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The Role of Digitalization of Financial Inclusion in Reducing Income Gaps: an Empirical Study at 33 Provinces in Indonesia

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A B S T R A C T

One of the problems faced by developing countries, including Indonesia, is income inequality. It is hoped that digitalization of financial inclusion can solve this problem. Increasing financial inclusion is expected to make financial services more accessible to everyone, especially for poor groups who previously did not have access to financial services. This research aims to analyze the role of digitalization of financial inclusion in reducing income gaps using empirical evidence from 33 provinces in Indonesia during the 2013-2022 period, using the fixed effects estimation method. The results of this study indicate that financial inclusion has a negative and significant impact on the Williamson index. This means that increasing financial inclusion can reduce income inequality. The decomposition results for each dimension show that the access dimension has a significant effect on reducing income inequality in Indonesia, while the usage dimension shows a positive influence on income inequality, but the presence of the SNKI policy in Indonesia in 2016-2022 has a negative influence on income inequality in Indonesia.

INTRODUCTION

Income inequality is an economic phenomenon that occurs in every country, based on this, each country tries to improve economic development and overcome the gap in opinion in their country. Generally, the problems that occur in developing countries are economic growth and the gap in opinion between low and high income groups. Not only developing countries face the problem of income inequality in their countries, but developed countries also have specific difficulties or problems in dealing with income disparities in their countries. This difference is based on low and high levels of inequality, as well as the level of difficulty in overcoming it which can be influenced by population growth and the size of the area. According to (Musfidar, 2012), this phenomenon cannot be avoided because the output of GDP can only be enjoyed by minorities based on a planned goal. Income inequality in Indonesia currently remains an important challenge in the government's national development strategy. The income gap in Indonesia is still quite high, especially the gap in the Eastern Region of Indonesia (KTI) and the Western Region of Indonesia (KBI). According to BPS (2020), Indonesia's economic structure is still dominated by the provincial group Java and Sumatra, with Java Island contributing 59 percent and Sumatra Island contributing 21.32 percent. Apart from that, in Presidential Regulation (Perpres) no. 63 in 2020-2024 there are still 62 disadvantaged areas. This income gap is related to equitable development of the financial sector.

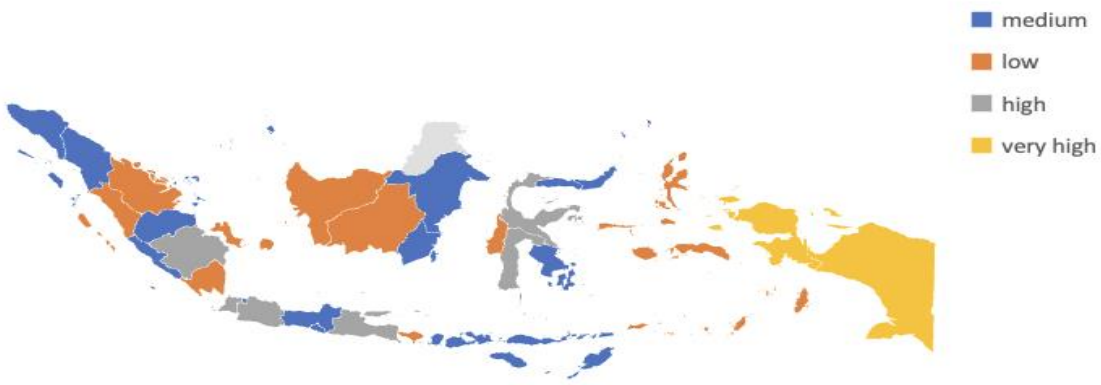


Figure 1 Average Indonesian Williamson Index 2013-2022
Source: BPS (processed)

Based on the results of data processing, the mapping above shows that there is still an income gap. Williamson and Sjafrizal (2014) tested the truth of Neo-Classical growth theory by measuring income gaps between regions using the Williamson Index. The Williamson Index figure for the Eastern Region of Indonesia shows 0.62, which means that the income gap in the Eastern Region of Indonesia is not evenly distributed compared to the Williamson Index figure for the Western Region of Indonesia which is 0.49. Because each region has different resources, workforce and technology, the ability of each region to drive the development process is also different, which causes income disparities between regions (Harun, 2012).

According to Allen et al. (2012) people's difficulties in obtaining financial services have implications for low-income people who only rely on limited savings for investment and small entrepreneurs who need to use other instruments to continue their business. Therefore, the implication of this is that economic growth slows down and income inequality does not decrease. One alternative to overcome the income gap is financial inclusion. Bank Indonesia defines financial inclusion as a form of financial service deepening provided to lower class people to be able to use formal financial products and services, such as saving money, savings, fund transfers, insurance and loans. Implementing financial inclusion in Indonesia is a collaborative task between the National Team for the Acceleration of Poverty Reduction (TNP2K), the Regional Financial Access Acceleration Team (TPAKD), Bank Indonesia (BI), and the Financial Services Authority (OJK) which can be called the National Strategy for Financial Inclusion (SNKI). .

The relationship between the financial sector and the real sector has the concept of a trickledown effect, which means that development in the financial sector will have a positive impact on economic growth, when growth increases it will reduce inequality because there is a distribution of income and the gap becomes smaller as a consequence of the economic growth process that occurs (Beck et al., 2020).

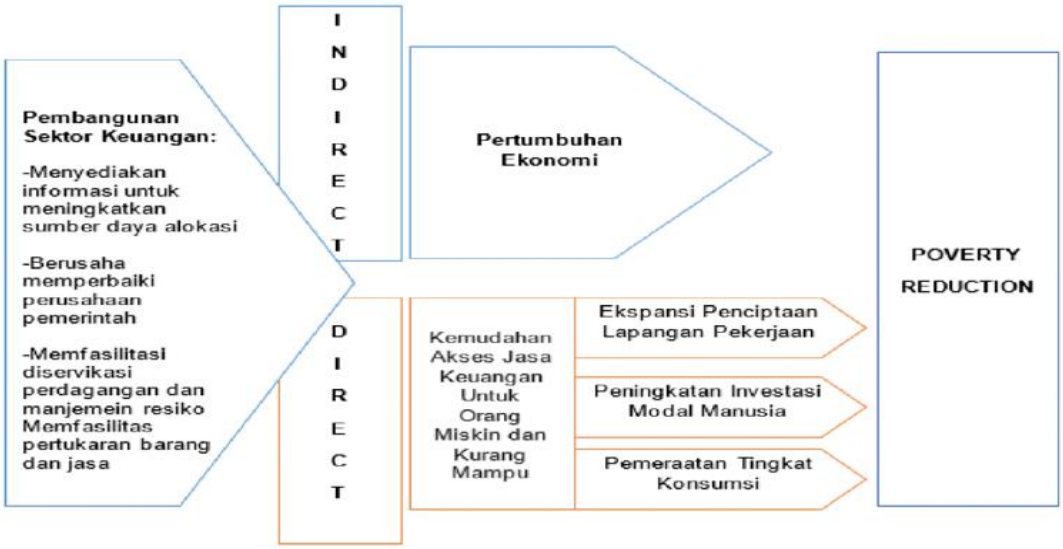
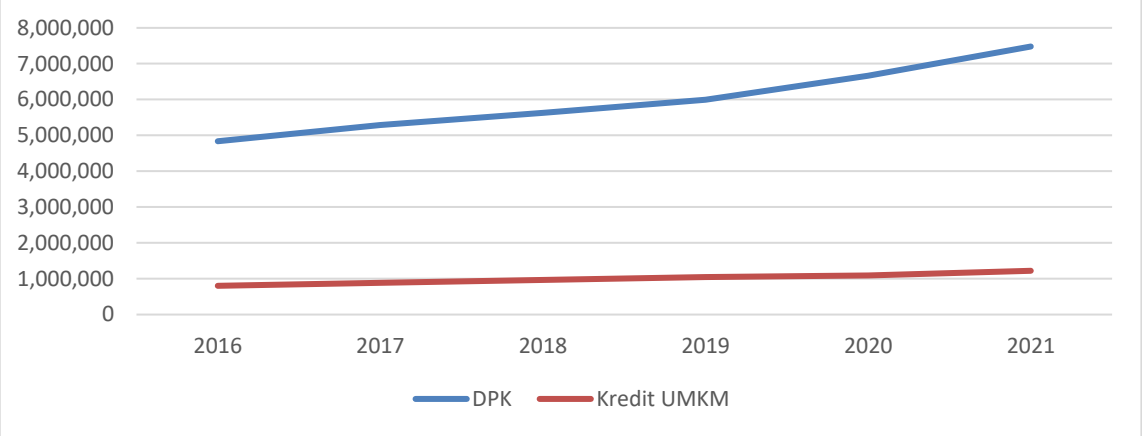


Figure 2 Illustration of Financial Sector Development
Source: Claessen dan Faijen (2017)

On the other hand, there is still a gap that exists in that around 50 percent of adults have accounts at formal financial institutions in the world, in other words the remaining 35 percent of adults who do not have accounts have other obstacles (Kunt et al, 2012). In Indonesia, the financial sector is divided into two, namely the non-bank sector and the banking sector. The condition of the banking ecosystem in Indonesia has experienced many changes over time. The financial industry in Indonesia is one of the sectors controlled by the banking sector. This is based on the contribution of the banking sector to GDP which shows an increasing trend every year. In 2014, the banking sector's contribution to GDP

reached IDR 11.5 trillion and will increase in 2022 to IDR 19.58 trillion (BPS 2022). When compared with other financial institutions, banks have larger assets. This describes banking as a financial institution that is of interest to the general public.

Overall, the Indonesian banking sector shows good growth. This is due to the large number of branches and increasingly diverse banking services. According to a report from Bank Indonesia (2021), Indonesian financial system statistics recorded growth in the number of branch offices in Indonesia, including in 2016 there were 22,335 branch offices spread across Indonesia and this increased in 2021 to 32,531 offices. This shows that the number of bank branch offices has increased significantly from year to year

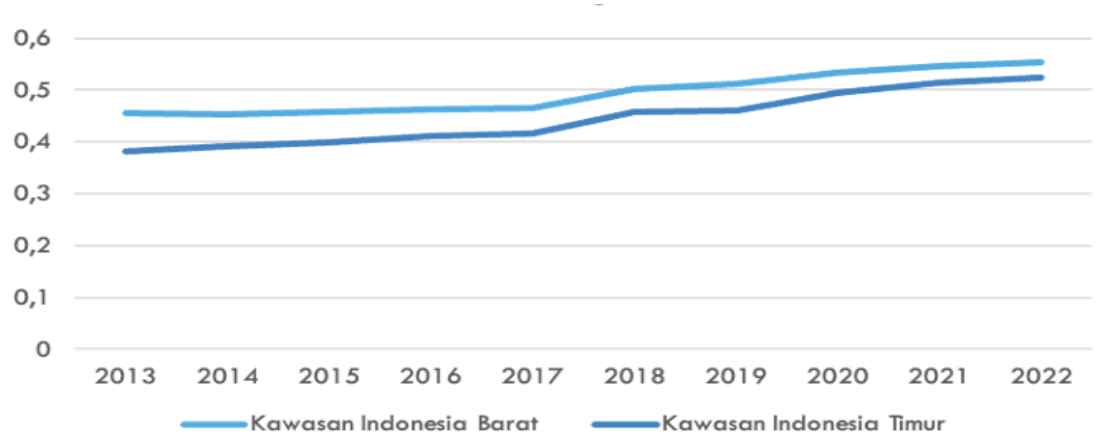


Graph 1 Total Number of Commercial Bank Credit & DPK in Indonesia (in billions)
Source: SPI OJK (processed)

The graph above shows that not only has the number of bank branch offices in Indonesia increased, but Third Party Funds (DPK) disbursed by commercial banks have also shown a significant increase. In 2016, DPK disbursement was recorded at 4,836 billion and MSME credit disbursement by banks was 802 billion. When compared with 2021, DPK experienced a significant increase of 7,479 billion, as well as MSME credit disbursed by banks experienced an increase in the positive trend of 1,221 billion. This shows that banking savings services continue to develop every year. Indonesia also collaborates with international organizations that support financial inclusion. The Financial Services Authority (OJK) is responsible for signing Presidential Regulation Number 82 of 2016 concerning the National Financial Inclusion Strategy (SNKI). OJK also supports various efforts by Financial Services Institutions (LJK) to increase national financial inclusion. It is hoped that this effort will provide equal opportunities for everyone to access banking and help economic growth. OJK stated that this step was based on awareness of how important the financial inclusion program is in Indonesia because there are still many people who do not have access to the formal financial sector due to financial obstacles from the banking sector.

Bank Indonesia's report on the Implementation of the National Strategy for Inclusive Finance and Financial Services Authority Regulation No.76/POJK.07/2016 concerning Increasing Financial Literacy and Inclusion in

the Financial Services Sector for Consumers and the Community are examples of other government efforts to increase the general public's access to banking services and financial inclusion programs. The National Financial Inclusion Strategy Program notes that the target percentage of the adult population with access to formal financial services is 75% by 2019. Therefore, to date, various approaches have been used. One of them is collaboration between the government and the National Team for the Acceleration of Poverty Reduction (TNP2K) and the Fiscal Policy Agency of the Ministry of Finance. By collaborating with the Regional Financial Access Acceleration Team (TNP2K), this collaboration seeks to overcome poverty and inequality and encourage economic growth by increasing community access to financial services. Currently, financial inclusion has become a global goal to overcome various country problems, not only in Indonesia.



Graph 2 Average Financial Inclusion Index 2013-2022
Source: OJK & BI (processed)

Apart from Third Party Funds and MSME Credit which continue to increase, if we look at the overall dimensions, the level of financial inclusion in Indonesia in the West and East is still relatively low and medium. In the graph above, the inclusion level for the Western Indonesia Region has a positive trend at a value of 0.45 to 0.55, while the Eastern Indonesia Region also has a positive trend at a value of 0.39 to 0.51. However, this value can be categorized as moderate level financial inclusion. Ummah et al (2015) found that socio-economic factors such as GRDP and income gaps significantly influence the level of financial inclusion at the provincial level.

Digital financial inclusion is essentially a derivative of financial inclusion. According to Sangmi (2013), financial inclusion can be described through three fundamental dimensions, namely accessibility of financial services, existence of financial services, and utilization of the financial system, especially society which is recognized as the bottom of the pyramid. Various efforts have also been made to show that inequality itself is the cause of the problem, apart from that the financial sector can also have implications for the economy. The basic problem of economic development is not only about how to increase GDP, but also which party will make the GDP increase, according to Kunt et al. (2008)

in their journal shows that the financial sector is the core of a country's development process. With the growth of the financial sector, especially the banking sector, more and more people can use the services offered by banking. As more people are able to use banking services, people's income projections may increase as a result of credit provided for economic activities that generate more money. Levine (1997) states that the financial system in a country has a relationship with the country's GDP in the long term. If it is high-income people who make the economy grow, it is likely that they will be taken advantage of, and progress against poverty will be slow, and inequality will worsen. But if this growth is produced by many people, then it can be utilized by many people, and the fruits of economic growth can be "shared" more evenly (Marcu, 2021).

Current economic progress has resulted in the digitalization of business. A specific area emphasized by the Indonesian government to support economic growth is digital financial integration. Digital financial integration enables the application of digital technologies that have the potential to facilitate the advancement of the digital economy, this spurs the ability to motivate individuals to engage in transactions, such as payments, through more convenient and efficient systems, ultimately reducing transaction costs for lower socioeconomic classes. Financial inclusion, which refers to expanding access to financial services, is characterized by the absence of barriers to the use of quality financial services, both in terms of price and other factors (Mir, 2014). The main aim of expanding financial accessibility is to target poor and underprivileged populations. Implementing financial inclusion programs can expand access to services such as savings, credit, insurance, pension funds and payment facilities. It can have a positive impact on marginalized and low-income groups by enabling them to increase their income, accumulate wealth, manage risk, and work to overcome poverty.

Based on a report from the Central Statistics Agency (2021), it shows that Indonesia's population is 272 million, consisting of around 205 million adults. However, World Bank Global Financial Inclusion Index research shows that in 2021, only 36% of the Indonesian population will have access to finance from formal institutions. This phenomenon is based on the results of Bank Indonesia Financial research which shows that there is more use of services and products from formal financial institutions compared to accounts registered in personal names. As many as 70.3% of Indonesia's adult population are registered as users of formal financial institution products or services. However, only 55.7% of the data have a personal bank account. As we understand, financial inclusion is important at the national and international level. When viewed at the provincial level, financial inclusion in each province still shows significant gaps. Based on this, policy makers or the government regarding the banking sector, especially the equitable provision of financial services in all provinces in Indonesia.

LITERATURE REVIEW

Several studies have found that digitalization has effects that can reduce income inequality and contribute to shared prosperity and inclusive growth. Mora (2021) argues that the spread of the internet contributed to reducing rural

poverty in Mexico, thereby reducing urban-rural income inequality. Yin (2022) examines the impact of digitalization of the banking sector on income inequality using G20 countries in 2002–2018, the results show that digitalization reduces income inequality. Ali (2019) found that the affordability of information and communication technology is positively related to income distribution and socio-economic inequality. Njangang (2022) examines the effect of digitalization on wealth inequality in 45 developed and developing countries from 2000 to 2017 and shows that digitalization increases inequality. Available economic and financial literature shows that a well-functioning financial sector is important for economic development through the efficient allocation of capital to productive economic sectors (Kapingura, 2017). With financial inclusion, it can provide benefits to all levels of society and the economy at large, including providing opportunities to save, invest, access credit, make payments more efficient and more transparent, overcome short-term shocks, improve daily financial management. today, reducing exploitative informal credit sources, and the community no longer faces obstacles, both in terms of prices and non-prices (Demirguc-Kunt, et al., 2017).

Generally, research shows that financial sector development has a positive impact on income distribution because advanced financial markets and freer markets increase the availability of credit, providing poor people with opportunities to also borrow and invest (Jeanneney & Kpodar, 2005; Beck et al., 2007 ; Clarke et al., 2006; Rehman et al., 2008). But on the one hand, Batuo et al. (2010) shows that the results of their research which contain good financial inclusion actually have the opposite effect, causing higher income inequality. This can happen because financial inclusion and financial sector development only move money from low-income communities to high-income communities, which then causes the distance between the rich and the poor to widen. According to the author's research, most previous research has only looked at the effect of financial development or increasing financial access on poverty, inequality or economic growth, as in research (Beck, et al., 2007; Aterido, et al., 2013; Greenwood. Jovanovic, 1990). For research that looks at financial inclusion, previous research mostly used several indicators to measure financial inclusion that used research calculation methods (Sarma, 2012) as in research (Sarma & Pais, 2011; Kumar, 2013; Kim, 2016; Ummah, et al., 2015; Sanjaya & Nursechafia, 2016; Omar & Inaba, 2020). This method calculates IIK using 3 dimensions, namely accessibility, availability and use. The advantage of this method is the ease of computing in processing data.

However, this method has been widely criticized by subsequent research. According to Camara & Tuesta (2014), the assumption that each dimension has the same weight in the process of building a composite index, this needs to be questioned and lacks scientific rigor. Hanivan & Nasrudin (2019) also stated the same thing, namely that the assumption of homogeneity in weighting could cause bias in the index calculation results obtained. Furthermore, according to Mialou, et al. (2017) that there is equal weighting for all dimensions, the assumption is that all dimensions have the same influence on financial inclusion.

Research related to financial inclusion with case studies in Indonesia is also available. However, no one has used the right calculation method and looked at poverty and inequality as a whole. First, research by Ummah, et al. (2015) who conducted an analysis of financial inclusion with income distribution in the 2007-2011 period. In this study, a multidimensional index was used, but obtaining IIK was carried out using a calculation method (Sarma, 2012). Second, research (Sanjaya, 2016) which analyzes the correlation between inclusive growth and provincial analysis, where the index development uses the method (Sarma, 2008). This research has not looked at the causal relationship with poverty or inequality.

Third, Hanivan's (2019) research conducted an analysis of financial inclusion at the country level using monthly data and looked at the correlation with outcomes. This research does not look at causality and does not use panel data. Lastly, in the research of Erlando, et al. (2020) who looked at financial inclusion towards inequality with a focus on the eastern region of Indonesia in 12 provinces in 2010-2016. This research also uses the Sarma (2012) method with a dynamic model and PVAR estimation techniques. There are three hypotheses that discuss the relationship between financial sector development and income inequality. These hypotheses are the inequality-widening hypothesis put forward by Ahmed and Still (2017), then the inequality-narrowing hypothesis, put forward by Galor and Zeira (1993), and the Greenwood-Jovanovich hypothesis put forward by Greenwood and Jovanovich in 1990.

Inequality-widening hypothesis which shows that the development of the financial sector is the cause of the increase/widening influence on income inequality. This hypothesis emphasizes that in countries with very weak institutions, rich people with many and good connections may benefit from the process of financial development. The financial system generally moves funds to people who are rich, can easily offer collateral and are more likely to repay credit. As the financial sector continues to grow, rich people are getting more funds from this sector. However, poor communities, who do not offer collateral, are neglected and cannot receive credit or debt from this sector. As a result of this trend, poor people do not receive adequate financial services. For this reason, it is much more difficult for the poor to migrate to cities, spend enough money on human capital or education and start new businesses (Clarke et al. 2006). Finally, the poor are only provided with basic education and participate in the unskilled labor market with low wages (Ahmed & Still, 2017).

The second is the inequality-narrowing hypothesis, which shows that financial development has a mitigating effect on income inequality. The hypothesis put forward by Galor and Zeira (1993) and Banerjee and Newman (1991), implies that the development of the financial sector will facilitate poor people's access to loans. Such a financial system might provide equal opportunities for talented and ambitious low-income individuals (Law & Tan, 2009). The final hypothesis that explains the relationship between financial sector development (including financial inclusion) and income inequality is the Greenwood and Jovanovic (GJ) hypothesis (1990). These two authors suggest that the relationship between financial sector development and income inequality has

an inverted U curve (non-linear). Based on the growth-inequality model, they state that a country passes through three stages. In the early stages of development, financial markets can be said to be non-existent coupled with low economic growth. During this phase only a few individuals can access financial services. When the economy reaches the final stage of its development, income across economic agents will stabilize, associated with a decrease in savings when the economy improves (Nikoloski, 2012). A number of studies have been conducted to test the applicability of the GJ hypothesis. Available studies include Clarke et al. (2003, 2006) in the case of developed and developing countries. The authors establish that there is a beneficial impact of financial sector development on income inequality and show support for the GJ hypothesis. Other studies conducted in this regard include Ang (2008, 2010), Rehman et al. (2008), and Islam (2015) although their conclusions vary. This hypothesis explains that the financial sector influences production, credit allocation and encourages demand for labor so that this will expand economic opportunities, reduce inequality and create an equal distribution of income. They found that the financial sector initially only benefited the rich, due to high intermediation costs.

METHODOLOGY

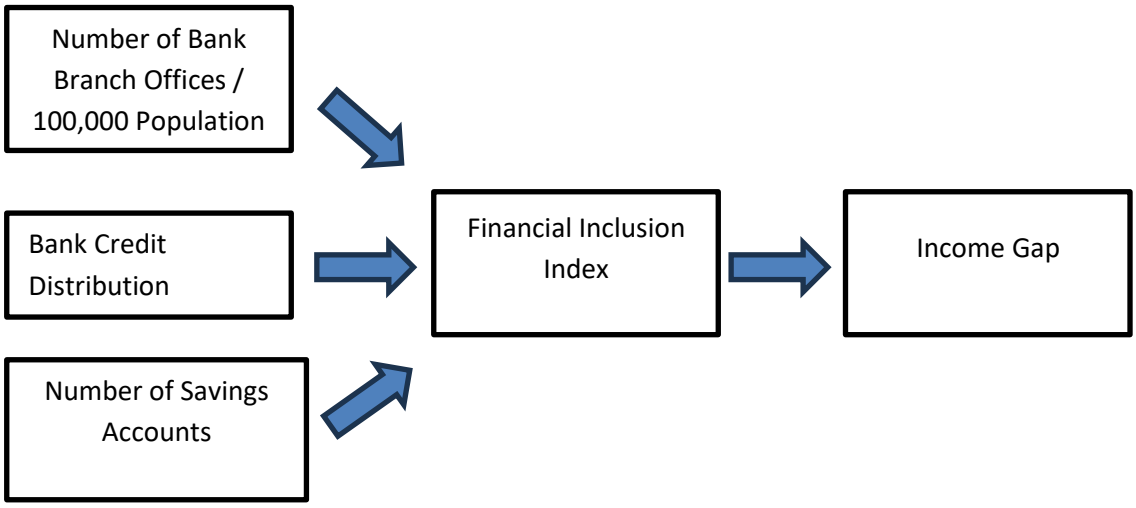


Figure 3 Conceptual Framework

Financial inclusion can influence income inequality through adequate bank access, credit distribution and savings services by banks. Access to financial inclusion can be described by the variable number of bank branches per 100,000 population in each province. This research also uses commercial bank credit distribution per GRDP of each province as well as Third Party Funds (DPK) per 1,000 population to describe the use of banking services and banking penetration in Indonesia. These three indicators will be combined into the Financial Inclusion Index (IIK) which will then measure its effect on the Williamson Index which describes the income gap. According to Tambunan (2012), MSMEs are one of the main supporting sectors, contributing around 99.8% of all businesses in that year. In addition, conditions in 2013 showed that the contribution of MSMEs covered around 90% of total business units (Setiawan, 2015). The Williamson Index

variable as an independent variable is a tool for measuring income inequality. According to (Smeru Research Institute, 2020) digital economic development can reduce various disparities, including income gaps, between sectors and between levels of welfare.

The data in this study uses annual data in panel form from 33 provinces from 2013 to 2022. To describe the dimensions of use, this research uses credit distribution data per GRDP, for the availability dimension using bank branch offices and to describe the accessibility dimension of financial inclusion using data on the number of accounts savings. According to Wang & Guan (2017), the Financial Inclusion Index (IIK) is a composite index compiled based on a calculation method. To combine each dimension of financial inclusion, researchers will use the Financial Inclusion Index developed by Omar & Inaba in 2020. Williamson Index data is used to describe income gaps (Muta'ali, 2015). The Williamson Index uses GDP per capita data as the basis for forming the index.

$$IW = \frac{\sqrt{\sum (Yi - Y)^2 \frac{fi}{n}}}{Y}$$

The Williamson Index calculation is carried out nationally and per province to see provincial disparities in Indonesia. Based on literature support, this research uses measurements from the Financial Inclusion Index (IIK) as developed by Omar & Inaba (2020). This particular approach was chosen for its ability to provide comprehensive and robust measurements that can be compared across provinces. To determine the Financial Inclusion Index value for each dimension, the formula used is as follows:

$$d_i = w_i \frac{D_i - m_i}{M_i - m_i}$$

Next, to determine the IIK value, use the following formula:

$$IIK = \frac{1}{2}\left[\frac{\sqrt{d1^2 + d2^2 + d3^2}}{\sqrt{3}}\right] + 1 - \left[\frac{\sqrt{1 - d1^2 + 1 - d2^2 + 1 - d3^2}}{\sqrt{3}}\right]$$

In analyzing the relationship between financial inclusion and income inequality and income inequality, the equation model used refers to research conducted by (Omar & Inaba, 2020; Andrian, T & Sitorus, N, 2021) which is as follows:

$$y_{i,t} = \alpha_0 + \beta_1 X_{i,t} + \alpha_1 + \mu_i$$

Where the variable Yi,t is the dependent variable, in this research it is the Williamson Index, $\alpha 0$ is the intercept, Xi,t is the exogenous variable, namely the Financial Inclusion Index (IIK), □1 is the parameter vector, $\alpha 1$ is treated as a random variable with a certain distribution. Apart from that, this research also adds a policy dummy variable to see the direction of the relationship between financial inclusion and provincial development gaps and provincial income gaps. This is based on the Indonesian Government's policy regarding the National Financial Inclusion Strategy. With this policy, there will be changes in the

inclusion index because it is encouraged to increase public access and penetration of financial services.

Therefore, this research model for analyzing the relationship between financial inclusion and income inequality in each province in Indonesia is as follows:

$$lIWi,t = a0 + \beta 1IIKi,t + \beta 2lINVi,t + \beta 3lLITi,t + \beta 4lUNEMPi,t + \beta 5lGOVEXPi,t + \beta 6lPHONEi,t + \beta 7lPDRBi,t + \beta 8DummyPolicyi,t + ei,t$$

Furthermore, to analyze the relationship between the dimensions of accessibility, availability and use and income gaps in each province in Indonesia, the model specifications used are as follows:

$$lIWi,t = a0 + \beta 1AccessIndexi,t + \beta 2AvailabilityIndexi,t + \beta 3UsageIndexi,t + \beta 4lINVi,t + \beta 5lLITi,t + \beta 6lUNEMPi,t + \beta 7lGOVEXPi,t + \beta 8lPHONEi,t + \beta 9lPDRBi,t + \beta 10DummyPolicyi,t*AccessIndex + \beta 11DummyPolicyi,t*AvailabilityIndex + \beta 12DummyPolicyi,t*UsageIndex + \beta 13DummyPolicyi,t + ei,t$$

Equation is used to test the relationship between the dimensions of accessibility, availability and usage on income inequality. These three dimensions are expected to be negatively related to poverty levels, because these three dimensions reflect the Financial Inclusion Index. Sarma (2012), Gupta (2014), Sanjaya (2016), Omar & Inaba (2020) use the measurement dimensions of accessibility, availability and usage as a method for calculating the Financial Inclusion Index (IFI).

In carrying out estimates, this research will use the Panel Least Square (PLS) estimation method. Of course, before estimation is carried out, the variables above must go through assumption tests which include the Multicollinearity Test, Heteroscedasticity Test, and Hausman Test. The Hausman Test was carried out to find out which type of panel data is better, using a comparison of the Random Effect Model (REM) and the Fixed Effects Model (FEM). The purpose of carrying out the test above is that this research can be said to be the Best Linear Unbiased Estimation (BLUE).

RESEARCH RESULT AND DISCUSSION

This research aims to find out how financial inclusion is related to income inequality, based on empirical evidence from 33 provinces in Indonesia with a research period of 2013 to 2022.

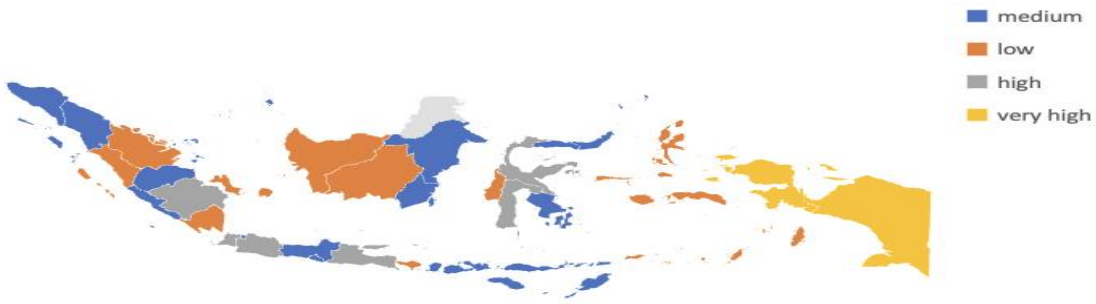


Figure 4 Average Indonesian Williamson Index 2013-2022
Source: BPS (processed)

In the picture above, it can be seen that on average all provinces in Indonesia are at the same Williamson Index level. It can be seen that provinces throughout the island of Papua are islands that have very high Williamson Index values when compared to the islands of Java, Sumatra and Kalimantan.

Province	IW	Category	Province	IW	Category
BALI	0.232	Low	KALIMANTAN SELATAN	0.441	Medium
KALIMANTAN BARAT	0.278		KALIMANTAN TIMUR	0.527	
KALIMANTAN TENGAH	0.214		KEPULAUAN RIAU	0.506	
KEPULAUAN BANGKA BELITUNG	0.191		NUSA TENGGARA BARAT	0.658	
LAMPUNG	0.274		NUSA TENGGARA TIMUR	0.641	
MALUKU	0.295		SULAWESI TENGGARA	0.449	
MALUKU UTARA	0.355		SULAWESI UTARA	0.497	
RIAU	0.351		SUMATERA UTARA	0.556	
SULAWESI BARAT	0.382		BANTEN	0.757	High
SUMATERA BARAT	0.258		JAWA BARAT	0.698	
ACEH	0.398	Medium	JAWA TIMUR	0.940	
BENGKULU	0.404		SULAWESI SELATAN	0.710	
DAERAH ISTIMEWA YOGYAKARTA	0.461		SULAWESI TENGAH	0.788	
DKI JAKARTA	0.505		SUMATERA SELATAN	0.707	
GORONTALO	0.513		PAPUA	1.944	Very High
JAMBI	0.494		PAPUA BARAT	1.497	
JAWA TENGAH	0.628				

Table 1 Average of All Regional Williamson Index Values 2013 - 022
Source: BPS (processed)

In general, if you look at the average of all regional Williamson Index values from 2013 to 2022 in the table above, the province with the highest average

Williamson Index is Papua province with an index value of 1.944. Meanwhile, if we look at the lowest average regional Williamson Index value, it is Bali province from 2013 to 2022. The table above shows several levels of income gap categories for each province in Indonesia through the average value of the Williamson Index from 2013 to 2022. There are ten provinces that fall into the low gap category, which means the level of inequality in the province is quite even, all ten provinces those are Bali, West Kalimantan, Central Kalimantan, Kep. Bangka Belitung, Lampung, Maluku, North Maluku, Riau, West Sulawesi, West Sumatra. At the middle category level are Aceh, Bengkulu, D.I. Yogyakarta, DKI Jakarta, Gorontalo, Jambi, Central Java, South Kalimantan, East Kalimantan, Riau Islands, West Nusa Tenggara, East Nusa Tenggara, Southeast Sulawesi and North Sulawesi. Provinces that fall into the high inequality category are North Sumatra, Banten, West Java, East Java, South Sulawesi, Central Sulawesi, and South Sumatra. There are also provinces of Papua and West Papua which have a Williamson Index of more than 1, which means that the income gap in these provinces can be said to be very high.

In table 2 it can be seen that on average each province experienced an increase in the Financial Inclusion Index (IIK), however there were several provinces that experienced a decline and did not experience any change. The most significant increase in IIK occurred in the provinces of NTB and North Sumatra. This is due to an increase in the accessibility dimension, namely a significant increase in savings accounts and the number of savings accounts in the provinces of Aceh and North Sumatra. This is supported by the 2022 OJK National Financial Inclusion Literacy Survey (SNLIK) report which shows that the level of financial inclusion in NTB increased significantly by 19.61 percent from the previous 62.73 percent to 82.34 percent. The increase in the Financial Inclusion Index in NTB is growing rapidly due to strong synergies in the context of accelerating the industrialization program in NTB.

Province	IIK		Category		Rank		Change in Rank
	2013	2022	2013	2022	2013	2022	
ACEH	0.26	0.26	Low	Low	12	33	↓
BALI	0.62	0.69	High	High	2	3	↓
BANTEN	0.20	0.31	Low	Medium	24	30	↓
BENGKULU	0.25	0.38	Low	Medium	13	17	↓
DAERAH ISTIMEWA YOGYAKARTA	0.38	1.00	Medium	High	8	1	↑
DKI JAKARTA	0.99	1.00	High	High	1	1	↔
GORONTALO	0.20	0.40	Low	Medium	25	14	↑
JAMBI	0.19	0.32	Low	Medium	28	27	↑
JAWA BARAT	0.21	0.34	Low	Medium	22	24	↓
JAWA TENGAH	0.24	0.38	Low	Medium	14	19	↓
JAWA TIMUR	0.24	0.38	Low	Medium	16	20	↓
KALIMANTAN BARAT	0.43	0.58	Medium	Medium	4	4	↔
KALIMANTAN SELATAN	0.40	0.54	Medium	Medium	7	7	↔
KALIMANTAN TENGAH	0.45	0.57	Medium	Medium	3	5	↓
KALIMANTAN TIMUR	0.42	0.56	Medium	Medium	6	6	↔
KEPULAUAN BANGKA BELITUNG	0.20	0.32	Low	Medium	27	26	↑
KEPULAUAN RIAU	0.35	0.43	Medium	Medium	9	11	↓
LAMPUNG	0.17	0.32	Low	Medium	33	29	↑
MALUKU	0.23	0.36	Low	Medium	17	22	↓
MALUKU UTARA	0.18	0.32	Low	Medium	30	25	↑
NUSA TENGGARA BARAT	0.21	0.45	Low	Medium	23	9	↑
NUSA TENGGARA TIMUR	0.42	0.41	Medium	Medium	5	13	↓
PAPUA	0.19	0.30	Low	Low	29	32	↓
PAPUA BARAT	0.31	0.49	Medium	Medium	10	8	↑
RIAU	0.22	0.32	Low	Medium	20	28	↓
SULAWESI BARAT	0.18	0.36	Low	Medium	31	23	↑
SULAWESI SELATAN	0.22	0.40	Low	Medium	19	15	↑
SULAWESI TENGAH	0.20	0.37	Low	Medium	26	21	↑
SULAWESI TENGGARA	0.24	0.39	Low	Medium	15	16	↓
SULAWESI UTARA	0.23	0.38	Low	Medium	18	18	↔
SUMATERA BARAT	0.30	0.42	Low	Medium	11	12	↓
SUMATERA SELATAN	0.18	0.31	Low	Medium	32	31	↑
SUMATERA UTARA	0.21	0.43	Low	Medium	21	10	↑

Table 2 Regional Financial Inclusion Index (IIK).
Source OJK, BI (processed by the author)

If we look nationally, the Financial Inclusion Index (IIK) in Indonesia has increased during the research period, namely from 2013 to 2022. Empirical data shows that the growth of the Financial Inclusion Index cannot be said to be significant with an average annual growth index of 0.04 per year. However, if we look at the annual trend, the Financial Inclusion Index has increased from 2013 to 2022. This data shows that the level of financial inclusion in Indonesia is included in the medium level of inclusiveness. This is in line with research by Muslikhah and Utami (2019) with the calculation of the Indonesian Financial Inclusion Index (IIK), which in 2012 reached 0.3 and rose to 0.445 in 2017.

On the other side, there are still several IIK values that are in the low category, namely the provinces of Papua and Aceh. According to the Financial Services Authority (2018), the sharia banking market share increased to 50.21% in 2017. However, the accessibility dimension of Aceh province is still at a low level. This means that even though service offices are spread out and functioning, the number of deposits representing savings account ownership is not evenly distributed. IIK in Papua province is still in the low category due specifically to the low level of skills, understanding and confidence in using financial services and products. Bank Indonesia's Regional Economic Study (2018) shows that the province's economic growth is slowing.

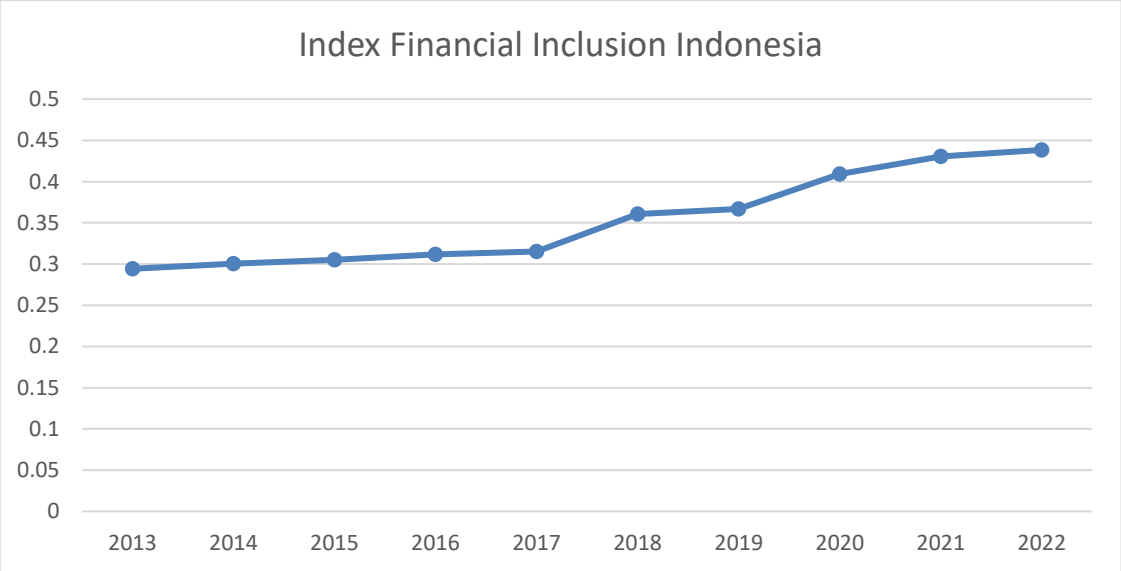


Figure 5 Average of Index Financial Inclu 2013 - 2022
Source: BPS (processed)

Based on the regression results, from a total of 33 provinces in the research sample, the results of determining the estimation method have gone through the Lagrange Multiplier test, Chow test and Hausman test. Based on the three methods, the LM test results show a chi square probability that is smaller than 0.05. The Hausman test shows that the chi square probability value is smaller than 0.05. Furthermore, the Chow test shows that the fixed effect model is the best estimate when compared to the common effect model.

By using the Williamson Index in each province as the dependent variable, this research shows that financial inclusion has a significant negative effect on all models except model 3. From the regression results, the results are significant with a negative sign in accordance with the expected hypothesis after controlling using several control variables. The results of this research are supported by research (Beck, et al., 2007; Omar & Inaba 2020) which shows that financial inclusion can significantly reduce poverty levels.

Variable	1 lIW OLS	2 lIW OLS	3 lIW FE	4 lIW FE
lIIK	-0.189**	-0.261***	0.057	-0.102*
	(-2.57)	(-3.58)	(1.19)	(-1.82)
Dummypolicy	0.053	0.0949***	-0.004	-0.0949***
	(0.082)	(3.24)	(-0.21)	(-3.53)
lPDRB		0.304***		0.953***
		(5.15)		(8.36)
lLIT		-5.305*		0.500
		(-1.96)		(0.55)
lUNEMP		0.0551		0.00196
		(0.70)		(0.05)
lPHONE		-1.374***		-0.201
		(-6.59)		(-1.41)
lGOVEXP		0.242***		0.0165
		(5.86)		(0.53)
lINV		-0.0375*		0.0105
		(-1.96)		(1.32)
Constant	-0.978***	18.73**	-0.657***	-12.45***
	(-8.95)	(1.49)	(-10.21)	(2.93)
Observations	327	327	327	327
RSquared	0.019	0.369	0.028	0.227

The dependent variable is the Williamson Index.
All error values indicate strong robust results and are presented in parentheses
The symbols *, **, and * indicate statistical significance of 1%, 5% and 10%, respectively.**
The dummy policy variable takes a value of 1 for the 2016-2022 research period and a value of zero for before the 2016 research period

Table 3 Regression Results of Financial Inclusion on Income Inequality

In the control variables, it can be seen that GRDP has a significant effect on income inequality. With an increase in GDP per capita in the province, the income gap will increase by 95.3%. This is in line with the theory presented by Kuznet (in Kuncoro, 2006) through the inverted U Curve, which states that inequality in the early stages of development will increase along with rapid economic growth. However, continued increasing economic growth can reduce

income inequality between regions after the development stage is completed. This increase in GDP per capita was caused by economic growth which provided benefits only to the rich group compared to the poor group. This suggests that low-income countries tend to face higher inequality than high-income countries in the long run. On the other hand, digital financial development such as the use of mobile banking, internet banking, or credit/debit cards is still limited to a handful of educated customers and tends to be uneven in the Eastern Indonesia region, causing an increase in income inequality.

Relationship between Accessibility Dimensions, Availability Dimensions, and Usage Dimensions with Income Inequality

The provincial financial inclusion index is obtained by calculating indices from the dimensions of accessibility, availability and use. For deeper analysis, this research will look at the influence of each dimension. By using the same model specifications when estimating the Financial Inclusion Index (IIK), this research looks at the influence of the access index, availability index and usage index on income inequality. So we can find out which dimensions have the most influence or which dimensions need to be improved in order to make financial inclusion the right tool in reducing income gaps.

Variabel	1 lIW OLS	2 lIW OLS	3 lIW FE	4 lIW FE
accessindex	0.460	-0.979*	-0.118	-0.390*
	(0.75)	(-1.86)	(-0.47)	(-1.66)
availabilityindex	0.965**	1.582***	-0.137	-0.0828
	(1.98)	(3.21)	(-0.57)	(-0.37)
usageindex	-1.461***	-0.796**	0.298	0.380*
	(-4.22)	(-2.15)	(1.45)	(1.91)
lLIT		-5.175*		0.363
		(-1.92)		(0.40)
lUNEMP		0.141*		0.0228
		(1.84)		(0.53)
lPHONE		-1.374***		-0.389**
		(-7.62)		(-2.58)
lGOVEXP		0.222***		0.0251
		(5.32)		(0.79)
lINV		-0.0169		0.0135*
		(-0.85)		(1.66)
lPDRB		0.0795		0.988***
		(0.91)		(8.57)
DummyPolicy		0.0372**		-0.00662
		(2.50)		(-0.13)
*DummyPolicy= 1*Acess*	0.114	1.161**	0.217	0.163
	(0.17)	(2.00)	(1.06)	(0.86)

*DummyPolicy= 1*Availability*	-0.700 (-1.27)	-1.121** (-2.37)	-0.169 (-1.03)	-0.0199 (-0.13)
*DummyPolicy= 1*Usage*	0.518 (1.39)	-0.117* (-0.30)	-0.0293 (-0.26)	-0.264** (-2.14)
Constant	-0.540*** (-6.57)	21.97* (1.73)	-0.782*** (-8.71)	-11.95*** (-2.71)
Observations	330	327	330	327
RSquared	0.091	0.389	0.028	0.250

The dependent variable is the Williamson Index.
All error values indicate strong robust results and are presented in parentheses
The symbols *, **, and * indicate statistical significance of 1%, 5% and 10%, respectively.**
The Dummy Policy variable takes a value of 1 for the 2016-2022 research period and a value of zero for before the 2016 research period..
The interaction variables Dummy Policy and dimensions are presented for the values Dummy Policy=1*Access, 1*Availability, 1*Usage.

Table 4 Regression Results for Accessibility, Availability and Usage Dimensions on Income Gaps

In the usage dimension (usage index), the results show that the usage dimension is significant and has a positive effect on income inequality. This result is consistent and significant when the control variables in column (4) are added. From these results, this finding is quite unique because it indicates that an increase in the use of financial services in each province has actually led to a wider income gap. The usage dimension is closely related to the proportion of total savings, GRDP, outstanding loans, outstanding deposits. This positive relationship shows that an increase in the proportion of this indicator causes income disparities in each province.

However, if we look at the time the SNKI policy was implemented in 2016-2022, this policy was quite effective in reducing the income gap in Indonesia. When the SNKI policy was implemented through financial inclusion strategy programs specifically aimed at expanding the use of financial services, the income gap fell by 26.4%. This means that in 2016-2022 the use of access to financial services in the community will run effectively. This finding is supported by the National Financial Inclusion Strategy Implementation Report (2021) where the use of financial services via banking accounts increased by 10% and server-based electronic money increased by 78%.

There are several factors that cause the use of financial services in Indonesia to not be effective in reducing income inequality in Indonesia. Erlando (2020) explains that in Indonesia most savings funds come from high-income groups which are used by high-income people in the form of credit. Therefore, the circulation of funds in the financial sector is only for people with strong capital capabilities. These findings provide information that the flow of credit funds has not been effective in developing the community economy and increasing Micro, Small & Medium Enterprises (MSMEs), especially in peril-

urban and rural areas. Research (Johnstor, 2008) found that many individuals do not have an account in Indonesia. High service costs and uncertainty are obstacles for people in peril-urban and rural areas to be able to use financial services.

CONCLUSION AND RECOMMENDATION

This research shows that digitalization of financial inclusion has a significant effect on reducing income inequality in 33 provinces in Indonesia. This result is consistent with adding other control variables as a reflection of the determinants of income inequality. If explored more deeply, it is found that the Financial Inclusion Index has a significant effect on reducing inequality in Indonesia, but if we look at the provincial level between the provinces of Eastern Indonesia and Western Indonesia it can be seen that there is quite a large gap in change, such as in the provinces of Papua and Aceh and in the region NTB & North Sumatra. It can be seen that the changes that occur on an annual basis are greater because the increase in the accessibility dimension occurs very significantly in the provinces of NTB and North Sumatra.

Meanwhile, the provinces of Aceh and Papua still tend to be in the low category. This means that even though service offices have spread rapidly, there is still a gap in the number of savings accounts and there is still a low level of understanding and skills in using digital technology. To be able to improve digital financial inclusion programs to reduce disparities and increase social equality in 33 provinces of Indonesia is to improve skills in utilizing digital technology, because this has the potential to support the running of the digital economy. This can encourage residents in each province to carry out transactions. On the regulator/government side, OJK has TPAKD which is a coordination team with several ministries/institutions to expand financial access in the regions. Currently, TPAKD itself has spread to 85% of districts/cities in 27 provinces in Indonesia. Based on the 2023 TPAKD performance evaluation, until 2023 there are still 11 provinces that have provincial TPAKD performance below the average. These provinces are Aceh, Bengkulu, DIY, East Java, NTB, North Kalimantan, Central Sulawesi, Maluku, West Papua and Papua. The government/regulator needs to make serious efforts between ministries/institutions to ensure the success of each TPAKD program.

To be able to increase the use of financial services, especially in the Eastern region of Indonesia, which has a lower level of usage compared to the Western region of Indonesia, the central government needs to equalize connectivity infrastructure, encourage the development of digital infrastructure in order to improve public service infrastructure in provinces that tend to fall into the category of high income gap, at the regional level TPAKD policies need to encourage financial inclusion through village economic independence programs. TPAKD needs to strengthen the use of financial access to People's Business Credit (KUR), Crown funding accompanied by expanding financial education so that lower class people can enjoy the presence of financial services in their area.

From the results of the analysis it can be concluded that these findings are in accordance with the hypothesis developed in Greenwood and Jovanovic's

research, initially before the policy was implemented financial sector development did not affect income inequality, but when the policy was implemented by expanding access to financial inclusion it would have an effect on reducing income inequality in Indonesia. Apart from that, to increase accessibility, the government and private sector need to continue to work together in adopting digital technology in payment systems. This is important in making it easier for people to access financial services, especially reducing transaction costs for people at the bottom of the pyramid. On the other hand, these findings provide important policy implications for improving access to financial services. First, there is a trade-off between financial inclusion, digital technology and income inequality. Formal financial institutions need to review appropriate products so that they can provide innovative financial products and services to reduce income gaps so that they suit the needs of the people in each province, because each province has different community characteristics. Second, the government must play a positive role in developing and implementing inclusive finance by formulating relevant regulations to achieve targets, building efficient financial infrastructure aimed at reaching the poor. On the regulatory side, the government also needs to formulate relevant regulations, in this case the compliance of Fintech (Financial Technology) financial institutions such as clear policies, specifications, standards and laws. Therefore, there needs to be a focus on the government and financial institutions to be able to make good use of this in order to increase effectiveness and use lower service costs to reach lower class communities.

The effect of digital financial inclusion on income inequality at the provincial level in Indonesia has research opportunities. Further research can seek to find appropriate variable instruments at the provincial level using all indicators according to the supporting literature. The next indicators needed are related to payment and remittance transactions to be able to compile a Financial Inclusion Index to get a broader picture.

ADVANCED RESEARCH

In writing this article the researcher realizes that there are still many shortcomings in terms of language, writing, and form of presentation considering the limited knowledge and abilities of the researchers themselves. Therefore, for the perfection of the article, the researcher expects constructive criticism and suggestions from various parties.

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