FINTECH DEVELOPMENT AND MONEY SUPPLY IN INDONESIA

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Abstract

Central Bank has a crucial role in conducting monetary policy in regulating adjusting money supply, generally through open market operations (IMF, 2022). As one monetary policy factor, money supply growth is associated with an increase in money demand, which is influenced by essential elements such as investment, consumption, exports, imports, and government spending (Yuliadi, 2020). A sufficient payment system should support a good circulation of the money supply. The payment system has an essential role in establishing solid infrastructure, trustworthy payment instruments, and secure transaction process systems in financial services in Indonesia. The development of the payment system goes along with the development of financial technology (fintech) in Indonesia. The fintech industry grows along with Indonesia's large population and middle-income class evolution. The immense penetration of the internet also encourages the progression of the fintech market in Indonesia (Sugandi, 2021). Electronic money, or e-money, is one of the fintech utilization in the financial industry in Indonesia. The development of e-money in society aims to reduce the growth rate of the use of cash. E-money dedicated is widely used for micro and retail payments. According to Bank Indonesia, e-money is a category of payment instrument, the value of money stored electronically on a server or card, and the procedures for use and issuance have been regulated and supervised directly by Bank Indonesia. Similarly, with e-money, card-based payment instruments such as credit and debit cards also play a crucial role in financial transactions. Card-based payment instruments include credit cards, automated teller machines (ATM), and debit cards (Bank Indonesia, 2020). This study analyses the impact of fintech e-money transaction values on money supply growth and the velocity of money in Indonesia. The methodology used in this study is quantitative analysis. The method uses Ordinary Least Square (OLS) and Assumption Classic Test analysis. All the data in this study are secondary data from the Bank of Indonesia (BI) and National Statistics Indonesia (BPS). The research is monthly data taken from 2013 until 2021 period. This study finds that fintech e-money has no significant and negative impact on money supply growth and the velocity of money in Indonesia. Meanwhile, the debit card as a part of the card-based payment instrument has a significant positive effect on money supply growth in Indonesia. This paper wishes to contribute inputs and recommendations to the academic communities, financial services industry, and Bank Indonesia.

Keywords: Financial Technology (fintech), Electronic Money (e-money), Money Supply (M2), Ordinary Least Square (OLS)

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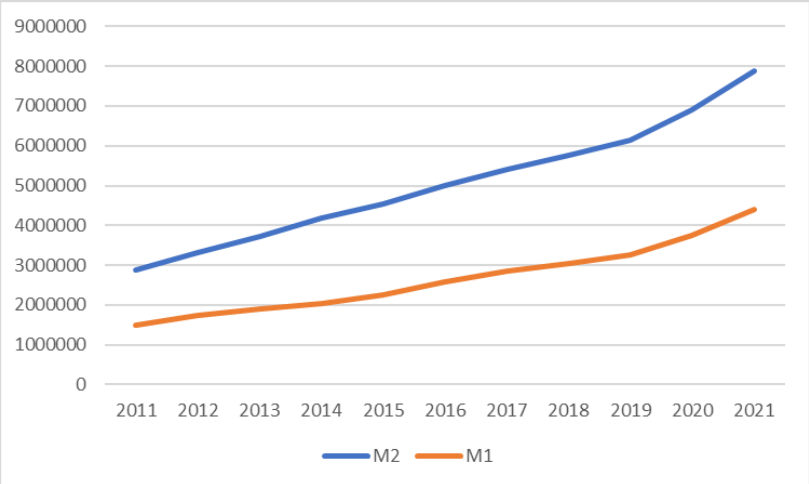
Introduction

1.1. Research Background
1.1.1. Indonesian Monetary Overview

Central Bank has a crucial role in conducting monetary policy to achieve price stability (low and stable inflation) and to help manage economic fluctuations (IMF, 2022). Bank Indonesia, as a financial regulator in Indonesia, is given authority to create and maintain rupiah stability. Act No.23 of 1999 concerning Bank Indonesia, as amended by Act No.3 of 2004 and Act No.6 of 2009 in article 7, states that Indonesia Rupiah (IDR) as Indonesian currency stability includes two dimensions. The first dimension is regarding rupiah stability in the terms of price stability of goods and services, as reflected by inflation. The second dimension relates to rupiah exchange rate stability against other currencies. Indonesia implements a free-floating exchange rate regime and exchange rate stability is necessary to achieve and maintain price and financial system stability (Bank Indonesia, 2020)

Money is fundamental to the functioning of market economies in as much as these based on exchange and credit (BIS, 2003). Money Supply or Broad Money (M2) used to be measured as liquidity of the economy (Bank Indonesia, 2021). In the narrow sense or M1, the money supply is defined as the monetary system's obligations to the domestic private sector consisting of currency and demand deposits. Meanwhile, the money supply in the comprehensive scope or M2, is defined as obligations of the monetary system to the domestic private sector consisting of currency, demand deposits, and quasi money.[1]

Figure 1 The Development of M1 and M2 in Indonesia (%)

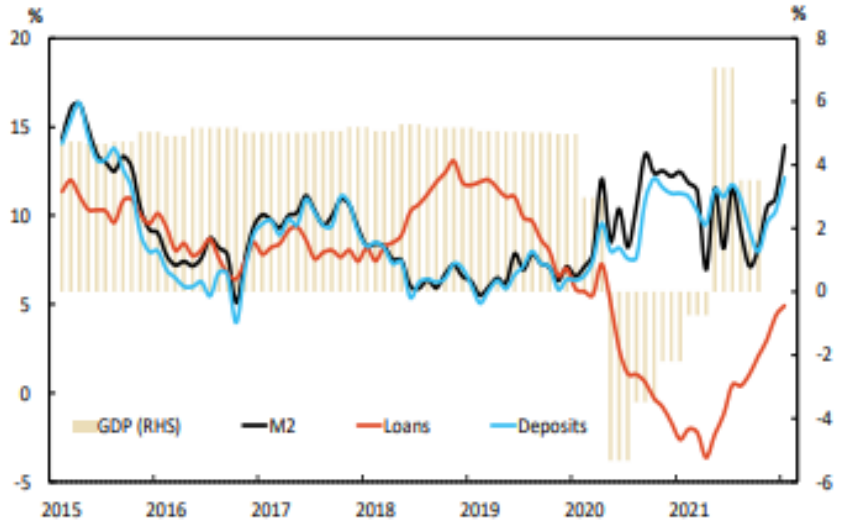


Source: Bank Indonesia, 2021

[1] In other words, M2 is the accumulation of M1 and quasi money (Suseno, 2002)

Figure 1 illustrates Indonesia's money supply M2 and M1 from 2011 until 2021. The growth is gradual and consistently increases year by year. Figure 2 shows the overall money growth compared to another economic indicator in December 2021. The total Broad Money (M2) reach Rp.7.867,1 trillion at the end of December 2021. M2 is identified significantly increased to 13.9% in December 2021 from 11.0% one month earlier. This movement is driven by narrow money (M1) recorded at 17.9% (yoy) and quasi-money at 9.3% (yoy)[2]. M2 movement seemingly goes along with deposits. Meanwhile, loans are significantly fluctuating, particularly at the beginning of 2020. Many factors affect the volume and circulation of the money supply. Besides economic situation and monetary policy, the payment system also plays an essential role in money supply circulation. A payment system includes regulations, institutions, and the procedure related to transferring funds to settle the obligations arising from economic activity[3]. In the system, fintech contributes an innovation of payment instrument fragment.

Figure 2 The Growth of GDP, Money Supply (M2), Deposits and Loans (yoy)



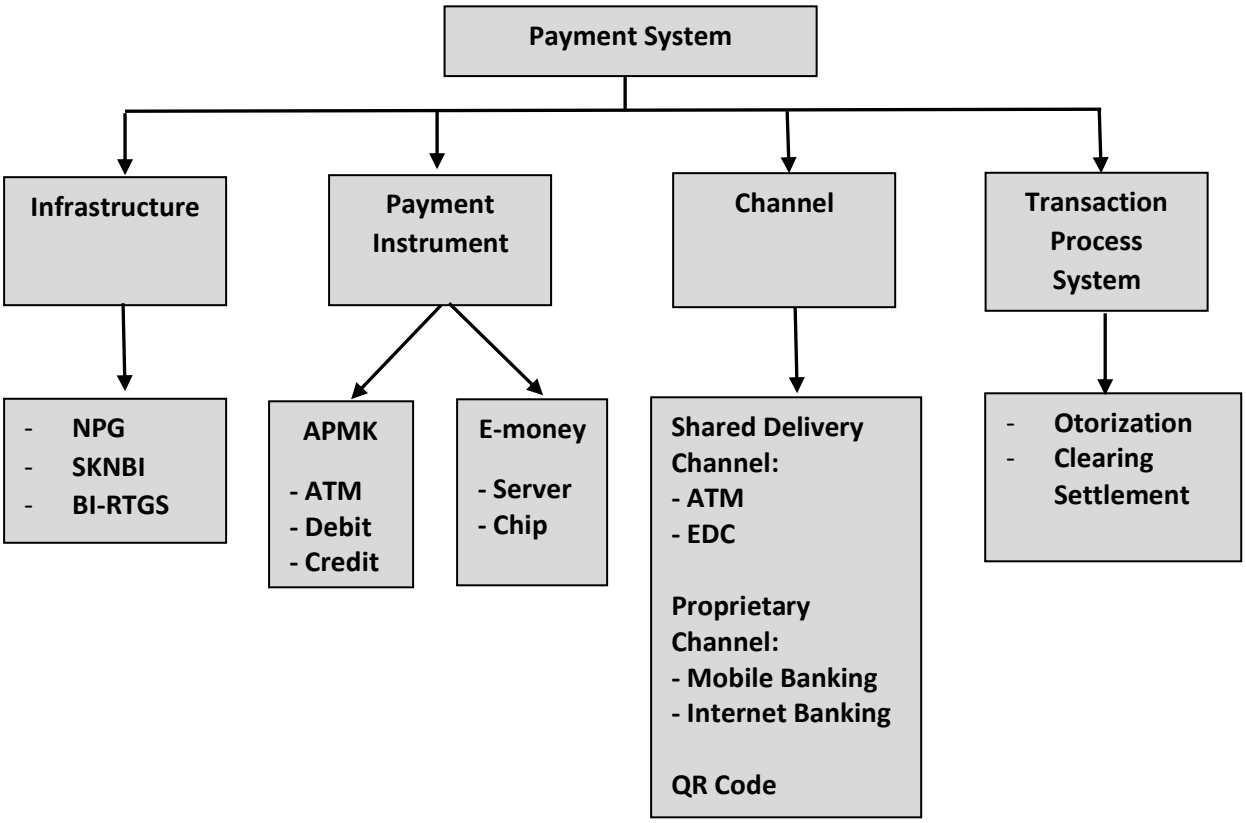
Source: Bank Indonesia 2021

1.1.2. Payment System Structure in Indonesia

The payment system was born simultaneously with the concept of 'money' as a medium of change or intermediary in goods, services, and financial transactions. In principle, the payment system carries three processing stages, namely authorization, clearing, and settlement (Bank Indonesia, 2020).

[2] The sources taken from (Bank Indonesia, 2022)
[3] Definition taken from (Bank Indonesia, 2020)

Figure 3 Payment System Structure



Source: Bank Indonesia

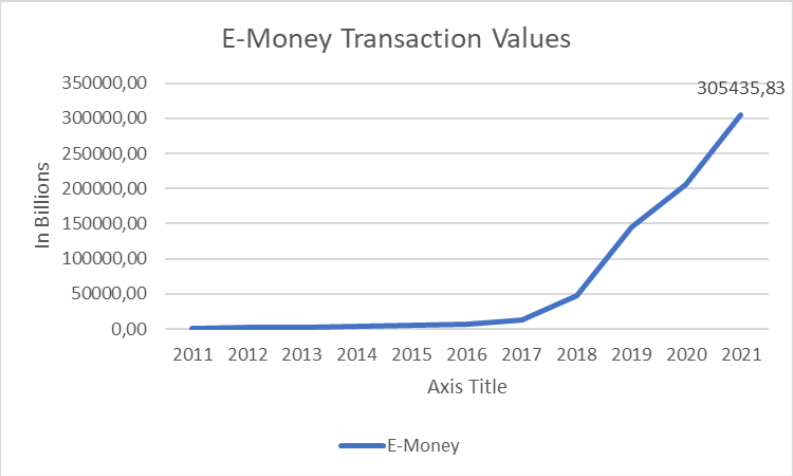
Figure 3 describes four components of the payment system: infrastructure, payment instrument, channel, and transaction process system. The focus discussion in this study is the payment instrument section. According to the scheme, the payment instrument is divided into two types; the first is a Card-Based Payment Instrument (APMK). APMK is a payment instrument in the form of credit cards, automated teller machine (ATM) cards, and debit cards. The second is electronic Money. Electronic Money (e-money) is a type of payment instrument with the value of Money that has been stored electronically on a server or card, and the procedures for use and issuance have been regulated and supervised directly by Bank Indonesia (Pramono, 2022). Bank Indonesia classified e-money into two types they are prepaid cards and electronic wallets. A prepaid card is a type of e-money issued by a bank that already has a license from bank Indonesia. The products of prepaid cards in Indonesia, for instance, are BCA Flazz, Mandiri e-money, BNI tap cash, Brizzi BRI, etc. Meanwhile, an electronic wallet

is an e-money product service that provides by not only banks but also telecommunication operations, for instance, CIMB Niaga mobile accounts and Mandiri e-cash[4].

1.1.3. Electronic Money Development in Indonesia

Over the past several years, electronic money (e-money) has emerged as an increasingly impactful payment instrument in many countries (Vichyanond, 2021). E-money—a type of privately issued asset that functions as money and is primarily stored and exchanged on computer systems, generally over the internet—has emerged as an increasingly popular means of payment.

Figure 4 E-Money Transaction Values



Source: Bank Indonesia

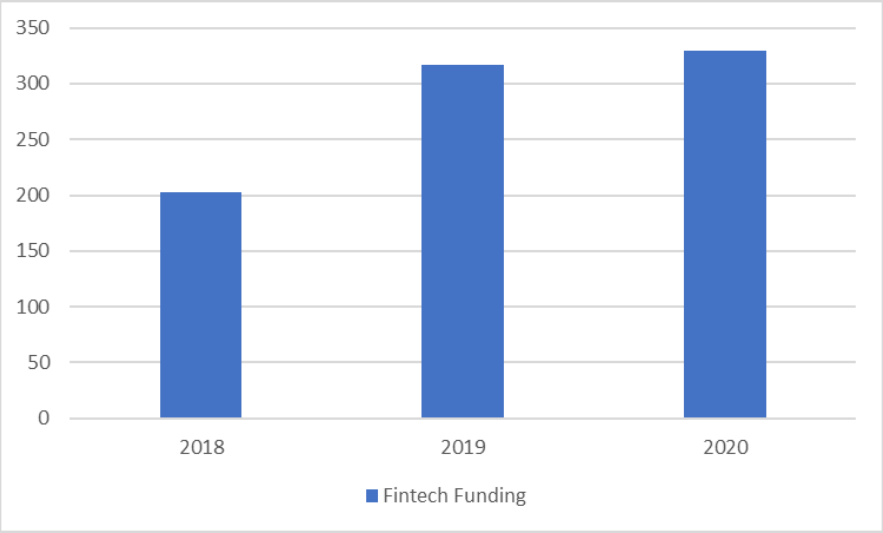
Figure 4 illustrates e-money transaction values recorded in Bank Indonesia. Significant growth of e-money drastically rose from 2017 to 2021. Bank Indonesia reported in 2021, the total transaction of e-money reached 305.435 billion IDR. This widescale e-money phenomenon is associated with smart mobile utilization, e-money diversification products, society's lifestyle shift, etc. Bank for International Settlement (BIS) states the adoption of digital money is supported by supply and demand factors. The supply factors include sufficient digital infrastructure adoption and public sector endorsement. Meanwhile, the demand factors involve industry cost and convenience, banking system confidence, and favorable macroeconomic situation.

1.1.4. Fintech Development in Indonesia

[4] Bank Indonesia recorded 51 e-money companies has registered in Indonesia (FIntechnews Indonedia, 2020). The companies list attached in the appendix pages.

The growth of financial technology (fintech) has become a game-changer in the financial market in Indonesia. Indonesia's large and diverse population also reinforces fintech's massive adoption. According to World Bank 2020, 52 million people in Indonesia comprise a middle-class society. World Bank also estimated that 51% of the Indonesian population is unbanked. Meanwhile, the internet users are 150 million population and social media users are 150 million population (Bank Indonesia, 2019). In addition, the demography of Indonesia from 265 million population, population covers 59.1% of generation Y and 40.9% of generation X. Meanwhile, the user of the digital landscape classifies into mobile phone users for 355.5 million or 133% of the population. Internet users for 150 million or 56% of the population. Then, social media users are 150 million, or 56% of the populations(Bank Indonesia, 2019). These statistics describe that Indonesia has excellent potency on technology users. This potential number of internet and technology users would be beneficial to be optimized in fintech industry. The prospects of fintech market potency reflected in the progression of fintech funding in Indonesia from 2018 until 2020. (Medici, 2021).

Figure 5 Fintech Funding in Indonesia



Source: Medici, 2021

The rise fintech industry has become the government spotlight. Indonesian President, Joko Widodo, expressed his appreciation to the fintech industry players and innovation actors who have contributed positively to the economy and widely opened access to funding for the Indonesian society. (Presiden RI, 2020). Specifically, the statistic mentions that in 2020, fintech contributed to the disbursement of 128.7 trillion IDR, or a raise of 113 percent compared to the previous year. 89 fintech players contributed 9.87 trillion IDR to financial service transactions in September 2020. Furthermore, allocation funds for 15.5 trillion IDR contributed from

registered fintech equity crowdfunding[5]. Responding to the digital technology sector's incredible potency, the government allocated funds to establish Information Communication and Technology (ICT) infrastructure for 413 trillion IDR (US$29.17 billion) and develop digital technology for 30 trillion IDR. The ICT infrastructure allocation included building base transmission receivers in more than 5,000 villages and 12,377 other locations to provide internet networks in reaching remote Indonesian areas.

1.2. Research Question and Hypotheses

According to the background and discussion mentioned above, this paper focuses on the development of fintech from the perspective of e-money and its impact on money supply growth and velocity of money in Indonesia from the period 2013 until 2021. There are two research questions to be addressed in this study:

1. Is there any significant positive impact of the growth of the fintech electronic money transaction values on money supply growth in Indonesia?
2. Is there any significant positive impact of the fintech electronic money transaction values on the velocity of money in Indonesia?

The economic theory basis in this analysis model is refers to Theory Quantity of Money:

$$MV = PY$$

Where:

Y = Output

M = Money

P = Price

V = Velocity

In answering the research questions, two regression model analyses are applied in this research. The first is regarding the correlation of fintech electronic money to money supply growth, and the second is regarding the impact of fintech electronic money on the velocity of money.

[5] Statistic sources compress from (Presiden RI, 2020)

1) $$\% \quad M2\ \mathbf{growth}_t = \beta_1 + \beta_2 \% \, EMgrowth_t + \beta_3 \% \, CCgrowth_t + \beta_4 \% \, \mathbf{DC}growth_t + \beta_5 \% \, EXCrategrowth_t + \beta_6 \mathbf{BI}rate_t + \beta_7 \mathbf{INF}_t + \beta_8 \% \mathbf{GDP\ growth} + \varepsilon_t$$

2) $$\frac{Y\ (nominal\ GDP)}{M2} = \beta_1 + \beta_2 \% \, EMgrowth_t + \beta_3 \% \, CCgrowth_t + \beta_4 \% \, DCgrowth_t + \varepsilon_t$$

Where: t = (1,2…,…,T)
β (1,2,3)) = Coefficient Matrix
M2 Growth = Real Money Supply Growth as endogeneity variable
EM Growth = Electronic Money as exogeneity variable
CC Growth = Credit Card as exogeneity variable
DC Growth = Debit Card as exogeneity variable
BIrate = BI rate as control variable (%)
EXCrate Growth = Exchange rate as control variable
INF= Inflation rate as control variable (%)
GDP Growth = GDP growth as control variable (%)

The study uses a time series analysis to respond to these research questions. In addition, this study also utilized secondary research from relevant public institutions such as Bank Indonesia and Badan Pusat Statistik (BPS)[6]. Previous research outputs and documents reviewed in this paper include academic journals, working papers, and reports published by the World Bank, IMF, ADB, and international organizations. The hypotheses of this study are as follows:

1. The fintech electronic money transaction values growth significantly positively impacts money supply growth in Indonesia.
2. The fintech electronic money transaction values growth has a significant positive impact on the velocity of money in Indonesia.

This research explains the correlation and impact of fintech e-money that is represented by transaction values nominal to the money supply growth in Indonesia. This study also points out the contribution of e-money to the monetary sector and policy. Besides empirical analysis, the discussion also enriched economic theory as a basis and findings from previous research. This study is constructed into five sections. The second section discusses a literature review from related academic journals and documents. The third section presents About the data

[6] *https://*www.bi.go.id and *https://www.bps.go.id*

research and methodology. The fourth section elaborates on the empirical result and analysis. The last section is a conclusion and policy recommendation.

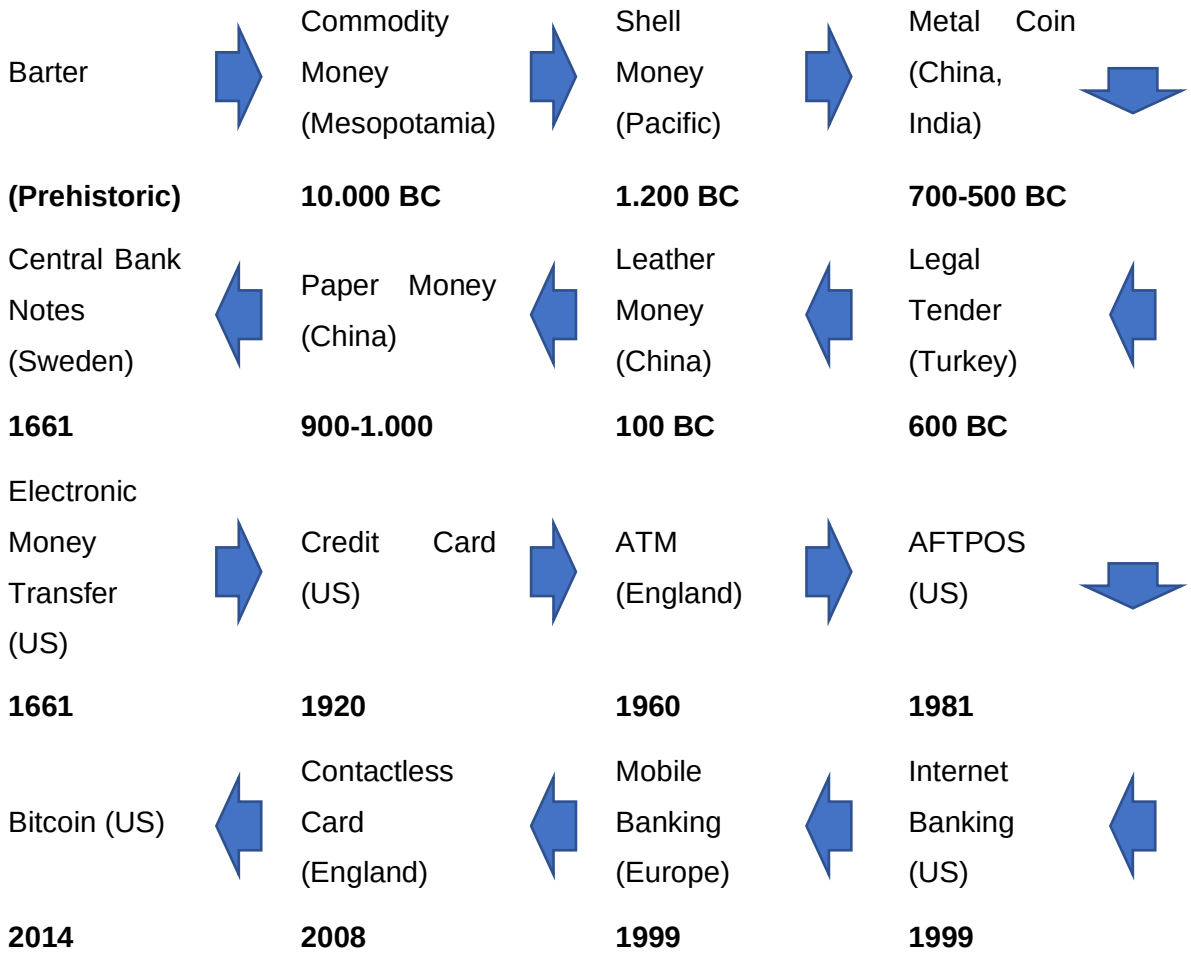
Chapter II
Literature Review

1.1. Evolution of The Payment System

The payment system is continuously progressing along with the evolution of money (Bank Indonesia, 2020). In principle, the Payment system is determined by three prominent factors. They are technological innovation and business models, public traditions, and the policies of the respective authorities (Bank Indonesia, 2020). Figure 6 illustrates the chronology of the evolution of the payment system. Initially, the barter trade system was the first introduced payment instrument in the prehistoric era. Along the time, Issues arose when the value of exchange and the goods were not according to each other's worth. To overcome those limitations, humans gradually developed commodity money. According to (Weber, 2010), Commodity money is an intrinsically valuable object as input to production or consumption. In ancient times, commodity money contained the primary intrinsic value of money that was required by all, such as salt, tea, tobacco, and various grains. On the other hand, Livestock such as wheat, vegetables, and plants also utilize as commodity money between 900-6000 BC. After the emergence of the agriculture sector, Livestock was replaced as commodity money. Over time, primitive money commenced arising around 1200 BC in the form of shells. Then, The Chinese started creating imitation cowrie shells from metal and copper. Further, ancient paper money began to distribute with white deerskin money in around 100 BC; then, it was given various colours. After that, Paper money has become the dominant payment instrument. In Europe, Sweden was the first country to use paper money in 1661, after Spain established a paper factory in 1150. (Bank Indonesia, 2020)

In general, based on the history and instruments used, the payment system is categorized into two types they are cash and noncash payment systems. The cash payment system applies currency (banknotes and coins) as a payment tool. Meanwhile, the noncash payment system consists of card-based payment instruments, cheques, funds transfers, debit notes, and card-based and server-based electronic money. Meanwhile, the cashless payment system includes wholesale and retail transactions. Wholesale transactions are identified according to their importance and perseverance, including interbank transactions, financial market transactions, and transactions with a ticket size beyond Rp1 billion. The excellent infrastructure must support a successful payment system. The infrastructure that maintains the payment system in Bank Indonesia includes Real Time Gross Settlement (BI-RTGS) system and Bank Indonesia and Scripless Securities Settlement System (BI-SSSS). Meanwhile, handling retail transactions with lower value using the National Clearing System (SKNBI). Higher frequency transactions between individuals with a ticket size of less than 1 billion IDR.

Figure 6 Evolution of Payment System

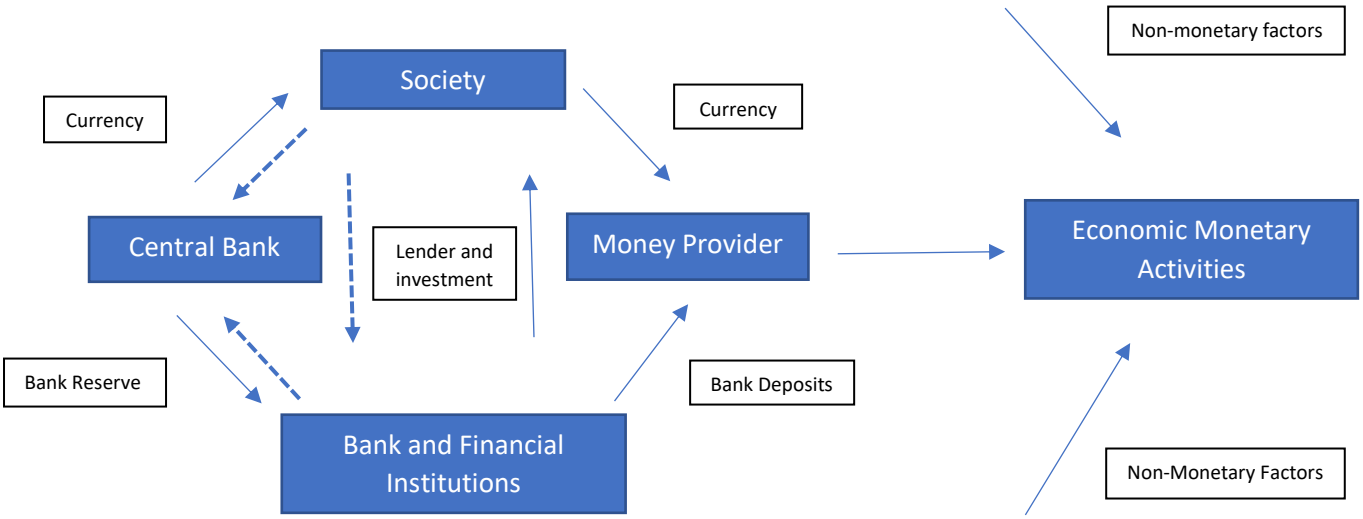


Source: Bank Indonesia, 2020

1.2. The Role of Money in Economy

Money is closely interrelated with all modern economic activities, such as production, investment, and consumption. Along with its development, the utilization of funds is dominantly used in trade transactions and as a commodity in the money market. The role of money is specifically illustrated by understanding the cash and goods circulation in economic activities. (Suseno, 2002) mention, basically economic activities identical with real sector and monetary sector. In a simple illustration, a transaction consists of a seller with goods and a buyer with money. The buyer has money but needs the goods; meanwhile, the seller has interests but needs money. It means there are an exchange of transaction values between these two parties.

Figure 7 Money Circulation



Source: Lestari, 2017

Figure 7 illustrates the money circulation in economic activities. Central Bank provides currency to society and bank reserves to the bank and financial institutions. Then communities and banks, and financial institutions perform lender and investment. Eventually, these circulations create economic and monetary activities.

As a transaction instrument, money should fulfil any requirements in terms of materials. The substantial indicator of money is described as following (Lestari, 2017):

1) Acceptability. It means that money should be acknowledged by society extensively. The money also should be recognized as a high-value exchange instrument and liaison by the government.
2) Stability of value. The value of money should be steady, accessible, and resistant to fluctuation time by time.
3) Portability. In terms of quantifiable, the money should be portable and divisibility.
4) Durability. Money must be durable and not easily damaged; therefore, the choice of material will determine the money's resistance.
5) Uniformity. Money should have an equal quality one and another.

Along with the times, people preference in using money are various according to their needs. According to (Lestari, 2017) the function of money in economy describe as follows:

1) Money as a medium of exchange. As the medium of exchange instrument, money can be used as a legal medium of exchange in economic transactions.

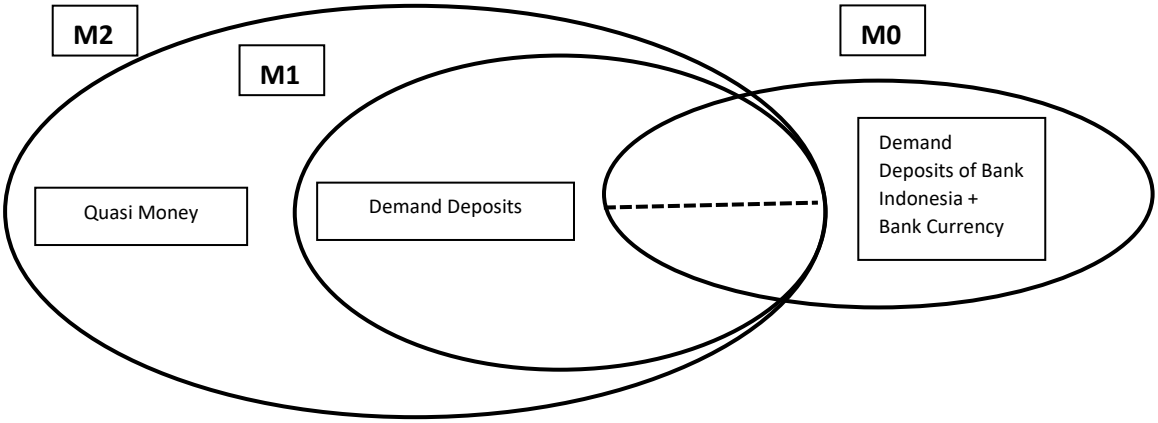
2) Money as a measure of value, as a unit of value (measure of value). In the function of money as a unit of measurement of weight, then the item exchanged can be valued in specific branches of cash. Money is also used to appraise the value of various goods and services traded, show the amount of wealth, and calculate the loan size. Money is also used to determine the prices of goods/services. As a unit of account, money plays a role in facilitating the exchange of goods.
3) Money as standard or deferred payment measure (standard for deferred payments).
4) Money as a store of value and wealth store of wealth. As a store of value or wealth, money transfers purchasing power from the present to the future. When a current seller receives a certain amount of money as payment for the goods and services he sells, he can save the money to buy goods and services in the future.

1.3. Money Supply and Money Creation Mechanism

The original history of money creation explains a simplified banking system that combines two parts. They are a central bank that sets monetary policies, including the amount of money base and the ratio of required reserves, and commercial banks that provide savings and loan services to the public (Wanting Xiong, 2016). Money creation is fundamental principals in the monetary system. According to (Suseno, 2002) there are three main actors in the money creation mechanism. They are monetary authorities, commercial banks, and society or domestic private sectors. These three main actors interact to meet sufficient money supply from monetary authority and money demand from the community. In a simple way to understand, financial power creates currency. Meanwhile, commercial banks make demand deposits and quasi-money, then society generally utilizes the money creations in their economic activities.

As the executor of the monetary authority, the central bank has the primary authority to create and distribute currency in cash and main currency. On the other hand, the central bank also accepts commercial banks' demand deposits. The accumulation of currency and commercial banks demand deposits called base money. According to Bank Indonesia, Base Money defines as obligations of the monetary authority to the domestic private sector and commercial banks, in the form of paper money and coins located outside Bank Indonesia and demand deposits from commercial banks at Bank Indonesia. Based money is given the symbol M0. The correlation between M0, M1, and M2 explain by the figure 8.

Figure 8 M0, M1 and M2 Correlation



Source: Suseno, 2020

Monetary authority balance sheet is an instrument to identify the factors that impact base money. In general, the factors explain as following:

Table 1 Monetary Authority Balance Sheet

Assets		**Passive**	
- Net Foreign Assets	(NFA)	- Currency	
- Net Domestic Assets	(NDA)	a. Society	(C)
a. Net bill to central government		b. Commercial Banks	
b. Bills on the domestic private sector		- Current account balance	(R)
c. Bills on commercial banks		a. Commercial banks	
d. Net other assets		**b.** Society	
	M0		M0

Source: Suseno: 2002

Table explain from the side of passive monetary authority balance sheet includes money-based components:

1) the circulation of currency in society and commercial banks
2) current account balances or reserve accounts belonging to commercial and public banks at Bank Indonesia.

Meanwhile, from the side of assets, the monetary authority balance sheet includes resources or factors that impact based money shift. They are:

1) Net Foreign Assets

Factors or sources that emerge as the cause of government foreign transactions such withdrawal and loan repayment.

2) Net Domestic Assets

   The factors sourced from domestic transactions of government, domestic private sector, and commercial banks. The transactions are related to government reception and expenditure.

3) Net Other Items

   This factor is a post that does not include form both assets, for instance: capital post and backup post.

1.4. Quantity of Money and the Impact to the Economic System

The quantity of money in the economy is related to the number of dollars exchanged in transactions. The quantity of money theory describes the correlation between transactions and money (Mankiw, 2005). The equation is explained as follow:

Money ×Velocity = Price × Transactions

$M \times V = P \times T.$

According to the equation, the right-hand side of the quantity equation explains transactions. T reflects the number of times in a year that goods or services are exchanged for money. P is the price of a typical transaction— the number of dollars exchanged. The product of the transaction price transaction and the number of transactions, PT, equals the number of dollars traded in a year. The left-hand side of the quantity equation tells us the money used to make the transactions. M is the quantity of money. V is the transaction velocity of money and measures the rate at which money circulates in the economy. In other words, velocity tells us the number of times a dollar bill changes hands in a given period.

According to (Suseno, 2002) The factors that impact the money supply categorize into two types:

1) The factors that impact money multiplier

   These factors are the aspects that impact the determinant of base money. They are demand deposit fees, convenience and safety, and relative costs (opportunity cost) such as interest rate, income, development of banking sector services, monetary policy, and bank's necessity for short-term liquidity.

2) The factors that influence changes in base money

The factors are related to the financial transaction changes in society. It is reflected on the monetary authority balance sheet post from the side of base money utility and the factors that impact base money.

1.5. The Money Demand Theory

Money demand has been defined in many theories. (Eduardus Arthur, 2016) has summarized fundamental ideas about money demand. First, Irving Fisher, in his quantity theory of money, states that money influences the economy, but the nature of the effect is limited to nominal variables. Irving also divides the variables in theory into two groups, namely real variables and nominal variables. Second, Keynes's theory of money demand reveals that people's motives for holding money are divided into three purposes. They are namely the demand for money for transactions (transactions) motive), demand for money just in case (precautionary motive), and demand for money for speculating (speculative motive). Third, the economic view of Cambridge, namely Marshall and Pigou, considers money to be a store of wealth, not a medium of exchange. Marshall and Pigou analysed the factors that influence a person to hold cash (cash balances), which are determined by the interest rate, the amount of wealth owned, expectations regarding future interest rates, and price levels.

The next theory is Milton Friedman argues that people demand money based on every opportunity cost that exists because the community has a rational mind. Friedman argues that people who ask for money are not only based on interest rates as in the Keynes model. Modern society considers other financial market factors, such as stock and bond yields. According to James Tobin, the fifth is that someone holding cash has a purpose for speculating. Here Tobin uses a portfolio approach to explain a person's motivation for holding money. According to Keynes's theory, a person's motivation in holding wealth is only using two options, namely held in cash and the form of letters valuable. Still, Keynes did not include the aspect of uncertainty in it. So that in holding securities, it can be ensured that someone gets profit becomes something uncertain.

1.6. Fintech Electronic Money and Monetary Policy

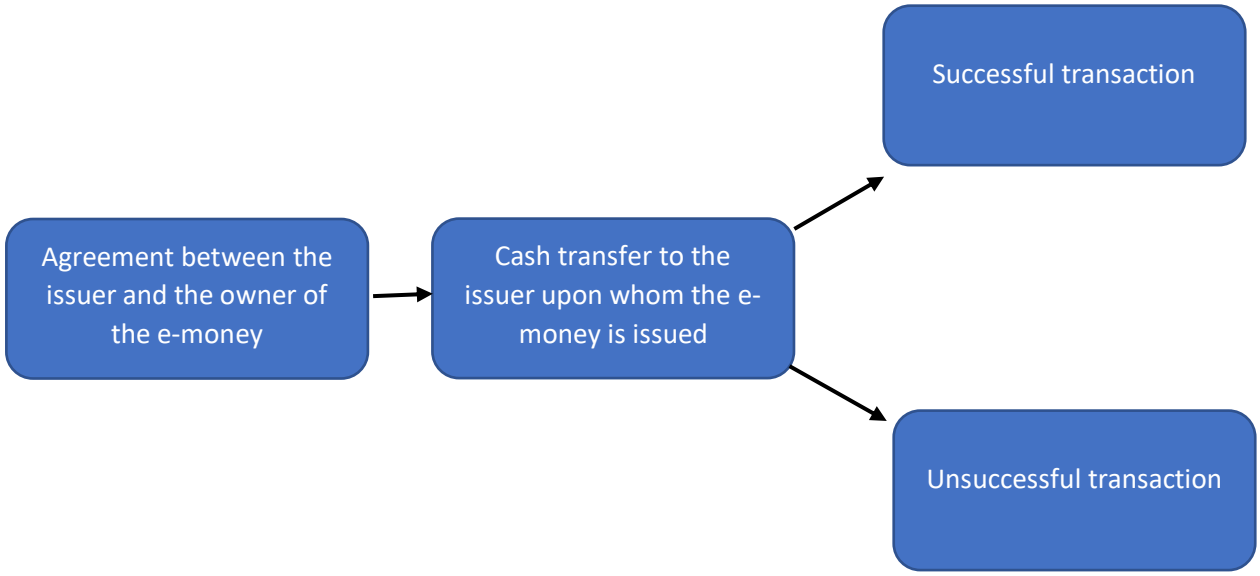
Electronic money is the newest instrument in the payment system, defined according to many perspectives. According to (Neda, 2014) from the broader definition, e-money is money that is transferred electronically. In a more complex and precise perspective, e-money is a part of monetary value, represented by a claim on the issuer that is stored on an electronic device. It also issues receipt of funds in an amount that is not less than the monetary value issued and accepted as means of payment by undertaking other than the issuer. Technically,

e-money is not printed money or deposit. The payments are limited only to the sum which is stored on the electronic device.

(Popovska-Kamnar, 2014) also, explain that electronic money has the following characteristics, they are:

1) E-money has lower transaction costs compared to other payment instruments. It is because the institutions didn't feel it necessary to keep cash in the ATM. The low-cost reason is that there is less data to be exchanged than other payment instruments.
2) E-money has a higher fixed cost compared to other payment instruments. The E-money system utilizes inevitable modern IT. Meanwhile, modern technology is consistently renewed and elevated with updated innovations.
3) E-money has no other alternative function except being used for the transaction. Meanwhile, different payment instruments can utilize banking deposits.
4) E-money is less transparent in terms of data-based. It is different with credit cards with the name and the number of holders.
5) E-money can substitute the currency in circulation, but this Impact is relatively low.

Figure 9 The Process of Transaction of E-Money



Source: (Popovska-Kamnar, 2014)

The highest number of transactions of e-money are registered in developed countries because they have the largest share of globalization of the financial system. However, e-money is used for insignificant transactions such as retail or virtual worlds. According to (Popovska-Kamnar, 2014), in terms of material, e-money is divided into two types they are hardware and software.

Hardware e-money is card-based e-money. Retailers mainly utilize it. In some cases, hardware e-money is also used according to the purpose, such as parking payments, transportation, etc. Besides, e-money also applies to a location such as university areas or sports centers. On the other hand, software e-money is the transaction through a telecommunication network and the internet.

According to (Widyati), Electronic money or e-money provides advantages for its users among others are:

a) E-money provides convenience, speed and practicality in doing various payment transactions.
b) E-money no need to receive change in the form of goods, because with E-Money the merchant only needs to do direct clearing via a computer network.
c) Electronic money guarantees more certainty and protection of consumer rights.
d) Very applicable because it can be used for various bulk transactions small value with high frequency, for example: toll fee, pay ticket transportation, parking, fast food and so on.
e) Reduce the circulation of counterfeit money
f) Preventing criminal acts due to someone carrying cash in large quantities.
g) Has a customer database that is useful for knowing the number of transactions that you have done.
h) Get special services such as bigger discounts, merchandise to other profitable promotions.
i) Using e-money is a form of citizen participation and participation in supporting the government's program to realize the Less Cash Society which beneficial.

Apart from providing benefits. E-money also has weaknesses, including the following:

a) Vulnerable to be hacked or hacked because it uses electronic systems and Internet.
b) There is a risk of data loss due to software errors.
c) Not all places have tools that are used to use digital money and not all places apply e-money including at merchants.
d) The money you save in e-money will be lost if you delete it the card or device used to store the money. There is still a lack of facilities to support the use of e-money in a number of areas, especially if you are in remote areas that are minimal, especially internet access. So, the use of e-money is still limited to big cities only.

According previous researchers explain by Neda, 2014 the effect of e-money on monetary policy mostly to be expected in following areas:

1) E-money utilization decrease the control of central bank over money supply. Decreasing the central bank’s control of money supply depends on the degree of substitution of currency in circulation with e-money. The currency in circulation is part of monetary aggregates, and if it is decreased as a result of wider use of e-money, it will produce difficulties in measurement of monetary aggregates and of the control of money supply by

the central bank. Possible solutions for limitations of this effect are for example, limitations of the use of e-money. But this will be in direct confrontation with the laws of technological progress and could produce negative external effects on the banking in general. Because of that, there is a need for intensified research on new opportunities to limit the adverse impacts of replacing cash with electronic money

2) E-money increase the velocity of money The influence of e-money over monetary policy can be seen through monetary aggregates, the ability of the central bank to control money supply. In the future impact should be seen through indicators related to monetary aggregates, like the velocity of money. With the use of e-money, transactions are relatively cheaper which allows increase in the number of transactions, and increase in the speed of money. Generally speaking, it will be useful, but only to the level that the central bank could control or measure the monetary aggregates
3) Volatility in exchange rates. The change of the monetary multiplier is an important indicator. This indicator shows the share of currency in the money supply. As a result of e-money the currency decreases producing effects to multiplier.
4) With the use of currency, the need for printing cash is decreasing, which influences the revenues of central banks.
5) E-money has a characteristic of easy portability and affordability which offers a wide use in trade among countries. It is assumed that the user of e-money, motivated with the cheaper foreign currency transactions, will prefer the transactions to be in the most powerful currency. So, through PayPal and other services, users from the country with weaker currency will prefer to transfer their money in higher currency. So, in this way the dollarization or euroization will be a subject to clicking the mouse.19 But still, this situation can weaken the central bank's control in the process of foreign currency exchange among the countries.

Chapter III
Data and Research Methodology

This section discuses about the data and methodology used for addressing the research questions and testing the hypotheses stated earlier in introduction chapter.

3.1. Data Observation

The scope of this research is the national level which is Indonesia. The data used in this research is the secondary data taken from Bank Indonesia (BI) and Badan Pusat Statistik (BPS) from 2013 until 2021 in a monthly period. This study mainly discusses fintech electronic money and other factors such as card-based payment instruments (in this case, credit card and debit cards) and the impact on money supply and velocity of money in Indonesia. The indicator variable of electronic money, credit cards, and debit cards used in this study is the growth of nominal transaction values. Electronic money transaction values nominal is values/nominal of payment transactions that used electronic money for a certain period. On the other hand, debit card transaction values nominal is a payment transaction by using a debit card for a certain period. Similar to a debit card, credit card shopping nominal is the value/nominal of the purchase transaction using a credit card for a certain period. Data sources these variables transaction values are obtained from banks and non-banks that reported online through the report application commercial bank head office and commercial banks another report(Bank Indonesia). The growth of electronic money, credit card and debit card transaction values are calculated from percentage growth transaction values in each month period.

The indicator variable of Money Supply (M2) growth is taken from the growth of the money supply percentage in each month. As mentioned in an earlier chapter, the scope of M2 in this research by definition which the accumulation from M1 and quasi money. In addition, the velocity of money variable is taken from the manual calculation of GDP nominal growth dividing Money Supply (M2) growth. Overall, the primary reason the model in this research uses percentage growth in each variable is to see the consistent data deployment in each variable. Furthermore, this research uses three monetary indicators: inflation rate, Bank Indonesia rate (BI rate), exchange rate growth, and GDP growth. These control variables indicate the factors that other factors that impact money supply and velocity of money situation in each period.

Table 2 Variable, Measurement and Data Sources

No.	Variable	Measurement	Period	Frequency	Data Source
1.	Electronic Money Transaction Values Growth	%	2013 - 2021	Monthly	Bank Indonesia https://www.bi.go.id/id/statistik/ekonomi-keuangan/ssp/apmk-transaksi.aspx
2.	Credit Card Transaction Values Growth	%	2013 - 2021	Monthly	Bank Indonesia https://www.bi.go.id/id/statistik/ekonomi-keuangan/spip/Default.aspx#floating-2
3.	Debit Card Transaction Values Growth	%	2013 - 2021	Monthly	Bank Indonesia https://www.bi.go.id/id/statistik/ekonomikeuangan/spip/Default.aspx#floating-2
4.	Money Supply Growth	%	2013 - 2021	Monthly	https://www.bps.go.id/indicator/13/123/2/uang-beredar.html
5.	Inflation Rate	%	2013 - 2021	Monthly	Bank Indonesia https://www.bps.go.id/indicator/13/379/2/bi-rate.html
6.	BI Rate	%	2013 -2021	Monthly	Bank Indonesia https://www.bps.go.id/indicator/13/379/2/bi-rate.html
7.	Exchange Rate Growth	%	2013 -2021	Monthly	Bank Indonesia https://www.bi.go.id/en/statistik/informasi-kurs/jisdor/Default.aspx
8.	GDP Growth	%	2013 -2021	Monthly	Bank Indonesia https://www.bi.go.id/en/statistik/informasi-kurs/jisdor/Default.aspx

Sources: Bank Indonesia and BPS

3.2. Research Methodology

The methodology used in this research is quantitative analysis. The quantitative analysis uses ordinary least squares (OLS) regression to estimate the model. Further research also uses Classic Test Assumption to test the statistic requirements in multi-linear regression. The regression tool used in this research is Stata MP -17. Using the state as a tool in this

analysis is to find accurate, fast, and complete integrated statistical results. In this research, there are two OLS regression models applied to this research.

3.2.1. Model Analysis 1

In estimating the significant impact of the fintech electronic money transaction values growth to money supply growth, regression model formulated as follows:

$$\%\ M2\ \mathrm{growth}_t = \beta_1 + \beta_2 \%\ EMgrowth_{\ t} + \beta_3 \%\ CCgrowth_{\ t} + \beta_4 \%\ \mathrm{DC}growth_{\ t} +$$

$$\beta_5 \%\ EXCrategrowth_{\ t} + \beta_6 \mathrm{BI}rate_t + \beta_7 \mathrm{INF}_t + \beta_8 \% \mathrm{GDP\ growth} + \varepsilon_t$$

Where: t = (1, 2, ,T)
β (1,2,3)) = Coefficient Matrix
M2 Growth = Real Money Supply Growth as endogeneity variable
EM Growth = Electronic Money as exogeneity variable
CC Growth = Credit Card as exogeneity variable
DC Growth = Debit Card as exogeneity variable
BIrate = BI rate as control variable (%)
EXCHrate Growth = Exchange rate as control variable
INF= Inflation rate as control variable (%)
GDP Growth = GDP growth as control variable (%)

The model illustrates M2 growth as an endogeneity variable. Endogeneity variable is designated variables in an economic/econometric model that are explained or predicted by that model. (OECD, 2014). In another words, endogenous variates are those which form an inherent part of the system. Meanwhile EM growth, CC growth and DC growth as exogeneity variable. exogeneity variable are those which impinge on the system from the outside (OECD, 2014) Then, this model also includes control variables such BI rate, Inflation rate, Exchange rate growth, and GDP Growth. Because these factors identify as indicators that impact the money supply growth. A control variable is anything that is held constant or limited in a research study. It's a variable that is not of interest to the study's aims but is controlled because it could influence the outcomes (Bhandari, 2022)

3.2.2. Model Analysis 2

Meanwhile, in measuring the significant impact of the fintech electronic money and card-based payment instruments transaction values growth to velocity of money, regression model formulated as follows:

$$\frac{Y\ (nominal\ GDP)}{M2} = \beta_1 + \beta_2\%\ EMgrowth_{\ t} + \beta_3\%\ CCgrowth_{\ t} + \beta_4\%\ DCgrowth_{\ t} + \varepsilon_t$$

Where: t=(1,…,…,T)

β_((1,2,3)) = Coefficient Matrix

EM Growth = Electronic Money as exogeneity variable

CC Growth = Credit Card as exogeneity variable

DC Growth = Debit Card as exogeneity variable

$\frac{\boldsymbol{Y\ (nominal\ GDP)}}{\boldsymbol{M2}}$ **=** Velocity of Money

3.3. Ordinary Least Square

Ordinary Least Square (OLS) is one of the economic methods where consist of independent variable as an explanatory variable and the dependent variable as a described variable in a linear equation (Gujarati, 2009). Furthermore, (Gujarati, 2009) also explain, that the component of OLS only consists one independent variable, meanwhile the amount of independent variable more than one. In the case of model which has one independent variable it means the type of the model is simple linear regression. Meanwhile, if the variable used more than one it means the type is multiple linear regression. From the econometric perspective, OLS regression that able to minimize number of error square. As the fulfilment requirement the linear regression model for OLS method, the model should meet the assumption of BLUE (Best Linear Unbiased Estimator) in estimate interval and population regression parameter testing. The assumption of BLUE, describe as follows:

1) Regression model is linear in its parameters.
2) Independent variable has fixed values for repeated sample (stocastic) and don't have any linear correlation that similar between two or more independent variable.
3) Error term has zero expectation values, E (εi) = 0
4) Error term or the model has constant variable for all observants (homoskedasticity),
5) Error term or error in one observation that not correlate with error term for another observation.
6) Error or normal distribution error.

3.4. Statistical Testing

In executing the regression model, there are regression output should include. (Indah, 2009) elaborate the concepts as follows:

3.4.1. Probability (P-Value)

P-value has a function to determine whether the independent variable significantly impacts the dependent variable. The p-value is an instrument to assess the possibility of accepting and rejecting H0 hypotheses. The parameter is equal to zero/ If the p-value is lower than the alpha value (α), we can reject the H0 hypotheses with the confidence level – alpha (α). In other words, the independent variable impacts the dependent variable significantly.

3.4.2. Determination Coefficient Test (R^2)

The function of R^2 statistic is to measure the success regression model used in predicting dependent variable value. This value as a fraction from variance that explain from the model. The range value of R^2 is between zero to one. If the value is closer to one, the model can be judged as a good model.

3.4.3. F-Statistic and Probability

The f-Statistic test is a model determination test commonly referred to as goodness of fit with the hypothesis H0: all parameters that we suspect are zero (but do not involve constants). The F value follows the F distribution with the degree of freedom (k-1) as the numerator and (T-k) as the denominator. The higher the F statistic value, the lower the F statistic value. The probability F value is the marginal significance level from F statistic. If the Probability F is less than alpha (α), the hypotheses H0 can be done. With the level of confidence 1 – alpha (α), it can be concluded that all the suspect parameter is different from zero. In other words, the model we use is good.

3.5. Classic Assumption Test

In order to fulfil the OLS regression model requirements, the data variable should comply prerequisite as explain below, (Indah, 2009):

3.5.1. Normality test

The normality test is carried out to determine whether the data used in the regression model, the dependent variable and the independent variable are normally distributed or not. This test criterion is if the significance or probability value is> the real level (0.05), then the residuals are normally distributed.

3.5.2. Heteroscedasticity Test

Heteroscedasticity is a violation of the OLS assumption that causes the parameters we suspect to be inefficient because the variance is constantly changing. In detecting the existence or absence of heteroscedasticity problems, the instruments used are white heteroscedasticity (no cross term). If the number of independent variables is small or white heteroscedasticity (cross term) if the number of independent variables used in the model is significant. We can use *the Obs*R-square statistic* as a reference to reject and accept H0: Homoskedasticity, where the value follows the Chi-Square distribution. If the probability of *Obs*R-square* is lower than alpha (α), the hypotheses of H0 are rejected. In this case, is detected the heteroskedasticity problem in the regression equation. To fix this problem, the solution by using weighted regression or bottling regression.

3.5.3. Multicollinearity Test

Multicollinearity or multiple collinearities is a violation of OLS where there is significant correlation between independent variables in a structural equation system. Number of procedures can be used as indication of multicollinearity detection. They are explained as follows:

1) High value of R-Square followed by the significant F-statistic value but mostly the t-statistic value is not significant.
2) The correlation between two independent variables. If the correlation values between the variable is relatively high or > 0.8 so it is indicated multicollinearity problem in the equation.
3) Normally, the condition number that related to the independent variable is worth between 20 or 30. The condition number can be obtained from the independent variable matrix separation procedure.

There are a number of solutions in fixing the multicollinearity problems, they are:

1) Reduce the independent variable in a model that have highly correlation.
2) Change the equation model.
3) add data or select a new sample
4) transform the variable, for example change the nominal variable into real variable.

Chapter IV
Empirical Results and Analysis

4.1. Quantitative Results
4.1.1. Descriptive Statistics

Table 3 Descriptive Statistic Electronic Money and Card Based Payment Instruments on Money Supply Growth (in %)

Variable	Observation	Mean	Standard Deviation	Min	Max
M2 growth	103	0.0081936	0.0138007	-0.0318007	0.0527876
EM growth	103	0.0663775	0.1910494	-0.3073181	0.7839992
DC growth	103	0.0171191	0.1131005	-0.3927799	0.21774
CC growth	103	0.0080175	0.0978823	-0.3448759	0.2403258
Inflation Rate	103	4.014854	2.072001	1.32	8.79
BI rate	103	5.616505	1.462277	3.5	7.75
Exchange Rate Growth	103	0.0039518	0.0223517	-0.0605795	0.1029621
NGDP growth	103	-0.0012525	0.03429	-0.2443184	0.0327213
Period	2013-2021 (yearly data)				

Source: Stata 17

Table X shows the descriptive analysis for regression model 1, which regresses the money supply growth on electronic money growth, credit card, and debit card. Over 2013 – 2021, the average Money Supply (M2) growth is 0.8%; meanwhile, in good economic conditions may reach 5.2%, and in bad times could reach negative as minus 3.1%. The standard deviation is more or less 1%. The average of Electronic Money (EM) is relatively high compared to Debit Card and Credit Card, which is 6.63%. The gap might come from the significant rise in transaction values from 2016 until 2021. In a good economic situation, the growth reaches 24%; meanwhile, a bad case could reach negative until minus 34.49%. Then the standard deviation is quite big, more or less than 19.1%. For Debit Card, the average is 1.7%. A good economic condition may reach 21.8%; meanwhile, when the financial situation is terrible could reach negative until minus 30.7%. And the standard deviation is more or less than 11.3 %. It also happens to Credit Card that, in average, reach 0.8%. The maximum growth reaches 24% meanwhile, the lowest is minus 34.48%. The standard deviation is more or less 9.79%.

Table 4 Correlation of Electronic Money and Card Based Payment Instruments on Money Supply Growth and Velocity of Money

	ndgp_g	m2_g	em	em_g	dc	dc_g	cc
ngdp_p	1.000						
m2_g	0.2826	1.000					
em	-0.0276	0.1077	1.000				
em_g	0.1171	0.0638	-0.0239	1.000			
dc	0.0150	0.1256	0.6552	0.1229	1.000		
dc_g	0.1798	0.4880	0.0593	0.2592	0.2366	1.000	
cc	-0.0233	0.0608	-0.1430	0.1993	0.5187	0.2215	1.000
cc_g	0.2025	0.4173	0.0361	0.2847	0.1804	0.7916	0.2943
Inf	-0.0815	-0.0009	-0.6809	-0.0350	-0.7639	-0.0275	-0.0987
Birate	-0.0430	-0.1261	-0.7019	-0.0663	-0.7119	-0.0156	0.0476
Excrate	0.0130	-0.0069	0.5860	0.0004	0.6929	-0.0480	0.2257
Excrate_g	0.0472	0.3238	-0.1102	-0.0097	-0.1792	-0.1580	-0.0206

	cc_g	inf	birate	excrate	excrate_g
cc_g	1.000				
Inf	-0.0121	1.000			
birate	-0.0256	0.8265	1.000		
excrate	-0.0660	-0.7362	-0.5942	1.000	
excrate_g	-0.0427	0.2618	0.1215	-0.0957	1.000

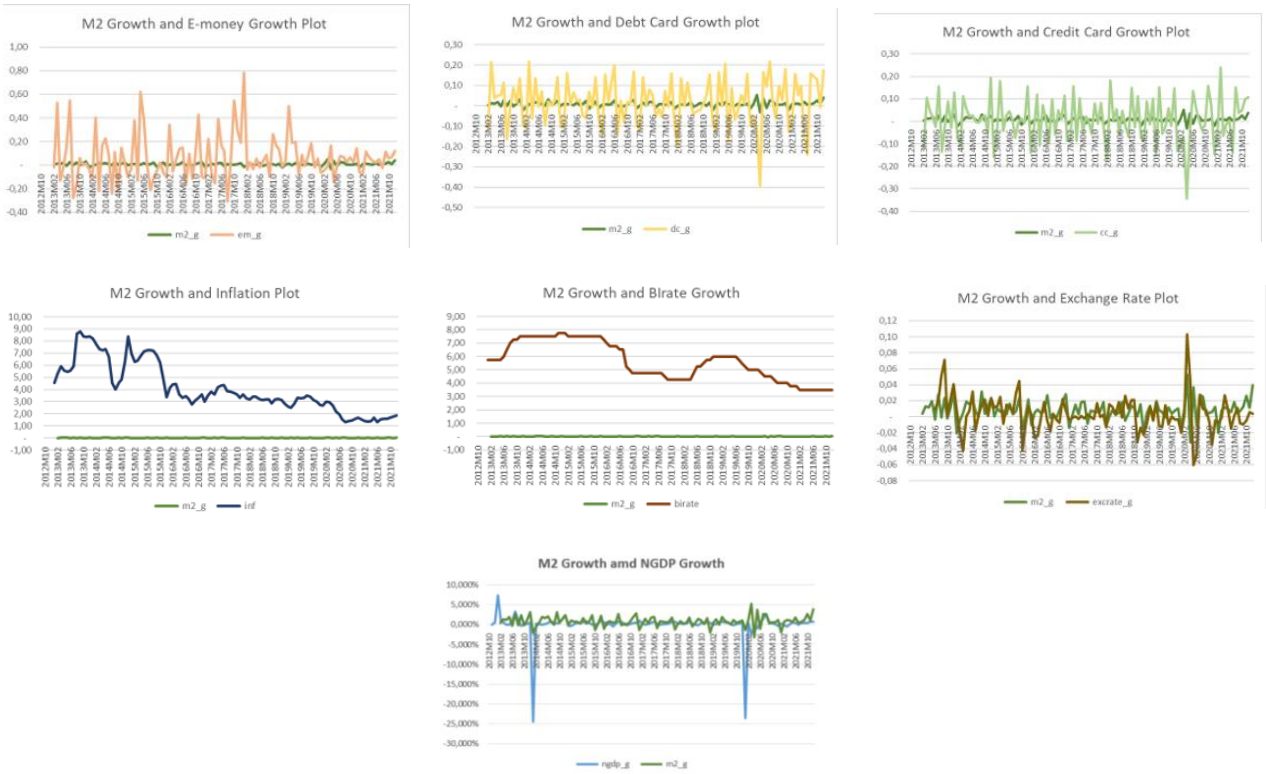
Source: Stata

As a part time series regression analysis, it is required to check the correlation among explanatory variables. Table X shows that among explanatory variables, they are relatively less correlated, and many of the are identified below 0.5. As illustrated in table X only some variables have a strong correlation. They are Debit Card (dc) and Electronic Money (EM), Credit Card (cc) and Debit Card Growth (dc_g), Credit Card (cc) and Debit Card (dc). Meanwhile, from the side of control variable exchange rate (excrate) and electronic money (em), then exchange rate (excrate) and Debit Card (dc).

4.2. Time Series Plot

4.2.1. Time Series Plot of Model Analysis 1

Figure 10 Time Series Plot of Electronic Money and Card Based Payment Instruments on Money Supply Growth

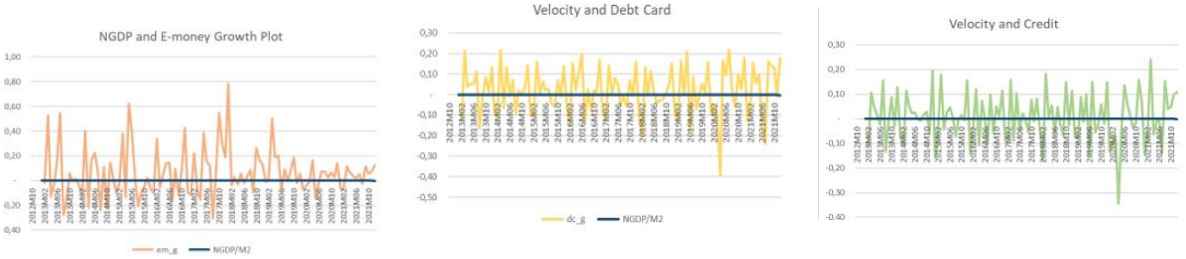


Source: Bank Indonesia and Author's Compilation

A time series chart, also in other words called times series graph or time series plot, is a data visualization tool that describes data points at successive intervals of time. Each point on the chart demonstrates both a time and a quantity that is being measured (TechTarget , 2022). The time series plots show the correlation between Money Supply (M2) growth with each variable. The variable M2 growth and exchange rate time series graph shows most corelate each other. Meanwhile inflation and BI rate growth have no correlation graph pattern during time period.

4.2.2. Time Series Plot of Model Analysis 2

Figure 11 Time Series Plot of Electronic Money and Card Based Payment Instruments on Velocity of Money



Source: Bank Indonesia and Author's Compilation

The time series plots show the correlation between Velocity of Money with each variable. Each variable seems have different pattern with velocity of money. Meanwhile inflation and BI rate growth have no correlation graph pattern during time period.

4.3. Regression Result

Table 5 Regression Result of Electronic Money and Card Based Payment Instruments on Money Supply Growth

Variables	**Model 1**	**Model 1 (R)**
	Coefficient Probability	**Coefficient Probability**
Intercept	**0.0085**	**0.0085**
(Standard error)	(1.8263)	(1.7969)
EM_g	**-0.0066**	**-0.0066**
(Standard error)	(-1.1864)	(-1.2436)
CC_g	**-0.0021**	**-0.0021**
(Standard error)	(-0.1183)	(-0.0997)
DC_g	**0.0657*** **	**0.0657*** **
(Standard error)	(4.3659)	(3.4898)
Exchange rate	**0.2535*** **	**0.2535*** **
(Standard error)	(5.1700)	(2.9574)
BIrate	**0.0001**	**0.0001**
(Standard error)	(0.0742)	(0.0803)
Inf	**-0.0006**	**-0.0006**
(Standard error)	(-0.6684)	(-0.7377)
NGDP_g	**0.0654***	**0.0654*** **
(Standard error)	(2.1395)	(3.4738)
R^2	0.4460	0.4460
R^2_a	0.4052	0.4052
P	0.0000	0.0000
N	103.0000	103.0000

Table X illustrates the correlation matrix between Money Supply (M2) growth and Electronic Money (EM). Debit Card (DC), Credit Card (CC), and other control variables from 2013 to 2021. The regression uses robustness to get better results. Robust regression is used to detect the outlier and give resistant results from the outlier (Nurdin, 2014). According to the result, electronic money transactions don't significantly impact the money supply. It means that

electronic money is not growing along with the money supply. With the coefficient minus 0.0066, it means when the transaction of e-money increase 1%, the money supply will decrease by 0.0066%. The result is also similar to a credit card. The result is identified that credit card transactions don't have a significant impact on money supply growth. The coefficient of credit card transactions is minus 0.0021. It means when the transaction of a credit card is increased 1% the money supply will decrease by 0.0021%. Meanwhile, the coefficients of debit card transactions are positively significant in the amount of 0.0657. It means when the debit card transaction increases by 1%, the money supply will increase by 0.0657%. Some of the control variables of this research also have positive significance. They are the Exchange rate (0.2535) and NGDP growth (0.0654). Overall, the R2 in this research is relatively moderate, only 44.6%. The independent variables' ability to explain the dependent variable is minimal. Conversely, if the value is close to 1 (one) and away from 0 (zero) it means that the independent variables can provide all the information needed to predict the dependent variable (Meiryani, 2021).

Table 6 Regression Result of Electronic Money and Card Based Payment Instruments on Velocity of Money

Variables	**Model 2**	**Model 2 (R)**
	Coefficient Probability	**Coefficient Probability**
Intercept	**0.0000*** **	**0.0000*** **
(Standard error)	(36.7933)	(35.4876)
EM_g	**0.0000**	**0.0000**
(Standard error)	(0.0575)	(0.0625)
CC_g	**0.0000**	**0.0000**
(Standard error)	(0.5068)	(0.4827)
DC_g	**-0.0000**	**-0.0000**
(Standard error)	(-0.4608)	(-0.4399)
R^2	0.0028	0.0028
R^2_a	-0.0274	-0.0274
P	0.9638	0.9694
N	103	103

Table X illustrates the correlation matrix between Velocity of Money and Electronic Money (EM). Debit Card (DC), Credit Card (CC), and other control variables from 2013 to 2021. The regression uses robustness to get better results. The coefficients are positive but do not show significant consequences for all variables. The R2 is also relatively low, only 0.2%, which means that the independent variables' ability to explain the dependent variable is

minimal. The result shows that electronic money transaction doesn't significantly impact the money supply. It means that electronic money is not growing along with the money supply. With the coefficient of 0.0000, it means when the transaction of e-money increase 1% don't have any impact on the velocity of money %. The result is also similar to a credit card. The result is that credit card transactions don't significantly impact the velocity of money growth. The coefficient of credit card transactions is 0.0000. It means when the transaction of credit card is increased 1% don't have any impact on the velocity of money. Next, the coefficient of the debit card is also not significant in the amount of 0.0000. It means when the debit card transaction increase 1% don't have any impact to the velocity of money.

4.4. Classical Assumption Test Result

4.4.1. Classical Assumption Test for Electronic Money and Card Based Payment Instruments on Money Supply (Model 1)

4.4.1.1. Normality Test

To check the normality in this analysis using Jarque-Bera Test. Jarque-Bera Lagrange multiplier test is most used instrument that to test normality of economic time series. The algorithm provides a joint test of the null hypothesis of normality that use skewness and kurtosis aspects (Katzgraber, 2009). If the p-value obtained from stata result is lower than chi (2) then the null hypothesis cannot be rejected. The result of Jarque-Bera in this model is 6.335 for chi (2), meanwhile the p-value is 0.0421. It means that p-value is lower than chi (2). The conclusion the data is normally distributed.

4.4.1.2. Autocorrelation Test

In this section, to check autocorrelation is using Durbin Watson as instrument analysis. Durbin Watson test is the test that frequently used to detect the presence of residual serial corelation from least squares regression analyses (Chen, 2016). The Durbin-Watson statistic will always have a value raging between 0-4. Value 2.0 indicates there is no autocorrelation detected in the sample. Values from 0 to less than 2 points to autocorrelation and values from 2-4 means to negative autocorrelation. The result of Durbin – Watson d-statistic in this model (8, 108) = 2.705363. It means no serial correlation because the result (2.705363) values between 2-4.

4.4.1.3. Multicollinearity Test

Multicollinearity refers to a situation in which two or more explanatory (predictor) variables in a multiple regression model are related with each other and likewise related with

the response variable (Akinwande, 2015). To check multicollinearity is using the Variance Inflation Factor (VIF) for each independent variable. It is a measure of multicollinearity in the set of multiple regression variables. The higher value of VIF the higher correlation between this variable and the rest. If VIF is greater than 10 roughly indicates significant multicollinearity. The VIF results of the variable in this model are below 10, it means that the data have no multicollinearity.

Table 7 Variance Inflation Factor Results

Variable	VIF	1/VIF
Inf	3.49	0.286381
birate	3.29	0.304173
dc_g	2.81	0.355558
cc_g	2.80	0.357199
excrate_g	1.17	0.857868
em_g	1.10	0.907561
NGDP_g	1.07	0.936767
Mean VIF	2.25	

4.4.1.4. Heteroskedasticity Test

Breusch-Pagan test helps to check the null hypothesis versus the alternative hypothesis. A null hypothesis is that where the error variances are all equal (homoscedasticity), whereas the alternative hypothesis states that the error variances are a multiplicative function of one or more variables (heteroscedasticity) (Sajwan, 2018). The Null Hypothesis (H0) is the regression have a Constant variance or Homokedasticity. Thus, i > f the p-value below 5%, it means we reject the Null Hypothesis. In this case we have problem with heteroskedasticity, then the Solution is we have to re-run regression in model 4 with vce (robust) option.

4.4.2. Classical Assumption Test for Electronic Money and Card Based Payment Instruments on Velocity of Money Regression (Model 2)

4.4.2.1. Normality Test

The result of Jarque-Bera test from using stata is obtained Chi (2) is 9.225 If the p-value is lower than the Chi2 value then the null hypotheses cannot be rejected. The regression of model 2 shows the p-value is 0.0099 which is below the chi (2) that result 9.225. Therefore, the residuals are normal distributed.

4.4.2.2. Autocorrelation Test

The Durbin-Watson statistic will always have a value raging between 0-4. Value 2.0 indicates there is no autocorrelation detected in the sample. Values from 0 to less than 2 points to autocorrelation and values from 2-4 means to negative autocorrelation. The result of Durbin-Watson statistic from stata result of Model 2 is 0.0350457. It means in this model data there is no serial corelation.

4.4.2.3. Multicollinearity

To check multicollinearity, each independent variable uses the Variance Inflation Factor (VIF). It is a measure of multicollinearity in the set of multiple regression variables. The higher value of VIF, the higher correlation between this variable and the rest. If VIF is greater than 10 roughly indicates significant multicollinearity. The result shows VIF for each variable is lower than 10. It means that the residuals don't have multicollinearity. The results of this multicollinearity using Stata are 2.73 for credit card growth, 2.69 for debit card growth, and 1.09 for the electronic money growth variable. All the results are lower than 10, which means the residuals don't have multicollinearity.

Table 8 Variance Inflation Factors Results

Variable	VIF	1/VIF
cc_g	2.73	0.366621
dc_g	2.69	0.372174
em_g	1.09	0.915870
Mean VIF	2.17	

4.4.2.4. Heteroskedasticity

To check heteroskedasticity is using Breusch–Pagan/Cook–Weisberg test ** The Null Hypothesis (H0) is the regression have a Constant variance or Homokedasticity. Thus, i > f the p-value below 5%, it means we reject the Null Hypothesis. In this case, we have problem with heteroskedasticity then the solution we have to re-run regression in model 2 with variance–covariance matrix of the estimators (VCE) robust option.

4.5. Analysis

4.5.1. Fintech E-money and The Impact to the Money Supply Growth

The study's regression result shows a negative and insignificant impact of e-money growth on money supply growth. The result is contradicted by this study's hypotheses and related theory. The result indicates that fintech e-money in Indonesia has not yet significantly impacted the money supply in Indonesia. Money supply growth is still dominantly influenced

by other instruments such as cash, debit card, or credit card transaction. The factors could be from the fintech e-money adoption that has still not been implemented comprehensively. The number of fintech companies is not as much as banks and other financial institutions. Besides, as a large archipelago country, equality and distribution still become a substantial issue in Indonesia. Digital infrastructure such as internet access hasn't reached the remote areas in Indonesia. It makes fintech e-money utilization in Indonesia, especially in remote regions, still poorly implemented. Conversely, Fintech e-money is mostly used for micro-scale transactions such as parking, toll payment, supermarket, restaurant, etc. Meanwhile, the widescale transactions such as business and company payment transactions use other payment instruments.

However, the similar result also finds in the previous research. The previous research from (Novitasari, 2019) shows electronic money has no significant impact on the money supply. This result is relevant to exist e-money products that currently have no interconnected network related to each other. It has become the system's weakness in Indonesia because some e-money can only be used to transact at merchants with e-money reader (e-money reader) issued by money product organizers electronics. Society as the buyer should have as many e-money or electronic money products as possible for transactions because not all merchants as merchants provide e-money readers that support all products of e-money or electronic money. Lack of knowledge and understanding of the community regarding e-money also makes transactions in cash still preferred today and also hinders the realization of a less-cash society. Meanwhile, from the monetary perspective, it can be explained that the issuance of e-money is carried out at the expense of a saving account (S) and future deposits (T) of customers at commercial banks. As a result, it will cause a decrease (M2). The S and T from M2 will use in the form of float as the publisher's obligation for the e-money they issue. From this cycle, the increase in the value of electronic money transactions, the money supply (M1) will increase in the short term.

On the other hand, the regression result finds that only the debit card transaction values growth variable has a significantly positive correlation with money supply growth than the electronic and credit card variable. The result indicates that debit card transaction significantly impacts the money supply. This result is relevant because debit card transaction values are substantially higher than credit card and e-money transaction values. Besides, wide-scale transactions such as business and company payments still dominantly utilize debit card transactions. This result has relevant results to the related research(Novitasari, 2019)[7].Debit card transaction values have a significant positive impact on money supply growth. It means if

[7] from the paper “Pengaruh Alat Pembayaran Menggunakan Kartu (APMK) dan E-money terhadap Jumlah Uang yang Beredar Periode Tahun 2014-2018”

the value of a transaction using a debit card/ATM is higher, then the amount of money in circulation will also increase. This result is relevant to the declaration of the Movement National Non-Cash[8] held by Bank Indonesia. This program rouses and develops transaction values and the amount of money supply. From the side of monetary perspective (Arthur, 2016) explain, the development of debit cards with saving as an underlying instrument has impacted the shift of the savings function from savings which cannot be withdrawn at any time into a type of deposit that can be withdrawn at any time as well as demand deposits. By paying attention to the degree of moneyness of the type of savings. Therefore, the classification of savings using an ATM or debit card is part of narrow money (M1) in the demand deposit category, no longer broad money (M2). As explained in the previous chapter that M1 consists of currency and demand deposits; meanwhile, M2 is M1 includes quasi-money that has a period. So, the high transaction of debit cards considers increasing the money supply (M1).

Lastly, credit card has a negative and insignificant impact on money supply growth. It means that greater credit card utilization will reduce the money supply growth. This result is relevant to the use of credit card because credit card provides loans that the transaction will be debited in the near future. That's why credit cards might help the payment transaction but do not increase the money supply in real-time. The result is also similar to the previous result. (Novitasari, 2019) The number of uses of card transactions credit disbursed by banks is expected can increase profitability through interest earned from card user's credit. However, the bank that issued the card credit suffered a loss due to the amount of credit disbursed but not returned by card using credit or customer.

4.5.2. Fintech Electronic Money impact to Velocity of Money

The regression analysis result shows no significant impact of fintech e-money, debit cards, and credit cards. According to the result, Indonesia's fintech e-money, debit card, and credit cards haven't increased the speed of money transactions. It might be the amount of unbanked society is still substantial, particularly in remote areas. The community still uses cash for payment transactions rather than e-money, debit cards, and credit. Limited digital infrastructures, especially in remote areas, also become a factor in cash utilization in society. This result has contradicted the theory and the previous research find. In his study (Popovska-Kamnar, 2014)[9] explains that fintech e-money is supposed to increase the velocity of money. Popovska-Kamnar also states that e-money transaction is relatively cheap and provide

[8] Bank Indonesia as the authority that regulates the payment system in Indonesia has designed a Non-Cash Payments or often called Toward a Less Cash Society (LCS) in 2006. Subsequently in 2014, Bank Indonesia designed the National Non-Cash Movement (GNNT) to support the community in using a cashless payment system

[9] The Use of Electronic Money and Its Impact on Monetary Policy

convenience. This advantage stimulates the number of transactions and increases the speed of money. His research also indicates e-money can be an instrument for boosting the velocity of money as an indicator of monetary aggregates that may contribute to the central bank to control of the money supply.

Chapter V
Conclusion and Policy Implication

5.1. Conclusion and Policy Implications

The innovation of payment systems and technology development has transformed cash-oriented transactions into electronic money and cards as a transaction method. Here, Indonesia is one of the countries at the expertise stage of the cash system, a non-cash payment system. As an instrument of the payment system, fintech electronic money transaction statistics consistently increase yearly. This research aims to study the impact of fintech electronic money transaction values on money supply growth. Besides, this research also seeks to find the effect of the development of fintech electronic money transaction values on the velocity of money. The regression result of the study considers the negative and insignificant impact of fintech e-money and credit cards on money supply growth during the period. The explanation is that the number of fintech companies is not as much as banks and other financial institutions. Besides, as an archipelago country, equality and distribution still become a substantial issue in Indonesia. Digital infrastructure such as internet access hasn't reached Indonesia's remote areas. It makes fintech e-money utilization in Indonesia, especially in remote regions, still poorly implemented. On the other hand, Fintech e-money is mainly used for micro-scale transactions such as parking, toll payment, supermarket, restaurant, etc. Meanwhile, widescale transactions use other payment instruments, such as business and company transactions. Conversely, debit card growth positively impacts money supply growth. This result is relevant because debt card transaction values are significantly higher than credit card and e-money transaction values. Besides, wide-scale transactions such as business and company payments still utilize debit card transactions.

From the monetary perspective, even though it contradicts the result, e-money is supposed to positively and significantly impact the money supply. The issuance of e-money is carried out at the expense of a saving account (S) and future deposits (T) of customers at commercial banks. As a result, it will cause a decrease (M2). The S and T from M2 will use in the form of float as the publisher's obligation for the e-money they issue. This cycle will increase the value of electronic money transactions, the money supply (M1), in the short term. In the case of debit cards, the development of debit cards with saving as an underlying instrument has impacted the shift of the savings function. From savings that cannot be withdrawn at any time into a type of deposit that can be withdrawn at any time and demand deposits. By paying attention to the degree of moneyness for the kind of savings. Therefore, the classification of savings using an ATM or debit card is part of narrow money (M1) in the demand deposit category, no longer broad money (M2). As explained in the previous chapter that M1 consists

of currency and demand deposits; meanwhile, M2 is M1 includes quasi-money that has a period. So, the high transaction of debit cards considers increasing the money supply (M1). The other regression result shows that fintech e-money, debit card, and credit card growth of transaction values have no significant impact on the velocity of money during the research period in Indonesia. It might be the amount of unbanked society is still substantial, particularly in remote areas. Community dominantly still uses cash as payment transactions rather than e-money, debit cards, and credit. Limited digital infrastructures, especially in remote areas, also become a factor in cash utilization in society.

From this research, there are several policy recommendations can be considered. First, the government is better able to improve coordination with Bank Indonesia regarding socialization to the public about the use of the system of non-cash payments, such as the Cashless Society and the National Non-Cash Movement. Second, for Bank Indonesia, it is better if this research can be used to review the operation of the non-cash payment system, especially card-based payment instruments and electronic money. In addition, Bank Indonesia should also be able to increase socialization among the public regarding the use of non-cash payment systems, especially in eastern Indonesia. One of the tasks of Bank Indonesia as the monetary authority is to regulate and maintain the smooth running of the system and oversee the system payment. Third, for the banking sector as the issuing institution for fintech electronic money and card-based payment instrument, it is better to improve services to the community. One is increasing digital infrastructure that can support community activities using the system's non-cash payments.

5.2. Research Limitation

This research uses fintech e-money as the indicator of fintech development in Indonesia. Meanwhile, the scope of fintech is relatively complex. Other fintech aspects include fintech lending, equity crowdfunding, insurance-tech, digital innovation, etc. It could be a thoughtful input for future research to study fintech in an enormous scope. The other limitation is that this study has fewer references that explain relevant results. Lastly, the practical involvement from institution, market, and industry perspectives could be beneficial to enrich the study analysis from many sides of view.

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Appendix

Appendix Table 1. Data Set for all variables

date	period	ngdp_g	m2_g	em_g	dc_g	cc_g	inf	birate	excrate_g
2013M01	4,00	7,354%					4,57	5,75	
2013M02	5,00	0,747%	0,356%	-1,817%	-11,701%	-11,521%	5,31	5,75	
2013M03	6,00	0,622%	1,284%	52,896%	21,364%	10,633%	5,90	5,75	
2013M04	7,00	-0,111%	1,156%	-13,068%	3,766%	4,701%	5,57	5,75	
2013M05	8,00	-0,041%	1,945%	-2,385%	5,154%	1,400%	5,47	5,75	
2013M06	9,00	1,020%	-0,377%	16,545%	5,174%	-2,415%	5,57	6,00	0,975%
2013M07	10,00	3,272%	2,730%	54,864%	11,289%	15,622%	5,90	6,50	1,942%
2013M08	11,00	1,107%	-0,118%	-27,706%	-16,413%	-13,466%	8,61	7,00	5,120%
2013M09	12,00	-0,364%	2,332%	-17,256%	-1,055%	-1,626%	8,79	7,25	7,150%
2013M10	13,00	0,072%	-0,201%	5,850%	8,694%	8,823%	8,40	7,25	0,182%
2013M11	14,00	0,097%	1,095%	-0,233%	1,527%	-2,959%	8,32	7,50	2,166%
2013M12	15,00	0,526%	3,163%	1,495%	13,494%	12,741%	8,37	7,50	4,082%
2014M01	16,00	-24,432%	-2,093%	-3,441%	-9,286%	-7,647%	8,22	7,50	0,766%
2014M02	17,00	0,238%	-0,473%	-11,511%	-10,865%	-10,437%	7,75	7,50	-2,008%
2014M03	18,00	0,058%	0,481%	40,103%	21,619%	11,337%	7,32	7,50	-4,257%
2014M04	19,00	-0,041%	1,899%	-21,995%	-6,377%	5,694%	7,25	7,50	0,076%
2014M05	20,00	0,137%	1,587%	16,739%	13,460%	2,297%	7,32	7,50	0,789%
2014M06	21,00	0,404%	2,037%	22,502%	-0,632%	2,557%	6,70	7,50	3,181%
2014M07	22,00	0,901%	0,763%	8,921%	7,033%	-0,157%	4,53	7,50	-1,712%
2014M08	23,00	0,441%	-0,023%	-23,951%	-9,403%	-0,685%	3,99	7,50	0,200%
2014M09	24,00	0,245%	3,181%	11,285%	2,031%	1,701%	4,53	7,50	1,523%
2014M10	25,00	0,439%	0,358%	-21,632%	0,003%	2,726%	4,83	7,50	2,137%
2014M11	26,00	1,478%	1,297%	14,681%	2,721%	-5,606%	6,23	7,75	0,111%

date	period	ngdp_g	m2_g	em_g	dc_g	cc_g	inf	birate	excrate_g
2014M12	27,00	2,440%	2,371%	2,459%	14,101%	19,341%	8,36	7,75	2,303%
2015M01	28,00	-0,264%	0,036%	-9,954%	-10,576%	-15,778%	6,96	7,75	1,132%
2015M02	29,00	-0,381%	1,037%	-2,822%	-10,145%	-5,454%	6,29	7,50	1,357%
2015M03	30,00	0,151%	0,669%	37,778%	16,085%	17,884%	6,38	7,50	2,486%
2015M04	31,00	0,347%	0,691%	-13,099%	0,618%	-4,384%	6,79	7,50	-0,911%
2015M05	32,00	0,483%	0,296%	62,149%	6,609%	2,677%	7,15	7,50	1,489%
2015M06	33,00	0,525%	1,642%	38,832%	2,298%	4,550%	7,26	7,50	1,314%
2015M07	34,00	0,926%	0,331%	0,316%	2,844%	0,543%	7,26	7,50	0,462%
2015M08	35,00	0,384%	0,706%	-20,711%	-4,673%	-7,215%	7,18	7,50	3,043%
2015M09	36,00	-0,050%	2,373%	-10,670%	-5,995%	-0,584%	6,83	7,50	4,458%
2015M10	37,00	-0,081%	-1,453%	-4,487%	6,832%	1,331%	6,25	7,50	-4,169%
2015M11	38,00	0,207%	0,208%	2,366%	-0,793%	-0,544%	4,89	7,50	-0,894%
2015M12	39,00	0,962%	2,167%	-6,494%	13,933%	15,614%	3,35	7,50	1,331%
2016M01	40,00	0,514%	-1,109%	-10,136%	-6,836%	-14,065%	4,14	7,25	0,249%
2016M02	41,00	-0,086%	0,524%	34,063%	-14,279%	-3,527%	4,42	7,00	-2,688%
2016M03	42,00	0,199%	0,883%	-5,237%	15,363%	12,040%	4,45	6,75	-2,387%
2016M04	43,00	-0,447%	0,439%	4,687%	1,936%	-10,735%	3,60	6,75	-0,101%
2016M05	44,00	0,242%	0,702%	13,939%	10,474%	7,242%	3,33	6,75	1,819%
2016M06	45,00	0,663%	2,674%	14,666%	19,724%	1,053%	3,45	6,50	-0,481%
2016M07	46,00	0,699%	-0,149%	-16,533%	-13,828%	-9,945%	3,21	6,50	-1,794%
2016M08	47,00	-0,009%	0,331%	9,722%	2,497%	9,888%	2,79	5,25	0,377%
2016M09	48,00	0,232%	-0,177%	-11,609%	-8,122%	-5,872%	3,07	5,00	-0,355%
2016M10	49,00	0,153%	0,862%	7,231%	1,966%	5,036%	3,31	4,75	-0,770%
2016M11	50,00	0,481%	1,887%	42,383%	1,572%	1,082%	3,58	4,75	2,253%
2016M12	51,00	0,434%	2,800%	-9,881%	16,793%	11,374%	3,02	4,75	0,798%
2017M01	52,00	0,987%	-1,361%	-11,200%	-9,565%	-8,736%	3,49	4,75	-0,433%

date	period	ngdp_g	m2_g	em_g	dc_g	cc_g	inf	birate	excrate_g
2017M02	53,00	0,253%	0,122%	22,002%	-11,851%	-8,242%	3,83	4,75	-0,134%
2017M03	54,00	0,005%	1,512%	-8,111%	14,109%	15,737%	3,61	4,75	0,035%
2017M04	55,00	0,109%	0,322%	-15,117%	0,439%	-8,793%	4,17	4,75	-0,290%
2017M05	56,00	0,415%	1,839%	38,757%	8,012%	10,387%	4,33	4,75	0,124%
2017M06	57,00	0,719%	1,927%	15,987%	4,906%	-4,636%	4,37	4,75	-0,199%
2017M07	58,00	0,247%	-0,901%	11,951%	-4,960%	2,264%	3,88	4,75	0,340%
2017M08	59,00	-0,036%	0,803%	-30,732%	-1,461%	-0,370%	3,82	4,50	-0,002%
2017M09	60,00	0,167%	0,661%	3,373%	-5,712%	-5,637%	3,72	4,25	-0,287%
2017M10	61,00	0,047%	0,574%	54,700%	7,094%	7,876%	3,58	4,25	1,673%
2017M11	62,00	0,242%	0,702%	30,281%	-0,447%	-1,032%	3,30	4,25	0,010%
2017M12	63,00	0,758%	1,837%	18,814%	16,012%	8,259%	3,61	4,25	0,217%
2018M01	64,00	0,671%	-1,245%	78,400%	-9,893%	-4,435%	3,25	4,25	-1,300%
2018M02	65,00	0,215%	-0,001%	-3,752%	-20,107%	-17,282%	3,18	4,25	1,567%
2018M03	66,00	0,246%	0,825%	2,911%	13,502%	18,207%	3,40	4,25	1,238%
2018M04	67,00	0,150%	0,246%	-3,057%	-0,204%	0,468%	3,41	4,25	0,325%
2018M05	68,00	0,265%	0,481%	5,418%	11,455%	5,473%	3,23	4,75	1,860%
2018M06	69,00	0,644%	1,823%	-1,835%	1,196%	-5,689%	3,12	5,25	-0,076%
2018M07	70,00	0,337%	-0,476%	3,255%	-4,143%	4,848%	3,18	5,25	2,602%
2018M08	71,00	0,010%	0,393%	8,842%	-2,649%	-2,216%	3,20	5,50	1,008%
2018M09	72,00	-0,114%	1,398%	-9,787%	-2,130%	-6,881%	2,88	5,75	2,121%
2018M10	73,00	0,344%	1,083%	26,458%	0,565%	14,906%	3,16	5,75	2,086%
2018M11	74,00	0,337%	0,061%	16,790%	5,228%	-2,739%	3,23	6,00	-3,176%
2018M12	75,00	0,687%	1,571%	13,293%	15,366%	11,333%	3,13	6,00	-1,360%
2019M01	76,00	0,397%	-1,998%	-1,169%	-9,039%	-7,610%	2,82	6,00	-2,303%
2019M02	77,00	-0,008%	0,457%	2,628%	-12,649%	-7,875%	2,57	6,00	-0,903%
2019M03	78,00	0,186%	1,348%	50,027%	16,540%	8,898%	2,48	6,00	1,252%

date	period	ngdp_g	m2_g	em_g	dc_g	cc_g	inf	birate	excrate_g
2019M04	79,00	0,519%	-0,009%	19,138%	0,104%	-1,201%	2,83	6,00	-0,481%
2019M05	80,00	0,760%	1,980%	20,096%	20,768%	10,053%	3,32	6,00	1,769%
2019M06	81,00	0,632%	0,819%	-7,344%	-17,364%	-15,078%	3,28	6,00	-1,155%
2019M07	82,00	0,389%	0,552%	8,968%	8,627%	15,112%	3,32	5,75	-1,284%
2019M08	83,00	0,191%	-0,111%	-0,474%	-6,860%	-5,558%	3,49	5,50	1,411%
2019M09	84,00	-0,204%	1,175%	7,317%	-1,790%	-2,128%	3,39	5,25	-0,919%
2019M10	85,00	0,083%	0,377%	18,453%	5,241%	5,899%	3,13	5,00	0,046%
2019M11	86,00	0,191%	0,788%	-1,772%	0,941%	-2,026%	3,00	5,00	-0,346%
2019M12	87,00	0,364%	1,027%	5,531%	15,713%	14,728%	2,72	5,00	-0,364%
2020M01	88,00	-23,475%	-1,447%	-6,468%	-9,798%	-13,324%	2,68	5,00	-2,035%
2020M02	89,00	0,365%	1,166%	-4,371%	-5,210%	-9,587%	2,98	4,75	0,320%
2020M03	90,00	-2,244%	5,279%	-0,939%	-10,549%	-6,956%	2,96	4,50	10,296%
2020M04	91,00	-0,764%	-3,180%	16,733%	-39,278%	-34,388%	2,67	4,50	4,428%
2020M05	92,00	-0,929%	3,667%	-14,348%	16,465%	-4,377%	2,19	4,50	-6,058%
2020M06	93,00	0,511%	-1,141%	-0,522%	9,504%	13,633%	1,96	4,25	-4,765%
2020M07	94,00	1,525%	2,739%	7,651%	21,774%	5,735%	1,54	4,00	2,722%
2020M08	95,00	2,611%	2,502%	7,025%	2,546%	0,936%	1,32	4,00	0,974%
2020M09	96,00	0,652%	0,265%	2,619%	-6,319%	-3,665%	1,42	4,00	0,838%
2020M10	97,00	0,291%	0,494%	6,284%	9,803%	-1,769%	1,44	4,00	-0,603%
2020M11	98,00	0,162%	0,576%	2,915%	2,513%	15,768%	1,59	3,75	-3,535%
2020M12	99,00	-0,307%	1,242%	14,448%	17,890%	6,947%	1,68	3,75	-0,500%
2021M01	100,00	0,214%	-2,006%	-6,274%	-12,829%	-14,383%	1,55	3,75	-0,733%
2021M02	101,00	-0,171%	0,744%	-7,507%	-8,484%	-5,647%	1,38	3,50	-0,129%
2021M03	102,00	-0,491%	1,141%	11,630%	15,500%	24,033%	1,37	3,50	2,659%
2021M04	103,00	0,156%	0,998%	6,663%	5,339%	-6,478%	1,42	3,50	0,928%
2021M05	104,00	0,521%	0,570%	3,553%	9,754%	-1,152%	1,68	3,50	-1,495%

date	period	ngdp_g	m2_g	em_g	dc_g	cc_g	inf	birate	excrate_g
2021M06	105,00	0,362%	1,798%	2,117%	-14,604%	0,130%	1,33	3,50	0,125%
2021M07	106,00	0,027%	0,428%	5,089%	-24,038%	-13,749%	1,52	3,50	1,086%
2021M08	107,00	0,354%	0,711%	-2,505%	15,929%	15,163%	1,59	3,50	-0,810%
2021M09	108,00	0,347%	1,240%	11,648%	14,322%	3,924%	1,60	3,50	-0,919%
2021M10	109,00	0,393%	2,613%	5,766%	12,900%	4,871%	1,66	3,50	-0,468%
2021M11	110,00	0,779%	1,089%	7,070%	-0,785%	9,814%	1,75	3,50	0,559%
2021M12	111,00	0,680%	3,923%	12,149%	17,579%	10,765%	1,87	3,50	0,398%

Appendix Table 2. Bank Licensed for e-money

No.	Bank Providers and E-money Products	No.	Bank Providers and E-money Products
1.	Bank Central Asia (Sakuku/Flazz)	8.	Permata Bank (BBM Money)
2.	CIMB Niaga (Rekening Ponsel)	9.	Bank Rakyat Indonesia (Brizzi/T-Bank)
3.	Bank DKI (Jakarta One/JakCard)	10.	Bank QNB Indonesia (Dooet)
4.	Bank Mandiri (Mandiri E-Money)	11.	Bank Sinarmas (Simas E-money)
5.	Bank Mega (Mega Cash/Mega Virtual)	12.	Bank BNI Syariah (HasanahKu)
6.	Bank Negara Indonesia (UnikQu	13.	OCBC NISP (One Wallet)
7.	Nobu Bank (Nobu E-Money)	14.	Bank Jabar dan Banten (DigiCash)

Appendix Table 3. Non-Banks Licensed for e-money (14 from total 37)

No.	Non- Bank Providers and E-money Products	No.	Non-Bank Providers and E-money Products
1.	Indosat (Imkas/PayPro/Dompetku)	8.	Airpay International Indonesia (ShopeePay)
2.	Telekomunikasi Indonesia (Flexi Cash/iVas Card)	9.	Fintek Karya Nusantara (LinkAja)
3.	XL Axiata (XL Tunai/XL Cash)	10.	Kereta Commuter Indonesia (KMT)
4.	Smartfren Telecom (Uangku)	11.	Mass Rapid Transit (MTT)
5.	Dompet Anak Bangsa (GoPay)	12.	Astra Digital Arta (AstraPay)
6.	Visionet Internasional (OVO Cash)	13.	Espay Debit Indonesia Koe (DANA/Unik)
7.	Veritra Sentosa Internasonal (Paytren)	14.	Finnet Indonesia (Finpay)

Source: Fintechnews Indonesia

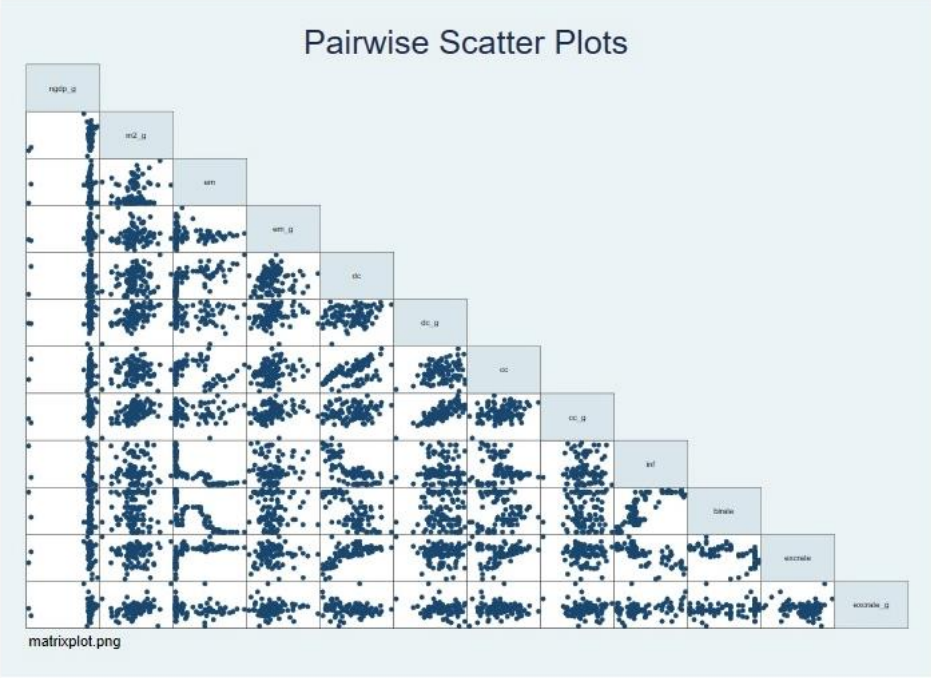
Appendix Table 4. Correlation Matrix for all Variables

```
. pwcorr $allvar
```

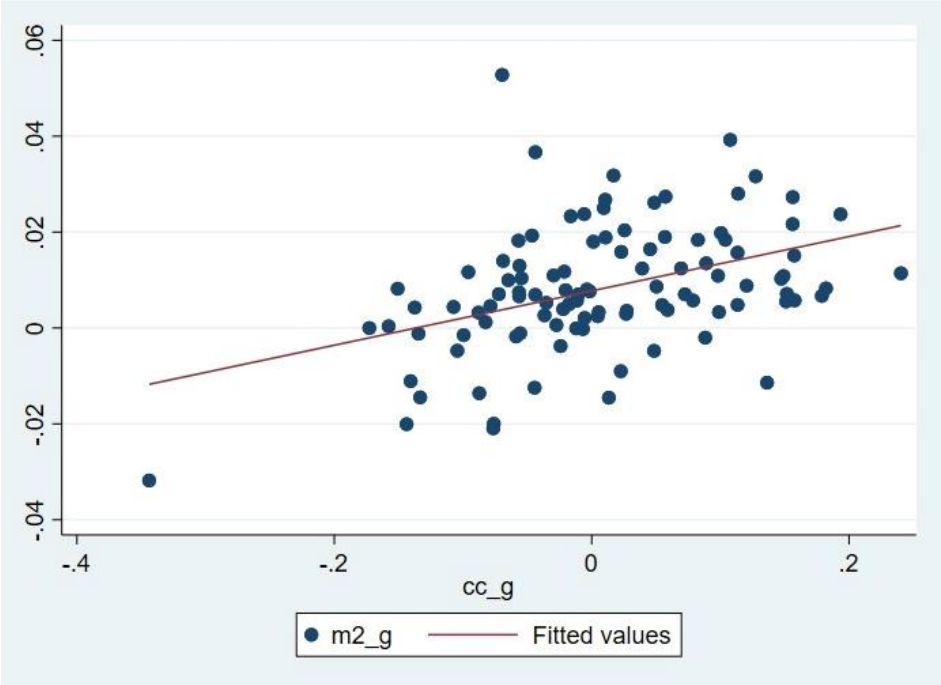
	ngdp_g	m2_g	em	em_g	dc	dc_g	cc
ngdp_g	1.0000						
m2_g	0.2826	1.0000					
em	-0.0276	0.1077	1.0000				
em_g	0.1171	0.0638	-0.0239	1.0000			
dc	0.0150	0.1256	0.6552	0.1229	1.0000		
dc_g	0.1798	0.4880	0.0593	0.2592	0.2366	1.0000	
cc	-0.0233	0.0608	-0.1430	0.1993	0.5187	0.2215	1.0000
cc_g	0.2025	0.4173	0.0361	0.2847	0.1804	0.7916	0.2943
inf	-0.0815	-0.0009	-0.6809	-0.0350	-0.7639	-0.0275	-0.0987
birate	-0.0430	-0.0261	-0.7019	-0.0663	-0.7119	-0.0156	0.0476
excrate	0.0130	-0.0069	0.5860	0.0004	0.6929	-0.0480	0.2257
excrate_g	0.0472	0.3238	-0.1102	-0.0097	-0.1792	-0.1580	-0.0206

	cc_g	inf	birate	excrate	excrat~g
cc_g	1.0000				
inf	-0.0121	1.0000			
birate	-0.0256	0.8265	1.0000		
excrate	-0.0660	-0.7362	-0.5942	1.0000	
excrate_g	-0.0427	0.2618	0.1215	-0.0957	1.0000

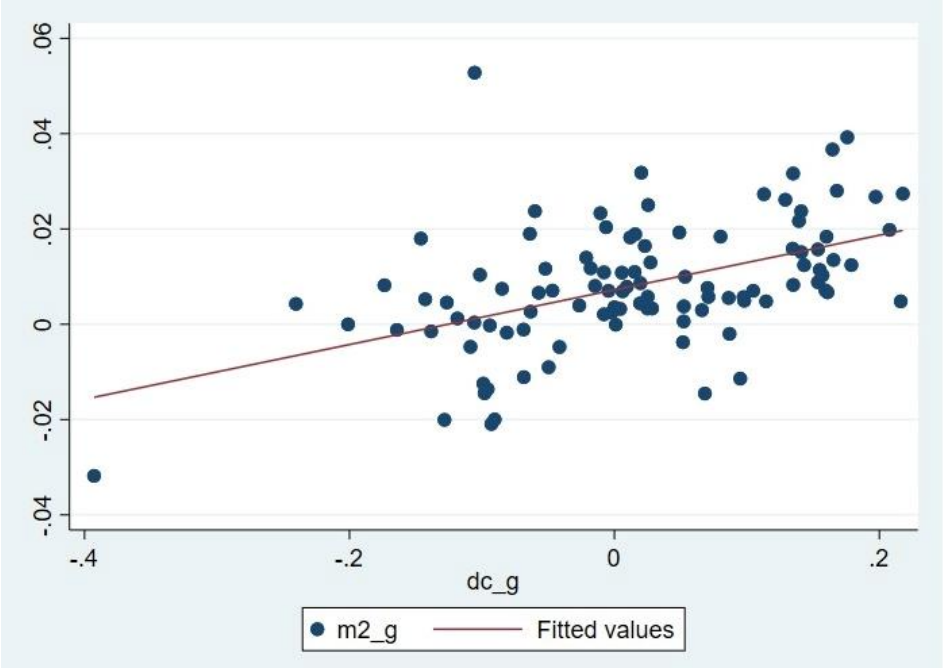
Appendix Figure 1. Scatter Plot Pairwise



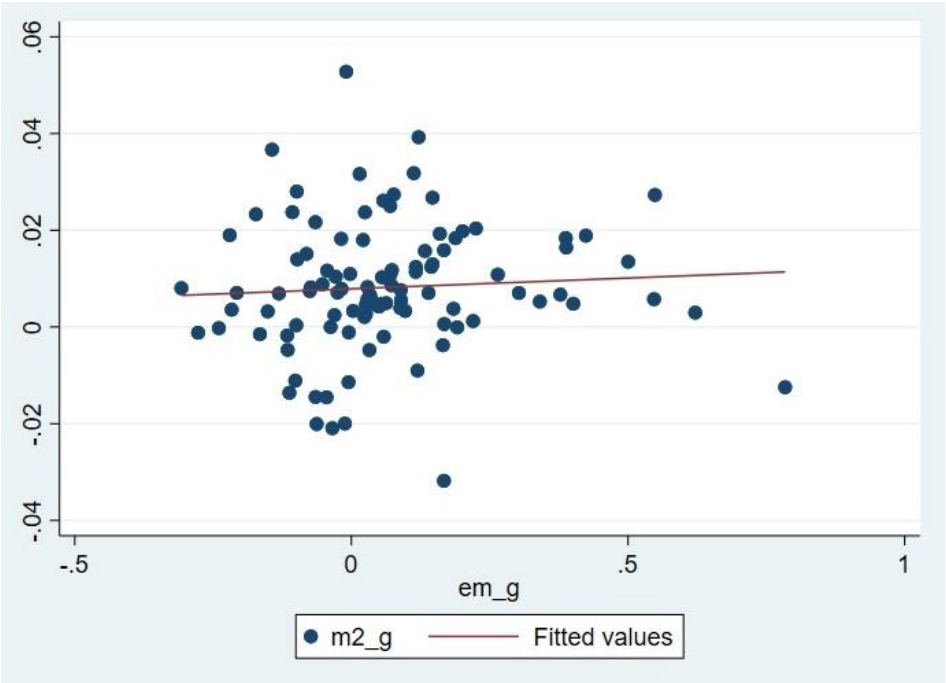
Appendix Figure 2. Scatter Plot Money Supply Growth and Credit Card Growth



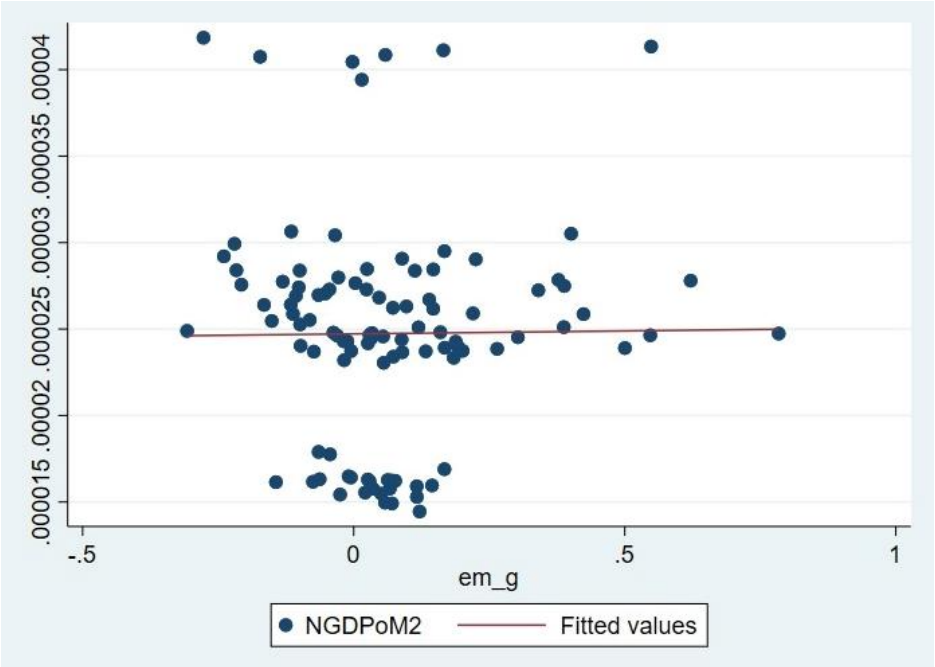
Appendix Figure 3. Scatter Plot Money Supply Growth and Debit Card Growth



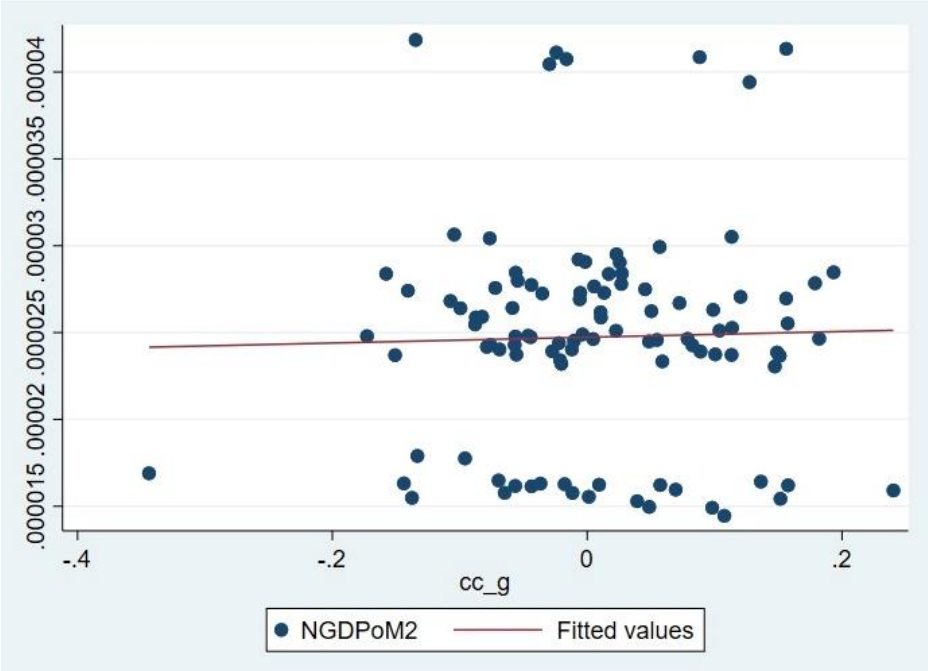
Appendix Figure 4. Scatter Plot Money Supply Growth and Electronic Money Growth



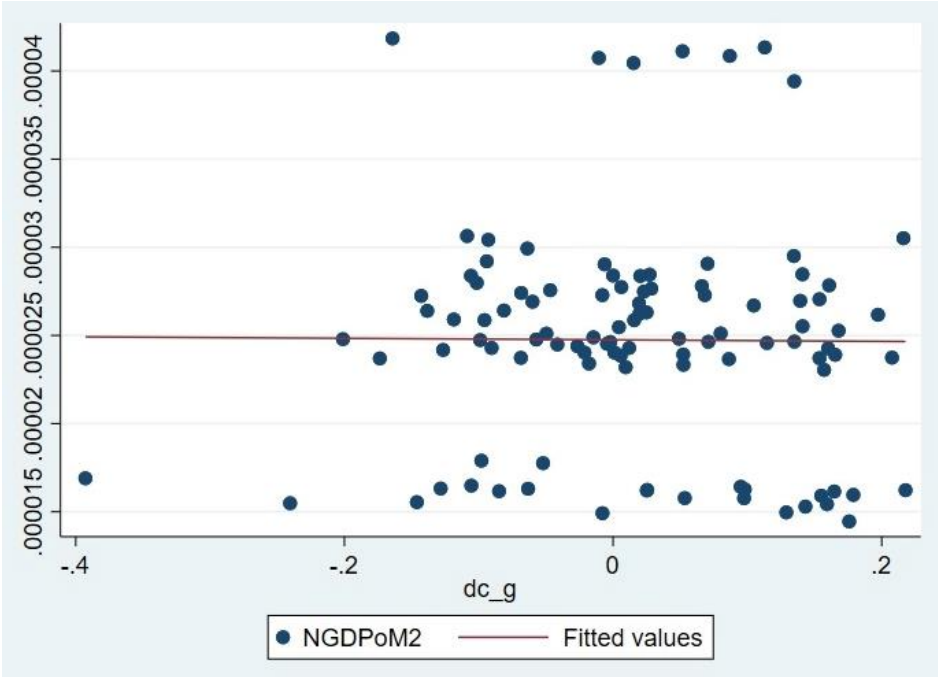
Appendix Figure 5. Scatter Plot Velocity of Money and Electronic Money Growth



Appendix Figure 6. Scatter Plot Velocity of Money and credit card growth



Appendix Figure 7. Scatter Plot Velocity of Money and Debit Card growth



Appendix Figure 8. Stata Coding Classical Assumption Test for Electronic Money and Card Based Payment Instruments on Money Supply Growth Regression (Model 1)

```
79. * C.4. Heteroskedasticity
80. ** The Null Hypothesis (H0) is the regression have a Constant variance or Homokedastic. Thus, i
  > f the p-value below 5%, it means we reject the The Null Hypothesis.
81. ** Comment: We have problem with heteroskedasticity
82. *** Solution: We have to re-run regression in model 4 with vce (robust) option
83. *estat hettest (no need)
84.
85. * D. Regression Plot (for Model 2)
86. ** D.1. m2_g on em_g
87. graph twoway (scatter m2_g em_g) (lfit m2_g em_g)

88. graph export plot18_m2_gonem_g.png, replace
  file plot18_m2_gonem_g.png saved as PNG format

89.
90. ** D.2. m2_g on cc_g
91. graph twoway (scatter m2_g cc_g) (lfit m2_g cc_g)

92. graph export plot19_m2_goncc_g.png, replace
  file plot19_m2_goncc_g.png saved as PNG format

93.
94. ** D.3. m2_g on dc_g
95. graph twoway (scatter m2_g dc_g) (lfit m2_g dc_g)

96. graph export plot20_m2_gondc_g.png, replace
  file plot20_m2_gondc_g.png saved as PNG format

97.
98. ** D.4. m2_g on NGDPGrowth
99. graph twoway (scatter m2_g NGDPGrowth) (lfit m2_g NGDPGrowth)

100 graph export plot21_m2_gonNGDPGrowth.png, replace
  file plot21_m2_gonNGDPGrowth.png saved as PNG format

101
102 * Closing the Log File
103 log close
       name:  <unnamed>
        log:  D:\GDrive\Lain Lain\Annisa\log_reg_ina.smcl
   log type:  smcl
  closed on:  11 Jun 2022, 08:40:09
```

Appendix Figure 8. Stata Coding Classical Assumption Test for Electronic Money and Card Based Payment Instruments on Velocity of Money Regression (Model 2)

```
74. * C. Classical Assumption Test (for Model 3)
75.
76. * C.1. Normality Test
77. ** If the p-value is lower than the Chi(2) value then the null hypothesis cannot be rejected. T
  > herefore residuals are normality distributed
78. ** Comment: The Data is Normally Distributed
79. predict resid, residuals

80. jb resid
  Jarque-Bera normality test:  9.225 Chi(2)  .0099
  Jarque-Bera test for Ho: normality:

81.
82. * C.2. Autocorrelation
83. ** If the Durbin-Watson d statistic is far from the centre of its distribution (E(d) = 2.0). As
  > suming that dependent variable is strictly exogenous, we can reject the null of no first-order
  > serial correlation.
84. ** Comment: No Serial Correlation
85. estat dwatson

  Durbin-Watson d-statistic(  4,   103) =  .0350457

86.
87. * C.3. Multicollinearity
88. ** If VIF is greater than 10 roughly indicates significant multicollinearity
89. ** Comment: No multicollinearity
90. estat vif
```

Variable	VIF	1/VIF
cc_g	2.73	0.366621
dc_g	2.69	0.372174
em_g	1.09	0.915870
Mean VIF	2.17	

```
91.
92. * C.4. Heteroskedasticity
93. ** The Null Hypothesis (H0) is the regression have a Constant variance or Homokedastic. Thus, i
  > f the p-value below 5%, it means we reject the The Null Hypothesis.
94. ** Comment: We have problem with heteroskedasticity
95. *** Solution: We have to re-run regression in model 4 with vce (robust) option
96. *estat hettest (no need)
97.
98. * D. Regression Plot (for Model 3)
99. ** D.1. NGDPoM2 on em_g
100 graph twoway (scatter NGDPoM2 em_g) (lfit NGDPoM2 em_g)

101 graph export plot15_NGDPoM2onem_g.png, replace
  file plot15_NGDPoM2onem_g.png saved as PNG format
```