippine.

3. Results

3.1 OLS Regression

The basic equations for this study are the stock return and real interest rate equations. Each equation will determine the integration between stock return/real interest rate of country i with the stock return/real interest rate and real interest rate/stock return for other countries. Referring to the regression model formation in equation (1a) and (1b), Table 1 shows the OLS regression result.

Table 1: OLS Regression Result for Equation (1a)

	RI	RM	RP	RS	RT
RI		0.146**	0.225*	0.166*	0.278*
		(2.267)	(3.784)	(3.761)	(4.091)
RM	0.149**		0.237*	0.001***	0.207*
	(2.250)		(3.990)	(0.016)	(2.984)
RP	0.268*	0.268*		0.082**	0.402*
	(3.901)	(3.958)		(1.675)	(5.676)
RS	0.358*	0.003***	0.145**		0.175**
	(3.862)	(0.033)	(1.655)		(1.732)
RT	0.239*	0.172*	0.306*	0.069***	
	(4.016)	(2.875)	(5.738)	(1.628)	
II		0.013***	-0.043***	0.008***	0.069***
		(0.315)	(-0.937)	(0.236)	(1.304)
IM	0.052***		0.042***	-0.026***	-0.455**
	(0.229)		(0.168)	(-0.142)	(-1.808)
IP	-0.093***	0.213**		-0.055***	0.151***
	(-0.875)	(2.050)		(-0.776)	(1.413)
IS	-0.593***	-0.064***	0.081***		-0.649**
	(-1.590)	(-0.171)	(0.240)		(-1.664)
IT	0.078***	-0.241**	0.085***	0.040***	
	(0.611)	(-2.175)	(0.750)	(0.460)	
Constant	2.110**	-0.654***	-0.090***	0.177***	0.290***
	(2.024)	(-0.696)	(-0.113)	(0.244)	(0.268)
R^2	0.474	0.369	0.509	0.234	0.520
F	26.035	16.902	29.924	8.821	31.273
D.W	2.164	2.406	2.263	1.890	2.217

*,**,*** denotes 1%, 5% and 10% significant level.

Table 1 shows the OLS regression result for 5 models which the stock return of Indonesia as the endogenous variable (Model 1), stock return for Malaysia as endogenous variable (Model 2), stock return for Philippines as endogenous variable (Model 3), stock return of Singapore as endogenous variable (Model 4) and stock return of Thailand as endogenous variable (Model 5). From the R^2 and Durbin Watson value, the result shows that the variables are in non-stationary state.

Table 2: OLS Regression Results for Equation (1b)

	II	IM	IP	IS	IT
RI		0.015	-0.033	-0.017	0.008
		(0.964)	(-0.822)	(-1.515)	(0.252)
RM	0.015		0.083**	-0.002	-0.067**
	(0.173)		(2.091)	(-0.141)	(-2.000)
RP	-0.122	0.002		0.005	0.015
	(-1.335)	(0.111)		(0.392)	(0.449)
RS	0.008	-0.007	-0.066		0.001
	(0.069)	(-0.296)	(-1.132)		(0.019)
RT	0.068	-0.018	0.061***	-0.013	
	(0.863)	(-1.221)	(1.711)	(-1.250)	
II		0.099*	0.027	-0.020**	-0.037
		(9.704)	(0.896)	(-2.311)	(-1.450)
IM	2.918*		-0.108	0.084***	1.012*
	(9.641)		(-0.645)	(1.793)	(8.400)
IP	0.137	-0.017		0.079*	0.258*
	(0.972)	(-0.681)		(4.464)	(5.037)
IS	-1.084**	0.166***	1.022*		0.747*
	(-2.187)	(1.814)	(4.542)		(4.000)
IT	-0.243*	0.229	0.386*	0.085*	
	(-1.425)	(8.367)	(5.109)	(3.914)	
Constant	-0.065*	1.621	5.751*	0.275	-2.087*
	(-0.047)	(6.972)	(10.873)	(1.510)	(-4.022)
R^2	0.341	0.560	0.323	0.353	0.534
F	14.923*	36.732*	13.801*	15.754*	33.057*
D.W	0.248	0.363	1.310	1.155	0.729

*,**,*** denotes 1%, 5% and 10% significant level.

Table 2 shows the OLS regression result for 5 models which the real interest rate of Indonesia as the endogenous variable (Model 6), real interest rate for Malaysia as endogenous variable (Model 7), real interest rate for Philippines as endogenous variable (Model 8), real interest rate for Singapore as endogenous variable (Model 9) and real interest rate of Thailand as endogenous variable (Model 10). From the R^2 and Durbin Watson value, the result shows that the variables are in non-stationary state. This is normal and often occurred in time series data. Therefore, to solve this problem, stationary test should be carried out to identify the stationarity of the data. In model prediction that uses time series data, unit root test needs to be done to each variable to identify non-stationary problem. Stationarity for each variable should be determined to avoid spurious regression problem and the variables stationarity is determined using Augmented Dickey Fuller (ADF) test introduced by Said and Dickey (1984) and Philip-Perron (PP) test introduced by Philips and Perron (1988).

3.2 Unit Root Test

Appendix 1 and 2 summarize the outcome of the ADF and PP tests on all variables in this study. The null hypothesis tested is that the variable under investigation has a unit root against the alternative that it does not. In each case, the lag-length is chosen using the Akaike Information Criterion (AIC). In the first half of Table 3 and Table 4, the null hypothesis that each stock return variable has a unit root can be rejected by both ADF and PP tests. While in the second half of Table 3 and Table 4, the real interest rate variables for each country are stationary at I(0), both ADF and PP tests reject the null hypothesis. Since the data appear to be stationary by applying the ADF and PP tests in level form, no further tests are performed. We, therefore, maintain the null hypothesis that each variable is stationary at level.

3.3 Cointegration Test

The results of Johansen VAR cointegration procedure are reported in Appendix 3 for stock return of Indonesia, Appendix 4 for stock return of Malaysia, Appendix 5 for stock return of Philippines, Appendix 6 for stock return of Singapore, Appendix 7 for stock return of Thailand, Appendix 8 for real interest rate of Indonesia, Appendix 9 for real interest rate of Malaysia, Appendix 10 for real interest rate of Philippines, Appendix 11 for real interest rate of Singapore and Appendix 12 for real interest rate of Thailand.

The results of testing for the number of cointegrating vectors are reported in Appendix 3-14, which presents both the maximum-eigenvalue $(\lambda_{Max-eigen})$ and the trace statistics (λ_{Trace}). The multivariate cointegration finding shows, both maximum-eigenvalue and trace test statistics exists at least 8 cointegrating vectors at 5% significance level. Appendix 3 to Appendix 7 shows that exists long run relationship between stock return of each country (namely; Indonesia, Malaysia, Philippines, Singapore and Thailand) with stock return and real real interest rate of other countries. While for the real interest rate equations, Appendix 8 to appendix 12 shows that the null hypothesis of no cointegration can be rejected and at least 8 variables are cointegrated. This clearly shows that, there is long-run relationship between the variables in this study and the relationship may be appearing in the short-run. In the long run, the stock returns of each country are integrated with the stock return and real interest rate of other country within the ASEAN region. While for the real interest rate equations, in the long run, the real interest rate of each country are integrated with the real interest rate and stock return of other country within the ASEAN region.

Based on the cointegration results, the next step is to test the short-run integration between variables in the stock return and real interest rate equations. Table 3 shows the ECT coefficients for each equation that provides evidence of an error correction mechanism are negative except for stock return of Malaysia.

Based on Table 3, the RI result shows that the stock return of Indonesia is depend on the stock return of Malaysia. Positive integration is reported for both variables. While for RM, the variability of RM are depends on the signal from RI, RP and IP. RI and RP can influence RM positively, but for IP the relationship is significantly negative at 1% significance level. In the RT equation, the significant variables that affect the stock return of Thailand are RI and II. While for the real interest rate equations, only the stock return of Thailand can influence the real interest rate of Indonesia. For Malaysia, the real interest rate equation result shows that RP and RT are significant at 5% and 1% significance level respectively. An increase in RP and RT will decrease the real interest rate of Malaysia. In the IP, the significant variables that affect IP are RI and IT. In the IS equation result shows that the relationship between RI and IS are positive, while the relationship between IP and IS is negative with 1% significance level for both variables. For the IT equation results, only stock return of Indonesia can influence the real interest rate of Thailand positively.

Table 3: VECM Results

Dependent variable	RI	RM	RP	RS	RT	II	IM	IP	IS	IT	ECT (e1,t-1) t value
						Lag Length = 1					
						AIC = 49.0580					
RI		0.2345***	0.1215	-0.0608	-0.0965		0.0042	-0.0409	0.0038	0.0028	-8.6666***
						AIC =51.8271					
RM	0.1656***		0.1738***	0.0272	0.1672	-0.0141		-0.0740***	-0.0126	-0.0073	2.3746***
						AIC =48.6505					
RP	0.0522	-0.0615		-0.0078	-0.0464	-0.0314	-0.0003		-0.0021	0.0146	-4.1321***
						AIC =51.210					
RS	-0.2198	0.1146	0.0974		0.2009	0.0460	-0.0102	0.0158		-0.0021	-1.9006
						AIC = 50.0070					
RT	-0.3329***	-0.0503	-0.1241	0.0154		0.0775*	-8.83E-05	0.0309	0.0004		-0.5683
						AIC =47.3190					
II		0.5168***	0.3394	0.0704	0.6574***		-0.0085	-0.0115	-0.0099	0.0431	0.1838
						AIC = 47.2027					
IM	-1.4890		-1.7371**	0.0841	-3.1343***	0.5886		0.2542	-0.0030	0.0548	-0.0425
						AIC = 47.2053					
IP	0.4391***	0.0810		-0.0297	0.2447	0.0692	0.0095		0.0100	0.0756***	-2.2966
						AIC =47.9190					
IS	-1.7651***	-0.0604	0.1892		-0.4737	0.1762	-0.0058	-0.6521***		0.1818	-2.4019*
						AIC = 46.977					
IT	0.7350***	0.2673	0.1090	0.0679		0.0786	0.0242	-0.0314	0.0064		0.8416

As explained by Rosilawati, Abu Hassan Shaari & Ismadi (2007) a positive ECT indicates that the endogenous variables are adjusted in the long run but their values are too high to be in equilibrium.

Therefore, for the case of RM as the endogenous variable, the positive ECT indicates that RM divert from the long run equilibrium steady state. While for RI, RP, RS, IP, and IS shows that the variables are convergence to the long run equilibrium and explain the short-run integration between variables in the RI, RP, RS, IP and IS equations.

4. Conclusion

This study empirically proves that there is a long run and short run relationship/integration within the ASEAN region in the movement of stock return and real interest rate. Therefore, in the short run, the investors' behaviour is based on the signal of stock return and real interest rate of other countries within the ASEAN region. While in the long run, the government policy should take into account the market integration for economic planning, especially in financial market. The study on integration is importance due to the implication to the international investment and monetary policy decision. Investors and policy makers are interested to economy integration because when financial markets integrated, investors could easy to diversify the investment to get the best portfolio formation in term of expected stock return and risk. The other hand if financial market integrated there is possibility investors will get zero profit cause the movement of price or value of the asset will similarly. Regards to monetary policy, economy integration would give signal for monetary policy maker to manage the economy especially in term of fund flow management, real interest rate policy and money supply policy. Opposite with that, if financial market is not integrated would give advantage to investment diversification due to investor would get profit through arbitrage mechanism.

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Appendix 1: ADF Unit Root Test Result

Variable	Augmented Dicker Fuller	
	I(0)	**I(1)**
Stock return of Indonesia		
Without Intercept	-13.02507*	-12.22734*
Intercept	-13.34767*	-12.20042*
Trend and Intercept	-13.32763*	-12.17362*
Stock return of Malaysia		
Without Intercept	-9.236011*	-13.34659*
Intercept	-9.343961*	-13.31686*
Trend and Intercept	-9.325275*	-13.28727*
Stock return of Phillipine		
Without Intercept	-14.16192*	-10.58955*
Intercept	-14.29130*	-10.56737*
Trend and Intercept	-14.25963*	-10.55001*
Stock return of Singapore		
Without Intercept	-13.24158*	-15.77519*
Intercept	-13.23855*	-15.74064*
Trend and Intercept	-13.24218*	-15.70491*
Stock return of Thailand		
Without Intercept	-15.00291*	-11.36804*
Intercept	-15.02848*	-11.34235*
Trend and Intercept	-15.00139*	-11.31742*
Real interest rate of Indonesia		
Without Intercept	-1.774247***	-16.87284*
Intercept	-2.490429	-16.83805*
Trend and Intercept	-2.489102	-16.81968*
Real interest rate of Malaysia		
Without Intercept	-1.202011	-17.46312*
Intercept	-2.777402***	-17.43290*
Trend and Intercept	-3.045124	-17.43112*
Real interest rate of Phillipine		
Without Intercept	-1.577410	-15.21504*
Intercept	-2.645449***	-15.20436*
Trend and Intercept	-11.97670*	-15.16639*
Real interest rate of Singapore		
Without Intercept	-1.931480***	-12.96940*
Intercept	-2.528044	-12.96049*
Trend and Intercept	-4.514849**	-12.93229*
Real interest rate of Thailand		
Without Intercept	-2.069790**	-21.27862*
Intercept	-2.619881***	-21.24233*
Trend and Intercept	-2.906308	-21.20881*

*,**,*** denotes 1%, 5% and 10% significant level

*,**,*** denotes 1%, 5% and 10% significant level.

Appendix 2: PP Unit Root Test Result

Variables	Phillips Perron (PP)	
	I (0)	I (1)
Stock return of Indonesia		
Without intercept	-12.94857*	-86.97636*
Intercept	-13.34767*	-86.69500*
Trend and intercept	-13.32763*	-86.78776*
Stock return of Malaysia		
Without intercept	-13.70878*	-143.1244*
Intercept	-13.78462*	-142.6975*
Trend and intercept	-13.75797*	-143.7077*
Stock return of Phillipine		
Without intercept	-14.18194*	-116.8137*
Intercept	-14.29728*	-116.5945*
Trend and intercept	-14.26586*	-120.9887*
Stock return of Singapore		
Without intercept	-13.38635*	-50.82601*
Intercept	-13.38204*	-50.68148*
Trend and intercept	-13.37366*	-50.52308*
Stock return of Thailand		
Without intercept	-15.00240*	-113.9356*
Intercept	-15.02848*	-113.8571*
Trend and intercept	-15.00139*	-114.7914*
Real interest rate of Indonesia		
Without intercept	-1.646456***	-16.92888*
Intercept	-2.390312	-16.89315*
Trend and intercept	-2.385462	-16.87762*
Real interest rate of Malaysia		
Without intercept	-1.077140	-17.46896*
Intercept	-2.633841***	-17.43875*
Trend and intercept	-2.883489	-17.43112*
Real interest rate of Phillipine		
Without intercept	-5.518003*	-59.10417*
Intercept	-7.374961*	-59.64063*
Trend and intercept	-12.07879*	-58.87119*
Real interest rate of Singapore		
Without intercept	-3.752385*	-63.46640*
Intercept	-7.252445*	-85.25212*
Trend and intercept	-9.399398*	-84.54337*
Real interest rate of Thailand		
Without intercept	-2.209761**	-21.48382*
Intercept	-3.007351**	-21.44967*
Trend and intercept	-3.532026**	-21.41173*

Appendix 3: Johansen and Juselius Cointegration Result for Stock return of Indonesia

Null Hypothesis	Max-eigenvalue	$\lambda_{Max\text{-}eigen}$	C.V=0.05
r=0	0.498169	164.0991	58.43354
r≤1	0.473690	152.7637	52.36261
r≤2	0.412044	126.4024	46.23142
r≤3	0.352389	103.4025	40.07757
r≤4	0.284717	79.74845	33.87687
r≤5	0.226154	61.01915	27.58434
r≤6	0.159070	41.23289	21.13162
r≤7	0.073668	18.21229	14.26460
r≤8	0.016994	4.079342	3.841466
Null Hypothesis	Max-eigenvalue	λ_{trace}	C.V=0.05
r=0	0.498169	750.9598	197.3709
r≤1	0.473690	586.8607	159.5297
r≤2	0.412044	434.0970	125.6154
r≤3	0.352389	307.6946	95.75366
r≤4	0.284717	204.2921	69.81889
r≤5	0.226154	124.5437	47.85613
r≤6	0.159070	63.52452	29.79707
r≤7	0.073668	22.29164	15.49471
r≤8	0.016994	4.079342	3.841466

Appendix 4: Johansen and Juselius Cointegration Result for Stock return of Malaysia

Null Hypothesis	Max-eigenvalue	$\lambda_{Max\text{-}eigen}$	C.V=0.05
r=0	0.495504	162.8384	58.43354
r≤1	0.478184	154.8050	52.36261
r≤2	0.406515	124.1750	46.23142
r≤3	0.330643	95.54203	40.07757
r≤4	0.283310	79.28057	33.87687
r≤5	0.219290	58.91736	27.58434
r≤6	0.166325	43.29500	21.13162
r≤7	0.066412	16.35526	14.26460
r≤8	0.048947	11.94410	3.841466
Null Hypothesis	Max-eigenvalue	λ_{trace}	C.V=0.05
r=0	0.495504	747.1526	197.3709
r≤1	0.478184	584.3143	159.5297
r≤2	0.406515	429.5093	125.6154
r≤3	0.330643	305.3343	95.75366
r≤4	0.283310	209.7923	69.81889
r≤5	0.219290	130.5117	47.85613
r≤6	0.166325	71.59436	29.79707
r≤7	0.066412	28.29936	15.49471
r≤8	0.048947	11.94410	3.841466

Appendix 5: Johansen and Juselius Cointegration Result for Stock return of Philippines

Null Hypothesis	Max-eigenvalue	$\lambda_{Max\text{-}eigen}$	C.V=0.05
r=0	0.493860	162.0643	58.43354
r≤1	0.471111	151.6006	52.36261
r≤2	0.408136	124.8258	46.23142
r≤3	0.309405	88.10808	40.07757
r≤4	0.265635	73.48242	33.87687
r≤5	0.188662	49.75871	27.58434
r≤6	0.107121	26.96641	21.13162
r≤7	0.078359	19.42057	14.26460
r≤8	0.046206	11.25911	3.841466
Null Hypothesis	Max-eigenvalue	λ_{trace}	C.V=0.05
r=0	0.493860	707.4859	197.3709
r≤1	0.471111	545.4217	159.5297
r≤2	0.408136	393.8211	125.6154
r≤3	0.309405	268.9953	95.75366
r≤4	0.265635	180.8872	69.81889
r≤5	0.188662	107.4048	47.85613
r≤6	0.107121	57.64609	29.79707
r≤7	0.078359	30.67968	15.49471
r≤8	0.046206	11.25911	3.841466

Appendix 6: Johansen and Juselius Cointegration Result for Stock return of Singapore

Null Hypothesis	Max-eigenvalue	$\lambda_{Max\text{-}eigen}$	C.V=0.05
r=0	0.500185	165.0571	58.43354
r≤1	0.479087	155.2170	52.36261
r≤2	0.415859	127.9518	46.23142
r≤3	0.331114	95.70962	40.07757
r≤4	0.250214	68.53626	33.87687
r≤5	0.212421	56.83246	27.58434
r≤6	0.087763	21.86166	21.13162
r≤7	0.073330	18.12551	14.26460
r≤8	0.050081	12.22809	3.841466
Null Hypothesis	Max-eigenvalue	λ_{trace}	C.V=0.05
r=0	0.500185	721.5195	197.3709
r≤1	0.479087	556.4624	159.5297
r≤2	0.415859	401.2454	125.6154
r≤3	0.331114	273.2936	95.75366
r≤4	0.250214	177.5840	69.81889
r≤5	0.212421	109.0477	47.85613
r≤6	0.087763	52.21526	29.79707
r≤7	0.073330	30.35360	15.49471
r≤8	0.050081	12.22809	3.841466

Appendix 7: Johansen and Juselius Cointegration Result for Stock return of Thailand

Null Hypothesis	Max-eigenvalue	$\lambda_{Max-eigen}$	C.V=0.05
r=0	0.497789	163.9187	58.43354
r≤1	0.477033	154.2804	52.36261
r≤2	0.421196	130.1365	46.23142
r≤3	0.326479	94.06631	40.07757
r≤4	0.275382	76.66242	33.87687
r≤5	0.222301	59.83687	27.58434
r≤6	0.082453	20.48024	21.13162
r≤7	0.061396	15.08000	14.26460
r≤8	0.032998	7.986108	3.841466
Null Hypothesis	Max-eigenvalue	λ_{trace}	C.V=0.05
r=0	0.497789	722.4475	197.3709
r≤1	0.477033	558.5288	159.5297
r≤2	0.421196	404.2484	125.6154
r≤3	0.326479	274.1119	95.75366
r≤4	0.275382	180.0456	69.81889
r≤5	0.222301	103.3832	47.85613
r≤6	0.082453	43.54635	29.79707
r≤7	0.061396	23.06611	15.49471
r≤8	0.032998	7.986108	3.841466

Table 8: Johansen and Juselius Cointegration Result for Real interest rate of Indonesia

Null Hypothesis	Max-eigenvalue	$\lambda_{Max-eigen}$	C.V=0.05
r=0	0.478926	155.1433	58.43354
r≤1	0.413064	126.8159	52.36261
r≤2	0.343275	100.0766	46.23142
r≤3	0.292632	82.39664	40.07757
r≤4	0.234753	63.67841	33.87687
r≤5	0.198122	52.55016	27.58434
r≤6	0.082374	20.45973	21.13162
r≤7	0.075749	18.74760	14.26460
r≤8	0.043124	10.49144	3.841466
Null Hypothesis	Max-eigenvalue	λ_{trace}	C.V=0.05
r=0	0.478926	630.3597	197.3709
r≤1	0.413064	475.2164	159.5297
r≤2	0.343275	348.4005	125.6154
r≤3	0.292632	248.3240	95.75366
r≤4	0.234753	165.9273	69.81889
r≤5	0.198122	102.2489	47.85613
r≤6	0.082374	49.69877	29.79707
r≤7	0.075749	29.23904	15.49471
r≤8	0.043124	10.49144	3.841466

Appendix 9: Johansen and Juselius Cointegration Result for Real interest rate of Malaysia

Null Hypothesis	Max-eigenvalue	$\lambda_{Max\text{-}eigen}$	C.V=0.05
r=0	0.488490	159.5523	58.43354
r≤1	0.421863	130.4107	52.36261
r≤2	0.372495	110.9090	46.23142
r≤3	0.291970	82.17396	40.07757
r≤4	0.227709	61.49789	33.87687
r≤5	0.187817	49.51116	27.58434
r≤6	0.080993	20.10180	21.13162
r≤7	0.073738	18.23043	14.26460
r≤8	0.046795	11.40627	3.841466
Null Hypothesis	Max-eigenvalue	λ_{trace}	C.V=0.05
r=0	0.488490	643.7935	197.3709
r≤1	0.421863	484.2412	159.5297
r≤2	0.372495	353.8305	125.6154
r≤3	0.291970	242.9215	95.75366
r≤4	0.227709	160.7475	69.81889
r≤5	0.187817	99.24965	47.85613
r≤6	0.080993	49.73849	29.79707
r≤7	0.073738	29.63670	15.49471
r≤8	0.046795	11.40627	3.841466

Appendix 10: hansen and Juselius Cointegration Result for Real interest rate of Philippines

Null Hypothesis	Max-eigenvalue	$\lambda_{Max\text{-}eigen}$	C.V=0.05
r=0	0.491738	161.0684	58.43354
r≤1	0.465614	149.1396	52.36261
r≤2	0.348183	101.8620	46.23142
r≤3	0.292804	82.45461	40.07757
r≤4	0.230832	62.46211	33.87687
r≤5	0.189084	49.88251	27.58434
r≤6	0.079023	19.59212	21.13162
r≤7	0.071038	17.53768	14.26460
r≤8	0.045526	11.08949	3.841466
Null Hypothesis	Max-eigenvalue	λ_{trace}	C.V=0.05
r=0	0.491738	655.0885	197.3709
r≤1	0.465614	494.0201	159.5297
r≤2	0.348183	344.8805	125.6154
r≤3	0.292804	243.0185	95.75366
r≤4	0.230832	160.5639	69.81889
r≤5	0.189084	98.10181	47.85613
r≤6	0.079023	48.21929	29.79707
r≤7	0.071038	28.62717	15.49471
r≤8	0.045526	11.08949	3.841466

Appendix 11: Johansen and Juselius Cointegration Result for Real interest rate of Singapore

Null Hypothesis	Max-eigenvalue	$\lambda_{Max\text{-}eigen}$	C.V=0.05
r=0	0.481763	156.4429	58.43354
r≤1	0.456414	145.0770	52.36261
r≤2	0.409300	125.2942	46.23142
r≤3	0.321325	92.25174	40.07757
r≤4	0.258136	71.06421	33.87687
r≤5	0.188805	49.80064	27.58434
r≤6	0.078570	19.47511	21.13162
r≤7	0.072477	17.90649	14.26460
r≤8	0.045920	11.18793	3.841466
Null Hypothesis	Max-eigenvalue	λ_{trace}	C.V=0.05
r=0	0.481763	688.5003	197.3709
r≤1	0.456414	532.0574	159.5297
r≤2	0.409300	386.9804	125.6154
r≤3	0.321325	261.6861	95.75366
r≤4	0.258136	169.4344	69.81889
r≤5	0.188805	98.37017	47.85613
r≤6	0.078570	48.56954	29.79707
r≤7	0.072477	29.09443	15.49471
r≤8	0.045920	11.18793	3.841466

Appendix 12: Johansen and Juselius Cointegration Result for Real interest rate of Thailand

Null Hypothesis	Max-eigenvalue	$\lambda_{Max\text{-}eigen}$	C.V=0.05
r=0	0.487283	158.9916	58.43354
r≤1	0.446627	140.8301	52.36261
r≤2	0.340479	99.06551	46.23142
r≤3	0.285493	80.00681	40.07757
r≤4	0.228506	61.74360	33.87687
r≤5	0.189148	49.90146	27.58434
r≤6	0.081178	20.14965	21.13162
r≤7	0.072974	18.03411	14.26460
r≤8	0.044209	10.76133	3.841466
Null Hypothesis	Max-eigenvalue	λ_{trace}	C.V=0.05
r=0	0.487283	639.4841	197.3709
r≤1	0.446627	480.4925	159.5297
r≤2	0.340479	339.6625	125.6154
r≤3	0.285493	240.5970	95.75366
r≤4	0.228506	160.5901	69.81889
r≤5	0.189148	98.84654	47.85613
r≤6	0.081178	48.94508	29.79707
r≤7	0.072974	28.79544	15.49471
r≤8	0.044209	10.76133	3.841466