Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Digital Financial Inclusion, Bank Credit, and Inequality Dynamics: Time-Varying Evidence of an Exclusive Growth Regime in Indonesia

Setyo Tri Wahyudi
setyo.tw@ub.ac.id
University of Brawijaya
Md. Mahmudul Alam
BRAC University
Firmansyah Firmansyah
Diponegoro University
Rihana Sofie Nabella
University of Brawijaya
Amalia Rahmawati
University of Brawijaya
Kartika Sari
University of Brawijaya

Research Article

Keywords: financial development, credit allocation, income inequality, digital financial inclusion, emerging economies

Posted Date: June 4th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-9816802/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Abstract

The relationship between financial development and income inequality remains contested, particularly in emerging economies with uneven financial access. This study examines the dynamic roles of digital financial inclusion and traditional bank credit in shaping inequality and economic growth in Indonesia. Employing a Time-Varying Parameter Vector Autoregression (TVP-VAR) model, the analysis captures evolving interactions among digital finance, credit expansion, income inequality, and per capita income. The results reveal three key findings. First, digital financial inclusion consistently reduces inequality, especially during its early diffusion stage. Second, bank credit increasingly promotes economic growth but simultaneously contributes to rising inequality. Third, these dynamics indicate the emergence of an "exclusive growth" regime, where growth becomes increasingly credit-driven while distributional disparities persist. The study highlights a structural asymmetry between inclusive digital finance and concentrated credit access, offering important policy implications for designing financial systems that simultaneously support growth and equitable income distribution.

JEL: G21; O16; D31; C32; O53

1. INTRODUCTION

The financial sector plays a pivotal role in shaping economic growth and income distribution, yet its distributional consequences remain theoretically and empirically contested. While banking development can stimulate investment and productivity, unequal access to credit and regionally concentrated financial services may amplify income inequality, particularly in emerging economies. Further, financial development is widely regarded as a key driver of economic growth and poverty reduction. by mobilizing savings, improving capital allocation, and expanding access to financial services, deeper financial systems are expected to support inclusive economic development. However, a growing body of empirical research shows that the relationship between financial development and income inequality is far from straightforward. In many emerging economies, financial deepening has coincided with widening income disparities, raising concerns about whether financial sector expansion benefits broad segments of society or primarily advantages already well-connected economic actors. As a result, the finance-inequality nexus has become one of the most debated topics in developing economics and financial policy (Nokulunga, 2023; de Vries, 2019; Minetti et al., 2021; Peruzzi et al., 2023).

One important explanation for these mixed outcomes lies in the structure and channels of financial development. Traditional studies often measure financial development using aggregate indicators such as private credit or financial depth, implicitly assuming that financial expansion affects growth and inequality through a single mechanism. Yet modern financial systems are increasingly characterized by multiple and heterogeneous financial channels, including bank-based credit intermediation, digital financial platforms, and fintech-enabled financial services. These different channels may have fundamentally different distributional implications. In particular, digital financial inclusion may expand access to financial services among underserved populations, while bank credit expansion may

concentrate financial resources among borrowers with stronger collateral or credit histories. Distinguishing between these channels is therefore critical for understanding how financial development affects income distribution.

At the same time, the distributional effects of financial development may evolve over time as financial systems mature. Theoretical perspectives such as the Financial Kuznets Curve (FKC) suggest that financial deepening may initially increase inequality before eventually reducing it one access to financial services becomes more broadly distributed (Öndes and Kızılgöl, 2024; Mushtaq et al., 2024). Similarly, research on credit cycles shows that periods of rapid credit expansion often amplify income inequality because access to formal credit markets remains concentrated among higher-income households and established firms. These insights imply that the finance-inequality relationship is inherently dynamics, evolving across different stages of financial development and across different stages of financial development and across different macro-financial regimes (Nokulunga, 2023).

Despite these theoretical insights, existing empirical studies often face two important limitations. First, many studies treat financial development as a single aggregate concept, without distinguishing between digital financial inclusion and traditional bank credit expansion. Second, most empirical analyses rely on constant-parameter models, implicitly assuming that the relationship between finance, growth, and inequality remains stable over time. These limitations may obscure important structural dynamics in the financial system, particularly in emerging economies undergoing rapid technological and institutional transformation.

Indonesia provides a particularly relevant context for examining these dynamics. Over the past two decades, the country has experienced substantial financial sector expansion alongside rapid growth in digital financial services. Mobile banking, electronic payments, and fintech platforms have expanded financial access to previously underserved populations. At the same time, bank-based credit has continued to play a central role in financing investment and economic growth. However, income inequality has remained a persistent policy concern, raising questions about whether financial development in Indonesia is generating inclusive economic outcomes or reinforcing existing disparities.

This study addresses these issues by examining the evolving relationship between digital financial development, bank credit expansion, income inequality, and economic growth in Indonesia. The analysis employs a Time-Varying Parameter Vector Autoregression (TVP-VAR) framework, which allows the interactions among these variables to change over time. This approach makes it possible to identify how financial shocks influence inequality and growth across different financial regimes, including periods of rapid digital financial adoption and shifts in credit dynamics.

The study makes three main contributions to the literature on financial development and inequality. First, the study distinguishes between digital financial development and traditional bank credit expansion, highlighting the possibility that these two forms of financial deepening operate through different economic channels. While digital finance primarily expands access to financial services, bank credit plays a central role in capital accumulation and investment. By separating these channels, the analysis

provides a more nuanced understanding of how financial sector expansion affects income distribution. Second, the study demonstrates that the relationship between financial development, inequality, and economic growth is time-varying rather than static. Using a TVP-VAR framework, the analysis shows how the distributional and growth effects of financial development evolve across different stages of financial system development. This dynamics perspective helps reconcile conflicting findings in the existing literature, which often arise from assuming stable relationships over time. Third, the results identify the emergence of what can be described as an “exclusive growth” regime, in which economic growth increasingly depends on credit expansion while income inequality simultaneously rises. This finding highlights and important challenge for financial development policy: financial deepening can support economic expansion without necessarily delivering inclusive distributional outcomes when access to productive credit remains uneven (Öndes & Kızılgöl, 2024; Atsebi et al., 2025; Mushtaq et al., 2024).

Beyond its empirical contribution, the study also provides policy-relevant insights for financial regulators, central banks, and policymakers concerned with inclusive financial development in emerging economies. By distinguishing between digital access channels and traditional credit allocation mechanisms, the analysis highlights how financial deepening can simultaneously generate growth opportunities while exacerbating distributional imbalances. The findings therefore inform debates on how financial policy—particularly digital financial inclusion strategies, credit allocation policies, and macroprudential regulation—can be better aligned with inclusive growth objectives. More broadly, the study contributes to the international literature on finance and inequality by providing time-varying evidence from a large emerging economy undergoing rapid financial transformation.

The findings carry important implications for policymakers in emerging economies undergoing rapid financial transformation. Expanding digital financial inclusion can play a meaningful role in reducing inequality by lowering barriers to financial participation. However, digital access alone may not be sufficient to generate inclusive economic growth unless it is complemented by policies that improve credit allocation and broaden access to productive lending opportunities.

The remainder of the paper is organized as follows. Section 2 reviews the relevant literature and develops the conceptual framework and research hypotheses. Section 3 describes the data and empirical methodology. Section 4 presents the empirical results. Section 5 discusses the implications of the findings for financial development and inequality dynamics. Section 6 concludes with policy implications and directions for future research.

2. LITERATURE REVIEW

2.1 Finance and Income Inequality: Competing Perspectives

The relationship between financial development and income inequality has long been debated in the economic literature. Early development perspective viewed financial deepening as a key driver of

economic growth and poverty reduction by mobilizing savings and expanding investment opportunities. However, more recent empirical evidence shows that the distributional consequences of financial development are more complex. Financial expansion may either reduce or increase inequality depending on institutional quality, financial access, and the structure of financial intermediation (Peruzzi et al., 2023; Delis et al., 2014).

Comparative studies demonstrate that banking systems characterised by inclusive access and decentralized financial intermediation are more likely to produce egalitarian outcomes than systems dominated by concentrated financial institutions with strong market power (Delis et al., 2014; Johansson & Wang, 2014; Peruzzi et al., 2023). Consequently, the concept of financial development has increasingly shifted from a purely quantitative notion of financial depth toward a broader framework that incorporates financial access, governance, and the institutional structure of financial intermediation (de Vries, 2019).

2.2 Financial Kuznets Curve and Non-Linear Finance-Inequality Dynamics

A substantial strand of the literature rejects linear interpretations of the finance-inequality relationship and instead emphasises non-linear dynamics. The most prominent framework is the Financial Kuznets Curve (FKC) hypothesis, which suggests that financial development may initially increase income inequality before eventually reducing it once access to financial services becomes widespread. Empirical evidence from newly industrialised and emerging economies frequently documents an inverted-U relationship between financial deepening and inequality (Johansson & Wang, 2014; Baiardi and Morana, 2016; Öndes and Kızılgöl, 2024; Mushtaq et al., 2024).

In early stages of financial development, access to formal financial services is often limited to high-income groups and established firms, allowing them to capture a disproportionate share of the benefits from credit expansion. As financial systems mature and access broadens, however, financial services become more widely available to lower-income households and small firms, potentially reducing inequality over time. Meta analytic studies reinforce this view, demonstrating that financial deepening tends to increase inequality when access remains segmented but can become equalising when accompanied by inclusive financial policies and institutional safeguards (Nokulunga, 2023).

2.3 Credit Allocation and Distributional Mechanisms

Beyond aggregate measures of financial depth, recent studies emphasize the importance of credit allocation mechanism in shaping distributional outcomes. The impact of financial development on inequality depends crucially on how credit is allocated across households, firms, and sectors. When banking systems allocate credit broadly and support productive investment among small firms and households, financial development may contribute to inclusive growth. However, when credit expansion is concentrated among collateral-rich borrowers and high-income households, financial deepening may reinforce economic inequality.

Empirical evidence from cooperative banking systems and locally oriented financial institutions shows that decentralized credit allocation and relationship lending can reduce regional disparities and income inequality, particularly in less developed regions (Minetti et al., 2021; Peruzzi et al., 2023). Studies of credit cycles also show that credit booms often amplify inequality because wealthier households and established firms have greater access to credit markets (Mian et al., 2020; Müller & Verner, 2024; Braun et al., 2024).

2.4 Credit Cycles, Financial Shocks, and Time-Varying Distributional Effects

A growing body of research also highlights the role of financial cycles and banking crises in shaping inequality dynamics. Empirical studies show that financial crises tend to increase income inequality, particularly when crises are preceded by excessive credit expansion and large credit gaps (Atsebi et al., 2025). These findings suggest that the distributional consequences of financial development are not constant but depend on macro-financial conditions and credit regimes. Periods of rapid credit growth may generate short-term economic expansion while simultaneously increasing financial vulnerability and inequality. This perspective underscores the importance of dynamic empirical approaches capable of capturing time-varying interactions between finance, growth, and inequality (Frost & van Stralen, 2018).

2.5 Digital Financial Development and Financial Inclusion

The rapid expansion of digital financial technologies has introduced new dimensions to the finance-inequality debate. Digital financial services—such as mobile banking, electronic payments, and digital wallets—have the potential to expand access to financial services by lowering transaction costs and reducing geographic barriers to financial participation. Several studies suggest that digital financial inclusion can reduce inequality by enabling previously excluded households to access payment systems, savings instruments, and basic financial services (Xuan & Trung, 2022; Mo et al., 2024). However, the growth effects of digital finance remain uncertain. In many emerging economies, digital financial development primarily improves transactional efficiency rather than directly expanding productive investment finance. As a result, digital finance may improve financial access without necessarily generating strong growth effects in the short run.

Evidence from Indonesia also suggests that the drivers of financial inclusion have evolved over time, particularly with the rapid expansion of fintech platforms and digital payment systems during the past decade. The determinants of financial inclusion changed significantly before and during the COVID-19 period, indicating that the distributional effects of digital finance are context-dependent and evolve alongside technological diffusion and regulatory adaptation (Prasetyoputra et al., 2025). These findings highlight the importance of distinguishing between access-enhancing financial channels. Such as digital financial services, and accumulation-enhancing channels, such as bank credit expansion.

2.6 Conceptual Framework and Research Hypotheses

Drawing on the preceding literature, this study develops a conceptual framework that distinguishes between two key financial transmission channels affecting inequality and growth: access-enhancing digital financial development and accumulation-enhancing bank credit expansion. Digital financial services primarily improve access to financial transactions and basic financial services thereby lowering barriers to financial participation for previously excluded households. In contrast, traditional bank credit plays a central role in capital accumulation and productive investment but may remain concentrated among high-income or collateral-rich borrowers. These two channels may therefore produce distinct distributional outcomes. Based on the theoretical and empirical literature, the study develops the following hypotheses:

H1: Digital financial development reduces income inequality, particularly during early stages of diffusion when financial access expands rapidly.

H2: Bank credit expansion increases income inequality when credit allocation remains concentrated among higher-income or collateral-rich groups.

H3: The growth effect of bank credit becomes increasingly positive over time as financial intermediation improves and credit allocation becomes more productive.

H4: The joint evolution of bank credit and inequality may generate an “exclusive growth” regime in which economic growth increases alongside rising income inequality.

These hypotheses motivate the empirical analysis using a Time-Varying Parameter Vector Autoregression (TVP-VAR) framework, which allows the relationships between financial development, credit expansion, inequality, and economic growth to evolve over time.

3. DATA AND METHODOLOGY

3.1 Empirical Strategy

This study employs a time-series econometric framework to examine the dynamic relationship between digital financial development, bank credit expansion, economic growth, and income inequality in Indonesia. Motivated by evidence that the finance-inequality nexus is non-linear and regime-dependent, the analysis explicitly accounts for time-varying interactions among financial variables (Atsebi et al., 2025; Braun et al., 2024). In particular, the empirical framework allows the transmission mechanisms linking financial development, credit expansion, and inequality to evolve over time in response to structural changes in the financial system and macroeconomics conditions. Such dynamics are particularly relevant in emerging economies, where financial deepening, digital financial innovation, and regulatory reforms often occur gradually and may generate changing distributional effects across different stages of financial development (Atsebi et al., 2025; Malovaná et al., 2025).

3.2 Data and Sample Period

The empirical analysis utilizes annual data covering the period 2008–2024, capturing several key phases of Indonesia's financial development. These include the post-Global Financial Crisis adjustment period, subsequent phases of domestic credit expansion during the 2010s, and the more recent period characterised by macroprudential policy adjustment and rapid digital financial adoption. Although the time dimension of the dataset is relatively short, the sample period is substantively meaningful because it coincides with the rapid expansion of digital financial services in Indonesia, the emergence of fintech platforms, and structural changes in the banking sector. Earlier periods lack comparable digital financial indicators, which limits the possibility of extending the sample backwards while maintaining consistent measurement. To address the relatively short sample size, the analysis adopts a Bayesian Time Varying Parameter VAR (TVP-VAR) framework, which is widely used in macroeconomic research with limited time series observations because Bayesian estimation allows the incorporation of prior information and produces more stable estimates in small samples.

3.3 Variables and Measurement

The analysis includes four endogenous variables: digital financial development (FIN_DEV), bank credit expansion to the private sector (CREDIT), income inequality (INEQ), and per capita income (GDP_PC). Digital financial development (FIN_DEV) is measured using a composite index capturing the expansion of digital financial services and financial technology adoption in Indonesia. The index aggregates indicators such as mobile banking usage, electronic payments, and digital wallet transactions, which reflect the diffusion of digital financial access. The index is normalised to ensure comparability across indicators and constructed as a composite measure of digital financial development. Detailed construction procedures, weighting methods, and data sources are provided in Appendix A.

Bank credit (CREDIT) is measured using domestic credit to the private sector provided by banks, expressed relative to GDP. This variable captures the role of traditional bank-based financial intermediation in supporting investment and consumption. Income inequality (INEQ) is measured using the Gini coefficient obtained from national statistical sources. The Gini index is widely used in empirical studies of financial development and inequality and provides a consistent measure of income distribution across time (Braun et al., 2024; Baiardi & Morana, 2016). Finally, per capita income (GDP_PC) is included to capture macroeconomic conditions and economic growth dynamics. Including this variable helps isolate the distributional effects of financial development from broader economic growth effects (Müller & Verner, 2024; Chiu & Lee, 2019). The list of variables, their proxies, and data source is summarized in Table 1.

Table 1
Definition and Data Sources of Variables

Variable	Proxied Variable	Indicator	Data Source
Banking Sector Development	Composite Financial Development (FIN_DEV)	· Indicators of digital financial services development · Fintech usage (mobile banking, e-wallets, digital wallets) · Financial Development Index (if available)	· Bank Indonesia · OJK · IMF – Financial Development Index · World Bank
Credit channels	Private sector credit (CREDIT)	· Domestic credit to the private sector · Outstanding banking credit · Credit-to-GDP ratio	Bank Indonesia
Income Inequality	Gini coefficient	· Gini Index · Income disparity indicators	· BPS · World Bank
Macroeconomic controls	Per Capita Income (GDP_PC)	· Per capita income · Real income growth	· BPS · World Bank

3.4 Time-Varying Parameter Vector Autoregression (TVP-VAR)

To capture evolving relationships among financial development, credit expansion, inequality, and economic growth, the study employs a Time-Varying Parameter Vector Autoregression [TVP-VAR] model. Unlike conventional VAR models with constant parameters, the TVP-VAR specification allows model coefficients and shock transmission mechanisms to change gradually over time, reflecting structural transformations in the financial systems. This specification is particularly appropriate in the context of Indonesia, where financial deepening, fintech innovation, and credit allocation patterns have evolved progressively over the past decade (Malovaná et al., 2025). The TVP-VAR model therefore provides a flexible framework for analysing regime-dependent dynamics without imposing discrete structural breaks.

The baseline TVP-VAR model can be expressed as:

$$Y_t = A_t Y_{t-1} + c_t + \varepsilon_t \quad (1)$$

where, Y_t represents the vector of endogenous (FIN_DEV, CREDIT, INEQ, GDP_PC) variables at time t, A_t denotes the time-varying coefficient matrix, c_t is the time-varying intercept vector, and ε_t is the vector of stochastic shocks. The model is estimated using Bayesian state-space methods, which allow coefficients to evolve smoothly over time while ensuring stable estimation in relatively small samples. After estimation, the analysis focuses on the time-varying impulse response functions (IRFs) to evaluate how shocks to digital financial development and bank credit affect income inequality and economic growth at different point in time. Lag length selection follows conventional information criteria and model stability considerations. Given the relatively short annual datasets, a lag length of p = 1 is selected to preserve degrees of freedom while ensuring model stability.

3.5 Diagnostic Tests and Robustness Strategy

Prior to estimation, the time-series properties of all variables are examined using standard unit root tests to ensure stationarity and avoid spurious regression results. Where necessary, variables are transformed to achieve stationarity while preserving their economic interpretation. To assess the robustness of the results, the empirical analysis is complemented by several diagnostic procedures. These include comparisons with constant-parameter VAR models and alternative specifications to verify that the key relationships—namely the inequality-reducing effect of digital financial development and the inequality-increasing effect of bank credit—are not driven solely by the time-varying specifications. Such robustness checks enhance confidence that the identified dynamics reflect underlying structural relationships rather than model artefacts.

4. RESULT

4.1 Time-Varying Dynamics of Digital Financial Development (FIN_DEV)

This subsection reports the estimated tine-varying coefficients for the digital financial development equation (FIN_DEV). The TVP-VAR specification allows the influence of bank credit, income inequality, and per capita income on digital financial development to evolve over time. Such a specification is particularly appropriate in contexts where financial innovation and fintech diffusion occur gradually and where institutional adaptation shapes the evolution of financial systems over time (Öndes & Kızılgöl, 2024; Mushtaq et al., 2024: Nikoloski, 2013; Baiardi & Morana, 2016).

The estimated coefficients reveal strong persistence in digital financial development. The lagged FIN_DEV coefficient declines gradually from approximately 1.43 in the early sample period to about 0.91 in later years. This pattern indicates that digital financial development initially evolves in a highly path-dependent manner but becomes progressively less dependent on its past values as digital platforms mature and adoption becomes more widespread. In substantive terms, the declining persistence suggests that digital finance in Indonesia transitioned from an early diffusion phase driven by existing

financial infrastructure toward a more autonomous adoption process (Nokulunga, 2023; Nikoloski, 2013; Öndes & Kızılgöl, 2024).

Table 2
Time-Varying Coefficient Dynamics in Financial Development Equation

FIN_DEV	CREDIT	INEQ	GDP_PC	(Intercept)
1.4326	0.8421	-2.3319	2.93E + 00	26.8740
1.3978	0.6774	-2.6757	2.56E + 00	52.0374
1.3630	0.5128	-3.0195	2.20E + 00	77.2006
1.3283	0.3481	-3.3633	1.83E + 00	102.3636
1.2935	0.1835	-3.7071	1.47E + 00	127.5263
1.2587	0.0190	-4.0509	1.10E + 00	152.6889
1.2239	-0.1455	-4.3946	7.33E-01	177.8513
1.1892	-0.3101	-4.7383	3.67E-01	203.0135
1.1544	-0.4744	-5.0821	-7.12E-05	228.1755
1.1197	-0.6389	-5.4258	-3.67E-01	253.3372
1.0849	-0.8033	-5.7694	-7.34E-01	278.4988
1.0502	-0.9677	-6.1131	-1.10E + 00	303.6602
1.0154	-1.1320	-6.4568	-1.47E + 00	328.8214
0.9807	-1.2963	-6.8004	-1.83E + 00	353.9824
0.9460	-1.4606	-7.1440	-2.20E + 00	379.1432
0.9112	-1.6249	-7.4877	-2.57E + 00	404.3038

Table 2 also shows that estimated coefficient of CREDIT gradually shifts from positive to negative over time. This pattern indicates that bank credit initially complements digital financial development but later becomes less strongly associated with the expansion of digital finance. The results also show a progressively stronger negative association between income inequality (INEQ) and digital financial development, suggesting that higher inequality may constrain the diffusion of digital financial services by limiting access among lower-income households (Xuan & Trung, 2022; Johansson & Wang, 2014; Chiu & Lee, 2019; Mushtaq et al., 2024; de Vries, 2019; Prasetyoputra et al., 2025).

4.2 Time-Varying Dynamics of Bank Credit (CREDIT)

This subsection presents the time-varying estimates for the bank credit equation. The analysis focuses on how digital financial development, income inequality, and per capita income influence credit dynamics

across different phases of Indonesia's financial cycle. The TVP-VAR framework allows credit behaviour to adjust gradually over time, capturing regime-dependent responses associated with financial deepening and macroeconomics fluctuations (Atsebi et al., 2025; Mian et al., 2020; Müller & Verner, 2024).

Table 3 indicates that digital financial development (FIN_DEV) exerts a positive but gradually declining influence on bank credit. This suggests that digital finance initially develops alongside traditional banking activity but becomes progressively less closely linked to aggregate credit expansion over time (de Vries, 2019; Prasetyoputra et al., 2025; Xuan & Trung, 2022). The estimated effect of income inequality (INEQ) on CREDIT is relatively small and varies over time. This pattern indicates heterogeneous access across different income groups, although the magnitude of this relationship changes across periods (Minetti et al., 2021; Peruzzi et al., 2023; Benczúr & Kvedaras, 2021).

Per capita income (GDP_PC) displays a consistently positive and strengthening relationship with bank credit, indicating that credit expansion in Indonesia is closely associated with macroeconomic growth conditions. The magnitude of this relationship increases during later periods of the sample, suggesting that credit becomes progressively more responsive to economic growth (Atsebi et al., 2025; Braun et al., 2024; Müller & Verner, 2024).

Table 3
Time-Varying Coefficient Dynamics in Credit Distribution Equation

FIN_DEV	CREDIT	INEQ	GDP_PC	(Intercept)
0.1150	1.1586	0.2450	2.3897	-29.0416
0.1105	1.0184	0.2121	2.1312	-20.4167
0.1060	0.8782	0.1792	1.8727	-11.7884
0.1014	0.7379	0.1461	1.6143	-3.1566
0.0969	0.5977	0.1130	1.3559	5.4785
0.0924	0.4574	0.0798	1.0975	14.1170
0.0879	0.3171	0.0465	0.8392	22.7590
0.0834	0.1768	0.0131	0.5809	31.4045
0.0788	0.0365	-0.0203	0.3227	40.0533
0.0743	-0.1037	-0.0539	0.0644	48.7055
0.0698	-0.2441	-0.0876	-0.1937	57.3612
0.0653	-0.3845	-0.1213	-0.4518	66.0203
0.0608	-0.5248	-0.1552	-0.7099	74.6829
0.0563	-0.6652	-0.1891	-0.9680	83.3488
0.0517	-0.8056	-0.2232	-1.2261	92.0182
0.0472	-0.9460	-0.2573	-1.4841	100.6911

4.3 Time-Varying Dynamics of Income Inequality (INEQ)

This subsection reports the time-varying determinants of income inequality. A time-varying specification is essential because the distributional effects of finance are known to differ across development stages, institutional contexts, and credit regimes (Öndes & Kızılgöl, 2024; Mushtaq et al., 2024; Nikoloski, 2013; Baiardi & Morana, 2016). The results presented in Table 4 indicate that digital financial development (FIN_DEV) exerts a consistently negative influence on income inequality across the sample period. However, the magnitude of this inequality-reducing effect gradually declines over time (Nokulunga, 2023; Xuan & Trung, 2022; Mo et al., 2024; Prasetyoputra et al., 2025).

In contrast, the estimated coefficient for CREDIT is positive and gradually increases over time, indicating that bank credit expansion is associated with higher levels of income inequality during later periods of the sample. This result supports the view that bank-based credit expansion, when not accompanied by inclusive access, can amplify inequality through collateral and segmentation channels (Minetti et al., 2021; Peruzzi et al., 2023; Mian et al., 2020; Müller & Verner, 2024). Per capita income (GDP_PC) also

displays a modest positive association with inequality, suggesting that income growth is accompanied by changes in income distribution over time (Mushtaq et al., 2024; Chiu & Lee, 2019).

Table 4
Time-Varying Coefficient Dynamics in Income Inequality Equation

FIN_DEV	CREDIT	INEQ	GDP_PC	(Intercept)
-0.0777	0.0265	1.1336	0.1563	-5.0944
-0.0740	0.0332	0.9409	0.1475	1.8379
-0.0703	0.0400	0.7481	0.1387	8.7705
-0.0667	0.0468	0.5554	0.1299	15.7033
-0.0630	0.0535	0.3626	0.1211	22.6363
-0.0593	0.0603	0.1699	0.1124	29.5695
-0.0556	0.0671	-0.0228	0.1036	36.5028
-0.0519	0.0738	-0.2156	0.0949	43.4363
-0.0482	0.0805	-0.4084	0.0862	50.3701
-0.0446	0.0873	-0.6012	0.0775	57.3040
-0.0409	0.0940	-0.7941	0.0689	64.2381
-0.0372	0.1008	-0.9869	0.0602	71.1724
-0.0335	0.1075	-1.1798	0.0516	78.1068
-0.0299	0.1142	-1.3727	0.0430	85.0415
-0.0262	0.1209	-1.5655	0.0344	91.9763
-0.0225	0.1277	-1.7584	0.0259	98.9114

4.4 Time-Varying Dynamics of Per Capita Income (GDP_PC)

This subsection examines the time-varying determinants of per capita income (GDP_PC). The time-varying estimates allow assessment of whether growth is driven by productive intermediation or by inequality-reinforcing financial mechanisms (Mian et al., 2020; Braun et al., 2024). The results indicate that digital financial development (FIN_DEV) has a relatively small and slightly negative association with per capita income growth across much of the sample period. The magnitude of this relationship remains relatively modest throughout the sample (Braun et al., 2024; de Vries, 2019).

The coefficient of CREDIT becomes increasingly positive over time, indicating that bank credit plays a progressively stronger role in supporting per capita income growth during later periods of the sample. At

the same time, inequality (INEQ) also displays a positive association with GDP_PC in several periods, indicating that economic growth and inequality may increase simultaneously during certain phases of the sample period. Such dynamics are consistent with non-linear finance-growth-inequality interactions observed in emerging economies (Öndes & Kızılgöl, 2024; Mushtaq et al., 2024; Müller & Verner, 2024; Nikoloski, 2013; Chiu & Lee, 2019).

Table 5
Time-Varying Coefficient Dynamics in Per Capita Income Equation

FIN_DEV	CREDIT	INEQ	GDP_PC	(Intercept)
-0.1514	-0.8389	0.3535	-0.7160	29.1426
-0.1459	-0.6848	0.3901	-0.6302	21.6114
-0.1403	-0.5308	0.4267	-0.5444	14.0772
-0.1348	-0.3767	0.4634	-0.4586	6.5399
-0.1293	-0.2226	0.5002	-0.3728	-1.0002
-0.1238	-0.0685	0.5370	-0.2870	-8.5435
-0.1183	0.0855	0.5739	-0.2013	-16.0899
-0.1128	0.2396	0.6109	-0.1155	-23.6393
-0.1073	0.3937	0.6480	-0.0297	-31.1917
-0.1018	0.5479	0.6851	0.0560	-38.7472
-0.0962	0.7020	0.7223	0.1417	-46.3056
-0.0907	0.8562	0.7595	0.2275	-53.8671
-0.0852	1.0104	0.7968	0.3132	-61.4317
-0.0797	1.1646	0.8342	0.3990	-68.9993
-0.0742	1.3189	0.8716	0.4847	-76.5699
-0.0687	1.4731	0.9091	0.5704	-84.1436

4.5 Time-Varying Impulse Response Functions (IRFs)

The time-varying impulse response functions (IRFs) provide additional insight into the dynamic transmission of financial shocks. The results indicate that shocks to digital financial development generally reduce income inequality, although the magnitude of this effect decline over time. In contrast, shocks to bank credit tend to increase inequality while simultaneously exerting a progressively stronger positive effect on per capita income growth in later years. This duality highlights the credit-allocation channel, whereby credit expansion stimulates growth but may simultaneously exacerbate income inequality when access is uneven (Atsebi et al., 2025; Mian et al., 2020).

Table 6
Impulse Response Function (IRF)

Year	FINDEV_to_INEQ	CREDIT_to_INEQ	FINDEV_to_GDPPC	CREDIT_to_GDPPC
2009	-0.0778	0.0265	-0.1512	-0.8391
2010	-0.0741	0.0333	-0.1461	-0.6853
2011	-0.0704	0.0401	-0.1431	-0.5311
2012	-0.0667	0.0468	-0.1352	-0.3772
2013	-0.0631	0.0536	-0.1293	-0.2231
2014	-0.0593	0.0603	-0.1242	-0.0686
2015	-0.0557	0.0671	-0.1185	0.0855
2016	-0.0521	0.0738	-0.1132	0.2432
2017	-0.0483	0.0806	-0.1071	0.3944
2018	-0.0446	0.0873	-0.1024	0.5482
2019	-0.0409	0.0941	-0.0963	0.7021
2020	-0.0373	0.1011	-0.0908	0.8561
2021	-0.0336	0.1081	-0.0853	1.0123
2022	-0.0299	0.1141	-0.0798	1.1621
2023	-0.0262	0.1212	-0.0743	1.3211

4.6 Model Fit and Dynamic Consistency

Model fit and diagnostic checks indicate that the TVP-VAR specification captures the main dynamic patterns in the data. Predicted series closely follow observed values across most variables, indicating that the model adequately reproduces the underlying time-series behaviour of digital financial development, credit expansion, income inequality, and economic growth. Residuals appear relatively small and do not display systematic patterns, suggesting that the model provides a consistent representation of the evolving relationships among the variables.

Overall, the diagnostic results suggest that the estimated TVP-VAR model successfully captures the evolving interactions among financial development, bank credit, income inequality, and economic growth in Indonesia during the sample period. In detailed, for FIN_DEV, predicted values closely track actual observations, reflecting high persistence and smooth adjustment dynamics. Residuals are small and randomly distributed, indicating that the model captures the dominant drivers of digital financial development without systematic misspecification.

For bank credit (CREDIT), predicted and actual series align closely, reproducing the observed rise, peak, and subsequent stabilization of income inequality. Residuals are small and randomly distributed, indicating accurate modelling of inequality dynamics. Overall, diagnostic evidence confirms that the TVP-VAR model effectively captures evolving relationships among digital financial development, credit expansion, growth, and inequality, consistent with gradual structural change in Indonesia's financial sector.

For income inequality (INEQ), predicted and actual series align closely, reproducing the observed rise, peak, and subsequent stabilization of income inequality. Residuals are small and randomly distributed, indicating accurate modelling of inequality dynamics. Overall, diagnostic evidence confirms that the TVP-VAR model effectively captures evolving relationships among digital financial development, credit expansion, growth, and inequality, consistent with gradual structure change in Indonesia's financial sector.

5. DISCUSSION

5.1 Digital Financial Development: Inclusive but Growth-Neutral in the Short-Run

The empirical results show that digital financial development consistently reduces income inequality across the sample period, although the magnitude of the effect declines gradually over time. This finding provides empirical support for **Hypothesis H1**, which posits that digital financial development can reduce income inequality by expanding access to basic financial services. In the Indonesian context, the expansion of mobile banking, digital payment platforms, and e-wallet ecosystems appears to have improved financial access among previously underserved groups, particularly during the early stages of digital finance diffusion.

The declining magnitude of this inequality-reducing effect suggests that the strongest distributional benefits of digital financial inclusion occur during the early diffusion stage. As digital financial access becomes widespread, additional expansion of digital services generates smaller marginal improvements in income distribution. This pattern is consistent with the broader literature on financial inclusion, which suggests that digital finance primarily reduces inequality by lowering entry barriers to financial services, rather than by directly transforming productive investment opportunities (Öndes & Kızılgöl, 2024; Mushtaq et al., 2024; Nikoloski, 2013; Baiardi & Morana, 2016).

At the same time, the results indicate that digital financial development has only a modest relationship with per capita income growth. This suggests that digital financial innovation in Indonesia currently operates primarily as a transactional infrastructure rather than as a major driver of productive investment. In other words, digital financial inclusion improves access to financial services but does not automatically translate into stronger economic growth (Xuan & Trung, 2022; Mo et al., 2024; Nokulunga, 2023; Braun et al., 2024; de Vries, 2019).

From a policy perspective, these results suggest that digital financial inclusion policies should be complemented by mechanisms that connect digital platforms to productive credit channels. Strengthening the integration between fintech platforms, SME lending programs, and credit assessment systems could enhance the ability of digital finance to support both inclusive access and long-term economic growth (Minetti et al., 2021; Mian et al., 2020; Peruzzi et al., 2023; Müller & Verner, 2024).

5.2 Bank Credit: From Macroeconomic Volatility to a Growth Driver

The behaviour of bank credit exhibits a clear structural transition over time, reflecting changes in intermediation quality and macro-financial conditions. In the earlier periods of the sample, credit shocks display relatively weak growth effects, whereas in later periods the positive impact of credit on per capita income becomes increasingly pronounced. This finding is consistent with **Hypothesis H3**, which suggests that the growth effects of bank credit become stronger over time as financial intermediation improves and credit allocation becomes more efficient. This transition aligns with international evidence that credit deepening supports growth only when lending is reoriented toward more productive activities and supported by stronger institutional frameworks (Atsebi et al., 2025; Öndes & Kızılgöl, 2024; Braun et al., 2024; Mian et al., 2020).

However, the results simultaneously show that bank credit expansion is associated with increasing income in equality, supporting **Hypothesis H2.** This pattern suggests that credit expansion in Indonesia remains unevenly distributed across income groups, with higher-income households and established firms capturing a disproportionate share of bank-based financial resources, particularly in emerging economies where access constraints, informality, and collateral requirements remain binding (Benczúr & Kvedaras, 2021; Chiu & Lee, 2019). As a result, credit-driven growth can coexist with rising inequality, highlighting a fundamental trade-off between growth and distribution when credit allocation remains segmented (Minetti et al., 2021; Minetti et al., 2021).

5.3 Credit Allocation and Inequality Dynamics

The findings highlight a clear asymmetry between digital financial development and traditional bank credit in shaping income inequality. Digital financial services operate primarily through access-enhancing mechanisms that broaden financial participation, whereas bank credit functions through accumulation-enhancing mechanisms that influence the distribution of capital and investment opportunities. Digital financial development (FIN_DEV) consistently reduces inequality, reflecting its role in expanding access to basic financial services, while CREDIT persistently amplifies inequality, underscoring the importance of distinguishing between access-enhancing and accumulation-enhancing financial channels (Atsebi et al., 2025; Baiardi & Morana, 2016).

The declining marginal impact of digital financial development (FIN_DEV) on inequality suggests that the strongest distributional benefits occur during early stages of financial inclusion (Nokulunga, 2023; Prasetyoputra et al., 2025). Once basic access becomes widespread, further improvements in financial

inclusion generate smaller distributional gains unless they are complemented by broader credit-access policies. This pattern is consistent with cross-country evidence that digital inclusion delivers its strongest returns (Xuan & Trung, 2022; Mo et al., 2024).

In contrast, the increasing association between bank credit (CREDIT) and inequality (INEQ) suggests that credit allocation remains concentrated among borrowers with stronger financial capacity and collateral access. This highlights the importance of credit allocation structures rather than aggregate credit volume in determining the distributional consequences of financial development (Mian et al., 2020; Müller & Verner, 2024), particularly in bank-dominated financial systems. An additional insight from the time-varying estimates is the declining persistence of income inequality, suggesting that inequality becomes more responsive to short-term shocks and policy interventions over time. This reduced persistence is consistent with evidence that macro-financial stabilization and targeted inclusion policies can moderate inequality dynamics, even when underlying structural disparities remain (Atsebi et al., 2025; de Vries, 2019).

5.4 Exclusive Growth and Policy Sequencing

Taken together, the results suggest the emergence of an “exclusive growth” regime in which economic growth increasingly depends on credit expansion while income inequality simultaneously rises (Öndes & Kızılgöl, 2024; Chiu & Lee, 2019; Mushtaq et al., 2025). This finding supports **Hypothesis H4** and highlights a central challenge for financial development in emerging economies: financial deepening may support economic expansion without necessarily delivering inclusive distributional outcomes.

These results underscore the importance of policy sequencing in financial development strategies. In early stages of financial inclusion, policies that expand digital access and financial literacy can generate significant reductions in inequality. As financial systems mature and credit becomes a primarily engine of economic growth, however, policy priorities must shift toward improving credit allocation mechanisms and expanding access to productive lending opportunities to underserved groups. This sequencing perspective reinforces the view that inclusive growth require coordinated financial, macroprudential, and distributive policies that adapt to evolving financial regimes rather than relying on one-size-fits-all solutions (Atsebi et al., 2025; Frost & van Stralen, 2018; Malovaná et al., 2025; de Vries, 2019).

6. CONCLUSION

This study investigates the evolving relationship between digital financial development (FIN_DEV), bank credit expansion (CREDIT), income inequality (INEQ), and economic growth (GDP_PC) in Indonesia using Time-Varying Parameter Vector Autoregression (TVP-VAR) framework. By allowing the interactions among these variables to change over time, the analysis provides new evidence on how different forms of financial development shape both economic growth and income distribution. This contributes directly to the literature on the non-linear finance-inequality nexus by offering country-level evidence from a large emerging economy (Öndes & Kızılgöl, 2024; Nikoloski, 2013; Baiardi & Morana, 2016; Mushtaq et al., 2024).

The results show that digital financial development contributes to reducing income inequality, particularly during the early stages of financial inclusion when access to financial services expands rapidly. This finding reinforces the distinction between inclusion-oriented financial services—such as digital payments—the later-stage fintech expansion, which yields smaller distributional benefits without complementary redistributive or credit-allocation policies (Nokulunga, 2023; Xuan & Trung, 2022; Mo et al., 2024). However, the impact of digital finance on economic growth remains relatively limited, suggesting that its primary contribution lies in improving financial access rather than directly stimulating productive investment. The findings reveal a clear financial development paradox: despite rapid banking expansion and digitalisation, income inequality remains persistent and at times intensifies, demonstrating that financial deepening alone is insufficient to generate inclusive growth. This paradox underscores the central role of credit allocation and institutional conditions in shaping distributional outcomes, consistent with international evidence that finance can either mitigate or exacerbate inequality depending on how financial resources are allocated (Nokulunga, 2023; Peruzzi et al., 2023; Mushtaq et al., 2024; Chiu & Lee, 2019).

In contrast, bank credit (CREDIT) becomes an increasingly important driver of economic growth over time. As financial intermediation improves, credit expansion plays a stronger role in supporting investment and economic activity. At the same time, the results indicate that credit expansion is associated with rising income inequality, reflecting uneven access to formal credit markets. This evolution confirms that credit supports growth only when lending is reoriented toward productive sectors and supported by effective regulatory and macroprudential frameworks (Atsebi et al., 2025; Öndes & Kızılgöl, 2024; Mian et al., 2020; Müller & Verner, 2024; Braun et al., 2024).

Taken together, the findings reveal a structural asymmetry between digital financial inclusion and traditional bank credit. Digital financial development operates primarily through an access-enhancing channel that reduces inequality, whereas bank credit functions through a capital-accumulation channel that supports economic growth but may widen income disparities. Despite its enhanced contribution to growth, bank credit continues to disproportionately benefit higher-income and collateral-rich groups, thereby amplifying income inequality over time. This result reinforces the arguments that credit allocation—rather than aggregate credit volume—is a central mechanism linking financial development to inequality, particularly in bank-dominated financial systems with segmented access (Minetti et al., 2021; Peruzzi et al., 2023; Benczúr & Kvedaras, 2021; Chiu & Lee, 2019).

More broadly, the results suggest the emergence of an “exclusive growth” regime in which economic expansion becomes increasingly dependent on credit while income inequality simultaneously increases. This pattern highlights the challenge of ensuring that financial deepening translates into inclusive development outcomes.

From a policy perspective, the results indicate that expanding digital financial inclusion can play an important role in reducing inequality by lowering barrier to financial participation. However, digital access alone is insufficient to generate inclusive growth. Policies must also address the allocation of bank

credit by expanding access to productive lending opportunities for small firms and underserved households. Improving credit access for small and medium-sized enterprises, strengthening financial literacy, and promoting inclusive lending frameworks may help ensure that financial development contributes to both economic growth and equitable income distribution.

Despite these contributions, several limitations should be acknowledged. First, the analysis relies on a relatively short time-series due to the limited availability of consistent digital financial indicators. Second, the study uses aggregate financial variables and therefore cannot fully capture differences in credit allocation across sectors, regions, or income groups.

Future research could extend the analysis by incorporating more detailed data on sectoral credit allocation, household financial access, and regional financial inclusion patterns. Such data would allow researchers to examine more precisely how credit allocation mechanisms shape inequality and growth dynamics. The findings of this study may also provide a useful framework for examining similar financial development dynamics in other emerging economies undergoing rapid digital financial transformation.

Declarations

ACKNOWLEDGEMENT

This research paper is compulsary outcome of the Lecturer Internal Grant for Research and Community Services (DPP) scheme for 2025 with grant number: **08751/UN10.F0201/B/PG/2025**, Department of Economics, Faculty of Economics and Business Universitas Brawijaya, collaborated with International Scholar from Universiti Utara Malaysia and BRAC University Bangladesh.

Authors' contributions

Setyo Tri Wahyudi was involved in the concept, design, research process, participated in data collections and statistics, and written the manuscript.

Md. Mahmudul Alam was involved written the manuscript (revision).

Firmansyah was involved in statistics and econometrics analyisis, also collaborate in writtehn of the manuscript.

Rihana Sofie Nabella supports the methodology process, collections of the data, statistics and econometrics analysis, also collaborate in written of the manuscript.

Amalia Rahmawati supports the methodology process, collections of the data, statistics and econometrics analysis, also collaborate in written of the manuscript.

Kartika Sari supports the methodology process, collections of the data, statistics and econometrics analysis, also collaborate in written of the manuscript.

All authors read and approved the final manuscript before submission.

Competing interest There is competing interest

Funding

The research leading to these results received funding from Faculty of Economics and Business Universitas Brawijaya under Grant Agreement No : **08751/UN10.F0201/B/PG/2025** under Lecturer Internal Grant for Research and Community Services (DPP) scheme for 2025.

About the Authors

Setyo Tri Wahyudi is a professor of economics at Department of Economics, Universitas Brawijaya. His research interest include regional economics, monetary economics, macroeconomics, and quantitative methods. He can contacted at: setyo.tw@ub.ac.id

Md. Mahmudul Alam is a professor of Finance at BRAC Business School, BRAC University. He also serves as a Senior Research Fellow at the Economic and Financial Policy Institute, Universiti Utara Malaysia (UUM), where he was a faculty member for over a decade. He can contacted at: mahmudul.alam@bracu.ac.bd

Fimansyah is a professor of economics at Department of Economics, Universitas Diponegoro. His research interest include development economics, macroeconomics, and quantitative methods. He can contacted at: firmansyah@lecturer.undip.ac.id

Rihana Sofie Nabella is a is a junior lectures at Department of Economics, Universitas Brawijaya Malang Indonesia and currently is Ph.D student at Department of Economics, Monash University Campus Indonesia. She can contacted at: sofierihana@ub.ac.id

Amalia Rahmawati is a junior lectures at Department of Economics, Universitas Brawijaya Malang Indonesia. She can contacted at: amaliar@ub.ac.id

Kartika Sari is a junior lectures at Department of Economics, Universitas Brawijaya Malang Indonesia. She can contacted at: ksari@ub.ac.id

ORCID

Setyo Tri Wahyudi https://orcid.org/0000-0003-4779-5747

Md. Mahmudul Alam https://orcid.org/0000-0002-7360-1259

Firmansyah https://orcid.org/0000-0003-3424-2545

Rihana Sofie Nabella https://orcid.org/0000-0003-3943-9240

Amalia Rahmawati No information

Kartika Sari No information

Data availability All original data used in this article are available on request.

References

1. Atsebi J-M, Ligonnière S, Mathonnat C (2025) Not all banking crises are alike: Assessing their distributional impacts relative to pre-crisis credit gaps. J Int Money Finance 150:103220. https://doi.org/10.1016/j.jimonfin.2024.103220
2. Baiardi D, Morana C (2016) The financial Kuznets curve: Evidence for the euro area. J Empir Finance 39:265–269. https://doi.org/10.1016/j.jempfin.2016.08.003
3. Benczúr P, Kvedaras V (2021) Nonlinear impact of financial deepening on income inequality. Empirical Economics 60(4):1939–1967. https://doi.org/10.1007/s00181-019-01819-w
4. Braun M, Marcet F, Raddatz C (2024) The good, the bad, and the not-so-ugly of credit booms? capital allocation and financial constraints. J Banking Finance 161:107098. https://doi.org/10.1016/j.jbankfin.2024.107098
5. Chiu Y-B, Lee C-C (2019) Financial development, income inequality, and country risk. J Int Money Finance 93:1–18. https://doi.org/10.1016/j.jimonfin.2019.01.001
6. de Vries BJM (2019) Inequality, SDG10 and the financial system. Global Sustain 2:e9. https://doi.org/10.1017/S2059479819000061
7. Delis MD, Hasan I, Kazakis P (2014) Bank Regulations and Income Inequality: Empirical Evidence. Rev Financ 18(5):1811–1846. https://doi.org/10.1093/rof/rft039
8. Frost J, van Stralen R (2018) Macroprudential policy and income inequality. J Int Money Finance 85:278–290. https://doi.org/10.1016/j.jimonfin.2017.11.010
9. Johansson AC, Wang X (2014) Financial sector policies and income inequality. China Econ Rev 31:367–378. https://doi.org/10.1016/j.chieco.2014.06.002
10. Malovaná S, Janků J, Hodula M (2025) Macroprudential Policy and Income Inequality: The Trade-Off Between Crisis Prevention and Credit Redistribution. Int J Cent Bank 21(4):249–349
11. Mian A, Sufi A, Verner E (2020) How Does Credit Supply Expansion Affect the Real Economy? The Productive Capacity and Household Demand Channels. J Finance 75(2):949–994. https://doi.org/10.1111/jofi.12869
12. Minetti R, Murro P, Peruzzi V (2021) Not all banks are equal: cooperative banking and income inequality. Econ Inq 59(1):420–440. https://doi.org/10.1111/ecin.12932
13. Mo Y, Mu J, Wang H (2024) Impact and Mechanism of Digital Inclusive Finance on the Urban–Rural Income Gap of China from a Spatial Econometric Perspective. Sustainability 16(7):2641. https://doi.org/10.3390/su16072641

14. Müller K, Verner E (2024) Credit Allocation and Macroeconomic Fluctuations. Rev Econ Stud 91(6):3645–3676. https://doi.org/10.1093/restud/rdad112
15. Mushtaq S, Younsi M, Sagheer Z (2024) J Knowl Econ 16(2):10136–10163. https://doi.org/10.1007/s13132-024-02302-3. Non-linearity Between Finance and Income Inequality: A Panel Data Analysis for EAGLE Countries
16. Nikoloski Z (2013) Financial sector development and inequality: is there a financial Kuznets curve? J Int Dev 25(7):897–911. https://doi.org/10.1002/jid.2843
17. Nokulunga M (2023) Financial deepening on income inequality: A quantitative meta-analysis study. https://doi.org/10.1556/204.2023.00026
18. Öndes H, Kızılgöl Ö (2024) Financial Development and Income Inequality in Newly Industrialized Countries: Does Financial Kuznets Curve Exists? J Knowl Econ 15(4):15618–15651. https://doi.org/10.1007/s13132-023-01705-y
19. Peruzzi V, Murro P, Di Colli S (2023) The distributional impact of local banking. Evidence from the financial and sovereign-debt crises. Eur J Polit Econ 80:102478. https://doi.org/10.1016/j.ejpoleco.2023.102478
20. Prasetyoputra P, Isnasari Y, Prasojo APS, Hermawan I, Statistics (2025) Optim Inform Comput, 15(1), 93–127. https://doi.org/10.19139/soic-2310-5070-2852
21. Xuan PTT, Trung ND (2022) Fintech Credit, Digital Payments, and Income Inequality: Ridge and Bayesian Ridge Approach (Vol. 427, pp. 621–634). https://doi.org/10.1007/978-3-030-98689-6_41

Figures

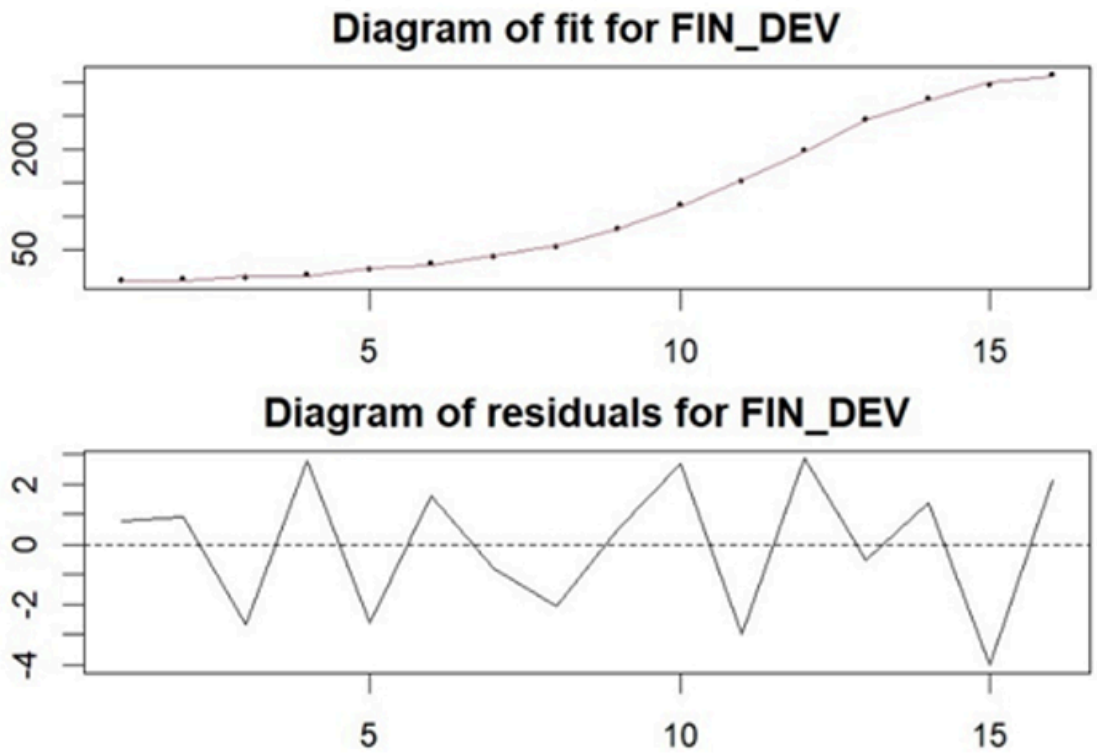


Figure 1

Dynamic Impact of the Financial Sector on Inequality

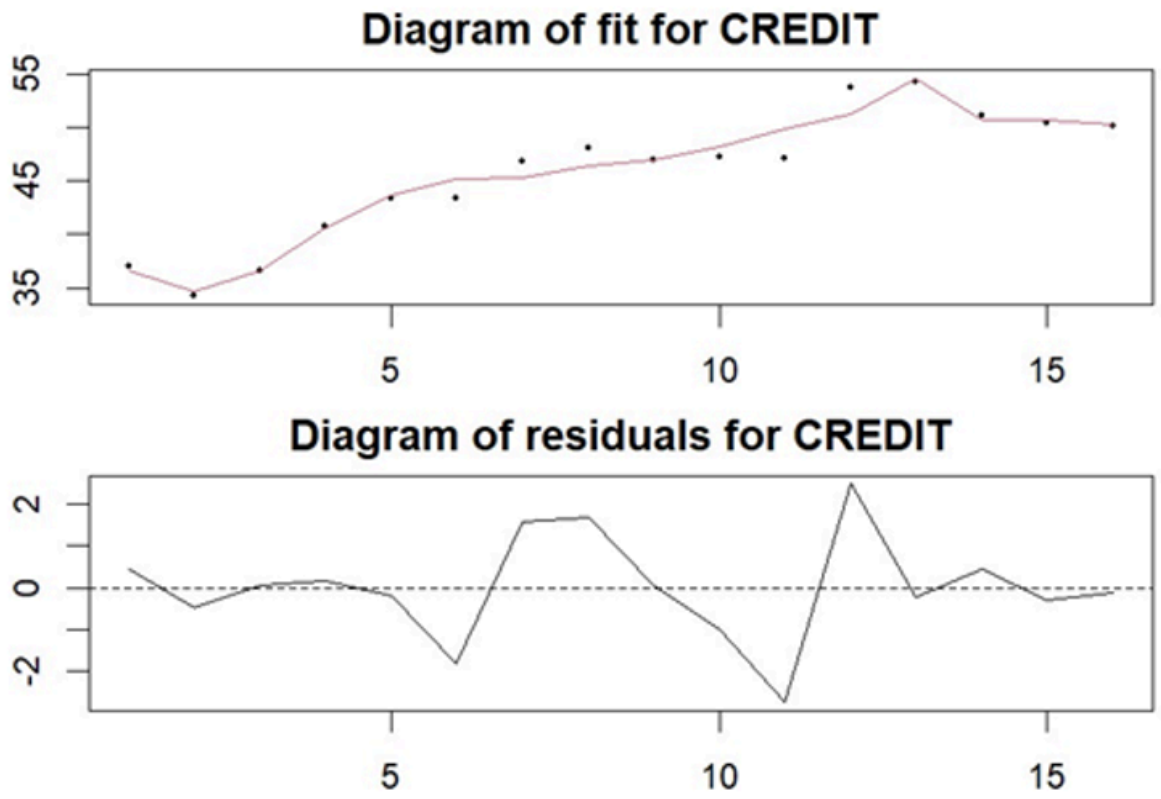


Figure 2

Dynamic Impact of the Credit

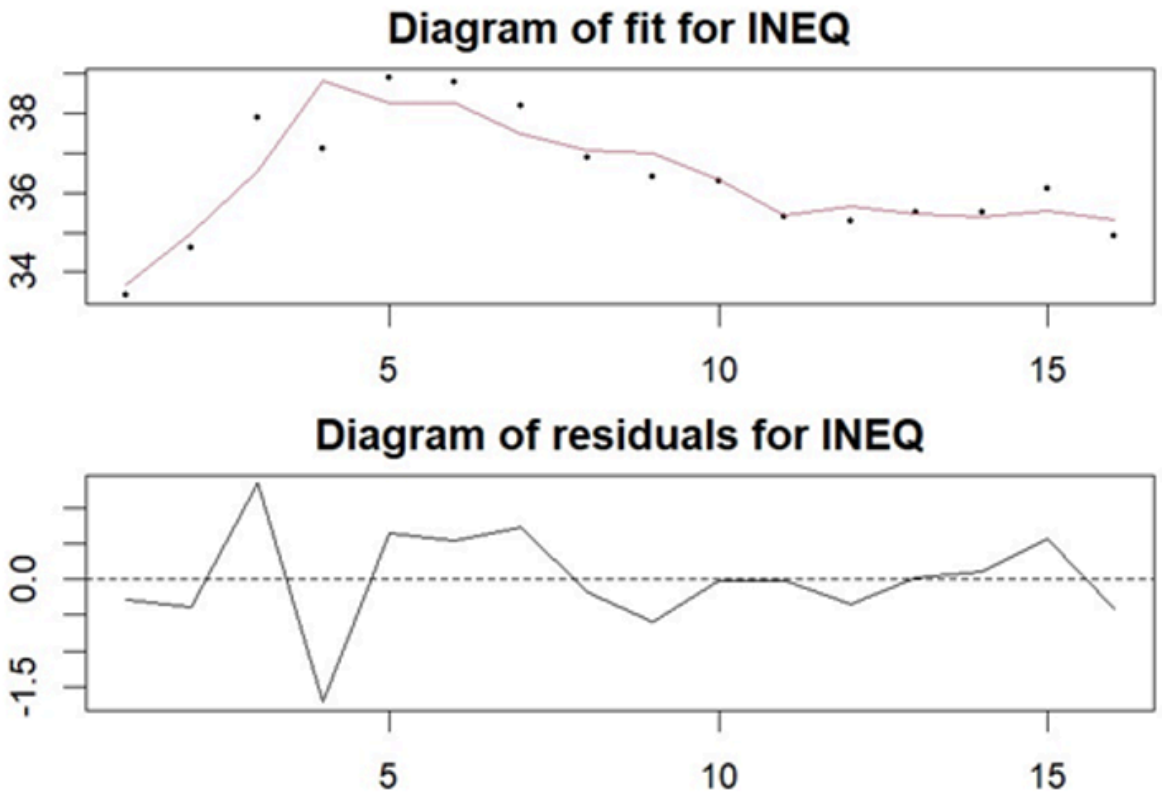


Figure 3

Dynamic Impact of the Inequality

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Appendix.docx