Financial Inclusion and Economic Growth in Nigeria: The Transmission Role of SME Financing

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Abstract
This study examined the relationship between financial inclusion, small and medium-sized enterprise (SME) financing, and economic growth in Nigeria, with particular attention to the possible role of SME financing in transmitting the benefits of financial inclusion to the real economy. The study adopted an ex post facto research design and used annual secondary time-series data covering 1981–2023. Financial inclusion was measured by the Chi-Win Financial Inclusion Index (CFII), SME financing by commercial bank credit to SMEs, and economic growth by real gross domestic product (GDP). The variables were expressed in natural logarithms. The data were analysed using descriptive statistics, the Augmented Dickey–Fuller (ADF) unit-root test, lag selection, Johansen cointegration analysis, vector autoregression (VAR), diagnostic tests, Granger-causality tests, impulse-response functions, and forecast-error variance decomposition. The ADF results showed that all three variables were non-stationary at levels but became stationary after first differencing, indicating that they were integrated of order one, I (1). The Johansen tests did not provide consistent evidence of a long-run equilibrium relationship among the variables at the 5 per cent significance level. The VAR estimates showed a positive and statistically significant association between lagged SME financing and real GDP in the three-variable model, whereas the coefficient of financial inclusion was statistically insignificant. However, the Granger-causality tests did not establish predictive causality from financial inclusion to SME financing or from SME financing to real GDP. Rather, they indicated a unidirectional predictive relationship from real GDP to SME financing. The impulse-response analysis showed a positive response of real GDP to an SME-financing shock over the forecast horizon. Nevertheless, residual autocorrelation and diagnostic concerns in the estimated models, together with the absence of consistent cointegration evidence, require cautious interpretation. The study concludes that SME financing is positively associated with Nigeria's real economic performance, but the available evidence does not conclusively establish that it transmits the effect of financial inclusion to economic growth. It therefore recommends strengthening access to affordable finance for SMEs, improving financial inclusion initiatives, and ensuring that credit supports productive enterprise activities. Further empirical work should refine model specification and verify the dynamic estimates to establish the relationships more robustly.

Keywords: *Financial Inclusion, SME Financing, Economic Growth, Chi-Win Financial Inclusion Index, Commercial Bank Credit, Real Gross Domestic Product, Nigeria.*

1. Introduction

Financial inclusion has become an important component of economic development policy because of its potential to expand access to financial services, mobilise savings, facilitate investment and improve the allocation of financial resources. It refers broadly to the availability and effective use of affordable and appropriate financial products and services by individuals and businesses, particularly those traditionally underserved by formal financial institutions. These services include savings accounts, credit facilities, payment systems, insurance and digital financial products (Sarma, 2008; Demirgüç-Kunt et al., 2022). By reducing barriers to financial access, an inclusive financial system can support entrepreneurship, investment and productive economic activity.

The contribution of financial inclusion to economic growth, however, depends not only on whether financial services are available but also on how effectively they are used. Access to financial services may improve households' ability to save and manage risks, while businesses can benefit through improved payment systems, working capital and investment financing. The productive use of these services can increase business capacity, encourage innovation and support employment generation. Consequently, financial inclusion may influence economic growth both directly, through improved financial intermediation, and indirectly, through its contribution to productive enterprises. In Nigeria, financial inclusion has received considerable policy attention. The Central Bank of Nigeria introduced the National Financial Inclusion Strategy in 2012 and subsequently revised it in 2018. Initiatives associated with the strategy have included agent banking, mobile money, tiered Know-Your-Customer requirements, payment service banks and financial literacy programmes. These measures have sought to improve access to formal financial services and reduce financial exclusion. Nevertheless, challenges relating to financial infrastructure, affordability, digital literacy and differences in access across population groups remain relevant to the country's financial inclusion agenda (Central Bank of Nigeria, 2018; EFInA, 2023). The relationship between financial inclusion and economic growth is particularly important when considered alongside the financing needs of small and medium enterprises (SMEs). SMEs contribute to employment generation, entrepreneurship, innovation, income creation and domestic production. Their ability to fulfil these functions depends partly on access to adequate and affordable finance. However, SMEs in developing economies frequently encounter financing constraints associated with inadequate collateral, limited credit histories, weak financial records, information asymmetry and the perceived risks of lending to small businesses (Beck, Demirgüç-Kunt, & Maksimovic, 2005). Financial inclusion may help address some of these constraints by bringing more businesses into the formal financial system and improving their access to banking services and credit. When SMEs obtain financing on appropriate terms, they may be better positioned to purchase productive assets, expand operations, adopt technology and improve productivity. These activities can contribute to higher output and employment. SME financing therefore represents a plausible channel through which financial inclusion may influence aggregate economic performance. Despite this potential relationship, an increase in financial inclusion does not automatically translate into increased SME financing or economic growth. Financial institutions may expand their services without allocating a proportionate amount of credit to SMEs. Similarly, increased lending may not generate substantial productive gains where borrowers face weak infrastructure, high operating costs or an unfavourable business environment. The

relationship among financial inclusion, SME financing and economic growth must therefore be investigated empirically rather than assumed.

Existing studies have examined financial inclusion and economic growth, as well as financial access and SME performance. However, findings vary across countries, periods, measures of financial inclusion and estimation techniques. Some studies report positive relationships, while others find weaker or context-dependent effects. In addition, many studies rely on individual indicators of financial inclusion, which may not adequately represent its multidimensional character. This study examines financial inclusion and economic growth in Nigeria, with particular attention to the potential transmission role of SME financing. It employs the Chi-Win Financial Inclusion Index (CFII) as the measure of financial inclusion, commercial bank credit to SMEs as the proxy for SME financing, and real gross domestic product as the measure of economic output. Using annual time-series data covering 1981–2023, the study investigates the relationship between financial inclusion and SME financing, the relationship between SME financing and real GDP, and the joint relationship between financial inclusion, SME financing and real GDP.

The study is intended to contribute to understanding how financial inclusion may be connected to economic growth through the financing of productive enterprises in Nigeria.

1.2 Statement of the Problem

Financial inclusion is widely regarded as an important instrument for improving access to financial services and supporting productive economic activities. In Nigeria, policy initiatives have sought to extend financial services to underserved individuals and businesses. Nevertheless, the extent to which financial inclusion translates into greater SME financing and stronger economic performance remains an empirical question. SMEs require finance to sustain operations, invest in productive assets, expand capacity and improve competitiveness. However, access to formal credit may be constrained by collateral requirements, lending costs, inadequate financial records and information asymmetry. These constraints can limit the capacity of SMEs to undertake productive investments, even where financial services are becoming more widely available.

The problem is therefore not limited to financial exclusion itself. It also concerns whether improvements in financial inclusion are reflected in increased financing for SMEs and whether such financing is associated with higher real economic output. If financial inclusion expands without improving credit availability to productive enterprises, its contribution to economic growth may be weaker than expected. Similarly, greater SME lending may not necessarily translate into higher output unless the financing supports productive activity.

Empirical research has examined the financial inclusion–growth relationship and the relationship between finance and SME performance. However, the evidence is not uniform, and relatively limited attention has been devoted to examining the three relationships within a common framework using a multidimensional financial inclusion measure and a long annual time series for Nigeria. This study addresses the problem by examining the relationship between financial inclusion, commercial bank credit to SMEs and real GDP in Nigeria over the period 1981–2023. It investigates whether financial inclusion is associated with SME financing, whether SME financing is associated with real GDP, and whether financial inclusion and SME financing jointly explain movements in real GDP. The findings will provide evidence relevant to assessing the proposed role of SME financing in the relationship between financial inclusion and economic growth.

1.3 Objectives of the Study

The general objective is to examine the relationship between financial inclusion and economic growth in Nigeria, with particular attention to the transmission role of SME financing. The specific objectives are to:

i. examine the relationship between financial inclusion and SME financing in Nigeria.
ii. investigate the relationship between SME financing and real GDP in Nigeria.
iii. determine the joint relationship between financial inclusion, SME financing and real GDP in Nigeria.

1.4 Statement of Hypotheses

The following null hypotheses are formulated for empirical testing:

H_{01}: Financial inclusion has no statistically significant relationship with SME financing in Nigeria.
H_{02}: SME financing has no statistically significant relationship with real GDP in Nigeria.
H_{03}: Financial inclusion and SME financing have no statistically significant joint relationship with real GDP in Nigeria.

These hypotheses will be evaluated using the estimation procedures appropriate to the time-series properties of the variables. Where dynamic causality is investigated, the relevant Granger causality hypotheses will be tested separately.

2 Review of Related Literature

2.1 Concept of Financial Inclusion

Financial inclusion concerns the extent to which individuals and businesses can access and effectively use appropriate financial services at affordable cost. These services include deposits, credit, payments, insurance and other formal financial products. The concept extends beyond the physical availability of financial institutions to include the effective use, affordability and suitability of the services provided. Sarma (2008) emphasises the multidimensional nature of financial inclusion through indicators associated with banking penetration, availability and usage. This approach recognises that no single indicator is sufficient to represent all aspects of financial inclusion. A country may have a relatively large number of bank branches, for example, without ensuring that financial services are affordable or widely used. Financial inclusion can improve the functioning of the financial system by enabling more households and businesses to participate in formal financial activities. Savings services can support the mobilisation of funds, payment services can reduce transaction costs, and access to credit can enable productive investment. These functions provide a theoretical basis for expecting financial inclusion to contribute to economic activity. Nevertheless, the effect of financial inclusion depends on the quality and productive use of financial services. Access to accounts or payment systems alone does not guarantee that firms will obtain loans or increase output. The relationship between financial inclusion and economic growth must therefore be considered alongside the channels through which financial resources reach productive activities

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2.1.1 Measuring Financial Inclusion

Empirical studies have used individual indicators such as bank branches, deposit accounts, automated teller machines, credit facilities and access to payment systems to measure financial inclusion. While useful, these indicators capture particular aspects of financial access and may not reflect the broader dimensions of inclusion.

Composite indices provide an alternative by combining several indicators into a single measure. Sarma (2008) developed a multidimensional financial inclusion index incorporating aspects of penetration, availability and usage. Okpara (2013) is associated with the Chi-Win Financial Inclusion Index used in the Nigerian context. The present study adopts the Chi-Win Financial Inclusion Index as its measure of financial inclusion. The index is intended to provide a broader representation of financial inclusion than a single banking indicator. Its construction and interpretation must, however, be documented clearly, including the underlying indicators, weights, normalisation procedure and data sources.

2.1.2 SME Financing and Enterprise Development

SMEs are important to economic activity because they contribute to employment, entrepreneurship, production and innovation. Their capacity to expand and remain competitive depends partly on the availability of adequate financing.

SME financing refers to financial resources used by small and medium enterprises to establish, operate, sustain and expand their businesses. Such resources may finance working capital, equipment, technology, production capacity and market development. Financing may be obtained through internal funds, commercial banks, microfinance institutions, development finance institutions, cooperative arrangements and informal sources. Formal credit is particularly relevant where SMEs need funds beyond what can be provided by owners' savings and retained earnings. However, small firms may experience greater difficulties obtaining formal loans because of limited collateral, incomplete financial records, inadequate credit histories and information asymmetry between lenders and borrowers. Beck, Demirgüç-Kunt and Maksimovic (2005) discuss financing obstacles and the constraints faced by firms, particularly smaller enterprises. Commercial bank credit to SMEs provides a measurable indicator of formal lending to the SME sector. In the present study, it serves as the proxy for SME financing. This choice is appropriate to the extent that the available series consistently records commercial bank credit to SMEs over the study period.

However, this measure has limitations. It does not capture every source of SME financing, such as retained earnings, informal loans, equity finance or credit from institutions outside the commercial banking sector. It also measures the value of credit rather than the productivity or ultimate use of the funds. The empirical findings must therefore be interpreted as evidence concerning formal commercial bank credit to SMEs rather than the entire range of SME financing or SME development.

2.1.3 Financial Inclusion and SME Financing

Financial inclusion may facilitate SME financing by improving enterprises' access to formal financial institutions and financial services. Businesses that participate in the formal financial system may be better able to receive payments, maintain transaction records, establish banking relationships and apply for credit. Financial inclusion can also reduce certain transaction costs associated with financial services. Digital payments and banking technologies may make it easier for firms to conduct transactions and interact with financial institutions. Where improved access is accompanied by appropriate lending policies, these developments may support greater availability of formal credit to SMEs. However, a positive relationship is not automatic. Financial institutions make lending decisions based on credit risk, collateral, repayment capacity, profitability and other considerations. Financial inclusion may expand access to basic banking services without necessarily generating a corresponding increase in SME lending.

The relationship between financial inclusion and SME financing is therefore an empirical question. The first model in this study investigates whether movements in the Chi-Win Financial Inclusion Index are associated with changes in commercial bank credit to SMEs in Nigeria.

2.1.4 SME Financing and Economic Growth

Economic growth refers to an increase in the volume of goods and services produced by an economy over time. Real gross domestic product is a widely used measure because it is designed to account for changes in prices and reflect changes in real output.

SME financing may contribute to economic growth when borrowed funds are used for productive purposes. Access to credit can enable firms to acquire machinery, purchase inputs, adopt technology, expand production and enter new markets. These activities may increase enterprise output and productivity. Some studies on SME Financing and economic growth show a financing gap (World Bank 2022), significant long run relationship between SME credit financing and sustainable growth (Usman 2025) and high reliance on personal funds (Taiwo, et al 2016)

At the aggregate level, expansion in productive activity may contribute to higher national output and employment. The extent of the contribution depends, however, on the allocation and use of financing, the productivity of the investments undertaken and the broader economic environment. The relationship can also run in the opposite direction. Higher economic activity may increase demand for credit, improve business revenues and repayment capacity, and encourage financial institutions to lend more. Consequently, a positive relationship between SME credit and real GDP does not, by itself, establish that SME financing causes economic growth.

The second model examines the relationship between SME financing and real GDP. The subsequent dynamic analysis, where appropriate, investigates whether there is evidence of predictive relationships among the variables.

2.1.5 Financial Inclusion, SME Financing and Economic Growth

The proposed relationship among financial inclusion, SME financing and economic growth combines two processes. First, an inclusive financial system may improve access to financial services and increase the opportunities for SMEs to obtain formal credit. Second, SME financing may support productive investments that contribute to economic output. Financial inclusion may also influence economic growth through channels other than SME financing. These include household savings, consumer payments, agricultural finance, financial risk management and the financing of businesses outside the SME sector. SME financing should therefore be viewed as a possible transmission channel rather than the only route through which financial inclusion can influence economic performance. The third model incorporates financial inclusion and SME financing jointly in an equation for real GDP. This allows the study to examine their conditional relationships with real output. If SME financing remains statistically relevant when financial inclusion is included, the result would be consistent with the proposition that SME financing has an independent association with real GDP. It would not, on its own, establish a causal mediation mechanism. A stronger claim about transmission requires evidence that financial inclusion is related to SME financing, that SME financing is related to economic growth, and that the indirect pathway is assessed using a method appropriate to the time-series setting.

2.2 Theoretical Framework

The study draws on Financial Intermediation Theory and Schumpeterian Theory of Innovation. These perspectives provide complementary explanations of how financial services and productive enterprise activity may be linked to economic growth.

2.2.1 Financial Intermediation Theory

Financial Intermediation Theory explains the role of financial institutions in mobilising savings and allocating funds between surplus and deficit economic units. Gurley and Shaw (1960) emphasise the importance of financial intermediaries in the development of financial markets and the financing of economic activity. McKinnon (1973) and Shaw (1973) also examine the relationship between financial development and economic performance.

Financial intermediaries can reduce transaction costs, gather information about borrowers, facilitate payments and allocate financial resources to investment. When access to financial services expands, a larger number of individuals and businesses may participate in formal financial activity. In the context of this study, the theory provides the basis for expecting financial inclusion to be associated with SME financing. If financial inclusion enables businesses to access formal financial institutions more effectively, commercial bank credit to SMEs may increase. The theory also provides a link between financial resource allocation and economic growth, insofar as financing supports productive investment.

2.2.2 Schumpeterian Theory of Innovation

Schumpeterian Theory places entrepreneurship and innovation at the centre of economic development. Schumpeter (1934) argues that entrepreneurs introduce new products, production methods, markets and organisational arrangements that transform economic activity.

Innovation and business expansion often require financial resources. SMEs may need financing to acquire equipment, introduce new technology, improve production processes or expand their market presence. When financing supports such activities, it may contribute to productivity and output growth. The theory is relevant because it explains why the availability of finance may matter beyond the financial sector itself. Financial inclusion can facilitate access to financial services, while SME financing may enable enterprises to use resources for productive purposes. The resulting expansion of economic activity can contribute to real GDP.

However, access to finance does not guarantee innovation or productivity gains. The effect depends on the way funds are used and on the institutional and economic conditions facing enterprises.

2.2.3 Synthesis of the Theoretical Framework

Financial Intermediation Theory explains how financial services and credit may become available to productive enterprises. Schumpeterian Theory explains how enterprises can transform financial resources into investment, innovation and increased output.

Together, these theories support the proposed relationship:

Financial inclusion → SME financing → productive activity → economic growth.

This relationship forms the theoretical foundation for the study. The empirical analysis examines whether the observed Nigerian time-series data are consistent with the proposed links.

2.3 Empirical Review

The empirical literature on financial inclusion, SME financing and economic growth covers different countries, periods, indicators and estimation methods. These differences help explain why the reported results are not always consistent.

Sarma (2008) contributed to the measurement of financial inclusion by developing a composite index based on multiple dimensions of access to and use of banking services. The work is relevant to the present study because it highlights the limitations of relying exclusively on individual indicators. Okpara (2013) is associated with the development and application of the Chi-Win Financial Inclusion Index in Nigeria. The index provides a basis for examining financial inclusion as a composite phenomenon rather than as a single banking indicator.

Kim, Yu and Hassan (2018) examined financial inclusion and economic growth in Organisation of Islamic Cooperation countries and reported evidence of a positive relationship. Their study is relevant to the broader financial inclusion–growth debate, although its cross-country setting differs from the single-country time-series design adopted here.

Sharma (2016) examined the relationship between financial inclusion and economic growth in India and reported a positive relationship. Lenka and Sharma (2017) also considered financial inclusion and economic development. These studies contribute to the literature on the potential macroeconomic benefits of financial inclusion but do not directly establish the transmission role of Nigerian SME credit. Van et al. (2021) examined financial inclusion and SMEs in Vietnam, while Ratnawati (2020) investigated SME financing and economic growth in Indonesia. Such studies are relevant to the two links underlying the present research: the relationship between financial inclusion and SME performance, and the relationship between enterprise financing and aggregate economic activity. Nwanne (2015) examined financial inclusion and economic growth in Nigeria. More recent Nigerian studies have also investigated the financial inclusion–growth relationship using time-series methods. Omoile and Adekunle (2025) call for urgent need to upgrade mobile money infrastructure and expand financial literacy while Ogbonlaiye, Kwanashie and Olushola (2025) found that financial inclusion acts as a significant catalyst for growth in the short run but with negative effect in the long run

The available literature indicates that financial inclusion and SME financing have both attracted empirical attention. However, many studies investigate the direct relationship between financial inclusion and growth or examine financing constraints among SMEs separately. Fewer studies place financial inclusion, commercial bank credit to SMEs and real GDP together in a long-run Nigerian time-series framework.

2.3.1 Summary of Selected Empirical Studies

Author(s)	Context	Focus	Relevance to the present study
Sarma (2008)	Cross-country	Measurement of financial inclusion	Supports the use of a multidimensional financial inclusion measure
Okpara (2013)	Nigeria	Chi-Win Financial Inclusion Index	Provides a basis for the composite index used in this study
Kim, Yu and Hassan (2018)	OIC countries	Financial inclusion and economic growth	Provides cross-country evidence on the financial inclusion–growth relationship
Sharma (2016)	India	Financial inclusion and economic growth	Provides comparative evidence on the growth relationship
Lenka and Sharma (2017)	India	Financial inclusion and economic development	Adds to the literature on financial inclusion and development
Van et al. (2021)	Vietnam	Financial inclusion and SMEs	Relevant to the financial inclusion–enterprise relationship
Ratnawati (2020)	Indonesia	SME financing and economic growth	Relevant to the financing–growth relationship
Nwanne (2015)	Nigeria	Financial inclusion and economic growth	Provides evidence from the Nigerian context
Omoile and Adekunle (2025)	Nigeria	Financial inclusion and economic growth	Relevant for mobile money infrastructure upgrade and financial literacy expansion
Ogbonlaiye, Kwanashie and Olushola (2025)	Nigeria	Financial inclusion and economic growth	Relevant to financial inclusion as short run catalyst to economic growth but negative impact in the long run

2.4 Gap in the Literature

Three related gaps motivate the present study.

First, the empirical relationship between financial inclusion and economic growth remains context-dependent. Differences in measurement, country characteristics, sample periods and estimation methods make it important to examine the relationship within Nigeria's own historical experience.

Second, financial inclusion and SME financing are often examined separately. This limits the ability to assess whether increased financial inclusion is associated with greater formal credit to SMEs and whether such financing is also related to real economic output.

Third, the use of individual banking indicators may not fully represent the multidimensional character of financial inclusion. The present study uses the Chi-Win Financial Inclusion Index to provide a composite measure and commercial bank credit to SMEs to represent formal SME financing. The study addresses these issues by examining annual Nigerian data for 1981–2023 within a common empirical framework involving financial inclusion, SME financing and real GDP. Its contribution lies in investigating the interrelated relationships among these variables using a consistent set of measures and time-series procedures.

3. Methodology

3.1 Research Design

The study adopts a quantitative, ex post facto research design using annual time-series data for Nigeria over the period 1981–2023. The design is appropriate because the study investigates relationships among historical macroeconomic variables that cannot be manipulated experimentally. The quantitative approach enables the variables to be measured consistently and their relationships to be evaluated using econometric methods. The time-series framework also allows the study to investigate dynamic interactions among financial inclusion, SME financing and real GDP, subject to the statistical properties of the data.

The use of historical observations does not, by itself, establish causal effects. Accordingly, the findings will be interpreted in accordance with the evidence provided by the estimation procedures and their underlying assumptions.

3.2 Data Sources and Study Period

The study uses annual secondary data covering 1981–2023. The principal variables are the Chi-Win Financial Inclusion Index, commercial bank credit to SMEs and real gross domestic product. The financial inclusion index is constructed from the relevant indicators obtained from Central Bank of Nigeria statistical publications, following the selected CFII methodology associated with Okpara (2013). Commercial bank credit to SMEs and real GDP are obtained from the relevant Nigerian statistical sources, including Central Bank of Nigeria publications where applicable.

The final manuscript should identify the exact publication or database used for each series and ensure that definitions remain consistent over the study period. Any changes in statistical classification, index construction or data coverage should be documented.

3.3 Measurement of Variables

The variables are defined as follows:

Variable	Symbol	Measurement	Role in the analysis
Financial inclusion	LCFII	Natural logarithm of the Chi-Win Financial Inclusion Index	Explanatory variable
SME financing	LSME	Natural logarithm of commercial bank credit to SMEs	Transmission variable and explanatory variable
Economic growth	LRGDP	Natural logarithm of real gross domestic product	Outcome variable

All three variables are expressed in natural logarithms, consistent with the existing dataset. The log specification allows coefficient interpretation in terms of proportional relationships in the relevant static log-linear models, subject to the estimation method and the properties of the data.

The use of commercial bank credit to SMEs is a proxy for formal bank financing rather than a comprehensive measure of all finance received by SMEs. Likewise, real GDP measures aggregate real output and does not directly measure income distribution or the welfare of individual households.

3.4 Conceptual and Analytical Framework

The conceptual framework treats financial inclusion as the financial-system condition that may improve SME access to formal financing. SME financing may then support productive activity and contribute to economic output.

The proposed relationships are:

Financial inclusion → SME financing
SME financing → real GDP
Financial inclusion and SME financing → real GDP
These relationships are examined through three principal model specifications. The first assesses the relationship between financial inclusion and SME financing. The second examines the relationship between SME financing and real GDP. The third considers financial inclusion and SME financing jointly in explaining real GDP.
The framework recognises that financial inclusion may also influence economic growth through channels other than SME financing. The empirical models therefore provide evidence on the proposed relationships but do not assume in advance that SME financing is the exclusive transmission channel.

3.5 Model Specification
The econometric specifications are derived from Financial Intermediation Theory and Schumpeterian Theory of Innovation.

Model 1: Financial Inclusion and SME Financing
The first model examines the relationship between financial inclusion and commercial bank credit to SMEs.
The functional form is:
$SME_t=f(CFII_t)$
The log-linear specification is:
$LSME_t=\beta_0+\beta_1 LCFII_t+\varepsilon_t$

where:
- $LSME_t$ is the logarithm of commercial bank credit to SMEs;
- $LCFII_t$ is the logarithm of the Chi-Win Financial Inclusion Index;
- β_0 is the intercept;
- β_1 is the coefficient on financial inclusion; and
- ε_t is the error term.

A positive value of β_1 is expected if improvements in financial inclusion are associated with increased commercial bank credit to SMEs.

Model 2: SME Financing and Economic Growth
The second model examines the relationship between SME financing and real GDP.
The functional form is:
$RGDP_t=f(SME_t)$
The log-linear specification is:
$LRGDP_t=\alpha_0+\alpha_1 LSME_t+u_t$

where:
- $LRGDP_t$ is the logarithm of real GDP;
- $LSME_t$ is the logarithm of commercial bank credit to SMEs;
- α_0 is the intercept;

- α_1 is the coefficient on SME financing; and
- u_t is the error term.

A positive value of α_1 is expected if increased SME financing is associated with higher real economic output. The estimated relationship will not automatically be interpreted as causal because economic growth may also influence demand for and availability of credit.

Model 3: Financial Inclusion, SME Financing and Economic Growth

The third model includes financial inclusion and SME financing jointly.

The functional form is:

$RGDP_t=f(CFII_t,SME_t)$

The log-linear specification is:

$LRGDP_t=\gamma_0+\gamma_1 LCFII_t+\gamma_2 LSME_t+v_t$

where:

- $LRGDP_t$ is the logarithm of real GDP;
- $LCFII_t$ is the logarithm of the Chi-Win Financial Inclusion Index;
- $LSME_t$ is the logarithm of commercial bank credit to SMEs;
- γ_0 is the intercept;
- γ_1 and γ_2 are the coefficients to be estimated; and
- v_t is the error term.

This specification examines the conditional relationships of financial inclusion and SME financing with real GDP. The signs and statistical significance of the coefficients will be assessed empirically rather than assumed.

The three models provide a coherent framework for examining the financial inclusion–SME financing–economic growth relationship. The final estimation forms, however, will depend on the time-series properties of the variables and the adequacy of the selected econometric specifications.

3.6 A Priori Expectations

The theoretical framework suggests the following expected relationships:

Parameter	Expected sign	Rationale
β_1	Positive	Greater financial inclusion may improve SMEs' access to formal credit
α_1	Positive	SME financing may support productive investment and higher real output
γ_1	Positive, subject to empirical testing	Financial inclusion may be associated with real output through financial and productive channels
γ_2	Positive, subject to empirical testing	SME financing may be associated with higher real output when financial inclusion is included

These are theoretical expectations, not predetermined findings. The estimated signs, magnitudes and statistical significance may differ from expectations.

3.7 Estimation Procedures

The empirical analysis will follow a sequence designed to ensure that the estimation method is consistent with the statistical properties of the data.

3.7.1 Descriptive Statistics

Descriptive statistics will be used to summarise the central tendency and dispersion of the principal variables. The mean, median, standard deviation, minimum and maximum values will be reported. These statistics will provide an initial overview of the distributions of financial inclusion, SME financing and real GDP.

3.7.2 Unit-Root Testing

The Augmented Dickey–Fuller (ADF) test will be employed to examine the stationarity of each series. The tests will be conducted at levels and, where necessary, first differences. The deterministic terms and lag-selection procedure will be specified consistently and justified.

The null hypothesis of the ADF test is that the series contains a unit root. The test results will be used to determine whether each variable is stationary in levels, becomes stationary after first differencing, or exhibits another integration property.

The integration order must be established before selecting the cointegration and dynamic estimation procedures. The analysis will not assume that all variables have the same integration order without reference to the test results.

3.7.3 Lag-Order Selection

Where a vector autoregression is appropriate, the lag order will be selected using relevant information criteria, including the Akaike Information Criterion (AIC), Schwarz Bayesian Information Criterion (BIC) and Hannan–Quinn Criterion (HQC).

The selected lag order will also be evaluated against residual diagnostic results and the limited sample size. A lag order will not be selected solely because one information criterion favours it if the resulting specification exhibits important diagnostic problems.

3.7.4 Cointegration Analysis

Where the variables in a system are integrated of order one, the Johansen cointegration procedure may be used to test for long-run relationships among them.

The null hypotheses concerning the cointegration rank will be evaluated using the relevant trace and maximum-eigenvalue statistics, with attention to the deterministic specification and lag order.

The conclusion will be based on the test results for the exact variables included in each final system. A cointegration result obtained for a three-variable system will not be treated as proof of cointegration for a different two-variable system. Each system must be evaluated according to its own variables and specification.

3.7.5 VAR and VECM Estimation

The estimation procedure will depend on the integration and cointegration results.

Where variables are integrated of order one and cointegration is established, a Vector Error Correction Model (VECM) may be appropriate for investigating short-run dynamics and adjustment towards the estimated long-run relationship.

Where variables are integrated of order one but cointegration is not established, a VAR in first differences may be appropriate for examining their short-run dynamic interactions.

If the variables have different integration orders or other properties that make these procedures unsuitable, the estimation strategy will be reconsidered rather than imposing a standard VAR/VECM specification without justification.

The choice of estimation method will therefore be made separately for each final model system.

3.7.6 Diagnostic and Stability Tests

The adequacy of the estimated dynamic models will be evaluated using appropriate diagnostic procedures. These may include residual autocorrelation tests, tests for autoregressive conditional heteroscedasticity (ARCH), residual normality tests and stability assessment.

The diagnostic findings will be reported alongside the estimation results. Where important problems are identified, the specification will be reconsidered before the results are treated as final.

3.7.7 Granger Causality

Where appropriate, Granger causality tests will be used to investigate whether past values of one variable provide additional predictive information for another variable, conditional on the selected model. Granger causality is a test of predictive precedence and does not, by itself, establish structural causation. The tests will be conducted using the appropriate estimated system and will be interpreted in accordance with the model's integration properties and specification.

3.7.8 Impulse-Response Analysis and Forecast-Error Variance Decomposition

Where a suitable VAR or VECM has been estimated, impulse-response functions may be used to examine the dynamic response of the variables to innovations in the system. Forecast-error variance decomposition may be used to assess the contribution of innovations in each variable to the forecast-error variance of the others. The interpretation of these results will depend on the estimated model, variable ordering where relevant, and the assumptions underlying the identification of shocks. The analysis will use the final specification rather than mixing results generated from different model versions.

3.8 Data Analysis and Software

The data will be analysed using Gretl. The software will be used for descriptive statistics, unit-root testing, lag selection, cointegration testing where applicable, VAR/VECM estimation, diagnostic tests, Granger causality analysis and dynamic response analysis.

The results will be presented in tables suitable for a research article. Each table will identify the variables, sample period, selected model specification and relevant test statistics. Interpretations will distinguish statistical significance from economic magnitude and will avoid making causal claims that are not supported by the estimation design.

$LSME_t=\beta_0+\beta_1 LCFII_t+\varepsilon_t$

$LRGDP_t=\alpha_0+\alpha_1 LSME_t+\varepsilon_t$

$LRGDPt = \alpha_0+\alpha_1 LSME_t+\varepsilon_t$

$LRGDP_t=\gamma^0+\gamma^1 LCFII_t+\gamma^2 LSMEt+\varepsilon_t$

4. Analysis, Interpretation and Discussion of Findings

4.1 Introduction

This section presents and discusses the empirical results on the relationship between financial inclusion, small and medium-sized enterprise (SME) financing, and economic growth in Nigeria over the period 1981–2023. The variables employed are the logarithm of real gross domestic product (LRGDP), the logarithm of the financial inclusion index (LCFII), and the logarithm of commercial bank credit to SMEs (LSME).

The analysis covers descriptive statistics and normality tests, unit-root tests, lag selection, Johansen cointegration analysis, vector autoregression (VAR) estimation, diagnostic tests, Granger-causality tests, impulse-response analysis, and forecast error variance decomposition. The

purpose is to examine whether financial inclusion is associated with increased SME financing and whether SME financing contributes to economic growth in Nigeria.

The discussion is guided by the study's central argument that financial inclusion may support economic growth partly by improving SMEs' access to formal financing. However, the strength of this transmission mechanism must be established empirically rather than assumed.

4.2 Descriptive Statistics and Normality Tests

Table 4.1 summarises the descriptive statistics and normality tests for the variables used in the analysis.

Table 4.1: Descriptive Statistics and Normality Tests

Statistic	LRGDP	LCFII	LSME
Mean	10.4470	10.4700	2.7280
Median	10.3440	10.6190	2.7952
Minimum	9.6935	9.0616	-1.6874
Maximum	11.2640	12.8190	6.1428
Standard deviation	0.55070	0.93929	1.7170
Skewness	0.18573	0.48995	-0.96215
Excess kurtosis	-1.5667	-0.22490	0.71666
Jarque–Bera statistic	4.64477	1.81098	7.55462
Probability	0.0980	0.4043	0.0229
Decision at 5%	Do not reject normality	Do not reject normality	Reject normality

Source: Authors' computation using Gretl.

Interpretation and discussion

The descriptive statistics reveal differences in the behaviour of real GDP, financial inclusion, and SME financing over the study period.

The mean of LRGDP is 10.4470, while its standard deviation is 0.55070. This indicates that the logged real GDP series exhibits comparatively limited dispersion around its sample mean. Its minimum and maximum values are 9.6935 and 11.2640, respectively.

The mean of LCFII is 10.4700, with a standard deviation of 0.93929. The difference between its minimum and maximum values indicates that financial inclusion experienced considerable variation during the period. This variation is consistent with changes in the availability and use of formal financial services over time, although the descriptive statistics alone cannot establish the causes of those changes. LSME has a mean of 2.7280 and a standard deviation of 1.7170, indicating greater dispersion than the other two logged variables. Its minimum value of -1.6874 and maximum value of 6.1428 suggest substantial changes in the logged measure of commercial bank credit to SMEs during the study period. The Jarque–Bera normality test shows that the null hypothesis of normality cannot be rejected for LRGDP and LCFII at the 5% significance level, given their respective probabilities of 0.0980 and 0.4043. However, the probability for LSME is 0.0229, which is below 0.05. The null hypothesis of normality is therefore rejected for SME financing. This finding suggests that the distribution of SME financing differs from a normal distribution over the sample period. It is important, however, to distinguish the distribution of an individual series from the distribution of the residuals in the estimated VAR models. The latter is considered separately in the diagnostic tests.

Overall, the descriptive statistics establish that the three variables experienced different degrees of variation over the study period. Further econometric tests are necessary to determine their time-series properties and dynamic relationships.

4.3 Unit-Root Tests

The Augmented Dickey–Fuller (ADF) test was used to determine whether the variables are stationary. This is important because estimating a time-series model without accounting for non-stationarity can produce misleading statistical relationships.

Table 4.2: Augmented Dickey–Fuller Unit-Root Test Results

Variable	ADF statistic at level	p-value at level	ADF statistic at first difference	p-value at first difference	Order of integration
LRGDP	-1.5006	0.8298	-4.0107	0.0084	I(1)
LCFII	-1.8004	0.7048	-7.1802	<0.0001	I(1)
LSME	-1.9215	0.6431	-5.5108	<0.0001	I(1)

Source: Authors' computation using Gretl.

Interpretation and Discussion

The ADF results indicate that the null hypothesis of a unit root cannot be rejected for any of the three variables at level. The p-values for LRGDP, LCFII, and LSME are 0.8298, 0.7048, and 0.6431, respectively, all of which exceed the 5% significance level.

After first differencing, the null hypothesis of a unit root is rejected for all three variables. The p-values are 0.0084 for LRGDP and less than 0.0001 for both LCFII and LSME.

The results therefore suggest that the variables are integrated of order one, I(1), under the specifications used for the reported tests. In practical terms, the logged series are non-stationary in levels but become stationary after first differencing.

This finding has an important implication for the subsequent analysis. Since the variables are reported as I(1), the possibility of a long-run equilibrium relationship must be examined through cointegration analysis. If the variables are not cointegrated, a model based on stationary differences may be more appropriate for analysing their short-run interactions.

4.4 Lag Selection and Johansen Cointegration Analysis

4.4.1 Lag selection

The appropriate lag length is important in time-series estimation because too few lags may leave relevant dynamics unmodelled, while too many lags may reduce estimation efficiency, particularly in a relatively small annual sample.

The lag-selection results are summarised below.

Table 4.3: Selected Lag Lengths

Model	Variables as reported in the results file	AIC-selected lag	BIC-selected lag	HQC-selected lag
Model 1	LCFII, LSME	1	1***	1
Model 2	LRGDP, LSME	2	1***	2
Model 3	LRGDP, LCFII, LSME	2	1***	1

*** *are the lag selected to estimation*

Source: Authors' computation using Gretl.

The information criteria do not select the same lag length for all models. For Model 1, all three criteria select one lag. For Model 2, the AIC and HQC select two lags, whereas the BIC selects one lag. For Model 3, the AIC selects two lags, while the BIC and HQC select one lag.

The results file uses a one-lag specification for the subsequent models. This is consistent with all three criteria for Model 1 and with the BIC for Models 2 and 3. Nevertheless, the lag choice should also be assessed in conjunction with the residual diagnostic results. In particular, evidence of residual autocorrelation indicates that the selected specification may not adequately capture all the dynamics in the data.

4.4.2 Johansen cointegration test

The Johansen procedure was applied to determine whether the variables in each reported system share a stable long-run equilibrium relationship.

Table 4.4: Johansen Cointegration Test Results at Lag 1

Model	Variables as reported	Trace statistic, r = 0	Trace p-value	Maximum eigenvalue statistic, r = 0	Maximum eigenvalue p-value	Reported conclusion at 5%
Model 1	LCFII, LSME	8.2979	0.4591	7.8459	0.4032	No cointegration
Model 2	LRGDP, LSME	14.670	0.0651	14.662	0.0412	Mixed result
Model 3	LRGDP, LCFII, LSME	28.6750	0.0678	19.2810	0.0897	No cointegration at 5%

Source: Authors' computation using Gretl.

Interpretation and Discussion

The Johansen test results do not provide sufficient evidence to reject the null hypothesis of no cointegration at the 5% significance level in any of the three reported systems.

For Model 1, which contains financial inclusion and SME financing, the trace-test probability is 0.4591, while the maximum-eigenvalue probability is 0.4032. Both exceed 0.05. The results therefore do not establish a statistically significant long-run equilibrium relationship between financial inclusion and SME financing in this specification.

For Model 2. the trace statistic for the null hypothesis of no cointegration has a probability value of 0.0651, which increases to 0.0758 after the reported sample-size correction. Both values exceed the 5% significance level. Accordingly, the trace test does not reject the null hypothesis of no cointegration. The maximum-eigenvalue test produces a probability value of 0.0412 for the null hypothesis of no cointegration, suggesting evidence of one cointegrating relationship at the conventional 5% level under the uncorrected test. However, the trace test does not provide corresponding evidence of cointegration. The two tests therefore produce mixed results. Given the absence of cointegration evidence from the trace test, including its sample-size-corrected result, the findings do not provide sufficiently consistent evidence to establish a stable long-run equilibrium relationship between real GDP and SME financing. This outcome does not imply that SME financing is economically irrelevant to real GDP. Rather, it indicates that the evidence for a long-run equilibrium relationship is sensitive to the cointegration test employed.

For Model 3, containing real GDP, financial inclusion, and SME financing, the trace-test probability is 0.0678 and the maximum-eigenvalue probability is 0.0897. Although these probabilities are closer to the conventional 5% threshold, both remain above it. The evidence is therefore insufficient to establish cointegration at the 5% significance level.

Taken together, the results do not establish a stable long-run equilibrium relationship among the variables in the reported systems over the period studied. This does not mean that financial inclusion, SME financing, and economic growth are unrelated. Rather, the tests do not provide sufficient evidence of the particular long-run equilibrium relationship examined by the Johansen procedure. Given the reported absence of cointegration, a stationary VAR framework was used for analysing short-run interactions, provided the variables used in estimation are stationary and the model is appropriately specified. Because the ADF tests identify the level variables as I(1), the estimation details should make clear whether the VAR was estimated in first differences or whether another specification was used.

4.5 VAR Estimation Results

The VAR analysis was intended to examine the dynamic relationships among financial inclusion, SME financing, and real GDP. The reported coefficient estimates are presented below exactly as they appear in the supplied results file.

Table 4.5: Selected VAR Coefficient Estimates

Regressor	Model 1: LSME equation, coefficient	p-value	Model 2: LRGDP equation, coefficient	p-value	Model 3: LRGDP equation, coefficient	p-value
Lagged dependent variable	0.942807	<0.0001	1.023650	<0.0001	0.990732	<0.0001
LCFII(-1)	0.141887	0.0743	-	-	-0.003070	0.7675
LSME(-1)	—	—	0.986835	<0.0001	0.014190	0.0259

Source: Authors' computation using Gretl.

Interpretation and Discussion

In Model 1, the coefficient on lagged LSME is 0.942807 and is statistically significant at the 5% level. This indicates substantial persistence in SME financing within the reported specification: past values of the series are strongly associated with its current value.

The coefficient on lagged financial inclusion is positive at 0.141887, with a p-value of 0.0743. It is not statistically significant at the 5% level, although it is significant at the 10% level. Thus, the estimate provides weak evidence of a positive short-run association between financial inclusion and SME financing in the reported model. It does not, on its own, establish a statistically significant effect at the conventional 5% level. In Model 2 the estimated level-VAR results indicate that the coefficient of lagged real GDP is positive at 0.986835 and statistically significant at the 5% level, with a probability value below 0.0001. This suggests considerable persistence in real GDP over the study period. The coefficient of lagged SME financing in the real GDP equation is positive at 0.015377 and statistically significant, with a p-value of 0.0018. This indicates that past SME financing is positively associated with current real GDP within the estimated level-VAR specification. In the SME financing equation, the coefficient of lagged real GDP is positive at 0.067325 but statistically insignificant, with a p-value of 0.6965. By contrast, the coefficient of lagged SME financing is positive at 0.904312 and statistically significant, with a p-value below 0.0001. This indicates substantial persistence in SME financing. Although the positive coefficient on lagged SME financing is consistent with the possibility that SME financing contributes to economic activity, the level-VAR results must be interpreted cautiously. The variables are reported as non-stationary in levels, and the Johansen tests do not provide consistent evidence of cointegration. Moreover, the level VAR exhibits residual autocorrelation. Consequently, the coefficient estimates should be treated as preliminary evidence rather than definitive estimates of the short-run or long-run effect of SME financing on real GDP. In Model 3, the coefficient on lagged LCFII is -0.003070, with a p-value of 0.7675. The coefficient is not statistically significant at 5%, indicating that the reported model does not provide evidence of a direct short-run relationship between lagged financial inclusion and real GDP in this equation.

By contrast, the coefficient on lagged LSME is 0.014190 and is statistically significant at 5%, with a p-value of 0.0259. This positive estimate suggests that past SME financing is associated with higher real GDP in the reported Model 3 specification, after accounting for the included lagged terms. This is potentially important for the study's transmission argument. It suggests that SME financing may be more directly associated with real GDP than financial inclusion alone.

The coefficient on the lagged dependent variable in Model 3 is 0.990732 and is highly significant. This points to strong persistence in the real GDP series within the estimated equation. However, a coefficient close to one also makes it especially important to ensure that the stationarity and model-specification requirements have been satisfied. Overall, the reported VAR estimates suggest a positive association between lagged SME financing and real GDP in Model 3, while the direct coefficient on financial inclusion is statistically insignificant in that equation. The evidence is suggestive rather than conclusive because the model definitions require reconciliation and the diagnostic results indicate potential specification problems.

4.6 VAR Diagnostic Tests

Diagnostic tests were conducted to assess whether the estimated VAR systems adequately capture the properties of the data. The reported tests cover residual autocorrelation, autoregressive conditional heteroskedasticity (ARCH), and residual normality.

Table 4.6: VAR Diagnostic Test Results

Model	Diagnostic test	Statistic	p-value	Interpretation at 5%
Model 1	Autocorrelation, LB(10)	51.7167	0.0435	Evidence of residual autocorrelation
Model 1	ARCH	LM = 2.649	0.9766	No evidence of ARCH
Model 1	Residual normality	$\chi^2(4) = 43.869$	<0.0001	Reject normality
Model 2	Autocorrelation, LB(10)	57.121	0.014	Evidence of residual autocorrelation
Model 2	ARCH	LM 6.963	0.6615	No evidence of ARCH
Model 2	Residual normality	$\chi^2(4)$ 8.9169	<0.0001	Reject normality
Model 3	Autocorrelation, LB(10)	103.543	0.0464	Evidence of residual autocorrelation
Model 3	ARCH	LM = 28.507	0.8087	No evidence of ARCH
Model 3	Residual normality	$\chi^2(6) = 30.8855$	<0.0001	Reject normality

Source: Authors' computation using Gretl.

Interpretation and Discussion

The autocorrelation test indicates that Model 1 has a p-value of 0.0435, which is below 0.05. The null hypothesis of no residual autocorrelation is therefore rejected. This suggests that the model may not fully capture the serial dependence in the data.

The diagnostic tests indicate that the level-VAR specification for Model 2 does not satisfy all the required residual properties. The Portmanteau test produces a statistic of 57.121 and a p-value of 0.0140. Since this probability is below 0.05, the null hypothesis of no residual autocorrelation is rejected. This suggests that the one-lag level-VAR does not adequately capture all the serial dependence in the variables. The ARCH test produces a p-value of 0.6618, which exceeds the 5% significance level. The null hypothesis of no ARCH effects is therefore not rejected, indicating no statistically significant evidence of the conditional heteroskedasticity examined by this test. The Doornik–Hansen normality test yields a chi-square statistic of 8.91699 and a p-value of 0.0632. Since the probability exceeds 0.05, the null hypothesis of residual normality cannot be rejected at the conventional significance level. Overall, the diagnostic results suggest that the level-VAR does not exhibit statistically significant ARCH effects or departures from residual normality at 5%, but it fails the residual autocorrelation test. The specification should therefore be reviewed before its coefficient estimates are relied upon for substantive conclusions. The diagnostic properties of the first-difference VAR should be used to assess the suitability of the preferred short-run model.

Model 3 has an autocorrelation-test probability of 0.0464. The null hypothesis of no residual autocorrelation is again rejected at 5%. This indicates that the reported three-variable system may also leave some dynamic relationships unexplained.

The ARCH-test probabilities for all three models exceed 0.05. The results therefore provide no evidence of ARCH effects under the reported tests. This is a favourable finding because it suggests that the conditional variance problem examined by these tests is not statistically evident.

However, the residual-normality tests reject the null hypothesis of normally distributed residuals in all three models. The p-values are below 0.0001 in each case. Thus, the residuals depart significantly from normality under the reported tests.

The diagnostic findings have important implications for interpreting the estimated relationships. The autocorrelation detected in Models 1 and 3 suggests that their specifications may require further attention. The non-normality of the residuals also warrants caution when interpreting conventional finite-sample test results.

4.7 Granger-Causality Tests

Granger-causality tests were used to determine whether past values of one variable provide statistically significant predictive information about another variable, conditional on the variables included in the relevant model.

The test should not be interpreted as proof of structural or economic causation. It identifies predictive relationships within the estimated time-series specification.

4.7.1 Model 1: Financial Inclusion and SME Financing

Table 4.7: Granger-Causality Results for Model 1

Null hypothesis	F-statistic	p-value	Decision at 5%
LCFII does not Granger-cause LSME	0.20950	0.6498	Do not reject
LSME does not Granger-cause LCFII	0.10992	0.7421	Do not reject

Source: Authors' computation using Gretl.

The results indicate that the null hypothesis that financial inclusion does not Granger-cause SME financing cannot be rejected at 5%. The p-value of 0.6498 provides no evidence that past financial inclusion improves the prediction of SME financing in this specification.

Similarly, the null hypothesis that SME financing does not Granger-because financial inclusion cannot be rejected, given the p-value of 0.7421.

Consequently, the reported Model 1 results do not establish Granger causality in either direction between financial inclusion and SME financing. This finding does not rule out an economic relationship between the variables; it indicates that the reported lagged predictive relationships are not statistically significant under this test.

4.7.2 Model 2: Real GDP and SME Financing

Table 4.8: Granger-Causality Results for Model 2

Null hypothesis	F-statistic	p-value	Decision at 5%
LSME does not Granger-cause LRGDP	0.777	0.3836	Do not reject
LRGDP does not Granger-cause LSME	07.1064	0.01124	Reject

Source: Authors' computation using Gretl.

The Granger-causality test was conducted to determine whether past changes in real GDP and SME financing provide statistically significant predictive information about one another.

The null hypothesis that changes in SME financing do not Granger-cause changes in real GDP cannot be rejected, given the F-statistic of 0.7771 and a p-value of 0.3836. This indicates that the reported first-difference model does not provide sufficient evidence that past changes in SME financing improve the prediction of changes in real GDP.

However, the null hypothesis that changes in real GDP do not Granger-cause changes in SME financing is rejected at the 5% significance level. The F-statistic is 7.1064, with a p-value of 0.0112. This indicates that past changes in real GDP provide statistically significant predictive information about changes in SME financing.

The results therefore indicate a unidirectional Granger-predictive relationship running from real GDP to SME financing, rather than from SME financing to real GDP, within the reported first-difference specification. This finding suggests that improvements in economic performance may precede changes in SME financing. It may reflect the possibility that stronger economic activity is associated with increased demand for credit, improved business prospects, or greater capacity to

access bank financing. However, these possible explanations are economic interpretations rather than relationships directly established by the statistical test.

The result does not demonstrate that SME financing has no economic contribution to real GDP. It establishes only that the reported model does not identify a statistically significant short-run predictive relationship from changes in SME financing to changes in real GDP at the 5% level.

4.7.3 Model 3: Real GDP, Financial Inclusion and SME Financing

Table 4.9: Granger-Causality Results for Model 3

Null hypothesis	F-statistic	p-value	Decision at 5%
LCFII does not Granger-cause LRGDP	1.5474	0.2213	Do not reject
LSME does not Granger-cause LRGDP	0.34250	0.5619	Do not reject
LRGDP does not Granger-cause LCFII	0.014945	0.9034	Do not reject
LSME does not Granger-cause LCFII	0.098071	0.7559	Do not reject
LRGDP does not Granger-cause LSME	6.9901	0.0120	Reject
LCFII does not Granger-cause LSME	0.26388	0.6105	Do not reject

Source: Authors' computation using Gretl.

The results indicate that neither financial inclusion nor SME financing Granger-causes real GDP at the 5% significance level in the reported Model 3. The respective p-values are 0.2213 and 0.5619. The null hypotheses are therefore not rejected.

The tests also provide no evidence of Granger causality from real GDP to financial inclusion or from SME financing to financial inclusion. Their p-values are 0.9034 and 0.7559, respectively.

However, the null hypothesis that real GDP does not Granger-cause SME financing is rejected at 5%, with an F-statistic of 6.9901 and a p-value of 0.0120. This indicates that past real GDP provides statistically significant predictive information about SME financing within the reported system. The null hypothesis that financial inclusion does not Granger-cause SME financing is not rejected, given the p-value of 0.6105. Thus, the reported tests do not establish a predictive relationship from financial inclusion to SME financing in this model.

Taken together, the Model 3 causality results indicate a statistically significant predictive relationship running from real GDP to SME financing, rather than from SME financing to real GDP. This is important because it suggests that economic performance may influence the availability or evolution of SME financing. It does not, however, establish that SME financing causes real GDP growth. The causality results therefore provide limited support for a transmission mechanism running from financial inclusion through SME financing to economic growth. In particular, the reported tests do not establish the complete sequence of predictive relationships required to demonstrate that mechanism. This conclusion must also be considered alongside the coefficient estimates and diagnostic limitations.

Summary of Granger Causality Tests

Model	Relationship examined	Main finding from the reported results	Implication
Model 1	LSME = f(LCFII)	Granger causality is not established in either direction. The coefficient on lagged financial inclusion is positive but only significant at 10%, not 5%.	Evidence that financial inclusion predicts SME financing is weak.
Model 2	LRGDP = f(LSME)	The first-difference Granger test indicates predictive information from real GDP to SME financing, but not from SME financing to real GDP.	The short-run evidence does not establish that SME financing predicts real GDP.
Model 3	LRGDP = f(LCFII, LSME)	The reported Granger tests do not establish that either financial inclusion or SME financing predicts real GDP. They indicate that real GDP predicts SME financing.	The full transmission mechanism is not established by the reported causality tests.

4.8 Impulse-Response Analysis

Impulse-response analysis examines how a variable responds over time to an unexpected shock in another variable within an estimated dynamic system. The reported results summarise the responses at periods 1, 5, and 10.

Table 4.10: Selected Impulse-Response Results

Model	Shock variable	Response variable	Period 1	Period 5	Period 10
Model 1	LCFII	LSME	-0.0290	0.2340	0.3440
Model 1	LSME	LCFII	0.0000	0.0066	0.00437
Model 2	LSME	LRGDP	0.0311	0.030	0.0291
Model 2	LRGDP	LSME	0.0000	0.0253	0.0441
Model 3	LCFII	LRGDP	0.0000	0.0053	0.0237
Model 3	LSME	LRGDP	0.0000	0.0257	0.0472

Source: Authors' computation using Gretl.

Interpretation and discussion

In Model 1, the response of SME financing to a financial-inclusion shock is initially negative, at -0.0290 in period 1. The response becomes positive by period 5 and increases to 0.3440 by period 10. The reported pattern suggests that the response of SME financing to a financial-inclusion shock changes over the forecast horizon. In Model 2, the response of financial inclusion to an SME-financing shock is positive but relatively small in the reported results. It rises from approximately zero in period 1 to 0.0066 in period 5 before declining slightly to 0.00437 in period 10. The response of SME financing to a real GDP shock is positive in the reported periods, although it declines slightly over these periods. The full impulse-response output extends to period 10. At period 10, the response of LSME to the LRGDP shock is reported as approximately 0.022655. The impulse-response analysis examines the dynamic responses of real GDP and SME financing to an unexpected shock in real GDP. The reported results show that the response of SME financing is

positive in the initial period and remains positive over the forecast horizon. The response of SME financing declines from 0.031105 in period 1 to approximately 0.030526 in period 3 and 0.022655 by period 10. This pattern suggests that a positive real GDP shock is associated with a positive but gradually diminishing response in SME financing. The result is consistent with the Granger-causality finding that changes in real GDP provide predictive information about changes in SME financing. It suggests that improvements in economic activity may precede an expansion in SME financing, although the impulse-response estimates do not establish a structural causal relationship. In Model 3, the response of real GDP to a financial-inclusion shock is approximately zero in period 1, rising to 0.0053 in period 5 and 0.0237 in period 10. The response of real GDP to an SME-financing shock also rises over the reported horizon, reaching 0.0472 by period 10.

These Model 3 results are consistent with the possibility that SME-financing shocks may be associated with a more pronounced positive response in real GDP than financial-inclusion shocks alone. Nevertheless, the responses should be interpreted cautiously. Their meaning depends on the model specification, variable ordering, shock-identification method, and the adequacy of the estimated system.

4.9 Forecast Error Variance Decomposition

Forecast error variance decomposition is used to assess the proportion of a variable's forecast-error variance attributable to shocks in itself and to shocks in the other variables in the system. It can provide additional information about the relative importance of different innovations over time.

Forecast Error Variance Decomposition (FEVD) tells how much of the future variability of a variable is explained by its own "shocks" (innovations) versus shocks from other variables in the system. At the 10th period (long-run horizon), the results reveal specific economic transmissions.

Model	Dependent variable	Horizon	Shock to LSME (%)	Shock to LCFII (%)	Shock to LRGDP (%)	Total (%)
Model 1	LSME	10th Period	69.48	30.52	-	100.00
Model 2	LSME	10th Period	64.79	-	35.21	100.00
Model 3	LRGDP	10th Period	35.29	5.87	58.84	100.00

Model 1 & Model 2: The Exogeneity and Drivers of LSME

"The 10th-period Forecast Error Variance Decomposition (FEVD) results for Model 1 indicate that LSME exhibits a relatively high degree of endogeneity, with 69.48% of its variance explained by its own innovations ('own shocks'). However, LCFII exerts a notable external influence, accounting for 30.52% of the long-run fluctuations in LSME.

When looking at Model 2, a similar pattern emerges for LSME, where its own shocks explain 64.79% of its variance. In this model, LRGDP acts as a stronger external driver than LCFII did, explaining 35.21% of the long-run variance in LSME. Taken together, these two models suggest that while LSME is primarily self-driven, it is highly sensitive to macroeconomic and financial shocks from LRGDP and LCFII."

Model 3: The Responsiveness of LRGDP

"Model 3 examines the structural composition of LRGDP variance at the 10th-period horizon. The results reveal that LRGDP's own shocks account for 58.84% of its forecast error variance. Crucially, LSME emerges as a major external transmitter of economic shocks, explaining a

substantial 35.29% of the variance in LRGDP. Conversely, LCFII plays a marginal role in directly driving LRGDP, contributing only 5.87% to its variance."

Synthesis & Economic Implications

"The overarching narrative across the three models points to a powerful bi-directional feedback loop between LSME and LRGDP. LSME explains 35.21% of LRGDP, and LRGDP explains 35.29% of LSME, highlighting a tightly coupled long-run equilibrium. Additionally, LCFII serves as an important direct catalyst for LSME variance (30.52%) but remains a weak direct driver of aggregate LRGDP (5.87%), suggesting its economic impact may be structurally routed through the LSME sector rather than impacting the broader GDP directly."

4.10 Discussion of Findings

The empirical findings provide a mixed picture of the relationships among financial inclusion, SME financing, and real GDP in Nigeria over the period 1981–2023.

First, the Augmented Dickey–Fuller tests indicate that LRGDP, LCFII, and LSME are integrated of order one under the reported test specifications. This highlights the importance of accounting for non-stationarity in the estimation of the dynamic relationships among the variables.

Second, the Johansen cointegration tests do not provide consistent evidence of a long-run equilibrium relationship across the three models. In Model 2, the trace test does not reject the null hypothesis of no cointegration, including after the reported sample-size correction, whereas the uncorrected maximum-eigenvalue test suggests cointegration at 5%. The conflicting results mean that a definitive claim of cointegration between real GDP and SME financing is not warranted.

Third, the coefficient estimates provide some evidence of a positive association between SME financing and real GDP. In Model 2 level-VAR, the coefficient of lagged SME financing in the real GDP equation is positive and statistically significant. Similarly, the reported Model 3 estimates indicate a positive and statistically significant coefficient on lagged SME financing. However, these coefficient estimates must be interpreted cautiously because of the non-stationarity of the level variables, the mixed cointegration evidence, and the diagnostic limitations of the level-VAR specifications. Fourth, the Granger-causality results do not establish the complete transmission mechanism proposed by the study. Model 1 does not identify statistically significant predictive relationships in either direction between financial inclusion and SME financing. In Model 2, the first-difference results identify a unidirectional predictive relationship running from changes in real GDP to changes in SME financing. The results do not establish that changes in SME financing predict changes in real GDP. Model 3 likewise does not establish that financial inclusion or SME financing Granger-causes real GDP at the 5% significance level, although it identifies predictive information running from real GDP to SME financing.

Fifth, the impulse-response and forecast error variance decomposition results suggest that shocks in real GDP and SME financing may be associated with subsequent movements in the other variable. In Model 2 variance decomposition, SME-financing shocks account for 35.21% of the forecast-error variance of real GDP at period 10.

Finally, the diagnostic tests reveal residual autocorrelation in the reported level-VAR specifications for Models 1, 2, and 3. Although, in Model 2, the ARCH and normality tests do not reject their respective null hypotheses at 5%, the autocorrelation result indicates that the model requires further attention. These diagnostic concerns limit the strength of the conclusions that can be drawn from the current estimates.

Overall, the evidence suggests that SME financing is potentially relevant to Nigeria's real economic performance, but the reported results do not conclusively establish that financial inclusion promotes economic growth through SME financing. In particular, the Granger-causality tests do not demonstrate the complete sequence of predictive relationships required to support the proposed transmission mechanism. The findings should therefore be seen as suggestive evidence of the relationships among the variables rather than definitive proof of a causal transmission process.

5. Summary, Conclusion and Recommendations

5.1 Summary of the Study

This study examined the relationship between financial inclusion, SME financing, and economic growth in Nigeria over the period 1981–2023. It was motivated by the view that access to formal financial services may contribute to economic development when such access improves the availability of finance for productive small and medium-sized enterprises.

The empirical analysis used the logarithm of real gross domestic product (LRGDP) as the measure of economic growth, the logarithm of the financial inclusion index (LCFII) as the measure of financial inclusion, and the logarithm of commercial bank credit to SMEs (LSME) as the measure of SME financing. The analysis involved descriptive statistics, ADF unit-root tests, lag selection, Johansen cointegration tests, VAR estimation, diagnostic testing, Granger-causality analysis, impulse-response analysis, and forecast error variance decomposition.

The descriptive statistics showed that SME financing exhibited greater dispersion than real GDP and financial inclusion. The normality tests did not reject normality for LRGDP and LCFII but rejected it for LSME. The ADF results indicated that all three variables were non-stationary at level but stationary after first differencing. The variables were therefore classified as I(1) under the reported test specifications. The Johansen cointegration results did not establish a long-run equilibrium relationship among the variables in any of the reported systems at the 5% significance level. The subsequent dynamic analysis was consequently intended to examine short-run relationships rather than to assert a confirmed long-run cointegrating relationship.

The reported VAR results indicated that lagged SME financing was positively and significantly associated with real GDP in Model 3. The coefficient was 0.014190, with a p-value of 0.0259. The coefficient on lagged financial inclusion in the same equation was not statistically significant.

The Granger-causality tests produced mixed results. The reported two-variable system did not establish predictive causality between financial inclusion and SME financing. In the reported three-variable system, real GDP Granger-caused SME financing, but the tests did not establish that financial inclusion or SME financing Granger-caused real GDP at the 5% significance level.

The impulse-response results indicated a positive response of real GDP to an SME-financing shock over the reported forecast horizon. However, the forecast error variance decomposition figures require verification against the original Gretl output before a definitive interpretation can be made.

Finally, the diagnostic tests identified residual autocorrelation in Models 1 and 3 and non-normal residuals in all three systems. These findings indicate that the reported estimates require further specification checks before they can serve as the basis for strong conclusions.

5.2 Conclusion

This study investigated the relationships among financial inclusion, SME financing, and real GDP in Nigeria over 1981–2023. The central concern was whether improved financial inclusion is associated with greater SME financing and whether SME financing can serve as a channel through which financial inclusion supports economic growth.

The empirical results provide some evidence of a positive relationship between SME financing and real GDP. In the reported three-variable VAR equation, the coefficient on lagged SME financing is positive and statistically significant, whereas the coefficient on lagged financial inclusion is not statistically significant. The impulse-response results also show a positive real GDP response to an SME-financing shock over the reported forecast horizon.

Nevertheless, the evidence does not conclusively establish the proposed transmission mechanism. The Granger-causality results do not show that SME financing Granger-causes real GDP at the 5% significance level in the reported three-variable system. Instead, they indicate that real GDP Granger-causes SME financing. In addition, the Johansen tests do not establish cointegration at the 5% significance level, and the diagnostic tests reveal residual autocorrelation in two of the three reported models. The appropriate conclusion is therefore that SME financing appears to be associated with real economic performance in Nigeria, but the available results do not provide conclusive evidence that SME financing transmits the effect of financial inclusion to real GDP. The relationship remains plausible and worthy of further investigation, but it should not be presented as a fully demonstrated causal mechanism on the basis of the current estimates.

The conclusion is also subject to the need to align the estimated models with the study's agreed specifications and to verify the variance-decomposition results. Once these matters have been resolved, the article will be in a stronger position to make a defensible empirical claim about the role of SME financing in the relationship between financial inclusion and economic growth.

5.3 Recommendations

Based on the subject of the study and the findings that can be cautiously drawn from the reported analysis, the following recommendations are proposed.

1. Strengthen the link between financial inclusion and productive SME finance

Policies aimed at expanding access to bank accounts, digital payment services, savings products, and other formal financial services should be complemented by measures that improve SMEs' access to appropriate credit. Financial inclusion initiatives should be assessed not only by the number of people and businesses accessing financial services but also by whether such access improves the availability of finance for productive economic activities.

2. Improve access to affordable SME financing

Financial institutions and relevant public agencies should consider measures that make suitable financing more accessible to viable SMEs. Loan products should reflect the cash-flow patterns, operating cycles, and financing requirements of different business sectors. Lending arrangements should balance affordability and access with prudent credit assessment and sound risk management.

3. Reduce information and collateral constraints

SMEs often face difficulties obtaining credit when lenders lack reliable information about their financial position, repayment capacity, and business prospects. Improving credit information systems, encouraging proper bookkeeping, supporting business formalisation, and strengthening

appropriate collateral arrangements could help reduce these information barriers. Credit-guarantee schemes, where used, should include transparent eligibility rules and risk-sharing arrangements.

4. Improve SMEs' capacity to use finance productively

Access to credit alone may not guarantee improvements in business performance or economic growth. SME support programmes should therefore be complemented by training in financial management, record-keeping, digital skills, business planning, and market development. Such measures can help enterprises make better use of borrowed funds and improve their capacity to repay loans.

5. Promote responsible digital and rural financial inclusion

Efforts to extend financial services to underserved communities should be accompanied by reliable digital infrastructure, accessible financial-service channels, transparent charges, effective consumer protection, and appropriate complaint-resolution mechanisms. Expanding access should not expose customers and small businesses to avoidable costs, fraud, or unsuitable financial products.

6. Monitor the quality and outcomes of SME lending

Relevant public agencies and financial institutions should monitor not only the volume of credit extended to SMEs but also its distribution, affordability, repayment performance, and contribution to productive activity. Monitoring can help distinguish between lending that supports sustainable business expansion and lending that does not produce the intended economic benefits.

7. Strengthen the evaluation of financial-inclusion policies

Financial-inclusion programmes should be evaluated using indicators that capture both access to financial services and their actual use by households and businesses. Where possible, evaluations should examine whether improved access is associated with greater SME borrowing, business investment, employment, productivity, and broader economic performance. Such evidence can help policymakers' direct resources towards interventions that achieve measurable outcomes.

5.4 Contribution to Knowledge

The study focuses on the relationship between financial inclusion, SME financing, and economic growth in Nigeria over an extended period, using real GDP as the measure of economic performance and commercial bank credit to SMEs as the measure of SME financing.

Its principal analytical contribution is the examination of SME financing as a possible link between financial inclusion and real economic performance. Rather than treating financial inclusion and economic growth as an isolated relationship, the study considers whether SME financing is associated with the dynamics of real GDP. The reported results suggest that lagged SME financing is positively associated with real GDP in the three-variable specification, while the direct coefficient on lagged financial inclusion is not statistically significant. This provides a useful basis for further research into the conditions under which greater access to formal financial services may translate into productive business financing. However, the study's contribution should be stated as evidence on the relationship and potential transmission channel, rather than as proof that the channel has been conclusively established. The mixed causality findings, absence of confirmed cointegration, and diagnostic limitations mean that stronger claims would require a verified final specification and additional empirical support.

5.5 Limitations of the Study

The findings should be interpreted in light of several limitations.

First, the study uses annual time-series data, which limits the ability to capture short-term changes in financial access, SME lending, and economic activity. Second, commercial bank credit to SMEs provides an important measure of formal SME financing but does not necessarily capture every source of funding available to small and medium-sized enterprises. Third, the reported Johansen tests do not establish cointegration at the 5% significance level. The analysis therefore does not establish a stable long-run equilibrium relationship among the variables under the reported specifications. Fourth, residual autocorrelation is detected in Models 1 and 3, while residual normality is rejected in all three reported systems. These diagnostic findings warrant caution in interpreting the estimated coefficients and associated statistical tests.Finally, the model specifications in the current results file do not fully correspond to the agreed three-model framework, and the variance-decomposition table requires verification. The final empirical conclusions should therefore be based on the corrected and fully verified results.

5.6 Suggestions for Further Research

Further studies could examine whether the relationship between financial inclusion and economic growth varies across different measures of financial inclusion, categories of SME financing, and periods of economic change. Researchers could also consider additional variables that may influence the relationship, provided that their inclusion is supported by theory and data availability. Future research may investigate whether the effects of financial inclusion depend on the availability of affordable credit, the productive capacity of SMEs, and the broader institutional and economic environment. Where suitable data are available, firm-level or sectoral studies could provide additional insight into how access to formal financial services influences SME investment, employment, and productivity. Further work should also ensure that model specifications, unit-root results, cointegration tests, dynamic estimates, and diagnostic tests are internally consistent. This would strengthen the reliability of the evidence and provide a firmer basis for evaluating the role of SME financing in the relationship between financial inclusion and economic growth in Nigeria. The study highlights the importance of examining not only whether financial inclusion expands but also whether it improves access to productive financing for SMEs. The reported estimates suggest a positive association between SME financing and real GDP, but the available evidence does not conclusively demonstrate that SME financing transmits the effect of financial inclusion to economic growth. The policy implication is that financial inclusion initiatives should be accompanied by efforts to improve the availability, affordability, and productive use of SME finance. At the same time, the empirical conclusions should be finalised only after the model specifications and variance-decomposition results have been verified and the diagnostic limitations have been addressed.

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