EFFECT OF MACROECONOMIC INDICATORS ON STOCK PRICE INDICES WITH THE VECTOR ERROR CORRECTION MODEL APPROACH

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Abstract

The capital market as one of the important instruments in the economy requires indicators to determine growth in it. The Composite Stock Price Index (IHSG) is used as one of the capital market indicators with various influencing factors. This research was conducted to test and analyze the effect of inflation, exchange rate, the Bank Indonesia (BI) rate, and money supply (M2) on the Jakarta Composite Index (JCI) in the period from January 2017 to March 2022. In this study, quantitative descriptive research was carried out with JCI as the dependent variable and inflation, exchange rate, BI-rate, and money supply as independent variables. The research used the vector autoregression (VAR) method using the EViews 12 analysis tool. From the tests conducted it showed that between variables only had a one-way relationship, with the R-squared value indicating that the independent variables in the model were able to explain changes in the dependent variable that occurred. The variables in the model are also indicated to have a simultaneous effect on the dependent variable; this is based on a high F-statistic value.

Keywords: Composite Stock Price Index, Macroeconomic, Vector Error Correction

1. INTRODUCTION

The capital market is an economic instrument that has an impact on economic development (Sumaryanto et al., 2021). The capital market is one of the foundations of the economy regarding the provision of capital in running the economy. The capital market acts as a means of funding for a company where the capital market plays a role in raising funds from the public or investors (Adisetiawan & Surono, 2016). According to Adisetiawan and Surono (2016), an indicator is needed that can be used by the public as investors to determine the value and conditions of the capital market before investing. The capital market is also a source of additional funding for companies as well

as for the government (Suhartini & Widoatmodjo, 2022). The Composite Stock Price Index (IHSG) is defined as an index that contains stocks listed on the Indonesia Stock Exchange (IDX) so that its movement indicates the condition of the IDX capital market.

The research gap in this study states that the influence of the variables inflation, the Bank Indonesia (BI) rate, exchange rate and money supply (M2) on the price index is the same as using the vector autoregression (VAR) model. According to research conducted by Azhar et al. (2019), the exchange rate, money supply, and interest rates do not have a reciprocal relationship, but only a one-way relationship for each variable. Research conducted by Sonia et al. (2022) found that inflation, interest rates, exchange rates and the money supply have a partial long-term balancing effect on the JCI. Sumaryanto et al. (2021) stated that the money supply is significant to the JCI, while inflation is not significant to the JCI. In a study conducted by Mulyani et al. (2020) states that the money supply and inflation have a negative effect on the JCI. Research conducted by Yuliani et al. (2021) shows that inflation, exchange rates, and money supply simultaneously have an influence on the JCI.

The current economic phenomenon is where the JCI plays a big role because the higher the investment in the country, the greater the capital flow. With this large capital, the economy will move and increase economic growth and state revenue through taxes paid by companies (Niyazbekova et al., 2016). The formulation of the research problem is that there are fluctuations in the growth of the JCI as a result of changes in various aspects that become factors in the JCI, both internal and external factors. In addition, the phenomenon of the COVID-19 pandemic, which was followed by the emergence of various adjustments and regulations in all aspects, caused various adjustments to occur.

The research question is:

RQ: Whether the influence of macroeconomic indicators such as inflation, exchange rates, money supply and interest rates can affect the stock price index?

It can be explained that these indicators explain the main function of the stock index as an indicator that describes market conditions in a certain period. The existence of this statistical measurement is very important in knowing the trend of stock price movements. The purpose of this research is to examine and analyze the effect of macroeconomic indicators on the stock price index.

The methodology used in this study is to use data analysis, namely the vector autoregression (VAR) method. Furthermore, the research findings are indications of simultaneous influence on the dependent variable due to the high F-statistic value resulting in a change in the dependent variable. The main contribution is expected that the variables in this study can improve performance in various sectors that can be managed properly. Furthermore, it is hoped that the government must focus more on building a more independent domestic economy and revitalizing industries that have priority on industrial resources and infrastructure development. Indonesia needs to build an economy that has high resilience in order to

continue to develop in an increasingly dynamic and competitive environment.

The structure of this paper is as follows. Section 1 is an introduction, explaining the research background, research gaps, phenomena, problems, and objectives. Section 2 describes the literature used and the development of the hypotheses. Section 3 describes the methods in this study. Section 4 shows and discusses the statistical results obtained and compared with the previous studies. Section 5 concludes this research along with the limitations of this research and provides recommendations from this research for further research and the implications for researchers.

2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

2.1. Macroeconomic theory

Macroeconomics is a branch of economics. Macroeconomics focuses on economic behavior and policies that can affect consumption and investment levels, a country's balance of trade and payments, important factors affecting changes in prices and wages, fiscal and monetary policies, the amount of money in circulation, interest rates and the amount of debt country. In summary, it can be said that macroeconomics pays close attention to the interactions between labour, circulation of goods, and economic assets which result in trading activities for each individual or country (Hassan et al., 2020). According to Olokoyo et al. (2020), the macroeconomic conditions of a country are one of the factors that can affect the performance of companies in that country.

When macroeconomic conditions in a country experience positive or negative change, investors will calculate the impact on company performance in the future, and then decide to buy or sell the company's shares in question. This selling and buying action will result in changes in stock prices, which will ultimately affect the capital market index in that country (Ligocká & Stavárek, 2018).

2.2. Composite Stock Price Index

The Composite Stock Price Index (IHSG) is one of the indices on the Indonesian Stock Exchange. This index is a combination of stocks listed on the IDX and is used as a measuring tool as well as to determine the performance value of these stocks. The JCI is used to find out how a capital market is developing in general so that it becomes basic information for investors (Parulian & Mahendra, 2021). All shares are included in the JCI calculation, including preferred shares and common shares (Fuad & Yuliadi, 2021). JCI also plays a role in assessing general market conditions and seeing whether there is an increase or decrease in the market.

2.3. Research hypotheses

Inflation is a process of continuously increasing prices in general as a result of the incompatibility of programs by the system in procuring commodities (production, money printing, pricing, etc.) with people's income levels (Kurpayanidi, 2020). An increase in the price of certain goods that only

occurs once is not included in the category of inflation, even though the increase is large. Inflation is related to the JCI because inflation affects people's purchasing power (Sia et al., 2023). Inflation is a phenomenon that describes conditions and situations in which goods have increased and currency values have decreased or weakened (Aryani & Maupula, 2021). If conditions continue, it can have an effect, namely a decline in overall economic conditions and can shake the country's political stability. Inflation also has an impact not only on the goods and services sector but also on wages and income levels (Rahmani 2019). Inflation has a negative impact on the JCI due to unavoidable economic turmoil (Kurpayanidi, 2020).

H1: Inflation has a negative effect on the Composite Stock Price Index.

The exchange rate is an important value for a country in the economic system because the exchange rate is very influential in conducting international transactions in an open economy. The exchange rate shows the balance between supply and demand in foreign currency against domestic currency (Azhar et al., 2020). The dollar exchange rate is the price of one dollar unit in rupiah. Increases and decreases in exchange rates depend on the supply and demand that occurs for money in circulation (Sa'adah, 2020). The increase in the domestic currency exchange rate that occurs is called the appreciation of the foreign currency, while the decrease in the domestic exchange rate is called the depreciation of the foreign currency. The exchange rate as one of the basics of an open economy has an important role in the JCI (Hutauruk, 2021). Changes in currency exchange rates have a positive effect on the JCI (Safitri et al., 2020; Sia et al., 2023).

H2: The exchange rate has a positive effect on the Jakarta Composite Index.

According to Bank Indonesia, the BI rate is the interest rate set as a monetary policy instrument by Bank Indonesia and announced to the public. The BI rate is an indicator used to determine economic stability (Gunawan & Bawono, 2021). The BI rate is announced at the monthly Board of Governors meeting by the Board of Governors of Bank Indonesia which is realized through managing liquidity in monetary operations on the money market to achieve monetary policy targets. The BI rate is at the same time a picture of the economy, both micro and macro in Indonesia (Putri et al., 2018).

H3: The Bank Indonesia rate has a negative effect on the Jakarta Composite Index.

The amount of money in circulation is all types of money circulating in economic activities, including demand deposits deposited in commercial banks. In Indonesia, the money supply is the duty and authority of Bank Indonesia. The money supply is a monetary policy whose management involves the monetary system of the central bank, commercial banks, and rural banks (Alfian & Mustafa, 2019). Erol and Aytekin (2019) explain that the money supply is divided into several types based on their level of liquidity, namely M1, M2, and M3. Previous research has shown that the amount of money in circulation (JUB) level has a positive effect on the JCI.

H4: The money supply has a positive effect on the Composite Stock Price Index.

3. RESEARCH METHODOLOGY

The study used quantitative analysis using secondary data in the form of time series data in the form of monthly data from January 2017 to March 2022. The data used in this study were obtained from Bank Indonesia and the Indonesia Stock Exchange. The authors use several statistical tools, such as Microsoft Excel 2016 which is used for data processing regarding table creation and analysis and while EViews 12 is used for processing time series data.

A suitable method for conducting this research is using the VAR method because the VAR method will be followed by the impulse response function (IRF) method used to determine the influence or response of variables to shocks on other variables where this method aims to find out and specify changes to certain variables. With the VAR method, it can also be known how much proportion a variable is to a shock through variance decomposition which is used to predict the contribution of variables to changes in certain variables.

In this study, JCI, exchange rate, and money supply (M2) data were converted into natural logs, while inflation and BI rates were not converted into natural logs. The VAR test is very suitable for use in modeling economic problems. This is because in creating a VAR model there is no need to distinguish between endogenous and exogenous variables, in the VAR model the theoretical approach is very minimally used and focuses more on the events or phenomena that occur. VAR analysis is very well used because VAR can be used to know and understand the reciprocal relationships between variables (Tesa, 2012). The VAR model can be used to describe data and forecast. The general equation of VAR is written as follows:

$$Y_t = A_0 + A_1 Y_{t-1} + A_2 Y_{t-2} + \cdots + A_P Y_{t-P} + \varepsilon_t \qquad (1)$$

where,
- Y_t = vector with a size (n.1) containing *n* variables according to the number contained in the VAR model;
- A_0 = vector intercept by size (n.1);
- A_i = matrix of sized coefficients (N.N) for values I = 1, 2, 3, ..., p;
- ε_t = vector error with size (n.1).

4. RESULTS AND DISCUSSION

4.1. Data stationarity test

After conducting the classical assumption tests (normality test, multicollinearity test, heteroskedasticity test, and autocorrelation test) so that it shows data that is free from problems, the next step is to determine the data stationariness. Station ability tests were performed using augmented Dickey-Fuller (ADF) tests with none, intercept, and trend & intercept models.

Table 1. Augmented Dickey–Fuller (ADF) test results

Variable	ADF level			ADF first diff		
	None	*Intercept*	*Trend & intercept*	*None*	*Intercept*	*Trend & intercept*
JCI	0,8905	0,3945	0,7050	0,0000	0,0000	0,0000
Inflation	0,3595	0,6441	0,1878	0,0000	0,0000	0,0000
Exchange rate	0,8313	0,0209	0,0218	0,0000	0,0000	0,0000
BI rate	0,4174	0,5760	0,3770	0,0145	0,1244	0,3236
M2	1,000	0,9988	0,9337	0,2499	0,0000	0,0015

Source: Data processed using EViews, 2022.

Based on Table 1, it is known that the *JCI, inflation, exchange rate, BI rate*, and *M2* variables are not stationary in the first diff, both on the none, intercept, and trend & intercept models. Meanwhile, at the level, the variables *JCI, inflation, exchange rate, BI rate*, and *M2* show their stationariness in the none model but still not stationary in other models. This stationariness can be seen by paying attention to probability numbers, if the probability value is less than 0.05 then the variable is known to be stationary. So that based on the ADF test, the variables *JCI, inflation, exchange rate, BI rate*, and *M2* are stationary at the level using the none model.

4.2. Optimal lag test

Determination of the optimum lag length was carried out by paying attention to the values on likelihood ratio (LR), financial prediction error (FPE), Akaike information criterion (AIC), Schwarz information criterion (SC), Hannan-Quin citations (HQ). The lag length selected in the optimal lag test on was 0 to 5. The lag of 0 to 5 is considered sufficient to test the data per month in the period January 2017 to March 2022. The optimal lag test results are provided in Table 2.

Table 2. Lag test results

Lag	LR	FPE	AIC	SC	HQ
0	NA	5.38e-17	-23,27121	-23,09359	-23,20203
1	605,1574	1.23e-21*	-34,04679*	-32,98104*	-33,63166*
2	38,01047	1.21e-21	-33,99345	-32,03958	-33,23238
3	35,42241	1.30e-21	-33,97477	-31,13278	-32,86776
4	14,42475	2.30e-21	-33,50256	-29,77245	-32,04961
5	27,74126	2.72e-21	-33,50741	-28,88917	-31,70851

*Note: * The optimal test lag that can be used in the model.*
Source: Data processed using EViews, 2022.

Based on the table above Table 2, lag 1 is the lag that has the most compliance with the criteria. Lag 1 has conformity with four criteria, namely FPE, AIC, SC, and HQ. Based on the results of these tests, in making a model in the VECM equation, the optimal lag used is lag 1.

4.3. Polynomial stability test

After obtaining the optimum lag value, it is necessary to test the stability of the selected lag. This is done to ensure that VAR estimation using selected lags will produce accurate results.

Table 3. Lag stability test results

Root	Modulus
0,984261 – 0,017778i	0,984421
0,984261 + 0,017778i	0,984421
0,880513 – 0,048369i	0,881841
0,880513 + 0,048369i	0,881841
0,507436	0,507436

Source: Data processed using EViews, 2022.

Based on Table 3, it is known that the modulus value for the lag length of 1 has a range of values smaller than one. A modulus value of less than 1 indicates that there is stability in VAR when using lag 1 so that lag 1 can be used in creating equations.

4.4. Autocorrelation test

The autocorrelation test is to find out whether is a correlation of data between variables. The autocorrelation problem causes the data to not be stationer. To find out whether there is an autocorrelation problem. To perform a correlation test, a test that can be used is the Lagrange multiplier (LM) test.

Table 4. Cointegration test results

Lag	LRE*stat	Df	Prob.	Rao F-stat	Df	Prob.
1	40,77585	25	0,0242	1,710182	(25.176,1)	0,0247
2	39,13401	25	0,0357	1,633901	(25.176,1)	0,0363
3	11,28070	25	0,9915	0,436561	(25.176,1)	0,9915
4	23,72108	25	0,5355	0,949440	(25.176,1)	0,5374
5	24,95312	25	0,4650	1,002108	(25.176,1)	0,4670

Source: Data processed using EViews, 2022.

Based on Table 4, in the LM test, there is a prob value that is greater than 0.05 so it can be mentioned that there is no autocorrelation problem in the selected variable.

4.5. Vector autoregression

The results of the study using lag = 1 show that there is a relationship between the variables *JCI, inflation, exchange rate, BI rate*, and *M2*. By paying attention to the value of the t-statistic, the relationship between variables can be explained as follows: Based on the results of testing using VAR, the relationship between the variables *JCI,*

inflation, exchange rate, BI rate, and *M2* only has a unidirectional relationship based on the estimates made. The R-squared value indicates that the independent variables in the model can explain the 80.6% change in the dependent variable that occurs. the variables in the model are also indicated to have a joint effect on the dependent variable, this is based on the high F-statistic value of 46.77.

Table 5. VAR test results

	LOG(JCI)	*INFLATION*	*LOG(RECEIPT)*	*BI_RATE*	*LOG(M2)*
LOG(JCI (-1))	0,913425	0,008498	0,009797	0,009509	-0,017675
	(0,07580)	(0,00417)	(0,04321)	(0,00229)	(0,02593)
	[12,0512]	[2,04027]	[0,22673]	[4,14660]	[-0,68162]
INFLATION (-1)	0,376270	0,857144	-1,114693	-0,045182	-0,369704
	(1,38177)	(0,07593)	(0,78778)	(0,04181)	(0,47272)
	[0,27231]	[11,2880]	[-1,41499]	[-1,08072]	[0,78208]
LOG(KURS (-1))	0,025483	-0,004530	0,588800	0,034676	-0,101174
	(0,24535)	(0,01348)	(0,13988)	(0,00742)	(0,083394)
	[0,10386]	[-0,33599]	[4,20928]	[4,67107]	[-1,20533]
BI_RATE (-1)	-0,487459	0,009249	0,722835	0,873238	0,154658
	(1,05969)	(0,05823)	(0,60415)	(0,03206)	(0,36253)
	[-0,46000]	[0,15883]	[1,19645]	[27,2359]	[0,42661]
LOG(M2 (-1))	0,034628	-0,006052	0,010734	-0,015566	1,004379
	(0,11692)	(0,00643)	(0,06666)	(0,00354)	(0,40000)
	[0,29617]	[-0,94189]	[0,16103]	[-4,40046]	[25,1104]
C	-0,015469	-0,06284	3,674703	-0,164016	1,062228
	(2,24580)	(0,12342)	(1,28037)	(0,06795)	(0,76831)
	[-0,0689]	[0,54518]	[2,87002]	[-2,41381]	[1,38254]
R-squared	0,806823	0,935375	0,600549	0,979335	0,988470
Adj. R-squared	0,789576	0,929605	0,564884	0,977490	0,987440
Sum sq. resids	0,0042557	0,002339	0,032965	9.28E-05	0,011870
S.E. equation	0,042557	0,002339	0,024262	0,001288	0,014559
F-statistic	46,77804	162,1083	16,83850	530,7772	960,1687

Source: Data processed using EViews, 2022.

Figure 1. Impulse response function (IRF) results
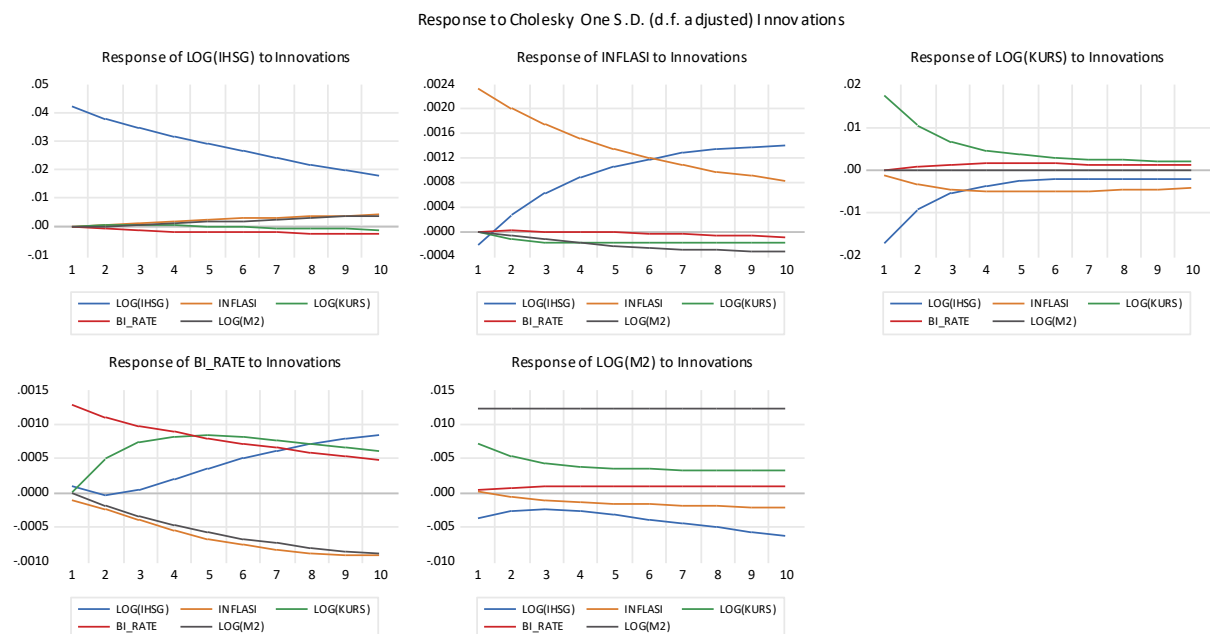
Source: Data processed using EViews, 2022.

From the figure the response to an increase in *inflation*, where when there is an increase in *inflation* there will be a decrease in the *exchange rate, BI rate, M2* variables, as well as the inflation variable itself. The decline was constant for the inflation variable but was gradually stagnant for *the exchange rate* variable, *BI rate, M2*. The response to an increase in

the *exchange rate* variable can cause a decrease in the *inflation* variable and *the exchange rate* itself, while for the *BI rate* variable; an increase in the *exchange rate* variable will cause an increase. The response to an increase in *the BI rate* is an increase in the *exchange rate* variable and a decrease in the *inflation* variable, *M2*, and *BI rate*

variable itself. The response to an increase in *M2* was a slight increase in the *BI rate* variable and a decrease in the *exchange rate* and *inflation* variables. Whereas in the face of an increase in the variable *M2* does not show an increase or decrease or is constant.

4.6. Variance decomposition analysis

Analysis of variance decomposition shows the big difference before and after the shock occurs in the variable, both in other variables and in the variable itself. From the tests carried out using the variance decomposition method with the EViews analysis tool, the following results were obtained: In the *inflation* variable, when a shock occurs at lag 1, the change is explained by the *inflation* variable itself, followed by the *JCI* variable. In the ten test periods, the proportion of change is dominated by the *inflation* variable itself, followed by the *JCI* variable. In the *exchange rate* variable, when a shock occurs at lag 1, changes are explained by the *exchange rate* variable itself (52%) followed by the *JCI* variable of (47.7%). In the ten test periods, the *inflation* variable showed a significant change in the 7th period, which was 11.6% and continued to increase.

In the *BI rate* variable, when a shock occurs at lag 1, changes are explained by the *BI rate* variable itself (98.7%) and followed by the *JCI*, *inflation* and *exchange rate* variables with each proportion below 1%. In the test period, the proportion of changes in each variable in each period shows an increase. In the 10th period of testing, it shows the proportion of changes, namely the *JCI* of 11.42%; *inflation* of 20.43%; *exchange rate* of 20.63%; *BI rate* of 30.73%; and *M2* of 16.77%. In the *M2* variable, when a lag 1 shock occurs, the change is explained by *the M2* variant itself of 70.21%; the *exchange rate* of 23.46%; and *JCI* of 6.16%. Changes in proportion experienced an increase and decrease in each variable. According to Bruno and Iacoviello (2020) explained that the corporate governance structure and control function are part of the impact of macroeconomic indicators in managing the company. The role of the price index is as follows. The price index is used to calculate inflation, so that the government can determine economic conditions and make appropriate policies. The price index is used to measure the extent to which the economy is developing (Assagaf et al., 2019). Furthermore, Onyina and Gyanor (2019) explain that policymakers implement and modify strict corporate governance practices so that they can help the growth of a good economy.

5. CONCLUSION

There are five macroeconomic factors that affect stock prices, namely economic growth, unemployment, inflation, interest rates and exchange rates. The purpose of this research is to examine and analyze the macroeconomic indicator factors on the stock price index. Based on the tests that have been carried out, it is known that the JCI, inflation, exchange rate, BI rate, and M2 variables can be estimated using the vector autoregression (VAR) model. This is done because the variables used do not pass the cointegration stage. By testing using VAR, the relationship between the JCI, inflation, exchange rate, BI rate, and M2 variables only has a unidirectional relationship based on the estimates made. The R-squared value indicates that the independent variables contained in the model can explain the change in the dependent variable that occurs by 80.6%. The variables in the model are also indicated to have a joint effect on the dependent variable. The managerial policy implications that can be taken in this study are if inflation rises, then interest rates will tend to increase where stock prices decrease. For this reason, inflation will increase negative sentiment for stock investors. Investors are expected to pay attention to these indicator factors.

This study still has several limitations: 1) this study only uses macroeconomic variables which include inflation, interest rates, and exchange rates, without paying attention to microeconomic factors which also affect the aggregate stock price index, 2) the data in this study are limited to data for 2017–2022 were obtained only in Indonesia, for further research it is better to use broader data, namely data from ASEAN countries. The model used is VAR.

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