Effect of Macroeconomic Factors on the Composite Stock Price Index Using the Vector Auto Regression (VAR) Method

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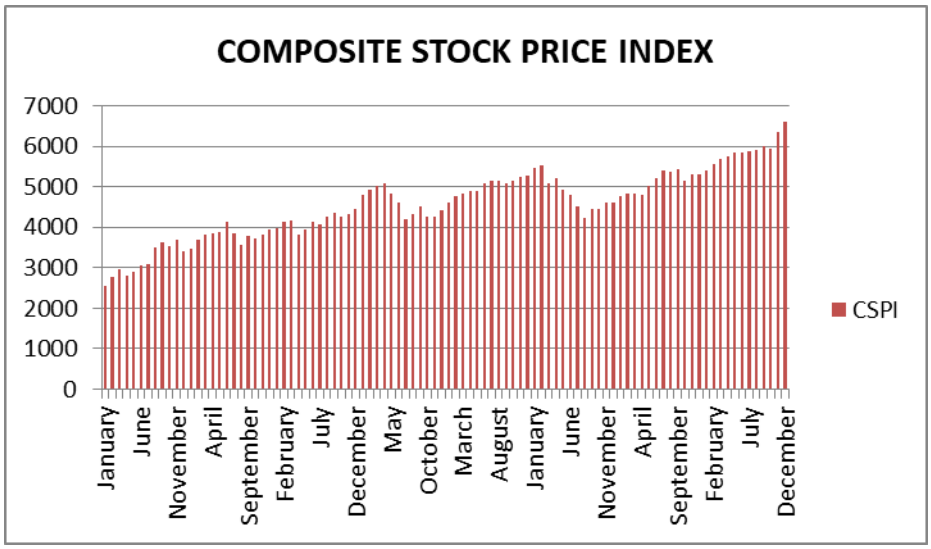
Abstract
This study aims to examine the effect of the exchange rate (ER), the money supply (M2) and interest rates (IR) to the composite stock price index (CSPI). The data used are monthly data from January 2010 to December 2017 and data collected from Bank Indonesia. In processing data using the Vector Auto Regression (VAR) method. From the results of this study it can be found that there is no reciprocal relationship between variables, but there is a one-way relationship between these variables. The variable that has the biggest contribution to the composite stock price index variable is the variable itself in Lag 1. There is a positive and significant relationship between each variable and there is also a negative and significant effect between each variable.

Keywords: Composite Stock Price Index, Money Supply, Exchange Rate, Interest Rate

Introduction
In the era of modernization and globalization at this time, almost all countries pay great attention to the world of capital markets, this is because the capital market has a strategic role in strengthening the resilience and economic development of a country.The flight of capital abroad is not only a result of the decline in the value of the Rupiah or the amount of money in circulation and low interest rates in a country, but this is due to the unavailability of profitable investment alternatives in the country, or at the same time, portfolio investment in other countries it is more profitable and far higher.

The existing capital market in Indonesia is an emerging capital market which in its development is very vulnerable to the conditions of macroeconomic conditions in general. Starting in 1998 the collapse of the pillars of the Indonesian national economy.



Graph 1: Composite Price Index January 2010 – December 2017
Source: Author's processed results

Starting with the lack of trust of the Indonesian people in Indonesian banks with the form of withdrawal of large amounts of funds by depositors then deposited abroad (capital flight). Apart from the high interest rates and also the depreciation of the rupiah against the dollar, there are other impacts that have led to a decline in public confidence which has affected the capital market. The price of the share price declined sharply, causing significant losses for investors. According to (Rini Astuti, 2016) states that inflation has a positive and significant effect on the CSPI, but interest rates have a negative and significant effect on the CSPI. High inflation results in a decrease in the purchasing power of money and reduces the level of real income earned by investors. This will automatically cause the CSPI to decrease (Kewal, 2012). High interest rates will also affect the present value of the company's cash flow, so that investment opportunities that exist will not be attractive anymore.

In addition to inflation and interest rates, the exchange rate variable also has an influence on the movement of the CSPI. The strengthening of the rupiah exchange rate against foreign currencies is a positive signal for investors. The exchange rate of the rupiah against foreign currencies has strengthened due to the large number of investors investing in shares. Of course due to the strengthening it indicates that the economy is in good condition. Meanwhile, when the rupiah exchange rate weakens, it means that foreign currencies are experiencing a strengthening, then this indicates that the economy is in a bad condition so that investors will hesitate to invest because of the benefits or returns they will get (Tandelilin, 2001).

This study aims to analyze the effect of macroeconomic factors on the Composite Stock Price Index (CSPI) in Indonesia. However, lately symptoms of the recovery of public confidence are beginning to appear. In November 2016 CSPI reached 5334,787109 and December 2017 reached 6686,347168 which was a significant increase. PT Jakarta Stock Exchange (JSE) continues to strive to create a market that is more liquid, reasonable, orderly and transparent, throughout the above period, the exchange has shown remarkable achievements.

Methods

This study examines the effect of interest rates, the amount of money circulating (M2), and the exchange rate on the Composite Stock Price Index (CSPI). The data used are monthly time series data from January 2010 to December 2017. With a total of 96 data. The data is sourced from Bank Indonesia, and also various sources of literature that support this research. The empirical model used in this study is a multivariate Vector Auto Regression (VAR). VAR is usually used to project system time series variables and analyze the impact of the system variables. Basically VAR analysis can be paired with a simultaneous equation model, because in VAR analysis we consider several endogenous variables together in a model (Hadi: 109).

The following models are used in this study:

1. CSPIt= a10+ a11 CSPIt-i + a12 ERti + a13 M2t-i +a14 IRt-i + et
2. ERt = a20 + a21 ERt-i + a22 CSPIt-I + a23 M2t-i + a24 IRt-i + et
3. M2t = a30 + a31 M2t-i + a32 CSPIt-I + a33 ERt-i + a34 IRt-i + et
4. IRt = a40 + a41 IRt-i + a42 CSPIt-i + a43 ERt-i + a44 M2t-i + et

Where:

CSPI : Composite Stock Price Index
M2 : Money Supply
ER : Exchange Rate
IR : Interest Rate
e : coefisient

Results and Discussion

From data processing using e-views 8, the results of the unit roor test are found that the CSPI variable at the unit level with a probability value of 0.7544> from the alpha level of 0.005, then it is not stationary, it needs to be tested at the 1st diference so as to obtain its probability value equal to 0.0000

<0.05, therefore the CSPI variable can be said to be stationary at the 1st diference. As for the variable interest rates and exchange rates are also stationary at the 1st diference. For M2 variables not stationary at the 1st diference, it is necessary to do a unit test at the 2nddifference. By getting the probability value of 0.1197> 0.05 confidence level, it is found that the M2 variable can be stationary at the 2nddifference.

Table 1 Stationarity test at the 1st difference

Variable	Prob.	Information
CSPI	0,0000	*Stationary*
IR	0,0000	*Stationary*
M2	0,1197	*Not Stationary*
ER	0,0000	*Stationary*

Source: Author's processed results

From the above table it can be concluded that there is one variable that is not stationary at the first difference level. To get perfect stationary data at the first difference level, M2 data is logged, so that it becomes stationary.

Table 2 Stationary test at the 1st difference

Variable	Prob.	Information
CSPI	0,0000	*Stationary*
IR	0,0000	*Stationary*
M2	0,0069	*Stationary*
ER	0,0000	*Stationary*

Source: Author's processed results

The optimum lag test is carried out to find out how much to use on this model. In the results of testing via E-views 8, we get the number of lags that are used Lag 2. One way to easily see lag is to see how many stars are in the data.

Granger causality test is performed to see the relationship between variables:

Table 3 Granger Causality Test

Null Hypothesis:	Obs	F-Statistic	Prob.
ER does not Granger Cause CSPI	94	0.9003 8	0.4101
CSPI does not Granger Cause ER		18.318 4	2.E-07
M2 does not Granger Cause CSPI	94	2.8711 5	0.0619
CSPI does not Granger Cause M2		0.9958 7	0.3735
IR does not Granger Cause CSPI	94	0.2063 8	0.8139
CSPI does not Granger Cause IR		1.1334 9	0.3265
M2 does not Granger Cause ER	94	2.3499 5	0.1013
ER does not Granger Cause M2		6.5054 2	0.0023

Table cont...

IR does not Granger Cause ER	94	0.8655 4	0.4243
ER does not Granger Cause IR		3.2951 8	0.0416
IR does not Granger Cause M2	94	1.6662 0	0.1948
M2 does not Granger Cause IR		2.7354 1	0.0703

Source: Author's processed results

Based on the Granger causality test it can be seen the relationship between variables, is there a one-way relationship or there is no relationship between variables, the following is a complete explanation:

1. The relationship between exchange rates and CSPI is not related to one another.
2. The relationship between M2 and CSPI is not related to one another.
3. The relationship between interest rates and CSPI is not related to one another.
4. The relationship between M2 and the exchange rate is a one-way relationship between the exchange rate and M2.
5. Relationship between interest rates and exchange rates there is a one-way relationship that is the exchange rate against interest rates.
6. Relationship between interest rates and M2 there is a one-way relationship that is M2 to interest rates.

Table 4 VAR Estimation Results

Source: Author's processed results

	CSPI	ER	M2	IR
CSPI (-1)	0.9488118	-0.681188	6.974184	32.90272
	(0.10835)	(0.13210)	(26.0249)	(74.4991)
	[8.75073]	[-515655]	[0.26798]	[0.44165]
CSPI (-2)	-0158857	0.705104	4.935732	-3.226991
	(0.07810)	(0.13232)	(26.0676)	(74.6211)
	[-1.46379]	[5.32887]	[0.18934]	[-0.04325]
ER (-1)	-0.053421	0.926195	49.84262	57.15247
	(0.07810)	(0.09523)	(18.7605)	(53.7040)
	[-0.68398]	[9.72611]	[2.65678]	[1.06421]
ER (-2)	-0.008032	-0.076477	-71.26014	10.03445
	(0.07810)	(0.09417)	(18.5525)	(53.1086)
	[-0.10399]	[0.81210]	[-3.84099]	[0.18894]
M2 (-1)	-0.000135	-0.000523	0.598899	0.336520
	(0.00042)	(0.00051)	(0.10110)	(0.28941)
	[-0.31995]	[-1.02004]	[5.92385]	[1.16279]
M2 (-2)	0.000422	0.000760	0.427082	-0.447535
	(0.00042)	(0.00051)	(0.10124)	(0.28981)
	[1.00229]	[1.47956]	[4.21846]	[-154422]
IR (-1)	-.000118	-8.78E-05	-0.042273	0.903103
	(0.00016)	(0.00019)	(0.3795)	(0.10957)
	[-0.74025]	[-0.45169]	[-1.10437]	[8.24199]

Table cont...

IR (-2)	8.31E-05	0.000378	0.098806	-0.151091
	(0.00016)	(0.00019)	(0.03795)	(0.10865)
	[0.52615]	[1.96149]	[2.60325]	[-1.39062]
C	658.5317	688.9606	115510.8	-400770.5
	(292.187)	(356.246)	(70183.1)	(200907)
	[2.25380]	[1.93394]	[1.64585]	[-1.99481]
R-squared	0.959951	0.989903	0.998383	0.844338
Adj. R-squared	0.956182	0.988952	0.998230	0.829687
Sum sq. resid	2444413	3633738	1.41E+11	1.16E+12
S.E equation	169.5813	206.7604	40733.28	116603.3
F-statistic	254.6740	1041.649	6558.687	57.63177
Log likelihood	-611.1832	-629.8167	-1126.441	-1225.304
Akaike AIC	13.19539	13.59184	24.15832	26.26179
Schwarz SC	13.43889	13.83535	24.40183	26.50530
Mean dependent	4610.169	11271.46	3706795	394536.2
S.D dependent	810.1196	1967.140	968306.6	282544.7

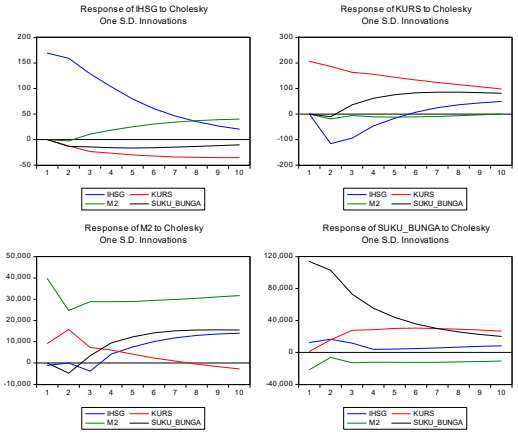
The results of the analysis from the above table are, if t-statistics> t-table then there is a significant influence on fellow variables. The t-table value for the number of data (N) 93 is 1,986 and the t-statistic value of the CSPI variable in lag 1 against the variable itself (CSPI) is 8.75073, greater than the t-table value. So, if there is an increase in the CSPI in the previous year, it will increase significantly the CSPI in the current year. The lag 2 exchange rate variable against the M2 variable is -3,84099 <1,986, meaning that if there is a decline in the exchange rate significantly in the previous two years, there will be a M2 reduction in the present.

From the results of the above table, using lag = 2 shows that there is a relationship between exchange rates, M2, interest rates and CSPI with lag 2, it can be concluded that by observing the t-statistics of each variable can be seen as follows:

1. Exchange variable: the biggest and positive contribution to the exchange rate is the variable itself in lag 1 which is 9.72 then followed by M2 variable which is 1.06 in lag 1, while the interest rate and CSPI have the lowest contribution to the exchange rate variable.
2. M2 variable: the biggest and most positive contribution to M2 is the variable itself (M2) at lag 1 of 5.92 and to the variable (M2) at lag 2 of 4.21 and also to the interest rate variable of 1.16 at lag 2. Whereas the exchange rate and CSPI have the lowest contribution to the M2 variable.
3. Interest Rate Variables: the biggest and most significant contribution to the interest rate variable is the variable itself (interest rate) at lag 1 of 8.24 and the M2 variable at lag 2 of 2.60, while the exchange rate and CSPI have the lowest contribution to the variable of interest rates.
4. CSPI Variables: the largest and most positive contribution to the CSPI variable is the variable itself (CSPI) at lag 1 of 8.75 and the exchange rate variable at lag 2 of 5.32 while the exchange rate has the lowest contribution to the CSPI variable.

Based on the results of the Vector Autoregression analysis it is known that the estimation results prove that there is only a unidirectional relationship between the exchange rate, M2, interest rates and CSPI variables. Thus, the hypothesis of a reciprocal relationship between exchange rates, M2, interest rates and CSPI as observed variables is not proven. The R-square value is 0.95 or 95%, meaning that how much the variable exchange rate, M2 and interest rates affect the CSPI variable. And by 5% other variables that explain CSPI variables that are not contained in the model. After estimating the VAR model, the VAR regression model is obtained as follows:

1. CSPI = 0.948*CSPI (-1) - 0.158*CSPI (-2) - 0.053*ER (-1) - 0.008*ER (-2) - 0.0003*M2(-1) + 0.0004*M2(-2) - 0.0001*IR (-1) + 8.313*IR (-2) + 658.531
2. ER = - 0.6811*CSPI (-1) + 0.7051*CSPI (-2) + 0.9261*ER (-1) - 0.0764766827627*ER (-2) - 0.0005*M2(-1) + 0.0007*M2(-2) - 8.7761*IR (-1) + 0.0003*IR (-2) + 688.960
3. M2 = 6.9741*CSPI (-1) + 4.9357*CSPI (-2) + 49.8426*ER (-1) - 71.2601*ER (-2) + 0.5988*M2(-1) + 0.4270*M2(-2) - 0.0422*IR (-1) + 0.0988*IR (-2) + 115510.831
4. IR = 32.902*CSPI (-1) - 3.226*CSPI (-2) + 57.1524*ER (-1) + 10.0344*ER (-2) + 0.3365*M2(-1) - 0.447*M2(-2) + 0.903*IR (-1) - 0.1510*IR (-2) - 400770.531



Graph 2 Impulse Response Function

Source: Author's processed results

This impulse response function is used to see the effect of a change of one variable on the variable itself or another variable. Estimates made for this IRF focus on the response of a variable to changes in a standard deviation of the variable itself or from other variables that can be in the model. After cointegration testing is done, then the classic assumption test will be performed.

1. Muticollinearity Test

Table 5 Multicolliniearity Test

Variable	VIF	Information
ER	1.64	*No Multicolliniearity*
IR	1.09	*No Multicolliniearity*
M2	1.14	*No Multicolliniearity*

Source: Author's processed results

From the table above we can conclude that there is no multicollinearity problem for each variable.

2. Heteroscedasticity Test

Table 6Heteroscedasticity Test

Variable	Prob.	Information
ER	0.08	*No Heteroscedasticity*
IR	0.67	*No Heteroscedasticity*
M2	0.99	*No Heteroscedasticity*

Source: Author's processed results

From the results of the table above it was found that the probability value of each variable is greater than the alpha value of 5% (0.05). It can be concluded that there is no heteroscedasticity problem on each variable.

Conclusions

From the results of the study it can be concluded that the relationship of exchange rates, M2 and interest rates to the CSPI there is no reciprocal relationship, but there are several variables that affect the relationship between one-way variables. CSPI variable has a significant and positive effect on the variable itself (CSPI) on lag 1. The exchange rate variable also has a significant and positive effect on the variable itself (exchange rate) on lag 1, the M2 variable has a significant and positive effect on the variable itself (M2) in lag 1, and the interest rate variable has a significant and positive influence on the variable itself (interest rate) in lag 1.

References

Anoraga, Panji dan Piji Pakarti. 2001. Pengantar Pasar Modal. Jakarta: PT. Rineka cipta

Gujarati, Damodar. Ekonometri dasar. Terjemahan Sumarno Zain. Jakarta: Erlangga

Kuncoro, Mudrajat. 1996. Manajemen Keuangan Internasional. Yogyakarta: BPFE

Mankiw, Gregory. 2007. Makroekonomi, Edisi keenam, Terjemahan: oleh Fitria Liza SE, dan Imam Nurmawan SE, Erlangga

Rahardja, Pratama dan Mandala Manurung. Pengantar Ilmu Ekonomi. Jakarta. FE Universitas Indonesia, 20014

Rahardja, Pratama dan Mandala Manurung. Uang, Perbankan, dan Ekonomi Moneter (Kajian Konseptual Indonesia). Jakarta. FE Universitas Indoneisa, 2004

Salvatore, Dominick. Ekonomi Internasional. Edisi kelima. Jakarta, Erlangga, 1997

Sukino, Sadono. 2003. Pengantar teori Makro Ekonomi. Edisi kedua, PT> Raja Grafindo Persada, Jakarta

Sunariyah. 2006. Pengantar Pengetahuan Pasar Modal. Edisi kelima, UPP, Yogyakarta

Website bank Indonesia. www.bi.go.id

Website Financeindonesia.org

Widarjono, Agus. 20015. Ekonometrika:Teori dan Aplikasi Untuk Ekonomi dan Bisnis. Ekonomi FE UII.Yogyakrta