

## **Digital Finance as a Significant Driver of Bank Stability in the Indonesian Banking Sector**

Wahyu Martanti, Nur Afifah<sup>1</sup>, Yohannes Kurniawan<sup>2</sup>

<sup>1</sup>Accounting Department, School of Accounting, Master of Accounting, Bina Nusantara University, Jakarta, Indonesia, 11480

<sup>2</sup> Information Systems Department, School of Information Systems, Bina Nusantara University, Jakarta, Indonesia, 11480

*nur.martanti@binus.ac.id, ykurniawan@binus.edu*

**Abstract.** This paper investigates the impacts of financial inclusion, digital finance, and credit risk on bank stability using panel data from 45 Indonesian banks for 2017–2022. Financial inclusion was measured via bank branches and ATMs while digital finance was operationalized as a dummy variable indicating mobile banking provision. Credit risk is measured through Non-Performing Loan to total loan. The Z-score represented bank stability as the dependent variable. Panel regression analysis revealed digital finance adoption significantly improved bank stability. However, financial inclusion and credit risk showed no effects. The paper discusses implications for Indonesian regulators and banks to focus policies and resources toward facilitating digital finance, which enhances stability through improved efficiencies and market reach.

**Keywords:** bank stability, financial inclusion, digital finance, credit risk, Indonesia banking

## 1. Introduction

The importance of maintaining banking stability is a crucial topic for policymakers in both developing and developed countries. Banking stability is the main thing that must be maintained in an economy. However, in reality, instability and bank failures are still common. Therefore, banking stability has become an important issue in many countries around the world. Based on the Otoritas Jasa Keuangan (OJK) financial stability study as of October 2019, the banking sector has the largest composition of assets in the financial industry in Indonesia, namely in conventional banking at 71.09% and Islamic banking at 6.01%. The high dependence on funding from the banking sector in Indonesia makes banks must maintain their stability because it can affect the country's economic growth (Gunawan, 2019). Amidst the COVID-19 pandemic, which has slowed economic growth, banking efforts to achieve profits in 2020 have also faltered. This is reflected in profitability metrics such as the Return on Assets (ROA) of the banking sector, that continuously decreases. OJK data released in May 2020 showed that industrial banking ROA was at the level of 2.08%, this position decreased from the May 2019 period, which was still in the range of 2.61%.

Bank sector still leads finance industry in Indonesia. COVID-19 pandemic is regarded as the biggest one globally that has drastically impacted the worldwide, including Indonesia. It is evident that Indonesia's domestically economy grew by 2.97% during the 1st qtr of 2020. This figure decreased from the previous quarter's figure of 4.97%. This, of course, weakens the stability of the bank it manages (Idawati & Syafputri, 2022). Despite contracting in 2020 due to the COVID-19 pandemic, bank credit in May 2022 grew 9.03% yoy. In addition, Indonesian banking assets increased 37.8% in the last five years, from 2017 to May 2022, reaching IDR10 trillion. The growth of third-party funds continued to grow during the COVID-19 pandemic, which amounted to 42.08% during the 2017-2022 period. Some studies show that bank stability or instability can be caused by bank-specific factors or bank fundamentals and efficiency (Shim, J., 2019). Therefore, this study wants to find out and answer the question of whether financial inclusion, digital finance, and credit risk affect bank stability. Increasing financial inclusion is a critical factor in achieving the 2030 Sustainable Development Goals (SDGs) (Allen et al., 2018). According to Banna & Alam (2021), financial inclusion not only ensures banking stability but also ensures inclusive and sustainable economic development, which contributes to financial sustainability, promoting financial sector stability by providing the right financial solutions and products for customers. The results of Jungo et al. (2022) and Vo et al. (2021) found that financial inclusion has a positive and significant effect on bank stability. However, the results of this study contradict the results of research by Rusdianasari (2018) and Iramayasari & Adry (2020), which has the results of financial inclusion with a proxy of 2/3 times the number of branches then summed with 1/3 times the number of Automated Teller Machine (ATMs) has no effect on bank stability.

According to Durai & Stella (2019) in Idawati W & Syafputri S.A (2022), digital finance is a financial service provided through a smartphone or computer via the internet to access mobile banking, e-wallet, mobile wallet, credit card, and direct debit. The emergence of digital finance, especially during the COVID-19 pandemic, makes it very easy for banks to continue to provide sound financial services to customers. Because digital finance is faster, more efficient, less time-consuming, and cheaper, many countries have begun to fully implement it during the pandemic to maintain the stability of the financial and banking sectors. Research results by (Ozili et al., 2018; Banna & Alam, 2020; Yudaruddin, 2020; Risman Asep et al., 2021; Idawati W & Syafputri, A S, 2022) found that digital finance has a positive effect on bank stability. However, the results of this study are different from the results of Rusdianasari (2018), who found that digital finance with the role of financial technology does not optimally affect bank stability. Digital finance can only be achieved by people who know the technology, speed, efficiency, and effectiveness that still cannot be used by people who do not have bank accounts. Credit risk on bank stability Risk management in all organisations, especially in the banking and financial sector, is critical to institutional stability (Matey, J., 2021). Increased credit risk could lead to difficulties for bank in maintaining stability. Banks generate their income by extending large amounts of credit to

borrowers, which involves significant credit risk. When borrowers in the banking sector cannot repay their loans on time, this is known as credit risk. The results of Ghenimi et al., (2017) study, in particular, showed that bank stability decreases with increasing credit risk. This may be because higher interest rates stem from higher consumer demand for credit risk. The results explain that credit risk has a negative effect on bank stability. Aini, I. N. (2017); and Habibie et al., (2017) showed that credit risk does not affect bank stability. Banks cannot if they continue to focus on reducing Non-Performing Loan (NPL) because banks that have high NPL lousy credit risk can still be covered by increasing Capital Adequacy Ratio (CAR) and liquidity (LDR) so that bank stability generated by banks can still be stable.

The banking sector in most developing countries is considered to have relatively low levels of inefficiency, resulting in high transaction and service costs, to improve the competitiveness, efficiency, and performance of the banking industry in Indonesia, a better understanding of the impact of bank stability on the banking industry is required. Bank stability is a key policy concern for financial market regulators, investors, and academics. Therefore, the findings of this study are directly helpful for stakeholders in Indonesia in particular and can always contribute to the development of capital markets and banking in Indonesia. The unique value contributed by studying these variables specifically on banks in Indonesia over the period 2017-2022 is that financial inclusion can improve economic efficiency, reduce shadow banking or irresponsible finance, and support the improvement of Indonesia's Human Development Index (HDI). Specific implications for regulators and bankers in Indonesia in increasing financial inclusion and stability which are policy priorities, are generally carried out through a national strategy approach that includes 3 aspects, namely the provision of appropriate service facilities, the provision of suitable products, responsible finance through financial education and consumer protection. Then digital finance contributes to increasing public access in Indonesia to digital-based financial products and transactions by utilizing existing technology in banks, as well as developing and utilizing technological advances to create innovation and various financial products in Indonesia, especially in the banking industry. Then by studying credit risk, it is hoped that banks will be able to provide control over credit risk through credit risk management which is very important and useful as an alternative in maintaining banking conditions to remain stable.

In this study, there are differences with previous research by Risman et al. (2021) and Idawati W & Syafputri S.A (2022), namely the addition of financial inclusion variables that have not been studied by these researchers. The next difference is that this study uses sample data from the banking industry listed on the Indonesia Stock Exchange (IDX), while previous studies such as Vo et al. (2021) focused on a sample of Asian Region banks and research by Jungo et al. (2022) only focused on banking samples in 46 countries Sub-Saharan Africa (SSA) and 31 countries in Latin America and the Caribbean (LAC), as well as research results that still vary. Then another difference is the research method used by research Neaime & Gaysset (2018), namely the Generalized Method of Moments (GMM) and Generalized Least Squares (GLS) econometric models and a large sample of eight MENA countries during the 2002-2015 period and research Risman et al. (2021) uses Multiple Linear Regression Models and Moderating Regression Analysis (MRA), while the authors use panel data regression research methods. This research has contributed to an improved understanding of bank stability and identified some important factors such as financial inclusion, digital finance, and credit risk whether they affect bank stability. However, the role of financial inclusion through the integration of the number of bank branches and the number of ATMs has not been able to reach a wide range of Indonesians and the dominant financial inclusion contribution in influencing bank stability has not been seen. Bank stability can be driven by the performance of financial variables including bank current assets, and direct investment. The above description shows that there is no consensus in the literature on the impact of financial inclusion on bank stability. Based on this background, this study aims to fill this gap.

## **2. Literature Review**

### **2.1. Bank Stability**

Bank stability means the absence of banking crises, which is achieved through the stability of all banks in the banking system Brunnermeier & Yogo (2009) in Yitayaw et al., (2023). The factors that determine banking stability and their effect on the stability of the financial system vary by country. The signaling theory first proposed by Michael Spence (1973) suggests that management will try to convey relevant information so that it can be utilized by investors. As for how to convey such information by giving signals or signals to investors. The relationship between signaling theory and bank stability in this study is an analysis of bank stability during the pandemic and post-pandemic Covid-19, which is viewed from the analysis of financial inclusion, digital finance, and credit risk that can be a signal for banks. and for parties interested in banking such as bank service users, investors, and creditors in decision making. For internal banking parties, signal theory can be used as a warning in maintaining the continuity of banking business processes, including when facing environmental changes due to certain conditions such as the Covid-19 pandemic and for external banking parties, signal theory can be used as a consideration in decision making.

### **2.2. Financial Inclusion**

Ahamed and Mallick (2019) considered the effects of financial inclusion on bank stability. On the one hand, they believe that capital extension increases deposits and reduces the marginal cost of providing banking services. On the other hand, implementing an inclusive financial system might be associated with NPL because of asymmetric information on risky borrowers. The results showed a positive relationship between financial inclusion and bank stability. The term financial inclusion refers to the availability and use of formal banking services required for both individuals and businesses Chiu & Lee (2020). (Hasan & Liu, 2022) state the financial inclusio is often used in the context of the financial sector to describe the rapid pace of growth and the introduction of new technology solutions.

Dupas & Robinson (2014) stated that financial inclusion has no significant effect on bank stability in western Kenya. This is because the increase in the number of bank branches is not followed by public trust and the quality of services provided by financial service providers. In addition, the lack of effect of the number of bank branches on the stability of the financial system in western Kenya is due to the credit channeled by bank branches not followed by a decrease in the cost of credit taken by the lower middle class. Research conducted by Rusdianasari (2018) also states that fintech, such as ATMs and e-money, does not have a significant effect on bank stability, because it is only reached by several layers of society who are more knowledgeable about technology, so that this fintech is only needed for speed and effectiveness of access not only limited to service access. The process of financial inclusion may have more potential for unfavorable implications on the stability of banks in the widening loan eligibility standards, according to articles from 2018 by Umair & Dilanchiev (2022) and Xiuzhen et al. (2022).

### **2.3. Digital Finance**

According to Durai & Stella (2019) and Idawati W & Syafputri S. A (2022), digital finance is a financial service provided through a smartphone or computer via the Internet to access mobile banking, e-wallets, mobile wallets, credit cards, and direct debit. Tudor dynasty (2020) states that mobile banking is one of the latest innovations in mobile technology that provides an effective distribution channel compared to other distribution channels. Mobile banking functionality that provides efficient services anytime, anywhere, including on the go. In addition, with the increasing use of smartphones, banks ' ability to offer innovative services to improve operational efficiency and market share will have a significant impact. Research Rismani et al., (2021) supporting the research of Ozili, P. K. (2018) stated that digital finance positively impacts banking stability.

However, research by Rusdianasari (2018) states that digital finance with the role of financial

technology has not been optimal in influencing banking stability. Digital finance can only be achieved by people who understand technology, speed, effectiveness, and efficiency so people who cannot access banks cannot use it. The results of the study (Romānova & Kudinska, 2016; Buchak et al., 2018; Tang, H., 2019) that digital finance has no effect on bank stability. This difference in findings is possible due to differences in the methodology used, especially data and proxies, where their research focuses on fintech that organizes peer-to-peer lending, as well as the independent variable is banking performance.

## **2.4. Credit Risk**

Increased credit risk can make it more difficult for banks to maintain stability. Banks earn revenue by extending large amounts of credit to borrowers and this activity involves significant credit risk. When borrowers in the banking sector are unable to repay their loans on time, this is known as credit risk (Siddique et al., 2021; Accornero et al., 2018). Research Matey, J. (2021) states that credit risk, as measured by NPL, can affect banking income and banking system efficiency. Ketaren and Haryanto (2020) also stated that the higher the NPL, the lower the value of bank stability. The bank's bad credit rate makes it clear that the risk of default from customers is borne by the bank.

Research by Habibie & Medan (2017) and Ali & Puah (2019) states that credit risk has no effect on bank stability, because banks have sufficient loss reserves to overcome non-performing loans. This is because even though there are loss reserves or write-off funds, banks still do not get profitability from loans. These results can be interpreted that the occurrence of credit risk has no significance to bank stability. Research by Aini, I. N. (2017) also suggests that credit risk caused by NPL does not affect bank stability. Where logically a low NPL can increase bank stability, on the contrary, if the NPL is high it can result in a decrease in bank stability. However, this logic can be broken by the test results in this study which states that the level of the NPL ratio has no effect on bank stability. Companies cannot if they continue to focus on reducing NPLs, because banking companies that have a high risk of NPL bad loans may still be covered by increasing their CAR and LDR so that bank stability generated by banks can still be stable.

## **2.5. Hypothesis Development**

According to Banna & Alam (2021), financial inclusion not only ensures banking stability but also ensures inclusive and sustainable economic development, which contributes to financial sustainability. Financial inclusion promotes financial sector stability by providing customers with the right financial solutions and products (Vo et al., 2020). Lopez & Winkler (2019) used a sample of 189 countries over the period 2004-2017; their main finding is that countries with higher levels of financial inclusion tend to experience a significant reduction in lending and credit deterioration. Neaime & Gaysset (2018) investigated how financial inclusion influences bank stability, findings in the paper indicate that financial inclusion is positively related to bank stability. This line of thought assumes that the level of financial inclusion is mainly driven by sociological factors. In addition, lower-income groups voluntarily access the available financial resources to improve their economic conditions. On that basis, financial inclusion mitigates income inequality by giving poor households an economically beneficial motivation to strive for improvement, rather than leading to persistent poverty. This finding empirically supports the view that a more effective financial inclusion process is positively correlated with a more resilient bank stability market. Meanwhile, research by (Dupas et al. 2014; Rusdianasari, 2018; Iramayasari & Adry, 2020) found that financial inclusion has no effect on bank stability. Therefore, this study refers to the research of (Lopez & Winkler, 2019; Vo et al., 2020; Jungo et al., 2022) that financial inclusion has an effect on banking stability, the hypothesis developed is as follows:

### **H1: Financial Inclusion has an effect on Bank Stability**

Digital financial innovation cannot be separated from financial services institutions, especially banks, to meet the needs of customers who are accustomed to digitalization (Babarinde et al., 2021).

Research by Rismani et al. (2021) supports research by Ozili, P. K. (2018) which states that digital finance has a positive impact on banking stability. Juengerkes (2016) findings show that collaboration between banks and digital finance can increase customer trust and provide complementary effects. Digital finance can help the government, financial and monetary system regulators to exercise control by providing faster early warnings because they also use technology in reporting and databases. Yudaruddin's research (2020) states that mobile banking is one of the latest innovations in technology that provides effective distribution channels. The function of mobile banking is to provide efficient services anytime, anywhere, including while traveling. In addition, with the increasing use of digital finance, banks' ability to offer innovative services to increase operational efficiency and market share will have a significant impact. Banna & Alam (2021) state that the timely and efficient implementation of digital finance can spur a country's overall economic condition by ensuring banking stability. However, this study is not in line with Rusdianasari (2018) research which found that digital finance with the role of financial technology does not affect bank stability. Therefore, it can be hypothesized that there is an influence between digital finance on banking stability. This research refers to the research of (Ozili, P. K., 2018; Banna & Alam 2020; Yudaruddin 2020; Risman Asep et al., 2021; Idawati W & Syafputri, A S, 2022), that digital finance has a effect banking stability. Based on the description above, a hypothesis can be formulated:

### **H2: Digital Finance has an effect on Bank Stability**

The NPL ratio value is an indicator of credit risk in the banking world. Babar et al. researchers (2019) concluded in their research that credit risk will affect the stabilize of a bank. Banks will get greater profits and stabilize their banking financial conditions if they get lower NPL values, and vice versa. Thus, it can be concluded that NPL will have a negative effect on banking stability. Ketaren & Haryanto (2020) stated that the higher the NPL, the lower the value of bank stability, because the higher the value of bad debts owned by the bank, the higher the value of customer default. This increase in default is a credit risk that has a significant impact on the banking industry because it has an impact on the company's poor performance as evidenced by the decline in banking stability. Research by Idawati W & Syafputri, A.S (2022) also shows that credit risk variables have a negative effect on bank stability. This research is inversely proportional to the results of (Aini, I. N, 2017); and Habibie, 2017; and Ali & Puah, 2019), which show that credit risk has no effect on bank stability because banks have sufficient loss reserves to overcome non-performing loans. Therefore, this study refers to the research of (Ketaren & Haryanto, 2020; Idawati W & Syafputri, A.S, 2022), who found that credit risk has an effect on bank stability. From the above results, hypotheses were developed and formulated:

### **H3: Credit Risk has an effect on Bank Stability**

## **3. Research and Methodology**

The sampling technique used in this research is purposive sampling, where there are criteria and data sources with certain considerations. The consideration in question is the selection of samples and the research period in accordance with the availability of data in the annual report of each bank. The sample selection in the study was carried out on the basis of data quality while maintaining the proportionality of the mix. The sample size of this study was determined by the availability of data for financial inclusion, digital finance and credit risk indicators. Specifically, data for all 45 relevant Indonesian banks required by the researcher is only available from 2017 to 2022. The screening criteria and processes used to select 45 banks over a 6-year period are banks listed on the Indonesia Stock Exchange, banks that have complete data in their annual reports related to research needs such as the availability of measurement components of each independent and dependent variable from 2017 - 2022. Research data processing was carried out using the Eviews 12 application. Based on the background, previous research and the theoretical basis that has been described, the research framework can be described as follows:

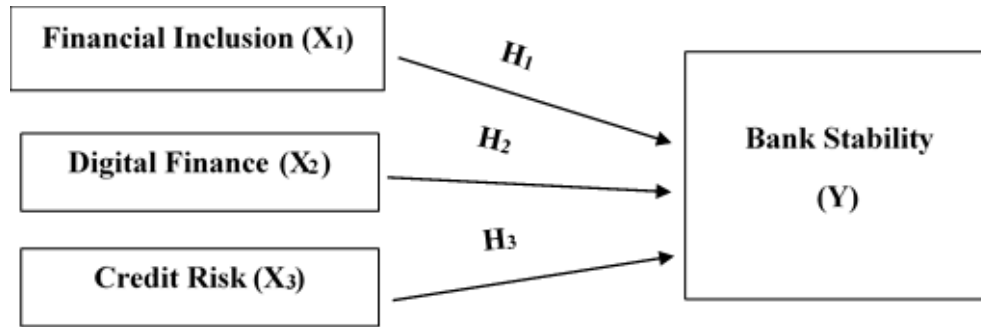


Fig. 1: Theoretical framework

The method in this research is quantitative method. Data analysis in this study uses panel data regression analysis techniques to discuss and process the data obtained and test the hypothesis. Because demographics are homogeneous, no control variables are needed in this study. This is because the data in this study have the same population variance, and the Sig. value in this study  $> 0.05$ . Data is assumed to be homogeneous, if the Sig value.  $> 0,05$ . From the results of the panel data regression model selection, the best model chosen is the Fixed Effect Model (FEM). The explanation is in the results and discussion section. The research design used in this study:

$$\text{Bank Z-Score} = \alpha + \beta_1 \text{FIN} + \beta_2 \text{DF} + \beta_3 \text{CR} + e$$

Description:

Bank Z-Score : Bank Stability  
 FIN : Financial Inclusion  
 DF : Digital Finance  
 CR : Credit Risk  
 E : Error

### 3.1. Dependent Variable

#### 3.1.1. Bank Stability

The proxy used in this study refers to the research of (Ghenimi & Omri, 2017; Ahamed & Mallick, 2019; Vo et al., 2021) using Z-score to measure bank stability. Z-score is a bank solvency index widely used in banking research. Where bank stability represents the bank's Z-score, ROA, TE/TA represents the bank's total equity to total assets, and  $\sigma$  ROA represents the standard deviation of the ROA.

$$Z\text{-Score} = \frac{\text{ROA} + \frac{\text{Total Equity}}{\text{Total Assets}}}{\sigma \text{ ROA}}$$

### 3.2. Independent Variable

#### 3.2.1. Financial Inclusion

Sarma and Pais (2011) measured financial inclusion using availability, and accessibility. They assigned a weight of 2/3 to bank branches and 1/3 to ATMs in computing the availability dimension and assigned 1, and 0.5 to accessibility, availability, and usage dimensions, respectively, in indexing overall financial inclusion. These weights assigned to the indicators and dimensions based on the judgment of the authors may differ from the actual contribution of the indicators and dimensions in explaining variations in data, potentially leading to indexing bias. Research (Camara and Tuesta, 2017) used the dimensions of use, access, and barriers as proxies for financial inclusion. They proxied the usage dimension by using

savings accounts, saving, and borrowing; and the access dimension by the number of bank branches, ATMs, and banking agents, per 100,000 adults. They used distance, trust, cost, and paperwork requirements as proxies for the barriers dimension. The proxy for financial inclusion in this study is the availability dimension. Two separate indices are calculated for the availability dimension; one for bank branches and another for ATMs. The weighted average of the two indices uses 2/3 of the weight of the bank branch index and 1/3 of the weight of the ATMs index. The proxy of financial inclusion in this study refers to the studies (Sarma and Pais, 2011; Nisa, Chaerani et al., 2018; Ozili P. K., (2020); Vo et al., 2021); which use the number of bank branches and ATMs as the access dimension to measure financial inclusion.

### 3.2.2. Digital Finance

Digital finance is a type of financial service that uses digital products and can be connected to digital payment systems. The proxy for digital finance in this study is to use dummy variables, namely 1 if the bank provides mobile banking services and 0 if the bank does not provide mobile banking services in accordance with research (Idawati & Syafputri, 2022).

### 3.2.3. Credit Risk

The proxy for credit risk in this study is NPL to total loan reference research by (Rupeika-Apoga & Grima 2020; Siddique & Khan, 2021). Credit risk involves fluctuations in debt instruments and derivative valuations that depend on the creditworthiness of borrowers. The level of banking stability increases with the reduction of NPL. Research conducted by Matey, J. (2021), supposes that banks with fewer loans can increase their stability through protection for customer withdrawals.

$$CR = \frac{\text{Non-Performing Loan}}{\text{Total Loans}} \times 100\%$$

## 4. Result and Discussion

The method used in this research uses the documentation method, which is a way of collecting data by using documents related to this research. The object from this study is the yearly report data of banking sector companies listed on the Indonesia Stock Exchange for the period 2017 - 2022. The number of banks listed is 47, and there are 2 banking companies that do not meet the research requirements. So that the total research sample was 45 banking companies, then multiplied by the research year, namely 6 years, the total sample used was 270.

### 4.1. Descriptive Statistic

Table 1: Descriptive Statistical Test Results

|              | Bank<br>Stability | Financial<br>Inclusion | Digital<br>Finance | Credit<br>Risk |
|--------------|-------------------|------------------------|--------------------|----------------|
| Mean         | 35.81852          | 833.9259               | 0.762963           | 0.035044       |
| Median       | 26.00000          | 74.50000               | 1.000000           | 0.029000       |
| Maximum      | 167.0000          | 8947.000               | 1.000000           | 0.223000       |
| Minimum      | 1.000000          | 5.000000               | 0.000000           | 0.000000       |
| Std. Dev     | 31.66883          | 1928.012               | 0.426055           | 0.026113       |
| Observations | 270               | 270                    | 270                | 270            |

Based on table 1 descriptive statistics above, the following results can be obtained:

1. The bank stability variable is the dependent variable (Y), where the data distribution shows that the average bank stability 35.81852 is relatively small by looking at the proximity of the average

and minimum value. While the data variance of 31.66883 is relatively large by looking at the magnitude of the mean value and standard deviation, so the amount of data is large.

2. The financial inclusion variable (X1) is the first independent variable, where the data distribution shows that the average financial inclusion 833.9259 is relatively small by looking at the proximity of the mean and minimum value. While the data variance of 1928.012 is relatively large by looking at the magnitude of the mean value and standard deviation, so the amount of data is large.
3. The digital finance variable (X2) is the second independent variable, where the data distribution shows that the average digital finance 0.762963 is relatively small by looking at the proximity of the mean and minimum values. While the data variance 0.426055 is relatively small by looking at the proximity of the mean value and standard deviation so that the amount of data is small, the data distribution is small.
4. The credit risk variable (X3) is the third independent variable in, where the data distribution shows that the average credit risk 0.035044 is relatively small by looking at the proximity of the mean and minimum value. While the data variance 0.026113 is relatively small by looking at the proximity of the mean value and standard deviation so that the amount of data is small, the data distribution is small.

## 4.2. Panel Data Regression Model Selection

Table 2: Chow Test Results

| Effects Test             | Statistic  | d.f      | Prob.  |
|--------------------------|------------|----------|--------|
| Cross-section F          | 58.495207  | (44.222) | 0.0000 |
| Cross-section Chi-square | 683.961920 | 44       | 0.0000 |

Table 3: Hausman Test Result

| Test Summary         | Chi-Sq. Statistic | Chi-Sq. d.f | Prob.  |
|----------------------|-------------------|-------------|--------|
| Cross-section random | 14.498515         | 3           | 0.0023 |

From the results of selecting the panel data regression model, the authors only conducted the chow test and the hausman test, because from these results it can be concluded that the chow test results Prob. 0.0000 < 0.05, and the results of the hausman test Prob. 0.0023 < 0.05, then the best model and chosen is the Fixed Effect Model. The fixed effect model in panel data assumes that the slope coefficient is constant for each variable, but the intercept varies across the cross section in each unit. To distinguish the intercept, dummy variables can be used, therefore this model is also known as the Least Squares Dummy Variable (LSDV) model. The estimation technique of panel data regression model with fixed effect model uses LSDV estimation method.

## 4.3. Classical Assumption Test

### 4.3.1. Normality Test

Table 4: Normality Test Result

|                   |           |
|-------------------|-----------|
| Series: Residuals |           |
| Sample 2017 2022  |           |
| Observations 270  |           |
| Mean              | -8.26e-16 |
| Median            | 0.128981  |
| Maximum           | 2.722161  |
| Minimum           | -2.293305 |

|           |           |
|-----------|-----------|
| Std. Dev. | 0.968593  |
| Skewness  | -0.202929 |
| Kurtosis  | 2.605765  |

|             |          |
|-------------|----------|
| Jarque-Bera | 3.601599 |
| Probability | 0.165167 |

From the results of the semi-log normality test above on the 2017 – 2022 period data with 270 observations, the JB probability value shows a number 0.165167 which means greater than  $> 0.05$ , it means that the data is normally distributed, so the normality assumption is met.

#### 4.3.2. Multicollinearity Test

The multicollinearity test aims to test whether the regression model found a high or perfect correlation between independent variables (Ghozali, 2016). In this study, a multicollinearity test has been carried out, the method used to see whether there is multicollinearity in this study is to use a correlation matrix.

Table 5: Multicollinearity Test Result

|                        | X1_Financial<br>Inclusion | X2_Digital<br>Finance | X3_Credit<br>Risk |
|------------------------|---------------------------|-----------------------|-------------------|
| X1_Financial Inclusion | 1.000000                  | 0.217844              | -0.136103         |
| X2_Digital Finance     | 0.217844                  | 1.000000              | -0.177147         |
| X3_Credit Risk         | -0.136103                 | -0.177147             | 1.000000          |

The table above shows that each variable has a correlation value below  $< 0.90$ , so it can be concluded that there is no multicollinearity.

The correlation matrix  $\Rightarrow$  X1\_FIN and X2\_DF is  $0.217844 < 0.90$ , X1\_FIN and X3\_CR is  $-0.136103 < 0.90$ , and X2\_DF with X3\_CR is  $-0.177147 < 0.90$ .

#### 4.3.3. Heteroscedasticity Test

The residual heteroscedasticity test can be seen that the residual value is between 500 and -500, meaning that the residual variance is the same. Therefore, there are no symptoms of heteroscedasticity or pass the heteroscedasticity test (Napitupulu et al., 2021). To determine the presence of heteroscedasticity in the data, a residual graph can be used. In this study, the heteroscedasticity test has been carried out, the method used to see whether there is heteroscedasticity in this study by using the residual graph (residual heteroscedasticity test).

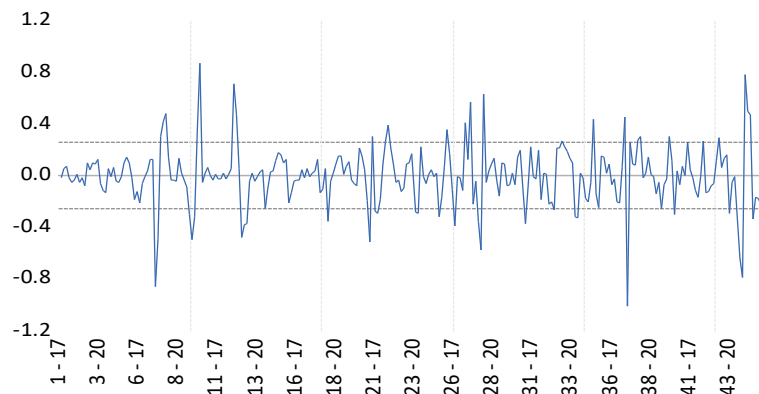


Fig. 2: Heteroscedasticity Test Result

From the residual graph, it can be seen that there is no heteroscedasticity where the residual graph (blue color) shows if the residuals do not cross the boundaries (500 and -500), it can be seen that the residual value is between 1.2 and -1.2 which does not cross the boundaries of 500 and -500 ( $1.2 < 500$  and  $-1.2 > -500$ ) which means that the residual variance is the same. Therefore, there are no symptoms of heteroscedasticity.

#### 4.4. Panel Data Regression Analysis

Based on the panel data regression results that have been carried out in this study, the regression equation is formulated as follows:

$$\text{LOG}(Y\_BS) = 3.06902260702 - 1.89054232622e-05 * X1\_FIN + 0.156455303783 * X2\_DF - 1.46406632579 * X3\_CR + [CX=F]$$

#### 4.5. Hypothesis Testing

##### 4.5.1. Simultaneous Test (F)

The F test basically shows whether all the independent variables used in the study simultaneously affect the dependent variable, with the feasibility of the resulting model at the  $\alpha$  level of 0.05 (Ghozali, 2018).

Table 6: Simultaneous Test (F) Result

|                    |          |
|--------------------|----------|
| R-squared          | 0.952502 |
| Adjusted R-squared | 0.942446 |
| S.E. of regression | 0.256871 |
| Sum squared resid  | 14.64820 |
| Log likelihood     | 10.29074 |
| F-statistic        | 94.72124 |
| Prob(F-statistic)  | 0.000000 |

The calculated F value is  $94.72124 > F$  table, which is 2.638538 and sig value.  $0.000000 < 0.05$ , then  $H_0$  is rejected, and  $H_a$  is accepted, meaning that the variables financial inclusion, digital finance and credit risk simultaneously affect bank stability in Indonesia.

##### 4.5.2. Test Adjusted R-square

According to Ghozali (2018) The coefficient of determination  $R^2$  measures how far the model's ability to explain the dependent variable. The coefficient of determination is between 0 and 1. The better regression will be indicated by the higher the Adjusted R-squared value approaching 1. If the Adjusted R-squared value is close to 0, it indicates that the independent variable in explaining the dependent variable is very limited.

Table 7: Adjusted R-square Result

|                    |          |
|--------------------|----------|
| R-squared          | 0.952502 |
| Adjusted R-squared | 0.942446 |
| S.E. of regression | 0.256871 |
| Sum squared resid  | 14.64820 |
| Log likelihood     | 10.29074 |
| F-statistic        | 94.72124 |
| Prob(F-statistic)  | 0.000000 |

The adjusted R Square value is 0.942446 or 94.2446%. The coefficient of determination shows that the independent variables consisting of financial inclusion, digital finance and credit risk are able to explain the bank stability variable in Indonesia by 94.2446%, while the remaining 5.7554% (100 – adjusted R Square value) is explained by other variables that are not included in this research model.

#### 4.5.3. Partial Test (t)

The t test shows how far the influence of one independent variable individually in explaining the dependent variable. The results of the t statistical test will be the basis for making hypothesis decisions in this study, if the independent variable affects the dependent variable, the hypothesis is supported (Ghozali, 2018). The following are the results of the partial (t) test that has been carried out in this study:

Table 8: Partial Test (t) Result

| Variable            | Coefficient | Std. Error | t-Statistic | Prob.  | Hypothesis Answer |
|---------------------|-------------|------------|-------------|--------|-------------------|
| C                   | 3.069023    | 0.080959   | 37.90821    | 0.0000 |                   |
| Financial Inclusion | -1.89E-05   | 6.53E-05   | -0.289728   | 0.7723 | H1 Rejected       |
| Digital Finance     | 0.156455    | 0.055769   | 2.805413    | 0.0055 | H2 Accepted       |
| Credit Ratio        | -1.464066   | 0.885188   | -1.653960   | 0.0995 | H3 Rejected       |

Table 6 shows the results of the coefficient, standard deviation, t-Statistic, and Prob. A Prob value below 0.05 means the hypothesis is accepted, while a Prob value above 0.05 means the hypothesis is rejected. Therefore, Table 6 shows that H2 is accepted while H1 and H3 are rejected. A positive value on the coefficient indicates that all relationships between variables have a positive direction, and vice versa.

#### 4.6. Discussion

The t test results on the FIN (X1) financial inclusion variable, obtained a t value of 0.289728 < t table, namely 1.968855 and a sig value. 0.7723 > 0.05, meaning that the FIN variable has no effect on bank stability in Indonesia. Thus H1 is rejected, which means that financial inclusion has no effect on bank stability. The same results were found in previous studies (Dupas et al. 2014; Rusdianasari, 2018; Iramayasari & Adry, 2020) which have the results of financial inclusion with a proxy weight of 2/3 for bank branches and 1/3 for ATMs has no effect on bank stability. This means that when the distribution of bank branches and ATMs changes in intensity, it has no effect on bank stability in Indonesia. This is because branches and ATMs are not productive in contributing to the financial inclusion program. This is due to the ineffective services provided by employees at a bank branch and also due to the limited network of a bank branch office. And this is also because the use of ATM cards for financial transactions has begun to shift with the use of mobile banking applications which are more effective and efficient because users can transact anytime and anywhere without the need to go looking for an ATMs machine. However, the results of this study differ from those of the study (Lopez & Winkler, 2019; Vo et al., 2020; Jungo et al., 2022;) which states that financial inclusion affects banking stability. The findings in these studies suggest that higher levels of financial inclusion can help banks increase revenue, reduce costs, and expand market share, and lead to greater bank stability.

The t test results on the DF (X2) digital finance variable obtained a t value of 2.805413 > t table, namely 1.968855 and sig value. 0.0055 < 0.05, meaning that the DF variable has an effect on bank stability in Indonesia. Thus H2 is accepted, which means that digital finance affects bank stability. The results of this study are relevant to previous research which found evidence that digital finance affects bank stability as in (Ozili, P. K., 2018; Banna & Alam, 2020; Yudaruddin, 2020; Risman Asep et al., 2021; Idawati W & Syafputri, A S, 2022). Yudaruddin's research (2020) states that mobile banking

provides efficient services anytime, anywhere, including on the go. In addition, with the increasing use of smartphones, banks' ability to offer innovative services to increase operational efficiency and market share will have a significant impact. However, the results of this study are inconsistent with previous research by Romānova & Kudinska (2016) that digital finance has no effect on bank stability. This difference in findings may be due to differences in the methodology used, especially data and proxies, where their research focuses on fintech that organizes peer-to-peer lending. And the results of this study contradict research (Buchak et al., 2018; Rusdianasari, 2018; Tang, H., 2019) which states that digital finance can only be accessed by people who understand technology, speed, effectiveness, and efficiency so that unbankable people cannot take advantage of it.

The results of the t test on the CR (X3) credit risk variable, obtained a t value of  $1.653960 < t_{table}$ , namely 1.968855 and a sig value.  $0.0995 > 0.05$ , meaning that the CR variable has no effect on Bank Stability in Indonesia. Thus H3 is rejected, which means that credit risk has no effect on bank stability. The same results were found in previous studies, namely Habibie & Medan (2017) and Ali & Puah (2019) which state that credit risk has no effect on bank stability, because banks have sufficient loss reserves to overcome NPL. This is because even though there are loss reserves or write-off funds, banks still do not get profitability from loans. This result can be interpreted that the occurrence of credit risk has no effect on bank stability, because when credit risk proxied by NPL describes a condition where the debtor is unable to pay the ongoing installments on time, it has no effect on banking stability in Indonesia. The results of this study are relevant to previous research, namely Aini, I. N (2017) which shows that credit risk proxied by NPL has no effect on banking stability. Because banks cannot if they continue to focus on reducing NPL, because banks that have a high risk of NPL bad loans can still be covered by increasing CAR and LDR so that bank stability generated by banks can still be stable. Acharya and Viswanathan (2011), explain that risk-tolerant banks eventually reduce funds available to meet depositor demand, thereby exposing them to liquidity crisis. As mentioned earlier, credit risk involves fluctuations in debt instruments and derivative valuation which depends on the credit worthiness of borrowers. The level of bank stability improves with diminished non-performing loans. Jeon and Lim (2013), posit that banks with fewer loans are able to enhance their stability through coverage for clients' withdrawals. This means provision of fewer loans leaves enough liquid assets for creditor needs. However, the results of this study are inconsistent with previous research by research (Matey, J, 2021; Idawati W & Syafputri, A.S, 2022) which found that credit risk affects bank stability, because the decline in bank credit growth and the amount of NPLs can affect bank income and the efficiency of bank system stability.

## **5. Conclusion**

This study makes both empirical and practical contributions regarding bank stability and its key determinants in Indonesia's banking system. The findings highlight that continued expansion of digital financial services should remain a top priority, as this directly strengthens bank stability even as financial inclusion and credit risk prove immaterial. Specifically, policymakers aiming to uphold stability should emphasize mobile banking and similar platforms that drive performance gains through improved efficiencies, risk management, and customer bases. Individual banks likewise need to accelerate digital capabilities while the lack of impact from physical access points like branches and ATMs imply these no longer require emphasis or substantial investment movin. The author realizes that there are limitations in conducting this research. These limitations include: The population of this study focuses on 47 companies in the banking industry. However, the total sample in this study only includes 45 banking companies with a research period of 6 years, from 2017 to 2022. The variables used in this study are also limited, namely only 3 independent variables which include financial inclusion, digital finance and credit risk. There is only one X or independent variable that affects bank stability in this study, namely digital finance.

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