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INTEGRATION AND LINKAGES BETWEEN GLOBAL STOCK MARKETS (CASE STUDIES ON STOCK MARKETS IN COUNTRIES IN ASIA, EUROPE AND AMERICA)

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Abstract

The existence of cooperative relations between countries has a positive impact, especially when there is a global economic crisis. Cooperation relations between countries are carried out through the stock market, where funds from abroad enter a country easily through the stock market. Thus, there will be integration and linkages between stock markets in countries that collaborate in the economic sector. This research aims to analyze the existence of integration and linkages of the Indonesia-JKSE stock market with other stock markets in the Asian region, (China-SSE, South Korea-KOSPI, Singapore-STI, and Japan-NIKKEI 225) and the global stock market (Germany-DAX, England-FTSE 100 and United States of America-DJIA). Data analysis was conducted using the Vector Error Correction Model (VECM) based on the research objectives. The data used in this research is monthly data for the 2015-2021 index year from each country's stock index. The research results show integration and linkages between stock markets in Asia, Europe and America in the short and long term. The research results show that three stock markets in the Asian region are integrated in the period January 2015 to December 2021. Namely, the Indonesian stock market (JKSE), South Korea (KOSPI) and the Singapore stock market (STI) and all three are influenced by other markets. The research results also show that in countries in Asia, Europe and America with strong economies, their main stock markets tend not to be influenced by other countries' stock markets. However, their main stock markets are more influenced by economic and non-economic forces in their countries.

Keywords: JKSE, SSE, KOSPI, STI, NIKKEI 225, DAX, FTSE 100, DJIA, INTEGRATION, LINKAGES, VECM

1. INTRODUCTION

Economic globalization has made it easier to channel investment in the form of portfolios into the stock market so that this investment flow can influence the stability of the domestic financial sector due to funds coming in from abroad. An increase in the stock market value can facilitate the inflow of funds, increase the balance of payments, and increase the currency's value. An increase in stock market value is identical to an increase in capitalization. Market capitalization (market cap) is a measure based on the aggregate value of a company, which is obtained from extracting the total number of outstanding shares of the company in circulation at the price of one share on the market. Investors often use the term market cap to measure the quality of a company. By knowing the market cap value, investors can determine how much money must be spent to buy the desired company's shares.

One of the main factors that greatly influences the size of the market cap value is public (investor) sentiment. This is very reasonable because market sentiment (public or investor), whether positive or negative, greatly influences market movements and thus influences market capitalization. In the last few decades, it can be seen that the Asian financial crisis in 1997 and

The Seybold Report
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the global financial crisis in 2008, as well as the global Covid-19 pandemic in 2020, gave rise to negative sentiment towards the capital market and had an impact on decreasing stock market capitalization in these periods. However, the financial crisis was slowly resolved by implementing various financial policies and strategies, both of which were carried out by each country affected by the crisis and in collaboration with other countries. The increase in stock market capitalization after the crisis period was due to the emergence of positive sentiment on the stock market and business players' awareness of the need for capital markets.

The existence of cooperative relations between countries has a positive impact, especially when there is a global economic crisis. The phenomenon of economic community agreements recognized by several countries has given rise to new regulations allowing foreign investors to invest their capital in inter-country capital markets. Capital flows that occur between countries can integrate capital markets. In reality, no world capital market has perfect integration between countries. Hence, a diversified securities portfolio across several different capital markets still provides the opportunity to gain portfolio profits compared to just investing shares in one capital market.

Many previous researchers have researched capital market integration. In general, the research carried out has different results because the objects used are also different depending on the approach used in the research. Fan et al. (2009) concluded that in the short term, the impact of market integration is very strong in boom regime conditions and weak in depression regime conditions on the Chinese stock market, with the international stock market consisting of the American and British stock markets.

Dunis and Shannon (2005), in measuring the degree of integration of the US capital market with several emerging market countries in Asia using a modern portfolio approach, concluded that the degree of integration investigated still provides benefits for US investors if they want to carry out an asset portfolio with these emerging market countries. In their research, Jiang et al. (2013) wanted to measure the degree of integration between China's capital markets and 15 countries combined in Asia-Pacific and Euro-American. This research wants to prove whether Chinese investors who diversify their capital into international markets will still provide profits and reduce risks. This research concludes that Chinese investors benefit effectively from risk reduction if they diversify their shares to developed Euro-American countries.

The study of interdependence, which causes stock market integration and linkages, is very interesting, especially before and after the global COVID-19 pandemic in the ASEAN countries where emerging market countries are located. The global Covid-19 pandemic has caused shocks to the economies of countries affected by Covid-19, including the stock market. Even though the impact of the Covid-19 outbreak was not as severe as the Asian financial crisis in 1997 and the global financial crisis in 2008, at certain times, especially in the first quarter of 2020, there was a sharp decline in stock indices and trading volumes in most countries exposed to the Covid-19 pandemic. 19. Departing from the description above, it is important to carry out further studies to understand the integration and linkages of the Indonesian stock market with international stock markets (Asia, Europe and the United States) in the period before and after the global Covid-19 pandemic (January 2015 - December 2021).

The Seybold Report
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2. LITERATURE REVIEW

2.1 Globalization and Financial Integration

Economic globalization is the increasing economic integration and interdependence of national, regional and local economies worldwide through intensifying the movement of goods, services, technology and capital across borders (International Business). Economic globalization includes production and finance, markets and technology, organizational regimes and institutions, companies and labor (James et al., 2007). Although economic globalization has expanded since the emergence of trade between countries, its growth has accelerated dramatically in the last 20–30 years thanks to the framework of the General Agreement on Tariffs and Trade and the World Trade Organization. All countries are slowly removing trade barriers and opening up their current and capital accounts (Gao, 2000). The impact that emerged then became a modern economic boom caused by integrating developed countries with developing countries through foreign direct investment, reduced trade barriers and cross-border migration.

Financial globalization occurred when the world's financial system began to shift to become open, so what is meant by financial globalization is a process in which financial markets from various countries are integrated into one. Supporting this opinion, Prasad et al. (2003) believe that financial globalization is an aggregate concept in which there is an increase in linkages between countries due to flows and cross borders. Meanwhile, financial integration is the link between a country's capital and international capital markets. Therefore, these two concepts are interconnected with each other. Increasing financial globalization will inevitably increase financial integration between countries. With increasing globalization and financial integration, there will be a freer flow of funds in and out between countries, which can then positively impact the financial markets of emerging market countries. With globalization and financial integration, the financial markets of emerging market countries will develop, and the number of investors, market capitalization and issuers will also grow.

2.2 Capital Market and Stock Market

Law Number 21 of 2011 concerning the Financial Services Authority defines the meaning of capital markets as follows: "Capital markets are activities related to public offerings and securities trading, Public Companies related to the securities they issue, as well as institutions and professions related to securities as intended in the law regarding capital markets." Meanwhile, according to Bruce Lloyd (1976), the capital market links investors, companies, and government agencies through instrument trading. The capital market investment instruments consist of various securities, including shares, mutual funds, debt securities or bonds, Exchange Traded Funds (ETF), and derivatives. Next, Halim (2015) believes that the capital market is a market that brings together parties who offer and those who need long-term funds, such as shares and bonds. Based on these definitions, it can be concluded that the capital market is a market for various financial instruments that can be traded in the form of debt securities (bonds), shares, mutual funds, warrants, rights and other derivative instruments such as options, futures, etc.

The Seybold Report
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Meanwhile, the stock market is part of the capital market itself, where only shares and their derivatives are transacted in the stock market. Meanwhile, shares and debt securities (bonds) are transacted in the capital market. In essence, both the capital market and the stock market function as vehicles for companies to seek funding (capital) for expansion. Funding can be obtained from releasing shares or debt securities. In the stock market, speculators and investors take advantage of changes in stock prices to make profits. Speculators earn profits through stock market indices. Meanwhile, the stock market can provide investors the right to sell options at a profit when share prices fall. This condition benefits investors because it can protect their investments.

2.3 Stock Index

Shares can be defined as proof of ownership or a sign of capital participation of a person or certain party (business entity) in a company or limited liability company. By including this capital, the party has a claim on the company's income and assets and has the right to attend the General Meeting of Shareholders (GMS). According to Bodie et al. (2018), shares are part of ownership in a company.

Each share gives the owner the right to one vote in all matters relating to corporate governance used in the annual General Meeting of Shareholders (GMS) and to obtain a share of the company's financial benefits. In simple terms, shares are proof of company or business entity ownership. Shares generally take the form of a piece of paper stating that the owner of the securities is the owner of the company that issued the securities.

When investing in the stock market, investors have many index choices that can be used as trading references. A stock index is a statistical measure of changes in price movements of a collection of stocks selected based on certain criteria and used as a means of investment objectives. With the large number of shares issued by many companies, this stock index was created to monitor the performance of an exchange in general.

The stock index is a measurement of the value of the stock market. Stock index calculations are calculated from price movements in certain shares, which generally use a weighted average. Another definition of a stock index is a statistical measure that reflects the overall price movement of a group of shares selected based on certain criteria and methodology and evaluated periodically. The stock market index reflects the performance of shares in a stock market.

The stock market index is also called the stock price index because it provides information about changes in stock prices. In a composite stock price index, the stock's market price is the market value of the stock itself. This means that market value is determined by supply and demand conditions for a share. This supply and demand activity is usually carried out on the stock exchange. The stock market value is determined by several factors, namely the level of organization of the stock trading place, the interaction of determining the price per share, the trend of profits and dividends, and daily changes in stock prices.

The Seybold Report
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3. METHODS

This research uses quantitative research methods. Quantitative research is a research approach that uses quantitative data collection and analysis methods to test hypotheses and answer research questions.

The data used in this research is monthly data for the 2015-2021 index year from each Indonesian stock index with stock markets in the Asian region (China, South Korea, Singapore and Japan) and global stock markets (Germany, England and the United States of America). The data comes from secondary data by accessing official international sites: Bloomberg, Yahoo Finance and ID. Investing, com.

Indonesian stock market with stock markets in the Asian region (China, South Korea, Singapore and Japan) and global stock markets (Germany, England and the United States of America). The 3 global stock markets (Germany, England and the United States of America) and the Japanese stock market were among the largest at the end of the 20th century.

Data was analyzed using the Vector Error Correction Model (VECM). Vector Error Correction Model (VECM) is a development of the VAR model for time series that are not stationary and have one or more cointegration relationships. The dynamic behavior of VECM can be seen through the response of each dependent variable to shocks to that variable or other dependent variables. There are two ways to see the characteristics of the VECM model: impulse response function and variance decomposition.

4. RESULTS

4.1 Stationarity Test Results

The results of the stock index stationary test for the research sample, as shown in Table 1, show that the overall stock index data is not stationary at a level where each stock index has a probability value (p-value) > 0.05 or a t-statistic value < calculated t value at 95% confidence level (5% level). The results of this test show that the stock indices of the research sample countries have a long-term relationship (there is cointegration). Thus, stationary testing was carried out at the differencing level to determine the degree of integration in the research data. The stationary test results at the differencing level, as shown in Table 1, show stationary research data at the first difference, where each stock index has a probability value (p-value) < 0.05 or t-statistic value > calculated t value at a confidence level of 95 % (5% levels). This means that the stock indices of the research sample countries have a long-term relationship (first-degree integrated).

The Seybold Report
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Table 1: Stationary Test Results for Stock Indexes for Countries in Asia, Europe and the United States January 2015 – December 2021

Countries/Index	Stationer Test					
	Level			First Difference		
	t-statistic	5% Level	Prob*	t-statistic	5% Level	Prob*
Indonesia (JKSE)	-1.3111	-2.8968	0.6211	-7.8146	-2.8972	0.0000
China (SSE)	-2.3270	-2.8968	0.1661	-7.1022	-2.8977	0.0000
South Korea (KOSPI)	-0.6663	-2.8968	0.8487	-7.9516	-2.8972	0.0000
Singapore (STI)	-2.3432	-2.8968	0.1612	-10.504	-2.8972	0.0001
Japan (Nikkei 225)	-0.8129	-2.8968	0.8100	-8.8911	-2.8972	0.0000
German (DAX)	-1.0967	-2.8968	0.7139	-9.1444	-2.8972	0.0000
England (FTSE 100)	-2.0374	-2.8968	0.2706	-8.9916	-2.8972	0.0000
USA (DJIA)	0.0114	-2.8968	0.9565	-9.7274	-2.8972	0.0000

Source: Researcher Processed E-Views Results

4.2 Optimum Lag Test Results

Optimum lag testing is very useful for eliminating autocorrelation problems in the model. At this stage, optimum lag testing uses the VAR model. This follows the previous test results, which showed stationary data in the first difference, so in the optimum lag test, the endogenous variable in the first difference was used. This research determines the optimum lag length based on the Akaike Information Criterion (AIC) and Schwarz Information Criteria (SC) values. The best model with optimum lag is based on the smallest AIC and SC values. The results of the optimum lag test in Table 2 show that, based on the goodness of the LR, FPE, AIC, SC and HQ models, the optimum lag selected is the lag with the most goodness of the model (marked *). In addition, based on the goodness of the Akaike Information Criterion (AIC) and Schwarz Information Criteria (SC) models, the selection of the optimum lag is based on the goodness of the AIC model with the smallest value (marked *), which is at lag 8, which is based on the goodness of the model SC. The smallest SC value (marked *) is at lag 0. Thus, the optimum lag length chosen for the model is the lag length based on the greatest goodness of the model as well as the goodness of the model with the smallest AIC criteria, namely lag 8.

Table 2: Optimum Lag Test Results for Stock Indexes for Countries in Asia, Europe and the United States January 2015 – December 2021

VAR Lag Order Selection Criteria						
Endogenous variables: D(JKSE) D(SSE) D(KOSPI) D(STI) D(NIKKEI_225) D(DAX) D(FTSE_100) D(DJIA)						
Exogenous variables: C						
Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	-4072.683	NA	2.51e+37	108.8182	109.0654*	108.9169
2	-3996.282	67.74629	1.06e+38	110.1942	114.3966	111.8722
4	-3878.107	84.41739*	2.16e+38	110.4562	118.6138	113.7134
5	-3803.769	67.40037	2.86e+38	110.1805	120.3156	114.2274
8	-3270.129	74.44461	1.52e+37*	101.0701*	117.1380	107.4858*

Source: Processed EViews Research Results

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4.3 Model Stability Test Results

Stability testing using the VAR model was carried out to determine whether the Impulse Response Function (IRF) and Variance Decomposition analyses were valid. If the VAR model estimation results show stability, then the Impulse Response Function (IRF) and Variance Decomposition analyses become valid.

Based on the results of the VAR stability test in Table 3, it is known that the VAR model meets the stability requirements because all its absolute values (modulus) are less than one. In other words, the stability model is valid for modeling Impulse Response Function (IRF) and Variance Decomposition.

Table 3: Stock Index Stability Test Results for Countries in Asia, Europe and the United States January 2015 – December 202

Roots of Characteristic Polynomial	
Endogenous variables: D(JKSE) D(SSE) D(KOSPI) D(STI) D(NIKKEI_225) D(DAX) D(FTSE_100) D(DJIA)	
Exogenous variables: C	
Lag specification: 1 2	
Date: 02/01/22 Time: 12:16	
Root	**Modulus**
-0.166276 - 0.563368i	0.587394
-0.166276 + 0.563368i	0.587394
0.583107	0.583107
-0.506309 - 0.256585i	0.567613
-0.506309 + 0.256585i	0.567613
0.285401 - 0.460776i	0.542004
0.285401 + 0.460776i	0.542004
0.189544 - 0.497040i	0.531954
0.189544 + 0.497040i	0.531954
-0.206105 - 0.451328i	0.496161
-0.206105 + 0.451328i	0.496161
0.316214 - 0.191781i	0.369825
0.316214 + 0.191781i	0.369825
-0.257943 - 0.145992i	0.296392
-0.257943 + 0.145992i	0.296392
0.066295	0.066295
No root lies outside the unit circle.	
VAR satisfies the stability condition.	

Source: Processed Eviews

4.4 Granger Causality Test Results

The Granger causality test is carried out to see whether there is a relationship between the influence of one variable and another variable, or in other words, each variable has the opportunity to be an endogenous or exogenous variable. In this research, the Granger causality test was carried out to see the direction of the relationship between the JKSE, SSE, KOSPI,

The Seybold Report
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STI, NIKKEI 225, DAX, FTSE 100 and DJIA index variables. The causality test in this study used the VAR Pairwise Granger Causality Test and a significance level of 5% (0.05).

The results of the causality test on the optimum lag (Appendix 9) are outlined in Table 6, and it is known that there are 28 paired stock indices. Of all the paired stock indices, only 4 stock indices have a unidirectional causality relationship, namely the JKSE – STI, STI – SSE, STI – KOSPI, and STI – DAX indexes.

a. The JKSE index variable does not significantly affect the SSE index variable (0.5283), which means accepting the null hypothesis. Likewise, the SSE index variable does not statistically significantly affect the JKSE index variable (0.7588), which means accepting the null hypothesis. Thus, it can be concluded that there is no causal relationship between the SSE index variables and the JKSE index (paired index no. 1).

b. The JKSE index variable does not significantly affect the STI index variable (0.3471), which means accepting the null hypothesis. On the other hand, the STI index variable statistically significantly influences the JKSE index variable (0.0362), which means it rejects the null hypothesis. Thus, it can be concluded that there is unidirectional causality between the JKSE index variable and the STI index, where only the STI index variable statistically influences the JKSE index variable. However, the reverse does not apply (paired index no. 3).

c. The SSE index variable statistically significantly influences the STI index variable (0.0456), which means it rejects the null hypothesis. On the other hand, the STI index variable does not significantly influence the SSE index variable (0.4129), which means accepting the null hypothesis. Thus, it can be concluded that there is unidirectional causality between the SSE index variable and the STI index, where only the SSE index variable statistically influences the STI index variable. However, the reverse does not apply (paired index no. 9).

d. The KOSPI index variable statistically significantly influences the STI index variable (0.0286), which means it rejects the null hypothesis. On the other hand, the STI index variable does not significantly affect the KOSPI index variable (0.8134), which means accepting the null hypothesis. Thus, it can be concluded that there is unidirectional causality between the KOSPI index variables and the STI index, where only the KOSPI index variable statistically influences the STI index variable. However, the reverse does not apply (paired index no. 14).

e. The STI index variable does not significantly affect the DAX index variable (0.7797), which means accepting the null hypothesis. On the other hand, the DAX index variable statistically significantly influences the STI index variable (0.0042), which means it rejects the null hypothesis. Thus, it can be concluded that there is unidirectional causality between the STI index variable and the DAX index, where only the DAX index variable statistically influences the STI index variable. However, the reverse does not apply (paired index no. 20).

f. The FTSE 100 index variable does not significantly affect the DJIA index variable (0.9122), which means accepting the null hypothesis. Likewise, the DJIA index variable does not

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statistically significantly influence the FTSE 100 index variable (0.5700), which means accepting the null hypothesis. Thus, it can be concluded that there is no causal relationship between the DJIA index variables and the FTSE 100 index (paired index no. 28).

4.5 Vector Error Correction Model (VECM) Estimation Results

Vector Error Correction Model (VECM) estimation was carried out to obtain short-term and long-term relationships between research variables. In this study, the stock indices of the research sample countries. The existence of short-term and long-term relationships between variables is based on comparing the estimated t-statistic values with the t-table values. If the estimated t-statistic value > t-table value (significant), then it can be said that there is a relationship between the stock indices of the research sample countries in the short term or long term.

If it is assumed that the JKSE index is the dependent variable, then in the long term, the JKSE index is significantly influenced at the 0.05 real level by the KOSPI, STI, NIKKEI 225, DAX, FTSE 100 and DJIA indexes. Meanwhile, the SSE index in the long term does not affect the JKSE index. The t-statistic value > t-table at the 5% significance level indicates whether there is a long-term influence.

Based on the data in Table 6 (1), it can be explained that the KOSPI index has a negative effect on the JKSE index, where an increase in the KOSPI index by 1 unit causes the JKSE index to fall by 0.85 units. The STI index has a negative effect on the JKSE index, where an increase in the STI index of 1 unit causes the JKSE index to fall by 1.79 units. It can also be explained that the NIKKEI 225 index positively affects the JKSE index, where an increase in the NIKKEI 225 index by 1 unit causes the JKSE index to increase by 0.18 units. The DAX index positively affects the JKSE index, where an increase in the DAX index by 1 unit causes the JKSE index to increase by 0.44 units.

Furthermore, the FTSE 100 index has a negative effect on the JKSE index, where an increase in the FTSE 100 index by 1 unit causes the JKSE index to fall by 0.23 units. The DJIA index has a negative effect on the JKSE index, where an increase in the DJIA index by 1 unit causes the JKSE index to fall by 0.23 units. The long-term relationship between stock indices in the complete research sample is shown in Table 6 (2). Furthermore, to explain this long-term relationship, each stock index is used or assumed to be the dependent variable, while the other indices are assumed to be independent variables.

From the VECM estimation results, it is known that in the short-term relationship, six stock indices influence the Indonesian stock index (JKSE), namely the Indonesian stock index (JKSE), South Korea (KOSPI), Singapore (STI), Japan (NIKKEI 225).), Germany (DAX) and USA (DJIA). Meanwhile, stock indices are influenced by the Indonesian Stock Index (JKSE), namely the South Korean Stock Index (KOSPI) and the Singapore Stock Index (STI). The large t-statistic value shows the influence between stock indices for a particular song, where the t-statistic value of each stock index is > t-table at the 5% significance level (0.05).

The Seybold Report
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The short-term estimation results show that the JKSE index variables at lags 1 and 3 each have a negative effect at a real level of 0.05 on the JKSE index itself. This can be interpreted as an increase in the JKSE index of 1 unit in the previous 1 and 3 periods, causing the JKSE index to decrease by 1.42 units and 1.71 units, respectively, in the current period.

The short-term estimation results show that the KOSPI index variable atlag 7 has a positive effect at a real level of 0.05 on the JKSE index. It can be explained that the KOSPI index increased by 1 unit in the previous 7 periods, causing the JKSE index to increase by 1.59 units in the current period. Meanwhile, the STI index variable atlag 6 has a positive effect at a real level of 0.05 on the JKSE index. It can be explained that the STI index increased by 1 unit in the previous 6 periods, causing the JKSE index to increase by 1.88 units in the current period.

The short-term estimation results show that the NIKKEI 225 index variable at lags 3, 4, 6 and 7 each has a negative effect at a real level of 0.05 on the JKSE index. It can be explained that the increase in the NIKKEI 225 index of 1 unit in the 3, 4, 6 and 7 previous periods caused the JKSE index to decrease respectively by 0.40 units, 0.33 units, 0.35 units and 0.17 units in the current period.

The short-term estimation results show that the DAX index variables at lags 1 and 7 each have a negative effect at a real level of 0.05 on the JKSE index. It can be explained that the increase in the DAX index by 1 unit in the previous 1 and 7 periods caused the JKSE index to decrease by 1.14 units and 0.34 units, respectively, in the current period.

The short-term estimation results show that the DJIA index variables at lags 1, 3, 4 and 6 each have a positive effect at a real level of 0.05 on the JKSE index. It can be explained that there was an increase in the DJIA index of 1 unit in the previous 1, 3, 4 and 6 periods, causing the JKSE index to increase respectively by 0.63 units, 0.56 units, 0.54 units and 0.31 units, in the current period.

From the VECM estimation results in Table 6 (2), it is known that the JKSE index variables at lags 1, 2, 3, 4 and 5 each have a negative effect at a real level of 0.05 on the KOSPI index. There was an increase in the JKSE index of 1 unit in the previous 1, 2, 3, 4 and 5 periods, causing the JKSE index to decrease by 1.25 units, 1.15 units, 0.93 units, and 0.65 units. And 0.55 units in the current period.

The VECM estimation results also show that the JKSE index variable at lag 7 has a positive effect at a real level of 0.05 on the STI index. It can be interpreted that the JKSE index increased by 1 unit in the previous 7 periods, causing the STI index to increase by 0.37 units in the current period.

Based on the VECM estimation results, if the JKSE index is the dependent variable, then in the short-term relationship, it is known that two stock markets in the Asian region are cointegrated or have a relationship that influences each other in the long term, namely the Indonesian stock market (JKSE) - South Korean stock market (KOSPI) and Indonesian stock market (JKSE) - Singapore stock market (STI).

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5. DISCUSSION

Cointegration testing in stock markets in Asia, Europe and America has been carried out on 8 (eight) stock markets, namely Indonesia (JKSE), China (SSE), South Korea (KOSPI), Singapore (STI), Japan (NIKKEI 225), Germany (DAX), England (FTSE 100) and United States of America (DJIA) show that there is long-term integration between stock markets in the region, where the results of the Johansen cointegration test show that there are 5 (five) vectors that are cointegrated.

The results of the VECM estimation at the maximum lag show that in the short-term relationship, six stock markets in Asia, Europe and America influence the Indonesian stock market (JKSE), namely the Indonesian stock market (JKSE), South Korea (KOSPI), Singapore (STI).), Japan (NIKKEI 225), Germany (DAX) and USA (DJIA). Meanwhile, the Indonesian stock market (JKSE) influences the South Korean stock market (KOSPI) and the Singapore stock market (STI). The VECM estimation results at the maximum lag show that in the short-term relationship, the Chinese stock market (SSE) is only influenced by the Chinese stock market (SSE). Likewise, in the short-term relationship, the US stock market (DJIA) is only influenced by the Japanese stock market (NIKKEI 225).

The results of the VECM estimation at the maximum lag show that in the short term, six stock markets in Asia, Europe and America influence the South Korean stock market (KOSPI), namely the Indonesian stock market (JKSE), Singapore (STI), Japan (NIKKEI 225), Germany (DAX), England (FTSE 100) and USA (DJIA). Meanwhile, the South Korean stock market (KOSPI) influences the Indonesian stock market (JKSE) and the Singapore stock market (STI).

The VECM estimation results at the maximum lag show that in the short term, seven stock markets in Asia, Europe and America influence the Singapore stock market (STI), namely the Singapore stock market (STI), Indonesia (JKSE), South Korea (KOSPI).), Japan (NIKKEI 225), Germany (DAX), England (FTSE 100) and USA (DJIA). Meanwhile, the Singapore stock market (STI) influences the Indonesian (JKSE) and South Korean (KOSPI) stock markets. In this research, the results of VECM estimation at the maximum lag show that in short-term relationships, three stock markets are not influenced by other stock markets, namely the Japanese stock market (NIKKEI 225), German (DAX) and England (FTSE 100).

The VECM estimation results also show that in the period January 2015 to December 2021, three stock markets in the Asian region are cointegrated (have a mutually influencing relationship) in long-term balance, namely the Indonesian stock market (JKSE) and the South Korean stock market (KOSPI), the Indonesian stock market (JKSE) and Singapore stock market (STI) as well as South Korean market (KOSPI) and Singapore stock market (STI).

The South Korean stock market (KOSPI) has a positive influence on the Indonesian stock market (JKSE), meaning that when the South Korean stock market (KOSPI) experiences a shock in the form of an increase or decrease in the stock index, both in the long and short term, it will influence the increase or a decline in the JKSE stock index. On the other hand, the Indonesian stock market (JKSE) has a negative effect on the South Korean stock market (KOSPI). This means that when the Indonesian stock market (JKSE) experiences a shock in

The Seybold Report
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the form of an increase in the stock index, both in the long and short term, it will impact the decline in the KOSPI stock index.

The Singapore stock market (STI) has a positive influence on the Indonesian stock market (JKSE), meaning that when the Singapore stock market (STI) experiences a shock in the form of an increase or decrease in the stock index, both in the long and short term, it will have an influence on the increase or decrease JKSE stock index. Likewise, the Indonesian stock market (JKSE) positively influences the Singapore stock market (STI). This means that when the Indonesian stock market (JKSE) experiences a shock in the form of an increase in the stock index, both in the long and short term, it will influence the increase or decrease in the STI stock index.

The Singapore stock market (STI) has a positive influence on the South Korean stock market (KOSPI), meaning that when the Singapore stock market (STI) experiences a shock in the form of an increase or decrease in the stock index, both in the long and short term, it will influence the increase or decrease. The decline in the KOSPI stock index. Likewise, the South Korean stock market (KOSPI) positively influences the Singapore stock market (STI). This means that when the South Korean stock market (KOSPI) experiences a shock in the form of an increase in the stock index, both in the long term and short term, it will influence the increase or decrease in the STI stock index. The results of the causality analysis show that of the entire stock market pair, there are only 4 stock markets that have a unidirectional causality relationship, namely:

1. Indonesian stock market (JKSE) and Singapore stock market (STI); only the Singapore stock market (STI) has a statistically significant influence on the Indonesian stock market (JKSE), but the reverse does not apply.
2. Singapore stock market (STI) and China stock market (SSE): Only the Chinese stock market (SSE) has a statistically significant influence on the Singapore stock market (STI), but the reverse is not true.
3. Singapore stock market (STI) and South Korean stock market (KOSPI): Only the South Korean stock market (KOSPI) has a statistically significant influence on the Singapore stock market (STI), but the reverse is not true.
4. Singapore stock market (STI) and German stock market (DAX); only the German stock market (DAX) has a statistically significant influence on the Singapore stock market (STI), but the reverse does not apply.

VECM estimation and causality analysis results prove that in the January 2015 period.

Until December 2021, stock markets in the Asian region (represented in this research by the Indonesia-JKSE, South Korea-KOSPI and Singapore-STI stock markets) are connected and influenced by the global stock market, both in the short and long term. Different from the five other stock markets in this study. Of the 5 stock markets (SSE, NIKKEI 225, DAX, FTSE 100 and DJIA), domestic factors from each country have more influence on the 5 stock markets.

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6. CONCLUSION

Based on the results of the research and discussion, at the end of this paper, it can be concluded that the implications of the research findings show that there is integration and linkages between stock markets in Asia, Europe and America, represented by the stock markets of Indonesia (JKSE), China (SSE), South Korea (KOSPI), Singapore (STI), Japan (NIKKEI 225), German (DAX), England (FTSE 100) and the USA stock market (DJIA) in the period January 2015 to December 2021. The research results show that three stock markets in the Asian region integrated in the period January 2015 to December 2021, namely the Indonesian stock market (JKSE) and the South Korean stock market (KOSPI), the Indonesian stock market (JKSE) and the Singapore stock market (STI) and the South Korean stock market (KOSPI) and the stock market Singapore (STI). The research results show that in countries in Asia, Europe and America with strong economies, their main stock markets tend not to be influenced by other countries' stock markets. However, their main stock markets are more influenced by economic and non-economic forces in their countries.

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