Testing The Effect of Islamic Financial Inclusion, Infrastructural Quality on Economic Growth in Nigeria: New Insight From Bootstrap and Non-Linear ARDL

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Abstract: Inclusive growth can hardly be achieved without improvement in the inclusive finance that would enable the vulnerable households to become key economic players. While efforts are now shifted towards the Islamic financial inclusion based on the realization of weakness of traditional financial inclusivity, the impact of Islamic financial inclusion particularly, its pathways of bridging infrastructural gaps and growth drive have been partially explored. This study examines the effect of Islamic financial inclusion, infrastructural quality on economic growth in Nigeria. The study uses monthly data covering from 2017 until 2020 which was analyzed via a newly developed Bootstrap Autoregressive Distributive Lag. The results reveal a number of findings. First, the result of bootstrap autoregressive distributed lag demonstrates that there is strong co-movement between economic growth, Islamic financial inclusion, Sukuk and infrastructural quality. This finding points to the existence of a strong positive relationship between Islamic financial inclusion, infrastructural quality and economic growth in Nigeria. Second, results from nonlinear models have revealed that Islamic financial inclusion and Sukuk have asymmetric effects on economic growth. This asymmetric pattern reinforces the claim that Islamic financial inclusion can play a dedicated role in ameliorating economic downturn. Third, the results of nonlinear causality reveal strong bidirectional causality Islamic financial inclusion, economic growth and Sukuk. In this sense, inclusive Islamic finance could play a dedicated role to help countries in overcoming economic recession.

Keywords: **Financial inclusion, economic growth, inclusive development, recession, nonlinear causality.**

1. INTRODUCTION

Finance is an operational tool in increasing economic opportunity and fighting poverty. Nigeria has a somewhat comprehensive financial system and a wide network of banks. Access to savings products, credit and transaction services enables people and businesses to accumulate financial assets, invest, spread risks and make payments cheaply and efficiently. There are well-established links between the size and scope of the financial system and the rate of economic growth (Mehar, 2014). Islamic finance is based on policies that exclude risk taking, interest earning, sinful activities, gambling, speculative trade and money lending to

customers. It relies on trading of established goods and services and a reward-sharing contract. It also centers on providing a fitting financial system with a motive of wealth redistribution, which will have a long term effect on poverty easing.

Indication globally shows that access to financial services contributes to economic growth as well as wealth creation and hence a key component aimed at tackling the poverty trap in Nigeria. Access to affordable, safe and reliable financial services provides the basic need for economic growth and poverty reduction. Cash inflow through the informal sector could be a source of resource mobilization leading to a positive impact on the country's economic growth and development. An inclusive financial system suggests accessibility of a variety of financial services for all income groups where policies of most countries usually focus on encouraging banks to open affordable savings accounts for the financially excluded.

Nigeria is part of the several countries struggling to achieve a greater financial inclusion at a targeted rate of 95% by the year 2024 (CBN, 2019) as such, measures have been put in place to achieve such rate through agent banking, Know-Your-Customer (KYC) requirements, financial literacy, consumer protection, linkage banking, the implementation of the Micro, Small and Medium Enterprises Development Fund (MSMEDF) and credit enhancement programs, among others by the Central Bank of Nigeria (CBN) in association with other organizations (Zauro et al., 2017a). CBN in 2011 approved the establishment of Islamic banks (IBs) with a view to providing alternatives to conventional finance that are Sharia-compliant for economic growth and development (Zauro et al., 2017b) among which include Sukuk, ijarah and Musharakah. Presently, Taj Bank Limited, which is another full-grown IB has emerged and commenced operation in Nigeria since December, 2019. Meanwhile, a Nigerian conventional bank that formerly had an Islamic window is making necessary groundworks for conversion into a fully Sharia-compliant bank. These show the prospective contributions of the Nigerian Islamic banking industry in facilitating Nigerians to have access to Islamic financial services.

Sukuk is presently most engaged in the international market and is seen to generate an important cross-border flow of funds as might be achieved beyond the domestic market (Mohd Zin et al., 2011). Despite the success of sukuk and the prospects it offers for governments and the private sector, its application is not fully understood. There is little or no awareness on the economic benefits and infrastructural development sukuk provides in other countries. In Nigeria, its application is also being misinterpreted as an attempt to Islamize the country (Ogunbado, Islam, Sharif, & Ahmed, 2017; Sulaiman, 2020). Islamic banking can promote the principles of profit and loss sharing among investors using Islamic finance, especially *sukuk* as a mechanism for raising capital and development of infrastructures in Nigeria.

As one of the financial instruments employed by organizations and governments to raise funds, sukuk, unlike traditional bonds that can be utilized for various purposes including recurrent expenditure, can only be utilized for assets such as infrastructure. Besides, investors receive income, according to the assets rather than interest, as in the case with traditional bonds. Investing in

infrastructure is among the objectives of the Economic Recovery and Growth Plan (2017-2020). Hence, all opportunities towards developing Nigeria infrastructure are being employed. The employment of the Sukuk to raise funds to finance infrastructure contributes directly to achieving this target. Existing studies have provided a strong case for using conventional financial inclusion as an important strategy of addressing economic exclusion, especially in alleviating poverty, income inequality and unemployment (Cavusoglu et al. (2019; Ibrahim & Aliero, 2020; Ozili, 2022). However, findings of the plethora of extant studies are unanimous that the rate of financial inclusion has not been increasing enough to pave way for individuals to enjoy the microeconomic and macroeconomic benefit of inclusivity. As such, it is important to systematically explore the impact of Islamic financial inclusion on economic growth. The objective of this paper is to examine the relationship between Islamic financial inclusion, infrastructural quality and economic growth in Nigeria.

This study built on extant studies addressing finance-growth nexus and fills the literature gap on three grounds. First, existing empirical studies have overlooked the importance of inclusive finance on infrastructural development. Current literature has not investigated the impact of financial inclusion on infrastructural quality. Importantly the Sukuk as a key instrument of Islamic financial inclusion can enforce the effect of financial inclusivity on economic growth through infrastructure quality. Second, the modeling framework of existing studies were implemented on linear models. In the process, the extant studies have omitted the potential asymmetric effect of financial inclusion, particularly the Islamic financial inclusion which is considered very dynamic. To address this, the current study uses a novel nonlinear unit root based on Fourier approach and exponential smooth transition autoregressive as proposed by Gurus (2019) which guide the selection of appropriate asymmetric variables in the modeling the dynamic of nonlinear autoregressive distributive lag. Finally, plethora of analytical techniques such as Ordinary Least Squares, vector error correction, and quantile regression have been used in the existing studies to examine impact of finance on economic growth (see, for instance Er & Mutlu, 2017; Ibrahim & Aliero, 2020; Khera et.al. 2021). However, this study adopts the Bootstrap Autoregressive Distributed Lag (BARDL) proposed by McNown et al. (2018) which is superior to the earlier version of ARDL in terms of power and small sample.

The remaining part of this paper is structured as follows: section two explains the conceptual issues and reviews empirical literature. Section three describes the empirical methodology. Section four discusses the findings from the analysis. Section five concludes the paper.

2.   LITERATURE REVIEW

2.1 Conceptual Literature

Financial inclusion is a means of delivering financial services at a cost that can be afforded by the less-privileged, weaker and low-income earners of the society, both individual households and small and medium enterprises (SMEs) (Seman, 2016). It could be seen as the availability and equal chances in accessing

financial services. It could also mean provision of financial services at affordable costs to the underprivileged and low-income earners of the society (Kelkar, 2009; Sharma and Kukreja, 2013).

Financial Inclusion makes provision of financial services at inexpensive costs to parts of disadvantaged and low income sections of a society easy. Unrestricted access to public goods and services is the performance measure of an open and efficient society. The term "financial inclusion" has gained importance since the early 2000s as a result of findings about financial exclusion and its direct relationship to poverty. Apex banks amongst the developing nations have common objective and perception of financial inclusion; it implies the provision of credit and other financial services at an affordable cost to large sections of the underprivileged and low income groups of people. This means that those who want credit should not be denied the same provided they are eligible. Therefore, the objective of financial inclusion is to extend the opportunity of activities of the organized financial system to include within its range, people with low income.
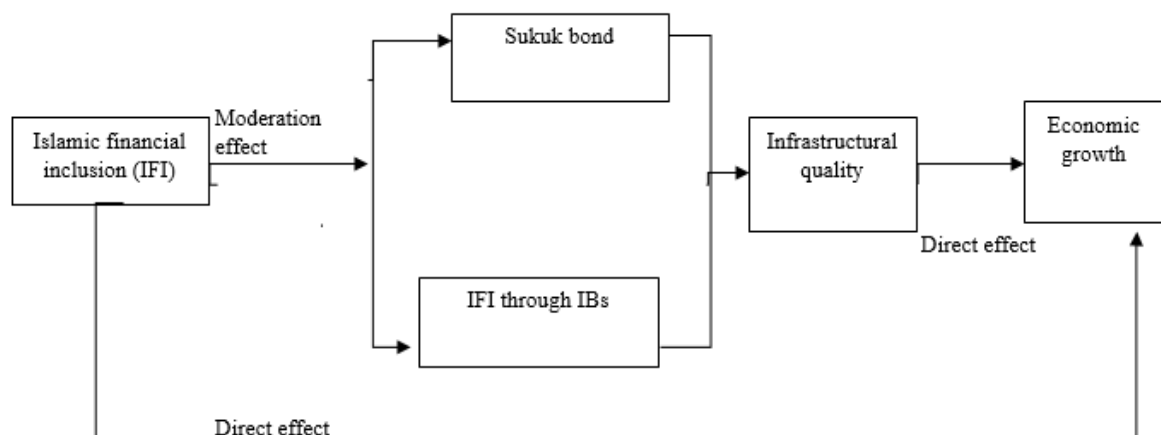

Fig. 1. Conceptual nexus between Islamic financial inclusion, infrastructural quality and economic growth

In Islamic finance, financial inclusion involves access to finance in risk-sharing contracts through the provision of realistic and non-interest funding as well as setting-up income redistributions mechanisms for poverty alleviation. Musharakah and sukuk are examples of a Sharia-compliant and risk-sharing contract, which is commonly practiced by the IBs, though it could be formed by individuals or non-IBs (Umar, 2019a). Sukuk as an important financing instrument is gradually holding up with the traditional bonds in terms of volume of transactions and number of sukuk issuances because it is a risk-sharing instrument with Sharia compliance as well as asset- backed mechanism. Sukuk is becoming an attractive investment tool for organizations and governments such as Islamic insurance (takaful) and Islamic banking and other Islamic financial institutions.

The Sukuk provides an important avenue of bridging the financial exclusion rate by providing pathways through which the noninterest investors will participate in the fixed income market. Nigeria raises funds through Sukuk bonds to finance infrastructure projects which assisted the economy exited the economic

recession experienced in 2016 (Ibrahim and Aliero, 2020). In this way, Sukuk provides an opportunity to further develop the savings culture, thereby deepening the financial inclusion, promoting infrastructural development and enhancing economic growth (see Fig. 1).

To enhance Islamic financial inclusion through Islamic banking, Shaikh et.al (2017) suggested thus; the application of information technology to accommodate those that are excluded due to distance barrier, the use of equity-based approaches of financing to support those that have no collateral security and giving entrepreneurial capital and other sources of income hence, paying special attention to Islamic microfinance for supporting the poor person in the society.

2.2 Empirical Literature

In analyzing the level of financial inclusion in Nigeria, Ozili (2022) used data from global financial index indicators and the findings revealed that Nigeria actually witnessed growth in several financial inclusion indicators in the early years of 2014, but the benefits were not sustained in the later years, especially in 2017. Sarpong and Nketiah-Amponsah (2022) examined the quantitative relationship between financial inclusion and inclusive growth in sub-Saharan Africa among 46 countries for the period 2004-2018 and found that usage of financial services among other covariates, has a quantifiable and discernible impact on inclusive growth compared with availability and knowledge of financial services. On investigating the relationship between diversification and Islamic banking systems' performance under the impact of the COVID-19 turmoil using a sample of 24countries from 2013Q4 and 2020Q4, Le et.at (2022) establish that performance of Islamic banking systems is positively associated with sectoral diversification of sharia-compliant financing and income diversification. Furthermore, using the financial inclusion indices developed in Khera et.al. (2021), the same authors address the questions on how financial inclusion through traditional services impact on economic growth and found that the exogenous component of digital financial inclusion is positively associated with growth in GDP per capita during 2011-2018. Cicchiello et.al. (2021) prove how economic growth leads to financial inclusion. According to the authors, unemployment and literacy rates are among the factors contributing to financial inclusion and it is observed that women are more vulnerable than men to lack financial inclusion. Moreover, AbdulKareem et.al. (2020) adopted content analysis of relevant previous studies to proffer thematic review on sukuk ijarah issued in Nigeria as an opportunity for economic development, their findings revealed the potential of sukuk ijarah as an alternative for rapid economic growth and its functional role in attracting government and client to invest in it.

In a study conducted in Norway between 2015 and 2016 by Brekke (2018) evidence shows that banks in the country did not offer banking packages that were in line with the Sharia, as such considered to be a major factor hindering the integration of Muslims in the country. More so, interviews and focus group discussions were used as tools to establish a high demand for Islamic financial products as a result of the increase in the awareness of Islamic economics. While conducting a survey of Islamic financial literacy index in Turkey, Er and Mutlu

(2017) found the general index of Islamic financial literacy to stand at 58%. Anwar and Amrullahi (2017) investigated the impact of financial inclusion on poverty in Indonesia using multiple regression and found that financial inclusion does affect the general economic growth and somewhat reduce poverty but increase income inequality mostly due to environmental, gender and age bias in financial inclusion. In Zulkhibri (2016) research where qualitative method was applied to ascertain the relationship between financial inclusion and the Islamic financial services industry in the Muslim world. It was evident that many individuals and businesses were however not financially included due to cost, distance, documentation, trust and religious devotion. Specifically, more than 40 million Muslims have no formal access to financial services solely for religious purposes.

Anwar, Uppun and Reviani (2016), in an attempt to investigate the role of financial inclusion in poverty reduction in Indonesia, reported that financial inclusion has a negative effect on poverty reduction but has positive effect on investment, employment and economic growth and indirectly reduces poverty and income inequality. Ali (2015) wanted to find out whether Islamic microfinance could eradicate poverty in Islamic countries. The study found that Islamic microfinance offers both financial inclusion and social inclusion (regarded as a motivator to the underprivileged members of the Islamic society that make provision of ṣadaqah, waqf and zakat to the poor and needy) to satisfy the basic needs of the society before credit is granted. Hence, concluded that Islamic microfinance plays a significant role in eradicating poverty.

Furthermore, aiming at assessing the contribution of Islamic Banks (IBs) to financial inclusion, Ocampos (2015) utilized data generated from the IMF and the World Bank databases on financial inclusion indicators and discovered that the IBs have insignificantly influenced financial inclusion and that the citizens of the OIC member countries does not have access to financial services, and thus make less use of them as compared to the citizens of non-member countries. Demirguc-Kunt et al. (2014) applied novel data with the aim of exploring access to financial services among a sample of 65,000 Muslim adults across 64 countries. The study discovered that Muslims are notably less likely than non-Muslims to formally open bank accounts or deposit their funds at conventional banks when individual- and country-level characteristics are controlled for. Andrianaivo and Kpodar (2012) assessed the relationship between mobile phone and economic growth in some selected African nations between 1998 and 2007. They found that mobile phones have significantly contributed to economic growth in the countries, part of which emerged as a result of financial inclusion.

Extant literature has provided a strong case for using conventional financial inclusion as an important strategy of addressing economic exclusion, especially in alleviating poverty, income inequality and unemployment. On the macroeconomic strand of macroeconomics, financial inclusion can provide impetus for helping countries to increase their GDP, reduce external debt overhang and achieve macroeconomic stability. However, findings of the plethora of extant studies are unanimous that the rate of financial inclusion has not been increasing enough to pave way for individuals to enjoy the microeconomic and macroeconomic benefit of inclusivity. As such, it is important to systematically explore the impact of Islamic financial inclusion on economic growth. Further, emergence of Sukuk as an

alternative measure of raising funds for infrastructural development was considered instrumental while exiting the economic recession, particularly during Nigeria's economic crisis of 2016. The Sukuk is a key instrument of Islamic financial inclusion which can provide a moderation effect in the finance-growth nexus as highlighted in Fig. 1. The extant literature has not examined the impact of financial inclusion on infrastructural quality which for part of the key issues addressed in this study.

3. EMPIRICAL METHODOLOGY

3.1. Data and model specification

This study set to examine the impact of Islamic financial inclusion (IFI^{X1}), infrastructural quality (IFR^{X2}) and Sukuk (SUK^{X3}) on economic growth (GDP^{Y1}). To achieve the objective, the primary empirical model takes the following functional form as:

$$lnGDP^{Y1}{}_t = \phi_0 + \phi_1 lnIFI^{X1}{}_t + \phi_2 lnIFR^{X2}{}_t + \phi_3 lnSUK^{X3}{}_t + \mu_t, \qquad (1)$$

Where the dependent variable in Eq. 1 is $lnGDP^{Y1}{}_t$ which represents economic growth, it is measured as the growth rate of gross domestic product as displayed in Table 1. The independent variable includes $lnIFI^{X1}{}_t$ which denotes Islamic financial inclusion, $lnIFR^{X2}{}_t$ represents infrastructural quality and $lnSUK^{X3}{}_t$ denotes the Sukuk bonds. The data for Sukuk and GDP growth rate ranges from 2017 until 2020 which were converted low to high frequency (yearly into monthly) using a quadratic function. This method was proved to be more effective than other alternatives, especially in small sample size (Cavusoglu et al. 2019). While the data was retrieved majorly from two sources, the variable codes, description and data sources are presented in Table 1.

Table 1. The variable codes, description and sources of the data

Variable Name	Abbreviation	Unit of Measurement	Source
Economic growth	$lnGDP^{Y1}{}_t$	Growth rate of gross domestic product	CBN
Islamic financial inclusion	$lnIFI^{X1}{}_t$	Savings of Islamic banks	CBN
Infrastructural quality	$lnIFR^{X2}{}_t$	Construction expenditure	CBN
Sukuk	$lnSUK^{X3}{}_t$	Total value of Sukuk bonds	DMO

CBN and DMO represent the Central Bank of Nigeria, and Debt Management Office, respectively.

3.2. Estimation Strategy

This study employs two sets of unit root tests: linear and nonlinear unit root. The linear test of stationary was run via the classical Augmented Dickey-Fuller

(ADF) and Phillips-Perron (PP) test. These tests were proved effective for small samples with no manifestation of structural break and nonlinearity in the series (Ibrahim, 2015; Cavusoglu et al. 2019). However, the nonlinearity appears in the series, the power and efficiency of traditional unit root breaks down. To deal with nonlinearity in the series several methods of testing nonlinear unit root were proposed within the framework of smooth transition autoregressive (STAR) model. The most recent test of nonlinear units was developed by Guris (2019) which was the extension of Fourier Kruse test where nonlinearity is modeled through exponential smooth transition autoregressive (ESTAR). The ESTAR process is specified as:

$$\Delta y_t = \beta_1 y_{t-1}^3 + \beta_2 y_{t-1}^2 + \sum_{i=1}^{k} \rho_i \Delta y_{t-i} + \eta_t. \tag{2}$$

In Eq. 2, the unit root hypothesis H$_0$: $\beta_1 = \beta_2 = 0$ will be tested against a globally stationary ESTAR process, H$_1$: $\beta_1 < 0, \beta_2 \neq 0$. Guris (2019) adopts a Fourier approach due to its ability to accurately capture unknown structural fractures in the series since the usage of dummy was proved inadequate to capture breaks. The Fourier approach can be presented as:

$$y_t = \delta_0 + \delta_1 \sin \sin \left(\frac{2\pi k t}{T}\right) + \delta_2 \cos \left(\frac{2\pi k t}{T}\right) + v_t, \tag{3}$$

Where k denotes optimal frequency, t and T represents trend and sample size, respectively. This test is proved to be flexible and has better power, especially for small samples.

To test the cointegration relation between Islamic financial inclusion, infrastructural quality, Sukuk and economic growth, the study adopts the Bootstrap Autoregressive Distributed Lag proposed (BARDL) by McNown et al. (2018). This method is superior to earlier versions of ARDL in terms of power and small samples. The estimating model for BARDL can be specified via the traditional ARDL given as:

$$
\begin{aligned}
\Delta lnGDP^{Y1}{}_t = \alpha_0 &+ \sum_{i=1}^{ol} \delta_1 \Delta lnGDP^{Y1}{}_{t-i} + \sum_{i=1}^{ol} \Delta\delta_2 lnIFI^{X1}{}_{t-i} \\
&+ \sum_{i=1}^{ol} \Delta\delta_3 lnIFR^{X2}{}_{t-i} + \sum_{i=1}^{ol} \Delta\delta_4 lnSUK^{X3}{}_{t-i} + \phi_1 lnGDP^{Y1}{}_{t-i} \\
&+ \phi_2 lnIFI^{X1}{}_{t-i} + \phi_3 lnIFR^{X2}{}_{t-i} + \phi_4 lnSUK^{X3}{}_{t-i} + \mu_t,
\end{aligned} \tag{4}
$$

where change Δ in Eq. 4 denotes the first difference process, α_0 is the constant term, δ_i is the estimated parameter short-run,$\phi_i$represent the long-run coefficients for all the variables, ol is optimal of lags. In BARDL modeling, McNown et al. (2018) suggested the addition of the coefficients of lagged independent variables which can be assessed with either t-test ($t_{dependent}$) or F-test ($F_{independent}$). The null hypothesis of $t_{dependent}$ is: $\phi_1 = 0$ against the alternative

hypothesis of $t/_{dependent}$ test is: $\phi_1 \neq 0$. Similarly, the null hypothesis of $F/_{independent}$ test is: H_0: $\phi_2 = \phi_3 = \phi_4 = 0$ will be tested against the alternative hypothesis of $F/_{independent}$ test of H_1: $\phi_2 \neq \phi_3 \neq \phi_4 \neq 0$. Then newly developed BARDL (CV) critical values are generated based on the combination of order of integration for each variable in the model (Wenyun et al. 2022).

To explore the asymmetric nexus between Islamic financial inclusion, Sukuk, infrastructural quality and economic growth, the study adopts the nonlinear autoregressive distributive lag (NARDL) proposed by Shin et al. (2014). This method suggested the decomposition of variables that exhibited asymmetric properties into positive and negative components as shown in Eq. 5.

$$y_{t,i} = y_{t,i}^- - +y_{t,i}^+. \tag{5}$$

Decomposed exogenous variables with asymmetric properties are added into Eq. 4 which yields NARDL specified in Eq. 6:

$$\begin{aligned}
\Delta lnGDP^{Y1}{}_t = \alpha_0 &+ \sum_{i=1}^{ol} \delta_1 \Delta lnGDP^{Y1}{}_{t-i} + \sum_{i=1}^{ol} \Delta\delta_2 lnIFI^{-X1}{}_{t-i} \\
&+ \sum_{i=1}^{ol} \Delta\delta_3 lnIFI^{+X1}{}_{t-i} + \sum_{i=1}^{ol} \Delta\delta_4 lnIFR^{X2}{}_{t-i} \\
&+ \sum_{i=1}^{ol} \Delta\delta_5 lnSUK^{-X3}{}_{t-i} + \sum_{i=1}^{ol} \Delta\delta_6 lnSUK^{+X3}{}_{t-i} \\
&+ \phi_1 lnGDP^{Y1}{}_{t-i} + \phi_2 lnIFI^{-X1}{}_{t-i} + \phi_3 lnIFI^{+X1}{}_{t-i} \\
&+ \phi_4 lnIFR^{X2}{}_{t-i} + \phi_5 lnSUK^{-X3}{}_{t-i} + \phi_6 lnSUK^{+X3}{}_{t-i} + \mu_t,
\end{aligned} \tag{6}$$

The asymmetric effect of Islamic financial inclusivity on economic growth presented in Eq. 5 has δ_2, δ_3 and δ_5, δ_6 as short run asymmetric effect of Islamic financial inclusion and Sukuk, respectively; whereas ϕ_2, ϕ_3 and ϕ_5, ϕ_6 are their respective long run asymmetric effects. To determine the joint negative and positive effect, Wald test will be applied on $\sum_{i=1}^{ol} \delta_i^- \neq \sum_{i=1}^{ol} \delta_i^+$. the decision rule is to reject the null hypothesis of symmetric relationship. As such if the negative component is statistically different from the positive component, it means that there exists a short-run symmetric effect. The study then applied a similar process while testing the long run asymmetric effect of the variables in question.

When nonlinearity exists, most of the conventional causality techniques such as the traditional Granger causality tests are prone to misspecification errors leading to possible wrong inferences Saliminezhad (et al. 2022). Nonparametric process was applied by Diks and Panchencko (2006) while attempting to extend the causality test into a nonlinear framework. This nonparametric causality is based on Eq. 7 as:

$$Q = \mathrm{E}[f_{X,Y,Z}(x,y,z)f_Y(Y) - f_{X,Y}(x,y)f_{Y,Z}(y,z)] = 0 \tag{7}$$

Let $\dot{f}_w(W_i)$ stands for a local mass appraiser of a d_w – random variate vector W at W_t explained by Let $\dot{f}_w(W_i) = (2\epsilon_n)^{-dw}(n-1)^{-1}\sum_{j,j\neq i}\quad I_{ij}^w$ where $I_{ij}^w = I(\parallel Wi - Wj \parallel < \epsilon_n)$ with $I(.)$. While indicator function and ϵ_n bandwidth depends on sample size n, test statistics can be formularized in Eq. 8.

$$T_n(\epsilon_n) = \frac{n-1}{n(n-2)} \times \sum_{i=1}^{n} \quad \hat{f}_{X,Y,V}(X_i,Y_i,V_i)\hat{f}_y(Y_i) - \hat{f}_{X,Y}(X_i,Y_i)\hat{f}_{Y,V}(Y_i,V_i)$$

8

Where T_n represents test statistics based the size of the sample (n), and ϵ_n denotes bandwidth which largely depends on the sample size (n). Moreover, for $\delta_x = \delta_y = 1, if \epsilon_n = Cn^{-\beta}\left(C>0, \frac{1}{4}<\beta<\frac{1}{3}\right)$ then this is proved beneath powerful integration (Diks & Penchenko, 2006) that the statistical test in Eq. 8 satisfies:

$$\sqrt{n}\,\frac{(T_n(\epsilon_n)-q)}{S_n}\,d \to N(0,1)$$

9

Where $d \to$ represent inter-section in distribution and S_n stands as appraiser of the asymptotical difference of T_n. it is pertinent to understand that nonlinear causality test is sensitive to optimal bandwidth which will ensure efficient and consistent estimates (Salinminezhad et al, 2022). The bandwidth selection was restricted within the bounds of 0.5 and 15 in the empirical estimation of Diks and Panchencko (2006).

Table 2. Unit root test results

Variables	ADF			PP		Integration	GNUR		Integration
	I(0)	I(1)		I(1)			I(0)	I(1)	
$lnGDP^{Y1}{}_t$	-0.049	-6.977***	I(1)	-7.023***	I(1)		25.429***	18.839***	I(0)
$lnIFI^{X1}{}_t$	0.786	-8.995***	I(1)	-9.015***	I(1)		7.2700	284.106*	I(1)
$lnIFR^{X2}{}_t$	0.356	-10.653***	I(1)	-10.653***	I(1)		9.620	-3.051***	I(1)
$lnSUK^{X3}{}_t$	2.241	-7.313***	I(1)	-7.313***	I(1)		8.619	5.363***	I(1)

Notes: ADP, PP, and BNUR refers to Augmented Dickey Fuller, Phillips Perron and Guris (2018) Nonlinear Unit Root, respectively.

*,**, ***indicates statistical significance at 10%, 5% and 1% level respectively.

4. RESULTS AND DISCUSSION

As indicated in the methodological section, properties of the series will be investigated with the framework of linear and nonlinear. The series were examined at the level and first differenced for all the tests in order to avoid making a wrong inference regarding the actual order of integration. Turning first to the unit root test that assumes linearity, Table 2 presents the results of traditional ADF and PP. While testing the properties of the series at the level, the null hypothesis of unit root is not rejected for all the variables across the ADP and PP tests.

Whereas, the study rejects the unit root null hypotheses at the 1% level of significance for all the series. The rejection of null hypothesis indicates that the variables are stationary at I (1) order of integration.

On the other hand, Guris (2019) test results of nonlinear unit root in Table 2 show that the null hypothesis of unit root is rejected at the level for GDP indication that the variable is I(0).Conversely, the null hypothesis of unit root is not rejected for IFI, IFR and Suk at level. However, their null hypotheses were rejected at the first difference indicating the variables are I (1) which satisfies the condition for asymmetric analysis.

Table 3. The results of bootstrap ARDL and Nonlinear ARDL

ARDL)1,1,0,1)	F_{BARDL}	F_{NARDL}	$t_{dependent}$	$F_{independent}$
$(lnGDP_t\,f\,(lnIFI_t\,,lnIFR_t\,,lnSUK_t\,)_{BARDL}$	5.054**		-4.93**	6.42**
$lnGDP_t\,=f\,(lnIFI_t\,,lnIFR_t\,,lnSUK_t\,)_{NARDL}$		3.017		
Bootstrap-based table C-V 5%	3.95	3.153	-4.035	4.77

** statistical sign at 5 percent level

The models specified to test for cointegration among the variables of interest were run in linear form and nonlinear and the estimated results are presented in Table 3. Starting with the linear model, the empirical result of bootstrap ARDL show that the values of $F/_{Pesaran}$, $t_{dependent}$, and $F/_{independent}$ are greater than their respective bootstrap critical values at the 5% level of significance. With this results the null hypothesis of no cointegration is rejected. This finding provides an uncontrollable premise to conclude that there is a linear cointegration among GDP, IFI, IFR and SUK variables. This evidence implies there is co-movement of the variables within the selected period which points the existence of at least unidirectional causal relation among the variables in question. However, the nonlinear model result in Table 3 indicates non rejection of null hypothesis at 5% level of significance. Given that this study found no evidence of cointegration in nonlinear model, existence of causal inference will depend on the nature of error correction term ECT (Cavusoglu et al. 2019). The result of ECT_{t-1} as highlighted in Table 4 indicates a value of -0.259 which is significant at 1% level. The negative sign of ECT_{t-1} shows the evidence of error equilibrating process with likelihood of detecting causal relation among the variable of interest.

Meanwhile, the non-linear dynamics of short-run and long- run impacts of the coefficients, as highlighted in Table 4, reveal that Islamic financial inclusion has a non-linear effect of reducing a negative growth rate of economic growth. Interestingly, Sukuk as another indicator of Islamic financial inclusion for long-term financing, has demonstrated a similar pattern with the short-term indicator of Islamic inclusive finance. The results indicate that Sukuk has a strong asymmetric impact on economic growth in Nigeria. Given that recession connotes a negative growth rate of GDP in two successive quarters (Aliero & Ibrahim, 2012; Ibrahim & Tanimu, 2016), deepening in Islamic financial inclusivity can facilitate exiting from economic recession. Similarly, the short-run coefficient of

infrastructural quality is 2.271 which is significant at the 1% level of significance. It indicates a positive relationship between infrastructural quality and economic growth. This finding is consistent with the findings of Shagali et al. (2019) which revealed that increase in infrastructure expenditure will enhance economic growth of Nigeria.

Table 4. Results of NARDL approach in short and long terms

Variables	Coeff.	t-statistics
$\Delta lnIFI\_neg^{X1}{}_t$	0.002	0.405
$\Delta lnIFR^{X2}{}_t$	2.271***	2.813
$\Delta lnSUK\_pos^{X3}{}_t$	−0.028***	−4.076
$\Delta lnSUK\_neg^{X3}{}_t$	0.004***	2.987
ECT_{t-1}	−0.259***	−5.266
$IFI-neg(-1)^{X1}{}_t$	−0.065***	−2.576
$IFI-pos^{X1}{}_t$	0.486	0.543
$IFR^{X2}{}_t$	−0.549	−0.833
$SUK\_pos(-1)^{X3}{}_t$	0.607**	2.188
$SUK\_neg(-1)^{X3}{}_t$	−0.006***	−3.165
Long run asymmetry Wald test	4.926** (0.0114)	
Short run asymmetry Wald test	6.1433*** (0.0043)	
Diagnostic tests		
N^{test}	1.110(0.382)	
$BPG-H^t$	1.807(0.812)	
A^t	0.513(0.152)	
LM^t	1.312(0.641)	
RR^t	0.681(0.344)	

Notes: This results indicate the effect of Islamic financial inclusion, infrastructural quality and Sukuk financing on economic growth

*, **, ***indicates statistical significance at 10%, 5% and 1% level respectively.

To test for the overall asymmetries in the short-run and long-run, Wald test was run and the result is presented in Table 4. The Wald test results for short-run asymmetries show a value of 6.1433 ($p < 0.05$) and the hypothesis of no short-run asymmetries is rejected. Similarly, the results for long-run asymmetries indicate the Wald test of 4.926 ($p < 0.05$) leading to rejection of null hypothesis of no long-run asymmetries. These results imply that Islamic financial inclusion plays a key role in the asymmetries of economic growth both in the short and long run.
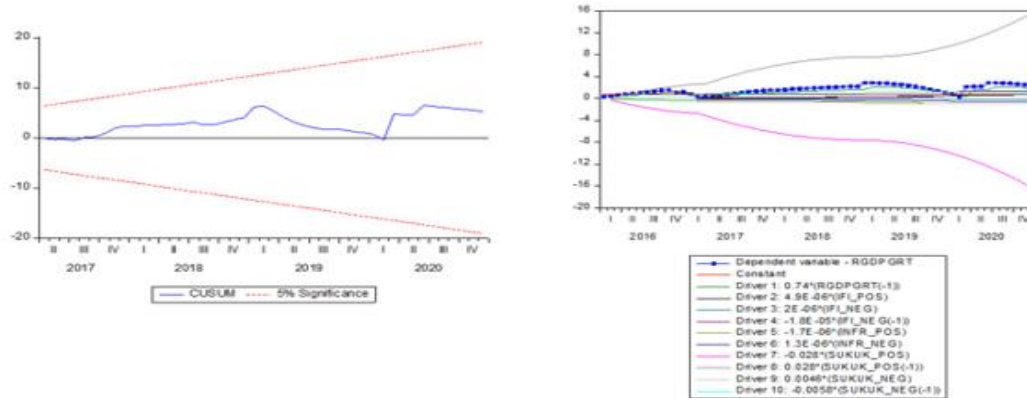
Fig. 2 Stability Test

With respect to diagnostic evaluation of the estimated models, the result of the JB normality test (N^t) indicates that the residuals of the estimated model are normally distributed. Moreover, the diagnostic results of the $BPG - H^t$, the ARCH test (A^t) and the BG-LM test (LM^t) showed no evidence of autocorrelation and the homoscedasticity in the estimated residuals, respectively. Similarly, the result of the Ramsey-Reset specification test (RR^t) reveals that the estimated model is correctly and well specified. Lastly, CUSUM test of stability of the estimated parameters is displayed in Fig. 2 and the result rejects the instability in the estimated model at the 5% level of significance.

Table 5. Results of Diks and Panchenko (2006) nonlinear causality test

Causal Settings		*Inferences*
ln(IFI) $\nrightarrow$ ln(GDP)	ln(GDP) $\nrightarrow$ ln(IFI)	
1.488*	1.930***	Bidirectional
ln(IFR) $\nrightarrow$ ln(GDP)	ln(GDP) $\nrightarrow$ ln(IFR)	
1.453*	0.210	Unidirectional
ln(SUK) $\nrightarrow$ ln(GDP)	ln(GDP) $\nrightarrow$ ln(SUK)	
1.448**	1.921***	Bidirectional
ln(IFR) $\nrightarrow$ ln(SUK)	ln(SUK) $\nrightarrow$ ln(IFR)	
1.633**	1.479*	Bidirectional
ln(IFI) $\nrightarrow$ ln(IFR)	ln(IFR) $\nrightarrow$ ln(IFI)	
1.752***	1.514*	Bidirectional
ln(IFI) $\nrightarrow$ ln(SUK)	ln(SUK) $\nrightarrow$ ln(IFI)	
1.839***	1.677***	Bidirectional

Note: $\nrightarrow$, symbolizes no causal linkage. Results are obtained using 2 embedded dimensions and a bandwidth of 0.532. The number of cells stands for the corresponding test statistics.

*, **, ***indicates statistical significance at 10%, 5% and 1% level respectively.

Turning to causal effect, the results of nonlinear causality for economic growth, Islamic financial inclusion, Sukuk and infrastructural quality implemented using Diks and Panchenko (2016) nonparametric causality is presented in Table 5.

The results reveal strong bidirectional causality Islamic financial inclusion, economic growth and Sukuk. The outcomes of feedback effect among these variables reinforce that there is a strong effect of Islamic financial inclusion on economic growth in Nigeria. This implies that Islamic financial inclusion through the IBs and capital investment via Sukuk have a direct effect on economic growth, which provides a strong case for using this unique financing strategy to address economic downturn (recession). This supports the findings of Ibrahim (2015), Shagali et al. (2019) and Cavusoglu et al. (2019). On the hand, a unidirectional causality was found which is running from infrastructural quality to economic growth. The implication of this is that while infrastructural development stimulates economic growth, the proceeds from economic growth were not utilized for the provision of critical infrastructural facilities. The funding for infrastructure projects in Nigeria heavily relied on domestic and external borrowing (Aliero and Ibrahim, 2010). This study provides to the literature a novel evidence that calls for switching towards Islamic financial inclusion in the funding of infrastructural facilities that prevent any potential economic crisis.

5. CONCLUSION

Islamic financial inclusivity is identified as a key strategy that could facilitate the achievement of inclusive growth. The rise of Islamic financial inclusion was informed by the realization of weakness of traditional financial inclusion both in terms of coverage and impact. This study examines the relationship between Islamic financial inclusion, infrastructural quality and economic growth in Nigeria. The study uses monthly data covering from 2017 until 2020 which was analyzed via a linear and nonlinear approach. The results reveal a number of findings. First, the result of bootstrap autoregressive distributed lag demonstrates that there is strong co-movement between economic growth, Islamic financial inclusion, Sukuk and infrastructural quality. This finding points to the existence of a strong positive relationship between Islamic financial inclusion, infrastructural quality and economic growth in Nigeria. Second, results from nonlinear models have revealed that Islamic financial inclusion and Sukuk have asymmetric effects on economic growth. This asymmetric pattern reinforces the claim that Islamic financial inclusion can play a dedicated role in ameliorating economic downturn. Third, the results of nonlinear causality reveal strong bidirectional causality Islamic financial inclusion, economic growth and Sukuk.

The outcomes of feedback effect among the variables modeled in this study reinforces that there is a strong effect of Islamic financial inclusion on economic growth in Nigeria. In this sense, inclusive Islamic finance could help countries overcome recession. The Sukuk investment bond has a robust implication towards the improvement in infrastructure quality and economic growth. As such, there is a strong need to solidify the existing policies that promote a deeper Islamic financial inclusion, especially in the wake of failure of conventional financial inclusion to reduce the number of excluded individuals.

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