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Dynamic Model of Digital Money Circulation in Indonesia Dual Economic System

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Abstract

Background: Bank Indonesia has undertaken pilot projects for Digital Rupiah, known as w-Digital Rupiah and r-Digital Rupiah. **Purpose:** This study aims to analyze the dynamic causal relationship model of digital money in Indonesia as the effect of implementing a dual economic system. **Method:** Vector Autoregressive (VAR), Vector Error Correction model including Granger Causality Test, Impulse Response Function and Variance Decomposition.
Results: The results indicate that the circulation of digital money is cointegrated and has a long-term causal relationship with economic growth, with a long-term balance adjustment speed of 24.22%. There is a positive response from Digital Money to Economic Growth shocks, with a response time of one month. However, there is no cointegration or causal relationship to the profit loss-sharing rate. **Practical implications:** The results suggest that monetary authorities should consider Islamic banks when implementing monetary policy in Indonesia.
Keywords: Dynamic Causal Relations, Digital Money, Profit Loss-Sharing Rate, Economic Growth.

Introduction

The money underwent a significant transformation. Digital money in the form of a virtual currency is a milestone in the transformation of modern money (Galdeano et al., 2019; Habib, 2021). There has been much discussion in recent years regarding the potential and effect of the Central Bank Digital Currency on the economy, and whether paper money will be reduced or eliminated from monetary circulation. What is the optimal monetary policy that maximizes welfare between the use of paper money and digital money? How much welfare will be achieved by using digital money in the economy? The Central Bank Digital Currency is a digital form of fiat currency that is issued and backed by a central bank and designed to be a digital version of physical cash, providing a secure and convenient means of payment and store of value.

Digital money has several potential benefits, including increased efficiency and security payments, reduced costs associated with cash management, and greater financial inclusion for people who are unbanked or underbanked. However, there are also potential risks and challenges associated with digital money, including the need to ensure cybersecurity and protect against fraud, the potential for disintermediation by commercial banks, and the potential impact on monetary policy and financial stability.

Several central banks have made decisions regarding the use of digital money in the economy, including Sweden's Riskbanks, which have issued digital money called e-krona (Davoodalhosseini, 2021). China has also issued digital money to support the digital economy. Bank Indonesia launched a digital money cash-like model to be used as a digital currency issued by the Central Bank. Other countries, such as the United States and European Union, are currently exploring the possibility of launching digital money in the future.

Several countries are currently exploring or implementing central bank digital currencies in various ways. Since 2020, China has been testing its digital yuan in various cities. It is retail digital money designed for every transaction and is backed by the People's Bank of China. Sweden's Riskbank is currently conducting a pilot project on e-krona. The Bahamas launched the Sand Dollar in 2020, a retail digital money aimed at impoving financial inclusion in the country.

The Bank of Canada is currently exploring the possibility of launching retail digital money with several research projects underway. The European Central Bank is conducting a two year investigation into the possibility of launching a digital euro, which would be retail digital money. The Federal Reserve is currently conducting research on the potential benefits and risks of a digital dollar, and several bills related to the dollar have been introduced in Congress.

The Bank of Japan launched a proof-of-concept project for its digital money, which is wholesale digital money designed for large value payments between financial institutions. The Bank of England launched a task force to explore the potential benefits and risks of a digital pound, which would be retail digital money. The central bank of Malaysia, Bank Negara Malaysia (BNM), has been actively exploring the potential of launching a digital currency central bank. In June 2021, BNM issued a discussion paper on the topic of digital money, outlining the potential benefits, risks, and design considerations.

The study highlights that digital money could provide benefits such as improving the efficiency of the payment system, enhancing financial inclusion, and reducing cash management. However, there are potential risks related to financial stability and cyber and privacy risks that need to be managed. In addition, BNM has been conducting trials and experiments on digital money, collaborating with both domestic and international partners in May 2021, and announced that it had entered into a partnership with the central banks of Thailand, Hong Kong, and the United Arab Emirates to explore the potential use of digital money for cross-border payments.

Bank Indonesia has been exploring the possibility of launching digital money. In August 2021, Bank Indonesia announced that it had formed a team to study the potential benefits and risks of a digital rupiah that could be used as a means of payment and settlement between individuals, businesses, and government institutions. The central bank is studying the possibility of using blockchain technology to support the issuance of digital money. In November 2022, Bank Indonesia issued a white paper on digital money implementation. Overall, the implementation of digital money varies across countries and each country's approach is influenced by its unique economic, regulatory, and technological circumstances.

Problem Statements

The increasing use and issuance of digital money has significant implications for Indonesia's financial system. Consequently, it is essential to analyze the dynamics and patterns of the relationships between key monetary indicators. Bank Indonesia piloted Digital Rupiah, a wholesale form of digital money known as w-Digital Rupiah. This currency is primarily utilized for conducting monetary operations, foreign exchange, and money market transactions. Furthermore, retail Digital Rupiah (r-Digital Rupiah) is distributed for various retail transactions, both in the form of payment transactions and transfers by individuals and corporations.

Bank Indonesia faces problems related to optimizing its monetary policy during the digitalization and uncertainty of the global financial system. These issues include the use of 1-month and 3-month SBI interest rates as operational targets for monetary policy, the effectiveness of monetary policy transmission mechanisms in controlling inflation rates, the time lag in achieving monetary policy targets, the trade-off between inflation output due to monetary policy under the exchange rate system, and the level of effectiveness of monetary policy in the dual economic system.

From a monetary policy perspective, Bank Indonesia requires information about the pattern of directions and the nature of the dynamics of the causal relationship between the main monetary variables and output to implement monetary policy effectively. This includes understanding the dynamic nature and pattern of directions in relation to policy aspects such as

interest rates, controlling the liquidity of the money supply, maintaining the external stability of the domestic currency through exchange rates, promoting economic growth output, and ensuring the internal stability of the domestic currency in terms of price levels.

Purpose of Study

This study analyzes the impact of digital money dynamics on economic growth, the BI rate, and the profit loss-sharing rate. By comprehending the pattern of direction and the nature of the causal relationship dynamics, it is possible to identify the key determinants of changes in interest rates or profit-sharing rates as responses to monetary policy, money demand, and exchange rates in a small open economy operating under a dual economic system. This analysis will help identify the relative roles of interest rates, profit- and loss-sharing rates, money supply, exchange rates, and price in influencing economic growth output in a small open economy.

Novelty

This study analyzes the dynamics of digital money in the dual economic system in Indonesia

Literature Review

Fluctuations in interest rates as a response to monetary policy are explained by interest rates, the interest rate reaction function, and the state-contingent rule. Meanwhile, aspects of liquidity control, namely changes in money supply or demand for money, are explained by Keynesian demand for money and the theory of currency assets. The external stability aspect of the domestic currency, namely exchange rate changes, is explained by purchasing power parity and exchange rate determination models, such as the monetary model, the balance of payments model, and the Mundell-Fleming model. The aspects of economic growth and the internal stability of the domestic currency, changes in real output, and prices are explained by the theory of monetary policy transmission mechanisms and the surprise aggregate supply function.

The Interest rate rule explains that changes in interest rates reflect a positive monetary policy response to changes in output and inflation (Tayor, 1993, 1995). According to the interest rate reaction function, the central bank responds systematically to the dynamics of output, inflation, and interest rates in the following period (Sack and Volker, 2000). In the state-contingent rule, changes in interest rates are a function of all information, including changes in exchange rates and money supply (King, 1997; Solikin, 2004).

Liquidity Control Theory

According to the Keynesian money demand theory, money demand is a positive function of income and a negative function of interest rates (Mankiw, 2003; Teddy et al., 2001).In the development of Keynes's theory, per capita money demand is a positive function of per capita money income and per capita money wealth as well as a negative function of the expected return on capital (Dobbel, 1970). Money demand is a negative function of the opportunity cost of holding money or interest rates and a positive function of the need for money or individual wealth income (Heikkila 1998). In the theory of demand for currency assets, changes in the demand for money and changes in money supply are determined by the response of monetary policy to unexpected price changes that can increase the risk of holding cash (Krugman & Maurice, 2000).

Domestic Currency External Stability Model

Cassel's absolute Purchasing Power Parity model states that the currency exchange rates of the two countries are positively related to their prices of the two countries (Krugman & Maurice, 2000). Meanwhile, the relative Purchasing Power Parity Model states that the depreciation or appreciation of the domestic currency is positively related to the difference between the domestic and foreign inflation rates. According to the monetary model, changes in exchange rates are a positive function of changes in money supply and relative interest rates as well as a negative function of changes in relative income (Frenkel, 1976; Bilson, 1978, 1979). In the balance of payments model, exchange rate changes are a positive function of changes in income and relative prices as well as a negative function of changes in relative interest rates (Dombusch & Fischer, 1990).

Theory of Internal Stability of Currency

The theory of the monetary policy transmission mechanism argues that changes in interest rates, exchange rates and the money supply affect output and domestic prices through a monetary policy transmission mechanism (Taylor, 1993, 1995). According to the Neutrality Hypothesis theory, an increase in the money supply that can be anticipated can cause price increases, and those that cannot be anticipated can cause an increase in output (Barro, 1978). Meanwhile, in the non-neutrality hypothesis, only the component of the amount in circulation that can be anticipated (M1) has a significant effect on the output (McGee & Stasiak, 1985; Yamak & Kiicukkale, 1988; Choundry & Parai, 1991). In Modigliani's model, it is stated that under conditions of wage rigidity, an increase in output prices (inflation) originating from expansionary monetary policy can reduce real wages and increase the demand for labor, thus increasing output (Ferry & Siguharso, 2004). Meanwhile, according to the shock aggregate supply function, the higher the actual price level compared with the expected price level, the greater the level of output produced by producers (Islam et al., 2020; Stevenson, 1988). In the wage rigidity model, if the actual price is higher than the expected price, then the real wage will be lower than the target, so the demand for labor increases. Producers produce a higher output level (Stevenson, 1988). In the wage rigidity model, if the actual price is higher than the expected price, then the real wage will be lower than the target, so the demand for labor increases. Producers produce a higher output level (Ahmed et al., 2016; Stevenson, 1988). In the wage rigidity model, if the actual price is higher than the expected price, then the real wage will be lower than the target, so the demand for labor increases.

Research Framework
The effect of one economic variable on one or a number of other economic variables is not direct but through a change in the intermediate variable within a certain time lag. This can be observed in the framework of the monetary policy transmission mechanism in an open economy with flexibility in the domestic currency exchange rate. Changes in policy instrument interest rates in response to economic dynamics ultimately affect monetary activity through direct and indirect monetary channels, namely, interest rates, exchange rates, asset prices, credit, and expectations.

Methods
Data
The data used were secondary data in the form of monthly time-series data obtained from reports from Bank Indonesia, the Central Bureau of Statistics, and the International Monetary Fund. Data analysis was carried out using the Vector Autoregressive (VAR) model, especially the Vector Error Correction (VEC) model, which includes three main analyses: the Grager Causality Test, Impulse response Function and Variance Decomposition, and is complemented by forecasting simulations of variable changes using the VEC model.

Vector Autoregression (VAR) and Vector Error Correction (VEC) Models
VAR models
Sims (1980) developed a Vector Autoregressive (VAR) in a macroeconomic context. The purpose of this model is to analyze the dynamic response of a system in a structural model.

$$U_t^{Digital\ Money} = \alpha_1 + \sum_{m=1}^{m=2} b_{11} U_{t-m}^{Digital\ Money} + \sum_{p=1}^{P=2} b_{12} r_{t-p}^{BI\ rate} + U_t$$

$$r_t^{BI\ rate} = \alpha_2 + \sum_{m=1}^{m=2} b_{21} U_{t-m}^{Digital\ Money} + \sum_{p=1}^{P=2} b_{22} r_{t-p}^{BI\ Rate} + V_t$$

$$U_t^{Digital\ Money} = \alpha_3 + \sum_{m=1}^{m=2} b_{31} U_{t-m}^{Digital\ Money} + \sum_{p=1}^{P=2} b_{32} r_{t-p}^{Profit\ Loss\ Sharing\ rate} + U_t$$

$$r_t^{Profit\ loss\ Sharing\ rate} = \alpha_4 + \sum_{m=1}^{m=2} b_{41} U_{t-m}^{Digital\ Money} + \sum_{p=1}^{P=2} b_{42} r_{t-p}^{Profit\ loss\ sharing\ rate} + V_t$$

$$U_t^{Digital\ Money} = \alpha_7 + \sum_{m=1}^{m=2} b_{71} U_{t-m}^{Digital\ Money} + \sum_{p=1}^{P=2} b_{72} r_{t-p}^{Economic\ Growth} + U_t$$

$$r_t^{Economic\ Growth} = \alpha_8 + \sum_{m=1}^{m=2} b_{81} U_{t-m}^{Digital\ Money} + \sum_{p=1}^{P=2} b_{82} r_{t-p}^{Economic\ Growth} + V_t$$

Matrix Representations

$$\begin{bmatrix} U_t^{Digital\ Money} \\ r_t^{BI\ rate} \end{bmatrix} = \begin{bmatrix} \alpha_1 \\ \alpha_2 \end{bmatrix} + \begin{bmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{bmatrix} \begin{bmatrix} U_{t-1}^{Digital\ Money} \\ r_{t-1}^{BI\ rate} \end{bmatrix} + \begin{bmatrix} U_t \\ V_t \end{bmatrix}$$

$$\begin{bmatrix} U_t^{Digital\ Money} \\ r_t^{Profit\ loss\ Sharing\ rate} \end{bmatrix} = \begin{bmatrix} \alpha_3 \\ \alpha_4 \end{bmatrix} + \begin{bmatrix} b_{31} & b_{32} \\ b_{41} & b_{42} \end{bmatrix} \begin{bmatrix} U_{t-1}^{Digital\ Money} \\ r_{t-1}^{Profit\ loss\ Sharing\ rate} \end{bmatrix} + \begin{bmatrix} U_t \\ V_t \end{bmatrix}$$

$$\begin{bmatrix} U_t^{Digital\ Money} \\ r_t^{Economic\ Growth} \end{bmatrix} = \begin{bmatrix} \alpha_7 \\ \alpha_8 \end{bmatrix} + \begin{bmatrix} b_{71} & b_{72} \\ b_{81} & b_{82} \end{bmatrix} \begin{bmatrix} U_{t-1}^{Digital\ Money} \\ r_{t-1}^{Economic\ Growth} \end{bmatrix} + \begin{bmatrix} U_t \\ V_t \end{bmatrix}$$

VEC models

$$\begin{aligned} \Delta Digital\ Money_t &= \alpha_1 + \alpha_{Digital\ Money}^{e_{t-1}} + \sum_{i=1}^{P} \alpha_{11}(i) \Delta Digital\ Money_{t-i} \\ &+ \sum_{i=1}^{P} \alpha_{12}(i) \Delta Economic\ Growth_{t-i} \\ &+ \sum_{i=1}^{P} \alpha_{13}(i) \Delta Profit\ Loss\ Sharing\ Rate_{t-i} \\ &+ \sum_{i=1}^{P} \alpha_{14}(i) \Delta BI\ rate_{t-i} + e_{Digital\ Moneyt} \end{aligned}$$

$$\Delta Economic\ Growth_t = \alpha_2 + \alpha^{e_{t-1}}_{Economic\ Growth} + \sum_{i=1}^{P} \alpha_{21}(i)\Delta Digital\ Money_{t-i} + \sum_{i=1}^{P} \alpha_{22}(i)\Delta Economic\ Growth_{t-i} + \sum_{i=1}^{P} \alpha_{23}(i)\Delta Profit\ Loss\ Sharing\ Rate_{t-i} + \sum_{i=1}^{P} \alpha_{24}(i)\Delta BI\ Rate_{t-i} + e_{Economic\ Growtht}$$

$$\Delta Profit\ Loss\ Sharing\ Rate_t = \alpha_3 + \alpha^{e_{t-1}}_{ProfitLossSharing\ Rate} + \sum_{i=1}^{P} \alpha_{31}(i)\Delta Digital\ Money_{t-i} + \sum_{i=1}^{P} \alpha_{32}(i)\Delta Economic\ Growth_{t-i} + \sum_{i=1}^{P} \alpha_{33}(i)\Delta Profit\ Loss\ Sharing\ Rate_{t-i} + \sum_{i=1}^{P} \alpha_{34}(i)\Delta BI\ Rate_{t-i} + e_{Profit\ Loss\ Sharing\ Rate_t}$$

$$\Delta BI\ Rate_t = \alpha_4 + \alpha^{e_{t-1}}_{BI\ rate} + \sum_{i=1}^{P} \alpha_{41}(i)\Delta Digital\ Money_{t-i} + \sum_{i=1}^{P} \alpha_{42}(i)\Delta Economic\ Growth_{t-i} + \sum_{i=1}^{P} \alpha_{43}(i)\Delta Profit\ Loss\ Sharing\ Rate_{t-i} + \sum_{i=1}^{P} \alpha_{44}(i)\Delta BI\ rate_{t-i} + e_{BI\ Ratet}$$

Where:

BI Rate	: Bank Indonesia real interest rate
Profit Loss Sharing Rate	: Islamic Banking Industry Deposit Rate
Economic Growth	: Indonesia Economic Growth in Period
D	: First Different value
E	: error correction terms of long-run equilibrium regression
CEt	: term error
Q	: period
ip	: lag length

In analyzing this model, the Granger Causality Test (GCT), Impulse Response Function (IRF), and Variance Decomposition (VDC) analyses were performed. The GCT was performed to analyze the direction of the causal relationship, whereas IRF was used to analyze the dynamics of the causal relationship between variables. VDC is used to analyze the relative role of changes in one variable to changes in all variables in the VECM system. VAR/VECM requires stationarity of time-series data at first different values as well as cointegration between variables at degree 1, CI (1.1). Therefore, in this study, the unit root test was carried out using the augmented Dickey Fuller (ADF) test and the Cointegration Test based on the procedure developed by Engle-Granger.

Results and Discussion

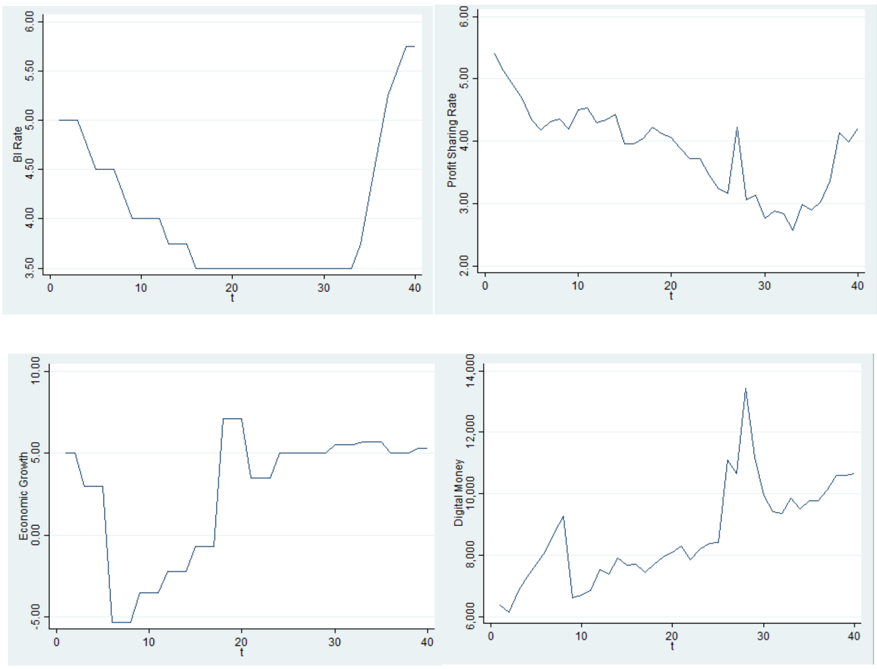
VAR Models specification for Indonesia monetary policy transmission

Table 1 presents the results of the unit root test using the Augmented Dickey Fuller test for autoregressive equations. The results of the unit root test in Table 1 indicate that BI Rate, Digital Money, Economic Growth are not stationary at this level. Meanwhile, the profit loss-sharing rate is stationary at the level. A graph of each variable is shown in Fig. 1.

Table 1
Augmented Dickey-Fuller tests on unit roots for all variables

No	Variables	Levels	FirstDifference
1	BI Rate	0.468	-2,466***
2	Profit Loss Sharing rate	-2,448***	-7,978***
3	DigitalMoney	-1,956	-7,442***
4	Economic Growth	-1,608	-6,000***

***1% Critical value: level -3.655 first difference: -3.662
** 5% Critical value: level –2,961 first difference: -2,964



Graph 1. Fluctuation of All Variables (November 2019-Maret 2023)

Cointegrating vectors and the VEC Models (long run relationship)

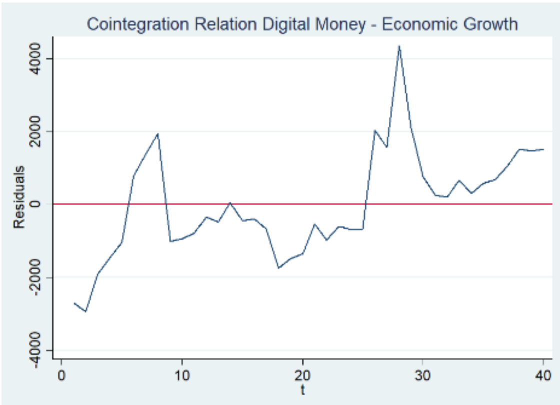
The results of the Engle-Granger cointegration test in Table 2 indicate the existence of cointegration or stationarity of linear combinations of nonstationary data variables. Based on the long-run regression model, Digital Money has no cointegration relationship with the profit-sharing rate, but has a long-term relationship with the output of economic growth, BI rate seen from the residual stationarity test stationary statistic t value at a level with a critical value of 5%.

Table 2
Long Run Relationships

Equation for long run relationships	Error Correction Model	Optimum lag	Johansen Cointegration	Granger Causality Test Wald test
Digital Money = 8,226.033 + 170.8744 Economic Growth	D(Digital Money) = 100.5473 – 25.78594 D(Economic Growth) – 0.2422886 ε(-1)	1	Trace statistic= 9.8777, cv 5% = 15.41 coins integrated	GDP predict the digital money circulation and supply at the 5% But digital money does not predict GDP in the future
Digital Money = 8579.151 + 23.34861 BI Rate	D(Digital Money) = 76.80574- 1133.063 D(BI Rate) – 0.2252611 ε(-1)	2	Trace statistics=9.4885 cv 5%=15.41 cointegrated	BI rate do not predict digital money , digital money do not predict BI rate

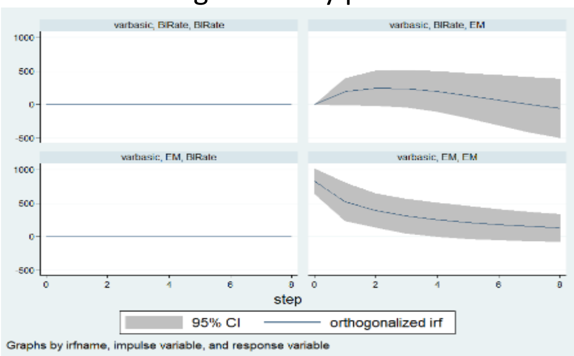
Table 2. We present the results of the Granger causality test based on the VEC model, where, for each VECM system, the optimal lag structure is determined based on the likelihood ratio test. The test results indicate no two-way pattern of causality (feedback causality). In the long term, the behavior of changes in one of the variables caused by changes in other variables in the same VECM system can be detected in the value of the t statistic and the error correction term,ECT_{t-1}.The relationship between economic growth and digital money shows a negative and significant error correction term of 0.2422886. If there is a fluctuation in economic growth, it will be immediately corrected by the previous error towards a long-term balance with a digital money circulation adjustment speed of 24.22%. However, if there is a fluctuation in the BI Rate, it will be immediately corrected by the previous error towards a long-term

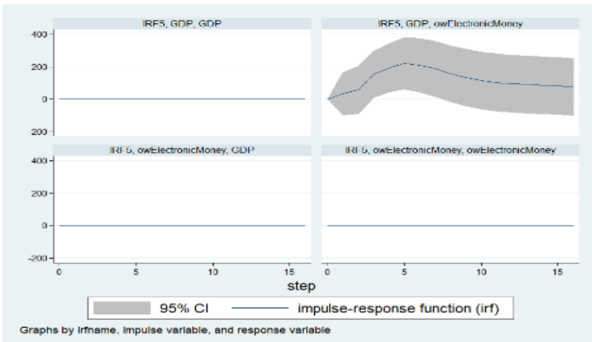
balance with an adjustment speed of 26.67% of the BI rate. Digital Money has a cointegration relationship with economic growth and BI rates. The growth of digital money has a causal relationship with the output of Economic Growth, and changes in the amount of digital money circulating in a community can be indicated by changes in Economic Growth. Changes in the profit–loss sharing rate do not have a short-term effect on digital money circulation in Indonesia's dual economy system. In the short term, the amount of digital money circulating in the community requires time to respond to changes in the profit–loss sharing rate.

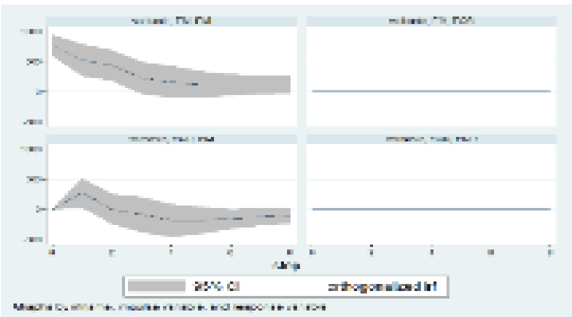


Graph 2. Cointegration of Digital Money and Economic Growth

Impulse Response Functions
The impulse response function reflects the response of one variable to the initial shock of all variables, or the impact of the initial shock of one of the variables on changes in all variables in the VAR and VECM systems. The instantaneous short-term impact or impact multiplier (IM) is indicated by the IRF value in a certain period, whereas the long-term impact or long-run multiplier (LRM) is the cumulative impact of the initial shock as a change in one variable to all variables during the study period.







Digital Money responded positively to the shock to Economic Growth, with a response time of one month.

Variance Decomposition (VDC)

Variance decomposition is used to determine changes in a variable caused by the variable itself compared with those caused by changes in other variables in a VECM system.

Tabel 3

Variance Decomposition

step	(1) Fevd	BI rates DigitalMoney	(1) Fevd	Economic Money	GrowthDigital
0	0	0	**0**	**0**	
1	1	0	1	0	
2	0.962052	0.037948	0.995076	0.004924	
3	0.917508	0.082492	0.984379	0.015621	
4	0.884425	0.115575	0.914254	0.085746	
5	0.866442	0.133558	0.825849	0.174151	
6	0.860298	0.139702	0.731170	0.268830	
7	0.860791	0.139209	0.664800	0.335200	
8	0.862859	0.137141	0.620149	0.379851	
9	0.862569	0.137141	0.594176	0.405824	
10	0.857623	0.142377	0.578299	0.421701	
11	0.847451	0.152549	0.568435	0.431565	
12	0.832875	0.167125	0.561068	0.438932	
13	0.815527	0.184473	0.554920	0.445080	
14	0.797240	0.202760	0.549280	0.450720	
15	0.779618	0.220382	0.544141	0.455859	
16	0.763817	0.236183	0.539555	0.460455	

Table 3 presents the results of Variance Decomposition calculations. In general, the results of Variance Decomposition are the same as those of the Granger causality test and the value of the impulse response function. Changes in the amount of digital money circulating in society are influenced by its own changes, with a forecast error variance contribution of 76.38%, and influenced by changes in Economic Growth output of 36.37% after 16 months.

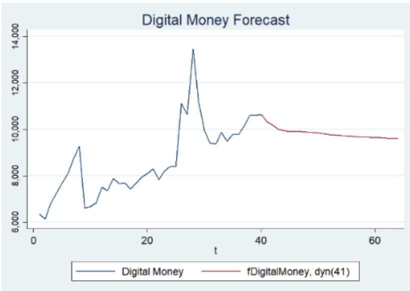
Growth of Digital Money as Monetary Policy Indicator

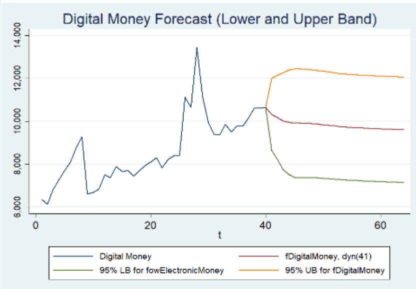
The growth of digital money can serve as an indicator of monetary policy and provide insights into monetary policy. The increasing adoption and usage of digital payment methods can reflect changes in consumer behavior and preferences. Monetary authorities can analyze the growth of digital money to understand how individuals and businesses are shifting from traditional cash transactions to digital transactions. Digital money can promote financial inclusion by providing individuals previously excluded from formal financial services with access to digital payment platforms. Monitoring the growth of digital money can indicate progress in expanding financial access and inclusivity, which is a key consideration for policymakers when formulating a monetary policy. As digital money becomes more prevalent, its share in monetary aggregates and money supplies may increase. Central banks use these aggregates to assess liquidity and the overall economic conditions. Tracking the growth of digital money within these aggregates could provide policymakers with a more accurate monetary landscape.

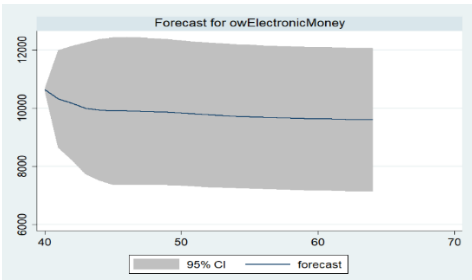
Forecasting Simulation of Digital Money Circulation

Digital Money and economic growth

During the Covid 19 pandemic, the demand for physical money decreased. People are concerned about the otential transmission of the virus through banknotes and coins, leading them to prefer digital payment methods (Kotkowski, 2023). Social distancing measures and government recommendations further encouraged the use of contactless paymets for convenience and safety. The overall trend during the pandemic was a decline in demand for physical money. The process of simulating the forecasting of digital money circulation in response to a shock in economic growth could be a negative shock, such as recession or a decline in the GDP growth rate, or a positive shock, such as a significant increase in economic activity due to a specific event or policy. According to a previous study, economic growth influences consumer behavior. During periods of economic decline, consumers tend to become more cautious about spending and may be more inclined to adopt digital payment methods because of their convenience and potential cost savings. Conversely, during economic growth, consumers may have increased purchasing power and be more willing to spend, which would further drive the use of digital payment methods.







Digital Money and Profit and Loss Sharing

In Islamic banking, profit and loss sharing is a fundamental principle that distinguishes it from conventional banking, which is based on inter-bearing transactions. Instead of fixed interest, Islamic banking emphasizes the concept of risk sharing and promotes the equitable distribution of profits and losses between banks and their customers. Regarding digital money in the context of Islamic banking and Islamic economic systems, digital money as electronic fund transfers or mobile payments can be used in Islamic banking transactions as a medium of exchange. The underlying principle of profit- and loss-sharing remains intact, irrespective of the mode of payment. The use of digital money does not alter the essence of the profit loss-sharing concept in Islamic banking. Islamic banks engage in various investment-based transactions, such as Mudharabah and Musharakah, which involve profit sharing between the bank and customers. Digital money can facilitate these transactions by providing a convenient and efficient means of transferring funds and conducting business. The use of digital money does not impact the profit-sharing rate determined through mutual agreements between the parties involved. Digital money can enhance transparency by providing a clear record of transactions and facilitating real-time monitoring. This transparency supports the assessment of profit and loss, enabling a fair distribution of profits between the bank and its customers, in accordance with the agreed-upon profit-sharing ratio. In ethical considerations, Islamic banking adheres to ethical and Sharia-compliant principles, which include avoiding prohibited activities such as usury (Riba) and engaging in speculative or uncertain transactions (Gharar). When utilizing digital money, islamic banks need to ensure that the digital payment systems and platfoms they use comply with these principles

Digital Money and BI rate

Monetary policy transmission: Digital money can have implications for the central bank's policy rate, often referred to as the benchmark interest rate or B rate. Digital money can influence the effectiveness and transmission of monetary policy. As digital payment methods become more prevalent, they can affect the velocity of money, which is the arte at which money circulates in an economy. Changes in the velocity of digital money can impact overall liquidity and spending patterns, potentially influencing inflation and economic activity.

Payment system efficiency: Digital money offers convenience and efficiency in transactions, potentially improving the efficiency of payment systems. A more efficient payment system could reduce transaction costs, enhance liquidity management, and foster economic development. This improved efficiency may indirectly affect central banks' policy rate by influencing the overall economic conditions.

Impact on financial intermediation: The growth of digital money can also affect traditional financial intermediation channels. As individuals and businesses increasingly rely on digital payment methods, traditional banking activities such as cash handling and physical transactions may decline. This shift in financial intermediation dynamics has implications for the effectiveness of monetary policy transmission channels.

Financial stability consideration: The growth of digital money and development of digital payment systems can have implications for financial stability. Central banks may need to monitor and regulate digital payment providers to ensure financial system stability. This may include assessing the risks associated with cybersecurity, fraud, money laundering, and consumer protection. Addressing these risks can indirectly influence the overall rate by ensuring stability of the financial system. It is important to note that the specific impact of digital money on the policy rate can vary across countries and regions because of differences in financial infrastructure, regulatory frameworks, and consumer preferences. Central banks carefully assess these factors and consider the broader macroeconomic environment when making policy rate decisions.

Conclusion

The relationship between economic growth and digital money shows a negative and significant error correction term of 0.2422886. If there is a fluctuation in economic growth, it will be immediately corrected by the previous error towards a long-term balance with a digital money circulation adjustment speed of 24.22%.However, if there is a fluctuation in the BI Rate, it will be immediately corrected by the previous error towards a long-term balance with an adjustment speed of 26.67% of the BI rate. Digital Money has a cointegration relationship with economic growth and BI rate. The growth of digital money has a causal relationship with the output of Economic Growth, and changes in the amount of digital money circulating in a community can be indicated by changes in Economic Growth. . Changes in the amount of digital money circulating in society are influenced by its own changes, with a forecast error variance contribution of 76.38%, and influenced by changes in Economic Growth output of 36.37% after 16 months.Changes in the profit–loss sharing rate do not have a short-term effect on digital money circulation in Indonesia's dual economy system. In the short term, the amount of digital money circulating in the community requires time to respond to changes in the profit–loss sharing rate.

Policy Recommendations

It is important to note that implementing digital money policies should be iterative and adaptable. Policymakers should monitor developments in the digital money landscape and make necessary adjustments to ensure that policies remain effective and align with evolving technological advancements and economic needs. Policymakers should consider the following recommendations to integrate Digita money into the economy:

1. established a clear, comprehensive regulatory framework for digital money. This framework should address issues such as consumer protection, anti-money laundering, knowledge of customer requirements, taxation, and fraud prevention. Regulations should strike a balance between fostering innovation and ensuring financial stability and security.
2. Promote interoperability and establish common standards across different digital currencies and payment systems. This facilitates seamless transactions and enhances the efficiency of the digital money ecosystem. Collaboration between governments, central banks, and private sector stakeholders can help establish the standard.
3. Use digital money as a toll to enhance financial inclusion. Design policies and initiatives that ensure easy access to digital money services for underserved populations such as unbanked and rural areas. This can be achieved through partnerships with financial institutions, mobile network operators, and technology companies to provide affordable and user-friendly digital monetary solutions.
4. Robust security standards for digital money platforms should be established, including encryption, multi-factor authentication, and secure storage mechanisms. Additionally, strict data privacy regulations have been enforced to safeguard individuals' financial data from unauthorized access.
5. Develop frameworks to manage the impact of digital money on monetary policy and overall financial stability. Central banks should carefully consider the introduction of digital money and its potential implications on money supply, interest rates, and financial intermediation. Close coordination between monetary authorities and financial regulators is crucial for effectively addressing any systemic risks arising from the digital money ecosystem.

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