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Does the East and Southeast Asian Equity Market have Integration? A Study of Cointegration Analysis

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ABSTRACT: Financial integration can improve the efficiency of capital allocation as well as help diversify risks**.** This study aims to find and analyze four cases. First, to find and analyze the long-term cointegration between East and Southeast Asian. Second, to find and analyze the short-term causal relationship between East and Southeast Asian equity market. Third, to find the most influential equity market from East Asian toward their Southeast Asian and the most influential equity market from Southeast Asian toward their East Asian. Last, to find the forecast structural analysis for five days horizon period of each country's price, both East and Southeast Asia. This study uses Johansen's cointegration method to test long-run relationships between East and Southeast Asian equity markets, Granger-causality, forecast variance decomposition method and forecast with VECM. This study uses daily indices prices collected from Refinitive covered from January 2002 to December 2019. Johansen's test emphasize that there is a cointegration relationship between East Asian and Southeast Asian stock markets, but the integration process is incomplete. The cointegration vector also emphasize that ASEAN+3 members react differently to external shocks. This study found that the Japan Granger-cause will lead to all stock markets in Southeast Asia, while Singapore and Philippine Granger-cause will lead to all stock markets in East Asia. These results show that Japan is the market with the most connections in Southeast Asia, while Singapore and Philippine are the markets with the most connections in East Asia. Another point of this paper is to emphasize that Japan is the most influential stock market in East Asia, while Singapore is the most influential stock market in Southeast Asia. This study shows that policymakers in East and Southeast Asian countries should synchronize capital market standards, regulations and reduce barriers to capital flow to stimulate the integration of regional stock markets.

KEYWORDS: ASEAN+3; Financial integration; FEDV; Granger-causality; IRF; Johansen's cointegration.

INTRODUCTION

Financial globalization can be defined as a trend characterized by increasing the integration of capital markets and international financial transactions [1] . The degree of integration is an important issue in international economics and finance. Along with the times, many countries made several agreements to increase the integration of one with another. The ASEAN Plus Three (APT) cooperation process began in December 1997 determined to strengthen and deepen the development of economic and social, political, and other fields, including finance [2]. APT 1st Summit was held in Kuala Lumpur when the region was hit by the economic crisis. One of the ultimate goals of financial integration is that Qualified ASEAN Banks (QAB) play a greater role in promoting intra-ASEAN trade and investment and the interconnected ASEAN stock market [3].

Financial integration can improve the efficiency of capital allocation as well as help diversify risks. Financial integration is also recommended to promote economic growth and guide consumption [4]. Financial integration can be achieved through the emergence of formal agreements, such as joining regional integration agreements [1]. An important aspect of financial integration is the link between the stock markets of member countries [5]. Links between stock markets can prevent investors from diversifying strategies, especially during turbulent times, such as the stock market crash in 1987, the Asian financial crisis in 1997, the technology company crisis in 2000, and the financial crisis in 2007-2009 [6]. For that reason, in September 2012, Indonesia, Malaysia, Philippines, Singapore, Thailand, and Vietnam worked together to form the ASEAN Exchanges created ASEAN trading links aiming to promote ASEAN capital market integration [7]. Besides the countries of ASEAN, the members of ASEAN+3 include three countries from East Asia; Japan, China, and South Korea. The strategic focus in the economic and financial sector was stated in the Press Statement by the Chairman of the 7th ASEAN Summit and the 5th Summit published in November 2001 when member countries agreed on the idea of an East Asian Economic Community in order to realize real cooperation between ASEAN+3

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countries. In the context of ASEAN+3, closer financial ties in the region can help East and Southeast Asian markets to reduce their dependence on the US or European economies for capital [8]. If regional stock markets are integrated among member states, each member will respond to changes in other members.

Table 1 displays the basic condition of the equity market of each country. China has the biggest equity market in 2019 compared to other ASEAN+3 members countries, while Hongkong has the biggest market capitalization to its GDP with the amount of 1339,64 percent. Singapore has the biggest equity market and the biggest market capitalization to its GDP for Southeast Asia's block. On the other hand, Japan has the largest number of stocks through East Asia with a total of 3.704 stocks, while Malaysia has the largest number of stocks with a total of 919 stocks in Southeast Asia. East Asia has the biggest average daily return in 2019 (0,0589 percent) than Southeast Asia (0,011 percent), while Southeast Asia has the biggest seventeen-year annualized growth rate of an equity index (14,488 percent) than East Asia (11,367 percent). These facts prove that there is a gap between the East Asian emerging market stock market and the Southeast Asian emerging market stock market.

Table 1. The condition of equity market in East and Southeast Asia

Country	Market capitalization 2019 (in US$ million)	Market capitalization to GDP 2019 (%)	No. of stocks 2019	Average daily return 2019 (%)	17-year annualized growth rate of equity index (%)
Hongkong	4.899.235	1339,64	2272	0,040	10,427
Japan	6.191.073	121,83	3704	0,073	11,224
China	8.515.504	59,37	1572	0,089	9,865
South Korea	1.459.450	89,72	2262	0,033	13,952
East Asia	21.065.262	402,64	9.810	0,0589	11,3670
Indonesia	523.322	46,76	668	0,009	24,919
Malaysia	403.957	110,77	919	-0,024	7,800
Philippines	275.302	73,06	265	0,023	17,222
Singapore	697.271	187,41	470	0,021	6,355
Thailand	569.228	104,72	725	0,006	15,140
Vietnam	149.817	57,20	745	0,032	15,495
Southeast Asia	2.618.898	96,65	3792	0,011	14,488

It is expected that the links between the stock markets of countries will reveal economic integration in the form of trade links and investment movement [9]. It is in line with ASEAN+3's program, which is committed to do cooperation in macroeconomic risk management and also monitoring of regional capital flows. The cooperation between countries can be seen from the connection when they do international trades. Table 2 displays the connection through flow of trade and investment from each country. For export and import, on the average ASEAN sends and receives most of its products to China for 5 years compared to the other countries from East Asia. We can see for five years, the export and import activities between ASEAN and China increased every year. Different from the trading with China, the export and import activities between ASEAN and the other East Asian countries increased from 2015 to 2018 and decreased in 2019. On the other hand, for foreign direct investment, ASEAN has the biggest inflow from Japan compared to the other East Asian countries for five years. The higher level of trade volume indicates that the member economies become more cooperative in terms of trade and investment which also requires financial dealing [10].

However, the issue of integration among stock markets has become an important topic in financial research. With a joint regional stock market, investors from all member countries will be able to allocate capital to the most productive locations in the region [11]. Empirical evidence on the degree of financial integration among ASEAN+3 countries is limited and inconclusive. Previous studies focused on the integration level among only ASEAN 5 [11]–[13], ASEAN 5 plus 3 countries [14] ASEAN 5 plus three and other stock markets around the world [4], [15]–[18]. The study about integrating ASEAN+3 stock market has been done by [5] without adding Shenzhen Stock Exchange. Different from other studies, besides we include Shanghai and Hongkong stock exchange as the proxy of China, we also include Shenzhen stock exchange since Shenzhen stock exchange was the 8th largest market capitalization in the world in 2020 [19].

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Table 2. Trade and investment flow between ASEAN and East Asia (in US billion)

Variables	2015	2016	2017	2018	2019	5-year growth rate (%)
ASEAN export to						
China	145.291	143.965	187.028	197.680	202.550	6,9
Japan	101.941	96.555	105.946	114.767	109.911	1,5
South Korea	45.421	45.918	56.732	60.486	59.380	5,5
Intra-ASEAN	287.106	277.896	311.825	344.507	332.312	3,0
Rest of the world	1.171.734	1.153.609	1.324.795	1.436.050	1.423.830	4,0
ASEAN imports from						
China	218.205	224.602	253.946	284.814	305.413	7,0
Japan	100.859	105.863	112.860	116.882	116.119	2,9
South Korea	75.146	78.549	98.118	101.025	97.127	5,3
Intra-ASEAN	248.274	240.058	277.291	304.279	300.292	3,9
Rest of the world	1.101.128	1.086.289	1.246.505	1.388.866	1.392.602	4,8
ASEAN FDI inflow from						
China	6.571,77	11.272,10	15.495,39	12.240,90	8.895,94	6,2
Japan	2.962,34	14.037,83	16.139,97	23.337,52	20.635,62	9,7
South Korea	5.608,82	6.284,38	4.610,48	5.460,02	2.390,80	-15,7
Intra-ASEAN	20.819,28	24.988,79	25.888,59	24.249,59	22.074,71	1,2
Rest of the world	118.667,09	114.591,06	155.025,01	153.120,37	158.864,36	6,0

In order to reconcile the ambiguity in past studies, this paper seeks the answer to four questions: First, is there any possibility of long-term cointegration between ASEAN+3 equity markets? Second, what are the short-term causal relationships between equity markets in ASEAN+3? Third, what is East Asia's most influential equity market toward their Southeast counterparts, and what is Southeast Asia's most influential equity market toward their East counterparts? Forth, what is the five days forecast price analysis for each country?

The results of the study, Johansen's test emphasize that there is a cointegration relationship between East Asian and Southeast Asian stock markets, but the integration process is incomplete. The cointegration vector also emphasize that ASEAN+3 members react differently to external shocks. Regarding short-term causality, this study found that the Japan Granger-cause will lead to all stock markets in Southeast Asia, while Singapore and Philippine Granger-cause will lead to all stock markets in East Asia. These results show that Japan is the market with the most connections in Southeast Asia, while Singapore and Philippine are the markets with the most connections in East Asia. Another point of this paper is to emphasize that Japan is the most influential stock market in East Asia, while Singapore is the most influential stock market in Southeast Asia. This study shows that policymakers in East and Southeast Asian countries should synchronize capital market standards and regulations and reduce barriers to capital flow to stimulate the integration of regional stock markets.

This research is structured in 5 sections. The second section analyses the literature on financial integration in Asia. The third section reviews the data and methodology used in this research. Results and discussion are presented in the fourth section, followed by the conclusion in section 5.

LITERATURE REVIEW

Empirical studies about the integration of several countries have been done. Previous studies focused on the integration level among only ASEAN-5, which consist of Indonesia, Malaysia, Singapore, Thailand, and the Philippines by [11]–[13]. They found that ASEAN-5 has integration. [12] found that there is long-run cointegration between ASEAN-5 and the Granger causality results indicate an increase in the integration between the ASEAN-5 markets after the financial crisis. Furthermore, [13] found that Singapore and Thailand are the main long-term drivers in the region while Malaysia and Indonesia are more short-term drivers.

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Furthermore, the studies between ASEAN-5 and East Asia have been done by [14], [9] and [18]. [14] found that investment and savings rates are found to be nonstationary and not to be cointegrated in panels while also [18] found that stock market integration in East and Southeast Asia is not as strong as it looks although governments in this region have been promoting financial market collaboration and integration. Different with them, [9] found that regional financial integration between China and ASEAN-5 has gradually increased.

[20] found that Japan, Hongkong and Singapore didn't have long-run linkages and it may provide potential benefits for the investors that look at emerging markets to enhance their risk adjusted returns by including emerging markets in their portfolios. [21] found that China and four countries from ASEAN's stock markets become more correlated, signaling a decrease in diversification benefits. Furthermore, [22] showed that several countries from Asia play towards the integration of regional and world economic markets.

On the other hand, several studies about ASEAN-5, East Asia and other countries had been done. [4] stated that Vietnam, compared to other countries in research, holds lower regional and international integration levels in both the bond market and the stock market, but demonstrates considerably strong signs of progressing regional and global stock market integration over the period. On the other hand, [15] found that there is cointegration among stock markets while Japan and Singapore appear to provide regional leadership, as they both exert the most significant influence on the other Asian financial markets. Similar with [15], [16] stated that there are long run links connecting Indonesia, Korea, the Philippines, and Thailand with Japan as the regional benchmark. [16] also found that with the exception of China, India and the Philippines, the examined emerging markets also displayed evidence of long run connections with the global market, proxied by the US. [10] found that the stock markets in the ASEAN region are integrated during both periods of financial crises and the markets are moving toward better integration, particularly during the post-crisis period. Moreover, [23] proved that in the recent crisis, the relationship within the South-East Asian countries seems to be stronger than that within the North-East Asian countries. [24] found that Philippines and Indonesia are more financially integrated with the ASEAN region and in contrast, the process of financial integration has been slow and insignificant in Malaysia.

While previous studies focus on ASEAN-5, [5] and [25] have documented evidence about ASEAN+3. It is important to note that ASEAN has 6 countries that have a stock market, there are Bursa Malaysia from Malaysia, Hochiminh Stock Exchange from Vietnam, Indonesia Stock Exchange from Indonesia, The Philippine Stock Exchange from Philippine, Singapore Exchange from Singapore and The Stock Exchange of Thailand from Thailand. [26]. [5] tests the cointegration among ASEAN and East Asia and found that there is cointegration between East and Southeast Asian equity markets while Japan is the market with most linkages in Southeast Asia, and Singapore and Vietnam are the markets with most linkages to East Asia. Furthermore, [5] also found that forecast variance decomposition reveals that Japan is the East Asia's most influential equity markets, while Singapore is the most influential equity market in Southeast Asia. [25] also stated that there is strong evidence of greater global and regional financial integration in East Asia and ASEAN equity markets. [27] found that Shanghai and Shenzhen stock market are cointegrated, and also present the evidence of strong error-correction effect in the short-rate equation. While the study of Shenzhen stock market and stock market from other countries is limited, we include Shenzhen in our study. To show the samples of previous studies, we present in Table 3. Samples of previous study.

This research considers East and Southeast Asia into two different blocks for the first step, following [5]. We use Japan's stock market index as a benchmark for the region of Asia and East Asia following the study of [5], [4], [5], [15], [16] and use Indonesia as benchmark for the region of Southeast Asia following [5]. We also use East's market and Southeast Asia's market as individual entity to find the short-run causal linkage.

Table 3. Samples of previous study

Authors, Year	Year of Observation	Stock Price	IDN	MLY	SGN	THA	PHI	VTN	CH-HK	CH-SZ	CH-SH	KR	JPN	Add. Country
Lim, 2009	1990-2008		√	√	√	√	√							
Chen et al., 2009	1994-2005		√	√	√	√	√							

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Click & Plummer, 2005	1998-2002	√		√	√	√	√								
Chien et al., 2015	1992-2013	√		√	√	√	√				√				
Guillaumin, 2009	1988-2006			√	√	√	√		√		√	√	√		
Wu, 2020	1999-2019	√		√	√	√	√		√		√	√	√		
Gupta & Guidi, 2012	1999-2009	√			√				√				√	√	
Nguyen & Elisabeta, 2016	2004-2014			√	√		√	√			√			√	
Anoruo et al., 2003	1988-1999	√			√	√	√		√			√	√	√	
Rahman et al., 2017	1992-1997 & 1999-2013	√		√	√	√	√	√			√	√	√		
Sheng & Tu, 2000	1996-1998	√		√	√	√	√	√	√		√	√	√	√	
Shafigni et al., 2016	1999-2013			√	√	√	√	√	√		√	√	√	√	
Brailsford et al., 2008	1998-2006			√	√	√	√	√		√			√	√	
Anh et al., 2020	2009-2018	√		√	√	√	√	√			√	√	√	√	
Awokuse et al., 2009	1988-2003	√		√	√	√	√		√			√	√	√	
Mohti et al., 2019	2009-2017	√		√	√		√	√	√		√	√	√	√	
Song et al., 2021	1999-2017	√		√	√	√	√	√			√	√	√	√	
Lin et al., 2013	2005-2010	√								√	√				
Arsyad, 2015	2003-2013	√		√	√	√	√	√	√		√	√	√		
Fry-McKibbin et al., 2018	1997-2006			√	√	√	√	√	√		√	√	√	√	

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Thomas et al., 2017	2000-2016	√	√	√	√	√	√	√	√		√	√	√	√

Notes: IDN represents Indonesia, while MLY represents Malaysia, SGN represents Singapore, THA represents Thailand, PHI represents Philippine, VTN represents Vietnam. CH-HK represents China-Hongkong, CH-SZ represents China-Shenzhen Stock Exchange, CH-SH represents China-Shanghai Stock Exchange, KR represents South Korea, while JPN represents Japan and Add. Country is the other country used from the study.

DATA & METHODOLOGY

To examine the cointegration between the ASEAN+3 stock market, this study uses daily indices prices collected from Refinitive covered from January 2002 to December 2019. In time series, the more data we observe will make a better result. For that reason, we use daily data as the process of [11], [12], [15]–[17], [25], [30]. The reason for using January 2002 is because the agreement of strategic focus in the economic and financial sector of ASEAN+3 was published at the end of 2001. The stock indices are Jakarta SE Composite Index for Indonesia, FTSE Bursa Malaysia KLCI for Malaysia, Strait Times Index for Singapore, The Philippine Stock Exchange Index for Philippine, Stock Exchange of Thailand Index for Thailand, Vietnam SE Series for Vietnam, Korea SE KOSPI Index for Korea, Japan Nikkei 225 Index for Japan, Hongkong Hang Seng Index for Hongkong, Shanghai SE Composite Index and Shenzhen SE Composite Index for China. We include Shenzhen Stock Exchange to fill the research gap, which is still rarely done by previous studies before. We use Eviews 9 software to test Johansen's cointegration test, Granger causality test, forecast variance decomposition (FEVD), impulse response function (IRF), and forecast with VECM.

Table 4. Descriptive Statistic

Country	N	Mean	SD	Minimum	Maximum
Hongkong	3267	20192.36668	5648.086141	8409.01	33154.12
Japan	3267	14164.23869	4541.038728	7054.97998	24120.03906
Shanghai	3267	2505.079759	897.4410908	1011.499	6036.281
Shenzhen	3267	1070.67882	580.0842859	238.37	3100.935
South Korea	3267	1647.197146	523.1458847	515.24	2598.19
Indonesia	3267	3262.990983	1966.865838	342.204	6680.619
Malaysia	3267	1345.113491	392.6953196	616.46	1895.18
Philippines	3267	4492.181715	2494.431113	999.46	9058.62
Singapore	3267	2716.005839	636.2641294	1170.85	3831.19
Thailand	3267	1042.327648	443.9535078	314.38	1837.49
Vietnam	3267	533.9602694	263.1921849	131.44	1198.12

Note: Denotes that null hypotesis of normality is rejected at 5% significance level

Augmented Dickey-Fuller (ADF)

In general, the econometric model time series is a structural model because it is based on existing economic theory. In 1980 Christopher A. Sims introduced the VAR model as an alternative in macroeconomic analysis. The VAR model is a non-structural model because it is theoretical. The VAR model has a simpler model structure with a minimal number of variables where all the variables are endogenous variables with the independent variable being lag. VAR models are designed for stationary variables that do not contain the trend [31].

Trend stochastic in the data indicate that there is a component of long-run (long-term) and Short-run (short term) in data time series. Research on trends stochastic in economic variables continues to grow so that in 1981, Granger developed the concept of cointegration. In 1987, Engle and Granger developed the concept of cointegration and error correction. Then, in 1990, Johansen and Juselius developed the VECM concept. VECM offers a simple working procedure to separate the long-run and components

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short-run of the data generation process [32] and [33]. Thus, VECM differs from VAR in that it can be used to model time series data co-integrated and not stationary. VECM is often referred to as a form of restricted VAR [34].

As discussed earlier, modeling using VECM is based on data time series that are not stationary but cointegrated. The VECM process contains Johansen's cointegration procedure which has one of the conditions, namely that the entire data set must be stationary at the first difference. To check the stationarity of the data, the unit root test can be used, with the test statistic used is Augmented Dickey-Fuller (ADF), as follows:

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \alpha_i \sum_{i=1}^{m} \Delta Y_{t-1} + \varepsilon_t \qquad (1)$$

Where Y: Endogenous Variable

α: coefficient

ε: error term

At the significance level (1 - α) 100%, H_0 rejected if the ADF statistic is less than the critical value at time α, or $p\ value$ is less than the significance value α. If $H_{0\,\text{is}}$ rejected then the data is stationary [35] and [36].

Johansen's Cointegration Test

Then to apply Johansen's (1988) procedure based on the Vector autoregressive (VAR) framework. Note that the model $VAR\ (p)$ is:

$$y_t = A_1\, Yt - 1 + \ldots\ldots\ldots + Ak\, Ytk + \Phi\, Dt + \mu + \varepsilon t \qquad (2)$$

y_t is a vector with k non-stationary variable I (1), x_t is a vector with d deterministic variable, $_t$ is an error vector. The equation $VAR\ (p)$ can also be written as:

$$\Delta Xt = \Gamma_0 + \Gamma_1 \Delta X_{t-1} + \Gamma_2 \Delta X_{t-2} + \Gamma_{k-1} + \cdots + \Delta X_{t-k+1} + \pi X_{t-1} + \varepsilon t \qquad (3)$$

where πX_{t-1} is error correction, where $\pi = \alpha \times \beta'$; The components of the matrix α are short-term correction parameters for long-term relationship which are implemented in the matrix β'. The Johansen's cointegration test aims to estimate π the infinite VAR model and therefore tests whether the restrictions imposed by rank π (i.e. cointegration vectors) can be rejected. This cointegration test can also provide the number of cointegration equations *(k).* Cointegration is considered to reach settlement if the number of variables (*n*), or the number of equity markets included in the estimate, minus the number of cointegration equations (*nk*) equals one [11]. Economic and financial theory often indicates a cointegration between two or more variables. Cointegration theory was proposed by [37], namely non-stationary variables because they contain trends (variables have a cointegration relationship). This means that there is a stable long-term relationship between variables. Even if these variables depart from the equilibrium level due to some short-run disturbance, with time, the degree of variation of the variable will gradually decrease and the variable will return to the general equilibrium level. In this case, the shortcomings of [37] method may result in a biased simultaneous equation, because it may fail to recognize the causal direction among equity markets in Asia besides that the Engle and Granger method cannot detect more than one cointegration equation in the case of multivariate cointegration so that is the weakness causes the inability to verify that the integration process in ASEAN+3 has reached its maximum completion or not. In this study, the maximum estimate was adopted likelihood cointegration proposed by Johansen to test whether there is cointegration between variables, and to find the number of cointegration groups of vectors, because the Johansen method can detect more than one multivariate cointegration equation, therefore it is more appropriate to use in research this time.

Granger Causality Test

The second objective of this study is to find and analyze the direction of short-term causality between East Asian equity markets and Southeast Asian equity markets. The causality test is a test to determine the causal relationship between variables in the VAR system. If there is causality in economic behavior, this econometric model does not contain exogenous variables. Causal relationships can be tested using Granger causality test, the test statistics as follows:

$$F_{calc} = (n-k)\frac{(RSS_R - RSS_{UR})}{m(RSS_{UR})} \qquad (4)$$

where:

RSS_R : the number of residual squares

RSS_{UR} : total number of root

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N : number of observations

The test criteria is if the value of F_{calc} greater than the value of F_{Table} with degrees of freedom k-1,n-k there is a causality relationship and vice versa [38].

The Granger causality test was chosen because this test tests which variables move first and then follow other variables. For this study, the Granger causality test provides a short-term causal direction among equity markets in the ASEAN+3 region. If there is a lot of evidence that the X Granger stock market-causes the stock market Y, it can be interpreted as shock X followed by shock Y; if the result shows that the stock market X Granger - causes Y and Y and Granger - causes X, and then says that X and Y have a two-way relationship. [11] suggest the importance of the selected lag in Granger causality.

Structural Analysis Using FEVD and IRF

The third objective in this study is to determine which equity market has the most influence in East Asia on the equity market in Southeast Asia and vice versa. In this study, the variance decomposition will be used to describe the relative importance of each variable in the VAR system due to shocks. Variance decomposition is useful for predicting the percentage contribution to the variance of each variable due to changes in certain variables in the VAR system [38]. Variance decomposition examines the proportion of changes in a particular stock market caused by random shocks, which can be attributed to random shocks in other equity markets in the ASEAN+3 region. Originating from the East Asian equity market.

Theoretically, the forecasting and structural analysis of VECM has similarities with the forecast analysis and structural analysis of the VAR model. In VAR modeling, the analysis can use impulse response analysis and variance decomposition [32]. Because individually, the coefficients in the VAR model are difficult to interpret, econometricians use analysis impulse response. This impulse response is one of the important analyzes in the VAR system because of a shock or change in the disturbance variable [38]. The Impulse Response Function (IRF) test can describe the rate of the shock of one variable against other variables in a certain period. IRF function is to see the duration of the effect of the shock of one variable on another variable until the effect is lost or returns to the equilibrium point.

Forecast Using VECM Analysis

Like forecasting analysis in general, to determine the accuracy of the forecast results from a model can use Mean Absolute Percentage Error (MAPE):

$$\boldsymbol{MAPE} = \frac{\sum_{t=1}^{n} \left| \frac{Y_t - \hat{Y}_t}{Y_t} \right|}{\boldsymbol{n}} \times \mathbf{100\%} \qquad (\mathbf{5})$$

And Mean Square Error (MSE):

$$\boldsymbol{MSE} = \frac{\mathbf{1}}{\boldsymbol{n}} \sum_{i=1}^{n} (\boldsymbol{Y_t} - \hat{\boldsymbol{Y}}_t)^2 \qquad (\mathbf{6})$$

where *n* represents the amount of data; y represents actual value; and ŷ represents the estimated value. The smaller the MSE and MAPE values, the more accurate the forecast results obtained [34].

RESULT AND DISCUSSION

This section discusses the results of Johansen's cointegration tests to check for long-run equity market linkage, Granger causality test to check for short-run causality, forecast variance decomposition and impulse response function for each market in East and Southeast Asia, also forecast with VECM to analyze the predicting price in the future.

Augmented Dicky-fuller Test

The first step in this procedure is to perform a unit root test of all available data variables. To test for long-run cointegration using the [39] procedure, the data allows the determination of the long-term relationship between each that is non-stationary at the level. One of the requirements in the Johansen cointegration procedure is that all data sets or all variables must be stationary in a first-differenced form, which is tested using the Augmented Dicky-fuller (ADF) test. The ADF test results are shown in Table 5.'

Based on the Table 5. ADF test result, it can be seen that all variables are data that contain the unit root at the level or not stationary at the level. This can be seen when the level, $p\ value$ ADF statistics for each variable is greater than $\alpha = 5\%$, this means accepting the hypothesis H_0, which is that there is a unit root in the data or the data is not stationary. Meanwhile, from the results of

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the first differentiation it can be seen that $p\text{-}value$ and the ADF statistics of each variable are smaller than $\alpha = 5\%$, this means rejecting the hypothesis H_0, namely that the data does not contain unit roots or is stationary. Thus, all variables are stationary variables in the first difference.

Table 5. ADF test result

Market	At Level		At First Difference	
	ADF Statistic	*p value*	ADF Statistic	*p value*
Hongkong	-1,670901	0,4461	-42,43834	0,0000
Japan	-0,677308	0,8505	-58,19529	0,0001
Shanghai	-1,999748	0,2871	-30,73177	0,0000
Shenzhen	-1,545815	0,5103	-29,82524	0,0000
South Korea	-1,582677	0,4914	-57,068	0,0001
Indonesia	-0,54497	0,8799	-35,66992	0,0000
Malaysia	-1,522028	0,5225	-53,31966	0,0001
Philippines	-0,731906	0,8368	-58,77485	0,0001
Singapore	-1,797401	0,3822	-57,12943	0,0001
Thailand	-1,200311	0,6766	-55,729	0,0001
Vietnam	-1,002051	0,7547	-50,22819	0,0001
Note: the critical value for the ADF t-statistic for the null hypothesis of the unit root is -3,43 at the 1% significance level; -2,87 at the 5% significance level; and -2,57 at the 10% significance level; for the level series, the null hypothesis of the unit root is not rejected while for the first difference series, the null Augmented Dickey hypothesis of the unit root is rejected,				

Johansen's Cointegration Test

In this section, we will discuss the results of the long-term relationship between East Asia and Southeast Asia using Johansen's cointegration test. To check the direction of short-term causality (relationship) used here, the Granger causality test will be used. It can predict that each market in East Asia and Southeast Asia uses the variance decomposition test, and to determine the optimal lag for the Johansen cointegration test, and the Schwarz information criteria are used.

Table 6 presents the cointegration test results from the equity markets of East Asia and Southeast Asia, wherein in the second column, the results of the cointegration test for the East Asian block equity market are presented. The third column shows the results of the cointegration test for the Southeast Asian equity market, while the fourth column shows the results of the cointegration test for all equity markets in East Asia and Southeast Asia.

Based on table 6 in column two, the results of the equity market cointegration test in the East Asia sub-region are obtained. The cointegration test results show that there is cointegration in the East Asian equity market, which is marked by the trace statistic value in the Johansen cointegration test, which is significant at the 95 percent level. The normalized East Asian cointegration vector around the Japanese equity market can be written in the following equation:

$$Japan = 2{,}920497\ Hong\ Kong - 4{,}817688\ Shanghai + 9{,}130625\ Shenzhen - 25{,}88772\ South\ Korea \quad \textbf{(7)}$$

From the cointegration vector equation 7, it is found that the Hongkong and Shenzhen stock markets have a relationship which is positive with the Japanese stock market, which means that if there is an increase of one percent in the Hongkong and Shenzhen stock markets, it could lead to an increase in the Japanese stock market index of 2,920497 and 9,130625 percent respectively. In contrast, Shanghai and South Korea have a long-term negative relationship with Japan, which means that if there is a one percent increase in the Shanghai and South Korea equity market indexes, it will result in decreases of 4,817688 percent and 25,88772 percent in the Japanese equity market index, respectively. Although the coefficients of Hongkong and Shenzhen do not make economic sense, the sign suggests that Hongkong and Shenzhen react to changes differently from the reaction between Japan and Shanghai and South Korea. The results of the Johansen cointegration test only show that there is one cointegration vector (k), while in the cointegration test between the East Asian sub-regions, there are five equity markets (n), resulting in nk equal to four.

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There are still opportunities for financial integration in the East Asia sub-region, or in other words, the integration process in East Asia has not yet been completed.

In column three of Table 6, it is known the results of the equity market cointegration test in the Southeast Asia block. The cointegration test shows that there is only one cointegration in the Southeast Asian equity market, which is marked by the trace statistic value in the Johansen cointegration test, which is significant at the 95 percent level. The normalized Southeast Asia cointegration vector around the Japanese equity market can be written in the following equation:

$$Indonesia = -31{,}84535\ Malaysia - 5{,}033526\ Philippines + 14{,}51468\ Singapore - 6{,}450407\ Thailand - 17{,}15477\ Vietnam \quad \textbf{(8)}$$

The equation for the cointegration vector 8 states that the Singapore equity markets have a long-term positive relationship with the Indonesian equity market, which means that if there is one percent increase in the equity market index of Singapore, it will result in an increase in the Indonesian equity market index of 14,51468 percent, respectively. On the other hand, the equity markets of Malaysia, the Philippines, Thailand, and Vietnam have a negative long-term relationship with the Indonesian equity market, which means that if there is an increase of 1 percent in the equity markets of Malaysia, the Philippines, Thailand, and Vietnam, it will result in a decrease in the Indonesian equity market index of 31,84535 percent, 5,033526 percent, 6,450407 percent, and 17,15477 percent respectively. This result implies that Indonesia, the Philippines, and Singapore respond to the same external shocks. On the other hand, Malaysia, Thailand, and Vietnam respond differently. This supports the findings of [11] which state that Malaysia and the Philippines do not have a positive long-term relationship with Indonesia. However, the conclusion is contrary to the findings of [5] which states that Malaysia and the Philippines have a positive long-term relationship. Furthermore, the results of the Johansen cointegration test show that there is only one cointegration vector, which means that the overall integration process in Southeast Asia is not yet perfect.

In the last column in table 6, the results of the cointegration test of East Asia and Southeast Asia equity markets are obtained simultaneously. The cointegration test shows that there is only one cointegration in the equity markets of East Asia and Southeast Asia which is marked by the trace statistic value in the Johansen cointegration test which is significant at the 95 percent level. The normalized cointegration vector of East and Southeast Asia around the Japanese equity market can be written in the following equation:

$$Japan = 3{,}610266\ Hong\ Kong - 5{,}471932\ Shanghai + 1{,}792236\ Shenzhen - 4{,}365973\ South\ Korea - 11{,}22311\ Indonesia - 8{,}427254\ Malaysia - 11{,}34086\ Philippines + 6{,}625608\ Singapore + 18{,}55856\ Thailand + 9{,}227584\ Vietnam \quad \textbf{(9)}$$

The equation for the cointegration vector 9 shows that the Japanese equity market has a positive relationship with the equity markets of Hongkong, Shenzhen, Singapore, Thailand, and Vietnam. The result means that an increase in the equity markets of Hongkong, Shenzhen, Philippines, Singapore, Thailand. and Vietnam by one percent will result in increases in the Japanese equity market of 3,610266 percent, 1,792236 percent, 6,625608 percent, 18,55856 percent, and 9,227584 percent respectively. On the other hand, the results of the cointegration test show that the Japanese equity market has a negative relationship with the equity markets of Shanghai, South Korea, Indonesia, Malaysia, and the Philippines, which means that if there is an increase in the equity markets of Shanghai, South Korea, Indonesia, Malaysia, and the Philippines by one percent, it will result in a decline in the Japanese equity market of 5,471932 percent, 4,365973 percent, 11,22311 percent, 8,427254 percent and 11,34086 respectively. When viewed from a regional policy perspective, the results of the cointegration test between East Asia and Southeast Asia equity markets show that each equity market responds differently to each regional policy shock, where the reaction of Japan, Hongkong, Shenzhen, Singapore, Thailand, and Vietnam may be different from the reaction Shanghai, South Korea, Indonesia, Malaysia, and the Philippines. If the response between East and Southeast Asia equity markets is unequal to external shocks or policy initiatives, this will hamper the effectiveness of regional authorities' policies. Therefore, policymakers in East and Southeast Asia countries need to coordinate respective countries' capital market regulations according to the ASEAN+3 equity market development framework to ensure a uniform response to policy incentives.

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Table 6. The result of Johansen's cointegration test

Variable	East Asia	Southeast Asia	East and Southeast Asia
H0: r = 0; Ha:r>= 1			
Optimal lag	9	4	2
Trace statistic	65,25179**	55,28323**	290,7987**
Cointegration Vector			
Japan	1,000000		1,00000
Hongkong	-2,920497**(0,39897)		-3,610266 (0,50113)
Shanghai	4,817688**(1,32022)		5,471932**(2,15856)
Shenzhen	-9,130625** (2,17084)		-1,792236**(4,09024)
South Korea	25,88772**(4,47182)		4,365973(5,68326)
Indonesia		1,00000	11,22311**(1,85297)
Malaysia		31,84535** (6,20897)	8,427254**(7,22259)
Philippines		5,033526(1,0795)	11,34086**(1,95887)
Singapore		-14,51468**(2,74859)	- 6,625608**(4,51659)
Thailand		6,450407**(5,33319)	-18,55856** (7,64244)
Vietnam		17,15477**(3,91881)	-9,227584** (4,93654)

Note*:* Johansen's (1988) cointegration test was used to test the multivariate cointegration of all variables with a critical value of 95%; *r* is the maximum number of cointegrated vectors; standard errors are in parentheses; ** indicates significance at the 5% level,

Granger Causality Test

Furthermore, the second objective of this paper is to look at the direction of short-term granger causality between East Asia and Southeast Asia equity markets. In this research, the Granger causality test was conducted by pairing individual equity markets in East Asia with individual markets in Southeast Asia. The first column shows the possible combinations that may occur when pairing individual equity markets in East Asia and Southeast Asian equities markets. Then the second column shows the F-test to see the relationship of the first equity market to the second equity market in each pair. Finally, the third column shows the F-test to see the relationship of the second equity market to the first equity market in each pair. The results of the Granger causality test are in table 7:

Table 7. Granger causality test

Market Pairs	*F-Test(1)*	*F-Test(2)*
Hongkong, Indonesia	1,1278**	3,629**
Hongkong, Malaysia	3,572**	2,366
Hongkong, the Philippines	15,123**	4,727**
Hongkong, Singapore	1,680	10,221**
Hongkong, Thailand	1,099	2,431
Hongkong, Vietnam	9,398**	4,724**
Japan, Indonesia	3,693**	5,862
Japan, Malaysia	2,914**	1,037
Japan, the Philippines	2,445**	3,872**
Japan, Singapore	1,788**	13,039**
Japan, Thailand	2,191**	9,625**
Japan, Vietnam	6,165**	0,356
Shanghai, Indonesia	1,509	2,247
Shanghai, Malaysia	0,518	0,682

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Shanghai, the Philippines	1,544	0,865
Shanghai, Singapore	5,952	9,744**
Shanghai, Thailand	1,242	0,692
Shanghai, Vietnam	3,494	7,160
South Korea, Indonesia	0,342**	5,827
South Korea, Malaysia	4,089	2,101
South Korea, the Philippines	12,48**	1,385
South Korea, Singapore	0,265	8,325**
South Korea, Thailand	2,667	6,783
South Korea, Vietnam	6,867	0,799
Shenzhen, Indonesia	1,859	3,135**
Shenzhen, Malaysia	0,830	3,828**
Shenzhen, the Philippines	2,613	4,728**
Shenzhen, Singapore	4,149	3,573
Shenzhen, Thailand	0,622	1,759
Shenzhen, Vietnam	0,400	2,187

Notes: The F-test (1) shows the Granger causality test for the first market causing the second market Granger; F-test (2) shows the Granger causality test for the second market Granger causes the first market; ** shows a level of significance at 5%,

Based on table 7, Hongkong has a two-way relationship with Indonesia, the Philippines, and Vietnam, while Singapore has a causal relationship with Hongkong, which shows that the Singapore equity market affects Hongkong's equity market but does not apply otherwise. Then Hongkong has a causal relationship in the direction of Malaysia, which shows that the Hongkong equity market affects the Malaysian equity market but does not apply the other way around, and the Hongkong equity market does not have a causal relationship with the Vietnam equity market.

The Japanese equity market, from the results of the Granger causality test, shows that Japan has a two-way relationship with Thailand, Singapore, and the Philippines. On the other hand, Japan has a causal relationship with Indonesia, Malaysia, and Vietnam, which shows that the equity markets of Indonesia, Malaysia, Singapore, and Vietnam are influenced by the Japanese equity market, but not the other way around.

In the Shanghai equity market, it is found that the Shanghai equity market does not have a two-way relationship, but the Singapore equity market has a one-way causal relationship with the Shanghai equity market, which shows that the Singapore equity market affects the Shanghai equity market, and the Shanghai equity market does not have a causal relationship with the Indonesia, Malaysia, Philippines, Thailand and Vietnam equity markets.

In the South Korean equity market, a two-way causal was not found, but a one-way causal relationship was found between South Korea and Indonesia and the Philippines, which shows that the Indonesian and Philippine equity markets are influenced by the South Korean equity market but not the other way around. A one-way causal relationship is found between Singapore. It shows that the equity market of South Korea is influenced by Singapore but not the other way around. Therefore, the South Korean equity market does not have a causal relationship with the equity markets of Malaysia, Thailand, and Vietnam.

It was found that the Shenzhen equity market did not have a two-way relationship. Therefore, the Indonesian, Malaysian and Philippine equity markets had a one-way causal relationship with the Shenzhen equity market, which means that the equity markets of Indonesia, Malaysia, and the Philippines affected the Shenzhen equity market. Shenzhen does not have a causal relationship with the Singapore, Thailand, and Vietnam equity markets.

Comprehensively, the results of the Granger causality test show that the Japanese equity market affects all movements in the Southeast Asian equity market, while the Philippines and Singapore cause several movements in the equity market in East Asia. It can be said that the Japanese equity market is the East Asian equity market with the most relationship with the Southeast Asian equity market, while the Philippine and Singapore equity markets are the most connected equity markets with Southeast Asia, although not as a whole. However, the results of the Granger causality test illustrate that not all equity markets in East Asia and Southeast Asia have connected both ways and in one direction. For example, the Shanghai equity market has a very limited short-

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term relationship with the Southeast Asian equity market. East Asia and Southeast Asia are far from over. The government may be able to assist individual countries in taking steps to address and help resolve international capital barriers to enhance regional financial integration.

Structural Analysis Using FEVD and IRF

Furthermore, the third research question is what equity market has the most influence on its counterparts in Southeast Asia and vice versa. To answer this question, the forecast variance decomposition method is used. The analysis in this section will be divided into two parts, first is to see which equity markets are most influential in East Asia, then the second section is aimed at seeing which Southeast Asian equity markets are the most influential. Below are presented two tables where table 8 shows the results of the estimated variance decomposition for the Southeast Asian equity market, while table 9 shows the results of the estimated variance decomposition for the East Asian equity market.

Table 8. Forecast variance decomposition for the Southeast Asian equity market

	Percentage of forecast variance due to						
Forecast variance of	Hongkong	Japan	Shanghai	Shenzhen	South Korea	Others ASEAN Markets	Domestic Shocks
Indonesia	15,920	11,100	0,377	0,047	3,696	0,239	68,622
Malaysia	16,804	17,200	0,191	0,004	2,877	7,512	55,412
Philippines	9,274	14,233	0,355	0,629	2,079	16,707	56,723
Singapore	26,578	33,421	0,811	0,038	2,484	3,110	33,558
Thailand	13,275	12,795	0,660	0,024	2,464	8,937	61,844
Vietnam	2,571	5,063	0,041	0,004	0,012	1,111	91,197
Note: all numbers are in percentage term; Forecast variance decomposition analysis: percentage changes in Southeast Asian equity markets due to random shocks in East Asian equity market (five days time horizon)							

Based on table 8, the results from the decomposition of forecast variances for Southeast Asian equity markets show that shocks in the Japan equity market contributed 17,2 percent of random shocks in Malaysia, 14,233 percent of random shocks in the Philippines, 33,421 percent of random shocks in Singapore and 5,063 percent shocks to the Vietnam equity market. However, this does not apply to the Indonesian and Thailand equity markets because the Hongkong equity market has a larger contribution than Japan and other East Asian countries with amounts of 15,92 percent and 13,275 percent, respectively. For some Southeast Asian equity markets, the largest random shocks came from Japan, but some could be due to the other four East Asian equity markets, but the one that predominantly rocked the Southeast Asian equity markets was Japan. These results strongly indicate that the Japanese equity market is the East Asian equity market that has the most influence on the Southeast Asian market. In addition, the results in table 7 reveal that random shocks in Southeast Asia equity markets were mainly caused by domestic shocks. If we look at the Vietnam equity market shocks, for example, they experienced 91.197 percent of domestic shocks, followed by Indonesia, Thailand, the Philippines, and Malaysia, which experienced more than 50 percent of domestic shocks.

Based on table 9, the results of the forecast variance decomposition for the East Asian Equity Market show that shocks in the Singapore equity market contributed significantly to the entire East Asian Equity Market by 0,256 percent random shocks in Hongkong, 0,203 percent random shocks in Japan, 0,167 percent random shocks in Shanghai, 0,063 percent shocks in the Shenzhen equity market and 0,121 percent shocks in the South Korean equity market. Furthermore, the results in table 8 show that the randomized design in the equity markets of Japan, Shanghai, and Hongkong is mainly caused by domestic shocks but does not apply to the equity markets of Shenzhen and South Korea, where random external shocks are more dominant. It can be concluded that Singapore is the most influential equity market in Southeast Asia against East Asia.

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Table 9. Forecast variance decomposition for East Asia equity market

Forecast variance of	Percentage of forecast variance due to							
	Indonesia	Malaysia	Philippines	Singapore	Thailand	Vietnam	Others East Asia Markets	Domestic Shocks
Hongkong	0,035	0,007	0,054	0,256	0,020	0,203	31,968	67,457
Japan	0,063	0,042	0,092	0,203	0,153	0,021	0,466	98,960
Shanghai	0,052	0,044	0,022	0,167	0,005	0,280	25,953	73,479
Shenzhen	0,016	0,032	0,003	0,063	0,004	0,057	67,967	31,858
South Korea	0,060	0,043	0,010	0,121	0,146	0,055	53,150	46,416

Note: all numbers are in percentage term; Forecast variance decomposition analysis: percentage changes in East Asian equity market due to random shocks in Southeast Asian equity markets (five days time horizon)

Overall the conclusion of the forecast decomposition variance analysis is that the random shocks in Southeast Asian equity markets are caused by the Japanese equity market, which is stronger than other random shocks in other Southeast Asian equity markets, whereas the influence of Singapore on East Asian equity markets is the strongest compared to other markets. Other Southeast Asian equities.

Furthermore, for analysis of impulse-response, the function can be used impulse-response function (IRF). The plot results of the IRF can be seen in Figure 1. In Figure 1, it can be seen that there are 121 IRF plots for the next ten periods, which visually explains the response of a variable that arises because of a shock/impulse of one standard deviation both from itself and other variables.

Based on Figure 1, the response of the Japan equity market to shocks from itself in period 1 was not that large, although in period two it had decreased, up to period three the response to shocks of itself has decreased. However, after a period of 4 to 10, the Japan equity market did not experience a decline. This means that after the 4th period, the reaction of the Japan equity market to shocks of its own is likely to stabilize. The response of the Japan equity market to shocks from the Shanghai and Malaysia equity markets is likely to be negative. This means that if there is a shock of 1 standard deviation from the Japan equity market, the Shanghai and Malaysia equity markets will react negatively to the Japan equity market. Meanwhile, the Japan equity market to other equity markets tended to react positively even though it tended to weaken until period 10.

The Hongkong equity market response to shocks from itself in period 1 was not that big, although, in period two, it had increased. After period 3, the Hongkong equity market continues to decline. This means that after period 3, the Hongkong equity market's reaction to shocks of its own is likely to weaken. The Hongkong equity market response to shocks from the equity markets of Shanghai, Malaysia, and the Philippines is likely to be negative. This means that if there is a shock of 1 standard deviation from the Hongkong equity market, the equity markets of Shanghai, Malaysia, and the Philippines will react negatively to the Hongkong equity market. Meanwhile, the Hongkong equity market to other equity markets tended to react positively even though it tended to weaken until period 10.

The response of the Shanghai equity market to shocks from itself in period 1 was not that big, although, in period two, it had increased. In period 3, the response to shocks of itself has decreased. However, after a period of 4 to 10, the Shanghai equity market was stable. This means that after the 4th period, the reaction of the Shanghai equity market to shocks of its own is likely to be weaker. The response of the Shanghai equity market to shocks from the Malaysia and Philippine equity markets is likely to be negative. This means that if there is a shock of 1 standard deviation from the Shanghai equity market, the Malaysian and Philippine equity markets will react negatively to the Shanghai equity market. Meanwhile, the Shanghai equity market to other equity markets tended to react positively even though it tended to weaken until period 10.

The response of the South Korean equity market to shocks from itself in period 1 was not that big, although, in period 2, it had decreased until period 3 in response to shocks from itself has decreased. However, after periods 4 to 7, the Shanghai equity market did not experience a decline until period 7. South Korea experienced a decline and was stable until period 10. This means that after period 4, the South Korea equity market reaction to shocks of its own tended to be weak. The response of the South Korean equity market to shocks from the equity markets of Shanghai, Malaysia, and the Philippines is likely to be negative. This means that if there is a shock of 1 standard deviation from the South Korean equity market, the equity markets of Shanghai, Malaysia, and the

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Philippines will react negatively to the South Korean equity market. Meanwhile, the South Korean equity market to other equity markets tended to react positively even though it tended to weaken until period 10.

The response of the Shenzhen equity market to shocks from itself in period 1 was not that big, even though until period 3 it had experienced an increase in shocks of itself it increased. However, after period 4 the Shenzhen equity market did not experience a decline and increase until period 10. This means that after period 4 the Shenzhen equity market reaction to shocks of itself tends to be weak. The response of the Shenzhen equity market to shocks from the equity markets of South Korea, Malaysia, the Philippines and Thailand is likely to be negative. This means that if there is a shock of 1 standard deviation from the Shenzhen equity market, the equity markets of South Korea, Malaysia, the Philippines and Thailand will react negatively to the Shenzhen equity market. Meanwhile, the Shenzhen equity market to other equity markets tended to react positively even though it tended to weaken until period 10.

The response of the Indonesia equity market to shocks from itself in period 1 was not that great, although it had increased until period two then decreased until period 5 in response to shocks of itself has decreased. However, after 5 to 10 periods, the Indonesian equity market experienced a steady rise from period 6 to period 10. This means that after period 6, the reaction of the Indonesian equity market to shocks of itself tends to be weak. The response of the Indonesian equity market to shocks from the Shanghai equity market is likely to be negative. This means that if there is a shock of 1 standard deviation from the Indonesia equity market, the Shanghai equity market will react negatively to the Indonesia equity market. Meanwhile, the Indonesia equity market to other equity markets tends to react positively even though it tends to weaken until period 10.

The Malaysia equity market response to shocks from itself in period 1 is non-existent. This means that after from period 1 to 10, the Malaysia equity market reaction to shocks from itself tends not to exist. The Malaysia equity market response to shocks from the Shanghai and Philippine equity markets is likely to be negative. This means that if there is a shock of 1 standard deviation from the Malaysia equity market, the Shanghai and Philippine equity markets will react negatively to the Malaysia equity market. Meanwhile, the Malaysia equity market to other equity markets tended to react positively even though it tended to weaken until period 10.

The response of the Philippine equity market to shocks from itself in period 1 to period ten, the Philippine equity market continued to decline. This means that after period 1, the Philippine equity market's reaction to shocks of its own is likely to weaken. The response of the Philippine equity market to shocks from the Shanghai equity market is likely to be negative. This means that if there is a shock of 1 standard deviation from the Philippine equity market, the Shanghai equity market will react negatively to the Philippine equity market. Meanwhile, the Philippine equity market to other equity markets tended to react positively even though it tended to weaken until period 10.

The response of the Singapore equity market to shocks from itself in period 1 was not that big, although in period two it had decreased, up to period three the response to shocks of itself has decreased. However, after a period of 5 to 10, the Singapore equity market did not experience a decline and tended to be stable. This means that after the 5th period, the reaction of the Singapore equity market to shocks of its own is likely to stabilize. The response of the Singapore equity market to shocks from the Shanghai equity market is likely to be negative. This means that if there is a shock of 1 standard deviation from the Singapore equity market, the Shanghai equity market will react negatively to the Singapore equity market. Meanwhile, the Singapore equity market to other equity markets tends to react positively even though it tends to weaken up to period 10.

The response of the Thailand equity market to shocks from itself in period 1 is not that big, although up to period four, the shocks of itself increased. However, after period 4, the Thailand equity market did not experience a decline and increase until period ten or tended to be stable. This means that after period 4, the Thailand equity market's reaction to shocks of its own tends to be non-existent or stable. The response of the Thailand equity market to shocks from the Shenzhen equity market is likely to be negative. This means that if there is a shock of 1 standard deviation from the Thai equity market, the Shenzhen equity market will react negatively to the Thailand equity market. Meanwhile, the Thailand equity market to other equity markets tended to react positively even though it tended to weaken until period 10.

The response of the Vietnam equity market to shocks from itself in period 1 was not that big, even though until period five, it had experienced an increase in shocks of itself it increased. However, after period 5, the Vietnam equity market did not experience a decline and increase until period 10. This means that after period 5, the reaction of the Vietnam equity market to shocks of itself

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tends to be weak. The response of the Vietnam equity market to all other equity markets tends to react positively even though it tends to weaken until period 10.

Figure 1: Impulse Response

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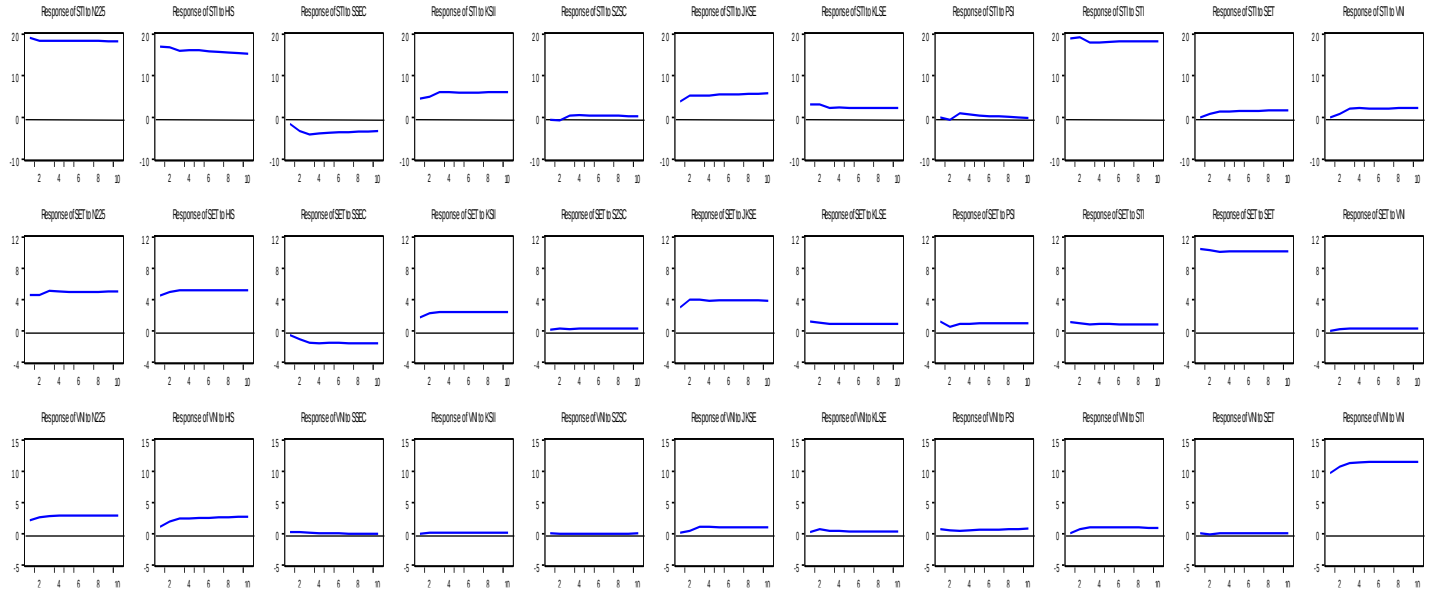

Forecasting

The final research question is to see the forecast results using VECM. We used five days horizon period time to see the predicting price for a week. The results can be seen in Table 10 Forecasting result. The results obtained in Table 10 are the forecast results from the stock price. The period for each variable in the actual data is the same as the forecast data period, namely the stock price in the same period.

Table 10. Forecasting result

	Indonesia		Malaysia		Singapore		Thailand		Philippine		Vietnam	
Day	**Act.**	**Fore.**	**Act.**	**Fore.**	**Act.**	**Fore.**	**Act.**	**Fore.**	**Act.**	**Fore.**	**Act.**	**Fore.**
1	6283,58	6234,56	1602,50	1612,96	3222,38	3229,58	1595,82	1598,60	7742,53	7735,08	966,67	967,98
2	6323,47	6329,71	1611,38	1617,65	3252,00	3250,96	1594,97	1592,17	7839,79	7840,30	965,14	962,31
3	6257,40	6229,49	1597,76	1599,62	3238,82	3238,48	1568,50	1568,10	7797,87	7788,29	955,79	956,38
4	6279,35	6289,42	1611,04	1619,72	3218,86	3219,23	1585,23	1589,13	7840,70	7837,53	958,88	963,31
5	6225,69	6255,47	1589,10	1592,76	3247,86	3249,25	1559,27	1568,15	7736,24	7740,30	948,98	952,32
	South Korea		**Hongkong**		**Shenzhen**		**Japan**		**Shanghai**			
Day	**Act.**	**Fore.**	**Act.**	**Fore.**	**Act.**	**Fore.**	**Act.**	**Fore.**	**Act.**	**Fore.**		
1	2175,17	2179,40	28543,52	28543,89	1756,16	1758,27	23205,00	23205,27	3085,20	3020,84		
2	2176,46	2184,57	28451,50	28455,45	1760,85	1769,85	23576,00	23579,78	3083,79	3017,29		
3	2155,07	2159,51	28226,19	28224,01	1768,68	1768,18	23205,00	23205,13	3083,41	3016,22		
4	2175,54	2180,76	28322,06	28321,32	1791,85	1792,52	23740,00	23742,08	3104,80	3017,26		
5	2151,31	2152,81	28087,92	28073,06	1769,58	1775,64	23851,00	23851,06	3066,89	3017,70		

Note*:* Act. = Actual data is obtained from 5 working days of each stock exchange; Fore = Forecast results

Next, we will evaluate the forecasting results using the mean squared error (MSE) and the mean absolute percentage error (MAPE) method. Following the calculation of the evaluation of forecasting by using MAPE and MSE:

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Table 11. Forecasting result using MSE and MAPE

	Indonesia	Malaysia	Singapore	Thailand	Philippine	Vietnam
MSE	841,9612	48,18081	11,02358	21,94442	34,80714	8,170513
MAPE	0,393 %	0,385%	0,064%	0,238%	0,064%	0,261%
	South Korea	**Hongkong**	**Shenzhen**	**Japan**	**Shanghai**	
MSE	26,57236	48,3455	24,553	3,743803	4631,937	
MAPE	0,217%	0,016%	0,208%	0,005%	2,169%	

Based on the table 10, it can be obtained the values of MSE and MAPE of each variable as shown in the table 11. In the table 11, the forecast is said to be very good if the MAPE is less than 10% and it is said to be good if the MAPE is between 10% to 20% [40]. It can be seen that the smallest MSE and MAPE is Japan. This means that forecasting using the model is VECM more accurate when applied to Japan.

CONCLUSIONS

This paper focuses on equity markets between East Asia and Southeast Asia, which can provide an overview of possible financial integration under the ASEAN+3 initiative. Although the process of financial integration requires macroeconomic movements as well as linkages between financial institutions within their respective regions, integration of the equity market is clearly one aspect of financial integration.

This study provides evidence that there is long-term cointegration between East Asia and Southeast Asia equity markets in each sub-region of East Asia and Southeast Asia. However, this study also shows that the integration process is incomplete, seen from the large number of vectors that have not yet integrated with each other. The notation of the cointegration vector also indicates that Japan, Hong Kong, Shenzhen, Singapore, Thailand, and Vietnam may react differently to external shocks than those of Shanghai, South Korea, Indonesia, Malaysia, and the Philippines. This shows the urgency of ASEAN+3 members to unify rules and standards in their equity markets to encourage the integration process. Harmonization of standards and regulations is needed in encouraging East and Southeast Asia equity markets to respond equally to any external shocks or policy initiatives.

In this study, it can also be concluded that Japan is the equity market in East Asia which is most closely related to Southeast Asia. Because of changes in the Japanese equity market, Granger-causes in all Southeast Asian stock market indexes. Meanwhile, the Philippines and Singapore are the Southeast Asian equity markets that are most connected to the equity markets in East Asia.

Another point of this paper is to emphasize that Japan is the most influential equity market in East Asia because the random shocks given by the Japan equity market to other Southeast Asian equity markets are higher for the Japan equity market than other East Asian equity markets. Likewise, Singapore is the most influential equity market in Southeast Asia because the random shocks in the East Asian market caused by random shocks in Singapore are higher than random shocks by other Southeast Asian countries. Finally, it can be seen that the minimum value of MSE and MAPE is in Japan, which means that the prediction using this model is more accurate when applied to Japan.

REFERENCES

1. A. D. Rillo, “Asean Financial Integration: Opportunities, Risks,and Challenges,” Public Policy Review, vol. 14, no. 5, pp. 901–924, 2018.
2. ASEAN Secretariat, “Overview of ASEAN Plus Three Cooperation,” ASEAN Secretariat Information Paper, no. April, pp. 1–7, 2020.
3. ASEAN, “SAP for Financial Integration 2025 for Publication,” 2012.
4. T. T. X. Anh, N. T. Hang, and N. T. L. Anh, “Assessing financial market integration in Vietnam: A price - Based approach,” Academic Journal of Interdisciplinary Studies, vol. 9, no. 4, pp. 105–124, 2020, doi: 10.36941/AJIS-2020-0066.
5. N. Arsyad, “Integration between East and Southeast Asian equity markets,” Journal of Financial Economic Policy, vol. 7, no. 2, pp. 104–121, 2015, doi: 10.1108/JFEP-02-2014-0012.

6. R. Dias, J. V. da Silva, and A. Dionísio, "Financial markets of the LAC region: Does the crisis influence the financial integration?," International Review of Financial Analysis, vol. 63, no. July 2018, pp. 160–173, 2019, doi: 10.1016/j.irfa.2019.02.008.
7. R. L. Montanes and S. L. Schmukler, "Financial Integration in East Asia and Pasific: Regional and Interregional Linkages," 2018.
8. S. Kim and J. W. Lee, "Real and Financial Integration in East Asia," Review of International Economics, vol. 20, no. 2, pp. 332–349, 2012, doi: 10.1111/j.1467-9396.2012.01025.x.
9. M. S. Chien, C. C. Lee, T. C. Hu, and H. T. Hu, "Dynamic Asian stock market convergence: Evidence from dynamic cointegration analysis among China and ASEAN-5," Economic Modelling, vol. 51, pp. 84–98, 2015, doi: 10.1016/j.econmod.2015.06.024.
10. M. S. Rahman, A. H. A. Othman, and F. Shahari, "Testing the validation of the financial cooperation agreement among ASEAN+3 stock markets," International Journal of Emerging Markets, vol. 12, no. 3, pp. 572–592, 2017, doi: 10.1108/IJoEM-05-2016-0127.
11. R. W. Click and M. G. Plummer, "Stock market integration in ASEAN after the Asian financial crisis," Journal of Asian Economics, vol. 16, no. 1, pp. 5–28, 2005, doi: 10.1016/j.asieco.2004.11.018.
12. L. K. Lim, "Convergence and interdependence between ASEAN-5 stock markets," Mathematics and Computers in Simulation, vol. 79, no. 9, pp. 2957–2966, 2009, doi: 10.1016/j.matcom.2008.12.004.
13. C. W. S. Chen, R. Gerlach, N. Y. P. Cheng, and Y. L. Yang, "The impact of structural breaks on the integration of the ASEAN-5 stock markets," Mathematics and Computers in Simulation, vol. 79, no. 8, pp. 2654–2664, 2009, doi: 10.1016/j.matcom.2008.12.012.
14. C. Guillaumin, "Financial integration in East Asia: Evidence from panel unit root and panel cointegration tests," Journal of Asian Economics, vol. 20, no. 3, pp. 314–326, 2009, doi: 10.1016/j.asieco.2009.02.002.
15. T. O. Awokuse, A. Chopra, and D. A. Bessler, "Structural change and international stock market interdependence: Evidence from Asian emerging markets," Economic Modelling, vol. 26, no. 3, pp. 549–559, 2009, doi: 10.1016/j.econmod.2008.12.001.
16. W. Mohti, A. Dionísio, I. Vieira, and P. Ferreira, "Regional and global integration of Asian stock markets," Research in International Business and Finance, vol. 50, no. June, pp. 357–368, 2019, doi: 10.1016/j.ribaf.2019.06.003.
17. Y. Song, R. Huang, S. R. Paramati, and A. Zakari, "Does economic integration lead to financial market integration in the Asian region?," Economic Analysis and Policy, vol. 69, pp. 366–377, 2021, doi: 10.1016/j.eap.2020.12.003.
18. F. Wu, "Stock market integration in East and Southeast Asia: The role of global factors," International Review of Financial Analysis, vol. 67, no. November 2019, p. 101416, 2020, doi: 10.1016/j.irfa.2019.101416.
19. Y. Finance, "20 Largest Stock Exchanges In The World," 2020. https://finance.yahoo.com/news/20-largest-stock-exchanges-world-175549152.html
20. R. Gupta and F. Guidi, "Cointegration relationship and time varying co-movements among Indian and Asian developed stock markets," International Review of Financial Analysis, vol. 21, pp. 10–22, 2012, doi: 10.1016/j.irfa.2011.09.001.
21. T. D. Nguyen and P. Elisabeta, "Financial integration and diversification benefits: China and ASEAN4 countries," Managerial Finance, vol. 42, no. 5, pp. 496–514, 2016, doi: 10.1108/MF-12-2014-0300.
22. E. Anoruo, S. Ramchander, and H. Thiewes, "Return dynamics across the asian equity markets," Managerial Finance, vol. 29, no. 4, pp. 1–23, 2003, doi: 10.1108/03074350310768265.
23. H. C. Sheng and A. H. Tu, "A study of cointegration and variance decomposition among national equity indices before and during the period of the asian financial crisis," Journal of Multinational Financial Management, vol. 10, no. 3–4, pp. 345–365, 2000, doi: 10.1016/s1042-444x(00)00034-7.
24. T. J. Brailsford, T. J. O'Neill, and J. Penm, "A NEW APPROACH FOR ESTIMATING RELATIONSHIPS BETWEEN STOCK MARKET RETURNS: EVIDENCE OF FINANCIAL INTEGRATION IN THE SOUTHEAST ASIAN REGION," Asia-Pacific Financial Markets: Integration, Innovation and Challenges, vol. 8, no. 07, pp. 17–37, 2008.

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25. R. Fry-McKibbin, C. Y. L. Hsiao, and V. L. Martin, "Global and regional financial integration in East Asia and the ASEAN," North American Journal of Economics and Finance, vol. 46, no. March, pp. 202–221, 2018, doi: 10.1016/j.najef.2018.04.007.
26. ASEAN, "Asean Exchange," 2020. https://www.aseanexchanges.org/#/ (accessed May 03, 2020).
27. X. Lin, Z. Tang, and F. Fei, "Testing for relationships between Shanghai and Shenzhen stock markets: A threshold cointegration perspective," Physica A: Statistical Mechanics and its Applications, vol. 392, no. 18, pp. 4064–4074, 2013, doi: 10.1016/j.physa.2013.04.050.
28. N. Shafigni, A. H. Shaari, B. Gharleghi, T. Sarmidi, and K. Omar, "Financial Integration via Panel Cointegration Approaches in ASEAN+5," Journal of Economic Studies, vol. 43, no. 1, pp. 2–15, 2016.
29. N. M. Thomas, S. Kashiramka, and S. S. Yadav, "Dynamic linkages among developed, emerging and frontier capital markets of Asia-Pacific region," Journal of Advances in Management Research, vol. 14, no. 3, pp. 332–351, 2017, doi: 10.1108/JAMR-10-2016-0088.
30. G. M. Caporale, K. You, and L. Chen, "Global and regional stock market integration in Asia: A panel convergence approach," International Review of Financial Analysis, vol. 65, no. July, p. 101381, 2019, doi: 10.1016/j.irfa.2019.101381.
31. D. Gujarati, Basic Econometrics, 4th ed. New York: Mc. Graw Hill, 2004.
32. H. Lutkepohl, New Introduction to Multiple Time Series Analysis. Berlin: Springer-Verlag, 2006.
33. H. Lütkepohl, "Vector autoregressive models," Handbook of Research Methods and Applications in Empirical Macroeconomics, pp. 139–164, 2013, doi: 10.4337/9780857931023.00012.
34. B. Juanda and Junaidi, Time Series Econometrics. Bogor: IPB Press, 2012.
35. Eviews, EViews 7 User's Guide II. Irvine CA: Quantitative Micro Software, 2009.
36. D. Rosadi, Econometrics and Applied Time Series Analysis with Eviews. Yogyakarta: Andi Offset, 2012.
37. R. F. Engle and C. W. J. Granger, "Co-integration and error correction: Representation, estimation, and testing," Applied Econometrics, vol. 39, no. 3, pp. 107–135, 1987, doi: 10.2307/1913236.
38. A. Widarjono, Econometrics Theory and Applications for Economics and Business Issue 2. Yogyakarta: ECONISLA, 2007.
39. S. Johansen, "Statistical analysis of cointegration vectors," Journal of Economic Dynamics and Control, vol. 12, no. 2–3, pp. 231–254, 1988, doi: 10.1016/0165-1889(88)90041-3.
40. N. Y. Zainun and M. Z. A. Majid, "Low Cost House Demand Predictor," Universitas Teknologi Malaysia, 2003.

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