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MODELLING THE INFLUENCE OF FINANCIAL INCLUSION ON THE REMITTANCE-GROWTH NEXUS IN NIGERIA

ABSTRACT: *In this paper, we explore the nexus between remittances and Nigeria's economic growth over the period 1996 to 2020 from the perspective of financial inclusion (FI). The fully modified ordinary least square (FMOLS) and Granger (1969) causality methodologies were employed. The findings of the FMOLS show that the increasing flow of remittances can significantly contribute to the growth of the Nigerian economy. Also, the interaction of financial inclusion and remittances has a significant impact on the country's development. The study concludes that the interaction of remittances with the measures of financial inclusion will lead to economic growth at a faster rate than when there is no interaction with financial inclusion. Using the Granger causality test, the study revealed that the relationship between financial inclusion and economic growth is a unidirectional one. It shows that the impact of financial inclusion on growth is conditional on remittances. Therefore, Nigeria's authorities need to work to strengthen all existing institutional weaknesses that allow questionable transactions in financial markets and to promote a more inclusive financial sector that will reduce the number of unbanked individuals in the country.*

KEY WORDS: *remittances, economic growth, financial inclusion, Nigeria*

JEL CLASSIFICATION: C13; G00; F24; F63

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1. INTRODUCTION

Globally, the attention of governments and policymakers is focused on leveraging financial inclusion and remittances as catalysts for precipitating economic growth and achieving sustainable development in many countries where large segments of society are excluded from the financial systems (Mader, 2016; Feghali et al., 2021). To complement the efforts of policymakers, financial economists and development scholars in recent times have focused on the consequences of international remittance flows, financial inclusion, and economic growth (Sobiech, 2019). It is argued that strengthening the financial system through financial inclusion policies would directly impact remittance inflows, and the latter would impact economic growth (Toxopeus & Lensink, 2008; Mashayekhi & Branch, 2015, Chuc et al, 2022). By improving financial inclusion, it is anticipated that the economic welfare of citizens will increase because cumulative savings of households and businesses have the propensity to increase consumption, augment income shocks, create a payment history for savers and increase future credit access (Feghali et al., 2021).

In the developing context, remittances play a vital role in the promotion of financial inclusion. The extant literature reports that an increase in remittances can influence the behaviour of households towards financial institutions (Anzoategui et al., 2014) owing to its capacity to change the financial habits of individuals. Moreover, remittances positively influence the demand for financial services in home countries as beneficiaries/recipients become more inclined to open bank accounts with formal financial institutions (Mashayekhi & Branch, 2015). The cause-effect relationships among remittances, financial inclusion, and economic growth were brilliantly explicated by Chuc et al. (2022), who found that international remittances positively impact the level of financial inclusion, which subsequently impacts economic growth. Consequently, financial inclusion has an important role in strengthening the growth-enhancing impact of remittances on recipient countries.

In Nigeria, the current situation of financial inclusion and remittances calls for structural improvement. Reliable reports indicate that Nigeria is one of the seven developing economies with a large unbanked population, corresponding to almost 50% of the global 1.7 billion unbanked adults (Demirguc-Kunt et al., 2018; Adegbite & Machethe, 2020). The remittance profile of Nigeria also requires policy interventions. Bolarinwa & Akinbobola (2021), who examined Nigeria and three other countries, found that past remittances had a significant role in the current financial development of Kenya and Nigeria. As a result, these countries need to develop their financial sectors in order to attract more remittances. Worse still, the household-level data on remittances received by households in Kano Nigeria were found to have a negative impact on education and investment in productive enterprises; hence, remittances do not cushion the effects of poverty (Adamu & Kabuga, 2016).

From the foregoing, remittances would be a valuable component of infrastructure financing in developing countries (Yoshino et al., 2020). Theoretically, remittances smooth household spending and thereby reduce production volatility (Dash, 2020). They benefit the recipient country's financial sector (Berk Saydaliyev, et al., 2020et al., 2020) by facilitating access to loans for investment by indigenous firms (Aggarwal et al., 2011). Furthermore, remittances can help boost the growth of a migrant's home country by providing a boost to household spending. According to Aggarwal et al. (2011), remittances can also help alleviate poverty in communities. The literature also contends that remittances help the migrant's country increase its internal savings (Connell & Conway, 2000; Sahoo & Dash, 2013). An increased household income typically results in increased savings rates in emerging countries. Likewise, remittances provide critical capital flows for the development of investment by allowing for the importation of capital and intermediate commodities (Chami et al., 2008). A review of recent events reveals that remittance inflows have risen dramatically and have surpassed other inflows that have historically figured prominently in developing countries (Dridi et al., 2019; Chuc et al., 2022) and have been considered a possible source of finance for sustainable development (Chuc, et al., 2022). Following the COVID-19 pandemic, the World Bank (2021) predicted a 19.7% decline in remittances to low- and middle-income countries (LMICs) to $445 billion in 2020. However, Nigeria's diaspora remittances inflows significantly exceeded the World Bank's prediction for 2021, increasing to $14.2 billion in the third quarter of 2021 and up from $12.9 billion in the same period of 2020, thanks to the impact of post-COVID economic recovery efforts by the Nigeria government.

Why have remittances become a front burner issue? Remittance inflows have become an important issue among policymakers because the quantum of funds remitted back to home countries by international migrants outweighs official development flows (ODFs) in middle-income countries and is comparatively larger than foreign direct investment (FDI) in low-income countries (Toxopeus & Lensink, 2008; Hassan et al., 2016; Murshed & Rashid, 2020; Chuc et al., 2022). In addition, a considerable amount of empirical literature suggests that remittances are catalysts for economic growth and financial development in poverty-ridden developing and emerging economies (see Adeniyi et al., 2015; Cismaș et al., 2020; Knoerich, 2017; León-Ledesma & Piracha, 2004; Meyer & Shera, 2017; Ratha, 2003; Sarma & Pais, 2011; Sobiech, 2019; Terry et al., 2004). Additionally, an ample number of studies have demonstrated that financial development is a vital component of the development of disadvantaged countries due to its ability to provide financing solutions (see Olagbaju & Akinlo, 2018; Anetor, 2020). These studies have led to a second set of empirical literature arguing that remittances and financial development are not mutually exclusive but that financial development tends to lessen the overall growth-inducing effects of remittances (Giuliano & Ruiz-Arranz, 2009). Specifically, Nyamongo et al. (2012) asserted that financial deepening appears to exacerbate remittances' positive effect on growth. It can be concluded, however, that no financial inclusion metrics nor an indicator for raising access to formal financial services is available in the previous literature. It is therefore likely that divergent results can be attributed to methodologies, sample scope, and financial inclusion metrics. There has only been a handful of studies in the past that examine the causal relationship between remittance inflows and regional development (De Vita & Kyaw, 2009; Donou-Adonsu et al., 2020; Nayak & Yingnan, 2019). The goal of this study is to provide a comprehensive analysis of the relationship between remittances, financial inclusion, and economic growth. This study attempts to fill a major gap in this field by examining the relationship between remittance inflows and the latter two issues.

Due to the complexity of the financial system, it is often difficult to determine this relationship. This is why it is important for researchers to understand the link between these three factors. The causation argument's direction is critical since in pursuing sustainable economic growth, remittance inflows and inclusive financial services have become critical issues in the line of activities aimed at revitalising the Nigerian economy. The preceding explanation demonstrates that the Nigerian government views remittances as a critical source of funding.

Notably, remittances to Nigeria have been volatile over the years, implying the necessity for reversals that exert significant pressure on domestic market circumstances. As a result, it is necessary to increase remittance flows, assist financial institutions, and attract further capital flows. Thus, given the commitments of stakeholders, financial sector expansion will have an effect on remittance inflows to Nigeria. The issue is whether financial inclusion through remittances into Nigeria is sufficient to spur economic progress. On the other hand, significant remittance inflows could have a detrimental effect on the country's growth process, resulting in external shocks and inflationary pressures. We argue that if remittance inflows are not accompanied by solid financial policies that promote an equitable financial system, their impact on the economy may be negligible. Hence, this study empirically examines the interactive effect of financial inclusion on remittance inflows-economic growth in Nigeria from 1996 to 2020 using time series data. In specific terms, the research questions are: (a) What is the impact of increasing the flow of remittances on the growth of the economy? (b) What is the interactive impact of financial inclusion and remittances on a country's development?

The present investigation demonstrates that access to financial services does not imply utilisation. Access to financial infrastructure often does not signify growth in the economy. Rather, it entails a state in which a growing proportion of a country's excluded populations cannot access and use formal financial services. In four different ways, this paper contributes to existing studies. First, it attempts to analyse the influence of financial inclusion on the remittance-economic growth nexus in Nigeria. This is despite contradictory findings in underdeveloped nations when the various indicators of financial development are used with divergent methodologies. Second, this study employs a composite index of financial inclusion (FIPHY) that is computed using principal component analysis (PCA). The distinctiveness of the PCA lies in its ability to eliminate the correlation and redundant details present among the variables. Information and communication technology (ICT) has been hailed as a vital aspect of promoting financial inclusion due to its involvement in bridging the financial infrastructure gap in many African nations and its ability to enhance social and economic inclusion (Kpodar & Andrianaivo, 2011; World Bank Group, 2016). In consonance with this, this study also follows Ajide et al. (2020) to measure financial inclusion with the measures of ICT (FIICT). Third, the study measures institutional quality with the institutional quality index (IQINDX), which is computed by averaging the six governance indicators. The selection of the variable is consistent with Olaniyi and Oladeji (2020). Fourth, while remittances have increased dramatically, evidence of an adverse nexus between remittances and economic growth has emerged (Chami et al., 2012), implying the possibility of an indirect causal relationship. The current study addresses this lacuna by examining the direction of causality between remittance inflows, economic growth, and financial inclusion in Nigeria. Last, our study emphasises that statistical analytical techniques such as the fully modified ordinary least squares (FMOLS) will shed light on the relationship between remittance inflows, financial inclusion, and economic growth in Nigeria. The rest of this study is arranged as follows. Section 2 presents a discussion of the associated empirical and theoretical literature. Section 3 discusses the methodology. Section 4 focuses on the empirical results, while Section 5 concludes the study.

2. REVIEW OF RELATED LITERATURE

This section reviews existing knowledge about the issue to obtain a better grasp of it based on the project's aims and objectives. Over the years, remittances have garnered much attention in the financial economics literature and have produced a range of findings. The first empirical view argues that remittances boost growth by providing capital for economic development, generating employment, enhancing the growth of the economy, and assisting recipient countries in reducing their current account deficits (León-Ledesma & Piracha, 2004; Meyer & Shera, 2017; Ratha, 2003; Terry et al., 2004). Cismaș et al. (2020) discovered that remittances do not increase economic growth. Similarly, Bandura et al. (2019) argued that while remittances aid economic development, they hamper financial development in 14 SADC countries. Additionally, a substantial body of empirical research has shed light on the nexus between remittances and financial development or inclusion. Remittances hypothetically transmit or influence financial development by enhancing demand for savings instruments, thereby stimulating households' financial capacity. Consequently, their demand for bank accounts may increase, as financial institutions provide households with a secure location to store their transitory surplus money (Misati et al., 2019; Berk Saydaliyev, et al., 2020; Muktadir-Al-Mukit & Islam, 2016). Furthermore, remittances can contribute to financial inclusion by increasing recipients' chances of obtaining loans from official banks and other financial institutions (Berk Saydaliyev et al., 2020). This may boost financial institutions' willingness to lend to previously opaque borrowers.

However, the literature on remittances and financial inclusion has clearly evolved in a fragmented manner, producing inconsistent results. The first empirical argument asserts that remittances boost senders' and recipients' use of financial services (Anzoategui et al, 2014; Orozco & Fedewa, 2005; Berk Saydaliyev, et al., 2020). The studies suggested that remittances' positive effect on financial inclusion is due to the increase in demand for bank accounts (Ambrosius & Cuecuecha, 2016). However, another viewpoint argued that these remittances may not lead to an all-encompassing financial system. (Ambrosius & Cuecuecha, 2013; Brown et al., 2013; Calderon et al., 2008; Chami & Fullenkamp, 2013; among others). In 2013, Chami and Fullenkamp noted that there was a negative correlation between financial inclusion and remittances. Berk Saydaliyev et al. (2020) recently argued for the importance of institutional quality in developing countries receiving high returns. Likewise, scholars have shown that political stability and institutional quality are important factors that can influence financial inclusion or remittance-growth nexus (see Adekunle et al, 2020; Ajide et al., 2017; Dabla-Norris et al., 2020; Ozili, 2021; Ogede, 2019). Meanwhile, studies such as Kabakova and Plaksenkov (2018) and Sharma and Kukreja (2013) previously argued that the technology aspect of financial inclusion encompasses new banking technologies such as internet and mobile banking, on which increased reliance has been placed to improve financial inclusion (Kabakova & Plaksenkov, 2018). Bala et al. (2017) claim, using dynamic panel methods, that financial development promotes economic growth in African OPEC member nations. Similarly, Chebab et al. (2020) believe that financial development was significantly and favourably associated with economic growth in resource-rich Middle Eastern and North African (MENA) nations from 1987 to 2015. Following the turning point, the findings suggest that increased financial development has a negative impact on economic growth.

Nevertheless, the literature on financial inclusion's involvement in the remittance-growth nexus is scant. As a result, the current study identifies the necessity to alleviate the disadvantages by undertaking a detailed examination of the effect of financial inclusion on the remittances-economic growth nexus. Flowing from the foregoing empirical review, we hypothesise the following:

Hypothesis 1: Increasing the flow of remittances can significantly contribute to the growth of the economy.

Hypothesis 2: The interaction of financial inclusion and remittances can significantly impact a country's development.

3. METHODOLOGY

3.1 Theoretical framework and model specification

This study relies on the work of Mankiw et al. (1992), Sobiech (2019), and Saydaliyev et al. (2020), which we subsequently modified to establish the nexus between remittance inflows, financial inclusion, and economic growth. The model is given as:

$$y_t = a_0 + a_1 A_t + \varepsilon_t \tag{3.1}$$

where y_t represents economic growth and A represents remittance inflows from citizens to the rest of the world due to global integration and the investment drive to fill funding gaps caused by research and growth, human capital, and technical spillover effects. The role of remittances on economic growth is at the forefront of the foreign capital inflows-growth discourse. The argument is that, on the one hand, remittance-growth theory posits that remittance inflow results in rising returns to scale. On the other hand, the neoclassical model emphasises declining returns to the marginal product in the long run (Adams & Klobodu, 2016). a_0 and a_1 are the parameters, while ε_t is the error term. The financial development literature has attached a vital role to financial inclusion in the growth process. Financial inclusion can directly have implications for economic growth through its growth-reducing role if the economy is financially excluded and growth-enhancing tendencies if the economy is financially inclusive (Gurley & Shaw, 1955; Sethi & Acharya, 2018). Consequently, we augment equation (3.1) to include the measure of financial inclusion (FI). Thus, equation (3.1) is re-specified as:

$$y_t = a_0 + a_1 A_t + FI_t + \varepsilon_t \quad (3.2)$$

In addition, FI can also indirectly have implications for economic variables without remittances being an exception. This study hypothesises that an all-encompassing financial structure can facilitate the flow of remittances and ultimately influence the economy through the channel of remittances. Hence, we augment equation (3.2) to include the interaction of remittances and financial inclusion.

$$y_t = a_0 + a_1 A_t + a_2 FI_t + a_3 FI_t * A_t + \varepsilon_t \quad (3.3)$$

Institutional quality (IQINDX) is crucial in guaranteeing an enhanced financial system and a suitable regulatory framework for remittance inflows. This study augments equation (3.3) to include the measure of institutional quality and other growth-determining factors such as foreign direct investment (FDI), trade openness (TRADE), and gross fixed capital formation (GCF). Representing the notations of equation (3.3) and in a log-linear format, equation (3.3) is given as:

$$\text{InGDPP}_t = a_0 + a_1 \text{lnREM}_t + a_2 \text{lnFI}_t + a_3 \text{lnFI}_t * \text{REM}_t + a_4 ln\text{GCF}_t + a_5 ln\text{FDI}_t + a_6 ln\text{IQINDX}_t + a_7 ln\text{TRADE}_t + \varepsilon_t \quad (3.4)$$

where LNGDPP is the natural log of GDP per capita, REM is the remittances received, and FI is a vector of both the physical access measure (FIPHY) and ICT measure (FIICT) of financial inclusion. $\text{FI} * \text{REM}$ is the interaction of remittances with the measures of financial inclusion; $\text{GCF}, \text{IQNDX}, \text{FDI}, \text{and TRADE}$ are defined earlier. On incorporating the proxies of financial inclusion into equation (3.4), the model to estimate the effect of financial inclusion on the remittance-growth nexus is given as follows:

$$\text{InGDPP}_t = a_0 + a_1 ln\text{REM}_t + a_2 \text{lnFI}_t + a_3 ln\text{FIPHY}_t * \text{REM}_t + a_4 ln\text{FIICT}_t * \text{REM}_t + a_5 ln\text{GCF}_t + a_6 \text{lnFDI}_t + a_7 ln\text{IQINDX}_t + a_8 \text{lnTRADE}_t + \varepsilon_t \quad (3.5)$$

In terms of the a priori expectation, remittances may have either a direct or indirect relationship with economic growth, depending on whether they are utilised for investment purposes or otherwise ($a_1 \gtrless 0$). Studies such as Iqbal and Satter (2008) and Vargas-Silva (2008) support a positive relationship, while Barajas, Gapen, Chami, Montieland, and Fullenkamp (2009) report the existence of a negative nexus. In addition, the coefficient of the interaction between remittance inflows and the measures of financial inclusion is expected to be positive $(a_3, a_4 > 0)$. Furthermore, the coefficients of $a_5, a_6, a_7 > 0$ are predicted to be positive because they are growth-enhancing (Haider et al., 2016). In view of the preceding discussion, the paper employs various econometric procedures to capture the economic analysis of the three variables in Nigeria. First, a pre-estimation assessment is conducted using descriptive statistics that aid in describing and summarising the data properties in clear way (Gujarati & Porter, 2009). The study further performs a unit root and cointegration to determine the stationarity and long-run co-movement of the variables. It then proceeds to estimate a cointegrating regression, 6+ specifically, using the fully modified ordinary least square. This method makes it possible to take into account the serial correlation effects in the independent variables. Hence, the FMOLS model provides cointegrating regression estimates that are optimal and unbiased.

3.2 Data and sources

The objective of this study is to examine the effects of financial inclusion on Nigeria's growth-remittances nexus. The research is based on data collected from 1996 to 2020, which are mainly influenced by the availability of global data sources such as the World Development Indicators and the World Governance Indicators. The dependent variable is economic growth, which is gauged using the real gross domestic product per capita (GDPPC). The usage of this measure is in accordance with Adrián Risso and Sánchez Carrera (2019) and Brueckner and Lederman (2018). The key regressors are remittances received and financial inclusion, whereas the control variables are foreign direct investment (FDI), gross fixed capital formation (GCF), trade openness (TRADE), and institutional quality (IQINDX). The study captures remittances using remittances received as a percentage of GDP, and its adoption aligns with Meyer and Shera (2017) and Barajas et al. (2009). Financial inclusion has been measured within the financial development literature with variables including automated teller machines (ATMs), account ownership at a financial institution (ACNT), and commercial bank branches (BRCH) (Ahamed & Mallick, 2019; Park & Mercado, 2021; Sarma, 2016). Since the sole use of these indicators can provide only partial and incomplete information about the comprehensiveness of the financial system (Sarma, 2016), and there is a high correlation between these variables, this study employs a composite index of FI (FIPHY) and FI (FIICT) computed using principal component analysis (PCA), as reported in Table 1 below.

Table 1. The principal composite index of FIICT and of FIPHY.

Principal components	ICT access		Physical access			Statistics		
	FBB	**MOB**	**ATM**	**ACNT**	**BRCH**	**Proportion**	**Cumulative (%)**	**Eigen**
1st comp (FIICT)	0.707	0.707	---	---	---	0.792	0.792	1.583
2nd comp	-0.707	0.707	---	---	---	0.208	1.000	0.416
1st comp (FIPHY)	---	---	0.695	0.715	-0.079	0.578	0.578	1.736
2nd comp	---	---	0.278	-0.166	0.946	0.362	0.940	1.085
3rd comp	---	---	-0.664	0.679	0.314	0.060	1.000	0.177

Comp: principal component; **Source:** Authors' calculation

Thus, using this principal component analysis of ATM, ACNT, and BRCH, the composite index of FI (FIPHY) is used to gauge the physical access index of financial inclusion following Ogede and Tiamiyu (2023) as reported in Table 1. Likewise, this study measures FI with the index of ICT (FIICT), which is generated through principal components analysis of mobile cellular subscriptions per 100 people (MOB) and fixed broadband subscriptions per 100 people (FBB). The distinctiveness of the PCA lies in its ability to eliminate the correlation and redundant details present among the variables. Information and communication technology (ICT) has been hailed as a vital aspect in promoting FI due to its involvement in bridging the financial infrastructure gap in many African nations and its ability to enhance social and economic inclusion (Kpodar & Andrianaivo, 2011; World Bank Group, 2016). This study therefore follows Ajide et al. (2022) in using the measures FI with the measures of ICT (FIICT) as mentioned above. The study also aligns with Khan et al. (2020) to measure FDI as foreign direct investment inflows as a percentage of GDP. Gross fixed capital formation is used to measure the level of investment. The selection of this measurement is in line with Meyer & Shera (2017). Trade openness (TRADE) is gauged using trade as a percentage of GDP, and its selection is in accordance with Khan et al. (2020). Last, the study measures the quality of institutions with the institutional quality index (IQINDX), which is computed by averaging six governance indicators. The selection of the variable is consistent with Olaniyi and Oladeji (2020).

4. RESULTS AND DISCUSSION

4.1. Summary statistics and correlation

Table 2 presents the descriptive statistics of the variables. The table reveals that the statistical measures of the series are statistically independent. From the table, all the variables except institutional quality are positive in their means, thereby giving an increasing tendency for all the variables except institutional quality. The average income per person is $2,095.33, while the highest and lowest values are $2688.27 and $1,416.52, respectively. Remittances received average 3.98% of GDP, while the physical access measure of financial inclusion, namely, ATM numbers, account ownership, and the number of commercial bank branches, average 22, 32.76, and 4.71, respectively. As for the ICT access measure of financial inclusion, mobile cellular and fixed broadband subscriptions average 40.79% and 0.020%, respectively. FDI, capital formation, institutional quality, and trade openness average 1.43%, 24.12%, -1.11%, and 37.65%, respectively. In addition, GDP per capita appears to be the most dispersed variable, while fixed broadband subscription is the most stable variable. Our data consist of both positively and negatively skewed series and, similarly, are either leptokurtic or mesokurtic in kurtosis. The table further reveals that all the variables except account ownership at a financial institution and commercial bank branches are normally distributed.

The results of the Phillips Perron and Dickey-Fuller tests are consistent, as displayed in Table 3. The first-order difference results of the PP and the ADF tests reveal that the variable sequences are not stationary at the level. However, when the first-order difference is taken into account, the variable sequences become stationary. The results of the unit root tests suggest that the presence of a long-run co-movement between the independent and dependent variables is possible. This study conducts the bounds test cointegration technique to ascertain the presence of long-run cointegration between the dependent variable and the independent variables. The bounds test is useful because it is applicable irrespective of the order in which the series is integrated. Table 4 presents the result of the bounds cointegration test between the measure of economic growth and our regressors when financial inclusion is proxied by the physical access measure of financial inclusion and when it is measured by the ICT proxy. The bounds test compares F-statistics against the critical values. The result reveals that the F-statistics of both the physical access proxy of financial inclusion (7.086) and the ICT measure of financial inclusion (6.752) exceed all the critical values of the lower and upper bounds at the 10%, 5%, and 1% levels of significance. The study rejects the idea that there is no cointegration between economic growth, remittances, and financial inclusion. It shows that there are long-run relationships between these factors and various other control variables.

Table 2. Description of variables

Variables	Notation	Mean	Max	Min	Std. Dev.	Skewness	Kurtosis	Jarque-Bera
GDP per capita (constant 2015 US$)	GDPPC	2095.334	2688.267	1416.516	461.426	-0.301	1.555	2.554
Remittances, received (% of GDP)	REM	3.979	8.312	0.581	2.257	-0.036	1.840	1.408
Automated teller machines (per 100,000 adults)	ATM	7.220	16.930	0.040	6.933	0.268	1.326	3.220
Account ownership at a financial institution (% of pop.)	ACNT	32.764	44.442	29.668	5.495	1.340	3.059	7.490 *
Commercial bank branches (per 100,000 adults)	BRCH	4.711	6.560	0.400	1.503	-1.715	6.227	23.098 ***
Fixed broadband subscriptions (per 100 people)	FBB	0.020	0.063	0.000	0.023	0.618	1.773	3.161
Mobile cellular subscriptions (per 100 people)	MOB	40.787	99.073	0.013	36.695	0.138	1.400	2.745
Foreign direct investment, net inflows (% of GDP)	FDI	1.428	2.900	0.195	0.759	0.258	2.066	1.186
Gross fixed capital formation (% of GDP)	GCF	24.117	40.553	14.169	8.572	0.474	2.009	1.962
Institutional quality (average of RQ, GE, PS, VA, CC, RL)	IQINDX	-1.106	-0.995	-1.265	0.077	-0.237	2.001	1.192
Trade (% of GDP)	TRADE	37.645	53.278	20.723	9.124	-0.088	2.219	0.668

Note: $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$; Max: maximum; Min: minimum; RQ: regulatory quality; GE: government effectiveness; PS: political stability and absence of violence/terrorism; VA: voice and accountability; CC: control of corruption; RL: rule of law.

Table 3. Unit root results

Test	Augmented Dickie Fuller (ADF)				Phillip Perron (PP)				Integration order
Variables	Level		1st difference		Level		1st difference		
	t-stat	Prob.	t-stat	Prob.	t-stat	Prob.	t-stat	Prob.	
GDPPC	-1.737	0.401	-4.228 **	0.004	-1.338	0.595	-5.412 ***	0.000	I (1)
REM	-2.098	0.247	-4.689 ***	0.000	-2.125	0.237	-4.600 **	0.002	I (1)
ACNT	-1.619	0.458	-4.176 **	0.004	-1.672	0.432	-4.176 **	0.004	I (1)
BRCH	0.022	0.952	-4.216 **	0.004	-0.118	0.937	-4.216 **	0.004	I (1)
FIPHY	-1.598	0.468	-3.330 ***	0.026	-1.258	0.631	-3.330 *	0.026	I (1)
FBB	-1.341	0.588	-5.801 ***	0.000	-2.063	0.260	-4.909 ***	0.001	I (1)
MOB	0.816	0.992	-3.739 *	0.010	0.571	0.986	-3.758 **	0.010	I (1)
FIICT	0.807	0.992	-3.802 **	0.009	0.565	0.986	-3.827 **	0.009	I (1)
FDI	-1.549	0.488	-7.464 ***	0.000	-1.550	0.491	-7.595 ***	0.000	I (1)
GCF	-1.411	0.560	-2.941 **	0.006	-1.448	0.542	-2.960 **	0.005	I (1)
IQINDX	-2.772	0.078	-5.542 ***	0.000	-2.792	0.075	-5.541 ***	0.000	I (1)
TRADE	-2.350	0.166	-5.773 ***	0.000	-2.254	0.194	-8.341 ***	0.000	I (1)

Note: *p < 0.05; **p < 0.01; ***p < 0.001; I (0): integrated of order zero; I (1): integrated of order one

Table 4. Bound cointegration test results

Model	F-statistics	Bounds		Conclusion
		Upper	Lower	
Financial inclusion (physical access proxy)	7.086	2.85 ***	1.85 ***	cointegration
		3.15 **	2.11**	
		3.77 *	2.62 *	
Financial inclusion (ICT proxy)	6.752	2.85 ***	1.85 ***	cointegration
		3.15 **	2.11**	
		3.77 *	2.62 *	

Note: *, **, and *** denote 1%, 5% and 10% statistical levels of significance

4.2. Econometric results and discussion

This section elaborates on the empirical findings of the study. The results for fully modified ordinary least squares are displayed in Tables 5 and 6. The results of the causal relationship are presented in Table 7.

4.2.1 FMOLS results

Tables 5 and 6 show the FMOLS findings for the relationship between remittances, financial inclusion, and economic growth in Nigeria when financial inclusion is measured by physical access and ICT proxies, respectively. Table 5 shows that at 0.898 adjusted R^2, the model has a good fit. Therefore, the effects of the various explanatory variables on the growth of the economy were able to explain almost 90% of the variation in the overall economic growth. Remittances play a positive role in the growth of the economy by increasing the level of economic activity by 0.031%.

Table 5. Fully modified OLS result of the effect of financial inclusion (proxied by physical access) on the remittances-economic growth nexus.

Variables	Coefficient	Std. Error	t-statistics	Prob.
REM	0.031 **	0.009	3.439	0.003
FINCPHY	0.174 ***	0.024	7.250	0.000
FINCPHY x REM	0.223 ***	0.021	10.619	0.000
FDI	-0.001	0.002	-0.431	0.673
TRADE	0.095 ***	0.019	5.148	0.000
GCF	0.022 ***	0.002	-9.090	0.000
IQINDX	0.366 *	0.145	-2.530	0.022
Constant	7.802 ***	0.185	42.114	0.000

Diagnostics

Adj. R^2	J-B Normality of residuals	J-B probability	Autocorrelation (Q-stat)	Partial Autocorrelation
0.898	1.699	0.428	absence	Absence

Note: *p < 0.05; **p < 0.01; ***p < 0.001

Table 6. Fully modified OLS result of the effect of financial inclusion (proxy with ICT) on the remittances-economic growth nexus.

Variables	Coefficient	Std. Error	t-statistics	Prob.
REM	0.010 *	0.005	2.163	0.033
FINCICT	0.360 ***	0.037	9.616	0.000
FINCICT x REM	0.036 ***	0.009	-4.178	0.001
FDI	-0.012	0.011	-1.039	0.314
TRADE	0.002 **	0.001	2.884	0.011
GCF	0.013 ***	0.001	-14.265	0.000
IQINDX	0.389 ***	0.063	-6.168	0.000
Constant	7.558 ***	0.077	97.984	0.000

Diagnostics

Adj. R^2	J-B Normality of residuals	J-B probability	Autocorrelation (Q-stat)	Partial Autocorrelation
0.983	1.512	0.470	absence	Absence

Note: *p < 0.05; **p < 0.01; ***p < 0.001

Table 6 shows that the effect of remittances on economic growth is not considerably different. This conclusion also implies that there is no doubt about remittances' ability to boost economic growth. This result is consistent with the findings of Cazachevici et al. (2020) and Meyer & Shera (2017) but contradicts the outcome of Sobiech (2019). In addition, Table 5 demonstrates that the physical access indicator of financial inclusion is significantly and positively associated with economic growth. In summary, a one percentage point increase in access to ATMs, bank branches, and the ability to own an account at a financial institution stimulates economic growth by 0.174 per cent. In agreement with this, when the ICT measure is used to proxy financial inclusion, Table 6 shows that the positive effect of financial inclusion on economic growth remains vibrant. In essence, a one percentage point increase in ICT factors will exert a 0.360% increase on economic growth. Although the physical access and ICT measure of financial inclusion are positive in their signs, the higher magnitude of the ICT measure suggests that faster economic growth will be realised through the ICT measure of financial inclusion. The positive impact of financial inclusion on economic growth is consistent with the findings of Kim et al. (2018) and Sethi and Sethy (2019). The result of the effect of the interaction of financial inclusion and remittances on economic growth reveals that the interaction of both measures has a magnifying and significant effect on economic growth in Nigeria. A one percentage point increase in the interaction of the physical measure and the ICT measure of financial inclusion will raise the level of economic growth by 0.223% and 0.036%, respectively. In essence, the interaction of remittances with the measures of financial inclusion will lead to economic growth at a faster rate than when there is no interaction with financial inclusion. The result implies that in the presence of an inclusive financial economy, the economic growth benefits of remittances will increase. In terms of the control variables, foreign direct investment exerts a negative, but insignificant, effect on economic growth. The result is consistent with that of Ayenew (2022). Trade openness, capital formation, and institutional quality are positively and statistically significantly related to economic growth. Furthermore, the result shows that the residuals of the models are normally distributed and do not suffer from either partial or total autocorrelation.

Table 7. Causal pathway results

Hypothesis	F-statistics	Probability	Causal Pathway
GDPPC to REM	0.753	0.485	One-way causality
REM to GDPPC	3.990	0.033 *	
FINCPHY to GDPPC	4.246	0.028 *	One-way causality
GDPPC to FINCPHY	1.356	0.283	
FINCICT to GDPPC	3.492	0.288	One-way causality
GDPPC to FINCICT	1.334	0.046 *	
FINCICT*REM to GDPPC	1.767	0.199	One-way causality
GDPPC to FINCICT*REM	3.630	0.042 *	
FINCPHY*REM to GDPPC	5.646	0.013 **	One-way causality
GDPPC to FINCPHY*REM	1.313	0.294	
GCF to GDPPC	9.513	0.002 **	One-way causality
GDPPC to GCF	0.250	0.782	
FDI to GDPPC	6.250	0.009 **	One-way causality
GDPPC to FDI	2.710	0.094	
IQINDX to GDPPC	0.367	0.698	One-way causality
GDPPC to IQINDX	3.602	0.042 *	
TRADE to GDPPC	1.092	0.357	No causality
GDPPC to TRADE	2.578	0.098	

Note: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

Furthermore, this study conducts Granger (1969) causality tests to ascertain the causal relation between remittances, financial inclusion, and economic growth. Table 7 presents the results of the causal relationships between our variables. It reveals that the null hypothesis of no causality is rejected for the relationship between remittances and economic growth; the relationship between the interaction of remittances and physical access of financial inclusion and economic growth; the relationship between the physical access measure of financial inclusion and economic growth; the relationship between the ICT measure of financial inclusion and economic growth;, the relationship between gross fixed capital formation and economic growth; and the relationship between foreign direct investment and economic growth. This implies that there exists only a unidirectional relationship that runs from remittances, the interaction of remittances and physical access, to the physical access measure of financial inclusion. The findings also indicate that economic growth is primarily driven by fixed capital formation, foreign direct investment, and financial inclusion associated with ICT investments. A one-way causal relationship is also found between economic growth and remittances, as well as any ICT measurement of financial inclusion. The study does not disprove the idea that trade openness does not cause economic growth. It is consistent with the findings of previous studies (Kim et al., 2018; Sethi & Sethy, 2019) that suggest financial inclusion can lead to higher economic growth.

5. CONCLUSION AND POLICY IMPLICATIONS

Remittances are front and centre within the discourse on foreign capital inflows and growth. Studies have found that some of the impacts are positive, while others are nonsignificant or even negative. It is possible that the mixed results are attributable to an important role played by financial inclusion (FI) during economic growth. The literature argues that financial inclusion can directly have implications for economic growth, as it has a growth-reducing effect if the economy is financially excluded and growth-enhancing tendencies if the economy is financially inclusive. This study examines the effect of financial inclusion (FI) on the remittance-economic growth nexus in Nigeria over the period 1996 to 2020. The FMOLS approach has been applied to ascertain the role of financial inclusion in the remittance-economic growth linkage. Furthermore, the Granger (1969) causality approach is used to ascertain the causal relation between remittances, financial inclusion, and economic growth in Nigeria.

The study reveals that remittances from abroad have a positive influence on the country's economic growth. The study also found that the increasing number of financial inclusion households has a significant positive effect on the country's economic growth. It shows that the ICT measure can be used to determine the impact of financial inclusion on the country's growth. Although the physical access and ICT measure of financial inclusion are positive in their signs, the higher magnitude of the ICT measure suggests that faster economic growth will be realised through the ICT measure of financial inclusion. It has also been shown that the interaction of remittances and financial inclusion has a significant impact on Nigeria's growth. It is expounded that the increase in remittances due to increased financial inclusion will lead to a faster rate of economic growth than if the country had not had this interaction. Economic growth is negatively affected by foreign direct investment, although it is not significant. In line with Ayenew

(2022), these results are promising. In fact, trade openness, capital formation, and institutional quality exhibit a positive and statistically significant relationship with economic growth. The findings of the Granger (1969) causality test reveal that there is only a unidirectional relationship running from remittances, the interaction of remittances and physical access, the physical access measure of financial inclusion, the ICT measure of financial inclusion, gross fixed capital formation, and foreign direct investment to economic growth. A one-way causality is also found from economic growth to the interaction of remittances and ICT measures of financial inclusion and institutional quality. In contrast, the study reports a positive causality running from financial inclusion to economic growth.

As a consequence of these findings, the study suggests that the appropriate authorities should make concerted efforts to remove all inherent weaknesses in Nigeria’s institutional mechanisms that enable questionable dealings in financial markets, leaving Nigeria's financial system uncompetitive and unproductive, resulting in reduced production. These efforts will lead to a rise in institutional values in Nigeria and can be accomplished by stepping up the battle against corruption, insecurity, violent behaviour, and violent extremism; by enhancing the rule of law and regulatory quality; by encouraging transparency; and by lessening inept government activities in order to guarantee long-term improvements in the institutional context. Hence, to increase economic growth in Nigeria, both measures of financial inclusion and remittances need to be considered together, with the aim of reducing the number of unbanked populations through the establishment of an inclusive financial sector. By encouraging remittance recipients to use financial services, the government can hope to spur growth given that excessive availability of these services without their being used may be wasteful and resource-intensive in Nigeria. According to research by Chuc et al. (2022), a more integrated financial system can assist migrants in sending money back home and keeping money in banks. Therefore, remittances placed in banks will significantly boost the number of families with access to financial services. This will also contribute to the economic expansion of the nation. Consequently, more capital will be allocated to productive investment initiatives.

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