



## INTEGRATION OF SOUTHEAST ASIAN STOCK MARKETS WITH THE WORLD STOCK MARKET: APPLICATION OF INTERNATIONAL ASSET PRICING MODEL

Muhammad Sofian Maksar<sup>1)</sup>  
Kusdhianto Setiawan<sup>2)</sup>  
Al Asy Ari Adnan Hakim<sup>3)</sup>

Faculty of Islamic Economics and Business, Muhammadiyah University, Kendari

<sup>1)</sup>muhsolianm@gmail.com

<sup>3)</sup>alasyariadnanhakim@febi.umkendari.ac.id

Faculty of Economics and Business, Gadjah Mada University

<sup>2)</sup>s.kusdhianto@ugm.ac.id

### *Abstract*

*This study aims to determine integration level of Southeast Asian stock market with world stock market using an international capital asset pricing model. The countries that were sampled in this study were Indonesia, Malaysia, Philippines, Singapore and Thailand. The sample period starts from January 2000 until August 2016. This study uses an partially-segmented international capital asset pricing model by including assumption of residual that were correlated between asset pricing equations. Because of this assumption, seemingly unrelated regression (SUR) estimation method is more appropriately compared to the ordinary least square (OLS) method. The results of this study indicate that the integration level of Southeast Asian stock market varies. Singapore and Thailand stock markets are fully integrated with world stock market, the Indonesian and Malaysian stock markets are partially integrated with world stock market, while Philippine stock market is segmented with world stock market. This finding shows the difference in effectiveness of stock market liberalization process in Southeast Asia.*

*JEL Code : C39, F15, F36*

*Keyword : Stock Market Integration; Asset Pricing Model; Seemingly Unrelated Regression*

### INTRODUCTION

This time, countries in various parts of the world are establishing more and more economic cooperation with other countries, both bilateral and multilateral. This collaboration is carried out to spur economic growth of the countries involved. This collaboration enables increased trade in goods and services by reducing economic barriers between countries. This collaboration also makes a country liberalize and open their financial markets so that flow of funds from other



countries can enter their financial markets. The process of economic liberalization and more open financial markets have various impacts. One of impacts of this process is integration of stock market. Fratzscher (2002) found empirical evidence that European unification process had increased level of integration, especially in countries that adopted euro currency. Johansson (2010) shows that China has experienced an increase in level of integration with several major financial markets over past decade.

Several studies have found stock market integration. Nasser and Hajilee (2016) found evidence of integration between stock markets in developing countries (Brazil, China, Mexico, Russia and Turkey) with stock markets in developed countries (United States, Britain and Germany). Setiawan (2014) found that integrated stock markets and the law of one price prevail when ignoring heteroscedasticity factors in market returns and market integration imperfections. Whereas, when considering these two factors, the market is only partially integrated. The stock market also becomes more integrated when there is a strong economic crisis or market shock in leading developed countries (Setiawan, 2011).

Unlike research that found stock market integration, several studies found a stock market segmentation. One of reasons is that although intensity of stock market liberalization process is very high, existence of indirect barrier is one of causes so that this effort fails to attract attention of foreign investors (Setiawan, 2014). However, there is a possibility that level of integration will increase in future because of ongoing integration process throughout world.

An integrated stock market will lead to lower capital costs, greater investment opportunities, and higher economic growth and savings through international risk sharing. However, one of negative consequences integrated stock market is shock on a country's stock market may have an impact on stock market of other countries. Bad news from one country indicated by deteriorating economic variables might trigger negative movements in prices or stock returns of other countries. This makes investors have to change way they assess risk of an asset in estimating expected return on a particular stock market. When stock market is integrated, investors must not only rely on domestic indicators, but also must consider economic indicators of other countries.

Husnan (1997) in Murtini and Ekawati (2003) said that market integration has three forms, namely full integration, partial integration between, and segmentation (no integration). International financial market theory states that investors bear common risk and country-specific risk if stock market is fully integrated, but only common risk factors are priced because country-specific risk can be eliminated by international diversification. Conversely, when capital markets are segmented, asset pricing relationships vary from one country to another and the expected return of an asset is determined by local risk factors. In



other words, markets where assets have same expected return regardless of their location are said to be integrated, while markets where assets have an expected return that depends on location are said to be segmented (Karolyi and Stulz, 2002). When capital market is partially integrated, investors face common risk and country-specific risk and must respect both risks. In this case, expected return should be determined by a combination of local and global risks.

Researchs on stock market integration have been widely carried out, both in developed and developing countries. These studies use a variety of methods to determine level of stock market integration. Gerard et al. (2003) found that local risks used in their pricing asset models had no significant effect on return of Thai and Malaysian stock markets. This resulted in stock market of Thailand and Malaysia being said to be fully integrated with world stock market. Carrieri et al. (2007) found that local risk still has strength in explaining stock market returns in developing countries. However, these studies do not consider correlation between residuals in asset pricing. Therefore, this study uses a model developed by Gérard et al. (2003) by considering assumption of a correlation between residuals in asset pricing.

## LITERATURE REVIEW

### Stock Market Integration

The concept of stock market integration is one of center attentions on international finance. Stock market integration is closely related to research on asset pricing. Nasser and Hajilee (2016) suggested that stock market integration is a process in which a country's stock market becomes more integrated with other countries or regional stock markets. Meanwhile, according to Bekaert and Harvey (1995), stock market integration is a condition where asset prices in a country are increasingly determined by global risk factors, in addition to country's own (local) risk factors.

Theoretically, stock market integration has several impacts, both positive and negative. Stock market integration should improve economic and financial efficiency that will lead to higher economic growth, better allocation of capital and other productive resources, dramatically lower transaction costs, and higher risk diversification opportunities (Baele et al., 2004; Mobarek and Mollah, 2015). Besides having a positive impact, financial market integration also has many bad sides. Mobarek and Mollah (2015) suggest that an increase in asset return volatility, financial instability, and contagion effects can be caused by market integration.

Bekaert and Harvey (1995) revealed that research on asset pricing can be classified into three broad categories, namely:



a. Fully-segmented stock market

Initially, research on asset pricing was carried out by assuming that a country's stock market was segmented. The stock market is said to be perfectly segmented if only local risk factors are taken into account in assessing an asset (Arouri et al., 2012). Market segmentation is generally result of three factor groups, namely (i) barriers to direct capital flows, (ii) indirect obstacles, and (iii) world economic conditions (Arouri et al., 2012). Barriers to capital flows directly affect ability of global investors to invest in assets in a particular country, while indirect barriers and global economic conditions affect ability of global investors to invest in these assets.

b. Fully-integrated stock market

The stock market is said to be fully integrated if there are no obstacles to capital flows in and out of and to a country and to have assets in each capital market. In a stock market like this, value of an asset is only determined by global risk factors. Local risk factors are not taken into account because these risk factors can be completely eliminated by diversifying. Full stock market integration is very difficult to occur due to indirect obstacles and also changing world economic conditions. Therefore, to make stock market more integrated, direct obstacles to capital flows must be eliminated.

c. Partially-integrated stock market

The presence of barriers does not necessarily lead to market segmentation, just as obstacles are eliminated which does not necessarily increase market integration (Bekaert et al., 2002). Although direct barriers to international investment are eliminated, indirect obstacles can still deter foreign investors and prevent integration of world stock market. Stulz (2005) suggests that one example of an indirect obstacle involves risk perception based on unconsciousness, expectations of appropriation by government or majority shareholders and markets or institutions that are less developed. Potential economic conditions can also affect level of stock market integration. All of these things cause process of valuing an asset in an integrated market partially to be a little complicated, because it must consider domestic and global risk factors simultaneously.

### Asset Pricing Theory

Every asset, whether tangible or intangible assets, real assets or financial assets, certainly has value. In financial world, value assets can be calculated using asset pricing theory. This theory tries to assess an asset by looking for relationship between risk and expected return of asset. There are two of most famous equilibrium asset pricing models, namely the capital asset pricing model (CAPM) and arbitrage pricing theory (APT).

In a functioning capital market, an investor should be rewarded for accepting the various risks associated with investing in an asset (Drake and Fabozzi, 2010). In general terms, asset pricing models can be expressed as a function of risk factors inherent in an asset, as follows:

$$E(r_i) = f(F_1, F_2, F_3, \dots, F_N) \quad (1)$$

$E(r_i)$  = expected return for asset i  
 $F_k$  = risk factor k  
N = amount of risk factor



Equation (1) can be modified using thought that investors require a minimum return on investment they make. The minimum return required by investors is based on return of a risk-free asset. Returns for assets like this are called risk-free rates. When an investor intends to invest in risky assets, investors will ask for a premium above risk-free rate. So that expected return that investor requires is:

$$E(r_i) = r_f + \text{Risk Premium} \quad (2)$$

$$E(r_i) = r_f + f(F_1, F_2, F_3, \dots, F_N) \quad (3)$$

$r_f$  = risk-free rate

According to Bodie et al. (2014), risk can be divided into two main categories. The first category is a risk that cannot be reduced by diversification. This risk cannot be eliminated in any way. This risk is referred to as systematic risk or risk that cannot be divided (nondiversifiable risk). The second category is risk that can be eliminated by diversification. This risk is a unique risk inherent in an asset and is usually called non-systematic risk or diversifiable risk.

a. Asset pricing when stock market is fully-segmented

Risk can also be divided based on provenance, namely local risk and global risk. The market assumption of full segmentation does not take into account global risks in assessing value of an asset so that expected return is calculated only by considering local risk factors. Asset pricing model for full-segmented stock markets can be written in the following model:

$$E(R_{it}|I_{t-1}) - R_{ft} = \delta_{dt-1} \text{var}(R_{it}|I_{t-1}) \quad (4)$$

where  $\delta_{d,t-1} = E(R_i) - R_{ft}/\sigma_i^2$ , which is local price of a risk. Merton (1980) argues that  $\delta_d$  is a relative measure of investor risk aversion. Equation (4) states that expected return in a segmented market is determined by return variance multiplied by variance price. Variance prices will be determined by relative risk aversion of investors in country i.

b. Asset pricing when stock market is fully integrated

In addition to asset pricing models that use fully-segmented market assumptions, there are also asset pricing models that assume that the stock market is fully integrated. In a market that is assumed to be fully-integrated, expected return of an asset is only determined by global risk factors. Local risk factors are not taken into account because this risk can be eliminated by international diversification. So, asset pricing equation for a fully-integrated stock market can be written as follows:

$$E(R_{it}|I_{t-1}) - R_{ft} = \delta_{mt-1} \text{cov}(R_{it}, R_{mt}|I_{t-1}) \quad (5)$$

where  $\delta_{m,t-1} = E(R_m) - R_{ft}/\sigma_m^2$ , which is global price of risk covariance,  $R_{it}$  is a return on stock market i, and  $R_{mt}$  is a global portfolio return. This equation states that the stock market's expected return is only determined by covariance between market return and global portfolio return and price of covariance.

c. Asset pricing when stock market is partially integrated

Efforts that have been made to eliminate direct obstacles to foreign investment may be able to make a country's stock market no longer fully segmented. However, this does not necessarily result in a country's integrated stock market. Indirect obstacles and global economic conditions prevent full integration. Therefore, several studies assume that stock market is not fully



segmented and also not fully integrated, in other words, a partially-integrated stock market (Errunza and Losq, 1985; Arouri et al., 2012). When the stock market is partially integrated, global risk factors and local risk factors must be considered in assessing an asset. However, local risk factors that are considered only cannot be diversified because there is still market segmentation. The asset pricing equation when partially-integrated stock markets can be written as follows (Gérard et al., 2003):

$$E(R_{it}|I_{t-1}) - R_{ft} = \delta_{mt-1}cov(R_{it}, R_{mt}|I_{t-1}) + \delta_{at-1}var(Res_{it}|I_{t-1}) \quad (6)$$

This equation states that expected market return of country *i* is determined by covariance between return of asset and global portfolio return multiplied by price of covariance and variance of residual return multiplied by price of variance.  $var(Res_{it})$  captures local market risks that cannot be diversified and are not related to global risks. Therefore,

$$var(Res_{it}) = var(R_{it}) - \frac{cov(R_{it}, R_{mt})^2}{var(R_{mt})} \quad (7)$$

### Information Variables

The asset pricing model developed by Gérard, et al. (2003) use a set of information that is expected to affect return of a stock. This collection of information can be divided into global information, for information that comes from outside a country and affects many economies when this information is released, and local information, which comes from within a country and only affects country. Combination of global information variables and local information is used to capture fluctuations in world business cycle and local economic conditions. Information used in this research is information that is easily obtained and is often used by investors to determine price of a stock.

Some studies have identified information that can be used to assess an asset. Global information variables in this study use a lot of economic information from the United States (US). According to Bekaert and Harvey (1995), US economic information is a good predictor of rates of return throughout world. Therefore, global information used to conduct asset pricing in this study is MSCI World Index's Dividend Yield, US Default Spread, US Term Spread, and Eurodollar Deposit Rate.

Other than using a collection of global economic information, some investors also use information that comes from within their investment destination countries, which in this study are called local information. Local information is expected to capture changes in a country's economic conditions. Therefore, this study uses local short term interest rate information variable. This short-term interest rate reflects expectations of country's inflation rate.

### Hypothesis Development

Southeast Asia is one of regions with very rapid economic development. Like other countries in region, countries in Southeast Asia continue to seek cooperation in economic field, both with regional and non-regional countries. Some forms of cooperation involving countries in Southeast Asia are ASEAN, WTO, and CAFTA. These collaborations have resulted in easier flows of goods and services



and capital flows into (out) these countries. This collaboration also requires these countries to liberalize several sectors of the economy. One sector that is often affected by liberalization is stock market. Liberalization of stock market can be achieved by eliminating some obstacles to direct investment for foreign investors so that they can invest in other countries. This liberalization can cause the stock market to be integrated with the world stock market.

Although investment barriers were immediately eliminated, this did not necessarily make the stock market integrated. Indirect investment barriers, such as political risk and the risk of forced seizure of assets can prevent foreign investors from investing in a country (Arouri et al., 2012). Because these Southeast Asian countries have established economic cooperation with many countries, it is likely that stock markets of these countries are integrated with world stock market. However, this integration is not perfectly shaped due to unavoidable local risk factors.

Gerard et al. (2003) found that local risks used in their pricing asset models had no significant effect on return of Thailand and Malaysia stock markets. This resulted in the stock market of Thailand and Malaysia being said to be fully integrated with world stock market. However, Carrieri et al. (2007) found that local risk still has strength in explaining stock market returns in developing countries. Developing country stock market is not fully integrated, only partial integration according to them. Setiawan (2014) tested stock market integration using assumption of a residual correlation between equations. The results of this study indicate that when using this assumption, stock market is only partially integrated.

H1: Stock market of (a) Indonesia, (b) Malaysia, (c) Philippines, (d) Thailand, and (e) Singapore is partially integrated with the world stock market when the correlation between residuals in the equation of asset pricing is considered

## DATA AND RESEARCH METHOD

This study uses five Southeast Asian stock markets, namely Indonesia, Malaysia, Philippines, Singapore and Thailand. Sample period starts from January 2000 to August 2016. Dependent variable in this study is the return of the stock market index of each country. Independent variable consists of MSCI World Index's Dividend Yield, US Default Spread, US Term Spread, Eurodollar Deposit Rate, and Short-term interest rate. The estimation method used in this study is seemingly unrelated regression (SUR). This method is used to overcome residual problem that correlate between asset pricing equations. The asset pricing equation can be written as follows:

$$\begin{aligned} R_{1t} - R_{ft} &= \delta_{mt-1}h_{1m} + \delta_{d1t-1} * q_1 + \varepsilon_{1t} \\ R_{2t} - R_{ft} &= \delta_{mt-1}h_{2m} + \delta_{d2t-1} * q_2 + \varepsilon_{2t} \\ R_{3t} - R_{ft} &= \delta_{mt-1}h_{3m} + \delta_{d3t-1} * q_3 + \varepsilon_{3t} \\ R_{4t} - R_{ft} &= \delta_{mt-1}h_{4m} + \delta_{d4t-1} * q_4 + \varepsilon_{4t} \\ R_{5t} - R_{ft} &= \delta_{mt-1}h_{5m} + \delta_{d5t-1} * q_5 + \varepsilon_{5t} \end{aligned} \quad (7)$$

$\delta_{mt-1}$  is price of global risk, while  $\delta_{dt-1}$  is price of local risk.  $h_{mt}$  is covariance of world's portfolio excess return.  $q_t$  is residual country volatility obtained by



calculating variance of excess returns of each country. Price of global risk is the same as aggregate global risk aversion coefficient, and because most investors are risk averse, price of this risk must be positive (Merton, 1980). Likewise with local market risks. Researcher models price of global and local risks as a nonlinear function of a set of information variables:

$$\begin{aligned}\delta_{mt-1} &= \exp(Z_{mt-1}) \\ \delta_{dt-1} &= \exp(Z_{dt-1})\end{aligned}$$

where  $Z_{mt-1}$  and  $Z_{dt-1}$  is a collection of global and local information variables. The collection of local information variables includes changes in monthly short-term interest rate (SI) of each Southeast Asian country. Global information variables include a constant, MSCI world dividend yield (WDY), US default spread (USDP), US term spread (USTP), and Eurodollar deposit rate (WIR).

Hypothesis testing is done by Wald test. Wald test is conducted to determine whether global and local information variables affect stock market return of a country. An empirical form to test whether global information variables affect stock market return can be written as follows:

$$\begin{aligned}\delta_{imt-1} &= 0, & i = 1, \dots, 5. \\ \text{while, testing domestic information variable can be written as follows:} \\ \delta_{idt-1} &= 0, & i = 1, \dots, 5\end{aligned}$$

## RESULT AND DISCUSSION

### Descriptive Statistic

Descriptive statistics such as mean, standard deviation, Jarque-Bera, as well as Q-statistic can be seen in Table 4.1. Correlation coefficients between stock market returns are presented in table 4.2. Based on Table 1., average monthly return on world stock markets and Singapore is negative, namely 1.916% and -0.113%, respectively, while for other four stock markets, average monthly return is positive during sample period. The volatility of monthly returns for five Southeast Asian stock markets ranging from 5,445% to 9,899%, higher than volatility of world stock market (5,356%).

Table 1. Descriptive Statistic of Excess Return

	ACWI	Indonesia	Malaysia	Filipina	Singapura	Thailand
<b>Mean</b>	-1.916	0.498	0.142	0.232	-0.113	0.351
<b>SD</b>	5.356	9.899	5.445	7.180	6.813	8.744
<b>Skewness</b>	-0.757	-0.878	-0.430	-0.446	-1.061	-0.738
<b>Kurtosis</b>	4.924	6.440	3.911	3.948	6.969	5.933
<b>Jarque-Bera</b>	49.97***	124.28***	13.09***	14.14***	168.76***	89.85***
$Q(r)_{12}$	97.90***	12.84	13.03	10.78	8.21	19.71*
$Q(r^e)_{12}$	52.79***	23.88**	15.20	13.55	21.86**	23.14**

\* Sig. at 10%, \*\* Sig. at 5%, \*\*\* Sig. at 1%

Table 1. also reports Jarque-Bera values used to determine whether a series has been normally distributed or not. Based on Jarque-Bera value of each stock market return, it can be concluded that all stock market returns in this study were not normally distributed. Problem of autocorrelation is an important problem in





time series data. Therefore, Q-statistics need to be displayed. Q-statistics presented are Q-statistics on lag 12. Based on table 1., only world market returns and Thailand have a significant Q-statistic value, while return of four other ASEAN stock markets is not significant at lag 12.

Table 2. Unconditional correlations of excess return

	ACWI	Indonesia	Malaysia	Filipina	Singapura	Thailand
<b>ACWI</b>	1.000					
	-					
<b>Indonesia</b>	0.546	1.000				
	<i>0.000</i>	-				
<b>Malaysia</b>	0.514	0.526	1.000			
	<i>0.000</i>	<i>0.000</i>	-			
<b>Filipina</b>	0.511	0.591	0.417	1.000		
	<i>0.000</i>	<i>0.000</i>	<i>0.000</i>	-		
<b>Singapura</b>	0.732	0.661	0.597	0.597	1.000	
	<i>0.000</i>	<i>0.000</i>	<i>0.000</i>	<i>0.000</i>	-	
<b>Thailand</b>	0.603	0.628	0.484	0.612	0.663	1.000
	<i>0.000</i>	<i>0.000</i>	<i>0.000</i>	<i>0.000</i>	<i>0.000</i>	-

\* The number in italic is p-value.

In addition to these statistics, it is also necessary to test correlation between stock market returns. Result of correlation test are presented in table 2. correlation between stock market returns in this study is quite high and all correlation coefficients are significant at 99% confidence level. The correlation of Malaysia's stock market with Philippine stock market has lowest correlation coefficient, which is equal to 0.417 while the highest correlation coefficient is on the world stock market with Singapore stock market, which is 0.732.

### Testing of Market Integration Hypothesis

Before testing the hypothesis, the researcher needs to know whether the specifications of the model used are correct or not. Therefore, the researcher uses the VAR and VECM methods to determine whether there are cointegration equations between the variables used in the model. The test results show that there are six cointegration equations. Therefore, the empirical model used in this study must be supplemented by these six cointegration equations.

Table 3. Estimation Result of SUR

	Indonesia	Malaysia	Filipina	Singapura	Thailand
<b>Konstan</b>	0.682 (1.08)	0.037 (0.10)	0.368 (0.77)	0.042 (0.10)	0.520 (0.94)
<b>Coint. Eq. 1</b>	0.026 (0.41)	0.071** (2.01)	0.019 (0.39)	0.058 (1.34)	0.167*** (3.07)
<b>Coint. Eq. 2</b>	0.238* (0.07)	-0.021 (-0.28)	0.072 (0.72)	0.072 (0.79)	0.154 (1.33)
<b>Coint. Eq. 3</b>	-0.062 (-0.62)	-0.021 (-0.38)	-0.156** (-2.04)	0.049 (0.72)	-0.064 (-0.74)
<b>Coint. Eq. 4</b>	-0.022 (-0.15)	0.092 (1.14)	0.151 (1.38)	-0.089 (-0.89)	-0.038 (-0.30)



<b>Coint. Eq. 5</b>	-0.031 (-0.39)	-0.104** (-2.34)	-0.021** (-0.35)	-0.086 (-1.56)	-0.219*** (03.18)
<b>Coint. Eq. 6</b>	0.020 (0.93)	0.008 (0.66)	0.033** (2.00)	-0.007 (-0.48)	0.021 (1.10)
<b>WDY<sub>t-1</sub></b>	-0.707** (-2.37)	-0.542*** (-3.16)	-0.103 (-0.46)	-0.643*** (-3.12)	-0.589** (-2.25)
<b>USDP<sub>t-1</sub></b>	-1.126** (-2.15)	-0.391 (-1.34)	-0.681* (-1.72)	-0.548 (-1.51)	-0.683 (-1.48)
<b>USTP<sub>t-1</sub></b>	1.107 (0.54)	0.300 (0.26)	-1.366 (-0.88)	2.263 (1.60)	1.586 (0.88)
<b>WIR<sub>t-1</sub></b>	-8.070*** (-3.74)	-2.309* (-1.91)	-3.952** (-2.41)	-4.337*** (-2.83)	-6.297*** (-3.34)
<b>SI<sub>t-1</sub></b>	0.000* (1.91)	-0.673*** (-4.25)	-0.005*** (-2.68)	-0.002 (-0.18)	-0.016 (-0.93)

The number in parentheses is *t*-statistic.

\* Sig. at 10%, \*\* Sig. at 5%, \*\*\* Sig. at 1%

Table 3 shows regression coefficients and t-statistic of each variable and cointegration equation obtained from results of seemingly unrelated regression (SUR) estimation. Some global information variables used in the asset pricing model in this study have a significant influence. MSCI World dividend price ratio (WDY) variable has a significant negative effect on return in almost all Southeast Asian stock markets, except Philippine stock market. The US default spread also has a negative effect on several stock markets, namely Indonesian stock market and Philippine stock market.

Meanwhile, world interest rate (WIR) proxied by eurodollar deposit rate has a negative influence on returns for all Southeast Asian stock markets. US term spread (USTP) has no effect on return Southeast Asian stock markets. The asset pricing model in this study also uses local information variables, namely short-term interest rate (SI) of each country. This short-term interest rate has a negative influence on stock market returns of Indonesia, Malaysia and Philippines. On Singapore and Thailand stock markets short-term interest rates have no significant effect.

Testing the first hypothesis is done using Wald test. Table 4. shows results of Wald test for Southeast Asian stock market individually. Wald test for each stock market shows full integration between Singapore and Thailand stock markets with world stock market. Global information variables for Singapore and Thailand stock markets have a p-value below 0.100, which is 0.001 on Singapore stock market, and 0.004 in Thai market. The p value for local information variable on Singapore and Thailand stock markets has a value above 0.100, which is 0.856 on Singapore stock market, and 0.352 on Thailand stock market. This full stock market integration resulted in 1d and 1e hypotheses being rejected.



Table 4. Testing of Stock Market Integration

	$\chi^2$	<i>Df</i>	<i>p-value</i>
1. Indonesia			
$H_0 : K_{world} = 0$	18.00	4	0.001
$H_0 : K_{Indonesia} = 0$	3.657	1	0.056
2. Malaysia			
$H_0 : K_{world} = 0$	12.036	4	0.017
$H_0 : K_{Malaysia} = 0$	18.050	1	0.000
3. Philippine			
$H_0 : K_{world} = 0$	7.143	4	0.128
$H_0 : K_{Filipina} = 0$	7.172	1	0.007
4. Singapore			
$H_0 : K_{world} = 0$	18.253	4	0.001
$H_0 : K_{Singapura} = 0$	0.033	1	0.856
5. Thailand			
$H_0 : K_{world} = 0$	15.312	4	0.004
$H_0 : K_{Thailand} = 0$	0.868	1	0.352

The stock market integration hypothesis is tested using the Wald test.  $K_{world}$  is a global coefficient of information consisting of MSCI World dividend yield (WDY), US default spread (USDP), US term spread (USTP), and Eurodollar deposit rate (WIR).  $K_{lokal}$  is local information coefficient which consists of short-term interest rate of each country.

Result of Wald test also found opposite. Based on estimation result, Philippine stock market turned out to be segmented with world stock market. This is indicated by insignificance of global information variable ( $p$ -value = 0.128) and significant local information variable on return of Philippine stock market ( $p$ -value = 0.007). This finding makes hypothesis 1c being rejected. Wald test for Indonesian and Malaysian stock markets shows a different level of integration from other Southeast Asian stock markets. Indonesian and Malaysian stock markets are partially integrated with world stock market. Global and local information variables for Indonesian and Malaysian stock markets both have a  $p$ -value below 0.100. In Indonesian stock market, the  $p$ -value for global information variable is 0.001 and  $p$ -value for local information variable is 0.056. The global information variable for Malaysian stock market has a  $p$ -value of 0.017 while local information variable has a  $p$ -value of 0.000. These findings make hypotheses 1a and 1b being accepted.

Table 5. Unconditional correlations of residual SUR

	Indonesia	Malaysia	Filipina	Singapura	Thailand
<b>Indonesia</b>	1.000				
	-				
<b>Malaysia</b>	0.512	1.000			
	0.000	-			
<b>Filipina</b>	0.576	0.492	1.000		
	0.000	0.000	-		
<b>Singapura</b>	0.612	0.665	0.590	1.000	
	0.000	0.000	0.000	-	



<b>Thailand</b>	0.585	0.495	0.586	0.617	1.000
	<i>0.000</i>	<i>0.000</i>	<i>0.000</i>	<i>0.000</i>	-

\* The number in italic is p-value.

To ascertain whether seemingly unrelated regression (SUR) method has been used correctly or not, it is necessary to check residual value of the regression results. Table 5. shows the correlation coefficient of residual value of the SUR regression results. All correlation coefficients between residuals in the equation system are significant. This indicates that use of SUR estimation method is appropriate.

Table 6. Autocorrelation Test Results

	<i>Q(12)</i>	<i>p-value</i>
Indonesia	3.549	0.990
Malaysia	8.855	0.715
Filipina	10.490	0.573
Singapura	4.485	0.973
Thailand	15.571	0.212

In addition, researcher also need to test whether there are symptoms of autocorrelation from empirical model used. Table 6 presents result of autocorrelation test using Ljung-Box Q-statistics. This autocorrelation test is done using residuals from each equation. Of five residuals estimated by SUR, all had no symptoms of autocorrelation. The p value for each residual is higher than significance level of 0.100. With this result, the empirical model used in this study does not contain autocorrelation problems.

## CONCLUSION

The results of this study provide some conclusions, namely Singapore and Thailand stock markets show full integration with world stock markets, Indonesian and Malaysian stock markets show partial integration, while Philippine stock market shows market segmentation. Global and local risk factors are valued on Indonesian and Malaysian stock markets. On Singapore and Thailand stock markets, valued risk factors are only global risk factors. In contrast, on Philippine stock market, risk factors that are valued are only local risk factors. Investors who want to assess a stock in Southeast Asian stock markets must consider global risk factors more than local risk factors.

This study has several limitations. First, this study only uses local and global information variables. Next researcher should consider regional information variables as well as latest information variables. Second, researchers only used five largest countries in Southeast Asia. Our suggestion, further research is to use more countries in conducting market integration research and use individual stock portfolios instead of market indexes. Third, we use the international asset pricing model to measure stock market integration. Future research should consider newer measurement methods such as machine learning and deep learning.

## REFERENCES

- Arouri, M. E. H., Nguyen, D. K., Pukthuanthong, K. (2012). An international CAPM for partially integrated markets: Theory and empirical evidence. *Journal of Banking and Finance*, 36, 2473–2493.



- Baele, L., Ferrando, A., Hordahl, P., Krylova, E., Monnet, C. (2004). Measuring financial integration in the Euro area. *European Central Bank Occasional Paper Series* No. 14.
- Bekaert, G., Harvey, C. R. (1995). Time-Varying World Market Integration. *The Journal of Finance*, 50 (2), 403–444.
- Bekaert, G., Harvey, C.R., Lumsdaine, R. (2002). The dynamics of emerging market equity flows. *Journal of International Money and Finance*, 21, 295–350.
- Bodie, Z. Kane, A., Marcus, A.J. (2014). *Investment, 10<sup>th</sup> Edition*. New York: McGraw-Hill Education.
- Carrieri, F., Errunza, V., Hogan, K. (2007). Characterizing World Market Integration through Time. *The Journal of Financial and Quantitative Analysis*, 42 (4), 915–940.
- Drake, P. P., Fabozzi, F. J. (2010). *The basic of finance: an introduction to financial markets, business finance, and portfolio management*. John Wiley & Sons.
- Errunza, V., Losq, E. (1985). International Asset Pricing under Mild Segmentation: Theory and Test. *The Journal of Finance*, 40 (1), 105–124.
- Fratzcher, M. (2002). Financial market integration in Europe: On the effects of EMU on stock markets. *International Journal of Finance & Economics*, 7 (3), 165–193.
- Gérard, B., Kessara T., Jonathan A. B. (2003). Are the East Asian markets integrated? Evidence from the ICAPM. *Journal of Economics and Business* 55, 585–607.
- Johansson, A. C. (2010). China's financial market integration with the world. *Journal of Chinese Economic and Business Studies*, 8(3), 293–314.
- Karolyi, G. A., Stulz, R. M. (2002). Are Financial Assets Priced Locally or Globally? *NBER Working Paper Series*, (8994).
- Merton, R. C. (1980). On estimating the expected return on the market: An exploratory investigation. *Topics in Catalysis* 8 (4), 323–61.
- Mobarek, A., Mollah, S. (2016). *Global stock market integration*. New York: Palgrave Macmillan.
- Murtini, U., Ekawati, E. (2003). Integrasi bursa efek Jakarta dengan bursa efek di ASEAN. *Jurnal Riset Akuntansi Indonesia*, 06 (3).
- Nasser, O. M. Al, Hajilee, M. (2016). Integration of emerging stock markets with global stock markets. *Research in International Business and Finance*, 36, 1–12.
- Setiawan, K. (2011). On the Dynamic of Stock Market Integration: a Minimum Spanning Tree Analysis. *The International Journal of Economic Policy Studies*, 6 (3), 43–68.
- Setiawan, K. (2014). Stock market integration: Are risk premiums of international assets equal? *Gadjah Mada International Journal of Business*, 16 (1), 39–53.
- Stulz, R. (2005). The limits of financial globalization. *Journal of Finance*, 60, 1595–1638.