

**FINANCIAL INCLUSION AND ECONOMIC GROWTH:
EXPLORING THE ROLE OF INCOME INEQUALITY****Oanh D.L.K.***

Abstract: Nowadays, income inequality affecting economic growth is receiving much attention from policymakers and the academic community. Therefore, this study aims to explore the influence of income inequality on economic growth in the context of financial inclusion. Furthermore, this study performs an in-depth review and compares low- and high-finance countries to get a more detailed and comprehensive picture. A new Bayesian regression method is applied to process data collected from 17 countries with low levels of financial development and 14 countries with high levels of financial development. Bayesian regression model results show that the Finance (FI) variable positively impacts economic growth (GDP) in both groups of countries. Additionally, this research observes that income inequality (GINI) negatively affects economic growth in both countries, but the magnitude of this effect varies depending on the level of financial development. Although GINI still has a negative impact in countries with high levels of financial development, this impact is significantly reduced compared to countries with low levels of financial development. These results highlight the importance of financial inclusion for economic growth and suggest appropriate regulatory policy implications for both groups of countries.

Keywords: Financial inclusion, economic growth, financial development, income inequality

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Introduction

According to Karim et al. (2022), the impact of income inequality on economic growth is a hotly discussed topic in both the academic community and policymakers. The reason comes from an essential goal of macroeconomic policy: to ensure equitable and sustainable economic and social prosperity over the long term by ensuring stable economic growth and poverty reduction globally. If a policymaker's strategy does not deliver sustainable economic growth, they must reconsider their approach to achieve this goal (Piece, 2012).

Policies to reduce income disparities can support long-term and sustainable economic growth (Berg and Ostry, 2011; Ostry et al., 2014) while enhancing social equity and economic growth. Establishing theoretical inferences between these factors is indispensable for making practical policy recommendations (Dominicis et al., 2008). Shahbaz (2010) and Topuz (2022) suggested that income inequality can stimulate economic development. However, Ratnawati (2020) proves it can suppress economic growth.

* **Dao Le Kieu Oanh**, Faculty of Banking, Hochiminh University of Banking, Vietnam;

✉ email: oanhdlk@hub.edu.vn,

ORCID: 0000-0003-4858-9099

The concept of financial inclusion has attracted the attention of global governments and central banks since the beginning of the twenty-first century, thanks to its expanding potential (Arya, 2014). Recent studies (Erland et al., 2020; Kim et al., 2018; Lenka and Sharma, 2017; Shen et al., 2021) agreed that financial inclusion positively impacts economic growth. In 2008, a World Bank study found that a 0.3% increase in GDP per capita growth could be explained by the rise in financial inclusion of up to 10% (Demirguc-Kunt et al., 2018). Also, according to research by Dabla-Norris et al. (2015) for the IMF, improving access to financial services in low-income countries could significantly increase GDP per capita. Because of these results, many governments have begun to believe that financial inclusion can play an important role in promoting economic growth and reducing socio-economic gaps. Some specific aspects have been the focus of previous research, including the impact of income inequality on economic expansion, the effect of financial inclusion on economic development, and the impact of financial inclusion on economic progress (Albiman and Bakar, 2021; Ifediora et al., 2022), as well as nonlinear studies on growth thresholds (Albiman and Bakar, 2021; Karim et al., 2022; Nizam et al., 2020).

Further research is needed to close the information gap regarding the impact of income inequality on economic development in the context of financial inclusion. Additionally, previous research, such as Ifediora et al. (2022) and Albiman and Bakar (2021), frequently includes frequency techniques in their methodological approaches. These studies examine how financial inclusion affects economic growth in countries in sub-Saharan Africa using GMM regression. Using the REM/FEM approach, Sethi and Acharya (2018) demonstrated a positive correlation between financial participation and economic progress in 31 countries. However, the Bayesian method's advantages and disadvantages have become the main topic of many studies, such as those of Gelman and Hill (2006) and Kruschke (2014). With a focus on financial development, this study examines the importance of financial inclusion and investigates how income inequality affects economic growth using a Bayesian approach. Furthermore, to provide customized guidance, especially about promoting economic growth and reducing inequality, this study adopts a multi-country approach, considering differences between countries at different stages of financial development.

This study highlights the importance of understanding the relationship between income inequality, economic growth, and financial inclusion. Using a Bayesian approach, the authors aim to provide specific policy recommendations to promote economic growth and reduce inequality while considering national diversity and stages of development in different finances.

Literature Review

The relationship between financial inclusion and economic growth:

Financial inclusion has become the focus of policy changes in recent years, replacing financial development (Johnson and Arnold, 2012). Core ideas in finance, such as

Mckinnon (2010), play an important role in explaining economic growth patterns. By providing affordable financial services, the financial sector contributes to the distribution of limited economic resources and promotes economic expansion (Chen and Yuan, 2021).

Furthermore, Kim et al. (2018) conducted research in 55 member countries of the Organization of Islamic Cooperation (OIC) using many analytical methods such as dynamic panel estimation, panel vector autoregression (VAR), impulse response function response (IRF), and panel Granger causality test. Their results support the hypothesis that financial inclusion promotes economic growth. Furthermore, with data from 2004 to 2010, Sethi and Acharya (2018) investigated the relationship between financial inclusion and economic progress in 31 industrialized and developing countries. Their findings also indicate a positive, long-term association between these two variables. On the other hand, Inoue and Hamori (2019) explored the extent to which financial inclusion influenced the global economy of emerging countries from 2004 to 2014. The findings showed a positive impact on the economic expansion of the countries studied and a positive association between the number of commercial enterprises, bank branches, and financial inclusion.

With data from 2005 to 2017, Dahiya and Kumar (2020) studied the link between financial inclusion and economic growth in India's developing economy. The connectivity estimation method of this study is autoregressive. Using Bayesian regression, it was found that financial inclusion was the only factor associated with economic development. Similarly, the impact of financial inclusion on economic growth in 63 developed and developing countries during 2014-2017 was studied by Nizam et al. (2020). Research has identified a positive correlation between economic growth and financial inclusion. This association is more potent at higher levels of the financial inclusion index. Karim et al. (2022) examine the impact of financial inclusion on economic development with a sample of 60 countries from 2010 to 2017. A financial inclusion index (IFI) has been created for each country to assess financial inclusion progress. According to the main findings using the dynamic panel threshold estimation technique, the financial inclusion growth relationship affects the threshold. It was found that financial inclusion has a favorable impact on economic growth and brings benefits at different levels in different regimes. Cihak et al. (2016) noted that financial development positively impacts economic growth by reducing firms' financial constraints. Additionally, Emara and El Said (2021) show that countries with relatively low financial inclusion services, such as the Middle East and Africa (MENA) region, will benefit the most from improving governance. From there, the author has the first hypothesis related to financial inclusion and economic growth as follows:

H1: Financial inclusion has a positive effect on economic growth.

The relationship between income inequality and economic growth:

Growth and income inequality in Italy from 1967 to 2012 were examined by Njindan Iyke and Ho (2017) using autoregressive distributed lag (ARDL) estimation. Studies show that growth is affected by both temporary and permanent income disparities.

Malinen (2012) examined the GINI index to assess income inequality in 60 industrialized and developing countries. The OLS method shows that income distribution and economic progress are negatively correlated. Furthermore, historical evidence links slow economic growth in rich countries to income disparities. Cingano (2014) researched more from 1980 to 2012 on the link between income inequality and economic progress in OECD (Organization for Economic Cooperation and Progress) countries. This investigation focuses on the industrialized world. According to GMM research, income disparity has a detrimental impact on economic growth in these countries. Examining how growth at different stages of financial development is affected by income inequality is the main argument put forward by Braun et al. (2019). Across 150 countries, they used dynamic panel and instrumental variable (IV) OLS results to find a link between less sustained economic performance and rising income disparities from 1978 to 2012. They also find that these effects decrease significantly as the economy's financial development level increases. The relationship between growth and income inequality in more than 200 comparable locations in 15 OECD countries was studied by Royuela et al. (2019) from 2003 to 2013. Additionally, statistics show that growth and inequality are negatively correlated in OECD countries. Breunig and Majeed (2020), using GMM to assess the link between economic development and inequality in 152 countries from 1956 to 2011, find that inequality hurts growth.

However, some studies show that income disparity has a detrimental impact on economic growth, as the authors' statistics show. The findings demonstrated that growth and inequality were positively related throughout the study. As part of another single-country study of growth and income inequality in Brazil from 1991 to 2000, Rangel et al. (2008) examined the inverted U-shaped hypothesis and linear correlation. According to these findings, growth and income inequality tend to follow. Based on an analysis of South Africa's poverty, inequality, and economic progress from 1995 to 2005, the findings are consistent with the inverted U theory. Using a distributionally neutral measure, the study calculates the proportional marginal replacement rate and the elasticity of poverty inequality. Research shows that income disparities tend to increase with growth rates as the allocation of income and resources changes during economic booms. The relationship between growth and wealth inequality in Pakistan was then examined by Shahbaz (2010) using the ARDL approach; the former study covers 1971–2005, while the latter covers 1975–2013. According to both studies, Pakistan's economic development during the study period was positively correlated with income inequality.

Scholl and Klasen (2019) examine the link between development and inequality, focusing on the impact of transition (post-Soviet) countries. The study spanned 1961–2012 and included a sample of 122 countries. The entire sample, driven by transition countries, finds a significant correlation between growth and inequality using FE, GMM, and IV estimation methods.

Therefore, the author has the following hypothesis:

H2: Income inequality negatively affects the economic growth.

Income inequality affects economic growth in the context of financial inclusion:

Financial inclusion helps low-income and small companies access loans, savings accounts, and insurance, allowing them to engage in profitable ventures, such as establishing or developing a company. This action can create jobs, increase income, and contribute to economic growth (Demirgüç-Kunt et al., 2018). However, according to research by Cecchetti and Kharroubi (2012) from the International Monetary Fund, this relationship can also be negative. Linear correlation shows that financial inclusion positively affects economic growth up to a certain threshold, but the impact can become negative beyond that threshold.

From 2004 to 2012, Inoue and Hamori (2016) studied 37 sub-Saharan African countries. Their results show that the number of bank branches and real GDP per capita are positively correlated. They also believe that financial deepening has a favorable and significant impact on the development of the financial system in this sector. Next, Thomas (2017) focuses on the relationship between access to finance and economic growth in eight South Asian countries from 2007 to 2015. The author finds that increasing revenue goes hand in hand with increases in accessible money and improvements in financial inclusion, which also have a more significant impact on the economic growth of low-income countries than in other countries—middle-income countries.

In countries with low levels of financial development, better access to finance will accelerate economic growth and increase the number of individuals who can access financial services. However, the beneficial effects on economic development will weaken and, in some instances, even disappear if financial inclusion reaches high levels. This is because the marginal benefits of financial inclusion may decrease as it becomes more widespread, and some individuals may begin to use financial services that no longer contribute positively to the developing economy.

Highly developed countries such as the US, Japan, and Canada are distinguished by their financial depth, emergence of financial inclusion, and access to financial services. In addition to helping companies grow and prosper, a simple method for consumers to fund their way through the system could reduce these costs, difficulties, and barriers that come with external financial constraints on businesses. This will also encourage economic development through higher production and service provision. However, at a higher level, the manufacturing sector became unstable due to rising inflation, mainly due to the rapid growth of the service and industrial sectors. Input costs and cash flows in and out of the financial system are also affected. As a result, the economy experienced a prolonged recession due to the negative impact of exports and services. From the above study, the author finds a linear and nonlinear relationship between an inclusive financial system and economic growth.

Boukhatem (2016) argues that many studies believe that the continued impact of financial inclusion on economic growth is poverty reduction. However, in Boukhatem's analysis, the growth assumption is ignored, so the relationship between financial inclusion and poverty reduction is unidirectional, with data obtained from

67 high-income countries with low and middle income from 1988 to 2012. The results show that financial development has a direct impact on poverty reduction. This is considered a phenomenon of increasing money supply or bank credit, improving the welfare of people experiencing poverty, and increasing financial transactions, leading to opportunities for capital accumulation, income distribution, and proficient consumption. Sarma and Pais (2011) empirically find out what factors cause different levels of financial inclusion across countries. It is found that the level of financial access is closely related to the level of human development and is significantly conditioned by socio-economic and infrastructural factors such as income, inequality, literacy levels, urbanization, and physical infrastructure.

Meanwhile, Erlando et al. (2020) show that financial inclusion positively impacts inequality, leading to widespread income inequality in East Indonesia. Toda-Yamamoto VAR bivariate causal model and Dynamic Panel Vector Autoregression (PVAR) are two methods used in this study. Ugbede et al. (2017) used VECM to examine empirical evidence on financial inclusion and the Nigerian economy from 1982 to 2014. The results demonstrated that loans and deposits by people in remote areas with depository bank branches significantly stimulated the performance of Nigeria's GDP.

With access to appropriate financial services, poor or disadvantaged people have equal opportunities to invest in education and material assets, reducing income inequality and promoting economic development (Mehrotra and Yetman, 2015). Kim (2016) found the positive impact of financial inclusion on economic growth in OECD countries through the indirect channel of income inequality. The positive impact is much more substantial in low-income and high-fragility countries. The classification into low income and high income (based on the level of income (ratio of bad debt to total bank debt) in the year has a lower or higher average value.

The author has the following hypothesis:

H3: Financial inclusion plays a moderating role in the relationship between income inequality and economic development.

Different theoretical approaches and models yield various results when examining income inequality and financial inclusion with economic development. Through an overview of previous studies, the author finds that (1) in terms of research, studies on comprehensive financial impacts and income inequality mainly stop at individual impact studies. The causes and results of these studies all have negative consequences as well as negative impacts. as a positive impact. There is a lack of research examining the effects of income disparities on economic development that takes into account financial inclusion; (2) in terms of methodology, previous studies used frequency methods such as OLS, FEM and GMM. This shows that the last research methods were not consistent and frequently applied the technique. Frequency econometrics; however, testing hypotheses using this method requires several unrealistic assumptions, leading to inaccurate inference and prediction. The most notable benefit of the Bayesian approach is that it overcomes model errors such as autocorrelation, heteroskedasticity, and endogeneity.

Research Methodology and Data

Zondervan-Zwijenburg et al. (2017) argue that the Bayesian approach, by incorporating both research data and prior knowledge to compute a posterior distribution, can address the limitations posed by small sample sizes in studies. The outcomes are a probability distribution of parameter values regardless of sample size. The interpretation of study findings varies between the Bayesian and frequency techniques because of their radical differences in how they treat what is fixed. The fixed observed data pattern and random model parameters are the foundations of the Bayesian method. Interpreting the data will require estimating the posterior distribution of the parameters, which will be based on the observed pattern and the parameter's prior distribution. It is assumed by the frequency distribution that the observed samples are random and that this parameter is unknown but remains constant across samples. The statistical characteristics of the data, or the sample distribution, serve as the foundation for interpretation. As stated differently, Bayesian analysis provides responses based on the parameter distributions conditional to the observed sample. Bayesian regression will follow these three stages to examine the proposed association between marginal interest income and explanatory variables.

Data from 31 countries worth of research were analyzed between 2004 and 2021 to divide country groups according to two criteria: high and poor financial development (Oanh et al., 2023). The authors determine the global financial development index (world average FD) using Oanh et al. 2023 study data. From 2004 to 2021, the average FD of nations with solid financial development will surpass the global average FD, and the opposite will apply to those with poor financial development. The split findings, comprising 17 nations with poor financial development and 14 with solid financial development, are displayed in Figure 1. The author researched 17 low-financial development nations and 14 high-financial development countries between 2004 and 2021.

The following factors are determined by combining theory and experience to evaluate how financial inclusion and inequality affect growth:

GDP economic growth variable

According to research by Albiman and Bakar (2021), Ifediora et al. (2022), Karim et al. (2022), and Soava et al. (2020), the economic growth variable is determined by dividing the nation's gross domestic product for the year by the average population for that same year.

FI financial variables

Based on previous studies by Karim et al. (2022), Albiman and Bakar (2021), Oanh et al. (2023), and Oanh (2023), the financial inclusion variable built by the author includes the integration of 6 indicators, including two indicators from the demand side and four indicators from the demand side bow:

The financial index includes both a usage index and an access index, providing a comprehensive view of a country's level of financial integration and accessibility. Among the demand-side factors, outstanding commercial bank credit (LCB) and

outstanding deposits at commercial banks (DCB) play an important role in assessing the use of financial services. At the same time, the financial inclusion index includes the number of commercial bank branches within a 1000 km² area (CBBP), the Branch count per 100,000 Adults (CBP), the number of ATMs per 1000 km² (ATMKM), and the number of ATMs per 100,000 adult residents (ATM). These indicators not only reflect the popularity of financial transaction points but also measure local communities' access to banking services and ATMs, creating a comprehensive picture of the state of the economy and financial situation of the country.

GINI income inequality variable

Based on the study of Soava et al. (2020) Khalifa and El Hag (2010), the authors use the GINI coefficient to measure countries' income inequality. In addition, the author added other control variables; the method of measuring the variables is explicitly presented in Table 2. Research model:

$$GDP_{i,t} = \beta_0 + \beta_1 FI + \beta_2 GINI_{i,t} + \beta_3 FI * GINI + \beta_x X_{i,t} + \varepsilon_{i,t} \quad (2)$$

Table 1. Description of variables in the model

Symbol of variables	Measure	Experimental study	Source
GDP	GDP growth per capita	Karim et al., 2022; Albiman and Bakar, 2021; Ifediora et al., 2022; Soava et al., 2020; and Meyer and Meyer, 2020	World Bank; FAS
GINI	GINI coefficient	Khalifa and El Hag, 2010; Soava et al., 2020; and Hailemariam and Dzhumashev, 2019	World Bank
FI (Financial)			
LCB	Outstanding loans from commercial banks/ GDP	Karim et al., 2022; Ifediora et al., 2022; and Albiman and Bakar, 2021	World Bank; FAS
DCB	Exceptional balance of deposits from commercial banks/ GDP		
CBBP	Commercial bank branch count per 1000 km ²		FAS
CBP	Bank branches for per 100,000 individuals		World Bank; FAS
ATMKM	ATM count per 1,000 km ²		FAS
ATM	The number of ATMs per 100,000 individuals		World Bank; FAS

INF	Inflation growth	Karim et al., 2022; Ifediora et al., 2022; and Nguyen et al. 2021
UR	Population in cities as a percentage of the total population	Li et al., 2022
POP	Annual population growth rate	Karim et al., 2022; and Ifediora et al., 2022
OPEN	GDP ratio derived from the total import and export of goods and services	Sethi and Acharya, 2018; Karim et al., 2022; and Ifediora et al., 2022
UNE	The ratio of jobless persons to the labor force in a nation	Karim et al., 2022

Source: The author's work

Research Results

Regression

Table 2 shows the results of the Principal Components Analysis (PCA) for the variables FI, ATM, ATMCM, DCB, LCB, CBP, and CBBP. Overall, the PCA coefficients show the relationship and influence of each variable on the respective principal component.

Table 2. Principal Components Analysis (PCA)

FI	ATM	ATMKM	DCB	LCB	CBP	CBBP
	-0.213	-0.1354	0.431	0.231	0.648	0.526

Source: Analysis results in PCA from R software

From Table 2, the authors achieved the following model results:

$$FI = -0.213 \cdot ATM - 0.1354 \cdot ATMKM + 0.431 \cdot DCB + 0.231 \cdot LCB + 0.648 \cdot CBP + 0.526 \cdot CBBP$$

Descriptive statistical results

Table 3. Figures illustrate the factors for high and poor financial development nations between 2004 and 2021.

	Countries with low financial development				Highly financially developed countries			
	Mean	Std. Dev.	Min.	Max.	Mean	Std. Dev.	Min.	Max.
GDP	3.10	4.91	-14.76	33.03	2.77	3.66	-12.24	13.64
FI	21.72	13.34	0.20	45.85	36.40	29.85	0.77	133.86
GINI	38.39	9.17	24.00	59.50	39.17	7.79	24.90	56.50
INF	5.94	7.12	-1.58	59.22	3.97	3.25	-1.42	16.33
UR	61.86	13.31	35.28	95.52	70.27	14.18	36.17	93.90
POP	0.47	1.04	-1.85	2.49	0.67	0.79	-1.20	2.39
OPE N	84.38	24.89	38.52	157.97	74.39	41.70	22.11	168.39
UNE	9.96	7.73	0.50	37.32	6.93	3.49	0.25	17.29

Source: Analysis results in PCA from R software

Table 3 shows that the average FI and GINI variables of low financially developing countries are 21.72 and 38.39, respectively, lower than those of highly financially developed countries, 36.40 and 39.17. This shows that the level of financial inclusion in financially developing countries is significantly low compared to highly financially developed countries. However, inequality is slightly higher in highly developed countries than in low financially developed countries. The average GDP growth rate per capita shows that low financial development countries have a higher growth rate at 3.10% compared to high financial development countries at 2.77%.

Results and discussion

Table 4, Bayesian regression results for two country groups, shows that the FI variable has a positive effect on GDP in low- and high-financial-development nations (coefficients of 0.0244 and 0.0644, respectively), with a probability of positive impact of 79.68% and 79.56% (Table 5). This implies that financial inclusion promotes economic growth in two groups of countries by encouraging individuals and households to save and invest, which can help mobilize resources and direct them into productive investments. This could increase the availability of funds to businesses and governments, which could support economic growth. Furthermore, in these countries, large numbers of people do not have access to products or are excluded from the financial system because they do not meet the need criteria, so increasing financial inclusion can Stimulate financial innovation by creating new opportunities for financial service providers to develop products and services that meet the needs of previously underserved individuals and businesses.

The research results are similar to previous research, such as Erlando et al. (2020), Kim et al. (2018), Lenka and Sharma (2017), and Shen et al. (2021).

With a likelihood of 93.34% in nations with low financial development and 99.47% in nations with solid financial development, the GINI variable has a negative effect on economic growth in both groups of countries. This implies that, in democratic societies, tax rates are determined by the majority group of voters, the middle class. Tax levels are proportional to income, while the benefits of public spending are distributed to everyone. The rich support low taxes to reduce their contribution to public spending, while the poor want higher taxes to benefit more from this source of expenditure. The higher the inequality in society, the stronger the pressure to increase taxes because the government will then decide on policy based on the wishes of the majority of voters, those in the middle class. Therefore, inequality creates pressure to increase taxes and leads to policies that slow growth, which aligns with Rangel et al. (2008).

The results of our analysis of the influence of financial inclusion indicate that, in nations with low financial development, the GINI has a 95.13% likelihood of favorably influencing economic growth. Still, in nations with low financial development, the probability is 95.13%. With high financial development, GINI still has a negative impact. Still, the probability is significantly reduced at 53.13%, showing that the more critical role of financial inclusion is, the more unequal the effect on economic growth is. Economic growth is positive.

Table 4. Results of the probability of independent variable impact on dependent variable

Variable	Countries with low financial development		Highly financially developed countries	
	Mean (Std. Dev)	MCSE	Mean (Std. Dev)	MCSE
Prob(GDP: FI)>0	0.7968 (0.055)	0.000	0.7956 (0.065)	0.001
Prob(GDP: GINI)<0	0.9334 (0.251)	0.003	0.9947 (0.073)	0.000
Prob(GDP: FI*GINI) <0			0.5313 (0.010)	0.000
Prob(GDP: FI*GINI) >0	0.9513 (0.314)	0.003		
Prob(GDP: INF) <0	0.8000 (0.399)	0.004	0.9830 (0.133)	0.001
Prob(GDP: UR) <0	0.5707 (0.494)	0.005	0.9919 (0.089)	0.001
Prob(GDP: POP) <0	0.999 (0.043)	0.000	0.8531 (0.351)	0.004
Prob(GDP: OPEN) >0	0.9973 (0.050)	0.000	0.7661 (0.431)	0.004
Prob(GDP: UNE) <0	0.9280	0.002	0.9707	0.001

	(0.257)		(0.168)	
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Source: Analysis results in PCA from R software

The average acceptance rate of the two equations for nations with small and high financial growth is both over 0.8, according to a Bayesian regression test. The abovementioned models satisfy the requirements since the minimum efficiency (Avg efficiency: min) of the two equations in both sets of nations is greater than the permissible limit of 0.01.

Since the posterior distribution is produced using the MCMC approach, the accuracy of the sample produced by the MCMC algorithm is required to estimate the Levy target distribution (2020) correctly. Thus, to confirm that Markov chains converge and that MCMC sampling stops, MCMC diagnostic tools are required. The author of this article tests the convergence of Markov chains using the Gelman-Rubin statistic, sometimes referred to as the Rc coefficient, and utilizes the efficiency index to determine when to halt MCMC sampling.

All parameters have Rc coefficients smaller than 1.1, as Table 4 demonstrates. Levy (2020) states that if the Rc coefficient is smaller than 1.1, it indicates that the Markov chains have converged and that the MCMC method has generated representative samples. In addition, the efficiency index of Markov chains is higher than 0.01, indicating that the posterior distribution features of the estimates derived using MCMC are more stable and reliable. As a result, the MCMC diagnostic, utilizing the efficiency index and Rc coefficient, demonstrated that the sample quality produced by the MCMC algorithm yielded a precise estimate of the posterior distribution.

Conclusion

This article focuses on research on the impact of income inequality on economic development in 17 countries with low levels of financial growth and 14 countries with high levels of financial development. From the results of Bayesian regression analysis on two groups of countries, we can see the positive influence of the FI variable (financial inclusion) on GDP in even countries with low and high financial development, with active probabilities of 79.68% and 79.56%, respectively. Financial inclusion can promote economic growth by encouraging individual and household savings and investment, directing resources into beneficial investments. This can provide capital for businesses and governments, supporting economic growth.

Second, the GINI variable (income inequality index) has a negative impact on economic growth in both groups of countries, with a performance probability of 93.34% in low-income countries, respectively, and 99.47% in countries with high financial development. Income inequality can create upward pressure on taxes and lead to policies that slow economic growth, consistent with previous studies.

Ultimately, the findings indicate that financial inclusion can be an effective way to promote economic growth. At the same time, income inequality can pressure regulatory policies—the vital role of regulatory policies in promoting sustainable

and equitable economic development. Governments should continue to encourage e-finance and digital finance to ensure broader and fairer access.

Governments worldwide have issued many policy documents, strategies, and guidelines to respond proactively to the 4.0 Industrial Revolution, helping to promote e-finance towards digital finance. This is entirely thanks to the advancement of 4.0 technology. As a result, financial apps give more people more accessible access to money. Therefore, financial inclusion can be assessed using metrics such as the number of individuals using credit cards, paying tuition using bank accounts, and online shopping accounts. Furthermore, future research should continue to explore the level of financial inclusion at a more significant level and establish appropriate regulations for the 4.0 era.

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INTEGRACJA FINANSOWA I WZROST GOSPODARCZY: BADANIE ROLI NIERÓWNOŚCI DOCHODÓW

Streszczenie: W dzisiejszych czasach nierówność dochodowa wpływająca na wzrost gospodarczy przyciąga dużą uwagę decydentów politycznych i środowiska akademickiego. Dlatego celem tego badania jest zbadanie wpływu nierówności dochodowych na wzrost gospodarczy w kontekście integracji finansowej. Ponadto, badanie to przeprowadza dogłębną analizę i porównuje kraje o niskim i wysokim poziomie rozwoju finansowego, aby uzyskać bardziej szczegółowy i kompleksowy obraz. Zastosowano nową metodę regresji bayesowskiej do przetworzenia danych zebranych z 17 krajów o niskim poziomie rozwoju finansowego i 14 krajów o wysokim poziomie rozwoju finansowego. Wyniki modelu regresji bayesowskiej pokazują, że zmienna dotycząca integracji finansowej (FI) pozytywnie wpływa na wzrost gospodarczy (PKB) w obu grupach krajów. Dodatkowo badanie wykazuje, że nierówność dochodowa (GINI) negatywnie wpływa na wzrost gospodarczy w obu grupach krajów, ale wielkość tego wpływu różni się w zależności od poziomu rozwoju finansowego. Chociaż wskaźnik GINI nadal ma negatywny wpływ w krajach o wysokim poziomie rozwoju finansowego, wpływ ten jest znacznie mniejszy w porównaniu do krajów o niskim poziomie rozwoju finansowego. Wyniki te podkreślają znaczenie integracji finansowej dla wzrostu gospodarczego i sugerują odpowiednie implikacje regulacyjne dla obu grup krajów.

Słowa kluczowe: integracja finansowa, wzrost gospodarczy, rozwój finansowy, nierówność dochodowa