



Correlation of Financial Innovation, Stock Market, Cryptocurrency on Economic Growth

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Indonesia has had the critical issue of economic growth in the last ten years which the trend of economic growth was declining year by year, in 2011 GDP growth YoY was 6.5% then declined become 5% in 2019 (before Covid-19 pandemic) and worst in Pandemic Era become -5.3%. This research aims to provide an understanding of the effect of short term and long term of Financial Innovation, Stock Market and Cryptocurrency on Indonesia's economic growth using the Vector Error Correction Model (VECM) method. The method was chosen based on Stationary Analysis and Cointegration Test. It is shown that the data was non-Stationary and the result of Cointegration Test there was a cointegration at 0.05 level. Enrich with the analysis in Impulse Response and Variance Decomposition to obtain the fluctuated economic growth impacted by those variables on a monthly basis, which previous researchers have not researched. The results showed that the correlation of the Stock Market, Financial Innovation and Cryptocurrency to Indonesia's economic growth, in the long run, all the variables give a positive correlation. Still, in the short-run, only the stock market and economic growth give a positive correlation. The result of the long and short run of VECM is supported by Impulse response and variance decomposition that stock market has the most significant impact to economic growth.

INTRODUCTION

Researching the driven factors of economic growth is challenging for Regulators and Researchers. In this paper, the economic growth as measured by GDP growth quarterly basis (Rudriger, 2006), Indonesia as emerging country face the critical issue of economic growth in the last ten years which the trend of economic growth was decline year by year, as shown in

Figure 1. in Q1 2011 GDP growth YoY was 6.5% then decline become 5% in Q4 2019 (before Covid-19 pandemic) and worst in Q2 2020 was -5.3% (the first quarter of Covid-19 pandemic). The Covid-19 pandemic, which started transmitted globally according to WHO was in March 2020, impacted to health, social and economic aspect, according to IMF's report (IMF, 2020), GDP as global has declined 4.9% in Q2 2020 due to economic disruption.

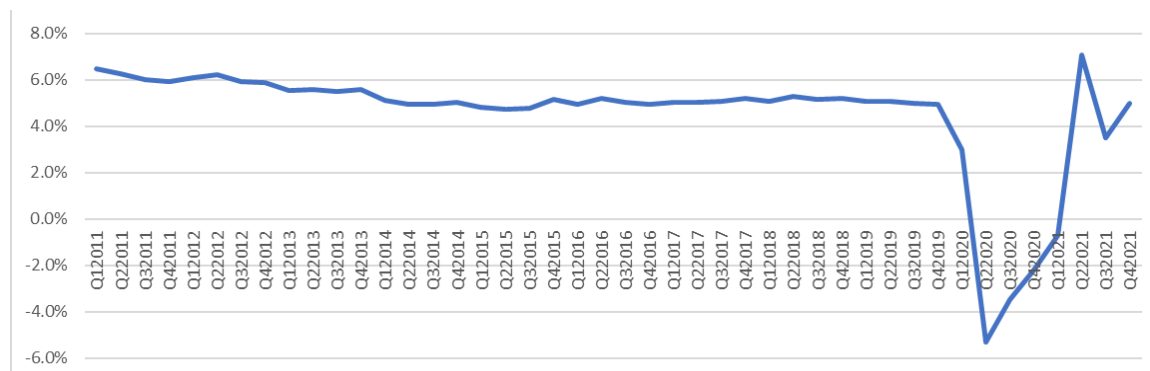


Figure 1. Indonesian Gross Domestic Product Growth

Source: Data Processed, 2022

Encountering the pandemic, Central Banks Globally release some policies such as increasing the scale of asset purchase, enhanced liquidity provision and limited the borrowing cost, the action followed by Financial Regulators by modify the policy of bank loan repayment terms and release of capital and liquidity buffers to support supply and quality of credit (GFSR, June 2020). Financial Authority Services of Indonesia (OJK) during the pandemic release some policies in the financial sector, such as POJK No. 11/POJK.03/2020, renewed by POJK no.48 /POJK.03/2020, the policy regarding financing restructuring such as asset quality assessment, for example, decrease interest rates, more extension of the credit's period, lower of principal arrears, decrease in interest arrears, offering credit facilities, offering conversion credit, and setting temporary Equity Participation, etc.

Several researches have been done to investigate various proxy variables of economic growth such as financial development, financial innovation, capital market development, foreign direct investment, and initial coin offering. Some

researchers have conducted the correlation between financial development and economic growth with the result is positive correlation across the countries such as Azam et al. 2016; Qamruzzaman & Wei (2018), financial development consists of both banking Industry and capital market. According to Liang & Reichert 2007, the Advanced financial sector is measured by broad money (M2), money market mutual funds and, innovative financial products in the stock market and prudent risk management. Azam et al. (2016), come out with the research result that there was a correlation between economic growth, foreign direct investment stock market and inflation in China, Singapore, Bangladesh and India.

Digital Finance such as Initial coin offerings (ICOs) is a new alternative to generate capital, especially for venture capital and angel finance (Howell, 2020). The various alternatives for business will impact to productivity and then increase economic growth as well. However, the example of ICOs such as bitcoin in Indonesia could be treated as investment products which not directly related to productivity; according

Kusumastuty et al., (2019) Bitcoin is the famous cryptocurrency in Indonesia, almost 50% who are understand cryptocurrency will know bitcoin and tread it as investment product.

Financial innovation is driven by financial development in process, service and new product alternatives. Information Technologies savvy creates a great room for better customer services, financial management efficiency and at the same time optimizes the accumulation of capital allocation. (Ansong et al. 2011). Implementation of technological innovation in financial development create sustainable economic growth in the long run (Chou and Chin 2011; Orji et al. 2015). Financial innovation also impacts to productivity and the result increase economic growth (Silve and Plekhanov 2014). Financial institution has function as an intermediary body of funding unit and lending unit, financial innovation creates the role of better financial support in trading and commerce activity (Shittu 2012; Cheng and Degryse 2014).

However, there is a possibility of financial innovation driven by risk/return incentives for an individual as well as institution player. Financial innovation will give a positive impact if it can reduce the cost of capital without an increase in systemic risk (Qamruzzaman & Wei, 2018). A ration of broad could measure financial innovation to narrow money (M2/M1) which indicates the real cash balance and income elasticities, has been done by Ansong et al. (2011); Bara & Mudzingiri (2016); Qamruzzaman & Wei, (2017); Qamruzzaman & Wei, (2018). Bank Indonesia as regulator and guardian of monetary policy setting the number of Broad Money (M2) and Flexible Inflation Targeting Framework (ITF). The number of M2 was monitored in the purpose to achieve the target inflation to control pricing and economic system.

A well-established capital market, especially stock market, directly impacts productivity and increases economic growth, Barna and Mura. (2010); Cooray. (2010); Shin. (2013). However, Husain. (2006) had different opinions that stock markets in developing countries have little impact on economic growth,

including Indonesia, while Ghosh and Revilla (2007), Lipinsky and Ong (2014) reported not effectiveness and not full capacity of Asia's stock markets. The stock market in Indonesia is under-regulated by Indonesia Stock Exchange (IDX), reactivated in 1977, IDX was not operated during 1956 – 1977 due to nationalism progress from Dutch's companies by the Indonesian Government. According to Indonesia Stock Exchange (IDX), one of the performance indicators is represented by the Indonesia Stock Exchange Composite (IDX Composite), which measured the aggregate performance of main board and development board stock in IDX.

Some studies regarding the correlation between GDP and stock market have been done, with the result is a significantly positive relationship between GDP and stock market performance in India (Reddy 2012); and Indonesia (Setiawan, n.d. 2018). According to Azam et al. 2016; in Bangladesh, China, India and Singapore; stock market development has a significant function in economic growth. According to Director of Trading and Member of the IDX, CNBC, 2021; during the pandemic, there was an increase in transactions from domestic retail investors. This is a positive catalyst to reduce the pressure on the stock market which the large capital outflows have shaken since the beginning of this year. During the pandemic, the number of retail customers increase significantly 70% compared to the last year with 51% of trading have been done by retail transactions.

The new digital era in financial transaction, has created the new money as transaction and investment tools, name cryptocurrency. According to Briere et al. (2013), Bitcoin is one of popular cryptocurrencies used as a financial instrument and alternative investment with diversification benefits. Cryptocurrency is a digital currency and has a unique character compared to fiat money, because cryptocurrency has a decentralized system which means no relationship with Government or any party; everyone can manage and produce it according to consensus and has a supply limitation, however since cryptocurrency has been trade as

digital money and new investment tools, it could give effect to supply and demand of production globally. The correlation of cryptocurrency among the monetary variable of Indonesia has been conducted by Kusumastuty et al., 2019 using VAR method with the result at the first-period inflation and interest rate don't have a significant impact; the impact showed at the second period.

Based on the explanation above, it is important to understand the variable of Indonesia's economic growth from the point of view financial innovation, development of the stock market and pricing of cryptocurrency in Indonesia Rupiah.

RESEARCH METHODS

The data is processed using Eviews 9 with quantitative descriptive analysis method and if the data used is stationary at the level using Vector Autoregression (VAR) analysis tool, but if the data used is stationary at the first difference thus using Vector Error Correction Model (VECM). VECM provides easier procedure to analyze the long-run and short-run effects from the data process. Thus VECM can be used to model cointegrated and non-stationary time series data it become VECM is different from VAR, so VECM is often referred to as the restricted form of VAR (Sulistiana, 2017).

The VAR method was first discovered by Sims in 1980 and is a multivariate analysis that provides a systematic way of capturing dynamic changes in multiple time series, and has a credible and easier to understand approach to data description and forecasting, structural inference, and analysis policy. The estimation results of the VAR model can be seen through the Impulse Response Function (IRF) and Variance Decomposition (VDC) of a variable against other variables or against itself, both IRF and VDC.

VECM, which Johansen and Juselius developed in 1990 as a VAR-stricted from concept, offers an easy working procedure to separate long-term and short-term components. This additional restriction is given due to the existence of non-stationary data forms at the level

level, so the VECM model can be used to model the data (Sulistiana, 2017). This is in accordance with the research objective, namely to determine the long-term and short-term contribution of Islamic banking to Indonesia's economic growth.

The VAR method was first discovered by Sims in 1980 and is a multivariate analysis that provides a systematic way of capturing dynamic changes in multiple time series, and has a credible and easier to understand approach to data description and forecasting, structural inference, and analysis. policy. The estimation results of the VAR model can be seen through the Impulse Response Function (IRF) and Variance Decomposition (VDC) of a variable against other variables or against itself, both IRF and VDC. VECM, which Johansen and Juselius developed in 1990 as a VAR-strict from concept, offers an easy working procedure to separate long-term and short-term components. This additional restriction is given due to the existence of non-stationary data forms at the level level, so the VECM model can be used to model the data (Sulistiana, 2017).

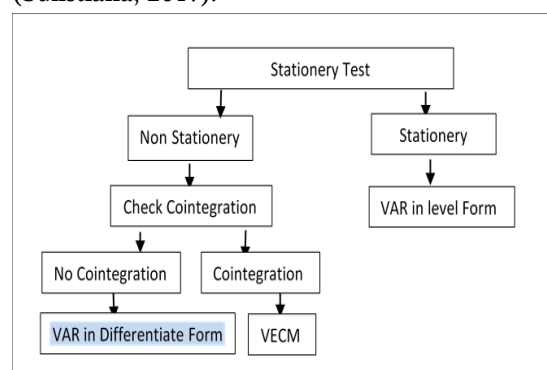


Figure 2. Model Development How to Choose VAR/ VECM.

Source: Riffin & Feryanto, 2021

In the cointegration test, the presence or absence of cointegration is based on the Trace and Max Eigen tests. If Trace-statistic value is smaller than the critical value, then (no cointegration) is accepted, it means the model is VAR in Differentiate Form. If the Trace-statistic value be greater than the critical value then (there is cointegration) received, it means the model is VECM.

The basic equation of VECM according to (Emy Widyastuti & Nena Arinta, 2020) will be as follows:

$$\Delta Y_t = \mu_{0x} + \mu_{1x}^t + \pi_x Y_{t-1} + \sum_{k=1}^{i=1} rix \Delta Y_{t-1} + et \dots\dots\dots (1)$$

Where, Y_t is Variables Vector in the obtained analysis, μ_{0x} is Interception Vector, μ_{1x} Coefficient Vector, t is time trend, $\pi_x = \alpha x$ is βy included cointegration equation Y_{t-1} is variable in level, rix is Matriks of regression coeffisien, dan et is error term.

The applied VECM equation for this research based on the elaboration of equation (1):

$$\Delta GDP_t = \mu_{0x} + \mu_{1x}^t + \pi_x GDP_{t-1} + \sum_{k=1}^{i=1} \Delta rix IDX_{t-1} + \sum_{k=1}^{i=1} \Delta rix BITC_{t-1} + \sum_{k=1}^{i=1} \Delta rix M1/M2_{t-1} + et \dots\dots\dots (2)$$

Where, GDP is Indonesia Growth Economic, IDX is Stock Market, BITC is Cryptocurrency, and M1/M2 is Financial Innovation.

Based on the Cointegration Test Criteria using MacKinnon-Haug-Michelis, the result of the model in this research is VECM which is at least cointegration as shown in Table 13, in Result and Discussion point.

Based on Literature, the hypothesis in this research that there was correlation among Financial Innovation (Silve and Plekhanov 2014), Stock Market (Barna and Mura. 2010; Cooray. 2010; Shin. 2013), Cryptocurrency (Kusumastuty et al., 2019) and Indonesia's Economic Growth will be analyzed using Impulse Response Test.

The data used in this study is secondary data in the form of quarterly data from Q1 2016 to Q4 2021, Time period is 5 years has included financial crisis due to Subprime mortgage in 2018 , COVID 19 in Indonesia started in the beginning of 2020. The variables data was chosen based on the literature research has been done by Ansong et al. 2011, Kusumastuty et al., 2019, Barna and Mura. 2010. Variable's definition and data sources as shown in Table 1.

Table 1. Research Data Descriptions

Variable	Description	Source of Data	Measurement
Financial Innovation (M1/M2)	M1/M2	Central Bank Indonesia	Percentage (%)
Stock Market (IDX)	IDX Composite	Indonesian Stock Exchange (IDX)	Logarithmic Natural (LN)
Cryptocurrency (BITCOIN)	Bitcoin's Transaction	Coin market cap	Logarithmic Natural (LN)
Indonesia Growth Economic (GDP)	GDP quarterly	Central Bureau Statistics Indonesia	Percentage (%)

Source: Data Processed, 2022

The measurement of GDP consists of two type, first is nominal GDP and the second is real GDP. The definition of nominal GDP is the value of goods and services measured at current prices, which can increase either because prices rise or quantities rise. While the definition of

Real GDP is the value of goods and services measured using a constant set of prices (Mankiw, 2010:24). In this research, the author uses the real GDP to measure GDP growth. Description of data statistic in Table 2, which explain the distribution of data:

Table 2. Statistic Data Variable

	GDP	IDX	BITC	M2/M1
Mean	3.67	8.66	18.27	3.91
Max	5.02	8.70	18.42	3.90
Median	7.07	8.79	20.56	4.30
Min	5.32	8.42	15.52	3.40
Std. Dev	-3.17	-0.11	-1.43	-0.18
Skewness	1.80	0.79	0.30	0.54
Kurtosis	4.90	2.37	2.30	4.36
Jarque-bera	16.55	2.89	0.84	3.01
Probability	0.00	0.24	0.66	0.22
Sum	88.03	207.79	438.54	93.90
Sum Sq. Dev	231.18	0.26	47.32	0.77
Observation	24.00	24.00	24.00	24.00

Source: Data Processed, 2022

The standard deviation is a measurement of variance data to the mean, which the higher the standard deviation is, the higher of the variance data to the mean. Based on Table 232, shows that only economic growth (GDP) has the biggest amount (3.17) while other variables have less amount.

In order to enhance the research about economic growth, in this paper will be conducted analyze the impulse response and variance decomposition of economic growth. By analyzing through this method, we expect to understand the response in monthly basis and

how much the contribution of each variable to the economic growth.

RESULTS AND DISCUSSION

The result of the Stationery test using Unit Root Test was stationary in level 1 and the result of the cointegration test based on MacKinnon-Haug-Michelis shown that there are 1 cointegrating equation at level 0.05 as shown in Table 343. As explained in Figure 2. How to Choose Model VAR/ VECM, if there is a cointegration, then the proper model is VECM.

Table 3. Cointegration Test

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.84	68.23	63.87	0.02
At most 1	0.46	28.67	42.91	0.58
At most 2	0.36	15.45	25.87	0.53
At most 3	0.24	5.93	12.51	0.46

Source: Data Processed, 2022

Where, Trace test indicates the value of 1 cointegrating eqn(s) at the 0.05 level. *denote rejection of the hypothesis at the 0.05 level, and **MacKinnon-Haug-Michelis (1999) p-values.

The purpose of Cointegration test is to analyze whether there is a cointegration in the residual regression, if there is a cointegration, it means the correlation among the variables will be stable in the long run.

Table 4. Equation Long Run of VECM

Variable	Coefficient	Std. Error	t-Statistic
GDP	0.03	-0.00	-9.88
BITC	0.10	-0.01	-6.92
M2/M1	0.73	-0.16	-4.51
IDX	0.01	-0.00	-3.40

Source: Data Processed, 2022

The equation of VECM for the long run as shown in Table 4. Coefficient of Variables has positive sign, it explains that in the long run financial innovation, Cryptocurrency prices, Stock market prices and economic growth has positive correlations. This result was in line with the result of some researchers, as mentioned by Silve and Plekhanov, 2014 for financial innovation, Reddy 2012 and Setiawan, n.d. 2018 for the stock market.

Table 5. Equation Short Run of VECM

Variable	Coefficient	Std. Error	t-Statistic
CointEq1	-23.64	-19.93	1.19
D(IDX(-1))	0.47	-18.67	-0.03
D(IDX(-2))	-7.12	-11.01	0.65
D(GDP(-1))	0.06	-0.44	-0.14
D(GDP(-2))	-0.09	-0.26	0.34
D(BITCOIN(-1))	-1.16	-1.36	0.85
D(BITCOIN(-2))	-0.72	-1.15	0.63
D(M2M1(-1))	-17.94	-13.75	1.31
D(M2M1(-2))	-8.77	-7.77	1.13
C	-0.04	-0.70	0.05

Source: Data Processed, 2022

While in the short run, the equation of VECM as shown in Table 5. In short-run correlation among the variables as shown in Table 5, the positive coefficient in Stock Market in difference level 1 and economic growth in difference level 1 while others have negative correlation.

The Response of Economic growth (GDP) to the fluctuated movement of other variables was analyzed using Impulse Response Test. The response of economic growth will be recorded in a monthly basis through X-axis, and the amounts of responses in percentage, if there are shocks in one standard deviation at other variables, will be described in Y-axis.

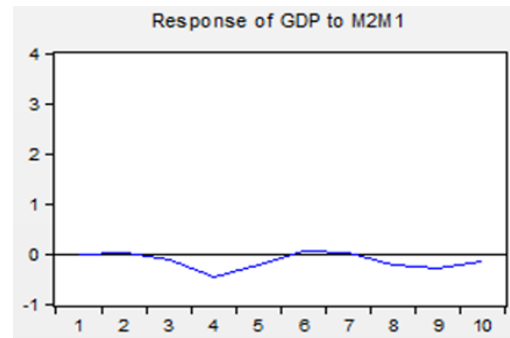


Figure 3. Respond Economic Growth to Financial Innovations.

Based on Figure. 3. If there is a shock in Financial Innovation (M2/M1) then the response of economic growth (GDP) up to 3 months earlier there are no respond, and will be recorded -1% during 3 months up to 6 months.

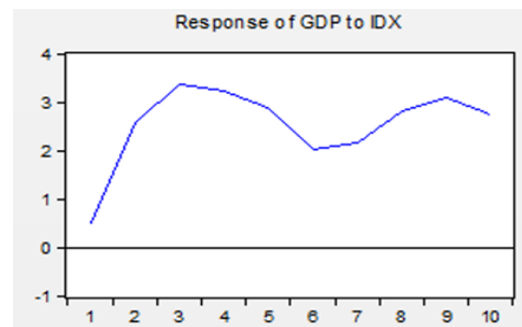


Figure 4. Respond Economic Growth to Financial Innovations.

Economic growth showed more responsive to the shock in the stock market, in Figure 4. the response can be obtained since the first month and become responsive at around 3.5% in the third month. Therefore, it is important to maintain the stability of the stock market.

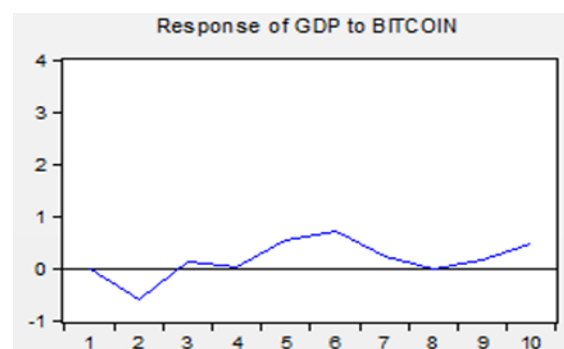


Figure 5. Respond Economic Growth to Cryptocurrency

The shock in cryptocurrency will be responded by economic growth after the first month, and the response becomes positive respond below 1% after the third month as shown in Figure 5

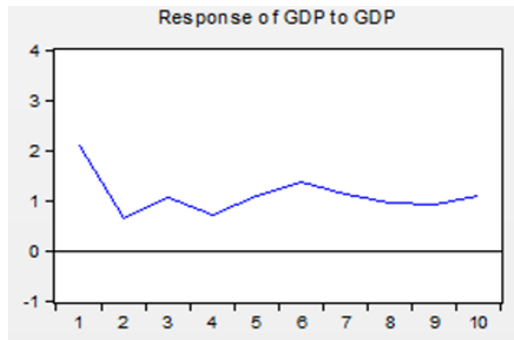


Figure 6. Respond Economic Growth to Economic Growth

Figure 6. explains that the shock in economic growth will be impacted to economic growth itself, in the earlier of second month the negative respond from 2% up to 1% will be impacted to economic growth and will be stable around 1% in the following month.

Table 6. Variance Decomposition of GDP

Period	S.E.	IDX	GDP	BITC	M2M1
1	2.13	5.35	94.65	-	-
2	3.45	57.49	39.37	3.14	0.01
3	4.93	74.71	23.63	1.59	0.07
4	5.96	80.64	17.60	1.09	0.67
5	6.73	81.44	16.43	1.48	0.65
6	7.19	79.22	17.96	2.24	0.58
7	7.60	79.10	18.29	2.10	0.52
8	8.16	80.47	17.19	1.82	0.52
9	8.78	81.89	15.95	1.60	0.55
10	9.27	82.10	15.70	1.67	0.53

Source: Data Processed, 2022

Variance decomposition of the movement economic growth in the 10 months was recorded in table 6. At the third month, it is shown that 74.7% economic growth fluctuated was caused by stock market, 1.5% by cryptocurrency and only 0.07% by financial innovation. The impact of stock market becomes bigger in the following month then in the tenth month it become 82.1% while cryptocurrency become 1.67% and 0.53%

in financial innovation. Thus, the result of variance decomposition of economic growth is aligned with the result of impulse response in Figure 4.

The comparison of this research with other research that in the long run financial innovation, Cryptocurrency prices, Stock market prices and economic growth has positive correlations. This result was in line with the result of some researchers, as mentioned by Silve and Plekhanov, 2014 for financial innovation, Reddy 2012 and Setiawan, n.d. 2018 for the stock market.

According to Indonesia Financial Authority (OJK), some actions was taken by Indonesia government in order to increase the performance and keep the stability of stock market and financial innovation such as, released permission of online register for investor in stock market, during the pandemic era there are phenomena the increasing of retail investor especially millennial generation, based on Indonesia Stock Exchange, the growth of new investors in 2011 is 103% and 81% of them are Millennial (Director of Stock Exchange Indonesia – CNBC, 2022). Even though the number of Initial Public Offering (IPO) has been decreased during the pandemic in 2020 up to 2022, but there were some attractive such as Mitral (State Owner company), Bukalapak and GOTO (digital startup companies). Foreign Capital Outflow in March 2020 during the first pandemic has been recover to Net Inflow which make Stock Exchange become more stable. In Financial Innovation, Bank Indonesia as regulator and guardian of monetary policy setting the number of Broad Money (M2) and Flexible Inflation Targeting Framework (ITF). The policy regarding cryptocurrency in Indonesia is treat cryptocurrency as a commodity and it is not allowed as legal money/ digital money. The regulation was written in Peraturan Badan Pengawas Perdagangan Berjangka Komoditi Number 5/2019, The regulation defines crypto-assets as intangible commodities in the form of digital assets, using cryptography, peer to peer networks, and distributed ledgers to set up new

units, verify transactions, and secure transactions without interference from other parties.

CONCLUSION

The correlation of stock market, Financial Innovation and Cryptocurrency to Indonesia economic growth in this paper has been conducted by VECM and the result in line with previous researcher, that in the long run all the variable give positive correlation, but in short-run only stock market and economic growth give positive correlation. The result of long and short run of VECM is supported by Impulse response and variance decomposition that stock market has the biggest impact to economic growth. Since stock market was influenced by foreign capital, Government should put prioritize action if there are capital outflow and encourage retail to be more familiar with stock exchange. External factor that impact to stock market volatile is interest rate which setting by Federal Reserve USA, Exchange Rate of USD-IDR, the volatile of commodity and mining price in global market since attractive share in Indonesia are belong to commodity and mining production.

Financial Innovation and Cryptocurrency give impact to economic growth in long run, since it takes more time to adjust financial innovation to economic growth, however since the number of money circulate in market can impact to inflation and will be impact to interest rate then it is also can impact to stock market. Cryptocurrency will be give more impact to economic growth if it is treated as legal money in trading.

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