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## Article

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## Article

# Integration of the Indonesian Stock Market with Eight Major Trading Partners' Stock Markets

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**Abstract:** This study investigates the integration of the Indonesian stock market with eight major trading partner countries, namely, China, Japan, the United States, Malaysia, India, Singapore, the Philippines, and South Korea. The analysis of the stock-market integration investigation includes the following two main things: short-term and long-term dynamic relationships within the *Vector Autoregressive* (VAR) model framework based on the unit root test, multivariate Johansen cointegration, and paired Granger causality test. The VAR model was analyzed using weekly closing index data of the Indonesian stock exchange and eight major trading partners from January 2013 to June 2024. The results of the study show that the integration of the Indonesian stock market with those of its main trading partners in the long term is relatively low. This finding implies that investors from the eight major trading partner countries can diversify their portfolios in international investments via the Indonesian stock market and vice versa. In the short term, these results prove that Indonesia's stock markets and those of its major trading partners are integrated, excluding China. The Chinese stock market has become segmented and more attractive for Indonesian investors who want to benefit from diversification and vice versa. Furthermore, the Indonesian stock market has two-way causal relationships with the US, Japanese, Indian, and Singaporean stock markets. In addition, the Indonesian stock market has unidirectional reciprocal-lagged relationships with Malaysia and the Philippines. An essential contribution of this study is helping policymakers and, especially, international investors understand the dynamic relationships of the Indonesian stock market with its major trading partners. Furthermore, this study contributes to the development of empirical literature on the comovement of the Indonesian stock market and those of its major trading partners, as well as the stock markets of developing and developed countries.

**Keywords:** stock-market integration; Indonesian stock market; major trading partner; vector autoregressive

**JEL Classification:** F15; F521; G12; G15



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## 1. Introduction

Indonesia's international trade transactions with major trading partners have impacted the interdependence of stock markets among countries. In this study, Indonesia's major trading partners took the following top eight countries: Malaysia, Singapore, the Philippines, South Korea, India, China, Japan, and the United States. Indonesia's eight major trading partner countries have significant trade volumes and essential sources of foreign investment. China is Indonesia's largest trading partner out of the top eight countries. Indonesia's export value in 2023 was USD 258.82 billion, of which 25.66% went to China. Meanwhile, Indonesia's total imports in 2023 reached USD 221.89 billion, of which 33.43% also came from China.

The tendency of comovement among global stock markets indicates that cross-border risk aggregation plays an important role in portfolio diversification by choosing different

assets from the stock market (Wang et al. 2024). Indonesia's main trading partners include developed and developing countries with low integration levels. Therefore, such a portfolio can be profitable for international investors. As a developing country, Indonesia has liberalized its stock market since 1997, providing more significant opportunities for global investors to invest with high potential returns, improved risk factors, maintained macroeconomic stability, and varied investment options. Economic and financial liberalization in developing countries, including Indonesia, was driven by the Washington Consensus. To revitalize their economy, developing countries used the Bretton Woods Institutions (World Bank and International Monetary Fund) "Structural Adjustment Program", which sought to liberalize prices in fragile and crisis economies. The implementation of this program marked the end of economic financial constraints and encouraged privatization, price stability, and capital market liberalization (Serra et al. 2008). The Washington Consensus was criticized by Arestis (2004) in that financial liberalization caused a widespread crisis in several developing countries. Financial market liberalization can cause irrational changes in investor confidence in a country's ability to repay its loans and trigger large capital outflows, causing the exchange rate to fall and pushing the economy into recession.

Trade and financial relations among countries determine international stock-market integration (Johnson and Soenen 2002; Forbes and Chinn 2004; Patel 2019). Caporale et al. (2019) revealed that trade relations and stock-market development encourage global stock-market synchronization. Foreign Direct Investment (FDI) is a form of international financial relations that can connect the economy, thus integrating the world market. Shi et al. (2010) revealed that high bilateral FDI flows can increase the movement of the Australian stock market with its main trading partners. Albuquerque et al. (2005) revealed the importance of FDI in emerging markets and its impact on increasing the integration of world capital markets due to economic globalization and liberalization in the 1980s.

The degree of international stock-market integration has increased in recent decades (Manopimoke et al. 2018; Graham et al. 2012). The increasing movement of stock markets has implied a decline in the benefits of international portfolio diversification in developed countries, and, therefore, investors have shifted their investments to developing countries (Gupta and Guidi 2012). Boamah (2017) revealed that developing countries' economies are more globally integrated than internally, indicating their connectivity to the global financial environment. The low correlation between developing and developed stock markets means that the stock market provides opportunities for potential benefits in international portfolio diversification (Phylaktis and Ravazzolo 2005). Berger et al. (2011) and Zaremba et al. (2019) revealed low levels of integration in emerging stock markets and showed evidence of diversification benefits. Driessen and Laeven (2007) confirmed that the benefits of international diversification are more significant in emerging markets. Al Nasser and Hajilee (2016) revealed stock markets in developing countries and short-term integrated developed markets.

High economic growth and globalization of developing countries, especially Asia, have increased the integration and comovement of stock markets compared to developed countries. The liberalization of financial markets by many Asian countries has also led to explosive growth in international economic transactions and capital flows, especially their linkages with developed countries. This phenomenon has attracted the interest of many researchers who want to investigate the dynamic linkages between developing Asian stock markets and their links to developed ones. Caporale et al. (2019) proved that Asian stock markets are regional and globally integrated. Dunis and Shannon (2005) found that portfolio investment in Asian countries can provide higher diversification benefits than portfolios without involving Asian countries. There are few studies on integrating the Indonesian stock market with other countries, especially with major trading partners. Most identified empirical studies examine the dynamic linkages of the Indonesian stock market with other ASEAN countries. Click and Plummer (2005) proved that the ASEAN5 stock markets, including Indonesia, are integrated, although still at a low level. Le et al. (2024) revealed the cointegration relationship of stock-market indices for seven ASEAN countries.

[Robiyanto \(2018\)](#) proved that the Indonesian and several Asian stock markets, especially in the ASEAN region, have become increasingly integrated since the 2008 subprime mortgage crisis. [Yuliadi et al. \(2024\)](#) proved that the Indonesian stock market is influenced by its main trading partners (Singapore, the US, and China) both in the short and long term.

Previous studies on integrating the Indonesian stock market, classified as a developing stock market with both developed and developing ones, still need further investigation. Here are some crucial contributions from this study. First, the study develops the literature that presents mixed findings, and more substantial evidence is needed to determine whether trade integration among countries also leads to stock-market integration. Regarding the Indonesian stock market, studies involving eight trading partner countries, the US and Japan as developed countries, and China, India, South Korea, Singapore, Malaysia, and the Philippines as developing countries are still limited. Therefore, this study also contributes to the literature on the dynamic relationship between stock markets in developing and developed countries. Second, the reciprocal-lag relationship between Indonesia's stock market and its major trading partners helps policymakers and international investors to estimate shocks in one market that can impact other markets. Third, this study uses a new method that can reveal both short-term and long-term dynamic relationships that have implications for the benefits of international portfolio diversification.

## 2. Literature Review

### 2.1. Theoretical Underpinning

The concept of stock-market integration is expressed in various bodies of empirical literature, which essentially state that integrated stock markets show stable comovement in the long term. However, in the short term, the possibility of stock prices among markets differ from each other (i.e., short-run divergence). Stock-market integration is often interpreted as "comovement"; some also use the terms "synchronization" or "correlation". Stock-market synchronization can explain the possibility of investors gaining international portfolio diversification benefits only in the short term if the degree of comovement of stock markets in the long term is high or the stock markets are increasingly integrated ([Manning 2002](#)). Thus, analyzing the long-term integration of domestic and global stock markets and the short-term temporal relationship is very important, especially for investors who benefit from international portfolio diversification and risk reduction.

Economic cooperation between countries and regions, globalization, and trade liberalization have opened up opportunities for each country to increase export and import transactions among countries. Financial liberalization is needed to support trade activities among countries by expanding the role of financial markets, especially the stock market. In addition, the deregulation of financial markets carried out by many countries, especially in Asia, has led to explosive growth in international economic transactions and capital flows, especially in developed countries. Indonesia has implemented a trade liberalization policy since the early 1980s. The government is gradually opening up the economy by issuing a series of tariff and non-tariff reduction policies that can hinder the entry of imported goods. In addition, Indonesia is also implementing regional trade cooperation through the ASEAN Free Trade Area. Trade liberalization is increasingly being carried out along with the rapid flow of globalization and Indonesia's entry into international cooperation through the World Trade Organization (WTO). Trade and financial liberalization have implications for Indonesia's increasing integration.

The leading theory underlying the research on the integration and interdependence of international stock markets is the modern portfolio theory, which recommends that investors diversify their assets across global stock markets. By diversifying internationally, investors benefit from international portfolio investment ([Bartram and Dufey 2001](#)). Based on the portfolio concept, diversification across countries is expected to provide higher returns and more significant risk reduction benefits than investing only in the domestic market. Risk reduction benefits are based on one recommendation for international stock portfolio diversification based on low correlations among international stock markets.

Alternatively, in other words, international portfolio diversification is carried out as long as stock returns in a stock market are not perfectly correlated with the domestic market (Syriopoulos 2004). Grubel (1968), Levy and Sarnat (1970), and Solnik (1974) reveal that international diversification is better than just domestic diversification, because there is a tendency for individual security returns in an economy to stay together.

The International Capital Asset Pricing Model (ICAPM) is a more innovative theoretical basis for international stock-market integration. ICAPM was initially pioneered by Solnik (1974), then developed by Black (1974), Grauer et al. (1976), Stulz (1981), and Adler and Dumas (1984). According to ICAPM, if a market is perfectly integrated with the world stock market, the expected return on assets is only influenced by global factors that reflect systematic risk. Conversely, if a market is segmented, systematic risk is reflected only by domestic factors. ICAPM has been applied by Errunza and Losq (1985) and Errunza et al. (1992), which is based on the assumption that no capital market is perfectly integrated or segmented, or, in their terms, called mild segmentation. The key weakness of ICAPM is that the degree of segmentation is assumed to remain constant over time.

Further developments were made by Bekaert and Harvey (1995) and De Santis and Imrohoroglu (1997), who allowed the degree of segmentation to vary over time. Arouri et al. (2012) tested the ICAPM for partially segmented markets and found that most emerging markets have become more integrated, and local risk premiums have declined over time. The International Arbitrage Pricing Theory (IAPT) developed from the Arbitrage Pricing Theory (APT) of Ross (1976) has also been used as an approach to measure global stock-market integration. Solnik (1983), who developed the IAPT, assumed that markets are perfectly integrated. Cho et al. (1986) were the first to test the IAPT and found that international capital markets are segmented. Abeysekera and Mahajan (1990) tested the IAPT using monthly individual security price data from Canada, the US, and the UK, finding weak evidence to support the IAPT as an asset pricing model in integrated markets.

## 2.2. Empirical Literature

International stock-market integration research in various literature reviews still needs to be revised. Some studies show empirical evidence of global stock-market integration, while others show that the markets are not integrated. These different findings can be reviewed from several aspects, including selection of stock markets among countries, research period (for example, whether or not there is a financial crisis), selection of currency (local or foreign currency), frequency of the observed data (daily, weekly, or monthly), and methodology used to empirically investigate stock-market integration among countries. Therefore, international stock-market integration analysis is a topic that cannot be concluded and needs further study. The literature review in this study focuses more on empirical findings related to integrating one country's stock market with the stock market of another country that is its trading partner.

Karim et al. (2009) tested the integration of the Indonesian stock market and its four main trading partners, namely, Singapore, China, the US, and Japan, using the Autoregressive Distributed Lag (ARDL) and Vector Autoregressive (VAR) framework approaches. The research findings reveal that the Indonesian stock market is synchronized with its four major trading partners. Yuliadi et al. (2024) tested the movement of the Indonesian stock market with its four main trading partners—Singapore, China, the US, and Japan—using the VECM framework approach with monthly data. The results proved that the Indonesian stock market is integrated with its four main trading partners in the short and long term. Suriawinata et al. (2023) tested the integration of the Indonesian capital market and four developed markets, namely, the US, Australia, Hong Kong, and the UK, using the Johansen and ARDL cointegration methods from January 2019 to December 2020. The findings revealed the comovement of the Indonesian stock market, with four comovements occurring during the COVID-19 pandemic. Using the VAR approach, Sampurna (2015) tested the stock-market integration between the Indonesian stock market and the following four selected European Union (EU) countries: Italy, France, Germany, and the UK. The

findings proved the integration of the Indonesian stock market with the four EU countries. [Anhar et al. \(2024\)](#) tested the synchronization of the Indonesian stock market with four other ASEAN countries, namely, Singapore, Malaysia, the Philippines, and Thailand, as well as three countries outside of ASEAN, namely, Japan, China, and the US, from January 2020 to December 2023. The findings prove that in the long-term analysis Singapore and the Philippines positively influenced the Indonesian market during the pandemic, while China had a negative impact. The short-term analysis revealed that China, Malaysia, and Thailand positively impacted the Indonesian stock market during the pandemic. The Malaysian stock market remained consistently correlated with Indonesia's after the pandemic.

[Abdul Karim and Shabri Abd. Majid \(2010\)](#) examined the stock-market integration of Malaysia and its major trading partners (US, Japan, Singapore, China, and Thailand) from January 1992 to May 2008 using the ARDL test method and VAR framework. The study's findings confirmed the long-term comovement of the stock market of Malaysia and its major trading partners. Trade relations contributed to the integration of the stock market, in addition to geographical proximity. A greater degree of integration between Malaysia and its major trading partners can be achieved by liberalizing trade, including reducing or eliminating trade and investment barriers. [Mahedi \(2012\)](#) investigated the stock-market integration of Bangladesh with its five major trading partners, namely, China, Germany, India, Japan, and the US, using weekly stock price indices from January 2000 to April 2011. Bivariate and multivariate Johansen methods and the Granger causality test were used, and it was found that Bangladesh's stock market and those of its major trading partners were not integrated. [Joyo and Lefen \(2019\)](#) investigated the integration and portfolio diversification between Pakistan's stock market and those of its major trading partners, namely, Indonesia, China, the UK, the US, and Malaysia, using the Dynamic Conditional Covariance (DCC)–Generalized Autoregressive Conditional Heteroscedasticity (GARCH) methodology. The study's findings, using daily return data from 2005 to 2018, confirmed that Pakistan's stock market was integrated with those of its trading partners during the 2008 financial crisis. In contrast, integration declined substantially after the financial crisis period.

[Sher et al. \(2024\)](#) investigated the dynamic linkages of China's stock market and its major developed partners—Japan, the US, Australia, the UK, and Germany—from 2012 to 2022. The cointegration method and VECM-based Granger causality test were used to test the integration, and a low interdependence of China's stock market and those of its major developed partners was found. The implication of the findings opens up opportunities for profitable diversification in China's stock market for developed country investors. [Lee et al. \(2024\)](#) investigated the dynamic relationship of Pakistan's stock market with the stock markets of the world's ten largest economies, as follows: India, Brazil, Canada, the UK, the US, Germany, China, Italy, France, and Japan. Johansen and Juselius's cointegration method and Granger causality were applied to test the integration. The findings reveal that Pakistan's stock market is not synchronized with its trading partners in the long run. The findings imply that investors benefit from diversifying their portfolios by investing in Pakistan and vice versa. Pakistan's stock market is integrated with nine other stock markets, excluding China, only in the short run. [Wang et al. \(2024\)](#) examined the movement patterns of the Malaysian stock market and those of its trading partners, including Indonesia, China, Singapore, India, Pakistan, the United States (US), Germany, France, and the United Kingdom (UK).

The wavelet approach was used to analyze the daily stock market index. The findings prove both short- and long-term comovements of the Malaysian stock market and those of its trading partners. The movement patterns change over time and are more dominantly influenced by the development of cooperation among stock markets rather than regional proximity. [Jana \(2024\)](#) investigated the integration of the Indian stock market with its 15 trading partner countries using weekly data from 1 January 1999 to 31 December 2019. The Johansen Cointegration Test proved that the Indian stock market is increasingly integrated with its 15 trading partner countries due to increasing trade connectivity. The

implication is that international investors do not receive portfolio diversification benefits if they invest in India and its 15 central trading partner countries. [Mohammed et al. \(2024\)](#) examined the correlation and integration between the South African stock market and its developed (UK and US) and emerging (India and Malaysia) stock market counterparts. Daily data were used from 1 January 2010 to 30 December 2022 using the Dynamic Conditional Correlation–Exponential Generalized Autoregressive Conditional Heteroscedasticity (DCC-EGARCH) approach. The findings demonstrate that the South African stock market moves with its counterparts.

### 3. Methodology

#### 3.1. Data and Variable

This study used the weekly closing stock price index from the Indonesian stock exchange and eight major trading partners (Table 1). The study period was conducted from January 2013 to June 2024. The use of weekly data and the number of data samples are sufficient to properly analyze the dynamic relationship between stock markets in both the short and long term. However, the daily data are limited by the large number of observations missing due to national holidays and stock exchange closures, especially in three countries, namely, India, Malaysia, and Indonesia. In addition, daily data are subject to day-of-the-week effects and contain excessive noise ([Bailey and Stulz 1990](#)). Each country's stock price index data consist of 595 observations from Yahoo Finance and ID Investing. All stock price index data were transformed into natural logarithmic (ln) and expressed in domestic currency. The stock price index in local currency describes the reaction of the domestic market to the foreign market from an investor's perspective ([Pan et al. 2007](#)). If there is a holiday in one country and not in another country, then the index value used for the holiday in that country is the last index value before the holiday. Using stock price indices in domestic currency is aimed at limiting fluctuations caused by stock price movements alone and avoiding distortions caused by exchange rate depreciation, which tends to increase in Asian countries ([Voronkova 2004](#)). Stock-market integration is only measured based on stock price movements among countries by ignoring changes in exchange rates. In other words, the stock price index in a local currency ignores the effects of exchange rate risks, an essential factor for foreign investors ([Dekker et al. 2001](#)). This means that investors use the domestic currency to measure their investment returns.

**Table 1.** Description of indices.

Country	Stock Market	Index
Indonesia	Jakarta stock exchange	Jakarta Composite Index (JKSE)
Malaysia	Kuala Mud Stock Exchange	Kuala Mud Composite Index (KLCI)
Philippines	The Philippine Stock Exchange	Philippine Stock Exchange Index (PSEI)
Singapore	Singapore Exchange	Straits Times Index (STI)
China	Shanghai Stock Exchange	Shanghai Stock Exchange Composite Index (SSE)
India	Bombay Stock Exchange	BSE Sensex (BSE)
South Korea	Korea Stock Exchange	KOSPI Composite Index (KS11)
USA	New York Stock Exchange	Dow Jones Industrial Average (DJIA)
Japan	Tokyo Stock Exchange	Nikkei 225 (N225)

#### 3.2. Vector Autoregressive (VAR) Model

The VAR model is used to test the comovement of the Indonesian stock market with major trading partners using the VAR model. The cointegrated stock market shows a stable relationship pattern in the long term, and price volatility in a stock market lasts temporarily not permanently. On the other hand, non-cointegrated stock markets show long-term structural instability in their interconnectedness among international stock markets. If evidence of cointegration is found, a joint force causes the markets to move together in

the long run, and these markets are said to be integrated. Stock prices can vary across markets in the short run. However, market forces, investor preferences, and regulation can cause stock prices to return to long-run equilibrium. In the VAR specification,  $y_t$  is a vector of nine endogenous variables, namely, the stock price index of Indonesia (JKSE), China (SSE), Japan (N225), the United States (DJIA), Malaysia (KLCI), India (BSE), Singapore (STI), Philippines (PSEI), and South Korea (KOSPI). The set of variables used in this research can be written as follows:

$$y_t = (\text{jkse}, \text{sse}, \text{n225}, \text{djia}, \text{klci}, \text{sti}, \text{bse}, \text{psei}, \text{kospi})$$

### 3.2.1. Unit Root Test

The issue of stationarity is essential in time series data for analyzing cointegration. A series is considered stationary if the mean and variance of the time series data are systematically constant over time. If the stationarity test shows that the time series data are not stationary at the level, then it is necessary to re-test by differencing the non-stationary data series. If the time series data are stationary at one differentiation, then the stock price index variable is said to be stationary at the differentiation level I (1). Unit root testing on the data series and stationarity testing was carried out using the Augmented Dickey–Fuller (ADF) test.

The unit root testing of Indonesia's and its major trading partners' stock price indexes used the Augmented Dickey–Fuller (ADF) test, which tests the underlying unit root of the stock price index series. The ADF test is based on the following equations, which have a non-zero mean in Equation (1) and a non-zero mean with a linear trend in Equation (2):

$$\Delta X_{jt} = \mu + \alpha * \Delta X_{jt-1} + \sum_{i=2}^p \gamma_i \Delta X_{jt-i+1} + \varepsilon_t, \quad j = 1, 2, \dots, 9 \quad (1)$$

$$\Delta X_{jt} = \mu + \beta_t + \tilde{\alpha} \Delta X_{jt-1} + \sum_{i=2}^p \gamma_i \Delta X_{jt-i+1} + \varepsilon_t, \quad j = 1, 2, \dots, 9 \quad (2)$$

where  $X_{jt}$  represents the stock price index of Indonesia and its major trading partners ( $X_{1t}$  = Indonesia,  $X_{2t}$  = Malaysia,  $X_{3t}$  = Philippines,  $X_{4t}$  = Singapore,  $X_{5t}$  = China,  $X_{6t}$  = India,  $X_{7t}$  = South Korea,  $X_{8t}$  = United States, and  $X_{9t}$  = Japan),  $\mu$  is a non-zero mean.  $\beta$  is a non-zero mean with a linear trend form. The unit root process was tested under the following null hypotheses:  $H_0: \alpha^* = 0$  using the  $\alpha$  t-statistic test in (1) and  $H_0: \tilde{\alpha} = 0$  using the  $\alpha$  t-statistic test in (2). The critical values are provided in Fuller (2009) and Dickey and Fuller (1981).

### 3.2.2. Determining the Optimal Lag Length

After conducting a stationarity test on the stock price index, the next step is determining the optimal lag length. In the Vector Autoregressive (VAR) model, determining the lag length is essential because a lag for any variable that is too long implies more parameters to be estimated and reduces the number of degrees of freedom. The VAR model with too short a lag is preferred, although it leads to specification error. Therefore, using the same optimal lag length for all equations is more appropriate. Various alternative criteria can be used to select the optimal lag length. The Akaike Information Criteria (AIC) and Schwarz Information Criterion (SIC) are commonly used indicators. The basic principle of both indicators is to provide a penalty for adding regressors to an equation, including in equations containing lags. Because of its nature, which imposes a penalty, the lowest values of the Akaike Information Criterion (AIC) and Schwarz Information Criterion (SIC) are the preferred values. Thus, the smallest Akaike and Schwarz criteria values determine the selected lag length.

$$\text{AIC} = \left( \frac{2k}{n} \right) + \ln \left( \frac{\text{RSS}}{N} \right) \quad \text{dan} \quad \text{SIC} = \left( \frac{k}{n} \right) \ln n + \ln \left( \frac{\text{RSS}}{N} \right) \quad (3)$$

where

$k$  = the number of parameters in the model, including the intercept;

$n$  = the number of observations (i.e., samples);

RSS = residual sum squared.

The penalty factor for the AIC is  $\left(\frac{2k}{n}\right)$  and that of SIC is  $\left(\frac{k}{n}\right) \ln n$ .

The penalty factor imposed by the SIC is stricter than for the AIC.

### 3.2.3. Multivariate Johansen Cointegration

Non-stationary time series variables can cause spurious regression unless one of the vectors is cointegrated. Cointegration testing is performed using the Johansen procedure (Johansen 1988; Johansen and Juselius 1990), a maximum likelihood method for multivariate autoregressive models. The Johansen cointegration approach estimates and tests several cointegrating relationships and common stochastic trends among the components of the vector  $X_t$  of the non-stationary variables, including short-term and long-term dynamic differences. The Johansen cointegration approach determines the number of cointegrating vectors from time series data. Cointegration also describes the stable long-term stationary relationships among integrated variables. It is an independent linear combination of non-stationary variables to achieve stationarity.

The Johansen procedure begins by declaring the stochastic variables in a vector ( $n \times 1$ ), with  $X_t$  as the unrestricted VAR. The VAR model used in this study is as follows:

$$X_t = A_1 X_{t-1} + A_2 X_{t-2} \dots + A_p X_{t-p} + c + \varepsilon_t \quad (4)$$

where  $X_t = [X_{1t}, X_{2t}, X_{3t}, X_{4t}, X_{6t}, X_{7t}, X_{8t}, X_{9t}]'$  is a ( $9 \times 1$ ) vector of the stock price indices of Indonesia and its major trading partners,  $A_i$  is a ( $9 \times 9$ ) matrix parameter,  $c$  is a ( $9 \times 1$ ) constant vector,  $\varepsilon_t$  is a ( $9 \times 1$ ) vector of random error terms with a zero mean and constant variance, and  $p$  is the lag length. According to Johansen (1988) and Johansen and Juselius (1990), the system in Equation (4) can be rewritten in the first difference form, as follows:

$$\begin{aligned} \Delta X_t &= \Gamma_1 \Delta X_{t-1} + \Gamma_2 \Delta X_{t-2} + \dots + \Gamma_{p-1} \Delta \Gamma_1 \Delta X_{t-p-1} + \Pi X_{t-p} + \varepsilon_t \\ &= \sum_{i=1}^{p-1} \Gamma_i \Delta X_{t-i} + \Pi X_{t-p} + \varepsilon_t \end{aligned} \quad (5)$$

where  $\Delta X_t = X_t - X_{t-1}$ ,  $\Gamma_i = -[I - \sum_{i=1}^{p-1} A_i]$ ,  $\Pi = -[I - \sum_{i=1}^p A_i]$ ,  $I_n$  is the identity matrix ( $9 \times 9$ ), and  $\Pi X_{t-p}$  contains information related to the balance of cointegration between variables and  $X_t$ .

The existence of comovements between the Indonesian stock price index and those of its major trading partners are indicated by the rank matrix  $\Pi$ ,  $r$ , where  $r$  is  $0 < r < n$ , and the two matrices,  $\alpha$  and  $\beta$ , with dimensions of ( $n \times r$ ), such that  $\alpha\beta' = \Pi$ . The matrix  $\beta$  contains  $r$  cointegration vectors and has the property of  $\beta' X_t$ , which is stationary;  $\alpha$  is a matrix of error correction percentages that measure the speed of adjustment in  $\Delta X_t$ .

Two statistical tests can be used to hypothesize the presence or absence of  $r$  cointegration vectors. The first is the likelihood ratio (LR) statistical test, or trace test, for the hypothesis that there are, at most,  $r$  different cointegration vectors with a common alternative, which has the following formula:

$$\lambda\text{-trace}(r) = -T \sum_{i=r+1}^n \ln(1 - \lambda_i) \quad (6)$$

The  $\lambda_i$ 's is the canonical least squares correlation,  $nr$ , between the residual series  $X_{tp}$  and  $\Delta X_t$ , corrected for the effects of the lagged differences of the process  $X$ , and  $T$  is the number of observations. Alternatively, the maximum eigenvalue test can be used to compare the null hypothesis of a cointegrating vector ( $r$ ) against the alternative hypothesis

of a cointegrating vector ( $r + 1$ ). The LR test statistic for this hypothesis is given by the following:

$$\lambda\text{-trace}(r, r+1) = -T \ln(1 - \lambda_{i+1}) \quad (7)$$

The linear restriction test on  $\beta$  reveals the market structure relationship developed with the long-run model. We used Johansen's (1991) LR test to test for this market constraint. The hypothesis for a linear restriction in the matrix cointegration vector can be formed as follows:

$$H_0: \beta = H\varphi \quad (8)$$

where  $\beta$  is the ( $n \times n$ ) cointegration matrix,  $H$  is the ( $n \times s$ ) matrix with  $ns$  restrictions, and  $\varphi$  is the ( $s \times r$ ) matrix. The LR statistical test is as follows:

$$LR: T \sum_{i=1}^r [\ln(1 - \lambda_i^*) - \ln(1 - \lambda_i)] \sim \chi^2(df) \quad (9)$$

where  $df = r(ns)$  is the number of degrees of freedom,  $\lambda_i^*$  is the eigenvalue  $s$  based on the restricted eigenvectors, and  $\lambda_i$  is the eigenvalue  $s$  based on the unrestricted eigenvectors.

### 3.2.4. Granger Causality

The short-run causal relationships between the Indonesian stock market and those of its major trading partners were tested using Granger causality. The Granger causality test can predict a single time series' values based on another time series' previous values. The Granger causality shows the cause-and-effect relationship between two time series, where each change in one series leads to a change in the other series. The Granger causality is a dynamic concept that considers the lag-lead relationship that can occur if there is a long-term relationship between the series. The Granger causality test can detect the relationship and direction of causality between the Indonesian stock market and those of its trading partners, which indicates the potential benefits of portfolio diversification to minimize the overall investment risk. The Granger causality test can also measure the level of integration among stock markets, meaning the extent to which markets are synchronized and guide international investment strategies and global risk management.

## 4. Results and Discussion

### 4.1. Preliminary Data

The initial data were used to detect the temporal and stochastic characteristics of the integration of the stock markets of Indonesia and those of its major trading partners using graphs at levels and first differences. Figure 1 shows the non-stationarity in all data series at the level, and Figure 2 shows the stationary time series after the first difference. The movements in the Indonesian stock market and those of its major trading partners from 2013 to 2024 show the tendency of a comovement pattern over time. In 2014, the Chinese stock market experienced an increase of 150 percent and was among the highest performing stock markets in the world. In July and February 2015 and 2018, the Chinese stock market experienced a significant decline in stock prices. The COVID-19 pandemic in 2020 resulted in sharp and sudden declines in the Indonesian stock market and those of its major trading partners.

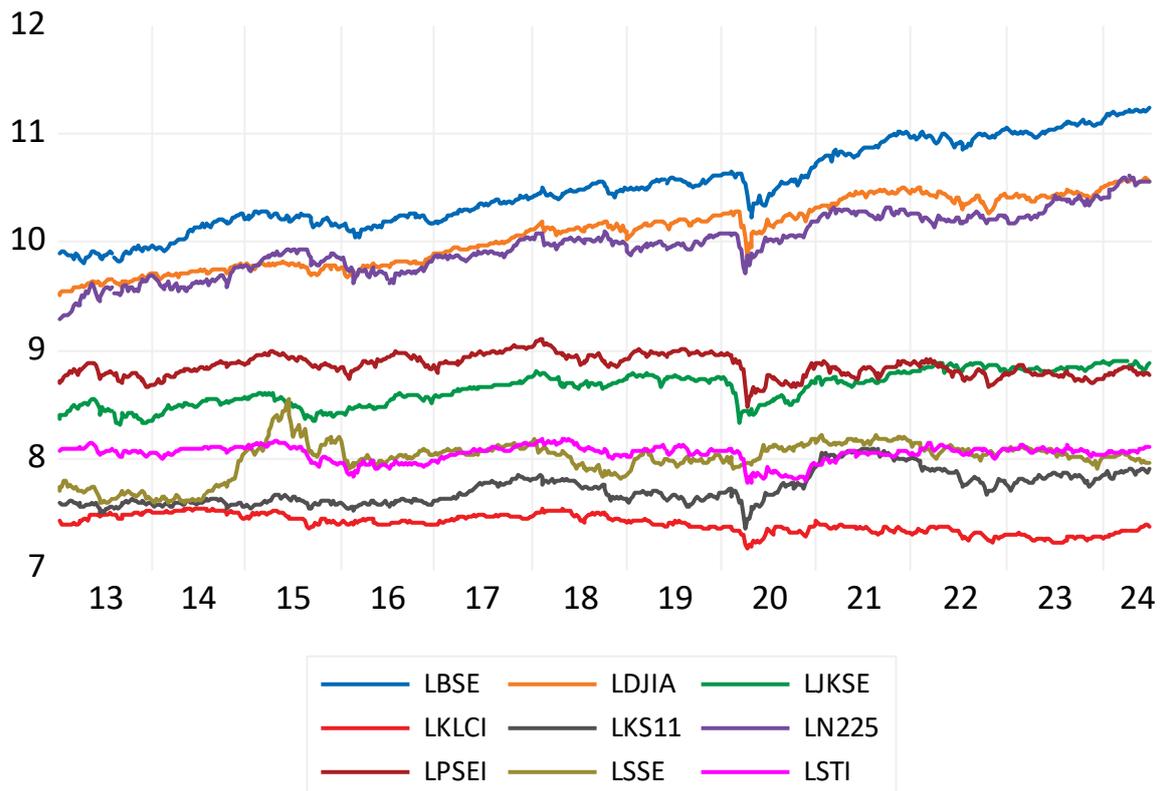


Figure 1. The stock price indexes of Indonesia and significant trading partners for January 2013–June 2024.

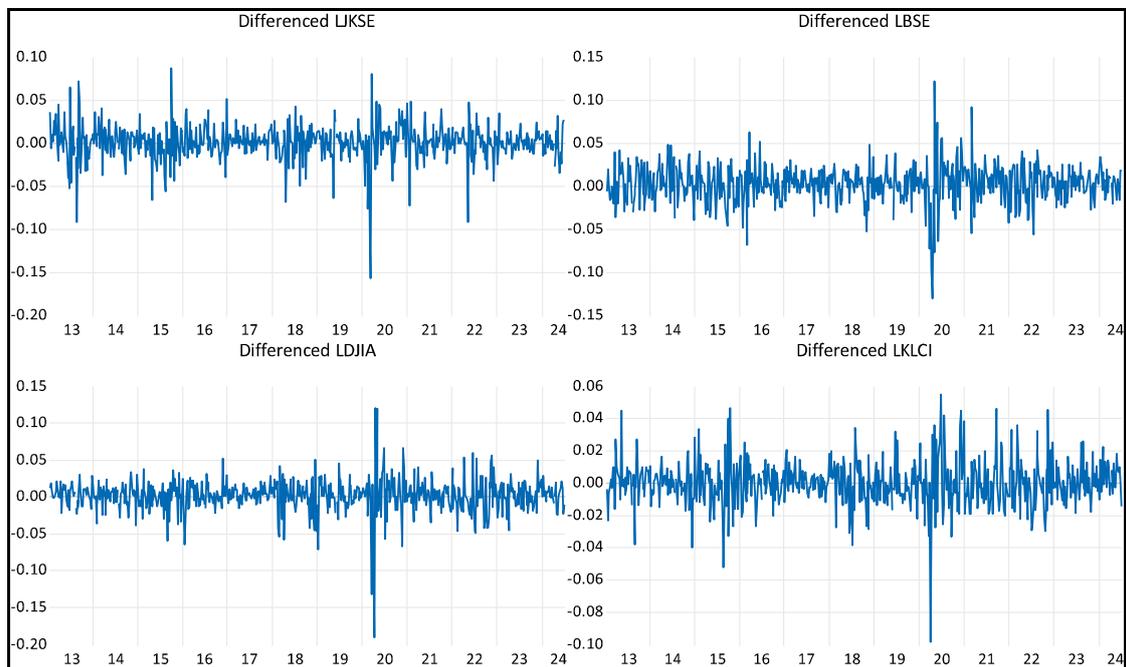
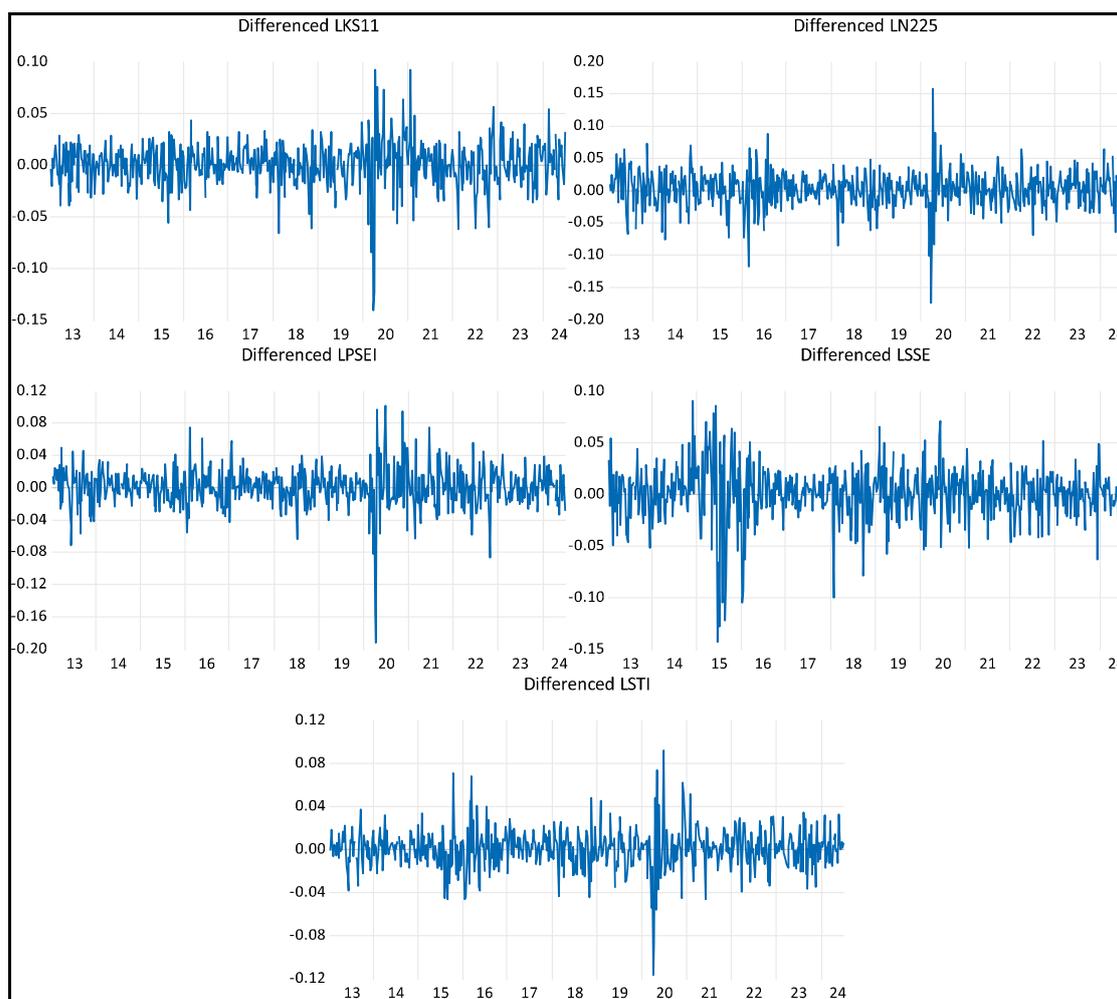


Figure 2. Cont.



**Figure 2.** Volatility grouping graph of the stock price index.

#### 4.2. Descriptive Statistics

Descriptive statistics are needed to obtain an initial picture of the behavior of the stock price index data explored for further analysis. Descriptive statistics include the mean, median, maximum, minimum, standard deviation, skewness, and kurtosis. The standard deviation measures the dispersion of the data, which shows how much risk there is in a stock market in this study. The skewness is a measure of the asymmetry in the spread of statistical data around the mean and which side of the distribution tail is more extended. The skewness of a symmetrical distribution is zero. Positive skewness indicates that the data spread has a long tail on the right side, and negative skewness has a long tail on the left side. This measure of skewness provides in-depth information about the contour and tendency of the distribution, thus enriching our understanding of its asymmetric characteristics. Kurtosis includes information on whether the stock price index distribution is standard, as measured by the height of the probability distribution. A kurtosis value of 3 is said to indicate a mesokurtic distribution of the data in line with normality. If the kurtosis exceeds 3, then the data distribution is said to be leptokurtic to normal. If the kurtosis is less than 3, the data distribution is flat (i.e., platykurtic) compared to normally distributed data.

Table 2 shows the results of descriptive statistics that provide an overview of the performance of the stock indices of Indonesia and its major trading partners. During the sampling period, the BSE and DJIA had the highest average values, while the KLCI and KS11 had the lowest. The volatility of the stock price indices, as measured by the standard deviation, shows that the BSE and DJIA had the highest volatility, while the KLCI

and STI had the lowest. Investors need to understand the importance of variance in the volatility levels of each market, especially when managing risk when considering a portfolio diversification strategy. The skewness results show positive skewness for the BSE and KS11, indicating that upward movements occur more often than downward movements.

**Table 2.** Descriptive statistics.

Description	JKSE	KLCI	STI	PSEI	BSE	SSE	KS11	N225	DJIA
Mean	8.651	7.403	8.050	8.858	10.499	8.001	7.726	9.979	10.081
Maximum	8.907	7.543	8.182	9.110	11.231	8.550	8.103	10.617	10.597
Minimum	8.312	7.172	7.779	8.472	9.812	7.590	7.356	9.287	9.510
Std. Dev.	0.154	0.083	0.077	0.099	0.383	0.170	0.147	0.274	0.301
Skewness	−0.201	−0.288	−1.263	−0.185	0.191	−0.690	0.709	−0.010	−0.067
Kurtosis	1.876	2.229	4.376	2.737	1.954	3.491	2.693	2.485	1.647
Jarque–Bera	35.345	22.968	205.003	5.128	30.768	53.196	52.251	6.583	45.849
Probability	0.000	0.000	0.000	0.077	0.000	0.000	0.000	0.037	0.000
Observation	595	595	595	595	595	595	595	595	595

In contrast, the other stock markets show negative skewness coefficients, implying that downward movements occur more often than upward movements. These skewness patterns indicate the potential opportunities and risks related to stock investment in each market, which are clues for investors who want to diversify their portfolios. All kurtosis coefficients displayed a platykurtic distribution during the study period, except for the STI and SSE. In addition, the Jarque–Bera test rejects the null hypothesis of a normal distribution, indicating a non-normal distribution of the data.

#### 4.3. Correlation Matrix

Correlation analysis among variables is conducted to measure the degree of closeness of the relationship between variables in pairs and determine the pattern of the positive or negative relationship directions between two variables. When there are two highly correlated variables, the coefficient value approaches +1 or −1. A positive relationship indicates that when the stock price index of one exchange increases, the other stock exchange also increases and vice versa. A correlation coefficient value approaching zero implies no relationship among stock exchanges. Table 3 shows the relationships between the Indonesian stock market and those of its major trading partners in pairs. The highest correlations were 0.970 between the BSE and DJIA and 0.9657 between the BSE and N225, while the lowest correlations were −0.019 between the PSEI and KS11 and −0.066 for the relationship between the SSE and STI. From the perspective of regional investors in the Philippines, Singapore, South Korea, and China, the low correlations increased the potential for portfolio diversification returns that could be obtained by investing in emerging stock markets. The Indonesian stock market had high and directional correlations with the stock markets of India, the US, and Japan.

**Table 3.** Correlation matrix.

Description	JKSE	KLCI	STI	PSEI	BSE	SSE	KS11	N225	DJIA
JKSE	1								
KLCI	−0.484	1							
STI	0.343	0.355	1						
PSEI	0.165	0.497	0.466	1					
BSE	0.883	−0.713	0.113	−0.127	1				
SSE	0.408	−0.364	−0.066	0.263	0.492	1			
KS11	0.697	−0.385	0.180	−0.019	0.770	0.502	1		
N225	0.833	−0.642	0.085	−0.088	0.957	0.574	0.795	1	
DJIA	0.872	−0.679	0.080	−0.097	0.970	0.487	0.812	0.953	1

#### 4.4. Unit Root Test Results

The Augmented Dickey–Fuller (ADF) test detects the data behavior for unit roots and the order of integration. The ADF test was performed on all series at the I(0) and the first difference I(1), with a trend only and a trend and intercept. The results of the ADF tests for the entire Indonesian stock market and those of its significant trading partners are presented in Table 4, which shows that all series were not stationary at the level, but at the first difference, all series were stationary at the 5% significance level. So, the order of integration of the series is I(1).

**Table 4.** ADF statistics.

	Level		First Difference	
	with a Constant	with a Constant and Trend	with a Constant	with a Constant and Trend
JKSE	−1.840	−3.174	−25.514	−25.492
KLCI	−2.098	−3.481	−23.198	−23.178
STI	−2.905	−2.889	−22.653	−22.638
PSEI	−3.203	−3.412	−24.272	−24.269
BSE	−0.290	−2.887	−23.638	−23.623
SSE	−2.291	−2.136	−23.120	−23.123
KS11	−1.720	−2.676	−24.120	−24.100
N225	−1.615	−4.081	−25.010	−24.991
DJIA	−1.207	−4.059	−26.309	−26.289

The critical value for a level of 5% with an intercept:  $-2.866$ ; with an intercept and trend:  $-3.417$ . The critical value for the first difference at 5% with an intercept:  $-2.866$ ; with an intercept and trend:  $-3.417$ . This indicates data stationarity at the 5% significance level.

#### 4.5. Johansen Cointegration Test

The ADF test results show that the weekly closing values of the stock price indexes become stationary in the first difference form, which allowed for the application of the cointegration procedure. The Johansen and Juselius cointegration technique was used to detect the integration of the Indonesian stock market and those of its major trading partners. The results of the Johansen–Juselius cointegration technique test are sensitive to the lag order chosen. Therefore, it is necessary to test the appropriate lag length criteria through the VAR lag order selection criteria. The optimal number of lags can vary based on the data and research questions, which aim to confirm uncorrelated residuals without unnecessary complexity. Five optimal lag selection criteria, namely, the LR test, Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Criterion (SC), and Hannan–Quinn information criterion (HQ). This study used the Akaike Information Criteria (AIC) to determine the optimal lag length, which guides the cointegration test selection. Table 5 presents the results of the optimal lag length test in the VAR system based on four criteria, namely, FPE, AIC, SC, and HQ, which suggested a lag of “2”. Therefore, a lag of “2” was selected to analyze the Indonesian stock market’s long-term and short-term joint movements with its major trading partners.

**Table 5.** Optimal lag lengths of the VAR.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	5653.145	NA	$3.60 \times 10^{-20}$	−19.23047	−19.16340	−19.20434
1	13,376.33	15,183.23	$1.77 \times 10^{-31}$	−45.26858	−44.59780	−45.00721
2	13,696.49	619.5983	$7.83 \times 10^{-32}$ *	−46.08345 *	−44.80895 *	−45.58683 *

\* Lag order was selected using the criteria.

The analysis of the Indonesian stock market’s integration with those of its eight major trading partner countries was carried out using the Johansen and Juselius multivariate cointegration test. The Johansen and Juselius cointegration test results, based on the trace

statistics and maximum eigenvalues, are presented in Tables 6 and 7. Table 6 presents the results of the multivariate cointegration test between the Indonesian stock market and those of its major trading partners. Based on the null hypothesis of zero cointegrating vectors, there was one significant cointegration vector with the trace statistic value. The eigenvalue of 220.302 is greater than the critical value of the trace statistic at the 5% confidence level. Table 6 shows the results of the maximum eigenvalue statistics, which lead to the same conclusion as the findings for the trace statistics, for which there was one cointegrated vector. One cointegrated vector was identified, indicating a stationary long-term relationship between the Indonesian stock market and those of its main trading partners. In other words, the Indonesian stock market and those of its main trading partners are integrated, but the level is still low. This finding also reveals that the trade relationships between Indonesia and its main trading partners impact stock-market integration. The presence of cointegration also indicates convergence among the stock markets that occurs in the long term, with the cointegration results showing eight or four common trends. These results are related to the partial convergence of the index. If there is more than one common trend, this means partial convergence of the index. In addition, the Indonesian stock market and those of its main cointegrated trading partners show stable behavior in the long term. This finding provides an opportunity for long-term portfolio diversification in the Indonesian stock market for investors from Malaysia, Singapore, the Philippines, China, India, South Korea, Japan, and the US. In addition, Indonesian investors can minimize risk by diversifying their portfolios internationally by investing in the stock markets of major trading partner countries.

**Table 6.** Cointegration test trace statistics.

Hypothesis	Eigenvalue	Trace Statistic	0.05% Critical Value	Prob. **
None *	0.115	220.302	197.371	0.002
At most 1	0.077	148.260	159.530	0.174
At most 2	0.053	100.896	125.615	0.573
At most 3	0.043	68.468	95.754	0.771
At most 4	0.033	42.550	69.819	0.899
At most 5	0.018	22.567	47.856	0.968
At most 6	0.012	11.845	29.797	0.937
At most 7	0.007	4.621	15.495	0.848
At most 8	0.000	0.254	3.841	0.614

Note: The trace statistic indicates one cointegrating equation at the 5% significance level. \* Denotes rejection of the null hypothesis at the 5% significance level. \*\* McKinnon–Haug–Michelis’s (1999)  $p$ -values.

**Table 7.** Cointegration test maximum eigenvalue statistics.

Hypothesis	Eigenvalue	Max Trace Stat.	0.05% Critical Value	Prob. **
None *	0.115	72.042	58.436	0.001
At most 1	0.077	47.364	52.363	0.149
At most 2	0.053	32.428	46.231	0.629
At most 3	0.043	25.918	40.078	0.708
At most 4	0.033	19.983	33.877	0.758
At most 5	0.018	10.722	27.584	0.972
At most 6	0.012	7.223	21.132	0.945
At most 7	0.007	4.367	14.265	0.819
At most 8	0.000	0.254	3.841	0.614

Note: The maximum eigenvalue test indicates one cointegrating equation at a 5% significance level. \* Denotes rejection of the null hypothesis at the 5% significance level. \*\* McKinnon–Haug–Michelis’s (1999)  $p$ -values.

This study’s results align with the findings of [Click and Plummer \(2005\)](#), who also proved that one cointegrated vector was found among the five ASEAN stock markets, meaning that the ASEAN5 are integrated. [Wu \(2020\)](#) revealed low integration between the ASEAN5 and East Asian (Japan, China, South Korea, and Japan) stock markets, although

governments in both regions have supported stronger economic and financial cooperation. [Sher et al. \(2024\)](#) confirmed one cointegration vector, meaning a relatively low degree of comovement among the Japanese, US, Chinese, Australian, UK, and German stock markets. This finding provides an opportunity for long-term portfolio diversification in the Chinese stock market for investors from developed countries. Conversely, Chinese investors can reduce risk by investing in developed stock markets. [Chien et al. \(2015\)](#) found one cointegration vector in the comovement between the ASEAN5 and Chinese stock markets, meaning that the stock markets are integrated but increasing gradually. [Wang et al. \(2024\)](#) proved the existence of joint risk movements between the Malaysian stock market and its trading partners. [Caporale et al. \(2021\)](#) proved the existence of long-term dynamic relationships between the ASEAN5 and US stock markets, while China and the US were found to have no cointegration. [Paramati et al. \(2015\)](#) confirmed that trade intensity strengthens the interdependence of the Australian stock market and its trading partners. [Abdul Karim and Shabri Abd. Majid \(2010\)](#) proved the synchronization of the Malaysian stock market and those of its major trading partners. Different findings were revealed by [Gupta and Guidi \(2012\)](#), who found that India's trade relations with its trading partners (Hong Kong, Japan, the US, and Singapore) had no impact on the integration of this stock market. [Teng et al. \(2013\)](#) revealed that the ASEAN5's stock markets did not respond to external shocks from the following four trading partners: the US, Japan, China, and India.

Pairwise Granger causality tests were conducted on 36 bivariate between the Indonesian stock market and those of its major trading partners. The results of the paired Granger test, as presented in Table 8, show 16 short-term bidirectional causality. The Indonesian stock market (JKSE) exhibited two-way causality with Singapore (STI), India (BSE), Japan (N225), and the United States (DJIA), which indicates a strong short-term relationship among the stock markets. The DJIA had the most two-way causalities with other countries' stock markets, which excluded the JKSE, Malaysia (KLCI), the N225, South Korea (KS11), and the Philippines (PSEI). The US stock market strongly influences other countries' stocks, especially Indonesia. The research results support the findings of [Robiyanto et al. \(2023\)](#), which proves the strong integration of the Indonesian and US stock markets, indicating that the movements of the two markets influence each other. [Endri et al. \(2020\)](#) proved that the Singaporean, Chinese, and US stock markets influence the Indonesian stock market. [Sarwar \(2019\)](#) confirmed that the US stock market strongly influences emerging markets. This raises concerns about the uncertainty of the US economy, which caused the US market's risk factors to rapidly increase the volatility in this market. [Chevallier et al. \(2018\)](#) revealed that greater exposure to US shocks drove ASEAN stock market synchronization. [Yuliadi et al. \(2024\)](#) revealed different findings, where the Indonesian stock market only responded positively to the US stock market in the short term but not to the Japanese and Singaporean stock markets. These findings are due to the frequency of the data and study period used and the number of major trading partners included in the research samples.

The N225 also had the same amount of bidirectional causality as the US stock market, in addition to the N225 and JKSE, as well as the BSE, KLCI, and PSEI. Furthermore, there was bidirectional causality between the KLCI and the BSE and STI, and, finally, between the KS11 and the PSEI and STI. The SSE was the only country with no reciprocal causality relationship with any stock market. This finding indicates that the Chinese stock market is segmented, so it is isolated from the influence of changes in other countries' stock markets, including Indonesia. The strong trade relations between Indonesia and China that have occurred recently have had no impact on increasing the degree of integration of the two countries' stock markets. As Indonesia's leading trade partner, China has contributed 26.3 percent of the total trade value. Singapore surpassed China's foreign investment dominance in Indonesia, which included Foreign Direct Investment (FDI) and Foreign Portfolio Investment (FPI). The latest data from the Indonesian Investment Coordinating Board show that the realization of foreign investment until the second quarter of 2024 totaled IDR 428.4 trillion, increasing by 6.7% quarter on quarter and growing by 22.5% year on year. China is second after Singapore for foreign investment in Indonesia, and FDI

dominates Chinese investment. [Errunza \(2001\)](#) revealed that FPI significantly influences capital market integration. FDI is more attractive to Chinese investors because Indonesia's degree of economic freedom is greater ([Azman-Saini et al. 2010](#)).

**Table 8.** Pairwise Granger causality test.

Null Hypothesis	F-Statistics	Prob.
DJIA does not Granger-Cause BSE	124.133	0.000 ***
JKSE does not Granger-Cause BSE	5.663	0.004 ***
BSE does not Granger-Cause JKSE	2.46	0.086 *
KLCI does not Granger-Cause BSE	65.005	0.000 ***
BSE does not Granger-Cause KLCI	6.229	0.002 ***
KS11 does not Granger-Cause BSE	16.49	0.000 ***
N225 does not Granger-Cause BSE	21.396	0.000 ***
BSE does not Granger-Cause N225	5.8	0.003 ***
PSEI does not Granger-Cause BSE	104.275	0.000 ***
STI does not Granger-Cause BSE	128.023	0.000 ***
JKSE does not Granger-Cause DJIA	6.276	0.002 ***
DJIA does not Granger-Cause JKSE	2.499	0.083 *
KLCI does not Granger-Cause DJIA	11.547	0.000 ***
DJIA does not Granger-Cause KLCI	5.457	0.005 ***
KS11 does not Granger-Cause DJIA	130.675	0.000 ***
DJIA does not Granger-Cause KS11	2.895	0.056 *
N225 does not Granger-Cause DJIA	44.734	0.000 ***
DJIA does not Granger-Cause N225	7.501	0.001 ***
PSEI does not Granger-Cause DJIA	2.91	0.055 *
DJIA does not Granger-Cause PSEI	5.245	0.006 ***
STI does not Granger-Cause DJIA	7.056	0.001 ***
KLCI does not Granger-Cause JKSE	3.064	0.048 **
N225 does not Granger-Cause JKSE	2.802	0.062 *
JKSE does not Granger-Cause N225	5.386	0.005 ***
PSEI does not Granger-Cause JKSE	6.679	0.001 ***
STI does not Granger-Cause JKSE	2.895	0.056 *
JKSE does not Granger-Cause STI	4.55	0.011 **
KS11 does not Granger-Cause KLCI	42.318	0.000 ***
KLCI does not Granger-Cause KS11	2.352	0.095 *
N225 does not Granger-Cause KLCI	13.323	0.000 *
KLCI does not Granger-Cause N225	3.259	0.039 *
KLCI does not Granger-Cause PSEI	5.758	0.003 **
STI does not Granger-Cause KLCI	2.826	0.060 *
KLCI does not Granger-Cause STI	2.426	0.089 *
PSEI does not Granger-Cause KS11	3.268	0.039 **
KS11 does not Granger-Cause PSEI	76.672	0.000 ***
ST1 does not Granger-Cause KS11	7.77	0.001 ***
KS11 does not Granger-Cause STI	106.027	0.000 ***
PSEI does not Granger-Cause N225	2.99	0.051 *
N225 does not Granger-Cause PSEI	24.817	0.000 ***
N225 does not Granger-Cause STI	35.61	0.000 ***
ST1 does not Granger-Cause PSEI	5.386	0.005 ***

\*\*\*, \*\*, and \* indicate significance at the 1, 5, and 10% levels.

Based on the 2024 Economic Freedom Index, Indonesia's score is higher than China's, at 63.5 compared to 48.5. However, the Economic Freedom Index of both countries decreased from 2020 to 2024. High economic freedom scores in trade and investment have been met with concerns over dependence on foreign investment, which can crowd out local businesses and increase economic vulnerability ([Szczepaniak et al. 2022](#); [Ahmad 2017](#)). In addition, institutional quality affects economic freedom. [Liu et al. \(2021\)](#) show that a free market economy and strong institutions can increase FDI. Conversely, weak institutions can reduce FDI and economic growth ([Herrera-Echeverri et al. 2014](#)). [Eldomiaty et al. \(2016\)](#) proved that economic freedom can reduce stock-market volatility. The US, Japanese, and

Singaporean stock markets influence the Indonesian stock market. The research results align with [Yuliadi et al. \(2024\)](#), who found that the Chinese stock market has no short-term relationship with the Indonesian stock market. [Jinghua and Kogid \(2024\)](#) proved the increasing integration of China's stock market with Singapore, Malaysia, and Vietnam but not with Indonesia. [Kenani et al. \(2013\)](#), using daily data, found that the Indonesian stock market moved in the same direction as China's after the financial crisis.

The findings also confirm a strong short-run causal relationship between the Indian and Japanese stock markets. Using weekly data, [Wong et al. \(2005\)](#) also proved that the Indian stock market was integrated with Japan's during the post-liberalization period. [Mukherjee and Bose \(2008\)](#) revealed that the Japanese stock market is synchronized with Asia, including India. [Gupta and Shrivastav \(2018\)](#) found a short-run and long-run dynamic relationship between the Indian and Japanese stock markets. Japan is noted to have a unique role in integrating the Asian stock markets, including India. India and Japan have strong economic ties and strategic geographical positions in both countries. In contrast, using daily data, [Tripathi and Sethi \(2010\)](#) found that the Indian stock market is not integrated with the Japanese stock market. These different findings imply that stock-market integration is a time-varying concept, and the results may depend on the frequency of the data used ([Bekaert et al. 2002](#)).

The pairwise Granger causality test also identified unidirectional causal relationships between the Indonesian stock market and those of 10 of its major trading partners. The JKSE influenced the KLCI and PSEI unidirectionally, while the BSE, DJIA, PSEI, and N225 influenced the STI. The BSE had the most unidirectional causal relationships with the STI, KSII, DJIA, and PSEI, meaning that the Indian stock market influenced the Singaporean, Philippine, South Korean, and US stock markets. This finding is supported by [Song et al. \(2021\)](#), who stated that the Indian stock market is increasingly synchronized with Asian countries. This is because the economic relations between these countries and India have increased over time. [Pattnaik and Gahan \(2018\)](#) proved otherwise, showing that the Indian capital market is not affected by emerging stock markets. The KLCI also had a unidirectional causal relationship with the PSEI.

The Indonesian stock market influenced the Malaysian and Philippine stock markets because, in addition to the geographical proximity and the fact that both are members of ASEAN, they also have strong economic and financial relations. [Anhar et al. \(2024\)](#) proved that the Indonesian stock market has strong relationships with the Malaysian and Singaporean stock markets. The results of the Granger causality tests also identified ten stock market pairs that did not have a causal relationship, including the JKSE with the KS11 and SSE. The Chinese stock market (SSE) also did not have unidirectional relationships with the stock markets of other countries, including the US and Indian stock markets. Due to differences in regulations and trade wars, [Sher et al. \(2024\)](#) also proved no causal relationship between the US and China. [Eronimus and Verma \(2024\)](#) proved that the Indian and Chinese stock markets were integrated.

## 5. Conclusions

This study examined the integration of Indonesia's stock markets and those of eight major trading partner countries, as follows: Malaysia, Singapore, the Philippines, India, China, South Korea, Japan, and the United States. Using weekly data from January 2013 to June 2024, this study identified long-term and short-term comovements. Johansen and Juselius's multivariate cointegration detects long-term market comovements, while pairwise Granger causality aims to investigate short-term market comovements. In the long run, the findings reveal that the JKSE is not integrated with the stock markets of major trading partner countries. The findings also indicate that the JKSE is more attractive to investors in the eight major trading partner countries who want to diversify their portfolios in international investment and vice versa. In the short run, the empirical evidence shows that the JKSE is integrated with seven major trading partners' stock markets, excluding China. The Chinese stock market has become segmented and more attractive to Indonesian

investors who want to diversify their portfolios and vice versa. Furthermore, the JKSE had a bidirectional causal relationship with the US, Japanese, Indian, and Singaporean stock markets, which implies that any movements in these four markets significantly impact the JKSE and vice versa. In addition, the JKSE exhibited a unidirectional reciprocal relationship with the KLCI and PSEI. These results reveal that any change in the Indonesian stock market impacts the Malaysian and Philippine stock markets' movement.

The findings have implications for investment decisions for investors developing portfolios in the Indonesian stock market and those of its major trading partners. Investors with a short-term investment horizon or an active portfolio management strategy can identify the causal relationships between stock markets and potential factors that influence their movements. In particular, Southeast Asian investors must understand the movements of common markets in emerging and developed markets and consider implementing hedging strategies involving various global portfolios. Another thing that needs to be considered in making investment decisions is that the integration of global stock markets has increased over time, which provides many benefits for investors that increase their portfolio diversification. Investment decisions in the Indonesian stock market also need to consider sector diversification. Choosing the right sector requires considering the state of nature, for example, economic conditions, government policies, specific events, and relationships among sectors. The banking and financial sector, agricultural and plantation sector, energy sector, and tourism sector are considered attractive now due to external sentiments driven by the policies of US President-Elect Donald Trump and China's economic policies. Domestically, these sentiments arise from the hopes that the new Indonesian President Prabowo Subianto can drive higher economic growth. [Defrizal et al. \(2021\)](#), based on the findings of their study, recommend the consumer goods and agricultural industry sectors, which have the highest average returns. [Santoso et al. \(2024\)](#) found that the technology stocks sector correlates the lowest with other stock sectors. [Santoso et al. \(2023\)](#) also recommend segmented sectors in the Indonesian stock market, namely, the technology, non-cyclical consumer goods, and health sectors, which are segmented with other sectors. Indonesia's trade relations with its eight major partners have made the stock market more integrated and open, the impacts of which lower the cost of capital, increase investment opportunities, and, ultimately, drive higher economic growth. However, in addition to the benefits gained, integration makes the Indonesian economy more vulnerable to global shocks. The benefits of integration become irrelevant in the event of a global economic and financial crisis because of the belief that high market synchronization spreads the crisis throughout global markets.

The study of the synchronization of Indonesia's capital market with those of its eight main trading partners needs further improvement, including data, capital market coverage, analysis methods, and integration determinants. This study used weekly data, and the use of daily and monthly data can produce different empirical findings. [Tiwari et al. \(2013\)](#) showed that Asian stock markets are highly integrated at lower frequencies (monthly, quarterly, and annually) and relatively less integrated at higher frequencies (daily and weekly). [Narayan et al. \(2014\)](#) proved that monthly dynamic conditional relationships are more prominent than weekly or daily correlations. The use of daily data can capture volatility spillovers and investor sentiment. In addition, the observation period can also provide different conclusions, especially if there are economic and financial crises that impact price movements in the stock market. Therefore, future research can be conducted over an extended period and consider various crisis events, including COVID-19. The scope of the Indonesian market's comovements with its trading partners was limited to eight countries across Asia, as well as the US. Future research can include a more significant number of countries and represent all continents. The weakness of the cointegration and Granger causality methods is that they cannot detect the impact of stock market spillovers. Therefore, the volatility model can provide a way to do so in future stock-market integration studies. Machine learning techniques are also an alternative methodology for further studies that can identify the drivers of global stock-market integration, especially

the prediction of future stock price movements and investor sentiment. Machine learning techniques can correct over-fitting, are less susceptible to disturbances, and allow for nonlinear relationships (Akbari et al. 2021). The level of comovement of the Indonesian stock market and those of its major trading partners in both the long and short terms is influenced by macroeconomic variables. Therefore, future research needs to investigate the impacts of macroeconomic variables, such as interest rates, exchange rates, inflation, and GDP, on international stock-market integration.

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