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# Revisiting the nexus between remittances and financial sector development in Nigeria

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**Abstract**

**Purpose —** The study aims to investigate the impact of remittances on financial sector development in Nigeria using data from 1990 to 2021.

**Method —** The study examines the variables' relationship using the Autoregressive Distributed Lag (ARDL) and Toda Yamamoto (TY) Causality.

**Findings —** The study finds that remittances have a positive and significant long-run impact on financial sector development. Total reserves and imports of goods and services have a negative and significant long-run impact. In the short run, remittances and deposit interest rates positively and significantly impact financial sector development, while total reserves and total population have negative and significant impacts. The Toda-Yamamoto causality result indicates a two-way causal relationship between financial sector development and remittances.

**Implication —** The study recommends that the government employs policies encouraging channeling remittances through a formal banking system, as well as ensuring that such remittances received are channeled to finance productive investment, hence financial development.

**Originality —** The novelty of this research relates to the use of the three main indicators of remittances in an economy, which are the import of goods and services, total reserves, and deposit interest rates, to examine its impact on financial sector development in Nigeria.

**Keywords —** Remittances, financial development, interest rate, cointegration, Nigeria

## Introduction

Migration has been a livelihood strategy among households in most developing countries. The World Bank reports that about 244 million migrants from developing countries lived and worked outside the country of their birth. Hence, only about 20 percent of sub-Saharan Africans educated abroad return home, and the remaining 80 percent stay in the country of their study as migrants (World Bank, 2018).

According to The World Bank Report, Nigeria is one of the top remittance recipients in Sub-Saharan Africa. The country was estimated to have received about 21 billion USD in remittances in 2012 compared to 2.3 billion USD in 2004. It also projected that up to 22 billion USD will flow into Nigeria 2017 through diaspora remittances. The European Union (2016) stated that more than 10 million Nigerians, representing more than 5% of the country's population, lived abroad, of which almost 50% were in Sub-Saharan Africa. The World Bank (2018) report has shown that remittances by Nigerians in the diaspora rose steadily in the last 13 years and recorded

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the highest at 71.3% in 2018. The remittance to Nigeria rose 11.2 percent in 2021 to $19.5bn from the $17.21bn recorded in 2020. The remittances are estimated to hit $20.9bn by the end of 2022. This represents a 75% increase from the prior year 2021.

Becker (1976), who propagated the theory of altruism, pointed out that the decision to remit relies on the income needs of the relatives of the emigrant worker. The migrant worker remits the money because his utility derives from that of his family members (Fullenkamp et al., 2008). In other words, the migrant worker gets satisfaction if the family's welfare left back home improves. This theory highlighted that the recipients received remittances through the financial sector; meanwhile, they do not have a positive relationship with private investment since they are primarily spent on consumption activities. Markowitz (1952) views remittances as a strategy by an emigrant worker to diversify their savings. Accordingly, remitting relies on the risk-return differential of assets in both the host and recipient countries. As such, the main determinants of the decision to remit include interest rate differential on deposit accounts in the host and recipient country, real estate return, and inflation rate, among others.

The roles of remittances in promoting financial sector development have received considerate attention in both theoretical and empirical literature (Aggarwal et al., 2011; Akkoyunlu, 2015; Attila et al., 2018; Fromentin, 2017; Gupta et al., 2009; Misati et al., 2019). Scholars have argued that remittance inflows boost demand for financial services and financial sector development. This notion is built on the premise that remittances encourage recipients to demand and gain access to financial products and services they would not otherwise have (Olowa, 2015; Orozco & Rouse, 2013). Thus, remittances encourage the recipients to use formal banking services to transfer funds and other financial services. Two, it is also assumed that remittance inflows enable the financial sector to reach the unbanked recipients or recipients with limited financial intermediation. Thus, it promotes financial inclusion activities in developing countries (Agarwal & Horowitz, 2002; Olowa, 2015). Third, since remittances usually involve large amounts, it is postulated that recipients often need financial products that will enable them to save such funds for future consumption as well as gain some amount of interest earnings from these savings (Aggarwal et al., 2011). This implies that remittance inflows could be a strong determinant of financial development.

Migrant remittances may lead to financial sector development in developing economies by increasing their aggregate volume of deposits and credit intermediated by the banking sector (Fromentin, 2017). He further stated that remittances might lead to a lower demand for credit and dampen the credit market development. Remittance can also pave the way for its recipients to demand and gain access to other financial products and services, which might tremendously lead to the development of the financial sector. At the same time, providing remittance transfer services allows banks to know and reach out to unbanked recipients or recipients with limited financial intermediation (Adams & Page, 2005; Bangake & Eggoh, 2020; Chowdhury, 2016; Chowdhury, 2011; Cooray, 2012; Gupta et al., 2009; Imai et al., 2014; Williams, 2017).

Remittances sent back home by migrants significantly impact the socioeconomic conditions of families left behind in the country of their origin (Ndlovu & Tigere, 2018). However, one of the areas of controversy in the literature is the need for one general acceptable definition of remittance. For instance, some of the early attempts to define remittances emerged from the work of Solimano (2003), who argued that Remittances are generally defined as that portion of migrants' earnings sent from the migration destination to the place of origin. Remittances can be sent in cash or kind. However, the issue with this definition is that remittance is not limited to monetary and other cash transfers by immigrants to their families in their home country. It also reflects local labor earnings in the global economy (Iheke, 2012).

On the other hand, since remittances might help relax households' financing constraints, the demand for and the overall level of credit might fall as remittances increase. Regardless of remittance recipients' demand for credit, overall credit levels might still increase in remittance-receiving areas if banks channel the increased liquidity from remittance deposits to previously unfunded or underfunded projects. However, a rise in remittances might not translate itself into an increase in credit to the private sector if these flows are instead channeled to finance the

government or if banks are reluctant to lend and prefer to hold liquid assets. Similarly, remittances might not increase bank deposits if they are immediately consumed or if the recipients distrust financial institutions and prefer other ways to save this fund (Benhamou & Cassin, 2021).

Despite these plausible arguments in the theoretical literature, most existing studies have neglected the feedback relationship (Demirgüç-Kunt et al., 2011; Olayungbo & Quadri, 2019). Also, few studies that have addressed the issue of reverse causation have reported contradictory evidence (Ahamada & Coulibaly, 2013; Akkoyunlu, 2015; M. B. Chowdhury, 2011; Coulibaly, 2015; Fromentin, 2017; Karikari et al., 2016; Motelle, 2011). The existing empirical literature reviewed the impact of remittances on financial sector development in Nigeria and used GMM and OLS as the analysis method (Olowa, 2015). Furthermore, both OLS and GMM have limitations when employing them as analysis methods. The method cannot accommodate variables of I(0) and I (1). Also, the techniques could be more robust when the sample size is small. Hence, there exists a vital justification for using ARDL in this study. Also, on methodology, a more robust estimation technique, i.e., Autoregressive Distributed Lag (ARDL), will be used to explore the short-run and long-run relationship between the variables. The above literature has shown that some studies establish a positive impact of remittances on financial development. In contrast, others found a negative relationship between them, and very few of the findings report no relationship between the variables.

This study makes significant contributions to the existing literature on remittances and financial sector development by introducing important variables overlooked in previous research, particularly within the context of Nigeria. The study identifies crucial factors such as real interest rate, broad money supply, total population, and importing goods and services, which are pivotal in advancing financial development. Notably, the study emphasizes the vital role of a well-educated population in facilitating the effective functioning of the financial system, as highlighted by (Elsherif, 2015). Furthermore, this research employs contemporary and advanced data analysis techniques, specifically the ARDL model and Toda Yamamoto causality, to provide a novel perspective. This approach sets the study apart from earlier investigations in Nigeria that predominantly employed conventional estimation methods, as evidenced in works such as (Kumar, 2019; Oke et al., 2011; Oluwafemi & Ayandibu, 2014). By incorporating these previously unexplored variables and employing advanced analytical tools, this study expands our understanding of the intricate relationship between remittances, financial sector development, and these critical contributing factors in the Nigerian context.

## Methods

This study adopts the portfolio theory approach coined by Markowitz (1952). In the Portfolio approach theory, remittances are viewed as a strategy by an emigrant worker to diversify their savings. The theory has the following assumptions: the desire to remit is based on the risk-return differentials of assets in both host and recipient countries, significant interest rate differential on deposit accounts, the desire to remit is purely motivated by investment opportunities and the relationship between private investment and remittances is positive since remittances are principally spent on investment activities.

Based on the theory, we assumed that the financial sector development has the following function:

$$FINDV = F(REMT) \tag{1}$$

Where $FINDV$ means financial development, and REMTS is remittances. Eq. 1, was transformed as:

$$FINDV_t = \beta_1 + \beta_2 REMT_t \tag{2}$$

Therefore, Equation 2 revealed that financial development depends on remittances. For this study, we follow the work of Barua (2007), and this equation was modified to include other variables of interest. For instance, scholars have argued that remittances impact credit to the private sector as a percentage of GDP (Karikari et al., 2016). In addition, credit to the private sector was

used in many empirical studies to measure financial sector development. Hence, financial development was substituted with credit to the private sector (CPSGD). Thus, the equation is specified as follows:

$$CPSGD_t = \beta_1 + \beta_2 REMT_t + \mu_t \quad (3)$$

Also, the deposit interest rate (DPIRR) is very significant in determining credit to the private sector. Chowdhury (2011) argued that the deposit interest rate has a lasting impact on financial sector development. Furthermore, total gold reserves (TRSVG) are also an important determinant of financial sector development. Takyi and Obeng (2013) argued that a negative relationship between total reserves and financial sector development could be expected. In addition, it has been argued that population (TPOP) can influence financial sector development. The variables mentioned above are theoretically linked with remittances, so they are included in the remittance models. Therefore, the general framework of the study is presented below:

$$CPSGD_t = F(REMT_t, DPIRR_t, TRSVG_t, TPOP_t, IMPGS_t) \quad (4)$$

CPSGD is the credit to the private sector as a percentage of GDP, REMTS is personal remittances received, DPIRR is the deposit interest rate, TRSVG is a total reserve, TPOP is the total population, and IMPGS is the import of goods and services.

**Model Specification**

Having established the theoretical framework, the general model of credit to the private sector (CPSGD), including variable of interest along with other important determinants of financial sector development such as REMTS, DPIRR, TRSVG, TPOP, and IMPGS, is specified as follows:

$$CPSGD_t = \beta_1 + \beta_2 lnREMT_t + \beta_3 DPIRR_t + \beta_4 lnTRSVG_t + \beta_5 lnTPOP_t + \beta_6 lnIMPGS_t + \mu_t \quad (5)$$

**Source of Data and Measurement of Variables**

The study used secondary data obtained from World Development Indicators (WDI), all the data for variables remittances (REMT), domestic credit % of GDP (CPSGD), domestic interest rate (DPIRR), Total reserves (TRSVG), Total population (TPOP) and Imports of goods and services (IMPGS) are from WDI (2022).

**Table 1.** Definition of variables and data sources

| Variables | Symbols | Description | Source of Data |
|---|---|---|---|
| Financial sector development | CPSGD | The dependent variable is Domestic credit to the private sector (CPSGD) and is measured as a percentage of GDP. Domestic credit to the private sector refers to financial resources provided to the private sector by financial corporations, such as through loans, purchases of non-equity securities, trade credits, and other accounts receivable that establish a claim for repayment. | World Development Indicators |
| Remittances | REMT | Personal remittances comprise personal transfers and compensation of employees. Personal transfers consist of all current transfers in cash or in kind made or received by resident households to or from non-resident households. | World Development Indicators |
| Deposit Interest Rate | DPIRR | The rate paid by commercial or similar banks for demand, time, or savings deposits. The terms and conditions of these rates differ by country, limiting their comparability. | World Development Indicators |
| Total Reserves | TRSVG | Comprise holdings of monetary gold, special drawing rights, reserves of IMF members held by the IMF, and holdings of foreign exchange under the control of monetary authorities. | World Development Indicators |

| Variables | Symbols | Description | Source of Data |
|---|---|---|---|
| Imports of Goods and Services | IMPGS | The value of all goods and other market services received from the rest of the world. They include the value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services. They exclude compensation of employees and investment income (formerly called factor services) and transfer payments. | World Development Indicators |
| Total Population | TPOP | The de facto definition of population is all residents regardless of legal status or citizenship. | World Development Indicators |

**Method of Analysis**

The method of analysis is the Autoregressive Distributed Lag ARDL. Similarly, the study will employ the Toda Yamamoto Causality Test.

**Unit Root Test**

The analysis began with the unit root test to determine the time series properties of the data. Whether the time series data were stationary at level or first difference, the unit root test will be conducted on each variable of the model. An Augmented Dickey-Fuller (ADF) test and Phillips-Perron test will be employed to examine the order of integration of the variables. The ADF is conducted by augmenting the DF equations by adding the lagged Values of the dependent variable to avoid serial correlation of the error term.

**The ARDL Approach to Cointegration**

This study adopts the bounds-testing approach to cointegration based on the Autoregressive Distributed Lag (ARDL) model framework, as proposed by Pesaran et al. (2001). The uniqueness of the ARDL approach compared to other cointegration approaches is that the ARDL does not restrict the integration order of the variables, being all I(1). Consequently, the ARDL can be applied regardless of whether the variables are all I(0), I(1), or mutually cointegrated (Pesaran et al., 2001). The ARDL approach involves estimating a restricted error correction (EC) version of the ARDL model.
The ARDL model is therefore specified as:

$$\begin{aligned}\Delta(CPSGD)_t = {} & a_0 + a_1 \ln CPSGD)_{t-1} + a_2 \ln(\mathrm{REMT})_{t-1} + a_3(\mathrm{DPIRR})_{t-1} + \\ & a_4 \ln(\mathrm{TRSVG})_{t-1} + a_5 \ln(\mathrm{TPOP})_{t-1} + a_6 \ln(\mathrm{IMPGS})_{t-1} + \\ & \textstyle\sum_{i=1}^{h} \beta_1 \, \Delta(CPSGD)_{t-i} + \sum_{i=0}^{o} \beta_2 \, \Delta \ln(REMT)_{t-i} + \sum_{i=0}^{j} \beta_3 \, \Delta(DPIRR)_{t-i} + \\ & \textstyle\sum_{i=1}^{q} \beta_4 \, \Delta \ln(TRSVG)_{t-i} + \sum_{i=0}^{k} \beta_5 \, \Delta \ln(TPOP)_{t-i} + \\ & \textstyle\sum_{i=0}^{l} \beta_6 \, \Delta \ln(IMPGS)_{t-i} + \mu_t \end{aligned} \quad (6)$$

The meaning of variables remains constant, $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ *and* $\beta_6$ are short-run parameters estimated, $\Delta$ denotes differencing, lmeanslogarithm, and *h, o, j, q k, l* is the optimal lag length.
An error correction model (ECM) is estimated to get the short-run coefficients. The ARDL specification of the ECM is represented in Equation (7) below.

$$\begin{aligned} Increment\Delta(CSPGD)_t = {} & \textstyle\sum_{i=1}^{h} \beta_1 \, \Delta(CPSGD)_{t-i} + \sum_{i=0}^{o} \beta_2 \, \Delta \ln(REMT)_{t-i} + \\ & \textstyle\sum_{i=0}^{j} \beta_3 \, \Delta(DPIRR)_{t-i} + \sum_{i=0}^{q} \beta_4 \, \Delta \ln(TRSVG)_{t-i} + \\ & \textstyle\sum_{i=0}^{k} \beta_5 \, \Delta \ln(TPOP)_{t-i} + \sum_{i=0}^{l} \beta_6 \, \Delta \ln(IMPGS)_{t-i} + \mu_t \end{aligned} \quad (7)$$

The error correction mechanism (ECM), first used by Sargan and later popularized by Engle and Granger (1987), corrects for disequilibrium. An important theorem, the Granger representation theorem, states that if two variables, Y and X, are cointegrated, the relationship between the two can be expressed as ECM.

### Toda Yamamoto Causality

If the series are integrated of the same order, then Engle and Granger (1987), Johansen (1988), and Johansen and Juselius (1990) tests for causality are valid. However, since the variables are a combination of I(1) and I(0), the study used Toda Yamamoto's (1995) causality test to examine the impact of Remittances on financial sector development. Toda Yamamoto (1995) has suggested a solution by estimating a VAR for the series in levels and testing general restrictions on the parameter matrices even if the series are integrated. They offer a modified version of the Granger causality test that involves a modified Wald (MWald) test in an intentionally augmented VAR model. The procedure for Toda Yamamoto causality involves first establishing the optimal order of the VAR process k, using AIC, SBC, and HQC information criteria. Once the optimal lag order is confirmed, Toda and Yamamoto (1995) suggest estimating a VAR (k+dmax) model where dmax is the maximal order of integration that captures the data generation process. Once the estimation is carried out, linear or non-linear restrictions on the k coefficients of the model can be tested using standard Wald tests, ignoring the last dmax lagged variables.

the To test for Toda-Yamamoto causality between remittances and financial sector development (credit to the private sector), the following bivariate VAR (*k*) model is specified:

$$the\ \Delta CPSGD_t = \omega_X + \sum_{i=1}^{k+m} \in_x \Delta CPSGD)_{t_{t-1}} + \sum_{i=1}^{k+m} \tau_x \Delta LREMT_{t-1} + \mu_{tx} \quad (8)$$

$$\Delta REMT_t = \omega_y + \sum_{i=1}^{k+m} \in_y \Delta REMT_{t-1} + \sum_{i=1}^{k+m} \tau_y \Delta CPSGD)_{t_{t-1}} + \mu_{ty} \quad (9)$$

In the equation, Δ is the first-deference operator, $k$ is the maximum order of integration, $m$ is the optimal lag length, $\omega_X\ and\ \omega_y$ are the intercepts (constants), $\in_x$ and $\in_y$ are the coefficients. The decision criteria for Toda Yamamoto causality is that if there is unidirectional causality from CPSGD to LREMT, the estimated coefficient of the CPSG must be statistically significant. In contrast, the estimated coefficient of the LREMTS is not statistically significant, and vice versa. Also, bi-directional causality is expected when the CPSGD and LREM coefficients are statistically significant. Finally, Independence causality is suggested when the CPSGD and LREMTS coefficients are not statistically significant.

### Diagnostic Tests

Diagnostic tests are conducted to ensure the goodness of fit of the models, enable the results to be relevant for policy recommendation, and verify the validity and reliability of the results. In this regard, serial correlation, normality, stability, functional form, and heteroscedasticity tests are performed. First, the study used the Breusch-Pagan-Godfrey test to test whether the error terms are homoscedastic. Heteroskedasticity is used to test whether the residual's size (either positive or negative) is related to any of the explanatory variables or combinations of explanatory variables. The null hypothesis is Homoscedastic errors.

Serial correlation is used to ascertain the relationship between observations of the same variable over a specific period. It happens when the errors associated with a given period carry over into future periods. Serial correlation is tested using the Breusch-Godfrey Serial Correlation LM Test. The null hypothesis of no correlation is tested. The Ramsey RESET test examines whether non-linear combinations of fitted values explain the response variable significantly at the 5% level. Similarly, as suggested by Pesaran and Pesaran (1997), the cumulative sum of recursive residuals (CUSUM) and the cumulative sum square of recursive residuals (CUSUMSQ) tests are executed to test for the stability of the parameters and model in the long run.

## Results and Discussions

Table 2 reports the summary of descriptive statistics. The results show that the average (mean) value of credit to the private sector % of GDP is 10.128%, with the maximum value of credit to the private sector in a year being 22.289% and the minimum value of 4.958% received in a year. This indicates that domestic credit plays a significant role in financial sector development. The contribution of remittance in a year is $ 8.250 billion on average, with the minimum and maximum values being $2.20 million and $2.25 million, respectively. The mean value of the deposit interest

rate is 12.085, the maximum value is 23.242, and the minimum value is 5.693. The average import of goods and services is 14.045, the maximum value is 22.811, and the minimum value is 3.887. The total population mean is 35.345, with a maximum value of 53.278 and a minimum of 9.136.

**Table 2.** Descriptive Statistics of the Variables

| | CPSGD | REMT | DPIRR | IMPGS | TPOP |
|---|---|---|---|---|---|
| Mean | 10.128 | 8.250 | 12.085 | 14.045 | 35.345 |
| Median | 8.242 | 1.260 | 12.339 | 13.087 | 36.540 |
| Maximum | 22.289 | 2.250 | 23.242 | 22.811 | 53.278 |
| Minimum | 4.958 | 2.200 | 5.693 | 3.887 | 9.136 |
| Std. Dev. | 4.452 | 9.490 | 3.906 | 4.756 | 10.627 |
| Observations | 31 | 31 | 31 | 31 | 31 |

**Results of Diagnostic Tests**

Two sets of diagnostic tests were conducted to verify the validity and reliability of the results. The first set deals with residual diagnostic tests comprising serial correlation, heteroscedasticity, and normality. In contrast, the second set focuses on the parameter's stability test consisting of the Ramsey reset test for functional misspecification. There are three tests conducted in this regard: Breusch-Pagan test for serial autocorrelation, which is conducted to establish whether the residual of the estimated model of the study is serially uncorrelated. The second test, the Breusch-Pagan-Godfrey test, is performed to investigate whether the residuals are homoscedastic. Third is the Jacque-Berra test, which is carried out to establish whether the residuals are normally distributed. Table 3 reports the results of these tests.

**Table 3.** Results of Diagnostic Tests

| Test | Test Statistic |
|---|---|
| Heteroscedasticity CHSQ (14) | 0.880 [0.784] |
| Serial correlation CHSQ (2) | 0.905 [0.815] |
| Normality: Jarque-Berra | 1.801 [0.406] |
| Functional form Ramsey Reset F statistic | 0.759 [0.840] |

Table 3 shows the Breusch-Godfrey serial correlation LM test to identify the residuals are not serially correlated because the Chi-square of the observed R-square and its associated p-value are statistically insignificant. The result shows that the residuals or the error terms are not serially auto-correlated. Moreover, the observed R-square and its p-value of the Breusch-Pagan-Godfrey test for heteroscedasticity turned out to be statistically insignificant, which suggests the acceptance of the null hypothesis of homoscedasticity in the residuals. In other words, the residuals are homoscedastic. In addition, the F-statistic and its p-value for the Jarque-Berra test for normality were statistically insignificant, hence the acceptance of the null hypothesis of normality in the residuals.

**Unit Root Test**

The unit root test results in Table 3 indicate that domestic credit to the private sector, remittances, domestic interest rate, and total reserves have unit roots at level, which means they are not stationary at level but stationarity at first difference. Therefore, the variables are integrated into degree 1 or I(1). However, total population, inflation, and import of goods and services are stationary at level. Therefore, the variables are found to be integrated of order zero or I(0). In summary, the variables of interest have a mixed order of integration. The mixed order of integration among these variables provides a vital justification for adopting the Autoregressive distributed lag ARDL approach for this study.

**Table** 3. Results of the Unit Root

| Variables | Level | | | | First Difference | | | | Result |
|---|---|---|---|---|---|---|---|---|---|
| | ADF | | PP | | ADF | | PP | | |
| | Intercept | Trend & Intercept | Intercept | Trend & Intercept | Intercept | Trend & Intercept | Intercept | Trend & Intercept | |
| CPSG | -2.136 | -3.631 | -1.232 | -1.850 | -5.068*** | -5.727 | -4.951*** | -4.806 | I(1) |
| LREMT | -1.687 | -2.066 | -2.149 | -1.986 | -4.330*** | -4.711 | -8.828*** | -8.593 | I(1) |
| DPIRR | -1.337 | -2.806 | -2.743 | -2.505 | -4.048*** | -4.892 | -7.046*** | -7.026 | I(1) |
| TRSVG | -1.200 | -2.066 | -1.061 | -1.603 | -5.104*** | -5.928 | -7.374*** | -21.857 | I(1) |
| TPOP | 3.411** | 1.214 | -3.411** | -0.051 | -5.851 | -6.215 | -5.850 | -13.520 | I(0) |
| IMPGS | -3.393** | 4.021 | -3.289** | -3.817 | -7.292 | -7.176 | -17.692 | -18.593 | I(0) |

Note: *** and ** indicated statistically significant at 1%, and 5%, respectively.

Since the stationarity status has been established, the ARDL bound test for cointegration was employed to check for the long-run relationship among the variables. The results presented in Table 4 show that the computed F statistics (32.566) is greater than the upper bound critical value (3.99) I(1) at a 1% level. This finding suggests the long-run relationship between CPSGD, REMT, DPIRR, IMPGS, and TPOP. The next step is to estimate the long-run as well as short-run/ECM coefficient of the optimum model of the study.

**Table** 4. Results of Bounds Test Cointegration

| Dependent Variables | Function | | | | | | |
|---|---|---|---|---|---|---|---|
| CPSGD | F(REMT, DPIRR, IMPGS, TPOP) | | | | | | |
| F-Statistic | Critical Value Bound | 10% | | 5% | | 1% | |
| 32.566*** | | I(0) | I(1) | I(0) | I(1) | I(0) | I(1) |
| | | 1.99 | 2.94 | 2.27 | 3.28 | 2.88 | 3.99 |

Source: *** denotes statistical significance at a 1% level

**Results of Selected Long Run and Short Run Model**

The Akaike Information Criterion (AIC) is used in model selection to balance model fit and complexity, particularly in the Autoregressive Distributed Lag (ARDL) context. Its formula, AIC = 2*k - 2 ln(L), combines estimated parameters ('k') and the natural logarithm of the likelihood function (ln(L)). A lower AIC indicates a better compromise between fit and complexity. In comparison, the Schwarz Criterion (SC), also aids model selection by considering goodness of fit and complexity but imposes stricter penalties on complex models. Its formula, SC = k*ln(n) - 2*ln(L), introduces a complexity and sample size ('n') weighted penalty, promoting simpler models. Like AIC, a lower SC value highlights a better fit-complexity balance. In this model, the SC suggests the optimal lag order for the long and short-run models is 2.

**Table 5**. Results of Akaike Information Criterion (AIC) and Schwarz Criterion (SC)

| Lag order | AIC value | SC value | F-statistic |
|---|---|---|---|
| 0 | 100.0 | 100.0 | 1.0 |
| 1 | 95.0 | 95.0 | 2.0 |
| 2 | 90.0 | 90.0 | 3.0 |
| 3 | 92.0 | 92.0 | 4.0 |

The SC test results, including the AIC and F-statistic, are presented in Table 5. The lag order with the lowest AIC and SC values in the table is 2, indicating it is the best choice for the ARDL model. Furthermore, the F-statistic for the bounds test is significant at the 1% level, supporting the selection of the ARDL model with a lag order of 2 as the best model for the data.

Having confirmed the long-run relationship between the variables, the ARDL model was estimated. The long-run and short-run coefficients for the estimated optimum model chosen by Akaike information criteria are presented in Table 6. The results in the long-run ARDL model show that the coefficient of remittances is positive and statistically significant at a 1 percent

significance level in the long run. This means that increases in remittances can stimulate financial development in Nigeria. A 1% increase in remittances leads to a 2.76% increase in CPSGD in the long run, while in the short run, remittances have a positive and significant effect on CPSGD at a 1% level. A 1% increase in remittances leads to a 1.05% increase in CPSGD. This finding is in line with the works of Coulibaly (2015) and Kakhkharov and Rohde (2020).

**Table 6.** Results of Short Run and Long Run ARDL model

| Long run ARDL Model | | | | |
|---|---|---|---|---|
| The dependent variable is CPSGD | | | | |
| Variables | Coefficient | Standard error | t-statistic | Probability |
| LREMT | 2.757 | 0.460 | 5.994 | 0.000 |
| DPIRR | -0.063 | 0.118 | -0.538 | 0.598 |
| TRSVG | -0.000 | 0.000 | -1.146 | 0.026 |
| TPOP | -0.723 | 0.946 | -0.765 | 0.455 |
| IMPGS | -1.505 | 0.628 | -2.398 | 0.028 |
| C | 44.752 | 6.595 | 6.786 | 0.000 |
| Short-run ARDL Model | | | | |
| The dependent variable is CPSGD | | | | |
| Variables | Coefficient | Standard error | t-statistic | Probability |
| Δ LREMT | 1.054 | 0.251 | 4.202 | 0.001 |
| Δ LREMT-1 | -1.762 | 0.296 | -5.958 | 0.000 |
| Δ LREMT-2 | -0.947 | 0.268 | -3.536 | 0.003 |
| Δ DPIRR | 0.243 | 0.076 | 3.212 | 0.005 |
| Δ DPIRR-1 | 0.250 | 0.086 | 2.898 | 0.010 |
| Δ DPIRR-2 | 0.524 | 0.101 | 5.196 | 0.000 |
| Δ TRSVG | -0.000 | 0.000 | -1.334 | 0.200 |
| Δ TPOP | -3.435 | 0.863 | -3.979 | 0.001 |
| Δ IMPGS-1 | -0.915 | 0.740 | -1.237 | 0.233 |
| CointEq-1 | -1.058 | 0.156 | -6.776 | 0.000 |

Source: Δ is the first difference operator.

Moreover, the results indicated that the deposit interest rate positively and significantly affects CPSGD at a 1% level in the short run. A 1% increase in deposit interest rate leads to a 0.24% increase in CPSGD in the short run. The findings are consistent with the results of previous studies (Khurshid et al., 2020; Tuuli, 2015). Furthermore, the total population negatively and significantly impacts CPSG at a 1% level in the short run. Also, the variable negatively and significantly impacts CPSGD at 1% in the short run. A 1% increase in total population leads to a 3.44% decrease in CPSGD in the long run, while in the short run, it leads to a 0.72% decrease in CPSGD. The finding supports the previous studies (Vanroose & Espallier, 2009). Moreover, importing goods and services as a percentage of GDP negatively correlates with CPSGD at 1% in the long and short run. A 1% increase in IMPGS leads to a 0.92% decrease in the long run and a 1.51% decrease in the short run. The results are consistent with the previous studies (Elsherif, 2015).

The estimation results show that an increase in remittances leads to a rise in domestic credit to the private sector in Nigeria. It is noted that migrant remittances or transfers help to ease the immediate budget constraints of the recipient and provide an opportunity for small savers to gain access to the formal financial sector. Remittances enable unbanked recipients to acquire certain financial products and services, improving financial sector development. The findings support the portfolio theory of private investment (or broad money), which states that increasing remittances tends to enhance the financial sector's development (Ajide, 2019).

This outcome is in line with the Nigerian context because remittances, from the empirical analysis, increased the saving pattern of recipients. Excess funds after consumption and use of other investments could be saved, introducing non-banked recipients to formal banking and investment systems. This is consistent with (Aggarwal et al., 2011; Gupta et al., 2009; Hussaini et al., 2021; Oke et al., 2011; Olowa, 2015). Also, the findings revealed that the domestic interest rate is an important determinant of financial sector development in such a way that a rise in domestic

interest rate leads to an increase in domestic savings, hence more loanable funds for investors, leading to financial sector development in Nigeria.

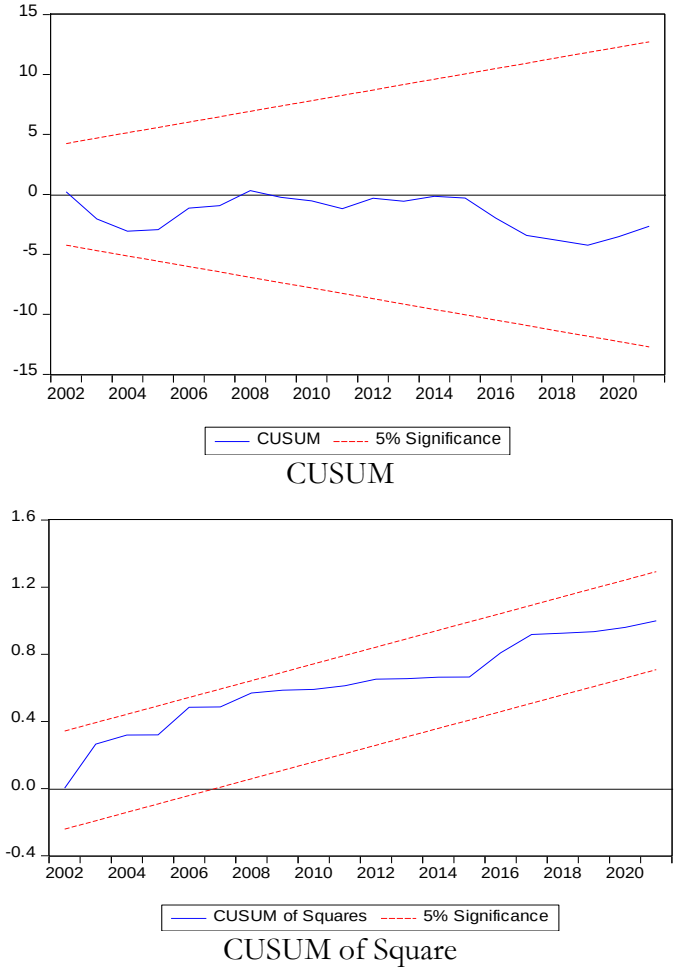
The negative sign of the coefficient of import of goods and services revealed that the more imported goods and services, the more the financial sector is underdeveloped in Nigeria. The situation shows the current circumstances in Nigeria, where it imports most of the goods and services needed for consumption and production purposes which retard the industries in Nigeria that produce the same goods and services, resulting in workers' retrenchment and subsequently reducing savings which will reduce financial sector development in the country (Ajide, 2019).

In addition, the empirical findings show that as total reserves increase, financial sector development also increases. It is real that the more the country's foreign reserves are appreciated, the more the financial sector develops, as the reserves serve as a mirror for future investors in the country. Similarly, the empirical result reveals that a country's population can improve financial sector development. Productive individuals can save their income in the financial sector, making loanable funds available for investment (Onyeisi et al., 2020).

The equilibrium correction coefficient takes the value of 1.05 and is highly significant, thus having the correct sign and implying a very high speed of adjustment to equilibrium after a shock. About 105 % of disequilibria from the previous year's shock converge back to the long-run equilibrium in the current year. Banerjee et al. (1998)state that a highly significant error correction term further proves a stable long-term relationship.

## Stability Test

The cumulative sum of recursive residuals (CUSUM) and the cumulative sum square of recursive residuals (CUSUMSQ) tests are executed to test for the stability of the parameters and model in the long run. The result of CUSUM and CUSUMSQ is shown in Figure 1.




CUSUM

CUSUM of Square

**Figure 1.** Stability Test using CUSUM and CUSUM of Square

The stability test (CUSUM) results show that the plots do not exceed the bounds at a 5% significance level, indicating that the long-run parameters and the model are stable. This shows that the parameters and the model are stable in the long run and, therefore, are relevant for policy recommendations.

**Results of Toda Yamamoto Causality Test**

The presence of cointegration among the variables does not show the direction of causality between them. Hence, this justifies examining the existence of a causal relationship between the variables using Toda Yamamoto's (1995) approach to causality. The summary of the results of the Toda Yamamoto causality test is presented in Table 7.

**Table** 7. Results of Toda Yamamoto Causality

| Null hypothesis | df | MWALD | Prob | Decision | Direction of causality |
|---|---|---|---|---|---|
| CPSGD→LREMT | 2 | 21.826 | 0.000 | Reject | Unidirectional |
| LREMT→ CPSGD | 2 | 2.332 | 0.312 | Do not reject | No causality |
| CPSGD →DPIRR | 2 | 0.006 | 0.937 | Do not reject | No causality |
| DPIRR→ CPSGD | 2 | 1.980 | 0.996 | Do not reject | No causality |
| CPSGD →TPOP | 2 | 15.184 | 0.005 | Reject | Unidirectional |
| TPOP→ CPSGD | 2 | 8.389 | 0.015 | Reject | Unidirectional |
| CPSGD →GCFG | 2 | 0.001 | 0.991 | Do not reject | No causality |
| GCFG→ CPSGD | 2 | 0.087 | 0.768 | Do not reject | No causality |
| CPSGD →TROP | 2 | 3.079 | 0.215 | Do not reject | No causality |
| TROP→ CPSGD | 2 | 1.752 | 0.416 | Do not reject | No causality |

Note: → denotes 'does not Granger cause'; df indicates degrees of freedom, and MWALD is the modified Wald chi-square of the Toda-Yamamoto (1995) causality test.

Table 7 shows a bidirectional causality running from CPSGD to remittances (LREMT) and a unidirectional causality from domestic credit to the private sector (CPSGD) to total reserves (DPIRR) in Nigeria. The results of the remaining variables indicate that there is no causality among the variables. The results of the Toda Yamamoto causality revealed the presence of causation between domestic credit to the private sector and remittance is bidirectional. This is consistent with the Nigerian context; broad money may cause an inflow of remittances (Keho, 2020).

## Conclusions

Given the preceding findings, this study makes the following recommendations. First, having established that remittances inhibit financial sector development, the government should employ policies encouraging the channeling of remittances through formal banking and ensuring that such remittances are channeled to finance productive investment, hence financial development.

In addition, through financial inclusion measures, policymakers may consider providing financial services and products to rural areas to facilitate and reduce transaction costs associated with receiving remittances. Doing so will inculcate banking habits among rural dwellers and ensure that remittances make them important sources of loanable funds to investors or entrepreneurs in the country. From the results, there exists a negative relationship between real interest rates and financial sector development. This implies that policymakers should maintain positive real interest rates to encourage more saving deposits and loanable funds in the financial sector.

The growth rate of Gross capital formation was found to have a positive impact on financial sector development, and this implies that policies should be designed to boost the growth rate of gross capital formation, which will enhance the performance of Nigeria's financial sector development. Lastly, the study found a positive relationship between trade openness and financial sector development. This demonstrates the importance of trade openness in promoting financial sector development, hence the need to implement policies to support more trade openness as a financier of promoting financial sector development in Nigeria.

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