ANALYSIS OF THE INFLUENCE OF EXCHANGE, INFLATION, GROSS DOMESTIC PRODUCT, INTEREST RATE, AND THE AMOUNT OF MONEY CIRCULATION ON THE LQ45 INDEX IN THE INDONESIA STOCK EXCHANGE BETWEEN 2016-2020

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INFO ARTIKEL	ABSTRACT
	The objective of this research was to analyze the short and the long-run relationship between five macroeconomics variables such as exchange rate, inflation, Gross Domestic Product (GDP), SBI rate, and money supply to examine their influence on the LQ45 stock price index. The data sample used in this study is monthly time series data from January 2016 to December 2020. This study used Vector Error Correction Model to analyze the problem. The result shows that in the short run (1 month ago), exchange rate, inflation, Gross Domestic Product (GDP), SBI rate, and money supply do not influence the LQ45 stock price index. In the long run, the exchange rate has positive inflation, SBI rate, and money supply negatively influence the LQ45 stock price index. Therefore, Gross Domestic Product (GDP) does not influence the LQ45 stock price index. The results of the Impulse Response Function and Variance Decomposition, SBI rate, is a variable that provides the most significant contribution to the LQ45 stock price index.

Introduction

Coronavirus Disease 2019 (Covid-19) has become a terrible pandemic. In a short time, a few months since the SARS-CoV-2 coronavirus emerged in China at the end of December 2019, this virus has spread to hundreds of countries across continents. Here are the infected cases and deaths from Covid-19 in the world.

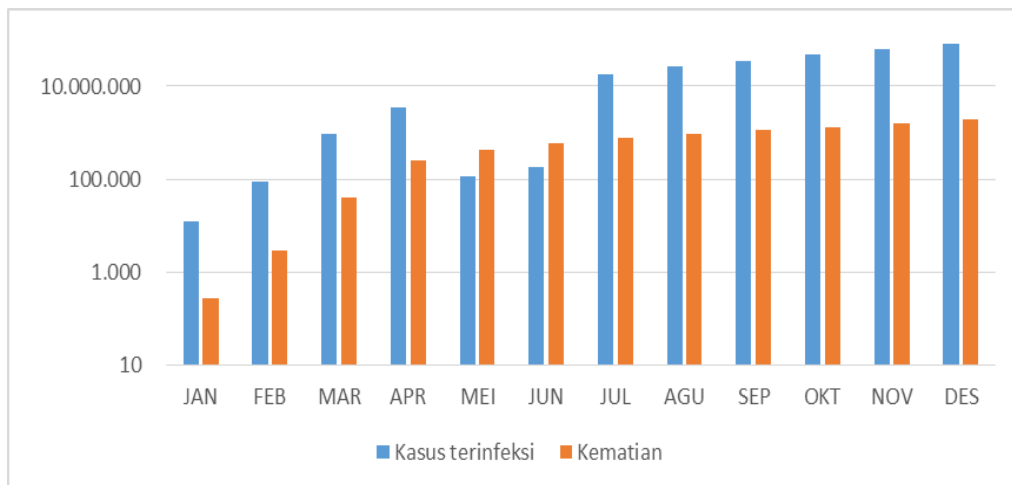Abdul Rahman Nurmansyah, Hakiman Thamrin
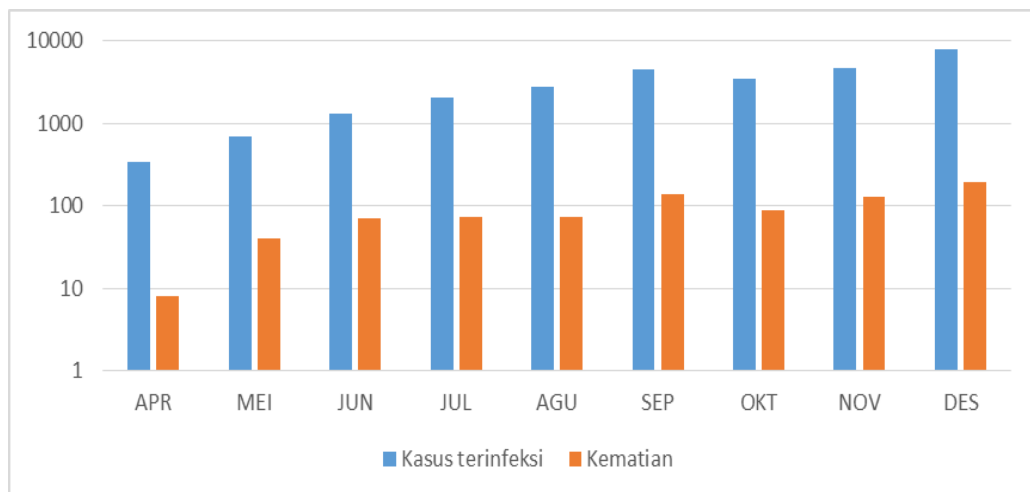
Figure 1
Infected Cases and Deaths As a result of
Source : Worldmeters (analyzed)

Based on the Worldmeters data, until the end of December 2020, there were at least 762,423,000 cases with 14,131,000 officially recorded deaths in the world. In Indonesia, the first case of Covid-19 appeared on March 2, 2020, and caused infected cases and deaths, increasing the trend of Covid-19 effects during 2020, as shown in Figure 2.

Figure 2
Infected Cases and Deaths As a result of
Covid-19 in Indonesia in 2020
Source: Ministry of Health of the Republic of Indonesia (analyzed)

Based on data from the Ministry of Health of the Republic of Indonesia until the end of December 2020, 8074 cases were confirmed with 194 deaths.

One of the policies of the Indonesian government in suppressing the transmission of the Covid 19 virus is to limit people's mobility. Restrictions on community mobility

have had a significant impact on the economy. Many production activities have stopped due to disruption of supply and demand and even a wave of massive layoffs. Based on data from the Central Statistics Agency, as of August 2020, of the total working-age population of 203.97 million people, the percentage of the population affected by Covid-19 is 14.28%.

The theory of economics states that restrictions on people's mobility will result in a decrease in Aggregate Supply (US), which impacts a decrease in the amount of production. The condition in which people stay at home, based on the law of supply and demand, will cause a decrease in aggregate demand or Aggregate Demand (AD), that leads to a decrease in the amount of production as a result of recession economic growth in 2020 as shown in Figure 3.
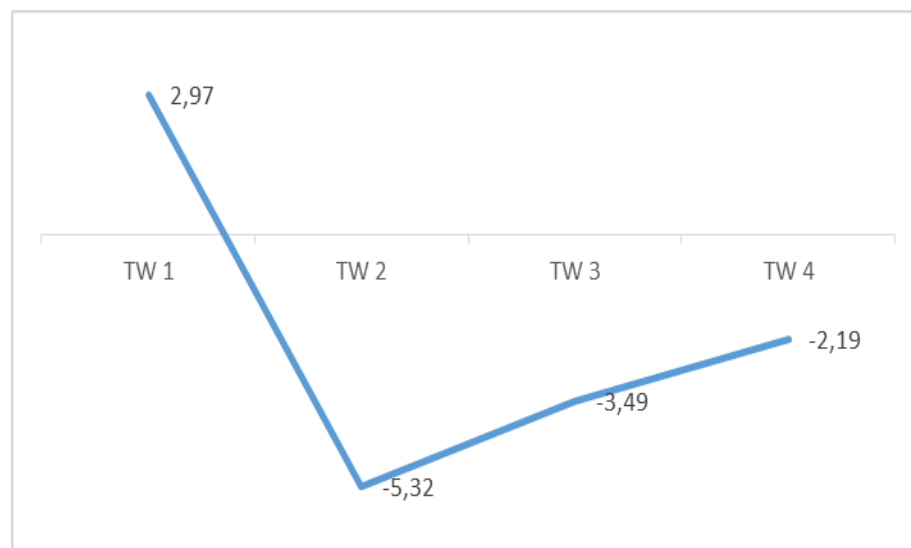
Figure 3
Economic Growth in ndonesia
in 2020Source : BPS 2020 (analyzed)

(Reich, 2019) states a recession is a condition where a country has negative Gross Domestic Product growth in two consecutive quarters. According to the National Bureau of Economic Research/ (NBER, 2020), a recession is a significant economic decline activity across a country that generally occurs when many people lose their jobs, companies experience a decline in sales levels, and the country's overall economic output decreases.

To maintain monetary and financial stability, the Government, through the Ministry of Finance and Bank Indonesia, has taken comprehensive steps as part of the National Economic Recovery program, such as maintaining exchange rate stabilization, controlling inflation, lowering interest rates, and injection of liquidity. In addition, to maintain exchange rate stabilization, Bank Indonesia increased the intensity of triple intervention by optimizing intervention strategies in the Domestic Non-Deliverable Forward (DNDF), spot, and SBN market to minimize the risk of increased exchange

rate volatility. As a result, during 2020, the rupiah exchange rate against the dollar moved in the range of Rp. 12,998, - up to Rp. 16,367,-.

Bank Indonesia tries to keep inflation low in line with weak demand and inadequate supply. Efforts include maintaining price affordability, supply availability, smooth distribution, effective communication. This effort is carried out through wise communication in shopping to avoid the panic buying phenomenon and create positive inflation expectations. As a result, during 2020, inflation moved in the range of 1.32% to 2.98%.

The Board of Governors' Meeting (RDG) decided during 2020 to reduce the BI *7-Day Reverse Repo Rate* (BI7DDR) by a total of 125 bps, which at the end of 2020 became 3.75% and was the lowest level in history. The decrease was carried out at the Board of Governors' Meetings (RDG) in February, March, June, July, and November 2020 by 25 bps each.

Bank Indonesia conducts liquidity injection (quantitative easing) to encourage economic growth and ensure financial system stability for the money supply. During 2020, the total rupiah liquidity injection was around Rp. 726.56 trillion or around 4.7% of Gross Domestic Product.

Along with changes in these macroeconomic variables, in 2020, the stock market experienced a significant decline. The LQ45 Index, 45 shares of companies actively traded on the Indonesia Stock Exchange, experienced a fluctuating decline during 2020. Many investors sold their shares from the Indonesia Stock Exchange, causing the LQ45 Index to touch its lowest point since the last five years, which occurred in March 2020 at the level of 691 points, as shown in Figure 4.
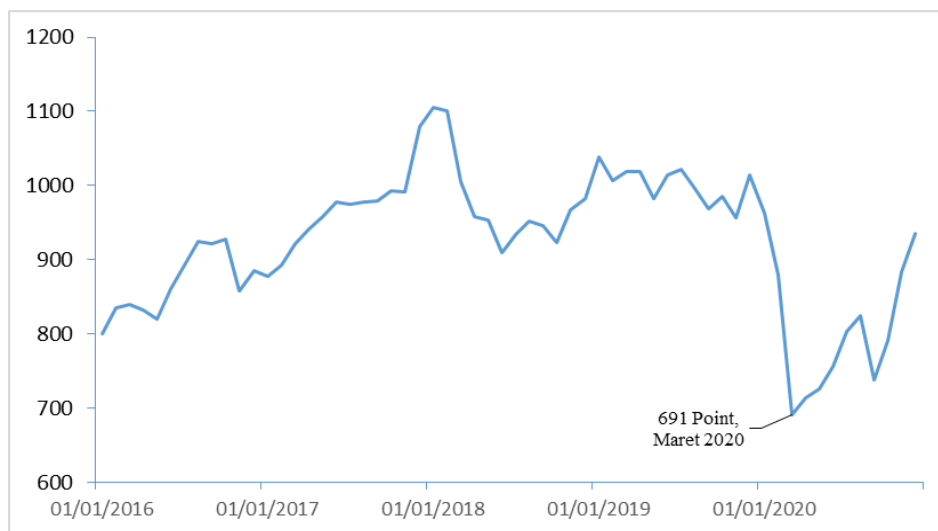
Figure 4
The LQ45 Index
between 2016-2020
Source : Yahoo Finance (analyzed)

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The fluctuation of the LQ45 index reflects the uncertainty of stock prices from period to period, which makes investors not sure of the return that will be obtained when buying shares at the beginning of the period. Investors in each portfolio investment selection begin with a decision to purchase shares at the beginning of the period, assuming that investors do not know how much portfolio return will be obtained at the end of the period. Therefore, investors must predict the expected portfolio return at the end of the period as a consideration for making investment decisions at the beginning of the period.

Tandelilin (2017) concludes a strong relationship between stock prices and macroeconomic performance. Investors who can predict future macroeconomic conditions will be able to make the right decisions whether to buy, sell, or hold shares. Macroeconomics does not affect the company's performance immediately but slowly and long term.

This research was also conducted because there is still a research gap in previous research. For the exchange rate variable, (Barakat et al., 2016) states that the exchange rate positively affects stock returns. This result is different from research (Ahmad & Ramzan, 2016), which states that the exchange rate harms stock returns. Different results were also obtained in research (Hidayat, L. R., & Azis, 2017) which stated that the exchange rate did not affect stock returns.

For the inflation variable, (Bertuah, E., & Sakti, 2019) states that inflation positively affects stock returns. Different results were obtained by researchers (Andyani, K. W., & Mustanda, 2018), stating that inflation harms stock returns. Research also obtained different results (Ilmi, 2017), stating that inflation does not affect stock returns.

For the Gross Domestic Product variable, (Giri, A. K., & Pooja, 2017) states that Gross Domestic Product has a positive effect on stock returns. Different results obtained by research (Ahmad & Ramzan, 2016) stated that Gross Domestic Product harmed stock returns. Research by (Umer, 2016) also obtained different results, which stated that Gross Domestic Product did not affect stock returns.

For the interest rate variable, (Candy, & Winardy, 2019) states that interest rates positively affect stock returns. Different results were obtained by research (Asmara, 2018), stating that interest rates harm stock returns. Research also obtained different results (Ahmad & Ramzan, 2016), stating that interest rates do not affect stock returns.

For the money supply variable, Restiawan and Asytuti (2020) state that the money supply positively affects stock returns. Different results by research (Ahmad & Ramzan, 2016) states that the money supply does not affect stock returns.

The data analysis method used in this study is the Vector Error Correction Model (VECM), which aims to explain the effect of macroeconomic variables with the LQ45 Index. The short term in this study was a month previously because the researcher used monthly data and the long term in this study was five years according to the time of the study, namely 2016 to 2020. According to (Santoso, 2013), the existence of a long-term or short-term relationship indicates that the independent variable affects the dependent variable.

Research Method

1. Research Design

This research uses a descriptive statistical approach and inferential statistics. According to (Sugiyono, 2016), descriptive statistics are used to analyze data by describing or describing the data that has been collected as it is, such as the mean, median, mode, frequency distribution, and other statistical measures without intending to make general conclusions or generalizations. According to (Nisfiannoor, 2009), inferential statistics is a method related to data analysis on samples, and the results are used to generalize the population.

Researchers collect data related to the problem to be studied to answer descriptive problem formulations and test the hypothesis of the effect of the exchange rate, inflation, Gross Domestic Product, and interest rates on the LQ45 Index.

2. Population and Sample

a) Population

The population is a generalization area consisting of objects/subjects with specific quantities and characteristics determined by the researcher to be studied and then concluded. The population in this study is the LQ45 Index on the Indonesia Stock Exchange in 2016-2020.

b) Sample

The sample is part of the number and characteristics possessed by the population. The sampling method is non-probability sampling because each member of the population does not have the same opportunity or opportunity as a sample. In contrast, the sampling technique used is saturated sampling, where all populations will be used as samples, namely the LQ45 Index on the Indonesia Stock Exchange in 2016-2020.

3. Data Collection Techniques

The data collection techniques used in this study are:

a) Documentation

Documentation is a data collection activity carried out through document tracking. This technique utilizes written documents, pictures, photos, or other objects related to the aspects studied.

b) Literature Study

Literature study is an activity of studying, exploring, and citing theories or concepts from several kinds of literature, books, journals, magazines, newspapers, or other written works relevant to the topic, focus, or research variable.

In this study, the researcher collects data and cites theories from books, journals, and websites www.idx.co.id., www.bi.go.id, and www.bps.go.id and other supporting websites.

4. Data Analysis Techniques

The data analysis techniques used in this study is the Vector Error Correction Model (VECM) which aims to see the short-term relationship and uses the cointegration test to see indications of the long-term relationship. According to (Santoso, 2013), the existence of a long-term or short-term relationship indicates that the independent variable affects the dependent variable. VECM is an restricted form of Vector Autoregressive (VAR). Restrictions are given because the data is not stationary but cointegrated. The assumptions that must be met in the VECM model are the same as those in the VAR model, except for the stationary problem. (Basuki, A. T., & Yuliadi, 2015) explains that in the VECM model all variables must be stationary at the level of differentiation of the first derivative.

Results and Discussion

A. Results

1. Deskriptive Statistics

Descriptive statistical calculations were carried out with the help of Eviews 12 software which produced the output in Table 1.

Table 1
Descriptive Statistics

	LQ45	KURS	INFLASI	PDB	SB	MS
Mean	923.6833	13949.77	0.031205	857414.6	0.050625	1393446
Median	943.5000	13926.00	0.032200	865612.0	0.047500	1385297
Maximum	1106.000	16367.00	0.044500	939574.0	0.070000	1855625
Minimum	691.0000	12998.00	0.013200	754907.0	0.037500	1035551
Std. Dev.	93.58862	647.0129	0.007405	50955.16	0.008445	201450.7
Skewness	-0.563515	1.002399	-0.696761	-0.297146	0.567184	0.294910
Kurtosis	2.935821	4.627362	3.438597	2.044479	2.353742	2.551640
Jarque-Bera	3.185786	16.66880	5.335681	3.165506	4.261101	1.372287
Probability	0.203337	0.000240	0.069402	0.205409	0.118772	0.503514
Sum	55421.00	836986.0	1.872300	51444876	3.037500	83606778
Sum Sq. Dev.	516771.0	24698917	0.003235	1.53E+11	0.004208	2.39E+12
Observations	60	60	60	60	60	60

Source : Eviews 12 (analyzed)

The dependent variable in this study is the LQ45 Index. Based on table 1 The LQ45 index has a mean value of 923.6833 which means that the LQ45 index has an average range at the level of 923.6833, the standard deviation value is 93.58862 which means that the LQ45 index has a possible deviation of 93.58862 from its average value, the maximum or highest value at the level of 1,106,000 which occurred in the month January 2018 and the minimum or lowest value at the level of 691.00000 points that occurred in March 2020.

The independent variables in this study are the exchange rate, inflation, Gross Domestic Product, interest rates and the money supply. For the independent variable, the exchange rate based on Table 1 has a mean value of 13.949.77, which means that the exchange rate has an average price of Rp. 13,949.77, the standard deviation value is 647,0129 which means the exchange rate has a possible deviation of Rp. 647.0129 of the average value, the maximum or highest value of Rp. 16,367.00 occurred in March 2020, and Rp's minimum or lowest value 12,998.00 in September 2016.

The inflation variable has a mean value of 0.031205, which means that inflation has an average value of 0.031205 or 3.12%, a standard deviation value of 0.007405 which means that inflation has a possible deviation of 0.007405 or 0.07% of the average value, the maximum value 0.044500 or 4.45% which occurred in March 2016 and the minimum or lowest value of 0.013200 or 1.32% in August 2020.

The Gross Domestic Product variable has a mean value of 857,414.6, - which means that the Gross Domestic Product of the Indonesian people in the period 2016 to 2020 has an average of Rp. 857,414.6,- per month, the standard deviation value is 50,955.16, which means that the Gross Domestic Product has a possible deviation of Rp. 50,955.16 of the average value, the maximum value of Rp. 939,574 occurred in July, August, and September 2019, and the minimum or lowest value was Rp. 754,907,- which occurred in January, February, March 2016.

The interest rate variable has a mean value of 0.050625, which means that the average Bank Indonesia interest rate in the 2016 to 2020 observation period is 0.050625 or 5.06%, the standard deviation value is 0.008445, which means that interest rates have a possible deviation of 0.008445 or 0.84% of the average value, the maximum or highest value of 0.070000 or 7% which occurred in January 2016 and the minimum or lowest value of 0.037500 or 3.8% which occurred in November and December 2020.

The money supply variable has a mean value of 1,393,446, which means that the average money supply in the 2016 to 2020 observation period is Rp. 1,393,446 billion. The standard deviation value is 201,450.7, which means that the money supply has the possibility of a deviation of Rp. 201,450.7 billion from the average value. the maximum or highest value of Rp. 1,855,625 billion occurred in December 2020, and the minimum or lowest value of Rp. 1,035,551 billion occurred in February 2016.

2. **Inferential Statistics**
   1. **Stationary Test**

      In getting the estimation of the VECM model, the first step that needs to be done in testing the data is by doing a stationarity test on the data for each variable, both independent variable data, and dependent variable data. The

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stationarity test is carried out for time series data, and this test is carried out to avoid spurious regression (Winarno, 2015).

The results of the stationary test data using the Phipils-Perron data can be seen in Table 2.

Table 2
Phillips-Perron Unit Root Test

Data	Level			Note	First Difference			Note
	PP Stat	Nilai Kritis (α) 5%	ρ value		PP Stat	Nilai Kritis (α) 5%	ρ value	
LQ45	-2.372662	- 3.546099	0.1537	Tidak Stasioner	-6.045688	-3.548208	0.0000	Stasioner
Exchange rate	-2,253341	- 3.546099	0.1512	Tidak Stasioner	-14.09809	-3.548208	0.0000	Stasioner
Inflation	-1.244964	- 3.546099	0.6491	Tidak Stasioner	-6.967782	-3.548208	0.0000	Stasioner
Gross domestic product	-1.873012	- 3.546099	0.3426	Tidak Stasioner	-7.729247	-3.548208	0.0000	Stasioner
Interest rate	-1.960015	- 3.546099	0.3034	Tidak Stasioner	-5.722630	-3.548208	0.0000	Stasioner
Amount of money circulation	0.652834	- 3.546099	0.9901	Tidak Stasioner	-11.66457	-3.548208	0.0000	Stasioner

Source : Eviews12 (analyzed)

As shown in table 2, it can be seen that there are no stationary variables at the level. Data can be said to be stationary if Phillips-Perron t-statistics > Critical Value. Furthermore, differentiation is done; the results of hasil 1st different indicate that all variables are stationary.

2. Optimal lag Length Test

The lag length test is used to determine how long it takes each variable to relate to the influence of its past variable (lag length). Determination of the optimal lag length in this study is by using AIC. Optimal lag length testing is needed to overcome the autocorrelation problem in the VAR system to analyze the stability of the VAR. With the optimal lag, it is hoped that there will be no autocorrelation problems. The optimal lag length can be shown in Table 3.

Table 3
Optimal Leg Lenght

Lag	Logl	LR	FRE	AIC	SC	HQ
0	-1336.724	NA	1.08e+15	51.64322	51.86836*	51.72953
1	-1310.831	44.81410	1.61e+15	52.03196	53.60797	52.63616
2	-1290.044	31.18111	3.05e+15	52.61706	55.54393	53.73915
3	-1258.075	40.57569	4.13e+15	52.77211	57.04984	54.41209
4	-1231.047	28.06730	7.92e+15	53.11720	58.74578	55.27506
5	-1187.228	35.39247	1.04e+16	52.81646	59.79590	55.49221
6	-1079.750	62.00641	1.91e+15	50.06731	58.39762	53.26096
7	-941.4784	47.86328	2.97e+14*	46.13378*	55.81495	49.84532*

Souce : Eviews12 (analyzed)

Based on the processing results above, the optimal lag length lies in lag 7 because it has the smallest AIC value. After the length of the lag is known to be located at lag 7, then lag 7 is the proper lag to be used in the VECM model.

3. **Model VAR Model Stability Test**

It is necessary to test the stability of the VAR model because if the estimation results of the VAR stability are not stable, the IRF and FEVD analysis will be invalid. The VAR system can be stable if all the roots have a modulus < 1 (Basuki, A. T., & Yuliadi, 2015). The stability of the VAR model can be shown in Table 4.

Table 4
VAR Model Stability Test

Root	Modulus
-0.510668 - 0.841972i	0.984733
-0.510668 + 0.841972i	0.984733
0.789451 + 0.587622i	0.984140
0.789451 - 0.587622i	0.984140
-0.612597 + 0.769259i	0.983379
-0.612597 - 0.769259i	0.983379
-0.080779 + 0.975756i	0.979094
-0.080779 - 0.975756i	0.979094
0.909605 - 0.337101i	0.970061
0.909605 + 0.337101i	0.970061
0.451742 - 0.852257i	0.964579
0.451742 + 0.852257i	0.964579
-0.833959 + 0.482819i	0.963640
-0.833959 - 0.482819i	0.963640
0.823732 + 0.479039i	0.952897
0.823732 - 0.479039i	0.952897
-0.940377 + 0.060892i	0.942346
-0.940377 - 0.060892i	0.942346
0.549188 - 0.759744i	0.937453
0.549188 + 0.759744i	0.937453
-0.863402 + 0.355167i	0.933599
-0.863402 - 0.355167i	0.933599
0.902401 + 0.112302i	0.909362
0.902401 - 0.112302i	0.909362
-0.057581 - 0.907365i	0.909190
-0.057581 + 0.907365i	0.909190
0.218347 - 0.825448i	0.853838
0.218347 + 0.825448i	0.853838
-0.262110 + 0.793448i	0.835620
-0.262110 - 0.793448i	0.835620
-0.610470 + 0.356392i	0.706886
-0.610470 - 0.356392i	0.706886
0.218006 - 0.484099i	0.530922
0.218006 + 0.484099i	0.530922
-0.429100	0.429100
0.095163	0.095163

Source : Eviews12 (analyzed)

Based on table 4, all values of the root or root and modulus < 1 so it can be explained that the model used in this study is stable and the variables can be continued to the next test, namely the cointegration test.

4. **Cointegration Test**

A cointegration test in this research to determine whether the non-stationary variables at these levels have met the requirements for the integration

process, where all variables are stationary at the same degree, namely at degree 1. This cointegration test aims to determine the existence of a relationship between variables, especially in the long term. If cointegration is found in the variables in this model. This shows a long-term relationship between variables and can be continued by using the VECM model. In VECM estimation, there must be a cointegration relationship in it.

In this study, cointegration testing uses Johansen's Cointegration Test method with a Critical Value of 0.05. Cointegration test results are shown in Table 5.

Table 5
Cointegration Test

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.961708	352.5561	107.3466	0.0000
At most 1 *	0.817540	182.9055	79.34145	0.0000
At most 2 *	0.690970	94.44180	55.24578	0.0000
At most 3	0.324050	33.37733	35.01090	0.0741
At most 4	0.207517	13.01222	18.39771	0.2404
At most 5	0.017496	0.917856	3.841465	0.3380

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.961708	169.6506	43.41977	0.0000
At most 1 *	0.817540	88.46375	37.16359	0.0000
At most 2 *	0.690970	61.06446	30.81507	0.0000
At most 3	0.324050	20.36512	24.25202	0.1505
At most 4	0.207517	12.09436	17.14769	0.2340
At most 5	0.017496	0.917856	3.841465	0.3380

Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values
Source : Eviews12 (analyzed)

Based on table 5, there are three cointegrations in the trace value and maximum eigenvalue test. This can be seen in the trace statistic and max eigenvalues which have a value greater than the critical value at a significance level of 5%. The trace test value is 352.5561 > 107.3466, the value is 182.9055 > 79.34145, and the value is 94.44180 > 55.24578, as well as the results of the max eigenvalue 169.6506 > 43.41977, the value is 88.46375 > 37.16359, and the value is 61.06446 > 30.81507 so it can be interpreted that H0 is rejected which means that there is no cointegration. Moreover, H1 states that cointegration is accepted. In other words, the variables used have a long-term

relationship (cointegration with one another). The VECM estimation in this study can be used to carry out further testing.

5. Granger Causality Analysis

Granger's quality test aims to determine whether these variables have a reciprocal relationship or not because each variable in the study has the opportunity to be an exogenous or endogenous variable. This Granger test uses the VAR Pairwise Granger Causality Test and a 5% level. The following are the results of the Pairwise Granger Causality Test analysis:

Table 6
Granger Causality Test

Null Hypothesis :	F-Statistic	Prob.	Results	Causality Pair
KURS does not Granger Cause LQ45	0.86440	0.5429	Accepted H0	No Pair
LQ45 does not Granger Cause KURS	2.19206	0.0568	Accepted H0	
INFLASI does not Granger Cause LQ45	0.17741	0.9884	Accepted H0	No Pair
LQ45 does not Granger Cause INFLASI	0.97794	0.4613	Accepted H0	
PDB does not Granger Cause LQ45	0.89165	0.5227	Accepted H0	One way pair
LQ45 does not Granger Cause PDB	3.06643	0.0116	Declined H0	
SB does not Granger Cause LQ45	0.78228	0.6062	Accepted H0	No Pair
LQ45 does not Granger SB	0.78669	0.6027	Accepted H0	
MS does not Granger Cause LQ45	0.61038	0.7437	Accepted H0	No Pair
LQ45 does not Granger Cause MS	1.02880	0.4274	Accepted H0	
INFLASI does not Granger Cause KURS	0.29268	0.9527	Accepted H0	No Pair
KURS does not Granger Cause INFLASI	1.22959	0.3110	Accepted H0	
PDB does not Granger Cause KURS	1.28657	0.2831	Accepted H0	One way pair
KURS does not Granger PDB	3.65875	0.0041	Declined H0	
SB does not Granger Cause KURS	0.53866	0.7997	Accepted H0	No Pair
KURS does not Granger Cause SB	1.15402	0.3515	Accepted H0	
MS does not Granger Cause KURS	2.21776	0.0542	Accepted H0	No Pair
KURS does not Granger Cause MS	1.20829	0.3220	Accepted H0	
PDB does not Granger Cause INFLASI	0.43747	0.8723	Accepted H0	No Pair
INFLASI does not Granger Cause PDB	0.72381	0.6526	Accepted H0	
SB does not Granger Cause INFLASI	1.05674	0.4095	Accepted H0	No Pair
INFLASI does not Granger Cause SB	0.95332	0.4784	Accepted H0	
MS does not Granger Cause INFLASI	1.40505	0.2318	Accepted H0	No Pair
INFLASI does not Granger Cause MS	0.93739	0.4896	Accepted H0	
SB does not Granger Cause PDB	0.60319	0.7494	Accepted H0	No Pair
PDB does not Granger Cause SB	2.39866	0.0390	Accepted H0	
MS does not Granger Cause PDB	1.09346	0.3868	Accepted H0	One way pair
PDB does not Granger Cause MS	4.73677	0.0007	Declined H0	
MS does not Granger Cause SB	1.86767	0.1024	Accepted H0	No Pair
SB does not Granger Cause MS	0.92515	0.4983	Accepted H0	

Source : Eviews 12 (analyzed)

6. Vector Error Correction Model (VECM)

The results of data processing on the VECM will get a long-term and short-term relationship between the dependent variable (LQ45) and the independent variable (EXCHANGE, INFLATION, GDP, SB, and MS). In this study using lag 7 based on the lag length criteria. The table below shows the short-term and long-term relationship between INDEX LQ45 (DLQ45) as the dependent variable and the exchange rate variable, Gross Domestic Product, inflation, interest rates and the money supply as independent variables, here are the results of the short-term VECM relationship:

Table 7
Short-Term VECM Estimation Results

| Variable | Short-Term | | | |
	Coefisien	T-Statistics	T Table	Note
D(LOGKURS(-1),2)	2.651326	1.11243	1.6740	Not significant
D(LOGINFLASI(-1)-2)	-0.026295	-0.20126	1.6740	Not significant
D(PDB)-1)-2)	-0.968923	-0.88741	1.6740	Not significant
D(LOGSB)-1)-2)	-0.721053	-0.69507	1.6740	Not significant
D(LOGMS)-1)-2)	-7.786742	-1.11054	1.6740	Not significant

Source : Eviews12 (analyzed)

Based on Table 7, the results of the VECM estimation in the short term show that the independent variables, namely exchange rate, inflation, Gross Domestic Product, interest rates and the money supply in the short term (1 month earlier) do not affect the LQ45 Index. This can be seen in the T-statistical values for each of the independent variables exchange rate, inflation, Gross Domestic Product, interest rates and the money supply which have a value smaller than T-table 1.6740. Here are the results of a long-term VECM relationship:

Table 8
Long-Term VECM Results

| Variable | Long-Term | | | |
	Coefisien	T-statistics	T- Table	Note
D(LOGKURS(-1))	2.833608	16.0578	1.6740	Significant
D(LOGINFLASI(-1))	-0.054666	-1.85819	1.6740	Significant
D(LOGPDB)-1))	-0.018793	-0.08532	1.6740	Not Significant
D(LOGSB)-1))	-1.618860	-22.0460	1.6740	Significant
D(LOGMS)-1))	-9.414183	-22.1512	1.6740	Significant

Source : Eviews12 (analyzed)

Based on Table 8, the results of the long-term VECM estimation are obtained, which explain that:

a. The exchange rate has a positive effect on the LQ45 Index. This is indicated by the partial t-statistic value of the exchange rate variable of 16.0578,

greater than the t-table value of 1.6740, which means that H0 is rejected. The magnitude of the effect is seen in the coefficient value. The coefficient value of the exchange rate variable in the long term is 2.833608, meaning that when there is an increase in the exchange rate of 1 rupiah, it will increase the LQ45 Index by 2.83 points.

b. Inflation harms the LQ45 Index. This is because the partial t-statistic value of the inflation variable is -1.85819, which is greater than the t-table value of 1.6740, which means that H0 is rejected. The magnitude of the effect is seen in the coefficient value. The coefficient value of the inflation variable is -0.054666, meaning that when there is an increase in inflation of 1%, the LQ45 Index will decrease by 0.05 points.

c. Gross Domestic Product does not affect LQ45. This is because the partial t-statistic value of the Gross Domestic Product variable is -0.08532, which is smaller than the t-table value of 1.6740, which means that H0 cannot be rejected.

d. Interest rates harm LQ45. This is because the partial t-statistic value of the interest rate variable is -22.0460 which is greater than the t-table value of 1.6740, which means that H0 is rejected. The magnitude of the effect is seen in the coefficient value. The coefficient value of the interest rate variable is -1.618860, meaning that when there is an increase in interest rates of 1%, the LQ45 Index will decrease by 1.62 points.

e. The money supply harms the LQ45 Index. This is because the partial t-statistic value of the money supply variable is -22.1512, more significant than the t-table value of 1.6740, which means that H0 is rejected. The magnitude of the effect is seen in the coefficient value. The coefficient value of the money supply variable is -9.414183, meaning that when there is an increase in the money supply by 1 rupiah, the LQ45 Index will decrease by 9.41 points.

7. *Impulse Respon Function* **(IRF)**

Impulse Response Function analysis describes the shock of one variable against another variable over a certain period. It can be seen the length of time it takes for the dependent variable to respond to the shock of the independent variable. This means that the Impulse Response Function test is used to determine the effect of the LQ45 Index in responding to shocks or changes that occur in the variables of the exchange rate, inflation, Gross Domestic Product, interest rates, and the money supply. The results of the IRF (Impulse Response Function) are presented in Figure 5.

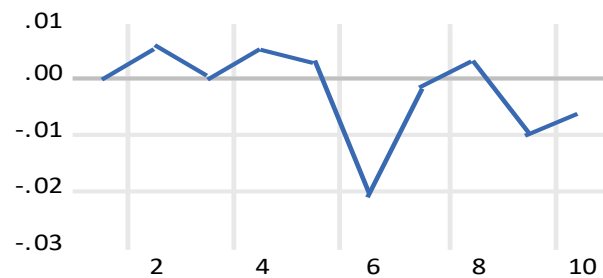Response of D(LOGLQ45) to D(LOGKURS) Innovation

Figure 5
The results of the LQ45 IRF analysis on the shock Exchange
Source : Eviews 12 (analyzed)

The graph shows the response of LQ45 to the shock of the exchange rate variable. LQ45 responded to the shock in month 1 to month 5 with a stable positive. The mobile response decreased significantly at 5 to 6 months negatively and increased negatively at 6 to 7 months. Then it moves down negatively in months 8 to 10. Overall in months, 1 to 10, the exchange rate variable shock moves above the horizontal line, which indicates that the exchange rate has a positive impact, meaning that if there is a shock of 1 standard deviation from the exchange rate, the LQ45 Index will react positively to exchange rate.

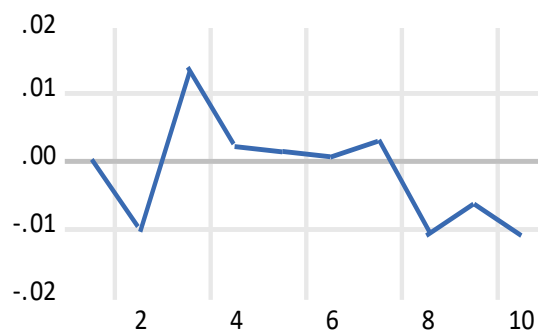Response of D(LOGLQ45) to D(LOGINFLASI) Innovation
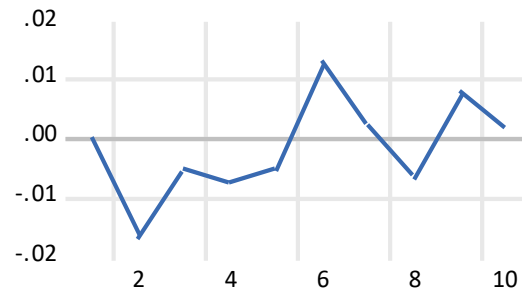
Figure 6
IRF LQ45 analysis results on Inflation shock
Source : Eviews 12 (analyzed)

The graph shows the response of LQ45 to the inflation variable shock. LQ45 responded to the shock downwards and negatively in month 1 to month 2. The response moved up significantly from month 2 to month 3 in a positive manner. And then dropped back at month 7 to month 10 in a negative way. Overall, in months 1 to 10, the inflation variable shock fluctuated below and above the horizontal line with a tendency below the horizontal line indicating that inflation had a negative impact, meaning that if there was a shock of 1

standard deviation from inflation, the LQ45 Index would react negatively to inflation.

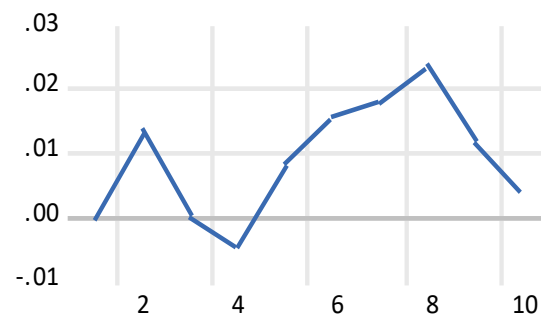**Response of D(LOGLQ45) to D(LOGPDB) Innovation**

Figure 7
IRF LQ45 analysis results on shock
Gross domestic product Source : Eviews 12 (analyzed)

The graph shows the response of LQ45 to the shock of the Gross Domestic Product variable. LQ45 responded to the shock downwards and negatively in month 1 to month 2. The response moved up from month 2 to month 6 positively. And then it fluctuates in the 6th to the 10th month. Overall in the 1st to 10th month the shock of the Gross Domestic Product variable moves below the horizontal line which indicates that the Gross Domestic Product has a negative impact, meaning that if there is a shock of 1 standard deviation of the Gross Domestic Product then the LQ45 Index will react negatively to the Gross Domestic Product.

Response of D(LOGLQ45) to D(LOGSB) Innovation
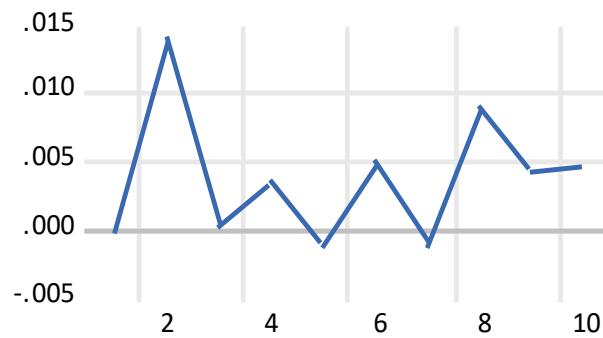

Figure 8
IRF LQ45 analysis results on SB shock
Source : Eviews 12 (analyzed)

The graph shows the response of LQ45 to the interest rate variable shock. LQ45 responded to the shock with a positive increase from month 1 to month 2. The response moved down significantly negatively from month 2 to month 4. The response rose significantly in month 4 to month 8 in a positive manner

and experienced a significant decline but still in the positive area from months 8 to 10. Overall in months 1 to 10 the interest rate variable shock moves above the horizontal line which indicates that interest rates have a positive impact, meaning that if there is a shock of 1 standard deviation from interest rates, the LQ45 Index will react positively to interest rates.

Figure 9
IRF LQ45 analysis results on MS .shock
Source : Eviews 12 (analyzed)

The graph shows the response of LQ45 to the shock of the money supply variable. LQ45 responded to this shock by fluctuating positively from month 1 to month 10. Overall in months 1 to 10 of the shock the money supply variable moved above the horizontal line indicating that the money supply had a positive impact, meaning that if there was a shock of 1 standard deviation of the money supply, the LQ45 Index will react positively to the money supply.

8. Variance Decompotion

Analysis of Variance Decomposition (VD) or decomposition analysis is helpful to explain the contribution of each variable to the shocks it causes to the observed variables. The following table describes the results of the Variance Decomposition analysis to see the effect of exchange rate shocks, inflation, Gross Domestic Product, interest rates, and the money supply on the LQ45 Index.

Table 9
VD LQ45 Results Analysis

Variance Decomposition of D(LOGLQ45):

Period	S.E.	D(LOGLQ45)	D(LOGKU...	D(LOGINF...	D(LOGPDB)	D(LOGSB)	D(LOGMS)
1	0.058387	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.067008	82.14180	0.898513	2.384824	6.070457	4.075880	4.428522
3	0.079358	83.95236	0.641115	4.590158	4.751339	2.906337	3.158689
4	0.083135	83.64039	0.980679	4.244782	5.116474	2.968950	3.048723
5	0.084662	82.56134	1.107772	4.111351	5.329065	3.927165	2.963307
6	0.089730	73.71178	6.328018	3.674210	6.816131	6.522847	2.947011
7	0.106871	78.51257	4.477171	2.678395	4.835989	7.408839	2.087036
8	0.115642	75.44714	3.880881	3.233309	4.450802	10.58025	2.407624
9	0.123161	76.02785	4.043967	3.112568	4.341532	10.24009	2.234000
10	0.131091	77.67160	3.808201	3.461258	3.846093	9.105919	2.106928

Source : Eviews 12 (analyzed)

Table 9 explained that in the first month, LQ45 was greatly affected by the LQ45 shock itself by 100 percent. Meanwhile, in the first month, the variables of the exchange rate, inflation, Gross Domestic Product, interest rates, and money supply have not affected LQ45. Furthermore, in the second month, the exchange rate variable contributed to the shock of 0.898513 percent, experienced a significant increase in the 6th month by 6.328018 percent, and then decreased until the 10th month, namely 3.808201.

In the 2nd month, the shock was given from the inflation variable, which was 2.384824 percent, experienced a significant increase in the 3rd month by 4.590158 and then decreased to the 10th month, which was 3.461258 percent.

The shock given in the 2nd month of the Gross Domestic Product variable was 6.070457 percent, decreased until the 10th month, which was 3.846093 percent. The shock given from the interest rate variable in the 2nd month was 4.075880 percent and consistently increased until the 10th month, namely 9.105919. The shock given from the money supply variable in the 2nd month was 4.428522 percent, which decreased until the 10th month, 2.106928 percent. Interest rates gave the biggest shock in the eighth month of 10,58025 percent compared to other variables.

9. **MAPE**

The following are the results of forecasting using VECM for the next four months based on last research period, namely January 2021 to April 2021, as shown in table 10.

Table 10
LQ45. Index Forecasting Results
January – April 2021

Months	Forcast	Actual	Absolute Error Percentage (%)
Jan-21	1.150	962	16
Feb-21	1.254	880	30
Mar-21	1.373	691	50
Apr-21	1.580	714	55
MAPE			**38**

Source : Eviews (analyzed)

Based on the table 10, it can be seen that the prediction for the LQ45 Index in January 2021 is 1,150 points and has increased until April 2021, which reaches 1,580 points. The result of forecasting calculation with MAPE value is 38% so it is categorized as a reasonable forecast (reasonable).

B. Discussion

a) The relationship between the exchange rate and the LQ45 Index

The data processing results show that in the short term (1 month earlier) the exchange rate does not affect the 2016 to 2020 LQ45 Index. Thus, the researcher's hypothesis states that in the short-term are:

H0 : Exchange rate does not affect the LQ45 Index. (received)

H1 : The exchange rate harms the LQ45 Index. (rejected)

This means that in the short term (1 month earlier) the exchange rate cannot be used to predict the LQ45 Index. Exchange rate changes on the company's performance cannot be seen in 1 month. Investors who invest based on the company's performance will make a minimum decision when the quarterly (Q) financial statements are published for 3 months. This is under Benjamin's statement (Giri, A. K., & Pooja, 2017) In the short term the stock market is a voting machine, but in the long-term the stock market is a weighing machine.

In the long-term, the exchange rate positively affects the LQ45 Index from 2016 to 2020. Thus, the researcher's hypothesis states that in the long-term are:

H0 : Exchange rate does not affect the LQ45 Index. (rejected)

H1 : The exchange rate harms the LQ45 Index. (rejected)

This result is different from the Purchasing Power Parity theory by Gustav Cassel (1918) that the exchange rate is a reflection of the difference in inflation/increase in goods and services between two countries that carry out buying and selling activities if measured in the same currency where an increase in inflation will reduce stock returns. In the long term, the exchange rate can have a positive effect because companies do a lot of export activities abroad. The cost of raw materials and production costs which are elements of the cost of goods obtained from within the country, will be sold using foreign currencies abroad, increasing company profits. Increased company profits will increase earnings per share and dividends per share, attracting investors to invest in the Indonesian capital market, especially in companies with good fundamentals, such as companies listed on the LQ45 Index.

These results follow the results of research conducted by (Barakat et al., 2016), (Bertuah, E., & Sakti, 2019), (Chandrashekar, R., Sakthivel, P., Sampath, T., & Chittedi, 2018), (Eldomiaty et al., 2019), (Giri, A. K., & Pooja, 2017), (Jamaludin et al., 2017), (Ismail et al., 2016), (Kwofie & Ansah, 2018), (Astuti, 2016) states that the exchange rate has a positive effect on stock returns.

b) The relationship between inflation and the LQ45 Index

The results of data processing show that in the short term (1 month earlier) inflation does not affect the 2016 to 2020 LQ45 Index. Thus, the researcher's hypothesis states that in the short term:

H0 : Inflation does not affect the LQ45 Index. (received)

H1 : Inflation harms the LQ45 Index. (rejected)

This means that in the short term (1 month earlier) inflation cannot be used to predict the LQ45 Index. Changes in inflation on company performance can not be seen in 1 month. Investors who invest based on the company's performance will make a minimum decision when the quarterly (Q) financial statements are published for 3 months. This follows Benjamin's statement (Giri, A. K., & Pooja, 2017) In the short term a stock market is a voting machine, but in the long term, the stock market is a weighing machine.

In the long term, inflation has a negative effect on 2016 to 2020 LQ45 Index. Thus, the researcher's hypothesis states that in the long term:

H0 : Inflation does not affect the LQ45 Index. (rejected)

H1 : Inflation harms the LQ45 Index. (received)

This means that inflation can be used to predict the LQ45 Index in the long term. This result follows Keynes' theory by John Maynard Keynes (1930) which states that inflation occurs because the demand for goods and services exceeds the amount of money available. Great demand will push the overall price of goods and services to increase continuously and if it is not balanced with the income of the people it will hamper people's purchasing power. The reduced purchasing power of the public will reduce the company's profit, earnings per share and dividends per share to reduce stock returns.

These results follow the results of research conducted by (Asmara, 2018), (Ahmad & Ramzan, 2016), (Andyani, K. W., & Mustanda, 2018), (Candy, & Winardy, 2019), (Chandrashekar, R., Sakthivel, P., Sampath, T., & Chittedi, 2018), (Eldomiaty et al., 2019), (Hidayat, L. R., & Azis, 2017), (Ilmi, 2017), (Innocent et al., 2018), (Jamaludin et al., 2017), (Ismail et al., 2016), (Khan, 2019), (Nkoro & Uko, 2016), (Sari, 2019) and Restiawan dan Asytuti (2020) state that inflation has a negative effect to stock returns. states that inflation harms stock returns.

c) **Relationship of Gross Domestic Product with LQ45 Index**

The data processing results show that in the short term (1 month earlier) Gross Domestic Product does not affect the 2016 to 2020 LQ45 Index. Thus, the researcher's hypothesis states that in the short term:

H0 : Gross Domestic Product does not affect the LQ45 Index. (received)

H1: Gross Domestic Product has a positive effect on the LQ45 Index. (rejected)

This means that in the short term (1 month prior) Gross Domestic Product cannot be used to predict the LQ45 Index. Changes in Gross Domestic Product on company performance cannot be seen in 1 month. Investors who invest based on the company's performance will make a minimum decision when the quarterly (Q) financial statements are published for 3 months. This follows Benjamin's statement (Giri, A. K., & Pooja, 2017) In the short term, a stock market is a voting machine, but in the long term, a stock market is a weighing machine.

In the long term, Gross Domestic Product does not affect 2016 to 2020 LQ45 Index. Thus, the researcher's hypothesis states that in the long term:

H0 : Gross Domestic Product does not affect the LQ45 Index. (received)

H1: Gross Domestic Product has a positive effect on the LQ45 Index. (rejected)

This means that the Gross Domestic Product cannot be used to predict the LQ45 Index in the long run. Gross Domestic Product growth from 2016 to 2020 experienced an upward trend even though in 2020 it decreased and was below the linear line. Based on the Central Bureau of Statistics, Gross Domestic Product data can be described in Figure 10
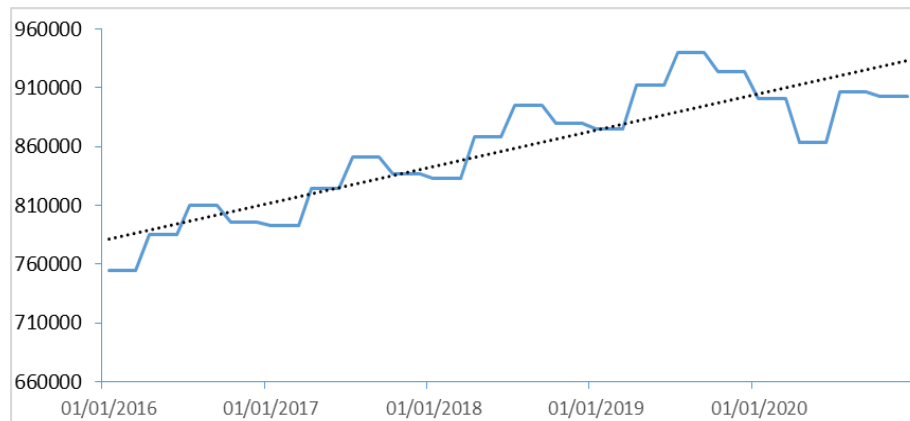
Figure 10
Gross domestic product
in 2016-2020
Source : BPS (analyzed)

The results of this study are not in the line with the theory of economic growth by Roy F. Harrod in 1984 and Esey D. Domar in 1957. According to this theory, economic growth in a country will encourage people to invest and vice versa, the more people invest, the country's economy will be. will grow. So it can be concluded that there is no effect of Gross Domestic Product on the LQ45 Index, indicating that public awareness to invest in the capital market is low.

These results are follows research conducted by (Ahmad & Ramzan, 2016), (Innocent et al., 2018) which states Gross Domestic Product does not affect stock returns.

d) The relationship between interest rates and the LQ45 Index

The data processing results show that in the short term (1 month earlier), interest rates do not affect 2016 to 2020 LQ45 Index. Thus, the researcher's hypothesis states that in the short term:

H0 : Interest rates do not affect the LQ45 Index. (received)

H1 : Interest rates harm the LQ45 Index. (rejected)

This means that in the short term (1 month prior) interest rates cannot be used to predict the LQ45 Index. Changes in interest rates on company performance cannot be seen in 1 month. Investors who invest based on the company's performance will make a minimum decision when the quarterly (Q) financial statements are published for 3 months. This is by Benjamin's statement

(Giri, A. K., & Pooja, 2017) In the short term the stock market is a voting machine, but in the long term the stock market is a weighing machine.

In the long term interest rates harm 2016 to 2020 LQ45 Index. Thus, the researcher's hypothesis states that in the long term:

H0 : Interest rates do not affect the LQ45 Index. (rejected)

H1 : Interest rates harm the LQ45 Index. (received)

This means that long-term interest rates can be used to predict the LQ45 Index. This result is by Adam Smith and David Ricardo (1776), which states that interest rates are the reason someone saves or invests. If the interest rate is high, the public's interest in saving in the bank will be significant and vice versa if the interest rate is low, the public's interest in saving in the bank will decrease and switch to investment.

The increase in interest rates has the opposite relationship with the LQ45 Index. This can be explained if interest rates rise, then the interest expense on companies that have bank loans will increase, causing company profits, earnings per share (earnings per share) and dividends per share to decrease and investors will sell their shares. from the capital market. An increase in interest rates will also make investors move their funds from the capital market to bank investment instruments that have high interest rates, such as deposits. These results are by research studies conducted by (Asmara, 2018), (Astuti, 2016), (Barakat et al., 2016), (Chandrashekar, R., Sakthivel, P., Sampath, T., & Chittedi, 2018), (Ilmi, 2017), (Innocent et al., 2018), (Jareño & Negrut, 2016), (Khan, 2019), (Umer, 2016), (Prasetiono, 2020), (Slamet Ardi Restiawan, 2020) states that interest rates harm stock returns.

e) **The Relationship between the Money Supply and the LQ45 Index**

The data processing results show that in the short term (1 month earlier) the money supply does not affect 2016 to 2020 LQ45 Index. Thus, the researcher's hypothesis states that in the short-term are:

H0 : The money supply does not affect the LQ45 Index. (received)

H1 : The money supply harms the LQ45 Index. (rejected)

This means that in the short term (1 month earlier) the money supply cannot be used to predict the LQ45 Index. Changes in the money supply on the company's performance cannot be seen in 1 month. Investors who invest based on the company's performance will make a minimum decision when the quarterly (Q) financial statements are published for three months. This is by Benjamin's statement (Giri, A. K., & Pooja, 2017) In the short term the stock market is a voting machine, but in the long term the stock market is a weighing machine.

In the long-term, the money supply harms 2016 to 2020 LQ45 Index. Thus, the researcher's hypothesis states that in the long term are:

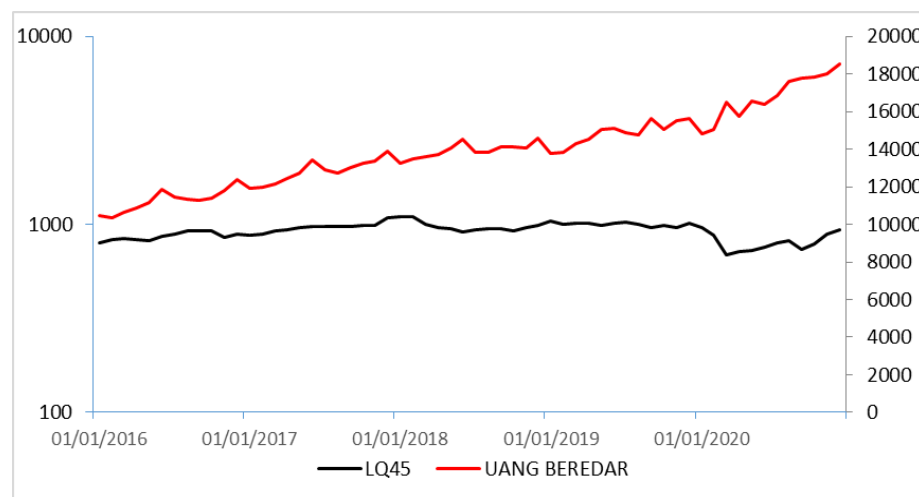H0 : The money supply does not affect the LQ45 Index. (rejected)

H1 : The money supply harms the LQ45 Index. (received)

This means that the money supply can be used to predict the LQ45 Index in the long term. The results of this study are by the quantity theory of money by Irving Fisher (1911) which states that changes in the money supply will cause an equally rapid change in prices. If the money supply increases by 5%, the price will increase by 5% and vice versa.

The increase in money supply in the community will encourage people's purchasing power for goods and services. The high purchasing power of the people if it is not balanced with the availability of products and services can lead to inflation, namely a continuous increase in goods and services. High inflation will increase production costs to reduce net income, earnings per share (eps), dividends per share (DPS) and stock returns.

Based on the data, the relationship between the money supply and the LQ45 Index can be seen in Figure 11.

Figure 11
Amount of Money Supply
in 2016-2020
Source : BI (analyzed)

Based on Figure 11 from 2016 to 2020, the money supply continued to experience an upward trend, but the LQ45 Index did not follow this. Even from 2018 to 2020, the LQ45 Index continued to decline. This explains that the money supply harms the LQ45 Index.

Conclusion

Based on the research analysis and results, the conclusions obtained are: (1) In the short term (1 month earlier) the variables of the exchange rate, inflation, Gross Domestic Product, interest rates and the money supply do not affect the LQ45 Index. This means that exchange rates, inflation, Gross Domestic Product, interest rates and money supply in the short term (1 month earlier) cannot be used to predict the LQ45 Index. According to Benjamin (Giri, A. K., & Pooja, 2017) in the short term, a stock

market is a voting machine, but in the long term, a stock market is a weighing machine. The share price is determined by the most significant number of buyers/demands or sellers/bidders in the short term. If the number of buyers is greater than the number of sellers, then the price will increase, and if the number of sellers is greater than the number of buyers, the price will fall, while in the long run, the stock price will follow the company's performance. (2) In the long term, the variables of the exchange rate, inflation, interest rate and money supply have a significant influence where the exchange rate has a positive effect. In contrast, inflation, interest rates and the money supply are negatively affected. In the long run, Gross Domestic Product has no effect. This means that in the long term Gross Domestic Product cannot be used to predict the LQ45 Index, which means that public awareness to invest in the capital market during 2016-2020 is still low.

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