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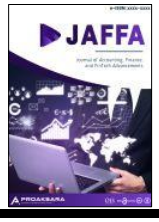

Analysis of the Role of Increasing Financial Inclusion Through Digital Transformation on the Stability of the Financial System in Indonesia

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ABSTRACT

The increase in financial inclusion in a country can affect the stability of financial system because it can maintain the stability of banking operations and reduce inequality in financial access in society. The increase in financial access caused by the emergence of digital financial products, such as transaction systems using e-money and QRIS financial transactions, has succeeded in reducing inequality in access to financial services in society. The advantages provided by digital transactions have disadvantages, namely regarding the guarantee and security of digital financial transactions which do not yet have regulations from the government. Hence, it is imperative to conduct a more thorough examination of how the expansion of financial products via digital transactions impacts the stability of Indonesia's financial system. The approach utilised in this research is the Autoregressive Distributed Lag (ARDL) methodology utilising data from the years 2021 to 2023. The factors assessed in this study encompass e-money and QRIS, alongside supplementary variables such as online loans, credit cards, and debit cards. Furthermore, a key variable under consideration is the Non Performing Loan (NPL) which serves as a gauge for financial system stability. The study results revealed that debit cards do not greatly impact the stability of the financial system, whether in the short or long run. Conversely, credit cards have a notable positive influence on financial system stability in the short term but do not have a lasting impact. On the contrary, e-money is found to have a considerable detrimental impact on financial system stability, both in the short term and long term. Similarly, QRIS is shown to have a significant positive effect on financial system stability in the short term but lacks significance in the long run. Online loans, on the other hand, have a substantial negative impact on financial system stability in the short term but are not significant in the long run.

Keywords: Financial Inclusion, Digital Transformation, Financial System Stability

1. INTRODUCTION

Financial inclusion is the main focus of economic development. This is because financial inclusion can increase community productivity in creating new product innovations with low operational costs. The emergence of new product innovations can increase community consumption which can ultimately trigger economic growth (Boachie & Adu-Darko, 2024). Not only that, the emergence of new product innovations can also make it easier for people to access credit at banks so that it can increase public consumption and create new jobs created by MSMEs (Amadasun & Mutezo, 2022; Aziz & Samad, 2016; Iskandar, 2022; Kamal et al., 2022; Koffi et al., 2021; Suryaningrum et al., 2023). Thus, the role of financial inclusion is very important and makes financial inclusion of the development indicators in Indonesia.

Indonesia uses the Inclusive Economic Development Index (IPEI) as a tool to assess and track financial inclusion. Financial inclusion is one of the indicators in the third pillar, namely expanding access and opportunities. Based on data from the Badan Perencanaan Pembangunan Nasional (National Development Planning Agency, BAPPENAS), financial inclusion in Indonesia is still quite good. Based on data from the Badan Perencanaan Pembangunan Nasional (National Development Planning Agency, BAPPENAS), financial inclusion in Indonesia is still quite good. Furthermore, based on Indeks Pembangunan Ekonomi Inklusif (The

Inclusive Economic Development Index, IEDI), the financial inclusion score in Indonesia is 5.93. The score has increased from previous years due to the increasing number of people accessing financial services in Indonesia. The ease of accessing financial services is due to the increasingly developing financial infrastructure. The development of financial infrastructure coupled with digital financial products which are usually referred to as financial technology can make it easier for people because access is quite easy, faster, more effective, and simpler via gadgets or mobile phones, especially for people who have limited reach (Baroto, 2024). Thus, the change from traditional to digital financial access through Financial Technology can increase the reach of people's financial access which can ultimately increase financial inclusion (Aleemi et al., 2023).

Moreover, digital finance and financial technology offer a range of platforms for conducting fundamental financial activities, such as settling bills for utilities, sending money to loved ones, and even obtaining loans. These services can be utilised by the populace to access digital financial solutions, consequently raising the usage of digital finance and boosting the volume of financial technology transactions in Indonesia. Various financial technology products have witnessed a surge in transactions, with online lending platforms being particularly notable among them. Online loans refer to services that offer credit facilities through a digital platform, eliminating the need to physically visit a financial institution like a bank. According to the Otoritas Jasa Keuangan (OJK), the value of fintech lending or online loans in Indonesia hit IDR 22.76 trillion by March 2024. This figure marked an 8.89% increase from the previous month, when it stood at IDR 20.90 trillion. Additionally, it surged by approximately 15.35% compared to the same period in the previous year, which recorded IDR 19.73 trillion in March 2023.

In addition to the rise in online loan distribution as a financial technology product, there has been a noticeable increase in other financial technology products such as electronic money and QRIS. In 2023, there was a significant rise in electronic money transactions, with the total reaching IDR 1,859 trillion - a substantial increase from the previous year's figure of 1,101 trillion. Furthermore, the number of electronic money users also saw a rise from 730 million units to 809.7 million units. The value of QRIS transactions showed a notable increase of 42 trillion in March 2024 compared to the previous month's figure of IDR 32 trillion. Additionally, there was a decline in the debit card transaction value when compared to credit card transactions. The declining availability of independent cash withdrawal services, such as ATMs, is a contributing factor. According to data from the Financial Services Authority (OJK) in the third quarter of 2023, there were 92,829 units of ATMs, CDMs, and CRMs in Indonesia. However, this number dropped to 91,412 units in the fourth quarter of 2023. In 2024, the total value of credit card transactions reached IDR 405 trillion, a significant increase from IDR 323.6 trillion in 2023. This surge in transaction value indicates a shift towards digital consumption habits among the population.

Changes in individuals' spending habits when utilizing financial technology for shopping may result in a boost in financial inclusion. The rise in financial technology transactions, along with improved efficiency and effectiveness in handling transactions, can play a role in upholding the stability of Indonesia's financial system. This is agreed by research from Anindyntha and Sulistyono (2022) which explains that financial inclusion with the integration of financial technology through credit card and e-money variable has a significant effect on the stability of the financial system in Indonesia. Another study by Kasri et al. (2022) explains that the rise in financial technology transactions has allowed the banking industry to see immediate benefits in terms of both revenue and security, thanks in part to rules regarding the movement of money that increase fee income from online payments. Nevertheless, this boost to banking security may not last over time, as banks will need to put money into their own systems, face greater expenses, and go up against fintech firms providing comparable digital payment services.

Financial technology transactions play a crucial role in ensuring the stability of the financial system. To uphold and reinforce the stability of the Indonesian financial system, Bank Indonesia enforces a macroprudential monetary policy. Macroprudential monetary policy plays a role in regulating the amount of money circulating in the community through monetary transmission such as interest rates, open markets, and minimum reserve requirements which directly affect the stability of the financial system. In addition, there is a microprudential monetary policy carried out by the Otoritas Jasa Keuangan (Financial Services Authority, OJK) through supervision of the health of a financial institution. The synergy of the two policies is able to maintain the stability of the financial system in Indonesia. In addition, the emergence of financial technology products also has the potential to cause problems for the stability of the Indonesian financial system.

The development of financial technology products in Indonesia such as the emergence of e-money and QRIS still does not guarantee the validity of fintech e-money products as a transaction tool. Thus, it raises several risks that can arise such as cyber attacks, system failures, and online fraud. This problem is exacerbated by the public's low understanding of fintech services. Furthermore, the issue of elevated interest rates in digital banks must be resolved as it has the potential to impact financial inclusion, subsequently affecting the stability of Indonesia's financial system. As a result, this research has been conducted to investigate the impact of expanding financial products via digital transactions on the stability of Indonesia's financial system.

2. LITERATURE REVIEW

2.1. Financial Technology

Financial technology, also known as fintech, is the combination of financial services and technology which revolutionises conventional business practices by allowing transactions to be conducted online without the need for face-to-face communication. Fintech offers advantages to the economy, particularly in upholding the resilience of the financial system. According to Antwi and Kong (2023), financial technology has a positive impact on the stability of a country's financial system. Financial technology is essential for enhancing financial participation in society by introducing various products like e-money and crowdfunding. These innovative products streamline transactions for producers and consumers, making them more efficient and leading to increased inclusion, ultimately impacting the stability of the financial system. The range of digital financial products available also includes QRIS, credit cards, and e-money.

2.1.1. Electronic Money

Digital currency is a contemporary form of payment that is rapidly gaining popularity around the world. Its influence on the financial system of Indonesia could be significant. This is in accordance with research from Lintangsari et al. (2018) which states that electronic money has a significant impact on the stability of the financial system. The study explains that electronic money influences the money supply, specifically M1, because it is easily transferable. This means that funds in electronic money can be used for payments at any time, making them highly liquid and comparable to cash or demand deposits, thus qualifying as part of M1.

$$M1 = COB+D+FLOAT$$

The research also suggests that digital currency plays a role in shaping the way interest rate policies are implemented. This implies that a rise in electronic transactions could result in a decrease in interest rates. When interest rates on savings accounts are low, individuals are more inclined to use their money for day-to-day expenses, causing an increase in the overall money supply. The rise in e-money transactions has led to a decrease in credit interest rates, encouraging more people to borrow money. However, if individuals are unable to repay their debts, it could negatively affect the stability of the financial system. This trend was evident during the Great Moderation of 2008 in the US, where low-interest rates resulted in a surge in popularity of housing loans that were securitized and traded on the financial market, ultimately leading to the global financial crisis of 2008/2009. The macrofinancial linkage to the economic boom increased systemic risk and led to a major financial crisis that had an impact throughout the world (Warjiyo, 2016).

2.1.2. Credit Card

In Indonesia, credit cards are considered as a form of non-cash payment. They have a significant impact on the financial system by providing fast and efficient payment options, but also pose risks if the cardholder is unable to pay their bills, potentially affecting the bank's performance (Goodhart, 2005). Other research from Lintangsari et al. (2018) stated that credit cards have a significant impact on the stability of the financial system due to changes in credit interest rates. The decrease in credit interest rates due to the increase in financial transactions in the community has made people choose to take out consumer credit so that it can increase the stability of the financial system in the community due to increasingly effective and efficient financial transactions. On the other hand, if the credit interest rate increases, it can make people fail to repay the credit. This condition is caused by the increase in credit transactions, the higher the credit transactions made, the higher the interest burden charged. Therefore, it is necessary to supervise the use of credit cards through tightening regulations and regulations to avoid the negative impacts of credit card use.

2.1.3. QRIS

QRIS is a cashless payment method introduced by Bank Indonesia to address the growing issue of digitalization. There are two different ways in which QR codes are used: Merchant Presented Mode (MPM) and Customer Presented Mode (CPM). QRIS operates under the motto UNGGUL (UNiversal, GampanG, Untung, dan Langsung), which carries the following meanings: UNiversal means QRIS is inclusive and accessible to all segments of society, enabling payment transactions both domestically and internationally; GampanG, means, that users can conduct transactions easily and securely using their devices; Untung, means the mutual benefits for both buyers and sellers, as QRIS enables efficient transactions through a single QR code compatible with all payment apps; and transactions via QRIS are instant and fast, ensuring seamless operation of the payment system (Paramitha & Kusumaningtyas, 2020). Convenience through payment effectiveness and easy transaction accessibility will accelerate money circulation and increase state revenues and encourage economic growth (Sriekaningsih, 2020). The role of QRIS as a payment system that is integrated with bank accounts and can influence the stability of the financial system is supported by research from Lintangsari et al. (2018.). Meanwhile, the significant influence of e-money on M1 is also supported by research from Pramono et al. (2006) that the QRIS system is akin to e-money, particularly through the concept of float, which refers to a portion of funds held by the issuer and recorded on an e-money card that may have been used for payments but has yet to be invoiced by the merchant. Given QRIS's feature of maintaining float funds that are readily available for transactions at any time, these funds are considered highly liquid and can be regarded as equivalent to cash or demand deposits, making them part of the M1 money supply.

2.1.4. Debit Card

Debit cards are one of the digital payment instruments used as an alternative to cash payments. Based on this understanding, debit cards are currently starting to shift their role because they are not only used as a savings function but also as a transaction tool and changes in the type of money classification of savings using debit cards to become part of narrow money (M1) (Pramono, Bambang, et al, 2006). The ease of using debit cards in transactions could potentially affect the overall stability of the financial system, as evidenced by a study conducted by Fauzie (2014). This study suggests that ATM/Debit transactions play a crucial role in both the short and long term stability of M1. Furthermore, research conducted by Lintangsari and colleagues in 2018 also highlights the positive impact of debit cards on financial system stability.

2.2. Theory of Money Demand

The concept of money demand involves analysing how much money people in a particular country want to hold. It is a crucial factor in a country's economy as it impacts exchange rates and overall economic development. This idea stems from Irving Fisher's theory of money demand, namely as follows:

$$M.V = P.T$$

M = Money Supply

V= Velocity of circulation

P= Average price of transactions

T= Total number of transactions

This money demand theory explains a country's economic expenditure in a certain period. According to Fisher (1992), the amount of money in a country describes the economic conditions of a country. This is because Fisher considers the velocity of circulation to be predictable or constant and total number of transactions to be constant when the economy reaches maximum production conditions in the long run. Thus, Fisher considers money supply can affect the economy especially when there is an increase in the price of goods. Based on Irving Fisher's theory, the existence of e-money will affect the theory especially velocity of money circulation. According to Irving Fisher's research, the amount of money transacted in society indicates a country's Gross National Product (GNP). Velocity of circulation depends on people's spending habits. Thus, the velocity of money (V) typically remains constant. In a full employment scenario, where all available production resources are fully utilized, the total output (T) or Gross National Product (GNP) stays constant. However, when the economy is not at full employment, an increase in the money supply can lead to higher output by utilizing idle resources, meaning that prices (P) will not rise. Fisher's theory assumes that money is used exclusively for

transactions, with people spending their entire income immediately on purchases.. But over time, Keynesian theory refuted this.

2.3. Keynesian Theory

Keynesian theory states that a person's considerations in holding money are influenced by three underlying motives, namely the transaction motive, the precautionary motive and the speculative motive.

a) Transaction motive

If the income and expenses made by a person have the same amount and time dimension, then the individual does not need money in his transactions. However, in reality, the amount and time dimension between income and expenditure are different so that money is needed to facilitate the transactions carried out. The volume of transactions made depends on the income. The greater the income, the greater the volume of transactions.

b) Precautionary motive

The existence of unplanned expenses is a reason for someone to hold money with a precautionary motive. This motive is often used for urgent and unexpected needs, such as medical expenses during illness and minimum reserve requirement held at the central bank as a form of countercyclical buffer policy. The amount of money needed for precautionary purposes generally depends on the size of the transactions conducted. Therefore, the precautionary demand for money is often combined with the need for transactions by economic thinkers.

c) Speculative motive

The speculative motive is speculation on securities, especially bonds When interest rates increase, bond prices decrease, which reduces the demand for money for speculative reasons. On the other hand, when interest rates decrease, bond prices rise, leading to an increase in the demand for money for speculative purposes. The interest rate is one of the indicators of financial system stability. Interest rate will changes affect the money supply in economy. Thus, fluctuations in the BI rate will influence people's decisions regarding the demand for M1, which consists of currency, demand deposits, and non-cash payments.

2.4. Previous Research

The following are some previous studies related to this research:

Lintangsari et al. (2018) analyzed the effect of on-cash payment methods, such as debit cards and e-money, on the stability of Indonesia's financial system was examined. The results show that e-money and credit card transactions significantly affect the money supply (M1) and interest rates. In particular, e-money transactions have a statistically significant negative impact on interest rates, while credit card transactions have a statistically significant positive effect on interest rates.

Hidayat and Anabel (2025) analyzed the effect of mobile banking transactions as well as technology and information investments on non-performing loans (NPL) and fee-based income in commercial banks listed on the Indonesia Stock Exchange during the 2018–2022 period. The results indicate that mobile banking transactions have a statistically significant negative effect on the NPL ratio, suggesting that increased use of mobile banking can reduce the level of non-performing loans. In contrast, technology and information investments do not have a significant effect on the NPL ratio but have a statistically significant positive effect on fee-based income. These findings suggest that the growth of digital transactions through mobile banking can support the reduction of NPLs and enhance banks' non-interest income.

Rusdianasari (2018) analyzed the role of fintech integration in the stability of the financial system. The analysis revealed that the number of bank branches has a significant long-term impact on financial stability through the performance of non-performing loans (NPLs), indicating that direct investment directed toward the banking sector also significantly influences long-term financial system stability. However, fintech tools like ATMs and e-money do not significantly impact the stability of the financial system. This is because fintech development in the financial sector remains limited, especially among communities that are unbanked.

Anindyntha and Sulistyono (2022) analyzed the effect of financial inclusion supported by fintech integration on Indonesia's financial stability was examined. Findings from the regression analysis reveal that

the use of fintech-based financial services, such as credit cards and e-money, has a significant impact on financial stability. Likewise, interest rates as a monetary factor also play an important role in influencing financial stability in the country.

3. RESEARCH METHODS

This study uses secondary data in the form of monthly time series data, covering a period of 36 months from 2021 to 2023. The data was obtained from a second party who had previously collected and published the data to the public, sourced from the Bank Indonesia (BI) website, the Otoritas Jasa Keuangan (Financial Services Authority, OJK), the World Bank, and the Badan Pusat Statistik (Central Statistics Agency, BPS). This study uses data and analytical materials based on a literature review related to previous research. The variable in this study consist of independent and dependent variable. The dependent variable is the variable that responds when connected to the independent variable. In this study, the independent variable include debit cards, credit cards, e-money, QRIS, and online loans. Meanwhile, the dependent variable includes NPL (Non-Performing Loan).

The technique employed is the Autoregressive Distributed Lag (ARDL) model, a dynamic approach in econometrics that examines the temporal connection between the dependent variable and its historical data. ARDL integrates the autoregressive (AR) and distributed lag (DL) methods. The use of the ARDL model is more effective and unbiased for relatively small data, can be applied regardless of whether the regressors are integrated at the level or first difference, and can reduce the dynamic error model (Error Correction Model or ECM) through a simple linear transformation. The analysis in this study was conducted using the E-Views 9 application software. E-Views 9 is a Windows-based computer program commonly used for analyzing econometric time series data.

The steps for data analysis using the ARDL approach in this study are as follows:

1. Stationarity test (Unit Root Test)

To determine the stationarity of the data, the Augmented Dicky-Fuller (ADF) Test or the Phillips-Perron (PP) Test is used.

$$Yt = \varrho Yt\text{-}1 + et$$

If the value of $\varrho = 1$, then the variable is non-stationary. However, if the probability value is less than 0.05, the data is considered stationary. Time series data can have different levels of stationarity, namely at the level or I(0), the first difference or I(1), or the second difference or I(2).

2. Determining Optimum Lag

The optimal lag test is conducted to determine the most appropriate lag length by using the Akaike Information Criterion (AIC), which serves to identify the most relevant lag length. A well-specified model is indicated by the smallest value of the information criterion.

3. Cointegration Test using Bounds Test

The cointegration test follows the stationarity test and is used to identify whether a long-term relationship exists among the variables in the study. The cointegration test based on the bounds testing method entails comparing the F-statistic to the lower and upper bound values. When the F-statistic is greater than both the lower and upper bound values, it implies that there is a cointegration relationship among the variables. On the other hand, if the F-statistic is below both bounds, it indicates that there is no cointegration among the variables in the model. If the F-statistic falls between the upper and lower bounds, no conclusion can be made, as the value is in the inconclusive range.

4. Autoregresive Distributed Lag (ARDL)

Autoregresive Distributed Lag (ARDL) is a model that is often used in time series data. This model can include several values in the past of both dependent and independent variable. Thus, this ARDL model can be compared to distinguish the responses that occur in the short and long term of the independent variable to the dependent variable.

$$\Delta LOGTBt = \alpha_0 + \sum_{i=1}^{n1} \alpha_1 \Delta NPL_{t-1} + \sum_{i=1}^{n1} \alpha_2 \Delta LOGDEBIT_{t-1} + \sum_{i=1}^{n1} \alpha_3 \Delta LOGCREDIT_{t-1} + \sum_{i=1}^{n1} \alpha_4 \Delta EMONEY_{t-1} + \sum_{i=1}^{n1} \alpha_5 \Delta QRIS_{t-1} + \sum_{i=1}^{n1} \alpha_6 \Delta ONLINELOANS_{t-1} + \sum_{i=1}^{n1} \delta_1 \Delta NPL_{t-1} + \sum_{i=1}^{n1} \delta_2 \Delta LOGDEBIT_{t-1} + \sum_{i=1}^{n1} \delta_3 \Delta LOGCREDIT_{t-1} + \sum_{i=1}^{n1} \delta_4 \Delta LOGEMONEY_{t-1} + \sum_{i=1}^{n1} \delta_5 \Delta QRIS_{t-1} + \sum_{i=1}^{n1} \delta_6 \Delta ONLINELOANS_{t-1}$$

Description t,i = 1, 2, 3, 4, 5 as long term, while function 1, 1,α_2,α_3,α_4,α_5, α_6 as short term coefficients of the ARDL model.

5. Classical assumption test

There are three classical assumptions, namely:

a. Normality Test

The normality test is performed to assess whether the variables in the model are normally distributed. The Jarque-Bera test is utilized for this purpose. If the Jarque-Bera probability value exceeds the 5% significance level (0.05), the model is considered normally distributed. In contrast, if the Jarque-Bera probability value is below 0.05, the model is deemed not to be normally distributed.

b. Heteroscedasticity Test

The heteroscedasticity test aims to determine whether the residuals exhibit constant variance, known as homoscedasticity. If the Chi-Square probability value exceeds the 5% significance level (0.05), it indicates that the model does not have a heteroscedasticity issue. However, if the Chi-Square value falls below the 5% threshold, it suggests the presence of heteroscedasticity in the model.

c. Autocorrelation Test

The autocorrelation test is used to identify issues involving the correlation between residuals over time or relationships among independent variables. If the Chi-Square probability value exceeds the 5% significance level (0.05), it indicates that there is no autocorrelation present. On the other hand, if the value is below 0.05, it signifies the existence of an autocorrelation issue.

6. Model Stability Test

In testing long-term and short-term variable, it is necessary to examine the stability of the parameters using a model stability test. The model stability test is conducted using the Cumulative Sum of Squares of Recursive Residuals (CUSUMQ). The CUSUMQ test is a reliable method for testing the stability of variable. If the CUSUM graph stays below the 95th percentile or does not go beyond the thresholds, then the assessment is deemed steady. Conversely, if it does cross the threshold lines, the assessment is seen as unstable. Apart from the CUSUM test, the CUSUMQ or Cumulative Sum of Squares of Recursive Residuals is utilised for a similar purpose.

4. RESULTS AND DISCUSSION.

4.1. Research Results

This research involves both dependent and independent variables. The independent variables comprise e-money and QRIS, along with supporting variables such as the volume of online loan transactions, credit card usage, and debit card usage. Meanwhile, the dependent variable in this study is the Non-Performing Loan (NPL). The results of this study are as follows:

4.1.1. Stationarity Test

The stationarity test is a form of data testing used to determine whether a time series dataset exhibits stationary properties. This test must be conducted to ensure that the ARDL model to be estimated does not violate the basic assumptions of econometrics. The results of the test are presented in Table 1.

Table 1. Stationarity Test

No.	Variable	t-statistic, PP	Stasionarity	Prob.	Notes
1	NPL	-7.262545	First difference	0,0000***	Stasioner I(1)
2	LOGDEBIT	-5,372999	Level	0,0001***	Stasioner I(0)
3	LOGCREDIT	-16,43617	First difference	0,0000***	Stasioner I(1)
4	LOGEMONEY	-8,238450	First difference	0,0000***	Stasioner I(1)
5	LOGQRIS	-8,028982	First difference	0,0000***	Stasioner I(1)
6	LOGONLINELOANS	-4,412060	First difference	0,0013***	Stasioner I(1)

Description: ***, **, * significant at 1%, 5%, 10%.

Source: Results of research, 2024

Based on the stationarity test using the Phillips-Perron method, as shown in Table 1 above, all variables have probability values less than the 1% alpha level (0.01), indicating that all variables are stationary. However, the six variables exhibit different levels of stationarity. Five variables—NPL, credit card, e-money, QRIS, and online loans—are stationary at the first difference level, while one variable, debit card, is stationary at the level form. Therefore, the ARDL model is applied in this study.

4.1.2. Determine Optimum Lag

The optimum lag test in this study is as follows:

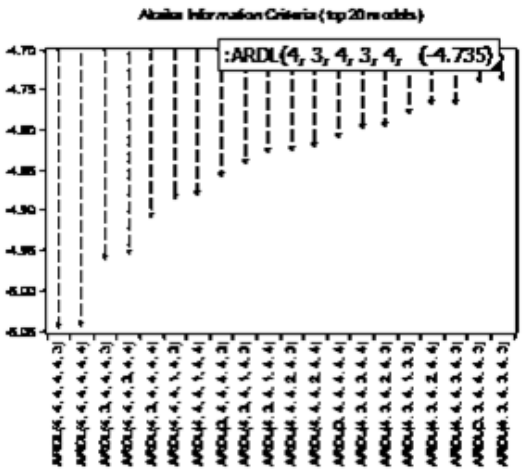

Figure 1. Lag Optimum Akaike Information Criteria

Based on the results of the optimal lag selection test, the chosen lag structure for this study is ARDL (4,4,4,4,4,3). Therefore, the best lag combination for this model consists of a maximum lag of 4 for the NPL variable, a maximum lag of 4 for the debit card variable, a maximum lag of 4 for the credit card variable, a maximum lag of 4 for the e-money variable, a maximum lag of 4 for the QRIS variable, and a maximum lag of 3 for the online loan variable.

4.1.3. Cointegration Test

The Cointegration Test aims to identify whether long-term and short-term relationships exist among the variables examined in the study. This test is carried out after verifying the stationarity of the variables through a unit root or stationarity test. The decision rule is as follows: if the F-statistic is below both the lower and upper bounds, it suggests no cointegration among the variables in the model. On the other hand, if the F-statistic exceeds both bounds, it indicates that cointegration is present and warrants further analysis.

Tabel 2. Cointegration Test

F-statistic	**10.27903**	
Signif.	**I(0)**	**I(1)**
1%	3.06	4.15
2.5%	2.70	3.73
5%	2.39	3.38
10%	2.08	3.00

Source: Results of research, 2024

The results of the cointegration test, as shown in Table 2 above, indicate that the F-statistic value of 10.27903 is greater than both the lower and upper bounds at the 1%, 2.5%, 5%, and 10% levels. Therefore, it can be concluded that there is cointegration between the dependent and independent variables in the model.

4.1.4. Autoregressive Distributed Lag (ARDL) Coefficients

Table 3. Autoregressive Distributed Lag (ARDL) Cointegration Test

Variable	**Coefficient**
NPL(-1)	-0.136178
NPL(-2)	-0.276829
NPL(-3)	-0.182121
NPL(-4)	-0.223287
LOGDEBIT	-1.087312
LOGDEBIT(-1)	2.346550
LOGDEBIT(-2)	-0.780650
LOGDEBIT(-3)	1.077272
LOGDEBIT(-4)	0.153566
LOGCREDIT	-0.139417
LOGCREDIT(-1)	-0.731416
LOGCREDIT(-2)	-0.725331
LOGCREDIT(-3)	-0.080660
LOGCREDIT(-4)	-0.869915
LOGEMONEY	-0.163208
LOGEMONEY(-1)	-0.837029
LOGEMONEY(-2)	-0.069449
LOGEMONEY(-3)	-0.210182
LOGEMONEY(-4)	0.364723
LOGQRIS	0.049128
LOGQRIS(-1)	-0.030320
LOGQRIS(-2)	-0.235703
LOGQRIS(-3)	0.171867
LOGQRIS(-4)	-0.254331
LOGONLINELOANS	0.797828

LOGONLINELOANS(-1)	-0.521841
LOGONLINELOANS(-2)	0.341622
LOGONLINELOANS(-3)	0.547672
C	8.450066

Source: Results of research, 2024

4.1.5. Classical Assumption Test

The classical assumption test is conducted to determine whether the developed model satisfies the criteria of BLUE (Best Linear Unbiased Estimator), meaning whether the model or estimation is biased or not. A model or estimation is considered BLUE if it passes the classical assumption tests. These classical assumption tests include:

A. Normality Test

The Jarque-Bera Normality Test is a statistical procedure used to evaluate if the skewness and kurtosis of a sample align with those of a normal distribution.

Table 4. Normality Test

Jarque-Berra	Prob.
2,391279	0,302510

Source: Results of research, 2024

The results of the normality test, as presented in Table 4 above, show that the variables in the analyzed model are normally distributed, as indicated by a probability value of 0.302510, which is greater than the 5% alpha level (0.05).

B. Heteroscedasticity Test

The heteroscedasticity test for the variables to be analyzed was conducted using the Breusch-Pagan-Godfrey method. The results of the heteroscedasticity test are as follows:

Table 5. Heteroscedasticity Test

Heteroscedasticity Test	Obs R-Squared	Prob Chi-Square
Breusch-Pagan Godfrey.	22.47286	0.7589

Source: Results of research, 2024

Based on the results of the heteroscedasticity test shown in Table 5 above, the Chi-Square probability value is 0.7589, which is greater than the 5% alpha level (0.05). This indicates that there is no heteroscedasticity problem.

C. Autocorrelation Test

The autocorrelation test for the variables to be explained was conducted using the Breusch-Godfrey Test or LM test. The results of the autocorrelation test are as follows:

Table 6. Autocorrelation Test

Autocorrelation Test	Obs R-Squared	Prob Chi-Square
Breusch-Godfrey Serial Correlation LM Test	31,94278	0,5275

Source: Results of research, 2024

Based on the results of the autocorrelation test shown in Table 6 above, the Chi-Square probability value is 0.5275, which is greater than the 5% alpha level (0.05). Therefore, it can be concluded that there is no autocorrelation problem in the model.

4.1.6. Short Term Coefficient

Tabel 7. Short Term

Variabel	Coefficient	Prob.
D(NPL(-1))	0.682237	0.0063***
D(NPL(-2))	0.405408	0.0116**
D(NPL(-3))	0.223287	0.0202**
D(LOGDEBIT)	-1.087312	0.0084***
D(LOGDEBIT(-1))	-0.450189	0.0587*
D(LOGDEBIT(-2))	-1.230838	0.0023***
D(LOGDEBIT(-3))	-0.153566	0.2985
D(LOGCREDIT)	-0.139417	0.1458
D(LOGCREDIT(-1))	1.675906	0.0022***
D(LOGCREDIT(-2))	0.950575	0.0021***
D(LOGCREDIT(-3))	0.869915	0.0023***
D(LOGEMONEY)	-0.163208	0.1831
D(LOGEMONEY(-1))	-0.085092	0.3036
D(LOGEMONEY(-2))	-0.154541	0.0840*
D(LOGEMONEY(-3))	-0.364723	0.0115**
D(LOGQRIS)	0.049128	0.3833
D(LOGQRIS(-1))	0.318167	0.0161**
D(LOGQRIS(-2))	0.082465	0.1322
D(LOGQRIS(-3))	0.254331	0.0155**
D(LOGONLINELOANS)	0.797828	0.0056***
D(LOGONLINELOANS (-1))	-0.889294	0.0152**
D(LOGONLINELOANS (-2))	-0.547672	0.0399**
CointEq(-1)*	-0.818415	0.0008***

Description: ***, **, * significant at 1%, 5%, 10%.

Source: Results of research, 2024

Based on the short-term ARDL model test results presented in the table above, the variables in this study exhibit short-term effects or responses. The significance of each independent variable is assessed at the 1%, 5%, and 10% significance levels. The Error Correction Term (ECT or CointEq) meets expectations, showing a negative coefficient and a probability value below the 1% threshold. This indicates that if a short-term deviation occurs, the model will adjust and return to equilibrium over the long term, with the adjustment process taking approximately 8.1 years..

Based on the short-term ARDL estimation results, it is evident that the variable NPL (-1) has the largest coefficient value, which is 0.68. This indicates that the previous year's NPL is the dominant factor influencing the current NPL. For example, the NPL one year earlier in Indonesia of 1% will cause NPL in Indonesia to be 68%. Then, the variables that have a significant influence on NPL are credit cards, e-money, QRIS, and online loans. The credit card coefficient of 0.86 means that 1% increase in credit cards will increase NPL by 86% in the third year. The e-money coefficient of 0.36 means that 1% increase in e-money will reduce NPL by 36% in the third year. The QRIS coefficient of 0.25 means that 1% increase in QRIS will increase NPL by 25% in the third year. The online loan coefficient of 0.54 means that 1% increase in online loans will reduce NPL by 54%.

Meanwhile, the debit card variable has a relatively small coefficient, namely -0.15, but is not significant for NPL.

4.1.7. Short Term Coefficient

Table 8. Long Term

Variable	Coefficient	Prob.
LOGDEBIT	0.940064	0.1623
LOGCREDIT	-1.400526	0.0557*
LOGEMONEY	-0.503265	0.0387**
LOGQRIS	-0.164626	0.2178
LOGONLINELOANS	0.640822	0.1467
C	4.646940	0.4917

Description: ***, **, * significant at 1%, 5%, 10%.

Source: Results of research, 2024

To conduct an economic analysis, it is not sufficient to rely solely on short-term information; the long-term effects must also be analyzed, with the influence of each independent variable determined using a significance level of alpha 5% or 0.05. The results show that e-money has a coefficient of -0.503265 and is significant, while credit cards have a coefficient of -1.400526 and are significant. On the other hand, debit cards, QRIS, and online loans are not significant.

4.1.8. Stability Test Result

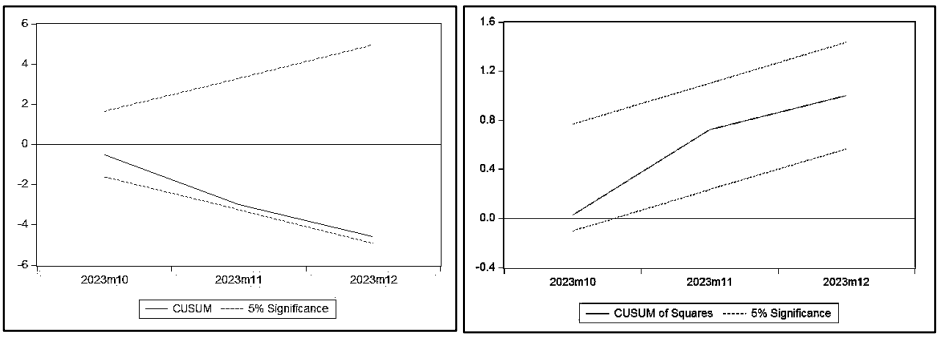

Figure 2. CUSUM and CUSUM of Squares

To assess long-term stability alongside short-term adjustments, the CUSUM and CUSUMQ (cumulative sum and cumulative sum of squares of recursive residuals) tests are utilized. If the CUSUM chart remains within the 5% significance level boundaries, meaning it does not cross the upper or lower critical limits—the model is considered stable. The same interpretation applies to the CUSUMQ test. According to the CUSUM test results, the model in this study is regarded as appropriate, demonstrating sufficient stability and reliability for analyzing the observed phenomena. The outcomes of both tests are illustrated in the figure above.

4.2. Discussions

The debit card variable shows that debit cards do not have a significant effect in either the short term or long term. This is due to a shift in how debit cards are used as a tool for financial transactions. Previously, debit cards were primarily used through offline ATM machines, but now there has been a transition toward the use of mobile banking applications, which are more effective and efficient, allowing users to conduct transactions anytime and anywhere. Moreover, with today's advanced technology, cash withdrawals from ATMs can be done without a physical card, as the machines are now integrated with mobile banking applications. Furthermore, according to Rusdianasari (2018).

Debit cards do not have a significant impact on NPL because their usage is limited to certain segments of society, particularly those who are more technologically literate, meaning that only specific groups of people are able to access and utilize debit cards (Rusdianasari, 2018).

The credit card variable shows that, in the short term, credit cards have a significant positive effect on NPL, while in the long term, they have a significant negative effect on NPL. Credit cards are one of the indicators that illustrate financial inclusion, as they can change the composition of customers in terms of saving and borrowing behavior (Laksmana, 2019). In the short term, as credit card usage increases, NPL will also increase. This occurs because credit cards offer loans that are more easily accessible compared to other types of credit, which can lead to irresponsible consumption behavior, especially among new users who lack experience in debt management.

The e-money variable shows that e-money has a significant negative effect on NPL both in the short term and the long term. According to research by Hanivan and Nasrudin (2019), e-money is one of the indicators that reflects access in the Financial Inclusion Index. The use of e-money among the public indicates that digital finance can provide effectiveness and efficiency in conducting financial transactions. In addition, e-money is also one of several programs implemented by Bank Indonesia as a new innovation in digital finance (Rusdianasari, 2018). The increasing use of e-money indicates that users have trust in it and gain benefits, especially in making payment transactions easily and quickly without the need to carry cash (Nizar & Hanifah, 2021). In this study, the e-money variable has a significant negative effect on NPL both in the short term and the long term, which means that when the use of e-money increases, it leads to a decrease in NPL. This, in turn, helps reduce credit risk and contributes to the stability of the financial system.

The QRIS variable shows that in the short term, QRIS has a significant positive effect on NPL, while in the long term, QRIS does not have a significant effect on NPL. QRIS payment is a standardized digital payment system that allows consumers to make payments via QR codes through e-wallet or mobile banking applications, which are already widely used in Indonesia (Rahmi et al., 2024). In the short term, increased use of QRIS will also lead to a rise in NPL, indicating that if digitalization increases credit usage without adequate risk management, it may result in higher levels of non-performing loans. For example, there is a risk of over-leverage, where QRIS, although intended to facilitate payments, can also be used to excessively increase credit access for some individuals or businesses beyond their repayment capacity. As a result, if this is not accompanied by sufficient financial education, it may contribute to an increase in non-performing loans (NPL).

The variable of online loans shows that, in the short term, it has a significant negative effect on NPL, while in the long term, it does not have a significant effect on NPL. The online loan variable shows that in the short term, it has a significant negative effect on NPL, while in the long term, it does not have a significant effect on NPL. This means that in the short term, an increase in online loans will reduce NPL. Online loans often offer quick and easy access to people who previously had difficulty obtaining loans from traditional financial institutions. With the increase in financial inclusion, more people are able to obtain funds to meet urgent needs. If used wisely and accompanied by good debt management, this can reduce the risk of default. In addition, online loans often offer more flexible terms, which can make it easier for borrowers to fulfill their obligations, thereby reducing the risk of non-performing loans, as debtors are more likely to repay on time under such schemes. However, in the long term, online loans do not have significant effect on NPL. This is because, over time, their influence on NPL becomes relatively small.

5. CONCLUSIONS

As technology continues to advance, payment instruments have evolved from cash-based to non-cash systems. This study aims to analyze the effect of fintech developments on financial inclusion, which in turn may affect the stability of the financial system. The objective of this research is to examine the influence of financial products supported by digital transformation within financial inclusion on the stability of the financial system in Indonesia. This study uses the Autoregressive Distributed Lag (ARDL) method to determine the long-term and short-term effects through the cointegration value of independent variables in influencing the dependent variable using the E-views application to process time series data with monthly data throughout 2021-2023. The independent variables in this study include e-money and QRIS as well as the addition of other supporting variables such as the number of online loan transactions, credit cards, and debit cards. In addition, there is also a dependent variable, namely Non-Performing Loan (NPL).

The results of the study indicate that the debit card variable does not have a significant effect on financial system stability in either the short term or the long term. The credit card variable has a significantly positive

effect on financial system stability in the short term and a significantly negative effect in the long term. The e-money variable has a significantly negative effect on financial system stability in both the short term and the long term. The QRIS variable has a significantly positive effect on financial system stability in the short term, but is not significant in the long term. The online loan variable has a significantly negative effect on financial system stability in the short term, but is not significant in the long term.

The limitations of this study include the use of only monthly data from 2021 to 2023, and the inclusion of only five independent variables (debit cards, credit cards, e-money, QRIS, and online loans) to represent financial products supported by digital transformation. Additionally, this study uses NPL (Non-Performing Loan) as the sole variable to measure financial system stability, even though there are many other variables that reflect the implementation of financial inclusion, such as exchange rates, inflation, and others. Therefore, future researchers are encouraged to expand the dataset, include additional independent variables, and incorporate other indicators to more comprehensively measure the stability of the financial system.

To maintain the stability of the financial system amidst the growing challenges related to digital transaction guarantees and loan guarantees, the government can implement several key policies. First, to ensure the security of digital transactions using e-money and QRIS, it is essential that the underlying funds are held in the form of savings or deposits that are guaranteed by a bank. To support this, a policy can be established requiring all e-money and QRIS issuers to maintain accounts with, or be affiliated with, a licensed bank. These issuers must also be registered and licensed by Lembaga Penjamin Simpanan (Deposit Insurance Corporation, LPS) to ensure the safety and integrity of customer funds. Second, to strengthen the loan guarantee system and address the issue of rising Non-Performing Loans (NPL), the government can enforce stricter eligibility and collateral requirements for individuals applying for online loans. Furthermore, all lending institutions involved in such activities should be required to register with the Otoritas Jasa Keuangan (Financial Services Authority, OJK), ensuring that they operate under proper regulatory oversight. These policies collectively aim to enhance public trust and financial system resilience in the digital era.

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