

# Measurement of An Index of Financial Inclusion in Nigeria: A Principal Component Analysis Approach

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**Abstract:** This study constructs a comprehensive Financial Inclusion Index (IFI) for Nigeria, utilising Principal Component Analysis (PCA) to capture the multi-dimensional nature of financial inclusion. To ascertain the efficient level of financial inclusion in Nigeria, this study employs Principal Component Analysis (PCA). The dimensions of financial access, financial usage, and financial quality are analysed using supply- and demand-side indicators. Post-estimation tests, including the Kaiser-Meyer-Olkin (KMO) test, are conducted to validate the adequacy of the data for PCA. The findings reveal a modest yet growing level of financial inclusion, with demand for financial services marginally surpassing supply. This study recommends broader measurement of the dimensions of the financial inclusion index; financial services should extend to rural areas with a well-functioning mobile banking to enhance financial inclusion that supports sustainable economic growth.

## I. Introduction

Financial inclusion is broadly understood as the deliberate effort to integrate individuals who are outside the formal financial system, granting them access to essential financial services such as payments, savings, credit, and insurance (Sibos, 2014; Hannig & Jansen, 2010; Marwa, 2017). It also refers to policy interventions that ensure every member of society can access and utilise affordable, high-quality financial products from recognised institutions (Hannig & Jansen, 2010).

Despite extensive policy efforts, existing studies have underexplored the extent to which increased access to financial services translates into tangible economic growth. In response, financial inclusion has been incorporated into the global Sustainable Development Goals (SDGs), with policymakers emphasising its potential role in stimulating economic development (Marwa, 2017).

The SDGs, adopted by all 191 United Nations member states, establish specific targets to combat extreme poverty in its various forms, including financial exclusion, ill health, illiteracy, inequality, and unemployment (Sahay et al., 2015; Ulfsgard, 2017). Consequently, global policymakers have increasingly pursued financial inclusion as a central objective, with the G20 leaders recognising it as a vital pillar of the global development agenda (Global Partnership for Financial Inclusion [GPFI], 2011). Achieving inclusive financial systems would allow previously unbanked populations to actively participate in economic activities, thereby improving living standards and fostering economic growth (Kim, 2016).

Nevertheless, despite widespread recognition of the financial system's role in driving economic convergence, over 2.5 billion individuals globally still lack access to formal financial services such as savings accounts, credit facilities, insurance products, and payment systems (United Nations, 2013). Even among those who do have access, the quality and range of services vary considerably, with many individuals possessing only basic bank accounts. However, barriers such as high costs, long travel distances, and stringent documentation requirements prevent many from accessing formal financial services. Of the 2.5 billion unbanked individuals, approximately 2.2 billion reside in developing regions—Asia, Africa, Latin America, and the Middle East (Nwankwo & Nwankwo, 2014).

In Africa, the penetration of formal financial services remains critically low. The Global Findex Report (2014) revealed that only 23% of adults on the continent held accounts with formal financial institutions. In Sub-Saharan Africa, while over 40% of the population regularly saves or sets money aside, only about half have access to formal service providers. Nonetheless, the region leads the world in mobile financial accounts: 11.5% of adults aged 15 and above had a mobile money account in 2014, compared to the global average of just 2% (Demirgüç-Kunt & Klapper, 2012).

Research by Fadun (2014) has predominantly focused on urban areas, where access to financial services is relatively easier, whereas studies by Abideen, Huq, and Mydian (2012) and Hussaini and Imo (2018) emphasise rural inclusion, highlighting the importance of reaching disadvantaged groups.

In Nigeria, the National Financial Inclusion Strategy (NFIS) (2018) reported that in 2016, 58.4% of the adult population (equivalent to approximately 96.4 million people) were financially included. Of these, 38.3% were banked, 10.3% accessed services through other formal institutions, and 9.8% utilised informal service providers. Despite progress, the 2020 NFIS review reported that 36.6 million Nigerian adults remained financially excluded, with a gender disparity favouring males (44.1%) over females (55.9%).

Fadun (2014) argued that financial inclusion should extend beyond basic banking services to include insurance, pension services, stock and foreign exchange markets, investment companies, and credit and leasing firms. Recognising this, key stakeholders—

including the Central Bank of Nigeria (CBN), World Bank, African Development Bank, and various financial institutions—have intensified efforts to promote financial inclusion (CBN, 2012).

These initiatives aim to integrate millions of unbanked Nigerians into the formal financial system, thereby reducing reliance on exploitative informal lenders, enhancing savings and credit facilities, improving financial security, and promoting broader economic welfare (Abdullahi, 2015).

Although several studies have proposed structural methods for constructing financial inclusion indices, they primarily focus on the banking sector (Pineyro, 2013; Sarma, 2008; Yorulmaz, 2017; Gupte et al., 2012). Other researchers, such as Cámara and Tuesta (2017) and Inyang, Eko, and Festus (2020), employed a two-stage Principal Component Analysis (PCA) approach to develop more comprehensive indices. Their models distinguish between three core dimensions: financial access, financial usage, and financial quality. Despite several researchers proposing different methodologies for measuring financial inclusion, there is no universally accepted global standard for this measurement. This study, therefore, aims to contribute to the body of knowledge by including other financial sector indicators, such as insurance companies, and develop an improved relevant model for the measurement of the level of financial inclusion in Nigeria.

## **II. Literature Review and Theoretical Framework**

### **Conceptual Framework of Financial Inclusion**

Financial inclusion, or inclusive financing, refers to the delivery of financial services at affordable costs to segments of society, in contrast to financial exclusion, where such services are either unavailable or unaffordable. Financial inclusion and access to finance are distinct concepts (GFDR, 2014). According to the GFDR (2014) report, financial inclusion refers to the proportion of individuals and firms that use financial services, while financial access is the ability to obtain those services, including credit, deposits, payments, insurance, and risk management. Lack of use does not necessarily mean lack of access; some individuals may choose not to use available services, while others are excluded due to prohibitive costs, regulatory barriers, legal hurdles, or cultural factors.

Hannig and Jansen (2010) explain that financial inclusion ensures that individuals and businesses have access to and use quality, affordable financial products and services that meet their needs. Access to a transaction account is often the first step toward broader financial inclusion, enabling people to store money and make payments. According to GFDR (2014), the key issue is understanding whether exclusion results from a lack of demand for financial services or from barriers preventing access.

Broader dimensions of poverty in developing countries—including income poverty, food insecurity, poor access to services and infrastructure, unsanitary environments, illiteracy, insecurity, and weak governance—often exclude individuals and firms from formal financial services (Aye, 2012).

Access for Financial Inclusion (AFI, 2013) describes financial inclusion as providing an array of needed financial services at fair prices, in appropriate forms, times, and places, without discrimination. It entails enabling people to access formal financial institutions and products.

The National Financial Inclusion Strategy (NFIS, 2018) defines financial inclusion as a state where adult Nigerians have easy access to a broad range of affordable financial services. Similarly, the Indian Committee on Financial Inclusion (Rangarajan, 2008) defines it as ensuring access to necessary financial services, particularly credit, for vulnerable and low-income groups at affordable costs.

### **Determinants of Financial Inclusion in Nigeria**

Following the frameworks proposed by Inyang, Eko, and Festus (2020), Cámara and Tuesta (2017), Triki and Faye (2013), Ondiege (2015), and Sethy (2016), the determinants of financial inclusion can be classified into three primary dimensions: financial access, financial usage, and financial quality.

#### **Financial Access (Supply Side)**

Financial access, often referred to as the supply side of financial services, pertains to individuals', households', or businesses' ability to access a range of financial products (Kama & Adigun, 2013). This includes services such as banking (availability of bank branches, ATMs, and POS devices), credit (personal loans, mortgages, business loans), insurance (life, health, property), and investment products (stocks, bonds, mutual funds). Indicators used to measure financial access typically include the Number of banks, the Number of bank branches, the Number of Micro-Finance Banks, the Number of Registered Primary Mortgage Institutions, and the Number of Insurance Companies.

#### **Financial Usage (Demand Side)**

Financial usage describes how individuals, households, or businesses utilise financial products and services to manage their financial lives (Oluymbo & Aina, 2014). This includes Commercial Bank Deposit (Bill), Commercial Bank Loan to Rural Areas (Bill), Commercial Bank Loans to SME's (Bill), Commercial Bank Credit to Private Sector (Bill), Deposits to Micro Finance Banks (Mill), Lending by Private Mortgage Firms (Mill). Effective financial usage promotes financial stability by enabling better financial management, encouraging savings and investment, and fostering broader economic participation.

### **Financial Quality (Regulation and Institutional Side)**

Financial quality encompasses both price and non-price barriers and reflects the extent to which financial systems and institutions can meet the needs of users effectively. According to Demirgüç-Kunt and Klapper (2013), financial quality concerns interest rate and real interest rate.

### **Theoretical Review**

#### **Finance-Growth Theory**

Bagehot (1873) was the first classical economist to propose a finance-led growth theory, emphasising that a sound financial system is essential for economic growth. Earlier economists recognised the importance of money circulation, but Bagehot provided a detailed description of the link between financial processes and the real economy (Stolbov, 2012). His work sparked broader interest in the role of finance throughout the 20th century (Marwa & Zhanje, 2015).

Bagehot (1873) predicted that "capital will run as surely and instantly where it is wanted... as water runs to find its level," suggesting that financial capital supports profitable enterprises and fosters economic growth. However, some assumptions—such as perfect competition and resource mobility—do not always hold, as shown by Stiglitz (2001), Akerlof (1970), and North (1990).

Nevertheless, Bagehot's theory remains influential, emphasising that financial systems mobilise resources and allocate them efficiently to productive sectors. This "loanable funds" mechanism promotes economic expansion, technology adoption, and overall growth.

#### **Patrick's Supply-Leading and Demand-Following Hypothesis**

Patrick (1966) proposed that the relationship between finance and growth could vary over time. Earlier scholars like Gurley and Shaw (1955), Gerschenkron (1962), Cameron (1967), McKinnon (1973), and Shaw (1973) also explored this nexus.

Patrick (1966) introduced two concepts: **Demand-Following**: Financial development responds to economic growth. As the real economy grows, financial systems expand to meet the increased demand for financial services (Robinson, 1952). **Supply-Leading**: Financial development precedes and stimulates economic growth by mobilising savings and allocating them toward investment in productive sectors. Supply-leading finance promotes technological adoption and boosts productivity across sectors. Conversely, Robinson (1952) and Carby et al. (2012) stress that enterprises lead finance—economic growth triggers demand for financial services.

Berthelemy and Varoudakis (1996) argue that finance and growth are mutually dependent. Economic growth can also foster financial deepening, promoting scale economies in finance that, in turn, boost economic development. The **accumulation channel** emphasises finance-induced growth via capital accumulation (Pagano, 1993), while the **allocation channel** stresses more efficient resource allocation (King & Levine, 1993).

### **Theoretical Framework**

The finance-led growth theory, initially proposed by Bagehot (1873), argues that financial intermediaries create a conducive environment for economic growth. Schumpeter (1934), McKinnon (1973), and Shaw (1973) reinforced Bagehot's theory by highlighting the critical role of financial institutions in fostering technological innovation through credit allocation. However, Robinson (1952) and Levine (1997) presented a contrasting view, suggesting that economic growth stimulates financial development, as demand for financial services rises alongside economic expansion.

Patrick (1966) further refined the discussion with his supply-leading and demand-following hypotheses. According to Levine (1997) and Bodie et al. (2008), financial systems contribute to growth by producing cheaper investment information and allocating capital, monitoring firms and enforcing governance, facilitating risk diversification and management, mobilising savings, and easing trade and transactions.

McKinnon (1973) emphasised that financial inclusion strengthens institutions by building capital buffers that shield against economic shocks. Meanwhile, the demand-leading argument, supported by Kuznets (1955) and Thanvegelu (2004), posits that financial development is driven by the needs of a growing economy, where new financial products and institutions emerge in response to rising demand. Thus, the finance-growth relationship can be framed within a model combining the supply and demand dynamics of financial systems, labour, and capital.

### **Empirical Literature**

Empirical evidence attests to the link between financial inclusion and economic growth, as highlighted below:

Inyang, Eko, and Festus (2020) measured different components of financial inclusion in Nigeria. They used Principal Component Analysis (PCA) to construct an index of financial inclusion. The results showed that non-bank sectors contribute more to the supply of financial services than the banking sector. Additionally, the demand for financial services in urban centres outpaces that of the more populated rural areas. The study recommended that policies specifically aimed at increasing service points in rural areas be

pursued if financial authorities hope to meet stated objectives. However, the study did not include mobile financial services variables.

Ali and Khan (2020) examined the impact of micro and macro financial inclusion on economic growth in Asia using annual panel data from 1995–2017. They adopted Sarma's (2008) financial inclusion index and Dynamic Factor Model (DFM) techniques. Their findings showed that the micro financial inclusion index based on Sarma (2008) was significant, while the macro financial inclusion index was insignificant. The DFM-based indices also exerted an insignificant impact on growth. Regarding individual indicators, the number of bank borrower accounts and deposit accounts positively impacted growth, while financial system deposits and insurance premiums did not. The study recommended that policymakers strengthen financial services accessibility. However, variables like interest rates would have enriched the analysis.

Thai-Ha, Anh, and Farhad (2019) investigated the impact of financial inclusion on financial efficiency and sustainability in 31 Asian countries from 2004–2016. They used PCA with normalised variables and analysed the results using Feasible Generalised Least Squares (FGLS). Findings indicated that increasing financial inclusion negatively affects financial efficiency but positively impacts financial sustainability. They recommended that policy measures to increase financial inclusion should be accompanied by proper governance and financial regulation structures.

Ngulung'wa (2019) studied the impact of financial inclusion on economic growth in 25 Sub-Saharan African countries using a financial inclusion index with a two-way random effects regression. The study found that savings-led growth is positive, but gross primary school enrollment had a surprising negative impact. The author recommended broadening both the usage and access dimensions of financial services. However, the study lacked a detailed analysis of the comparative impact across countries.

Park and Mercado (2018) introduced a new index of financial inclusion for 151 economies using PCA to aggregate nine indicators of access, availability, and usage. They assessed the impact of financial inclusion on poverty and income inequality. Results showed that high- and middle-high-income economies with high financial inclusion have significantly lower poverty levels, whereas no such relationship was found in middle-low and low-income economies. However, the study's timeframe was limited, and it did not closely match the period relevant to the current study.

Sarma and Pais (2018) conducted a cross-country analysis using 2004 banking data across 49 countries. They used Sarma's (2008) financial inclusion index and found a strong positive correlation between human development and financial inclusion, with some exceptions. However, the study did not update its analysis to reflect more recent trends, nor did it provide recommendations based on the findings.

Piñeyro (2013) examined financial inclusion in 32 Mexican states and municipalities using PCA. The study found that about 36% of municipalities were financially inclusive, while 29% were excluded. Education had a strong positive correlation with financial inclusion, while poverty had a negative correlation. Piñeyro recommended promoting equitable growth and equal opportunities but did not propose specific policies for achieving these goals over the long term.

Decanay, Nito, and Buensuceso (2011) conducted a cross-country study on financial inclusion, microfinance, and financial development across 80 countries. Using Sarma's (2008) index, they found that: (1) microfinance outreach has a significant positive relationship with financial inclusion; (2) financial inclusion positively relates to financial development; and (3) financial inclusion in the microfinance industry moderately relates to financial development and GDP. However, the study's methodology (relying on simple indices) might have been better complemented by more robust methods like VAR or VECM. Furthermore, no specific recommendations were made.

Prior research underscores the positive correlation between financial inclusion and macroeconomic performance. Studies such as Thai-Ha and Farhad (2019) and Kim, Yu, and Hassan (2018) affirm that higher financial inclusion promotes financial sustainability and growth. Similarly, Onaolapo (2015) emphasises the role of financial activities in poverty reduction. However, the construction of a composite index tailored to Nigeria's context remains sparse, justifying the relevance of this study.

### **III. Methodology**

#### **Nature and Sources of Data**

This research utilises secondary annual time series data spanning from 1990 to 2020. Data on financial access indicators—such as the number of banks, bank branches, microfinance banks, prime mortgage finance institutions, and insurance companies—were sourced from the *Central Bank of Nigeria Statistical Bulletin* (CBN, 2020). Data on financial usage—such as commercial bank deposits, loans to rural areas, loans to small and medium enterprises, credit to the private sector, deposits to microfinance banks, and loans by primary mortgage finance institutions—were also sourced from CBN (2020). Data on lending rates and prime lending rates were sourced from the *World Bank Global Financial Index* (2020).

#### **Model Specification**

The objective of this study is to construct an Index of Financial Inclusion (IFI), serving as a single metric to measure the level of financial inclusion in Nigeria. The study follows the framework used by Inyang, Eko, and Festus (2020); Goel and Sharma (2017); Yorulmaz (2017); and Sarma (2008), emphasising that the comprehensiveness of an index depends on the dimensions it considers.

Thus, this study identifies 13 indicators distributed across three dimensions: Financial Access (Supply-side indicators): 5 indicators, Financial Usage (Demand-side indicators): 6 indicators, and Financial Quality: 2 indicators.

Principal Component Analysis (PCA) will be used to construct the index.

**Table 3.1: Financial Inclusion Variables Indicators for the Index of Financial Inclusion**

| Financial Access                                | Financial Quality  | Financial Usage                            |
|-------------------------------------------------|--------------------|--------------------------------------------|
| Supply Side                                     |                    | Demand Side                                |
| No. of Banks                                    | Real Interest Rate | Commercial Bank Deposit in Rural Area      |
| No. of Bank Branches                            | Interest Rate      | Commercial Bank Loan to Rural Area         |
| No. of Microfinance Banks                       |                    | Commercial Bank Loan to SMEs               |
| No. of Registered Primary Mortgage Institutions |                    | Commercial Bank Loan to the Private Sector |
| No. of Insurance Companies                      |                    | Deposit to Microfinance Banks              |
|                                                 |                    | Lending by Private Mortgage Firms          |

Source: Constructed by Author

### Model Specification for the Index of Financial Inclusion (IFI)

The models for constructing the components of IFI are specified as follows:

#### Financial Access (FA):

$$FA = A1NB + A2NBB + A3NMFB + A4NRPMI + A5NICFA$$

Where: NB = Number of Banks, NBB = Number of Bank Branches, NMFB = Number of Microfinance Banks, NRPMI = Number of Registered Primary Mortgage Institutions. NIC = Number of Insurance Companies

#### Financial Quality (FQ):

$$FQ = \pi_1 RIR + \pi_2 INTRFQ$$

Where:

RIR = Real Interest Rate (%) and INTR = Interest Rate (%)

#### Financial Usage (FU):

$$FU = \lambda_1 CBD + \lambda_2 CBLR + \lambda_3 CBLSME + \lambda_4 CBCPS + \lambda_5 DMFM + \lambda_6 LPMFFU$$

Where: CBD = Commercial Bank Deposit (Billions), CBLR = Commercial Bank Loan to Rural Areas (Billions), CBLSME = Commercial Bank Loans to SMEs (Billions), CBCPS = Commercial Bank Credit to Private Sector (Billions), DMFM = Deposit to Microfinance Banks (Millions), LPMF = Lending by Private Mortgage Firms (Millions)

Hence, the functional form of the IFI can be written as:

$$IFI = f(FA, FQ, FU)$$

### Principal Component Analysis (PCA)

PCA is employed to extract the most significant components explaining the maximum variance among the variables. Variables are standardised before PCA to address scale inconsistencies, following Pineyro (2013).

#### Post-Estimation Tests

##### Kaiser-Meyer-Olkin (KMO) Test of Sampling Adequacy

The KMO test checks whether the variables selected are suitable for PCA analysis.

**Null Hypothesis (H<sub>0</sub>):** Correlation matrix is an identity matrix.

**Alternative Hypothesis (H<sub>1</sub>):** Correlation matrix is not an identity matrix.

#### Decision Rule:

0.90s – Marvelous

0.80s – Meritorious

0.70s – Middling

0.60s – Mediocre

0.50s – Miserable

Below 0.50 – Unacceptable

#### IV. Discussion and Interpretation of Results

##### Financial Access (Supply Side)

| Variables | PCA1   | PCA2   |
|-----------|--------|--------|
| NB        | 0.461  | -0.541 |
| NBB       | -0.346 | 0.195  |
| NIC       | -0.551 | 0.271  |
| NMFB      | 0.258  | 0.302  |
| NRPMI     | 0.549  | 0.711  |

Table 4.1 reveals the results for financial access (supply side). The table reveals that in PCA1, the variable/indicator with the largest loading for the supply dimension is Number of Registered Primary Mortgage Institutions (NRPMI) with a weight of 0.55. The second largest loading is the Number of Banks (NB) in Nigeria, with 0.46. The third Number of Micro Finance Banks with a weight of 0.26. The remaining variables possess negative signs associated with their weights and indicate their insufficiency in the supply dimension. The fourth position is taken by the Number of bank branches (NBB) with a weight of -0.35. The fifth is the Number of Insurance Companies with a weight of -0.55. The positive sign of the results on the number of registered primary mortgage institutions, number of banks and number of microfinance banks implies that their supplies are enough to meet the populations that are willing to access financial services in Nigeria. The number of bank branches and the number of insurance companies are negative, probably because the bank branches and insurance companies are located only in the urban areas of the 36 states in the country. This result goes in tandem with other studies that report that the number of bank branches and insurance companies in Nigeria is insufficient for supplying to supply the needed financial products and services in the country, and their operations are very scanty in rural areas.

##### Table 4.2 Financial Usage (Demand Side)

| Variables | PCA1   | PCA2   |
|-----------|--------|--------|
| CBD       | 0.414  | 0.529  |
| CBLSME    | 0.469  | -0.082 |
| CBLR      | -0.040 | -0.088 |
| CBCPS     | -0.490 | -0.011 |
| DMFB      | -0.568 | -0.563 |
| LPMF      | 0.210  | 0.624  |

Table 4.2 is the PCA results, which reveal the loadings for the demand dimension indicators (financial usage). The result shows that Commercial Bank loans to Small and Medium Enterprises have the highest weight of 0.47, followed by Commercial Bank deposits in rural areas, 0.41 and then Loans in Private Mortgage finance, which is 0.21. while Deposits in Microfinance Banks, Commercial Bank Loans to Small and Medium Enterprises and Commercial Bank Branch Loans in Rural Areas have the lowest and negative loadings results of -0.57, -0.49 and -0.04, respectively. The results imply that indicators representing demand for services for loans to the private sector (Household, Individuals & Firms), Mortgage services, Commercial Bank Deposits by rural area, are services offered in most urban areas, leading the category of financial services in high demand. While the indicators representing demand for financial services, which comprise deposit to microfinance banks, Commercial Bank Branch Loans in Rural Areas, and Commercial Bank Credit to Private Sectors (CBCPS), occupy the lowest weights. Hence, the demand for financial services such as loans to the private sector and loans for primary mortgage finance is highly needed. The result implies that the demand for financial services is greater than their supply in Nigeria. While the results for the commercial bank deposit in rural areas show that demand for financial services in rural areas is only needed for deposit purposes.

**Table 4.3 Financial Quality**

| Variables | PCA1   |
|-----------|--------|
| RIR       | -0.707 |
| INTR      | 0.707  |

Table 4.3 reveals a price barrier (financial quality) of two indicators of real interest rate and interest rate. The real interest rate result is -0.71 indicates how the interest rate negatively affects both the supply and the demand of financial services in Nigeria. The lack of sufficient data greatly hampers the quality dimension, as only indicators representing the price barrier are available.

**Table 4.4 Index of Financial Inclusion (IFI)**

| Variables | PCA1   |
|-----------|--------|
| FA        | 0.616  |
| FQ        | -0.176 |
| FU        | 0.768  |

Table 4.4 shows the results of the financial inclusion index. The results disclose that in PC1, the demand-side dimension possesses the highest loading with a weight of 0.77 and followed by the supply-side dimension with a weight of 0.62. This suggests that demand for financial services is slightly above the supply for financial services in Nigeria; this is in line with the study of Sethy (2016), which found high financial inclusion on case of demand side but low financial inclusion on case supply side in India. The financial quality possesses a negative weight of only -0.176, which could be due to the price factors (inverse relationship) that affect the contribution of Financial Inclusion in Nigeria.

**Table 4.5: KMO Test Results**

| Variables   | MSA   |
|-------------|-------|
| FA          | 0.594 |
| FQ          | 0.756 |
| FU          | 0.642 |
| Overall KMO | 0.647 |

Table 4.11 results show that the KMO result is 0.64, revealing that the result is mediocre. Hence, the null hypothesis is rejected and the alternative hypothesis that the correlation matrix is not an identity matrix is accepted. This implies that the variables in the correlation matrix are well-suited for PCA.

## V. Discussion of findings

To ascertain the level of financial inclusion in Nigeria by constructing an index. As such, the model is constructed to build an Index of Financial Inclusion for Nigeria. The index serves as a measurement of the level of financial inclusion. Applying the use of the PCA method, IFI is at 3.0366097 as of 2020. The KMO result of 0.64 (64%) indicates that the result is mediocre. This implies that the variable in the correlation matrix is well-suited for PCA. The result is in line with the guideline of Kaiser and Rice (1974), which stated that the result above 50% can be accepted. The result implies a growing level of financial inclusion in Nigeria, which is in line with the study of Thai-Ha and Farhad (2019), who revealed that growing financial inclusion favourably influences financial sustainability, and Kim, Yu and Hassan (2018) supported that a high level of financial inclusion tends to support growth. Also, the coefficients of the financial inclusion index are negative in both the long run and the current lag of the ARDL Bound, which means that an increase in the index leads to a significant reduction in the poverty level and widens economic activities, which have the tendency to influence economic growth. This is in line with the study of Erlando, Riyanto and Masakazu (2020), which considered the impact caused by the developing financial sectors in reducing poverty.

## VI. Conclusion

The study finds that financial inclusion in Nigeria is progressing, albeit with significant room for improvement, particularly on the supply side and quality of financial services. Demand for financial services outpaces supply, highlighting the need for targeted interventions to address structural barriers. Thus, the study concludes that high financial inclusion reduces income inequality and miserable poverty. Therefore, the usage of financial services appears to widen economic activities, which in turn increases the standard of living while economic growth is accelerated. As expected, well-designed financial inclusion, if put in place by the policy makers, tends to boost Nigeria's economic activities through effective and efficient channelling of funds to real investors for the sake of investment.

## VII. Recommendations

In line with the study findings and conclusion, the following recommendations are hereby offered by the study:

1. Financial services should be extended to rural areas with well-functioning mobile banking, as these tend to increase the level of financial inclusion in rural areas and will widen their participation in economic activities.
2. The monetary authorities and financial service agencies should provide a sound and stable monetary policy that includes a reduction in the lending rate that will be affordable to both rural and urban investors in accessing desired loans, as this will widen economic activities and contribute to sustainable economic growth in Nigeria.
3. The government should improve on the infrastructural development, such as power, energy, road network and telecommunication, as that will widen the economic activities in Nigeria that can lead to the participation in financial services and sustain economic growth.

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## Appendix A

### Data on Financial Inclusion Indicators

| YEARS | FINANCIAL ACCESS (SUPPLY SIDE) FIN. QUALITY |       |     |      |       |        |       |
|-------|---------------------------------------------|-------|-----|------|-------|--------|-------|
|       | NB                                          | NBB   | NIC | NMFB | NRPMI | RIR    | INTR  |
| 1990  | 58                                          | 1934  | 80  | -    | -     | 17.47  |       |
| 1991  | 65                                          | 2018  | 100 | 66   | -     | 0.99   |       |
| 1992  | 65                                          | 2,269 | 105 | 401  | 145   | -14.99 | 29.8  |
| 1993  | 66                                          | 2,352 | 105 | 879  | 252   | -7.05  | 18.32 |
| 1994  | 65                                          | 2,397 | 103 | 970  | 279   | -15.92 | 21    |
| 1995  | 64                                          | 2,362 | 90  | 1355 | 279   | -31.45 | 20.18 |
| 1996  | 64                                          | 2,402 | 90  | 1368 | 278   | -5.26  | 19.74 |
| 1997  | 64                                          | 2,402 | 83  | 1015 | 115   | 12.13  | 13.54 |
| 1998  | 54                                          | 2,180 | 57  | 1015 | 115   | 11.48  | 18.29 |
| 1999  | 54                                          | 2,180 | 57  | 1014 | 115   | 6.05   | 21.32 |
| 2000  | 54                                          | 2,188 | 57  | 881  | 115   | -1.14  | 17.98 |
| 2001  | 90                                          | 2,188 | 57  | 747  | 71    | 12.14  | 18.29 |
| 2002  | 90                                          | 3,005 | 57  | 769  | 80    | 3.02   | 24.85 |
| 2003  | 90                                          | 3,242 | 57  | 774  | 81    | 9.94   | 20.71 |
| 2004  | 89                                          | 3,487 | 103 | 753  | 83    | -2.60  | 19.18 |
| 2005  | 25                                          |       | 103 | 757  | 90    | -1.59  | 17.95 |
| 2006  | 25                                          | 3,233 | 103 | 750  | 91    | -5.63  | 17.26 |
| 2007  | 24                                          | 4,200 | 77  | 709  | 93    | 9.19   | 16.94 |
| 2008  | 24                                          | 4,952 | 54  | 695  | 82    | 6.68   | 15.14 |
| 2009  | 24                                          | 5,436 | 49  | 828  | 93    | 18.18  | 18.99 |
| 2010  | 24                                          | 5,809 | 49  | 801  | 102   | 1.07   | 17.59 |
| 2011  | 24                                          | 5,454 | 61  | 821  | 102   | 5.69   | 16.02 |
| 2012  | 21                                          | 5,564 | 60  | 883  | 82    | 6.22   | 16.79 |
| 2013  | 24                                          | 5,639 | 53  | 825  | 82    | 11.20  | 16.72 |
| 2014  | 24                                          | 5,526 | 48  | 891  | 82    | 11.36  | 16.55 |
| 2015  | 25                                          | 5,470 | 49  | 948  | 82    | 13.60  | 16.85 |
| 2016  | 25                                          | 5,570 | 49  | 987  | 82    | 6.69   | 16.87 |

|      |    |       |    |     |    |      |       |
|------|----|-------|----|-----|----|------|-------|
| 2017 | 26 | 5,714 | 60 | 987 | 82 | 5.79 | 17.58 |
| 2018 | 27 | 5,301 | 47 | 987 | 82 | 6.05 | 16.72 |
| 2019 | 29 | 5,437 | 58 | 909 | 32 | 5.92 | 15.38 |
| 2020 | 30 | 5,385 | 58 | 909 | 33 | 5.37 | 13.60 |

Source: Nigeria Statistical Bulletin, 2020

### Appendix B

| YEARS | FINANCIAL USAGE (DEMAND SIDE) |           |         |          |            |         |
|-------|-------------------------------|-----------|---------|----------|------------|---------|
|       | CBDR (B)                      | CBLP (B)  | CBLR(M) | CBLS (B) | DMFB (M)   | LPMF(B) |
| 1990  | 8.36                          | -         | 4.73    | -        | -          | -       |
| 1991  | 10.58                         | -         | 5.96    | -        | -          | -       |
| 1992  | 4.61                          | 75.46     | 1.90    | 20.40    | 639.60     | 0.21    |
| 1993  | 19.54                         | 88.82     | 10.91   | 15.46    | 2,188.20   | 0.33    |
| 1994  | 4.86                          | -         | 1.60    | 20.55    | 3,216.70   | 0.56    |
| 1995  | 8.81                          | 204.09    | 8.66    | 32.37    | 2,834.60   | 0.39    |
| 1996  | 12.44                         | 254.85    | 4.41    | 42.30    | 2,876.30   | 0.75    |
| 1997  | 19.05                         | 311.36    | 11.16   | 40.84    | 3,181.90   | 0.74    |
| 1998  | 18.51                         | 366.54    | 11.85   | 42.26    | 4,454.20   | 0.79    |
| 1999  | 15.86                         | 449.05    | 7.50    | 47.00    | 4,140.32   | 0.92    |
| 2000  | 20.64                         | 588.00    | 11.15   | 44.54    | 7,689.40   | 0.86    |
| 2001  | 16.88                         | 844.49    | 12.34   | 52.43    | 3,294.00   | 1.02    |
| 2002  | 14.86                         | 948.46    | 8.94    | 82.37    | 9,699.20   | 6.60    |
| 2003  | 20.55                         | 1,203.20  | 11.25   | 90.18    | 18,075.00  | 12.90   |
| 2004  | 64.49                         | 1,519.24  | 34.12   | 54.98    | 21,407.90  | 6.00    |
| 2005  | 18.46                         | 1,991.15  | 16.11   | 50.67    | 47,523.70  | 2.10    |
| 2006  | 3.12                          | 2,609.29  | 24.27   | 25.71    | 34,017.70  | 7.56    |
| 2007  | 3.08                          | 4,820.70  | 27.26   | 41.10    | 41,217.70  | 40.76   |
| 2008  | 13.41                         | 7,799.40  | 46.52   | 13.51    | 61,568.10  | 108.53  |
| 2009  | 3.30                          | 9,667.88  | 15.59   | 16.37    | 76,662.00  | 118.59  |
| 2010  | 0.02                          | 9,198.17  | 16.56   | 12.55    | 75,739.60  | 132.88  |
| 2011  | 0.02                          | 9,614.45  | 19.98   | 15.61    | 59,375.90  | 122.81  |
| 2012  | 0.02                          | 10,440.96 | 22.58   | 13.86    | 98,789.10  | 120.91  |
| 2013  | 0.02                          | 11,543.65 | 739.92  | 15.35    | 121,787.60 | 132.29  |
| 2014  | 0.48                          | 13,179.60 | 988.59  | 16.07    | 110,688.41 | 47.68   |
| 2015  | 90.37                         | 13,568.54 | 29.17   | 12.95    | 159,453.52 | 74.23   |
| 2016  | 87.93                         | 16,500.15 | 43.78   | 10.75    | 149,798.38 | 81.89   |
| 2017  | 185.93                        | 16,193.86 | 530.99  | 10.75    | 186,405.86 | 107.95  |
| 2018  | 308.85                        | 5,438.60  | 200.07  | 44.82    | 201,721.84 | 105.78  |

|      |        |           |        |        |            |        |
|------|--------|-----------|--------|--------|------------|--------|
| 2019 | 354.86 | 17,436.99 | 202.59 | 123.93 | 260,810.46 | 89.76  |
| 2020 | 351.50 | 19,818.38 | 107.52 | 62.51  | 266,185.73 | 121.67 |

Source: Nigeria Statistical Bulletin, 2020

## Appendix C

### Financial Inclusion Index

#### C: Financial usage (demand side)

|                                                   |           |            |            |            |            |           |
|---------------------------------------------------|-----------|------------|------------|------------|------------|-----------|
| Principal Components Analysis                     |           |            |            |            |            |           |
| Date: 11/24/21 Time: 08:25                        |           |            |            |            |            |           |
| Sample (adjusted): 1992 2020                      |           |            |            |            |            |           |
| Included observations: 28 after adjustments       |           |            |            |            |            |           |
| Balanced sample (listwise missing value deletion) |           |            |            |            |            |           |
| Computed using: Ordinary correlations             |           |            |            |            |            |           |
| Extracting 6 of 6 possible components             |           |            |            |            |            |           |
| Eigenvalues: (Sum = 6, Average = 1)               |           |            |            |            |            |           |
|                                                   |           |            |            | Cumulative | Cumulative |           |
| Number                                            | Value     | Difference | Proportion | Value      | Proportion |           |
| 1                                                 | 3.433673  | 1.940516   | 0.5723     | 3.433673   | 0.5723     |           |
| 2                                                 | 1.493156  | 0.750579   | 0.2489     | 4.926829   | 0.8211     |           |
| 3                                                 | 0.742578  | 0.486920   | 0.1238     | 5.669406   | 0.9449     |           |
| 4                                                 | 0.255658  | 0.190473   | 0.0426     | 5.925064   | 0.9875     |           |
| 5                                                 | 0.065185  | 0.055434   | 0.0109     | 5.990249   | 0.9984     |           |
| 6                                                 | 0.009751  | ---        | 0.0016     | 6.000000   | 1.0000     |           |
| Eigenvectors (loadings):                          |           |            |            |            |            |           |
|                                                   |           |            |            |            |            |           |
| Variable                                          | PC 1      | PC 2       | PC 3       | PC 4       | PC 5       | PC 6      |
| CBDR__B_                                          | 0.413578  | 0.469076   | -0.040439  | -0.490205  | 0.568410   | 0.209508  |
| CBLP__B_                                          | 0.528701  | -0.081837  | -0.087708  | -0.011378  | -0.563064  | 0.623630  |
| CBLR__M_                                          | 0.274125  | -0.320583  | 0.888159   | 0.055782   | 0.173432   | 0.008051  |
| CBLS__B_                                          | -0.002567 | 0.759680   | 0.261493   | 0.581766   | -0.119853  | 0.041044  |
| DMFB__M_                                          | 0.528262  | 0.119831   | -0.036108  | -0.155774  | -0.343619  | -0.750291 |
| LPMF__B_                                          | 0.441834  | -0.281112  | -0.363541  | 0.627487   | 0.444242   | -0.050050 |
| Ordinary correlations:                            |           |            |            |            |            |           |
|                                                   |           |            |            |            |            |           |
|                                                   | CBDR__B_  | CBLP__B_   | CBLR__M_   | CBLS__B_   | DMFB__M_   | LPMF__B_  |

|          |          |           |           |           |          |          |
|----------|----------|-----------|-----------|-----------|----------|----------|
| CBDR__B_ | 1.000000 |           |           |           |          |          |
| CBLP__B_ | 0.677956 | 1.000000  |           |           |          |          |
| CBLR__M_ | 0.137525 | 0.472491  | 1.000000  |           |          |          |
| CBLS__B_ | 0.443319 | -0.111564 | -0.186653 | 1.000000  |          |          |
| DMFB__M_ | 0.840452 | 0.955210  | 0.409889  | 0.103475  | 1.000000 |          |
| LPMF__B_ | 0.379188 | 0.841692  | 0.324643  | -0.303520 | 0.726308 | 1.000000 |
|          |          |           |           |           |          |          |
|          |          |           |           |           |          |          |

#### Appendix D: Financial access (supply side)

|                                                   |           |            |            |            |            |
|---------------------------------------------------|-----------|------------|------------|------------|------------|
| Principal Components Analysis                     |           |            |            |            |            |
| Date: 11/24/21 Time: 08:27                        |           |            |            |            |            |
| Sample (adjusted): 1992 2020                      |           |            |            |            |            |
| Included observations: 28 after adjustments       |           |            |            |            |            |
| Balanced sample (listwise missing value deletion) |           |            |            |            |            |
| Computed using: Ordinary correlations             |           |            |            |            |            |
| Extracting 5 of 5 possible components             |           |            |            |            |            |
| Eigenvalues: (Sum = 5, Average = 1)               |           |            |            |            |            |
|                                                   |           |            |            | Cumulative | Cumulative |
| Number                                            | Value     | Difference | Proportion | Value      | Proportion |
| 1                                                 | 2.754505  | 1.541216   | 0.5509     | 2.754505   | 0.5509     |
| 2                                                 | 1.213289  | 0.526133   | 0.2427     | 3.967794   | 0.7936     |
| 3                                                 | 0.687156  | 0.504416   | 0.1374     | 4.654950   | 0.9310     |
| 4                                                 | 0.182740  | 0.020429   | 0.0365     | 4.837689   | 0.9675     |
| 5                                                 | 0.162311  | ---        | 0.0325     | 5.000000   | 1.0000     |
| Eigenvectors (loadings):                          |           |            |            |            |            |
|                                                   |           |            |            |            |            |
| Variable                                          | PC 1      | PC 2       | PC 3       | PC 4       | PC 5       |
| NB                                                | 0.461060  | -0.346220  | -0.551079  | 0.250373   | 0.548798   |
| NBB                                               | -0.540600 | 0.194637   | 0.270634   | 0.302450   | 0.710738   |
| NIC                                               | 0.475101  | -0.142191  | 0.654509   | 0.563730   | -0.088805  |
| NMFB                                              | 0.171396  | 0.817288   | -0.326544  | 0.417693   | -0.146854  |
| NRPMI                                             | 0.489976  | 0.392518   | 0.296741   | -0.594625  | 0.405239   |
| Ordinary correlations:                            |           |            |            |            |            |
|                                                   |           |            |            |            |            |
|                                                   | NB        | NBB        | NIC        | NMFB       | NRPMI      |

|       |           |           |           |          |          |
|-------|-----------|-----------|-----------|----------|----------|
| NB    | 1.000000  |           |           |          |          |
| NBB   | -0.793654 | 1.000000  |           |          |          |
| NIC   | 0.433140  | -0.598415 | 1.000000  |          |          |
| NMFB  | 0.004042  | -0.116802 | -0.018415 | 1.000000 |          |
| NRPMI | 0.353906  | -0.567855 | 0.639862  | 0.498915 | 1.000000 |
|       |           |           |           |          |          |
|       |           |           |           |          |          |

#### Appendix E: Financial Quality (barrier)

|                                                   |          |            |            |            |            |
|---------------------------------------------------|----------|------------|------------|------------|------------|
| Principal Components Analysis                     |          |            |            |            |            |
| Date: 01/13/22 Time: 11:00                        |          |            |            |            |            |
| Sample (adjusted): 1990 2020                      |          |            |            |            |            |
| Included observations: 31 after adjustments       |          |            |            |            |            |
| Balanced sample (listwise missing value deletion) |          |            |            |            |            |
| Computed using: Ordinary correlations             |          |            |            |            |            |
| Extracting 2 of 2 possible components             |          |            |            |            |            |
|                                                   |          |            |            |            |            |
| Eigenvalues: (Sum = 2, Average = 1)               |          |            |            |            |            |
|                                                   |          |            |            | Cumulative | Cumulative |
| Number                                            | Value    | Difference | Proportion | Value      | Proportion |
| 1                                                 | 1.064879 | 0.129759   | 0.5324     | 1.064879   | 0.5324     |
| 2                                                 | 0.935121 | ---        | 0.4676     | 2.000000   | 1.0000     |
| Eigenvectors (loadings):                          |          |            |            |            |            |
|                                                   |          |            |            |            |            |
| Variable                                          | PC 1     | PC 2       |            |            |            |
| INTR                                              | 0.707107 | -0.707107  |            |            |            |
| RIR                                               | 0.707107 | 0.707107   |            |            |            |
| Ordinary correlations:                            |          |            |            |            |            |
|                                                   |          |            |            |            |            |
|                                                   | INTR     | RIR        |            |            |            |
| INTR                                              | 1.000000 |            |            |            |            |
| RIR                                               | 0.064879 | 1.000000   |            |            |            |
|                                                   |          |            |            |            |            |
|                                                   |          |            |            |            |            |

#### Appendix F: Index of Financial inclusion

|                               |  |  |  |
|-------------------------------|--|--|--|
| Principal Components Analysis |  |  |  |
| Date: 11/24/21 Time: 08:32    |  |  |  |
| Sample (adjusted): 1992 2020  |  |  |  |

|                                                   |           |            |            |            |            |
|---------------------------------------------------|-----------|------------|------------|------------|------------|
| Included observations: 27 after adjustments       |           |            |            |            |            |
| Balanced sample (listwise missing value deletion) |           |            |            |            |            |
| Computed using: Ordinary correlations             |           |            |            |            |            |
| Extracting 3 of 3 possible components             |           |            |            |            |            |
|                                                   |           |            |            |            |            |
|                                                   |           |            |            |            |            |
| Eigenvalues: (Sum = 3, Average = 1)               |           |            |            |            |            |
|                                                   |           |            |            | Cumulative | Cumulative |
| Number                                            | Value     | Difference | Proportion | Value      | Proportion |
|                                                   |           |            |            |            |            |
|                                                   |           |            |            |            |            |
| 1                                                 | 2.323654  | 1.823714   | 0.7746     | 2.323654   | 0.7746     |
| 2                                                 | 0.499940  | 0.323535   | 0.1666     | 2.823594   | 0.9412     |
| 3                                                 | 0.176406  | ---        | 0.0588     | 3.000000   | 1.0000     |
|                                                   |           |            |            |            |            |
|                                                   |           |            |            |            |            |
| Eigenvectors (loadings):                          |           |            |            |            |            |
|                                                   |           |            |            |            |            |
| Variable                                          | PC 1      | PC 2       | PC 3       |            |            |
|                                                   |           |            |            |            |            |
|                                                   |           |            |            |            |            |
| FA                                                | 0.615531  | -0.176221  | 0.768158   |            |            |
| FQ                                                | 0.533425  | 0.810648   | -0.241470  |            |            |
| FU                                                | -0.580154 | 0.558387   | 0.592980   |            |            |
|                                                   |           |            |            |            |            |
|                                                   |           |            |            |            |            |
| Ordinary correlations:                            |           |            |            |            |            |
|                                                   |           |            |            |            |            |
|                                                   | FA        | FQ         | FU         |            |            |
| FA                                                | 1.000000  |            |            |            |            |
| FQ                                                | 0.658810  | 1.000000   |            |            |            |
| FU                                                | -0.798624 | -0.518057  | 1.000000   |            |            |
|                                                   |           |            |            |            |            |
|                                                   |           |            |            |            |            |

#### Appendix G: KMO

|                                       |  |  |
|---------------------------------------|--|--|
| Kaiser's Measure of Sampling Adequacy |  |  |
| Factor: Untitled                      |  |  |
| Date: 11/24/21 Time: 08:36            |  |  |

|                      |           |          |          |
|----------------------|-----------|----------|----------|
|                      |           |          |          |
|                      |           |          |          |
|                      | MSA       |          |          |
| FA                   | 0.594279  |          |          |
| FQ                   | 0.755777  |          |          |
| FU                   | 0.641958  |          |          |
| Kaiser's MSA         | 0.646733  |          |          |
|                      |           |          |          |
|                      |           |          |          |
| Partial Correlation: |           |          |          |
|                      |           |          |          |
|                      | FA        | FQ       | FU       |
| FA                   | 1.000000  |          |          |
| FQ                   | 0.476088  | 1.000000 |          |
| FU                   | -0.710698 | 0.017857 | 1.000000 |
|                      |           |          |          |
|                      |           |          |          |