COMPARISON OF VECTOR AUTOREGRESSIVE (VAR) AND VECTOR ERROR CORRECTION MODELS (VECM) FOR THE COMPOSITE STOCK PRICE INDEX (JCI) IN INDONESIA

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Abstract

The capital market has a major role for economic development which is able to encourage capital formation and sustain economic growth. Financial liberalisation between countries in the world will make capital markets in each country interconnected. If there is a large movement in the global stock index, it will also have an impact on the JCI in Indonesia. In addition to global indices, macroeconomics is also seen as capable of influencing capital markets. Inflation and interest rates are macroeconomic components that can be used. The purpose of this research is to be able to see the relationship between one variable and another, namely the Composite Stock Price Index (JCI), Dow Jones Industrial Average (DJIA), inflation rate, interest rate. The VAR/VECM analysis approach was used in this study. Data was taken from 2017 to 2023. The data used for modelling is 84 observations. Based on the results, Inflation and DJIA have a long-term influence on the increase of JCI, while interest rates have no long term influence on JCI in Indonesia. With the model projection for the next 10 years. The projection results state that the variability of JCI in Indonesia is most dominantly explained by the JCI variable itself with a proportion of 95.21619%, while inflation contributes 0.193202%, interest rates 0.249170%, and DJIA index 4.341438%. The results of this analysis can be used as a consideration of strategies in increasing the JCI in Indonesia to maintain the health and stability of the economy.

Keywords: JCI, DJIA, Inflation, Interest Rate

1. INTRODUCTION

The introductory section provides a brief overview of the research context, areas where further research is needed, and the goals of the study. It is important for the introduction to be succinct and backed up by appropriate sources. The capital market serves as a key indicator of the overall economy, with the performance of companies listed on the stock exchange reflecting its development. In Indonesia, the JCI (Composite Stock Price Index) is used to measure this. Approximately 800 companies are listed on the Indonesian stock exchange with the goal of raising capital. An improperly functioning financial system can lead to inefficiencies in the economy and hinder the achievement of expected economic growth. Therefore, the growth of the JCI is vital for maintaining a healthy and stable economy according to Antono et al. (2019).

Various internal and external factors can influence the fluctuations of the JCI in Indonesia, including changes in foreign stock indices. The contagion effect theory suggests

that economic changes in dominant global economies can be transmitted to developing or underdeveloped nations. Consequently, the movement of the JCI not only reflects national circumstances but also worldwide conditions (Sasono, 2010). Internal factors, such as exchange rates, interest rates, inflation, money supply, and others, originate from within the country and can influence the stock market. Systematic risk is the potential danger associated with investing in stocks, caused by macroeconomic factors that impact all publicly traded companies. These factors can result in the Jakarta Composite Index (JCI) fluctuating in response to changes in the country's overall economic conditions (Endri & Abidin, 2020).

The current global economic crisis has caused the global stock index to decline. One of them is caused by the covid 19 pandemic that occurred in 2020 which made many countries in the world issue fiscal policies to help their people, causing the economy to decline. In addition, geopolitical tensions between Russia and Ukraine, Israel and Palestine are also one of the domino effects of global economic instability. The breakdown of producers' supply chains has caused commodity prices to soar, leading to an energy crisis and a food crisis. The crisis that hit developed countries certainly had an impact on the whole world, especially developing countries like Indonesia.

The weakening of the global economy has caused macroeconomic instability in Indonesia. The Fed's move to raise interest rates more rapidly/aggressively has depressed the rupiah exchange rate against the US dollar. One of the quickest ways to arrest depreciation in Indonesia is by raising interest rates. Nonetheless, the economy in Indonesia is currently considered quite good, as shown by the high trade balance surplus due to the increase in benchmark prices of Indonesia's leading commodities such as coal, CPO, and nickel. It is expected that Indonesia's economic growth prospects will be maintained.

This phenomenon can make it difficult for investors to decide to invest in the Indonesian stock market, which will have an impact on fluctuations in the JCI. The movement of the JCI is actually more influenced by global sentiment which tends to be negative due to geopolitics, so investors who conduct analyses with only domestic scope and believe that economic conditions in Indonesia will experience strengthening are wrong. Conversely, if investors focus too much on the global economy. Opportunities for investors to obtain positive returns on the domestic economy will be lost. Therefore, investors must be able to analyse both internal and external factors before deciding to invest in the capital market so as to increase the JCI and achieve economic growth.

The Dow Jones Industrial Average (DJIA) index, inflation, interest rates and the Jakarta Composite Index (JCI) are analysed in this study using a vector autoregression (VAR)/vector error correction model (VECM). The VAR/VECM model has an accountable and easy-to-understand model for data description, forecasting, structural inference, and policy analysis. It also presents a systematic method to capture dynamic changes in multiple time series.

The VAR/VECM model was used in the analysis of stock price indices in ASEAN countries by Suharsono (2018), and also used in the analysis of factors affecting JCI in Indonesia by Suhadak (2020). Forecasting and dynamic behaviour of time series of economic data can be explained by VAR/VECM models. In addition, the advantage of the VAR/VECM model can be expressed as a system of equations containing the same set of explanatory variables, and the coefficients can be estimated in an effective and consistent manner. Research conducted by Suharsono et al. (2017), Antono et al. (2019), Luwihono et al. (2021), Chandrashekar (2019), Shahzad et al. (2016), Khan et al. (2019), Zainuri (2021),

Herwany et al. (2021), Wahyu Umaryadi et al. (2021) stated that the connection between JCI, inflation, interest rates, and DJIA variables has been established. This research is focused on examining the correlation among the DJIA index, inflation, interest rates, and JCI in Indonesia while determining the level of impact each variable has on the others.

2. LITERATURE REVIEW

2.1. Contagion Effect Theory

Contagion Effect Theory comes from the concept of interdependence, or the fact that market economies depend on each other for things like macroeconomics, trade relations, and bank lending. These channels are based on the idea that real and financial relationships can spread shocks, both local and global, to all countries. If countries have similar economic or macroeconomic conditions or trading relationships, then the crisis will spread between them. Since bank credit and investor behaviour through financial channels are significant sources of crisis triggers, bank credit channels also play a role in crisis propagation (Gambacorta & Marques-Ibanez, 2011). When a crisis occurs, it can have a negative impact on other countries and weaken the economy, according to the report by Karim et al. (2009) states that Contagion Effect Theory depends on the extent to which other countries co-operate with each other in the economic field and the impact may be relative and not identical.

2.2. Macroeconomics

The study of the economy as a whole is called macroeconomics. It incorporates population expansion, price changes, inflation, interest rates, exchange rate changes, and GDP. According to Mankiw (2007), economists seek to explain economic events and consider policies to improve economic performance. According to the results of research conducted by Chandrashekar (2019), in developing nations like India and Brazil, there exists a lasting connection between stock prices and macroeconomic factors like inflation, industrial output, and interest rates. In addition, research by Khan et al. (2019) stated that stock prices on the Karachi Stock Exchange are heavily influenced by inflation, interest rates, and exchange rates in the long term.

2.3. Composite Stock Price Index (JCI)

According to Evi & Pramesworo (2021), a stock price index is a financial gauge that represents the performance of a specific group of stocks on a market. Different stock exchanges have their own unique formulas for calculating these indices. The Jakarta Composite Index (JCI) is an example of such an index, encompassing all stocks traded on the Indonesian stock exchange.

According to Nugroho et al. (2020), The index number is an indicator of the economy's performance, signalling whether it is improving, declining, or remaining stable. A rising stock price index suggests a vibrant market, while a steady index reflects a consistent market condition and a falling index points towards a sluggish market. The movement of the JCI is primarily influenced by large-cap stocks, as they hold significant power in determining its direction.

The Composite Stock Price Index experiences daily fluctuations due to changes in market prices and an increase in the number of outstanding shares. This increase is often the

result of newly listed companies entering the market and various corporate actions like stock splits, rights issues, warrants, stock dividends, bonuses, and conversions (Ichsani et al., 2019).

2.4. Dow Jones Industrial Average (DJIA)

The Dow Jones Industrial Average (DJIA) is the world's oldest stock index and is frequently utilised as a reference point for tracking stock market movements globally. Comprising of the stock prices of the top 30 publicly traded American companies, the DJIA is calculated as a weighted average (Rahmayani, 2020). Being the biggest country globally, the focus of investors worldwide, including Indonesia, is on the state of the US economy. Due to the strong economic connection between Indonesia and the US, with exports and foreign investments in the Indonesian capital market, any positive economic developments in the US will affect Indonesia's economy too (Endri, 2020). Foreign investment capital entering the Indonesian capital market will have a definite impact on the JCI movement (Salim & Siregar, 2022).

2.5. Inflation

The liquidity of a country's economy will increase during inflation. This understanding is based on what happens when there is more money in circulation, which will cause the prices of some goods to rise. Inflation can also be referred to as the trend of increasing value of goods and services that continue to increase along with the rapid development (Lesmana, 2022). Excessive inflation can detrimentally affect the economy, leading to multiple businesses facing bankruptcy due to the increased expenses of raw materials. If there is a drastic increase in inflation, it will certainly affect the stock price of a country which will have an impact on fluctuations in the JCI (Suhadak, 2020).

2.6. Interest Rate

Banking development can be disrupted by inappropriate changes in exchange rates. Investors will be more likely to keep money in deposit instruments if interest rates are high, which will cause more money to flow into the banking industry. Since investors will naturally be more interested in keeping their funds in banks to earn higher interest rates and lower risk, an increase in the BI Rate will negatively impact the increase in the JCI. As a result, the JCI will fall. Based on research conducted by (Endri, 2020), according to reports, a rise in interest rates will harm companies listed on the stock exchange, leading to higher borrowing costs and lower profits. Shareholders may choose to sell their shares, contributing to the decrease in the JCI as company earnings drop.

3. RESEARCH METHODS

This research utilises data from investing.com as a secondary source, the Indonesian stock exchange, and Bank Indonesia, from January 2017 to December 2023, the data consists of monthly observations. There are four data used for modelling which are Indonesian stock price index (JCI), inflation, interest rate, and American stock price index (DJIA). There are 84 observations in total. The vector autoregression (VAR)/vector error correction model

(VECM) method supported by Eviews application version 10.0 will be used to analyse the research model.

Monthly time series data from 2017 to 2023 are used to estimate this model. Using the Augmented Dickey-Test (ADF), non-stationarity of each data series is tested. At first differencing, the test results show that all data are stationary. To minimise the Akaike Information Criteria (AIC) value, the number of lags of the ADF test is selected. The optimal lag test results recommend using a lag length of one (which contains white noise residuals). The ADF form used to evaluate the unit root problem of the data series (equation [1]) is shown below.

Equation (1)

$$\Delta \boldsymbol{Y_t} = \boldsymbol{\beta_1} + \boldsymbol{\beta_2 t} + \boldsymbol{\delta Y_{t-1}} + \boldsymbol{\alpha_1} \sum_{\boldsymbol{i=1}}^{\boldsymbol{m}} \Delta \boldsymbol{Y_{t-1}} + \boldsymbol{\varepsilon_t}$$

The examination determines whether the lack of stationarity in the data series significantly skews the regression estimates for the entire dataset. As a result of this discovery, we carried out a test for cointegration. Typically, there are two common methods for conducting cointegration tests: Johansen's maximum likelihood estimation and Engle and Granger (1987). In this research, we employed the Johansen technique to assess the presence of cointegrating vectors and calculate the long-term impacts due to the limitations of the Engle and Granger method in separately estimating multiple cointegrating vectors.

The estimation for the VAR model in this study is obtained as follows:

$$JCI = \alpha + \sum_{i=1}^{9} \emptyset_{i1}\ INF(t-i) + \sum_{i=1}^{9} \beta_{i1}\, INT\,(t-i) + \sum_{i=1}^{9} \omega_{i1}\, DJI\,(t-i) + \sum_{i=1}^{9} \tau_{i1}\, IHSG\,(t-i)$$

$$INF = \alpha + \sum_{i=1}^{9} \emptyset_{i1}\ INF(t-i) + \sum_{i=1}^{9} \beta_{i1}\, INT\,(t-i) + \sum_{i=1}^{9} \omega_{i1}\, DJI\,(t-i) + \sum_{i=1}^{9} \tau_{i1}\, IHSG\,(t-i)$$

$$INT = \alpha + \sum_{i=1}^{9} \emptyset_{i1}\ INF(t-i) + \sum_{i=1}^{9} \beta_{i1}\, INT\,(t-i) + \sum_{i=1}^{9} \omega_{i1}\, DJI\,(t-i) + \sum_{i=1}^{9} \tau_{i1}\, IHSG\,(t-i)$$

$$DJIA = \alpha + \sum_{i=1}^{9} \emptyset_{i1}\ INF(t-i) + \sum_{i=1}^{9} \beta_{i1}\, INT(t-i) + \sum_{i=1}^{9} \omega_{i1}\, DJI\,(t-i) + \sum_{i=1}^{9} \tau_{i1}\, IHSG\,(t-i)$$

Incorporating the VAR framework suggested by Sims (1980), equation [2] considers all variables to be endogenous. The appropriate VAR order is determined through the Bayesian Schwarz criterion (SBIC), Hannan and Quinn information criterion (HQIC), and adjusted likelihood ratio evidence (AIC).

Equation (2)

$$z_t = A_1 z_{t-1} + \cdots + A_k z_{t-k} + \mu_t$$

In order to examine the connection between endogenous variables, we will be looking at the vector error correction model (VECM) as outlined in equation [3].

Equation. (3)

$$\Delta Z_t = \ \Gamma_1 \Delta Z_{t-1} + \ \Gamma_2 \Delta Z_{t-2} + \cdots + \Gamma_{k-1} \Delta Z_{t-k+1} + \ \Pi Z_{t-k} + \mu_t$$

In this scenario, Zt represents a set of stationary exogenous variables, while Zt represents a set of non-stationary endogenous variables. The parameter matrix si, with a size of (n x n), is calculated using the equation i = -(I - A1 - A2 -...Ai), where i ranges from 1 to k - 1 and = (I - 1 - 2 -...- k). The matrix Γ.i provides insights into short-term and long-term adjustments based on changes in Zt. The rank of this matrix helps in determining the number of co-integrating relationships present in the vector Zt. If the rank is denoted as r, with 0 < r > n, the matrix can be divided into two separate (n x r) matrices to estimate the long-term impact and error correction in the short-term impact. Two likelihood ratio (LR) tests, namely the trace test and the maximum eigenvalue test, are conducted to evaluate the cointegrating vector according to equations [4] and [5].

Equation (4)

$$\lambda_{trace} = -T \sum_{i=r+1}^{n} \log(1 - \hat{\lambda}_1)$$

Where r = 0,1,2, ..., n - 1, T = number of observations, λ̂_1 = estimation of characteristic roots (eigenvalues).

Equation (5)

$$\lambda_{max} = -T \log(1 - \hat{\lambda}_1)$$

Where r = 0, 1, 2, …, n − 2 n – 1.

4. RESULTS AND DISCUSSION

4.1. Data stationarity test

In order to meet the requirements of VAR modelling, it is essential to carry out a stationarity test first. The Augmented Dickey Fuller Test (ADF) unit root test is utilized in this research to assess stationarity. Using non-stationary data can lead to spurious regression, which occurs when a relationship between variables seems significant but is actually not. The results of the initial stationarity test conducted using Eviews 10 for each variable are as follows:

Table 1. Stationarity Test

Variable	Stationary test		Conclusion
	Level	difference	
JCI	0.3512	0.0000	stationer
Inflation	0.3587	0.0000	stationer
Interest Rate	0.1115	0.0000	stationer
DJIA	0.5460	0.0000	stationer

Table 1 shows that the JCI, Inflation, Interest Rate, and DJIA variables are stationary at the degree of differentiation. Therefore, further testing can be done.

4.2. Optimal Lag Determination

VAR modelling's performance can be greatly affected by the number of lags incorporated in the model. Hence, the identification of the ideal lag length is crucial. This can be achieved by observing the smallest value of the Akaike Information Criteria (AIC).

Table 2. Lag Optimal

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1157.053	NA	2.19e+08	30.55404	30.67671*	30.60306*
1	-1134.725	41.71919*	1.85e+08*	30.38750*	31.00085	30.63262
2	-1126.711	14.12997	2.29e+08	30.59765	31.70168	31.03888
3	-1114.247	20.66390	2.54e+08	30.69071	32.28542	31.32803
4	-1109.323	7.644937	3.46e+08	30.98218	33.06758	31.81561
5	-1101.666	11.08290	4.43e+08	31.20173	33.77780	32.23125
6	-1082.537	25.67244	4.26e+08	31.11940	34.18616	32.34503
7	-1062.522	24.75632	4.07e+08	31.01372	34.57116	32.43545

Based on table 2, the AIC value produces the minimum value at lag-1 so that the optimum lag length is chosen, namely 1. This lag length will be used to estimate the vector autoregressive model.

4.3. Stability Model Check

Stability can be assessed using the model stability test. if the test results show that the characteristic root has a modulus of less than 1, then the model is considered stable. Conversely, the VAR model is unstable if the characteristic root has a modulus greater than 1. The following are the results of the VAR stability test:

Table 3. Model stability

Root	Modulus
0.337879	0.337879
0.172470	0.172470
-0.139683	0.139683
-0.103468	0.103468

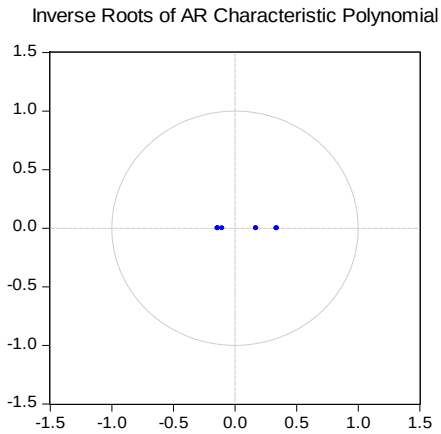

Figure 1. Inverse roots

Based on table 3 and figure 1, it can be seen that the VAR model is stable because the modulus value of the characteristic roots is less than 1 and all characteristic roots are in the unit circle (a circle with radius 1 on the complex plane).

4.4. Granger Causality Test

The Granger test is used to examine the relationship of cause and effect among different variables. This research will investigate the causal connections between JCI, inflation rate, interest rate, and DJIA. By conducting the causality test, we aim to determine if an endogenous variable can be considered as an exogenous variable due to lack of awareness about the influence between variables. If the likelihood value is less than 0.05, it suggests the presence of a causal relationship.

Table 4. Granger Causalities

Null Hypothesis:	Obs	F-Statistic	Prob.
INF does not Granger Cause JCI	84	0.38879	0.5347
JCI does Granger Cause INF		12.2601	0.0008
Interest rate does not Granger Cause JCI	84	1.71073	0.1946
JCI does Granger Cause Interest rate		8.40449	0.0048
DJIA does not Granger Cause JCI	84	1.00305	0.3196
JCI does not Granger Cause DJIA		0.51773	0.4739
Interest rate does not Granger Cause INF	84	3.46742	0.0663
INF does Granger Cause Interest rate		8.08121	0.0057
DJIA does Granger Cause INF	84	4.73454	0.0325
INF does not Granger Cause DJIA		0.13464	0.7146
DJIA does not Granger Cause Interest rate	84	0.86917	0.3540
Interest rate does not Granger Cause DJIA		1.72605	0.1927

According to the data in table 4, it appears that there is no direct correlation between inflation and the JCI variable, however, the JCI variable does affect inflation. The interest rate variable does not seem to impact the JCI variable, but rather, the JCI variable affects interest rates. There is no clear causality between the DJIA variable and the JCI variable, and vice versa. The interest rate variable does not have a direct relationship with inflation, but inflation does affect interest rates. The DJIA is linked to inflation, while inflation does not have a direct impact on the DJIA. There is no causality between the DJIA variable and interest rates, and likewise, there is no direct relationship between interest rates and the DJIA.

4.5. Cointegration Test

The aim of the cointegration analysis is to establish if there will be a balance in the future. In other words, to see if the connection between the variables in this research behaves in a consistent and steady manner. The Johansen cointegration test is employed for this analysis. If the likelihood score is below 0.05, the equation shows long-term balance and is known as a cointegrating equation.

Table 5. Cointegration test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.485213	127.2757	47.85613	0.0000
At most 1 *	0.370896	73.49157	29.79707	0.0000
At most 2 *	0.216712	35.95145	15.49471	0.0000
At most 3 *	0.180934	16.16683	3.841466	0.0001

Based on table 5 above, it can be seen that each variable has a probability value <0.05, which means that there is cointegration or a long-term relationship between variables.

4.6. VECM Test

Table 6. VECM Test

Cointegrating Eq:	CointEq1			
D(JCI(-1))	1.000000			
D(INFLATION(-1))	-1401.314 (323.623) [-4.33008]			
D(Interest rate (-1))	599.7463 (393.106) [1.52566]			
D(DJIA(-1))	0.832675 (0.08946) [9.30792]			
C	186.0146			
Error Correction:	**D(SER01,2)**	**D(SER02,2)**	**D(SER03,2)**	**D(SER04,2)**
CointEq1	0.095807 (0.05057) [1.89440]	7.52E-05 (7.8E-05) [0.96612]	2.38E-05 (4.9E-05) [0.48961]	1.805971 (0.27203) [6.63891]
D(SER01(-1),2)	-0.499981 (0.11880) [-4.20866]	5.80E-05 (0.00018) [0.31728]	7.83E-05 (0.00011) [0.68586]	-0.289000 (0.63899) [-0.45227]

D(SER02(-1),2)	67.30309	-0.501389	0.010138	1586.651
	(70.7068)	(0.10881)	(0.06796)	(380.319)
	[0.95186]	[-4.60781]	[0.14917]	[4.17190]
D(SER03(-1),2)	37.75883	0.065984	-0.479126	-550.1876
	(110.063)	(0.16938)	(0.10579)	(592.007)
	[0.34307]	[0.38956]	[-4.52888]	[-0.92936]
D(SER04(-1),2)	0.046451	-2.51E-05	9.02E-06	0.270708
	(0.02739)	(4.2E-05)	(2.6E-05)	(0.14734)
	[1.69577]	[-0.59597]	[0.34252]	[1.83733]
C	-6.200797	-0.003624	0.002994	-18.74456
	(28.3837)	(0.04368)	(0.02728)	(152.671)
	[-0.21846]	[-0.08296]	[0.10976]	[-0.12278]

According to table 6, the VECM model produces two estimation results for assessing the cointegration or long-term equilibrium relationship between variables, as well as gauging the error correction or the rate at which these variables move towards their long-term equilibrium using VAR and VECM models. This study evaluates the impact of one variable on another using a T-table value of 1.96 and a 5% significance level. The upper section presents the outcomes of the long-term regression relationship involving JCI, inflation, interest rate, and DJIA index based on the cointegration examination. Following the VECM assessment, there is a considerable negative association between inflation and JCI in Indonesia. Which means that when inflation increases it will reduce the JCI, the same research is also conducted by (Endri, 2020) and (Antono et al., 2019) stated that inflation negatively affects the increase in JCI, this is because an increase in inflation is a negative signal for investors to invest in the capital market, due to an aggressive increase in inflation which makes investors tend to switch to other forms of investment such as savings or deposits. The shift in investment will cause a decline in the JCI. Interest rates have no influence on the JCI in Indonesia. This research is similar to the research conducted by (Ahmad, 2021) said that BI Rate has no effect on JCI. This is because investors do not pay attention to the movement of the BI Rate in investing in the capital market, so interest rates do not have an impact on the JCI in Indonesia.

The rise in JCI is impacted by the DJIA index. Being the most established stock index globally, the Dow Jones Industrial Average (DJIA) is commonly utilised as a benchmark for stock index variations worldwide. With the United States boasting the largest economy globally, it has drawn investors from various countries, including Indonesia. Due to the robust economic connection between Indonesia and the United States in terms of exports and foreign investment flowing into the Indonesian stock market, any positive economic situation in the US will affect Indonesia's economy (Endri, 2020). The movement of the JCI will certainly be influenced by foreign investment capital entering the Indonesian capital market (Salim & Siregar, 2022). Research findings conducted by Suharsono et al., (2017), Endri & Abidin (2020), Lesmana (2022), Arsy et al. (2021), Nuraeni & Panjawa (2021), Ahmad (2021), Situngkir (2019), Slaihin (2021), Lesmana (2022), Rahmayani (2020) stated that the DJIA has an effect on the movement of the JCI in Indonesia.

4.7. Variance decomposition

In the VAR system, variance decomposition assesses the significance of each variable in relation to a shock. It strives to anticipate the extent to which alterations in specific variables within the VAR system impact the variance explained by each variable.

Table 6. JCI variance decomposition results

Period	S.E.	D(JCI)	D(Inflation)	D(rate)	D(DJIA)
1	255.2936	100.0000	0.000000	0.000000	0.000000
2	293.0695	98.13002	0.036652	0.351392	1.481932
3	349.7680	95.88926	0.120805	0.248599	3.741337
4	386.9450	95.92672	0.160792	0.303660	3.608828
5	426.4215	95.74978	0.152634	0.265166	3.832425
6	459.8535	95.50925	0.175554	0.274116	4.041076
7	492.1476	95.43050	0.178929	0.259207	4.131364
8	521.9411	95.34283	0.185362	0.258104	4.213707
9	550.3804	95.27317	0.189253	0.251689	4.285890
10	577.2792	95.21619	0.193202	0.249170	4.341438

Based on the table, it can be seen that in the first period, the diversity of changes in the JCI level variable is influenced by the JCI level variable itself by 100%, but in the same period other variables have not given a big influence on the diversity of variable changes, which means that other variables have not contributed to changes in the JCI level variable. In the next period the contribution of the JCI level variable that influences the change in the JCI level variable itself continues to decline. In contrast to the level of contribution of other variables in influencing changes in the JCI level variable continues to increase and fluctuate. This means that the Inflation, Interest Rate and DJIA index variables have an important influence or contribution to changes in the JCI variable.

Table 7. Variance decomposition results Inflation

Period	S.E.	D(JCI)	D(Inflation)	D(Rate)	D(DJIA)
1	0.392880	8.389331	91.61067	0.000000	0.000000
2	0.454113	8.569234	87.08605	0.066839	4.277874
3	0.536620	9.033867	87.84199	0.048864	3.075279
4	0.597613	8.726337	88.30045	0.052575	2.920643
5	0.655049	8.998309	88.28934	0.050943	2.661407
6	0.707146	8.955058	88.52767	0.048987	2.468288
7	0.755936	9.005823	88.62571	0.048911	2.319554
8	0.801678	9.014368	88.72208	0.047843	2.215705
9	0.844944	9.037000	88.78911	0.047597	2.126296
10	0.886118	9.046348	88.85252	0.047025	2.054110

Based on the variance decomposition results of the inflation variable which can be seen in the table above, it shows that the JCI variable in the first period contributed to changes in the Inflation variable by 8.389331% and the inflation variable influenced the inflation

variable itself by 91.61067%, but the interest rate variable and the DJIA variable have not contributed in the first period. In the next period, the contribution of JCI, interest rate, and DJIA index variables contributed with fluctuating values.

4.8. Interest Rate decomposition variance results

Table 8. Interest Rate decomposition variance results

Period	S.E.	D(JCI)	D(Inflation)	D(rate)	D(DJIA)
1	0.245391	0.163340	1.350395	98.48627	0.000000
2	0.278758	1.047255	1.231527	97.54919	0.172032
3	0.335084	0.758557	1.144591	97.78769	0.309166
4	0.370826	0.924199	1.093095	97.63951	0.343197
5	0.408864	0.850192	1.074885	97.72913	0.345797
6	0.441074	0.878850	1.053838	97.68890	0.378409
7	0.472301	0.855524	1.037366	97.72143	0.385676
8	0.500977	0.860594	1.027692	97.71486	0.396853
9	0.528412	0.852482	1.017679	97.72572	0.404115
10	0.554326	0.851783	1.010706	97.72657	0.410941

Based on the variance decomposition results of the interest rate variable which can be seen in the table above, it shows that the JCI variable in the first period contributed to changes in the interest rate variable by 0.163340% and the inflation variable influenced the interest rate variable by 1.350395%, but the DJIA variable has not contributed to the first period of the interest rate variable. In the next period, the contribution of JCI, inflation, and DJIA index variables contributed to the interest rate with fluctuating values.

Table 9. Variance decomposition results of DJIA Index

Period	S.E.	D(JCI)	D(inflation)	D(rate)	D(DJIA)
1	1373.178	24.04457	13.55955	1.615114	60.78076
2	1456.972	26.90220	14.36552	1.808739	56.92354
3	1613.589	25.08325	24.58498	2.335298	47.99647
4	1705.789	27.13137	26.76668	2.413155	43.68879
5	1799.101	28.43871	29.56329	2.704037	39.29397
6	1884.465	29.18580	32.14708	2.839846	35.82727
7	1967.009	30.01122	34.11797	2.986349	32.88447
8	2045.680	30.69971	35.79629	3.100126	30.40387
9	2121.691	31.26388	37.26804	3.203006	28.26508
10	2195.007	31.76288	38.53924	3.289374	26.40851

Based on the variance decomposition results of the DJIA index variable which can be seen in the table above, it shows that the JCI variable in the first period contributed to changes in the DJIA variable by 24.04457% and the inflation variable influenced the DJIA variable by 13.55955%, the interest rate variable contributed to the DJIA by 1.615114%, and the DJIA variable contributed to the DJIA by 60.78076. In the next period, the contribution of JCI, inflation and interest rate variables to the DJIA increased in value.

5. CONCLUSION

The occurrence of long-run cointegration is observed in the estimation of the vector autoregression (VAR) model at first difference with lag 1. The VECM estimation shows that the interest rate variable has no long-run effect on the JCI, while the DJIA and inflation variables have a significant impact on the increase in the JCI in Indonesia. The model is projected for ten years. The projection results show that the variability of JCI in Indonesia is still dominantly explained by the JCI variable itself with a proportion of 95.21619%, while inflation contributes 0.193202%, interest rate 0.249170%, and DJIA index 4.341438%.

The contribution of each of the factors identified contributes to changes in the JCI in Indonesia, therefore this variable should be the focus of investors' attention in investing in the capital market so as to increase the JCI in Indonesia and ultimately contribute to economic progress

REFERENCES

Ahmad, F. (2021). Analisis Pengaruh Makroekonomi, Komoditas Dunia, dan Indeks Dunia Terhadap Indeks Harga Saham Gabungan (IHSG) pada Periode 2014-2019. *Jurnal Ilmu Manajemen*, *9*(2019), 295–310.

Antono, Z. M., Jaharadak, A. A., & Khatibi, A. A. (2019). Analysis of factors affecting stock prices in mining sector: Evidence from Indonesia Stock Exchange. *Management Science Letters*, *9*(10), 1701–1710. https://doi.org/10.5267/j.msl.2019.5.018

Arsy, F. R., Nurmatias, & Mulyantini, S. (2021). Analisis kausalitas indeks harga saham global dengan indeks harga saham gabungan. *Konferensi Riset Nasional Ekonomi, Manajemen, Dan Akuntansi*, *2*(December 2019), 213–229.

Chandrashekar, R. (2019). Macroeconomic variables and stock prices in emerging economies : A panel analysis. *Theoretical and Applied Economics*, *XXV*(3), 91–100.

Endri., Abidin, Z. (2020). Indonesian Stock Market Volatility: GARCH Mode. *Montenegrin Journal of Economics*, *16*(2).

Endri, E. (2020). Indonesian stock market volatility: GARCH model. *Montenegrin Journal of Economics*, *16*(2), 7–17. https://doi.org/10.14254/1800-5845/2020.16-2.1

Evi, T., & Pramesworo, I. S. (2021). Combined Share Price Index (IHSG) In Indonesia Stock Exchange Affected By Regional Asia Southeast Exchange Index. *International Journal of Research and Innovation in Social Science (IJRISS)*, *V*(Ix), 868–878.

Gambacorta, L., & Marques-Ibanez, D. (2011). The bank lending channel: lessons from the crisis. *Economic Policy*, *26*(66), 135–182.

Herwany, A., Febrian, E., Anwar, M., & Gunardi, A. (2021). The Influence of the COVID-19 Pandemic on Stock Market Returns in Indonesia Stock Exchange. In *Journal of Asian Finance, Economics and Business* (Vol. 8, Issue 3, pp. 39–47). https://doi.org/10.13106/jafeb.2021.vol8.no3.0039

Ichsani, S., Mariana, C., & Andari, D. (2019). *Does the Indonesia Composite Index get Affected By The Asia Composite Index ? 6*(7), 1–13.

Karim, B. A., Majid, M. S. A., Ariffin, S., & Karim, A. (2009). *INTEGRATION OF STOCK MARKETS BETWEEN INDONESIA AND ITS MAJOR TRADING PARTNERS*. 229–

252.

Khan, J., Khan, I., & Hospital, A. (2019). The Impact of Macroeconomic Variables on Stock Prices : A Case Study of Karachi Stock Exchange The Impact of Macroeconomic Variables on Stock Prices : A Case Study of Karachi Stock Exchange. *Journal of Economics and Sustainable Development*, *June*.

Lesmana, A. (2022). The Effect of the World Exchange Indexes (DJIA, SSEC and NIKKEI 225) on the Indonesia Stock Exchange Index (IDX) Alvin Lesmana1 Email: *Journal of Asian Multicultural Research for Economy and Management Study*, *3*(1), 1–9.

Luwihono, A., Suherman, B., Sembiring, D., Rasyid, S., Kalbuana, N., Saputro, R., Prasetyo, B., Taryana, Suprihartini, Y., Asih, P., Mahfud, Z., & Rusdiyanto. (2021). Macroeconomic effect on stock price: Evidence from Indonesia. *Accounting*, *7*(5), 1189–1202. https://doi.org/10.5267/j.ac.2021.2.019

Mankiw, N. G. (2007). *Monetary policy* (Vol. 29). University of Chicago Press.

Nugroho, R. H., Andarini, S., Wijaya, R. S., Prabowo, B., Sciences, P., Programs, S., Economics, D., Nugroho, R. H., Andarini, S., Wijaya, R. S., Effect, T., Exchange, O., Level, I., Index, H. S., Rate, E., Rate, I., & Index, H. S. (2020). *Analysis of the Effect of Exchange Value, Inflation Level, Sbi Interest Rate and Hang Seng Index for Joint Stock Price Index in Indonesia Stock Exchange (Study on Idx 2016 - 2019)*. *17*(6), 8304–8314.

Nuraeni, R., & Panjawa, J. L. (2021). *Analisis pengaruh indeks saham asing terhadap indeks harga saham gabungan dengan pendekatan Error Correction Model*. *1*(1), 25–39.

Rahmayani, D. (2020). Does the Covid-19 pandemic affect the stock market in Indonesia? *Jurnal Ilmu Sosial Dan Ilmu Politik*, *24*(1), 33–47. https://doi.org/10.22146/JSP.56432

Salim, M. N., & Siregar, J. (2022). Analysis of Determinants of Stock Transaction Volume and its Effect on the IDX Composite in IDX 2010-2020 Period. *Dinasti International Journal of Economics, Finance & Accounting*, *2*(6), 581–600.

Sasono, H. (2010). *Global Index Effect on JCI*.

Shahzad, S. J. H., Kanwal, M., Ahmed, T., & Ur Rehman, M. (2016). Relationship between developed, European and South Asian stock markets: a multivariate analysis. *South Asian Journal of Global Business Research*, *5*(3), 385–402. https://doi.org/10.1108/sajgbr-01-2015-0002

Situngkir, T. L. (2019). *Pengaruh Dow Jones Indeks , Strait Time , dan Hang Sheng Terhadap Indeks Harga Saham Gabungan Dengan Pendekatan Error Correction Model*. *3*(2), 307–313.

Slaihin, A. (2021). Pengaruh Pasar Saham Global Dan Variabel Makro Ekonomi Terhadap Pasar Saham Indonesia. *J-EBIS (Jurnal Ekonomi Dan Bisnis Islam)*, *6*(April), 1–17.

Suhadak. (2020). The Influence of Exchange Rates on Inflation , Interest Rates and the Composite Stock Price Index : Indonesia 2015 - 2018. *AABFJ*.

Suharsono, A., Aziza, A., & Pramesti, W. (2017). Comparison of vector autoregressive (VAR) and vector error correction models (VECM) for index of ASEAN stock price. *AIP Conference Proceedings*, *1913*(December). https://doi.org/10.1063/1.5016666

Wahyu Umaryadi, M. E., Hamdana, Saragih, D. A., & Burhan, H. (2021). Interest Rate, Inflation and Jakarta Composite Index on Digital Media Based Companies Stock Return in Indonesia. *Journal of Physics: Conference Series*, *1807*(1). https://doi.org/10.1088/1742-6596/1807/1/012025

Zainuri, Z. (2021). The Impacts of the COVID-19 Pandemic on the Movement of Composite Stock Price Index in Indonesia. *Journal of Asian Finance, Economics and Business*, *8*(3), 1113–1119. https://doi.org/10.13106/jafeb.2021.vol8.no3.1113

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