Causality of the Growth of Bitcoin Prices with Monetary Conditions in Indonesia

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Abstract
Virtual currency has been a hot topic for discussion lately. One of the popular virtual currencies is bitcoin which has a status as a commodity in Indonesia today. The purpose of this study is to determine whether there is influence and causality between bitcoin and monetary variables in Indonesia. The study used time series data in monthly form March 2012 to July 2019. The study used Johnsen's co integration test, vector auto regression estimation, granger causality test, forecasting with Impulse Response Function (IRF), and decomposition variance analysis. In this research, it is known that in the long run the growth of bitcoin prices, the exchange rate, inflation, the price of gold, and interest rates does not have balance and similarity in movement. Causally there is a direct relationship between the price of gold and the exchange rate with the consumer price index. In the VAR estimation it is known that bitcoin price growth affects the consumer price index in Indonesia, and the consumer price index affects the price of gold. In impulse response function forecasting there are positive and negative responses of each variable in the study of other variables. In decomposition variance analysis, it is known that the contribution of influence of a variable is more dominated by the variable itself when shock or shock occurs.

Keywords: Bitcoin, monetary variable, vector auto regression

Introduction
After the end of the 2008 financial crisis which had an impact on almost all countries, an idea of virtual currency emerged. Virtual currency is a digital based currency with a very secret security code. One of the most popular forms of virtual currency today is bitcoin. Bitcoin has been released since 2010. The circulation of bitcoin gave birth to various views that ended on the contention in various countries. This also happened in Indonesia. Bitcoin is the most popular cryptocurrency and is superior to 1500 other forms of cryptocurrency. Since it was first launched in 2010, bitcoin has grown rapidly (Wallace, 2011). Nowadays bitcoin is one of the investment instruments, for example when someone invests USD1000 in bitcoin in 2010, then in the next seven years namely in 2017 the return of profits will be around USD81 million (Phillip, Chan, & Peiris, 2018). From this story can be seen that the exchange rate BITC o in developing very rapidly. Based on (Dastgir, Demir, Downing, Gozgor, & Lau, 2019) found that there is a causal relationship between bitcoin, bitcoin return, and bitcoin trends in google trends. This gives a signal that the bitcoin trend depends on the digital world today.

Some countries in the world have legalized bitcoin, such us Australia and Japan. In Indonesia, where bitcoin when it has been recognized as a commodity. This has been stated and approved by the Ministry of Trade through Bapppeti (Commodity Futures Trading Regulatory Agency). The existence of Bitcoin in Indonesia is only limited to commodities, this is because Bank Indonesia and the Financial Services Authority still prohibit the use of bitcoin as a means of payment. It is clear that the position of bitcoin in Indonesia is strengthened by the issuance of four Bappeti regulations which legalize bitcoin, including regulation No. 2 of 2019 concerning the organization of commodity physical markets on the Futures Exchange, regulation No. 3 of 2019 concerning commodities which can be subject to futures contracts, sharia derivative contracts and other derivative contracts traded on the Futures Exchange, regulation No. 4 of 2019 concerning the technical

provisions for the operation of digital physical gold markets on the Futures Exchange, and the last is Bappeti regulation No. 5 of 2019 concerning the technical provisions for the operation of the physical market of crypto assets on the Futures Exchange.

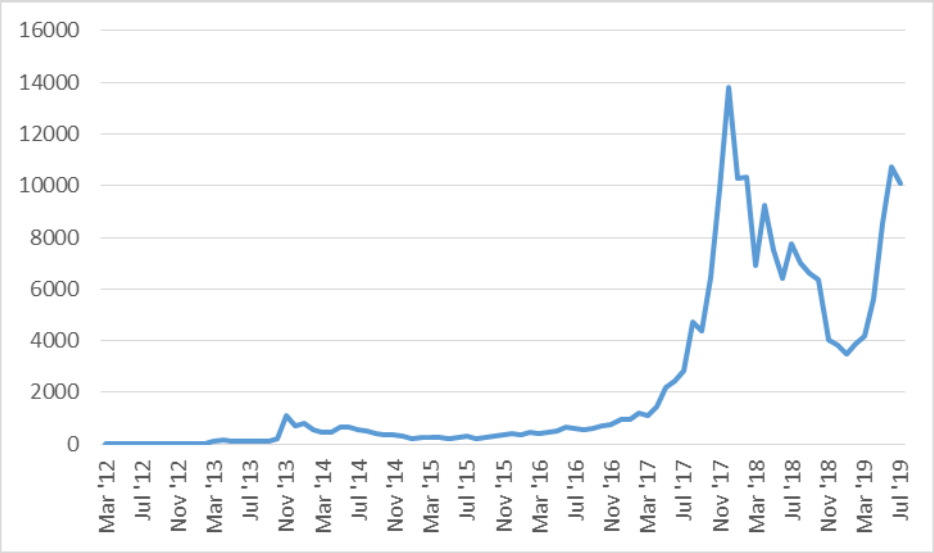

Figure 1 Development of Bitcoin Price Year 2012-2019

Source: (Investing.com, 2019), processed

Based on research (Narayan, Narayan, Eki Rahman, & Setiawan, 2019) found that when there is an increase in bitcoin price growth, an increase in inflation the exchange rate will appreciate, and the velocity of money will decrease. Based on these findings it can be concluded that the growth of bitcoin prices is very much for the monetary system in Indonesia. However, based on research (Aharon & Qadan, 2018) found that the movement of bitcoin is outside the speculation of capital markets, bonds and commodities. This indicates that there will be an impact arising from the movement of the bitcoin. In a previous study (Holub & Johnson, 2019) proved that during 2017, 8 of the 13 currencies showed that when there was an increase in the price of bitcoin indicated there would be a spreading impact on their monetary conditions. However, the other five countries do not have a wide spread impact because of the existence of clear regulations which make the impact of bitcoin movements narrow. In addition to the impact of the spread caused by bitcoin there are new findings based on research (Kim, Lee, & Kang, 2019) although market bitcoin less stable while in 2017, due to the lag for the introduction of futures markets, in line with the time in the future bitcoin will tend to be stable. However, in the following year a finding (Almudhaf, 2018) showed that there were inefficiencies in bitcoin pricing so practitioners were encouraged to introduce the digital currency market, specifically bitcoin. Beyond the doubts and risks predicted in the future caused by bitcoin, it is necessary to study how the influence of the reality and the long-term relationship of bitcoin with monetary variables in Indonesia. So that it is known and can be formulated new policies and strategies to minimize the risks that may arise from new goods on the commodity market.

Methods

The type of data used in this study is secondary data in the form of time series data. Data is presented monthly from March 2012 to July 2019. This study is supported by 435 samples of five variables. In this study the data used are bitcoin data, the rupiah exchange rate, Bank Indonesia interest rates, inflation, and the price of gold. To test the relationship between the growth of bitcoin prices with the exchange rate,

interest rates, consumer price indexes, and the price of gold, several tests are performed first. First, the test carried out was stationarity using the unit root test from the Augmented Dicky Fuller test (ADF Test).

Table 1 Variables Used

Variable	Definition	Source
Bitcoin	Bitcoin data taken is data from monthly average prices	Investing.com
Exchange rate	The exchange rate data used is the average exchange rate every month	Bank Indonesia
Interest rate	The interest rates used in this article are the reference rates released by Bank Indonesia	Bank Indonesia
consumer price index	The Consumer Price Index in this study illustrates the inflation conditions that occur every month	Financial Database
Gold price	The price of gold used is the world price of gold with a monthly average	Investing.com

Furthermore, to find out the optimal lag that is used in research, an estimation is performed. To find out how the relationship of variables that exist in the long run, Johansen's co integration test was performed. To find out how the influence between variables were analyzed using VAR models (Vector Auto Regression), and analysis of impulse response function, and variance analysis decomposition. According to (Lin, Law, Ho, & Sambasivan, 2019) the vector auto regression method is suitable for research with variables in a lot of time series. Vector auto regression was first coined by Sims in 1980 which is generally used in macroeconomic analysis. At present the VAR method has developed further, such as VAR panels and others. The model used is a general model of VAR in this study, namely

$$A_t = \alpha_1 + \sum \beta_{1i} Y_{t-1} + \sum X_{t-1} + \varepsilon_t \quad (1)$$

$$B_t = \alpha_2 + \sum \beta_{2i} Y_{t-1} + \sum X_{t-1} + \varepsilon_t \quad (2)$$

$$C_t = \alpha_3 + \sum \beta_{3i} Y_{t-1} + \sum X_{t-1} + \varepsilon_t \quad (3)$$

$$D_t = \alpha_4 + \sum \beta_{4i} Y_{t-1} + \sum X_{t-1} + \varepsilon_t \quad (4)$$

$$E_t = \alpha_5 + \sum \beta_{5i} Y_{t-1} + \sum X_{t-1} + \varepsilon_t \quad (5)$$

Results and Discussion

The first test carried out was the stationarity test. The purpose of this test is to find out whether the data is stationary or not. According to (Zulfikar Bagus Pambuko, 2018) time series data which often causes *spurious regression* problems. The symptoms of spurious regression are high R-square value, statistically t-value and statistically significant F but dw value is smaller than 0.5. This is also because the data used is time series data which has a tendency to contain unit roots (*unit root*). Data is not stationary if the average value and variance are constant. In addition, a stationary test was also carried out to see whether the *random walk* pattern or not. Stationarity tests were carried out for each variable in the study, namely the price of bitcoin, interest rates, exchange rates, the price of gold, and the consumer price index. The test is carried out using a five percent real level. In concluding later, a variable is said to have no unit roots if the ADF-test value (*Augmented Dickey Fuller Test*) is greater than its critical value or the critical value of five percent (*MacKinnon Critical Value*). From the tests conducted, all variables are not stationary at the level. However, all variables in the study are stationary at the first difference and second difference levels. After the stationarity test was conducted with the Philips Peron test the results also showed that all variables in the study were stationary at the first difference and second difference levels. Stationary test results are presented in table two and table three.

Table 2 Augmented Dickey Fuller Stationary Test Results (ADF-Test)

Variable	Root Test Unit on	ADF Test Statistics	Critical Values 5%	Information
Bitcoin	1st Difference	-8.817506	-2.895109	*Stationary*
Interest rate	1st Difference	-3.891014	-2.895512	*Stationary*
Exchange rate	1st Difference	-9.763201	-2.895109	*Stationary*
Gold price	1st Difference	-8,562451	-2.895109	*Stationary*
Consumer Price Index	1st Difference	-8.450069	-2.895512	*Stationary*

Source: Author's processed results

Table 3 Philips Peron Stationarity Test Results

Null Hypothesis: Unit root (individual unit root process)
Series: BTC, BI_RATE, ER, P_GOLD, CPI
Date: 09/28/19 Time: 10:45
Sample: 2012M01 2019M12
Exogenous variables: Individual effects
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 435
Cross-sections included: 5

Method	Statistics	Prob. **
PP - Fisher Chi-square	164,332	0.0000
PP - Choi Z-stat	-11.7480	0.0000

Source: Author's processed results

Optimal Lag (Lag Length Criteria)

Besides needing to test the stationarity of the data used in each variable also requires determining the lag length used. Determination of lag is very important in estimating the VAR model. Determination of the lag length is intended to avoid autocorrelation problems in the VAR model. Many methods are used in determining the length of the lag, including the Akaike Information Criteria (AIC), the Schawarz information criteria, and Hannan Quinnon. Here are the results of determining the length of the lag.

Table 4 Results of Determining the Optimal Lag Length

Lag	Log L	LR	FPE	AIC	SC	HQ
0	-2213,670	NA	4.26e + 17	54.78197	54,92977	54.84127
1	-1708,827	934.8933	3.05e + 12 *	42.93401	43.82084 *	43,28982 *
2	-1690,429	31,80027	3.61e + 12	43,09700	44.72286	43,74932
3	-1658,634	51,02914	3.11e + 12	42,92922 *	45.29411	43.87805
4	-1640,916	26,24834	3.85e + 12	43.10903	46.21295	44.35437
5	-1612,534	38,54270 *	3.75e + 12	43,02554	46,86849	44,56738
6	-1594,116	22.73922	4.82e + 12	43.18804	47.77001	45,02639
7	-1573,414	23.00224	6.09e + 12	43.29417	48,61516	45.42902
8	-1549,880	23.24322	7.57e + 12	43,33037	49.39039	45.76173

Source: Author's processed results

From the results of determining the lag it can be seen that the optimal lag that can be used is lag 1 for further testing.

Co-Integration Test

According to (Eroğlu, 2019) at this time many researchers make co-integration test as a test to determine the long-term relationship of the research variable, so that it looks integrated or not. Co-integration test is conducted to find out how the balance of research variables is in the long run. The main thing that is seen from the balance there was movement and stability of the relationship of each variable in this study. The co-integration test used in this study is the Johansen`s co-integration test method.

Table 5 Johansen`s Co-Integration Test Results

Hypothesized No. of CE (s)	Eigenvalue	Trace Statistics	0.05 Critical Value	Prob. **
None	0.245390	37.48256	47,85613	0.3251
At most 1	0.077810	13686889	29.79707	0.8789
At most 2	0.046120	6.302522	15.49471	0.6598
At most 3	0.025731	2.241793	3.841466	0.1343

Hypothesized No. of CE (s)	Eigenvalue	Max-Eigen Statistics	0.05 Critical Value	Prob. **
None	0.245390	24,21367	27,58434	0.1274
At most 1	0.077810	6.666367	21.13162	0.9552
At most 2	0.046120	4,060728	14646460	0.8529
At most 3	0.025731	2.241793	3.841466	0.1343

Source: Author's processed results

Co-integration test results using the Johansen`s method show a trace statistic value of 37.48256 smaller than the critical value of 47.85613 which indicates that in this study there was no co-integration. The trace statistic value of 13.26889 is smaller than the critical value in alpha 0.05 which is 29.79707 indicating there is no co-integration. Then, seen from the maximum Eigen statistical value that is 24.21367, it is smaller than the critical value of 0.05 which is 27.58434 indicating that in the variable there are no co-integrated equations. The statistical max-eigen value of 6.966367 is smaller than the critical value which also indicates there is no co-integration. So, it can be concluded that after the Johansen`s co-integration test was conducted there was no co-integration between variables in the research in the long run. This indicates the movement of bitcoin prices, exchange rates, inflation, gold prices, and interest rates do not have balance and similarity in movement in the long run.

Granger Causality Test

Causality test is performed to determine whether each variable has a causality relationship between one variable and another. In the granger causality test it will be known how causality of each of the two variables. In the granger causality test it can be seen that a variable has a causality relationship with other variables when the probability value is smaller than alpha five percent (0.05). So when the probability is

greater than 0.05, the variable does not have a causal relationship with other variables. From table 7 tab below it can be seen that between a bitcoin with interest rates do not have a causal relationship and do not influence each other. This can be seen from the probability value respectively 0.8413 and 0.4365 greater than alpha 0.05. Between bitcoin and the consumer price index also have no causality relationship. This can be seen from the probability value respectively 0.1274 and 0.6180 greater than alpha 0.05. Between bitcoin, the price of gold and the exchange rate also does not have relationship influential mutual causality and statistical significance.

Table 6 Granger Causality Test Results

Variable	F-Statistics	Probability
Bitcoin with interest rates	0.27779	0.8413
Interest rates with Bitcoin	0.91727	0.4365
Consumer price index with bitcoin	1.95574	0.1274
Bitcoin with a consumer price index	0.59825	0.6180
Exchange rates with bitcoin	0.63499	0.5947
Bitcoin with exchange rates	0.81236	0.4908
The price of gold with bitcoin	0.30373	0.8226
Bitcoin with the price of gold	0.40154	0.7523
Interest rates at the price of gold	0.17172	0.9152
The price of gold at interest rates	1.67303	0.1795
Consumer price index with the price of gold	8,72660	5.E-05
The price of gold with the Consumer Price Index	2,88930	0.0406
Exchange rates with the price of gold	0.62067	0.6037
The price of gold with an exchange rate	0.49170	0.6891
Consumer price index with interest rates	1.06731	0.3678
Interest rates with the consumer price index	0.23714	0.8702
Exchange rates with interest rates	1.89198	0.1377
Interest rates at exchange rates	1,35838	0.2616
Exchange rates with the consumer price index	0.20030	0.8959
Consumer price index with exchange rates	2.91204	0.0395

Source: Author's processed results

This can be seen from the large probability value of alpha 0.05. Interest rates with gold prices are statistically equally significant influence. This can be seen from the probability value respectively 0.9152 and 0.1795 greater than 0.05. The consumer price index has no statistically significant effect on the price of gold. It is characterized by a probability value of 5, 05 greater than 0.05. However, the price of gold has a significant effect on the consumer price index with a probability of 0.0406 less than 0.05. So that there is directional causality between the price of gold with the consumer price index which is a reflection of the inflation rate in Indonesia. The exchange rate and the price of gold do not have a causal relationship because the probability values are 0.6037 and 0.6891, respectively, greater than 0.05. The same thing happens between the consumer price index with interest rates that also do not have a causality relationship. The probability values are 0.3678 and 0.8702, respectively, greater than 0.05. Interest rates with exchange rates also do not have a causality relationship. However, between the consumer price index and the exchange rate there is a direct causal relationship between these variables.

VAR Model Estimation Results

From the estimation results of the VAR model in table 7 a decision was made based on a significant level of alpha value of 0.05. The decision is made by comparing the value of t table with the calculated t value. The t table value in this study at the level of 0.05 is 1.9893. If t arithmetic is greater than the variable is declared to

have a significant effect, and vice versa. From the estimation results it can be seen that bitcoin price growth affects the consumer price index with a value of 1.99763 greater than the value of t table 1.9893. Consumer price index affects the price of gold with a value of 3.47168 greater than the value of t table 1.9893. So it can be concluded that those who have an influence on other variables in the study are bitcoin and the consumer price index, while the exchange rate, interest rates, and gold prices have no significant effect in the study.

Table 7 Estimated Results of the VAR Model

	BTC	BI_RATE	CPI	ER	P_GOLD
BTC (-1)	[8.47442]	[-0.15779]	[1,99763]	[-1.43408]	[1,35599]
BTC (-2)	[-1.03078]	[1.47841]	[-1.20201]	[1,59530]	[-0.96856]
BI_RATE (-1)	[1.09403]	[9,57592]	[1,01196]	[1,25933]	[-0.75149]
BI_RATE (-2)	[-0.98646]	[-1.24458]	[-1.08025]	[-0.70012]	[0.45675]
CPI (-1)	[-0.40364]	[-1.11617]	[9,99827]	[0.66252]	[3.47168]
CPI (-2)	[0.91614]	[0.92548]	[-1.28434]	[0.10076]	[-3,46265]
ER (-1)	[-1.43480]	[0.27788]	[-2,03919]	[5,33989]	[-0.03572]
ER (-2)	[0.08032]	[-1.02825]	[0.58135]	[-0.72286]	[0.45812]
P_GOLD (-1)	[-0,67239]	[-1.00915]	[-2.81418]	[-1.23272]	[7,67110]
P_GOLD (-2)	[0.60236]	[-0.56712]	[0.18157]	[-0.38473]	[-0.06793]
C	[-1.20586]	[2.43355]	[3,04541]	[0.46423]	[1,18910]

Source: Author's processed results

Impulse Response Function (IRF) Analysis

Impulse response analysis is performed with a purpose to examine the surprise response of a variable to other variables in the study. This analysis assumes that each variable in the study does not have a correlation with each other. The final goal of the impulse response function analysis is to find out how long the effect of shock or shock has on other variables. IRF can also be used to see which variable gives the biggest response to variables when shock occurs.

Figure 1 shows the graph of the impulse response function analysis. The vertical axis in the graph illustrates the standard deviation. This value is used to see the response of a variable when a shock occurs. The horizontal axis shows the length of the period of response that occurs after a shock or shock. The existence of a positive response is shown when the response is above the horizontal axis. Conversely, a negative response is shown when the response is below the horizontal axis. IRF analysis of bitcoin as a response illustrates that in the next 25 time periods the highest response is bitcoin to the consumer price index with a positive response which is expected to be stable in the twenty-fourth period. The next highest response is followed by the price of gold which is expected to be stable in the twenty- fourth period. Bitcoin gets a negative response from interest rates which tend to be stable in the twenty-fifth period. Bitcoin response to bitcoin itself is negative and is expected to be stable in the twenty-fifth period. A high response is also seen by the exchange rate which initially gave a negative response in the second to the sixth period and returned to stable to the horizontal axis in the twenty-third period.

IRF analysis with the interest rate gets the highest response from the interest rate itself. The interest rate is expected to stabilize after the twenty-fourth period. Interest rates have received a high and positive response from bitcoin which is expected to stabilize in the twenty-fifth period. Consumer price indexes, exchange rates, and gold prices give a negative response to interest rates. However, when the variable tends to approach the standard value of zero deviation and is expected to be stable in the twenty-second period.

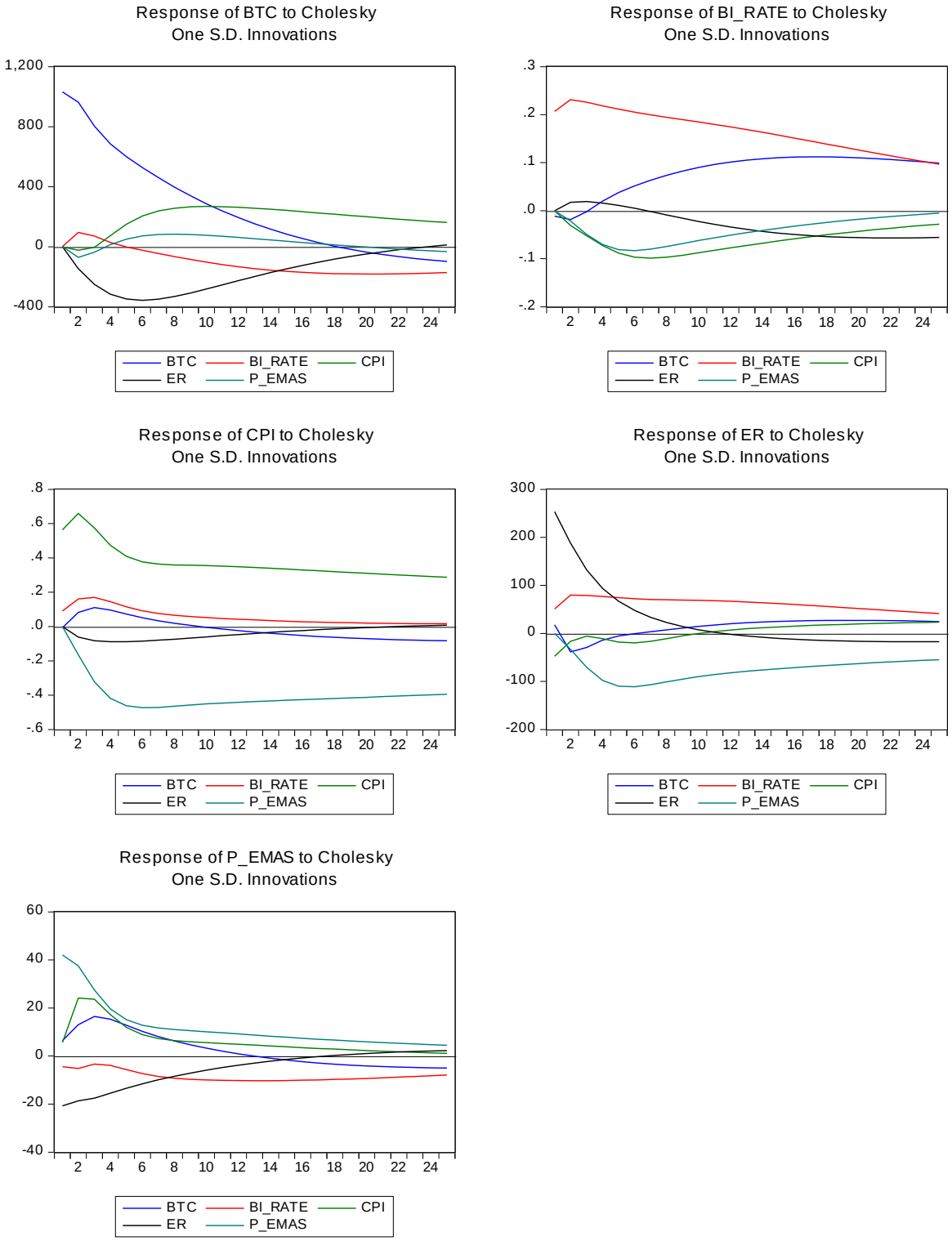

Figure 2 Impulse Response Function (IRF)

Source: Author's processed results

IRF analysis with the consumer price index which shows the highest positive response by the consumer price index itself. The consumer price index is expected to stabilize in the fourteenth period. The highest response is always indicated by the interest rate which tends to approach the standard deviation of zero. Interest rates are expected to stabilize in the seventeenth period. The consumer price index received the highest negative response from the price of gold. However, the price of gold is expected to stabilize in the eighteenth period. A negative response to the consumer price index is also shown by bitcoin which initially showed a positive response in the initial to eighth period and showed a negative response in the ninth. Bitcoin is expected to stabilize in the twentieth period. The exchange rate gives not too high a response to the consumer price index with a graph that tends to approach the standard deviation of zero. The exchange rate is expected to stabilize in the eighteenth period.

IRF analysis with the exchange rate gets the highest response by interest rates. Interest rates are expected to stabilize in the twenty-second period. A positive response to the exchange rate is also shown by bitcoin and the consumer price index which are expected to be stable in the twelfth period. The negative response is shown by the exchange rate itself which is expected to be stable in the sixteenth period. The price of gold also showed a negative response and is expected to stabilize in the seventeenth period.

IRF analysis with the price of gold obtained a fairly positive response from several variables. The highest response is indicated by the price of gold itself which is expected to be stable in the twentieth period. Consumer price index shows a positive response but tends to approach the value of the standard deviation. It is estimated that the consumer price index will be stable in the seventeenth period. The negative response shown by bitcoin and interest rates that are both expected to be stable in the twentieth period. The exchange rate initially showed a negative response to the price of gold, but in the seventeenth period there was a positive response from the exchange rate. It is estimated that the exchange rate will stabilize in the seventeenth period.

Decomposition Variance Analysis (VD)

Decomposition variance analysis is performed with the aim of estimating how much a variable contributes to changing the variable itself and changing other variables in the future. In this decomposition variance analysis, the unit used is the percentage. From table 8 it can be seen that the variables that affect bitcoin and contribute most to bitcoin are bitcoin itself. The table shows how the percentage development and contribution of each variable to bitcoin. Of the 25 periods the largest contribution of bitcoin is at an average of 76.30%. Although the contribution of bitcoin is quite large in the 25 periods, the contribution trend tends to decrease from one period to the period. This can be seen from the percentage of contributions in the twenty-fifth period which only reached 62.78%. The percentage is much smaller when compared to the average contribution of the bitcoin. The smallest contribution was shown by the price of gold which only contributed by an average of 0.64%. A fairly good contribution was given by the exchange rate variable, with an average of 12.87%. Interest rates only contributed by an average of 2.33%, and the consumer price index contributed an average of 7.85%.

Analysis of the decomposition variance of the highest interest rates is influenced by the interest rate itself. The percentage level is also quite high, with an average of 76.18%. However, other variables contributed quite low to interest rates, with an average of only 8.34% of bitcoin, 8.71% of the consumer price index, 5.48% of the price of gold, and 1.27% of the exchange rate. Analysis of decomposition variance on the consumer price index shows that the consumer price index itself and the price of gold are the highest contributors. Consequently, the consumer price index contributed an average of 57.14% and the price of gold with an average of 38.00%. However, other variables make a small contribution to the consumer price index. Consequently, the average contribution of other variables is 0.99% of bitcoin, 2.83% of interest rates, 1.02% of exchange rates.

Table 8 Analysis of the Bitcoin Decomposition Variant

Variance Decomposition of BTC:						
Period	SE	BTC	BI_RATE	CPI	ER	P_GOLD
1	1032,528	100.0000	0.000000	0.000000	0.000000	0.000000
2	1424,616	98.22783	0.451037	0.027162	1.046563	0.247406
3	1656,557	96.15953	0.514412	0.020766	3.072846	0.232449
4	1822,278	93.62652	0.449227	0.180230	5.546435	0.197590
5	1956,564	90.63809	0.389737	0.747312	7,986458	0.238402
6	2069,258	87,53796	0.361921	1,646327	10,11961	0.334174
7	2163,619	84.59333	0.374074	2.716404	11,86785	0.448342
8	2242,047	81.92029	0.433380	3.841753	13.24697	0.557601
9	2306,917	79.54276	0.545171	4.957023	14.30383	0.651217
10	2360,501	77.44293	0.711787	6.028647	15,09070	0.725932
11	2404,864	75.58820	0.932635	7,040738	15,65625	0.782175
12	2441,818	73,94390	1.204656	7.986647	16,04289	0.821907
13	2472,909	72,47866	1.522877	8.864265	16,28660	0.847598
14	2499,422	71,16610	1.880936	9.673638	16,41754	0.861793
15	2522,403	69.98473	2.271585	10.41589	16.46084	0.866952
16	2542,689	68,91733	2,687133	11,09280	16,43735	0.865381
17	2560,938	67.95004	3.119818	11.70663	16,36432	0.859202
18	2577,657	67.07164	3.562127	12.26005	16,25584	0.850335
19	2593,231	66.27292	4.007042	12.75614	16.12342	0.840480
20	2607,945	65,54615	4.448224	13,19827	15,97625	0.831114
21	2622,004	64.88470	4.880139	13.59005	15.82162	0.823486
22	2635,550	64.28279	5.298118	13,93526	15,66520	0.818631
23	2648,676	63,73525	5,698377	1437776	15.51125	0.817373
24	2661,441	63,23737	6.077991	14.50139	15,36290	0.820345
25	2673,875	62.78486	6,434839	14.72994	15,22235	0.828006

Source: Author's processed results

Analysis of decomposition variance on the exchange rate shows that the biggest contribution to the exchange rate is the exchange rate itself with an average contribution of 50.71%. However, the contribution to the exchange rate shows a downward trend from the first period to the twenty-fifth period. This can be seen from the contribution in the twenty-fifth period which reached 33.79% lower than the average contribution. The high contribution to the exchange rate was also shown by the gold price with an average of 26.76%. The price of gold shows a trend of contributions that tends to increase from each period. This can be seen clearly from the percentage contribution of gold prices which reached 36.75% in the twenty-fifth period is greater than the average contribution. Interest rates also showed a fairly high contribution to the exchange rate with an average of 19.05%. If seen further, interest rates also have a positive trend in contributing to the exchange rate. This can be seen from the contribution that tends to increase every period, especially in the twenty-fifth period which reached 24.31% greater than the average contribution. The lowest contribution to the exchange rate is shown by the bitcoin variable and the consumer price index which respectively contributed 1.83% and 1.64% respectively.

Analysis of decomposition variance on the price of gold shows that the price of gold has the highest contribution to itself. The percentage of gold price contribution from the first to the twenty-fifth period reached an average of 50.60%. If observed for a long time there was a shock or shock, the contribution of the price of gold is quite volatile. A fairly good contribution to the price of gold was also shown by the consumer

price index and the exchange rate with an average of 16.17% and 16.69% respectively. Both of these variables have a downward trend in contributions. This can be seen from the contribution value in the twenty-fifth period which is below the average contribution, which is 15.41% and 15.03%. Interest rates provide a positive trend in contributions to the price of gold with an average contribution of 7.17%. However, bitcoin contributes a tendency to decline but is stable, with an average contribution of 9.36%.

Table 9 Analysis of the Interest Rate Decomposition Variant

Variance Decomposition of BI_RATE:						
Period	SE	BTC	BI_RATE	CPI	ER	P_GOLD
1	0.207062	0.287996	99,71200	0.000000	0.000000	0.000000
2	0.313643	0.476692	97.79055	0.958408	0.311976	0.462378
3	0.393468	0.305844	95,05610	2,346113	0.437227	1.854712
4	0.461909	0.407730	91,33719	4.150838	0.437941	3.666296
5	0.523486	0.839561	87,44875	6.076255	0.386273	5.249158
6	0.578903	1.486592	84,07215	7.769218	0.323540	6,348504
7	0.628600	2.280553	81.37811	9,065919	0.275179	7,000235
8	0.673335	3.185165	79.26344	9,969761	0.257122	7.324511
9	0.713914	4.170627	77.56566	10.55398	0.278011	7.431718
10	0.751008	5.208224	76.14872	10,90046	0.340771	7.401829
11	0.785119	6,271909	74,91845	11,07731	0.444225	7.288107
12	0.816613	7.339811	73,81512	11.13549	0.584557	7.125022
13	0.845757	8.394578	72.80242	11.11168	0.756493	6.934823
14	0.872757	9.423017	71.85883	11,03199	0.954172	6.731992
15	0.897776	10.41548	70.97166	10.91509	1.171724	6.526055
16	0.920951	11,3655	70.13342	10.77444	1.403627	6.323298
17	0.942398	12,26777	69,33967	10,61982	1,644903	6.127837
18	0.962224	13,12051	68,58766	10,45834	1.891202	5.942288
19	0.980524	13,92217	67,87561	10.29518	2.138815	5.686820
20	0.997388	14.67257	67,20227	10.13405	2.384648	5.606464
21	1.012901	15,37231	66,56662	9.977568	2.626175	5,457326
22	1.027144	16.02258	65,96775	9.827542	2.861374	5.320751
23	1.040195	16.62502	65.40473	9.685159	3,088667	5.196428
24	1.052129	17.18154	64.87658	9.551138	3.306857	5.083881
25	1.063019	17.69426	64.38228	9.425854	3.515074	4.982522

Source: Author's processed results

Table 10 Analysis of the Decomposition Variant of the Consumer Price Index

Variance Decomposition of CPI:						
Period	SE	BTC	BI_RATE	CPI	ER	P_GOLD
1	0.570849	0.014280	2.489380	97.49634	0.000000	0.000000
2	0.908323	0.842190	4.131168	91,31428	0.453809	3.258555
3	1.143273	1.463179	4.814487	82.90794	0.812457	10.00194
4	1,321107	1.624748	4.816140	74,97460	1.060696	17.52381
5	1.467014	1.561507	4,524001	68.58055	1.223854	24.11009
6	1.592746	1.428052	4.171260	63.78194	1.323289	29.29546
7	1,704377	1.286381	3,843179	60.25999	1.374985	33,23546
8	1.805560	1.157560	3.557907	57.65672	1.391377	36,23644
9	1.898640	1.048060	3.312589	55.68472	1.382395	38.57223
10	1.985157	0.959221	3,100254	54,14050	1.355878	40,44415
11	2.066160	0.890469	2.914557	52.88841	1.317862	41,98870
12	2.142403	0.840461	2.750611	51,84062	1.272881	43.29543
13	2.214461	0.807522	2.604777	50,94049	1.224265	44.42295
14	2.282792	0.789846	2,474306	50.15097	1.174409	45.41047
15	2,347776	0.785599	2.357052	49,44710	1.124990	46.28526
16	2.409727	0.792986	2.251286	48.81143	1.077147	47,06715
17	2.468916	0.810301	2.155572	48.23136	1.031617	47.77115
18	2,525568	0.835953	2,068699	47,69748	0.988845	48.40902
19	2.579881	0.868489	1,989634	47.20265	0.949059	48.99017
20	2.632023	0.906592	1.917491	46,74130	0.912337	49,52228
21	2,682141	0.949088	1.851501	46.30908	0.878648	50111168
22	2,730365	0.994935	1.791004	45.90252	0.847889	50.46365
23	2.776807	1.043222	1.735423	45,51882	0.819910	50,88262
24	2.821569	1.093155	1,684257	45.15570	0.794530	51.27235
25	2.864743	1.144049	1.637069	44.81128	0.771556	51.63604

Source: Author's processed results

Table 11 Analysis of Exchange Rate Decomposition Variants

Variance Decomposition of ER:						
Period	SE	BTC	BI_RATE	CPI	ER	P_GOLD
1	263.5862	0.450098	3.722077	3.251444	92,57638	0.000000
2	337,6851	1.559522	7.870351	2.221102	87.38450	0.964523
3	378,9300	1.834133	10.57195	1.785979	81.59300	4.214946
4	410,0897	1.683336	12.54627	1.593764	74.88908	9.287547
5	436.7045	1.499669	13.98663	1.575710	68.39881	14,53918
6	459.3288	1.355707	15.12182	1,609446	62,91457	18,99845
7	478.3358	1.255394	16.13213	1.601858	58.50618	22.50444
8	494,5171	1,197115	17.09602	1.546430	54.94855	25,21188
9	508.6793	1.179865	18,02496	1.471256	52.00812	27.31580
10	521,4156	1.201465	18.90486	1.400259	49,51865	28.97476
11	533,0996	1.257981	19.71905	1.345275	47.37346	30.30424
12	543.9513	1,344241	20.45666	1.309802	45.50357	31.38573
13	554,1002	1.454537	21.11359	1.293437	43.86166	32.27678
14	563.6258	1.583186	21,69075	1.294463	42.41278	33,01882

Table Cont...

15	572.5819	1.724871	22,19220	1.310978	41.12943	33.64252
16	581.0088	1.874832	22.62354	1.341251	39.98910	34.17128
17	588.9396	2,028935	22,99099	1.383788	38.97294	34,62335
18	596.4032	2.183674	23,30082	1.437291	38,06495	35,01327
19	603.4259	2,336154	23.55907	1,500618	37.25142	35,35275
20	610.0318	2.484035	23.77139	1.572750	36.52059	35.65124
21	616.2441	2.625486	23,94300	1.652764	35,86231	35,91644
22	622.0848	2.759122	24,07868	1.739819	35,26777	3615460
23	627.5750	2.883953	24,18275	1.833142	34,72935	36.37080
24	632.7351	2,999322	24.25913	1.932018	34,24036	36.56917
25	637.5848	3.104859	24,31131	2.035784	33.79501	36.75304

Source: Author's processed results

Table 12 Analysis of Decomposition Gold Price Variants

Variance Decomposition of P_EMAS:

Period	SE	BTC	BI_RATE	CPI	ER	P_GOLD
1	47.89406	1.776069	0.867138	1.380905	18,73248	77.24341
2	69,48723	4.363244	0.965728	12,73065	16.12218	65,81820
3	82.02037	7.160632	0.857377	17.42602	16.12418	58.43179
4	88.88588	9,093105	0.922636	18.60301	16,74443	54,63682
5	92,98410	10.19808	1.214545	18,65237	17,37029	52,56471
6	95.81247	10,74962	1.729607	18.42093	17,80941	51.29043
7	98.00142	10,95865	2.405162	18.15562	18,04150	50.43907
8	99.81176	10.95959	3.173832	17,91930	18,10315	49,84413
9	101.3640	10.83918	3,989398	17.71994	18,04014	49.41134
10	102.7241	10.65517	4.824668	17.54959	17,89211	49,07846
11	103,9346	10.44621	5.663437	17,39746	17.68959	48.80331
12	105.0262	10.3778	6,494758	17.25449	17.45498	48.55800
13	106,0228	10,04625	7.310064	17.11449	17,20441	48.32478
14	106,9428	9.881590	8.102064	16.97392	16,94943	48,09299
15	107,8004	9,749209	8.864500	16.83118	16,69831	47,85680
16	108,6059	9.651280	9.592212	16,68595	16.45690	47,61366
17	109.3667	9.587676	10.28122	16,53873	16.22918	47.36320
18	110.0880	9.556689	10.92873	16,39041	16,01776	47,10641
19	110.7734	9.555573	11.53307	16,24214	15,82410	46,84512
20	111,4252	9.580965	12.09355	16,09510	15,64884	46.58154
21	112,0449	9,629,199	12,61035	15,95043	15.49196	46.31806
22	112.6335	9.696537	13848432	15.80921	15,35295	46.05700
23	113.1917	9.779339	13,51683	15,67236	15,23096	45,80052
24	113,7199	9,874171	13.90970	15,54068	15.12491	45,55054
25	114,2187	9,777,885	14,26500	15,41480	15.03359	45.30872

Source: Author's processed results

Conclusions

The position of bitcoin in Indonesia has now been determined as a commodity by Bappeti in early 2019. This is marked by the issuance of four new regulations that form the legal basis for bitcoin in Indonesia. However, before 2019 bitcoin transactions already existed in Indonesia. After a number of tests, it was found that from 2012 to the beginning of the semester in 2019 there was no long-term co-integration between bitcoin, exchange rates, interest rates, gold prices, and consumer price indexes. This means that there is no balance and equality of movement in the long run between variables. However, causality is found that there is directional causality between the price of gold with the consumer price index and the consumer price index with the exchange rate. After further stimulation, bitcoin is known to have a significant effect on the consumer price index, and the consumer price index also has an effect on gold prices. After forecasting used Impulse Response Function, it is known that there exist t positive and negative response of each variable to another variable in the event of a shock. On average all variables will be stable in the eighteenth period. As for who contributes to each variable when there is a shock is more dominated by the variable itself.

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