Research Article

Effect of Inflation on Economic Growth in Indonesia: The Moderating Role of Electronic Money Transaction

M Meliza

Universitas Pekalongan, Pekalongan, Indonesia

Abstract.

This research aims to examine the effect of inflation on economic growth in Indonesia from 2012 to 2021. Besides, this research also analyses the electronic money transaction role in the relationship between inflation and economic growth, especially after the Covid-19 phenomenon. The result of analysis shows that all variables are stationary at the first difference, while the Johansen cointegration test indicates long-run cointegration. On the other hand, inflation has a negative and significant effect on economic growth in the long run. In addition, electronic money transaction is successful in moderating the relationship between inflation and economic growth in the long run.

Keywords: economic growth, electronic money, inflation

Corresponding Author: M Meliza; email: meliza_zafrizal@yahoo.com

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1. INTRODUCTION

Indonesia has experienced significant economic growth in the last ten years. According to [1], Indonesia's gross domestic product increased 68.36% from 9,546,134 (billion rupiah) in 2013 to 16,070,789 (billion rupiah) in 2021. Gross domestic product is the amount of added value produced by all business units in a particular country or is the total value of final goods and services produced by all economic units. One of the factors which can affect economic growth is inflation. According to [2], the inflation rate of Indonesia decreased dramatically from 8.38% in 2013 to 1.87% in 2021. The inflation rate declined, especially in 2021, due to the still weak domestic demand due to COVID-19 [2]. In addition, the decline in the inflation rate was also due to the synergy between Bank Indonesia and the government's policies at the central and regional levels in maintaining price stability [2].

[3] found a relationship between inflation and economic growth. Similar to [3], [4] showed that inflation affects economic growth in Turkey. The existence of inflation causes uncertainty, causing difficulties in determining consumption and production [4]. Inflation can also increase costs associated with the technology adopted and the poverty level, such as in Nigeria [5]. Meanwhile, several studies also prove that inflation can affect economic growth in Indonesia. [6] found that inflation can hamper economic growth and economic activity in the city of Jambi. [7] found that an increase in the inflation rate can negatively affect economic growth.

Besides inflation, another factor affecting a country's economic growth is the increase in electronic transactions [8];[9]. Technological developments have led to an increase in the number of electronic transactions in Indonesia. Non-cash money is considered more effective as payment transactions and is the main driver of current economic growth [10].

According to [11], the electronic money transaction value increased by about 66.1%, from 473,443 billion rupiah in 2019 to 786,454 billion in 2021. These transactions consist of electronic cash withdrawals, money transfers, and shopping. Moreover, the increasing number of electronic transactions was supported by the increasing number of electronic money instruments by 96.8%, from 292 million units in 2019 to 575.3 units in 2021 [11].

However, the number of cash transactions in Indonesia is still greater than that of non-cash transactions using electronic money. The number of cash transactions was 3,204,459 (billion rupiah) in 2019. Nevertheless, this number decreased by 1.9% to 3,143,608 (billion rupiah) in 2021 [11]. Despite the decline, the number of cash transactions remains to dominate the types of transactions in Indonesia. Increasing the use of electronic money can increase economic growth [12]. [13] showed that a cashless payment policy could benefit and impact economic growth. Furthermore, the digitalisation of the economy can increase the number of electronic transactions and open up business opportunities through the internet, affecting economic growth [14].

Furthermore, electronic money transaction also has the potential to affect the inflation rate. Based on several previous studies, electronic money has various effects on the inflation rate. [9] revealed that using electronic money could increase inflation in Indonesia. This increase in inflation occurred due to increased business activities which increased the demand for digital financial products. [15] found that electronic money transactions could affect Indonesia's inflation rate. Increasing the promotion of electronic money causes a decrease in the amount of money demanded, causing a

decrease in the inflation rate. Indeed, [16] also showed that electronic transactions positively influence the inflation rate in Indonesia. On the other hand, [17] showed that electronic transaction negatively affects inflation in Indonesia. It was due to the increasing electronic transactions during the COVID-19 pandemic, which caused a decrease in the amount of money in circulation. Therefore, decreasing the money supply lowers the inflation rate [17]

Many previous studies have discussed the movement of inflation that can affect economic growth [3]; [6]; [5]; [4];[7]. Moreover, several studies also proved that not only inflation but electronic money transactions could also affect economic growth [14]; [13]; [12] and inflation [9];[17];[15]. However, few studies discussed the role of electronic money transactions as a moderator variable of the relationship between inflation and economic growth. Hence, this study examines not only the effect of inflation on economic growth but also the role of electronic transactions as a moderator variable in the relationship between inflation and economic growth.

The first part of this study describes the background of the research discussing the relationship between inflation and economic growth with electronic transactions as a moderating variable. The second part of this study presents a literature review concerning the theory and previous research regarding the relationship between inflation and economic growth and the role of electronic transactions as a moderating variable. The third part of this study explains the methodology that will be used to analyse the effect of inflation on economic growth. Moreover, this part also examines the role of electronic transactions as a moderating variable in the relationship between inflation and economic growth. Subsequently, the fourth part of this study discusses the data analysis result. Finally, the last part concludes the research.

2. LITERATURE REVIEW

2.1. Fisher Hypothesis

Fisher hypothesis will explain the relationship between inflation and economic growth. This hypothesis is also employed to explain the role of electronic money transactions as a moderator in the relationship between inflation and economic growth. According to [18] in [19], the Fisher relationship states that the nominal interest rate is the sum of the expected constant real interest rate plus expected inflation. According to [20], Fisher hypothesis shows a positive relationship between interest rate and expected

inflation. [4] applied Fisher hypothesis to analyse the relationship between inflation and economic growth in Turkey. They found that inflation creates uncertainty in the economy. [21] also employed Fisher hypothesis to examine the relationship between inflation and economic growth in developed and developing countries. They showed that inflation could hamper economic growth.

2.2. The Effect of Inflation and Economic Growth

Many studies have analysed the influence of inflation and economic growth. [3] examined the relationship between inflation and economic growth in the long run in Qatar from 1980 to 2016. The study found cointegration between inflation and economic growth.[5] analysed inflation's impact on Nigeria's economic growth from 1986 to 2020 due to the cost-driven adoption of technological methods and poverty levels. Therefore, if inflation is regressed, it may behave abnormally concerning the output growth rate. [4] discussed inflation and economic growth in Turkey from 2003 to 2017. They revealed that economic growth responds negatively to increases and lower inflation in the long run. It is due to uncertainty resulting from inflation, making it challenging to develop prospective production and consumption decisions.

Furthermore, [6] analysed the influence of inflation on economic growth in the city of Jambi, Indonesia, from 2001 to 2015. The study revealed that inflation has a negative influence on economic growth. High inflation is one of the factors hindering development and economic activity, reducing economic growth. In addition, [7] also examined the effect of inflation on economic growth in Indonesia from 2008 to 2019; the higher the inflation, the lower the level of purchasing power, impacting the economy.

Based on the theory and previous studies above, an increase in inflation impacts decreasing economic growth and vice versa. Therefore, the first hypothesis in this study is that inflation affects economic growth.

2.3. The Effect of Electronic Money Transaction on Economic Growth

Many previous studies also discussed the effect of electronic money transactions on growth. [13] analysed the cashless payment policy on economic growth in India from 2010 to 2018. They found that the increasing cost of using cheques to purchase goods and services causes customers to use online payments to reduce transaction costs. As

a result, this will increase the number of transactions and economic activities, increasing economic growth. [22] examined the effect of the cashless payment system on economic growth showing that the increased use of electronic payment systems reduces cash circulation. It encourages economic growth through substitution and efficiency effects in the economy. [9] analysed the impact of electronic money on monetary policy. They found that electronic money has an impact on economic growth. Banking transformation into the digital economy is challenging for banks to innovate in financial products. It increases the synergy and spread of e-money usage and increases the effectiveness of e-money in monetary policy.

Furthermore, electronic money also can affect inflation. [9] showed that electronic money positively affects inflation. An increase in electronic money transactions can increase inflation, and the increasing demand for electronic money can increase inflation and increase people's purchasing power in several ways. On the other hand, [15] revealed that electronic money transactions negatively influence inflation; the increase in electronic transactions can reduce the money supply. [17] also found a relationship between electronic money transactions and inflation. The increase in electronic transactions reflects an increase in consumption, leading to an increase in aggregate demand.

According to some previous studies, electronic money transactions can affect not only economic growth but also the inflation rate. Hence, this study also investigates the role of electronic money transactions on the relationship between inflation and economic growth.

3. METHODS

This study uses macroeconomic data consisting of consumer price index as inflation estimator, gross domestic product, the number of electronic transactions, interest rate, and exchange rate in Indonesia. Furthermore, this study uses monthly time series data from 2012 to 2021. The Bank Indonesia website generates the data on inflation and electronic money transaction. Meanwhile, the data on gross domestic product is derived from the Badan Pusat Statistik website.

This study employs a unit root test using Augmented Dickey-Fuller (ADF) and cointegration tests. The ADF test is used to test the stationarity of the data [23], aiming to eliminate the possibility of erroneous estimates [23]. On the other hand, Johansen

cointegration is used to build an overall long-term cointegration model [23]. The advantage of cointegration analysis is that it can produce a more precise framework than the vector autoregression standard model (VAR) [24]. Besides, this study also applies normality test using Jarque-Bera test.

Furthermore, this study also applies the error correction model (ECM) to investigate the influence of inflation on economic growth and the role of electronic money transactions as a moderating variable in the relationship between inflation and economic growth. In addition, this study employs interest rates and exchange rates as control variables.

The following model explains the influence of inflation and economic growth:

$$Economic\ Growth = \beta_0 + \beta_1 Inflation + \beta_2 Interest\ rate + \beta_3 exchange\ rate + \square \quad \text{.....(1)}$$

On the other hand, the following model explains the influence of inflation and economic growth using electronic money transaction as a moderating variable:

$$Economic\ Growth = \beta_0 + \beta_1 Inflation + \beta_2 Interest\ rate + \beta_3 exchange\ rate + \beta_4 electronic\ money\ transaction + \beta_5 electronic\ money\ transaction.inflation + \square \quad \text{.....(2)}$$

Table 1 describes the variables applied in this study. The study's independent variable is inflation. Inflation is a continuous increase in the general prices of goods and services, measured as an annual percentage increase [25]. The consumer price index is applied to calculate inflation. The consumer price index is calculated based on the weighted average of the prices of goods and services, such as gasoline, food, clothing, medical care, and cars [26]. Nevertheless, the study's dependent variable is economic growth. This variable is measured by gross domestic product [27]; [28]. Furthermore, this study employs electronic money transactions as a moderating variable. This variable is calculated by the total number of electronic money transactions [9]. In addition, this study also applies interest rates and exchange rates as control variable. According to [29] in [30] real interest rate is the loan interest rate adjusted for inflation as measured by GDP deflator [29]. Meanwhile, exchange rate is the unit price of foreign currency in local currency units or the number of units local currency that can be exchanged to buy one foreign currency [31]. This study compared the rupiah as local currency to US dollar as foreign currency. In addition, Table I also describes the transformation of variables using natural logarithm.

TABLE 1: Description of Variables and Time Series Transformation.

Variable	Description	Previous Studies	Transformation
Inflation	Consumer Price Index	[25]; [26]	Natural logarithm of Consumer Price Index
Economic Growth	Gross Domestic Product	[27]; [28]	Natural logarithm of Gross Domestic Product
Electronic Money Transaction	The number of electronic money transactions	[9]	Natural logarithm of the number of electronic money t transactions
Interest Rates	The loan interest rate adjusted for inflation as measured by GDP deflator	[29]	Natural logarithm of the loan interest rate adjusted for inflation as measured by GDP deflator
Exchange Rates	Unit price of foreign currency in local currency units	[31]	Natural logarithm of unit price of foreign currency (US dollar) in local currency (Rupiah) units.

4. RESULTS AND DISCUSSION

4.1. Descriptive Statistics

Table 2 presents the descriptive statistics results of all variables. According to this table, gross domestic product (GDP) as an economic growth indicator has a mean value of Rp 860,475 (in billion rupiah). The minimum value of the gross domestic product is Rp 668,551 (in billion rupiah), while the maximum value is Rp 1,064,930 (in billion rupiah). On the other hand, the mean value of consumer price index as inflation estimator is 0.041, while the minimum and maximum values of inflation are 0.013 and 0.088, respectively. Concerning the interest rate, it has a mean value of 0.056. The minimum value of the interest rate is 0.035, and the maximum value is 0.078. The mean value of the exchange rate is Rp 12,927, while the minimum and maximum values of the exchange rate are Rp 9,000 and Rp 16,367, respectively. Lastly, the mean value of electronic money transaction is Rp 261,563 (in billion rupiah). The minimum value of electronic money transaction is Rp 4,549 (in billion rupiah), while the maximum value of electronic money transaction is Rp 795,243 (in billion rupiah).

Table 2: Descriptive Statistics.

Variable	Mean	Minimum	Maximum
Gross Domestic Product	860,472	668,551	1,064,930
Consumer Price Index	0.041	0.013	0.088
Interest Rate	0.056	0.035	0.077
Exchange Rate Electronic Money Transaction	12,927 261,563	9,000 4,549	16,367 795,243

Source: Author Calculation

4.2. Normality Test

The result of normality test using Jarque-Bera test shows that only Gross Domestic Product (GDP) had normally distributed data with a probability of 0.434 or higher than 0.05. Meanwhile, consumer price index has probability about 0.003 or lower than 0.05. Interest rate and exchange rate have probability of Jarque-Bera test about 0.028 and 0.000 respectively. Indeed, electronic money transaction also has probability about 0.000 or lower than 0.05. Hence, these variables are not normally distributed. therefore, data transformation is carried out using natural of logarithm on variables consume price index, interest rates, exchange rates, and electronic transactions.

4.3. Unit Root Test

Table 3 presents the Augmented Dickey-Fuller test results. According to this table, gross domestic product is stationary at the first difference level, and the value of its *t*-statistic is -4.57 Similar to gross domestic product, other variables are stationary at the first difference level. The *t*-statistic value for consumer price index is -8.36. On the other hand, the *t*-statistic value of the interest rate is -4.48. Meanwhile, the exchange rate has a *t*-statistic value of -0.22. Lastly, electronic money transaction has a *t*-statistic value of -16.54. The value of the Augmented Dickey-Fuller test is higher than that of critical values. In addition, the model shows also that there is no unit root, or the data is stationary.

4.4. Cointegration

Table 4 shows the Johansen cointegration test results for the first equation model, namely the effect of inflation on economic growth. According to this table, there is one

Table 3: Augmented Dickey-Fuller Test Results.

Variable	Level	*t*-Statistic
Gross Domestic Product	Level	-0.41
	First difference	-4.57***
Consumer Price Index	Level	-1.80
	First difference	-8.36***
Interest Rate	Level	-1.68
	First difference	-9.53***
Exchange Rate	Level	-0.22
	First difference	12.49***
Electronic Money Transaction	Level	-1.65
	First difference	16.54***
Test Critical Values (Mackinon's)		-3.48*** -2.88** -2.58*

Note: (***) significant at 1%, (**) significant at 5%, and (*) significant at 10%
Source: Author Calculation

cointegrating at the 0.05 level. The trace statistic value is about 55.58 or higher than the critical value. Moreover, this trace statistic value is also higher than Eigenvalue (0.209). The probability value is about 0.044 or lower than 0.05. These results indicate that inflation, interest rate, exchange rate, and gross domestic product cointegrated.

Table 4: Johansen Cointegration Test Results for the Effect of Inflation on Economic Growth.

Hypothesised No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	Prob**
None	0.209	55.58	51.64	0.044
At most 1	0.152	27.89	32.06	0.251
At most 2	0.0631	8.36	16.16	0.971
At most 3	0.006	0.675	2.70	0.587

Source: Author Calculation

Table 5 presents the Johansen cointegration test results for the second equation model, namely the influence of inflation on economic growth using electronic money transactions as a moderator variable. Similar to the result of the first equation model, there is one cointegrating at the level of 0.05. The trace statistic value is about 98.72 or higher than the critical value (95.75), and the trace statistic value is also higher than Eigenvalue (0.297). Hence, these results also show that there is cointegration in this model.

Table 5: Johansen Cointegration Test Results for the Effect of Inflation on Economic Growth with Electronic Money Transaction as a Moderator Variable.

Hypothesised No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	Prob.**
None	0.297	98.72	95.75	0.030
At most 1	0.181	57.09	69.81	0.335
At most 2	0.135	33.49	47.85	0.529
At most 3	0.076	16.32	29.79	0.688
At most 4	0.053	6.98	15.49	0.579
At most 5	0.003	0.442	3.841	0.506

Source: Author Calculation

4.5. Error Correction Model for Long-Run Estimation

Table 6 presents the error correction model (ECM) analysis results concerning the influence of inflation on economic growth in the long run. According to this table, consumer price index negatively and significantly influences gross domestic product. This result also means that inflation negatively and significantly influences economic growth. The *t*-statistic value is -4.36 and significant at 1%. Moreover, the interest rate positively influences gross domestic product; however, the *t*-statistic value of the interest rate is 1.58. In other words, the interest rate has no significant influence on economic growth. Furthermore, the exchange rate negatively and significantly influences gross domestic product. The *t*-statistic value of the exchange rate is -9.98 and significant at 1%.

Table 6: (Dependent Variable: Gross Domestic Product).

Variable	Coefficient	*t*-statistic
C	19.50	33.07***
Log of Consumer Price Index	-0.14	-4.36***
Log of Interest Rate	0.10	1.58
Log of Exchange Rate	-0.64	-9.98***
Adjusted R-squared	0.45	
F-statistic	33.61	
Prob (F-statistic)	0.000	

Note: (***) significant at 1%, (**) significant at 5%, and (*) significant at 10%
Source: Author Calculation

Table 7 shows the error correction model analysis results for the long-run estimation concerning the effect of inflation on economic growth using electronic money transactions as a moderator. According to Table 7, consumer price index negatively and significantly affects the gross domestic product. The value of the *t*-statistic of inflation is about -2.45. In contrast to the result in Table 6, the interest rate has a positive and significant influence on the gross domestic product. The value of the *t*-statistic is about 0.163. Similar to the result in Table 6, the exchange rate negatively and significantly influences the gross domestic product. The exchange rate has a *t*-statistic value of about -9.00. Electronic money transaction has a positive and significant influence on the gross domestic product. Table 7 also shows that electronic money transaction can moderate the relationship between inflation and gross domestic product. In other words, electronic money transaction is successful in moderating the relationship between inflation and economic growth. The t-statistic value of this moderator variable is about -4.40. This value is significant at 1%.

Table 7: (Dependent Variable: Gross Domestic Product).

Variable	Coefficient	*t*-statistic
C	23.30	23.95
Log of Consumer Price Index	-0.086	-2.45**
Log of Interest Rate	0.163	2.65***
Log of Exchange Rate	0.930	9.00***
Log of Electronic Money Transaction	0.044	3.76***
Electronic Money Transaction.Inflation	-1.19E-05	-4.4***
Adjusted R-squared	0.524	
F-statistic	27.22	
Prob (F-statistic)	0.000	

Note: (***) significant at 1%, (**) significant at 5%, and (*) significant at 10%
Source: Author Calculation

4.6. Error Correction Model for Short-Run Estimation

Table 8 presents the error correction model analysis results for short-run estimation. According to Table 8, inflation which is estimated by consumer price index has no significant effect on economic growth. The *t*-statistic value is 1.26, but the significant value is higher than 0.05. Moreover, interest and exchange rates as control variables

also have no significant effect on economic growth. The *t*-statistic value of the interest rate is 0.48, while the *t*-statistic value of the exchange rate is -1.16.

Table 8: (Dependent Variable: Gross Domestic Product).

Variable	Coefficient	t-statistic
C	0.001	0.819
D (Log of Consumer Price Index)	0.015	1.27
D(Log of Interest Rate)	0.012	0.48
D(Log of Exchange Rate)	-0.058	-1.16
RES(-1)	-3.24E-09	-0.184
Adjusted R-squared	-0.01	
F-statistic	0.673	
Prob (F-statistic)	0.611	

Note: (***) significant at 1%, (**) significant at 5%, and (*) significant at 10%
Source: Author Calculation

Table 9 shows the error correction model analysis result for short-run estimation concerning the effect of inflation on economic growth using electronic money transactions as a moderator. The table shows that electronic money transaction is unsuccessful in moderating the relationship between inflation and economic growth. The *t*-statistic value of this moderator value is -0.341, with a significant value higher than 0.05.

Table 9: (Dependent Variable: Gross Domestic Product).

Variable	Coefficient	t-statistic
C	0.001	0.892
D(Log of Inflation)	0.016	1.36
D(Log of Interest Rate)	0.0073	0.298
D(Log of Exchange Rate)	-0.081	-1.56
D(log of Electronic Money Transaction)	-0.005	1.95*
D(Electronic Money Transaction.Inflation)	-3.81E-07	-0.435
RES(-1)	-6.04E-09	0.341
Adjusted R-squared	0.004	
F-statistic	1.09	
Prob (F-statistic)	-6.04E-09	

Source: Author Calculation

According to the results in the result section, inflation has a negative and significant value on gross domestic product. This result means inflation has a negative and significant effect on economic growth. It is consistent with [6], [5], [4], and [7]. An increase

in inflation may decrease purchasing power [7]. Nevertheless, an increase in inflation can increase the price of goods and services, reducing people's purchasing power for goods and services.

The long-run regression analysis indicates that electronic money transactions can moderate the relationship between inflation and economic growth. It may be due to the large number of electronic transactions, so it affects the number of demands for a product or service. Therefore, a significant increase or decrease in the demand for a product or service causes a significant change in inflation.

The results of the analysis in this study can be used by the authorities in determining macroeconomic policies related to the o the equilibrium price of goods and services. This research is also useful for the industrial world in determining the price of goods and services. In addition, This research can also be a reference for banks in controlling electronic transactions.

5. CONCLUSION

Increasing the number of electronic transactions in Indonesia has an impact on inflation and economic growth. This article examines how electronic transactions can moderate the relationship between inflation and economic growth. The results of the analysis using the error correction mode found that inflation has a significant negative effect on economic growth. Indeed, the number of electronic transactions can affect the number of demand of products and services and eventually moderate the relationship between inflation and economic growth.

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