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Analyses of the Transformative Impact of Foreign Remittances on Nigeria's Economic Growth

[1]Ikechukwu Eze Okereke, [2]Ikwor Ogbonnaya, [3]Elechi Ogbonnaya Okpara, [4]Okereke Chukwu Ugwu, [5]Abraham Cecilia Ezinne, & [6]Eze Amarachi Truelove

[1,2,4,5&6] Department of Economics and Dev. Studies, Alex Ekwueme Federal University Ndufu, Nigeria
[3] Department of Accountancy, Ebonyi State University, Abakaliki, Nigeria

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Corresponding Author:
Ikechukwu Eze Okereke

Abstract

This paper investigates the impact of foreign remittances on economic growth in Nigeria over an annual sample period ranging from 1980 to 2022. Specifically, it examined the impact of foreign remittances on the growth rate of the real gross domestic product, analyzed the impact of gross fixed capital formation on the growth rate of the real gross domestic product, and investigated the impact of trade openness on the growth rate of the real gross domestic product. The paper adopted a secondary method of data collection and employed the Autoregressive Distributed Lag (ARDL) model, which showed that the underlying variables were integrated of order 1(0) and 1(1), that is, stationary at level and after first difference, with the growth rate of the real gross domestic product as the dependent variable and foreign remittances, gross fixed capital formation, and trade openness as the independent variables. After a careful investigation into the study, the results of the long-run ARDL model estimation indicated that trade openness has a positive and statistically significant effect on RGDP at a 5% significance threshold. However, both foreign remittances and gross fixed capital formation, while negatively related to the RGDP, do not show a significant impact on the RGDP. The paper therefore recommends, among other things, that while foreign remittances and gross fixed capital formation did not show significant impacts in the long run, it is essential to monitor their trends and consider policy measures to attract foreign remittances and encourage domestic savings and investments.

Background to the Study

Foreign remittances refer to the transfer of money from international or foreign migrants to their family members in their country of origin (World Bank, 2022). Unlike other external capital inflows like foreign direct investment, foreign loans, and aids, foreign remittances have a stable nature (Kapur, 2004). These inflows have been recognized as a crucial driver of the economies of developing countries, particularly Nigeria, playing significant roles in poverty reduction, income redistribution, and economic growth (Ratha et al., 2021).

Nigeria stands out as the largest recipient of remittances in Sub-Saharan Africa, receiving nearly 65 percent of officially recorded remittance inflows to the region and 2 percent of global flows (Hernandez-Coss & Bun, 2006; World Bank, 2022). The Central Bank of Nigeria (CBN) reported remittances of approximately US$2.26 billion in 2004 (CBN, 2022). Notably, diaspora remittances to Nigeria have experienced substantial growth, rising from US$5 million per week in June 2020 to over US$100 million per week in October 2021 (World Bank, 2021).

Despite the phenomenon of Nigerian emigrants being considered an escape from hardship and a depletion of human capital (IOM, 2020), it has proven beneficial for the country. In 2021, Nigerians abroad contributed a staggering US$21 billion in remittance inflows, representing a 3.79% increase compared to the previous year, which was heavily impacted by the global pandemic (World Bank, 2021). Consequently, Nigeria receives the highest remittance inflows in Sub-Saharan Africa, estimated at around US$24.3 billion per year, accounting for 6% of GDP and ranking as the sixth highest globally (World Bank, 2021).

Statement of the Problem

Despite the significant number of remittances received by Nigeria, persistent issues of poverty, unemployment, and inequality suggest that the country may not have effectively utilized the benefits of remittances resulting from brain drain (Adeagbo & Ayansola, 2014). Adeagbo and Ayansola (2014) emphasize the need to assess the impact of foreign remittances on Nigeria's economic growth, highlighting the importance of further research in this area.

Moreover, it is important to consider the possibility that the reported increases in remittances might be misleading due to changes in measurement methods, potentially not accurately reflecting the actual financial inflow. Clemens and McKenzie (2018) argue that even if these increases are accurately measured across countries, conventional regression analysis alone may not capture the true effects of remittances on economic growth. Therefore, they suggest conducting country-specific studies to obtain more precise insights.

Thoroughly examining the direct and indirect effects of foreign remittances on economic growth is crucial as the impact can vary from country to country, encompassing both

positive and negative outcomes (World Bank, 2022). It is necessary to disaggregate the components of remittances to identify the specific elements that effectively contribute to economic growth. For instance, personal remittances serve as a proxy for foreign remittances, while gross fixed capital formation represents domestic investment in physical capital, and trade openness, measured by the ratio of exports and imports to GDP, plays a significant role (Ratha et al., 2021). Higher trade openness can potentially reduce production costs, stimulate domestic consumption, and increase the willingness of remitters to send funds for consumption purposes.

However, it is important to acknowledge that the specific components and their effects on economic growth in developing countries, including Nigeria, have not been extensively studied in existing literature, indicating a research gap. Therefore, the present study aims to address this gap by investigating the intricate relationship between different components of remittances, economic growth, and development in Nigeria.

Research Questions

The statement of the problem has motivated series of questions which this study endeavors to procure answers to. These questions are;

a. To what extent is the impact of foreign remittances on the growth rate of the RGDP?
b. What is the impact of gross fixed capital formation on the growth rate of the RGDP?
c. To what extent is the impact of Trade Openness on the growth rate of the RGDP?

Research Hypotheses

H_0: Foreign remittances have no significant impact on RGDP in Nigeria.
H_0: Gross fixed capital formation has no significant impact on RGDP in Nigeria.
H_0: Trade openness has no significant impact on RGDP in Nigeria.

Scope of the Study

The scope of this study spans from 1980 to 2022 to provide useful results for the evaluation of the impact of foreign remittances on economic growth in Nigeria.

The choice of the scope from 1980 to 2022 for studying the impact of foreign remittances on economic growth in Nigeria are based on several considerations:

1. Data availability: Availability of reliable and consistent data is crucial for conducting empirical research. By choosing a time frame that covers a significant period, researchers can access a sufficient amount of data on foreign remittances and economic indicators for analysis, ensuring the robustness of the study.
2. Policy relevance: The selected time frame aligns with Nigeria's historical policy initiatives and economic reforms. It allows researchers to assess the impact of foreign remittances on economic growth within the context of policy interventions and measures implemented during different periods, providing insights into the effectiveness of such policies.

3. Long-term trends and patterns: Analyzing the impact of foreign remittances over a longer period allows researchers to identify any long-term trends, patterns, or structural changes in the relationship between remittances and economic growth. It enables the examination of potential shifts in the magnitude or significance of the impact over time.

The Theoretical Foundation and Empirical Support

These theoretical perspectives provide frameworks for understanding the potential mechanisms through which foreign remittances can impact economic growth in Nigeria and assess the specific dynamics and effects of remittances on Nigeria's economy.

1. **Investment and Capital Formation Theory**: This theory is a fundamental concept in economics related to investment and capital accumulation and suggests that foreign remittances can contribute to economic growth by increasing investment and capital formation. Remittances can provide households and businesses with additional funds for savings and investment, leading to the expansion of productive capacities, entrepreneurship, and the creation of new job opportunities.
2. **Human Capital Theory**: Gary Becker is a notable economist who extensively contributed to the development of human capital theory. His work on human capital earned him the Nobel Prize in Economic Sciences in 1992. According to this theory, foreign remittances can enhance human capital development in Nigeria. Remittances can be used to finance education and skills training, leading to a more educated and skilled workforce. A better-educated workforce can positively impact productivity, technological advancement, and innovation, thereby promoting economic growth.
3. **Consumption and Demand Theory**: John Maynard Keynes is known for his influential work on consumption and demand theory, particularly in his book "The General Theory of Employment, Interest, and Money," published in 1936. Keynesian economics, including his theories on consumption and demand, had a significant impact on economic thought during the 20th century. This theory emphasizes the role of remittances in stimulating consumption and aggregate demand. Foreign remittances increase the disposable income of recipient households, leading to higher consumption levels. Increased consumption, in turn, can drive economic activity, boost domestic production, and spur overall economic growth.
4. **Financial Intermediation Theory:** The understanding of financial intermediation has developed over time, with contributions from various economists. Franklin Allen, Douglas Diamond, and Ross Levine, among others, have made important contributions to the study of financial intermediation, with their works published from the late 20th century onwards. This theory highlights the potential role of remittances in facilitating financial intermediation and access to credit. Remittances can provide a source of funds for households and businesses to engage in financial activities, such as saving, investing, and borrowing. Improved access to financial services can promote entrepreneurship, investment, and

economic growth.

5. **Network and Social Capital Theory**: Mark Granovetter is a sociologist and economist who made significant contributions to the study of social networks and social capital. His influential paper "The Strength of Weak Ties," which discusses the role of weak ties in social networks, was published in the American Journal of Sociology in 1973. This theory emphasizes the role of social networks and social capital in leveraging foreign remittances for economic development. Remittance-receiving households may benefit from networks and connections established by migrants abroad, leading to improved business opportunities, knowledge transfer, and access to markets, thus contributing to economic growth.

The Existing Empirical Literature

In Vesna B.'s (2022) research, the study focused on the effect of remittances on economic growth in South-East European Countries (SEE6). The research used a quarterly balanced panel dataset covering the period from 2008q1 to 2020q2 and included six countries: Albania, Bosnia and Herzegovina, Croatia, Montenegro, the Republic of North Macedonia, and Serbia. The fixed-effects model in panel regression was employed to address potential cross-section heterogeneity. The variables used in the analysis were the rate of change of real GDP as the dependent variable, while remittances received as a percentage of GDP, foreign direct investment as a share of GDP, gross capital formation relative to GDP, inflation rate, and trade openness of the country served as independent variables. The results indicated that remittances had a statistically significant positive impact on economic growth within the panel of SEE6 countries.

Debelo and Fetene (2022), conducted a study titled "Effect of International Remittance on Economic Growth: Empirical Evidence from Ethiopia." In this research, the authors aimed to address the aforementioned issues by utilizing the ARDL model and Granger causality test to examine both the short- and long-term impacts of remittances on real GDP during the period from 1980 to 2015. The key findings are as follows:

1. Remittance inflow has a significant positive effect on real GDP in the long run.
2. However, in the short run, remittances have a negative impact on economic growth.
3. The study reveals a unidirectional causality, where remittances influence economic growth but not vice versa.
4. Furthermore, the short-term negative effect of remittances on economic growth outweighs the positive long-term impact.

Adenike (2020) conducted an empirical study titled The Impact of Migrants' Remittances on Economic Growth in Nigeria." The study explored the relationship between remittance inflow and various economic indicators in Nigeria. The dependent variable was remittance inflow, while the independent variables included gross domestic product, inflation, imports, and exports. Quantitative data collected for the study were analyzed using descriptive statistics. Hypotheses were formulated and tested using multiple linear regression, ANOVA, correlation, and coefficient analysis. Based on the study's findings

and the tested hypotheses, it was revealed that a significant relationship exists between remittances and gross domestic product, as well as exports and imports in Nigeria. However, the study did not find any significant relationship between remittances and inflation in the country.

Muhammad et al. (2019) conducted a study that examined the impact of migrant remittances on the economic growth of Pakistan during the period from 1976 to 2016. The researchers utilized the autoregressive distributed lag model (ARDL) to analyze the effect of workers' remittances on the Pakistani economy. The dependent variable was GDP (current US$), while the independent variables included migrant remittance inflow as a percentage of GDP, foreign direct investment inflow as a percentage of GDP, exchange rate (LCU per US$, period average), inflation, consumer prices (annual %), expenditure on household consumption as a percentage of GDP, and gross domestic savings as a percentage of GDP. The study's findings indicated that foreign direct investment, remittance inflow, and gross domestic product significantly influenced Pakistan's long-term economic growth positively. However, the variables of consumption and inflation exhibited a negative impact on Pakistan's long-term economic growth.

Anetor (2019) conducted a study examining the relationship between remittances and economic growth in Nigeria. The researcher employed the autoregressive distributed lag (ARDL) model to investigate both the long-run and short-run connections between the variables. The study's findings revealed that the variables are linked together in the long-run. Moreover, it was observed that remittances exerted a negative and significant influence on economic growth in both the long-run and short-run. Similarly, the research showed that the development of the financial sector negatively and significantly impacted economic growth in both the long-run and short-run. Additionally, the study identified a complementary relationship between remittances and financial sector development in influencing economic growth. Furthermore, inflation was found to have a negative and significant effect on economic growth in both the long-run and short-run. On the other hand, the study found that trade openness, government expenditure, and population growth had no significant impact on economic growth, both in the long-run and short-run. Overall, the results of the study confirmed the negative impact of remittances on economic growth in Nigeria, both in the short-run and long-run.

Sebil and Abdulazeez (2018), conducted a study to examine how remittances influenced the economic growth of Nigeria from 1981 to 2011. The researchers utilized an Error Correction Modeling (ECM) approach to analyze the data during this period. The variables considered in the analysis included the influx of remittances, trade openness, foreign aid, foreign direct investment, and GDP. The study's findings highlighted that remittances indeed have a significant impact on Nigeria's economic growth.

Furthermore, Olusuyi, Adedeji, Giwa, and Ebun (2017), conducted a study to explore the changing effects of remittances on economic growth in Nigeria. They employed the generalized method of moments (GMM) estimation technique for their analysis. The

variables considered in the study included real GDP, remittances as a percentage of GDP, health-oriented official development assistance (another form of international capital flow), per capita income, and total government expenditure on health as a percentage of GDP. The study's outcome reaffirmed the positive influence of remittances on economic growth within the Nigerian context.

Tolcha and Rao (2016), conducted a study to evaluate the impact of remittances on the economic growth of Ethiopia. They utilized annual secondary time series data covering the years 1981 to 2012 and applied the ARDL technique for their analysis. The data were sourced from official sources. The study's results revealed that in the short run, remittances had a positive and significant effect on Ethiopia's economic growth. However, in the long run, the impact of remittances turned out to be negative.

Research Design

This is ex post facto research, as it is suitable for examining the dynamic connections between variables in a single equation. It deals with the statistical relationship between how the dependent variable is affected by the independent variables and their lag values. The research design is based on the use of the autoregressive distributed lag (ARDL) model in analyzing the relationship between variables over time, considering both short-term and long-term effects.

Model Specification

The study focused on investment and capital formation theory, a crucial economic concept associated with investment and capital accumulation. This theory proposes that foreign remittances enhance economic growth by fostering investment and capital formation.

The model that will analyze the relationship is implicitly stated as follows:

$$RGDP = f(FREM, GFCF, TOP) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots. \quad 1$$

Stating the model in its explicit form gives credit to equation (2) as given below:

$$RGDP_t = \beta_0 + \beta_1 FREM_t + \beta_2 GFCF_t + \beta_3 TOP_t + \mu_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 2$$

Where:

$RGDP$ = Real Gross Domestic Product growth rate
β_0 = Constant or intercept
β_1 to β_3 = Parameter estimates
$FREM$ = Foreign Remittances
$GFCF$ = Gross Fixed Capital Formation
TOP = Trade Openness
μ = error term
t = trend variable

In order to have the same unit measurement and improve linearity between the dependent and independent variables, the model is log transformed into the linear log specification below:

$$RGDP_t = \beta_0 + \beta_1 LFREM_t + \beta_2 GFCF_t + \beta_3 TOP_t + \mu_t \dots\dots\dots\dots\dots\dots\dots\dots 2$$

Where:
All variables are as specified above.
L is the natural logarithm of the input variable "FREM"

Hence, the expanded model is expressed as follows:

$$\Delta RGDP_t = \alpha_{01} + b_{11} RGDP_{t-1} + b_{21} LFREM_{t-1} + b_{31} GFCF_{t-1} + b_{41} TOP_{t-1} + \sum_{i=1}^{p} \alpha_{1i} \Delta RGDP_{t-1} + \sum_{i=1}^{q} \alpha_{2i} \Delta LFREM_{t-1} + \sum_{i=1}^{q} \alpha_{3i} \Delta GFCF_{t-1} + \sum_{i=1}^{q} \alpha_{4i} \Delta TOP_{t-1} + {} + e_{1t} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots .3$$

The lag orders for both the predicted and predictor variables are denoted by p and q, respectively.

e_t is the random disturbance.
α *and* b are the parameters to be calculated.
Δ denotes the change operator.

Since co-integration is evident, the error correction model (ECM) takes the following formulation:

$$\Delta RGDP_t = \alpha_{01} + \sum_{i=1}^{p} \alpha_{1i} \Delta RGDP_{t-1} + \sum_{i=1}^{q} \alpha_{2i} \Delta LFREM_{t-1} + \sum_{i=1}^{q} \alpha_{3i} \Delta GFCF_{t-1} + \sum_{i=1}^{q} \alpha_{4i} \Delta TOP_{t-1} + \lambda ECT_{t-1} + e_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots ...4$$

Where;
$\lambda = (1 - \sum_{i=1}^{p} \delta_i)$ refers to the error correction term coefficients indicated by a negative symbol.
ECT_{t-1} represents the error correction term lagged by one period.
$a_{1i}, a_{2i}, a_{3i}, a_{4i}$ signifies the short-term evolving coefficients within the model that capture the convergence towards the long-term equilibrium.

Data Sources
The data used in this research were gathered from secondary sources, including the Annual Statistical Bulletin of the Central Bank of Nigeria (CBN), the National Bureau of Statistics (NBS), and the World Development Indicators (WDI). Specifically, annual time series data for the variables were collected from 1980 to 2022 for the purpose of this study.

Findings and Discussion
Unit Root Test
When analyzing time series data for macroeconomic variables, it is important to conduct a unit root test to determine their stationarity state and prevent inaccurate results. To make

this determination, the augmented Dickey-Fuller t-statistic is calculated and compared to a 5% critical value. If the absolute value of the t-statistic is greater than the critical value, the null hypothesis is rejected, while a value less than the critical value results in acceptance of the null hypothesis.

Decision criterion
H_0: *there is unit root*
H_1: *there is no unit root*

Table 1: Summary of the Augmented Dickey-Fuller (ADF) Unit Root Test

Variables	ADF Statistics	Test Critical Values (5%)	Order of Integration	Conclusion
RGDP	-3.509817	-2.936942	I(0)	Stationary
LFREM	-6.641035	-2.935001	I(1)	Stationary
GFCF	-3.850154	-2.935001	I(0)	Stationary
TOP	-8.320153	-2.935001	I(1)	Stationary

Source: Author's compilation (Eviews10)

Table 1 displays the results of a unit root test, indicating that the variables RGDP and GFCF are stationary at level with no unit roots, while LFREM and TOP are stationary at first difference with no unit roots. This mixed order of integration necessitates the use of the bounds test. Using the ARDL Bounds Test approach to co-integration, a co-integration test was performed. The results showed that there is a long-term relationship between the series, leading to the rejection of the null hypothesis and acceptance of the alternative hypothesis.

Table 2: Summary of Diagnostic test results

Test	Type	Statistic value		Probability value
Goodness of fit	R-Squared Adjusted R-Squared	0.445986 0.384429		
Joint significance	F-statistics	7.245076		0.000218
CUSUM	Recursive estimates	Lies within 5% significance level		
CUSUMSQ	Recursive estimates	Lies within 5% significance level		
Normality	JB test	Jarque-Bera	0.551198	0.759117
Serial correlation	Breusch-Godfrey LM Test	F-statistic	0.644625	0.5312
Multicollinearity	Variance Inflation Factors	Coefficient variance	Less than 10	No sign of multicollinearity
Durbin- Watson statistic				1.948098
Linearity	Ramsey Reset	t-statistic f-statistic likelihood ratio		0.6431 0.6431 0.6135
Error Correction model (ECM)		-0.724453		It shows that there is convergence in the long run

Source: Author's compilation (Eviews10)

Figure 1 shows the Plots of the cumulative sum of Recursive Residuals (CUSUM), the cumulative sum of squares of Recursive Residuals (CUSUMSQ), and the normality test, respectively.

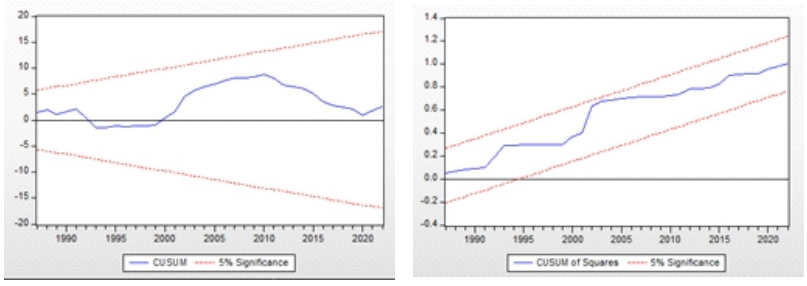

Fig. 1

The test results presented in the table above demonstrate the model's goodness of fit. The independent variables explain 45% of the variance in the dependent variable, with an R-squared value of 0.445986. Taking into account the number of variables and degrees of freedom, the adjusted R-squared value is 0.384429, accounting for 38% of the variation.

The Durbin-Watson statistic, at 1.948098, falls within an acceptable range, indicating no serial autocorrelation in the model. This reinforces the model's efficiency since the Durbin-Watson statistic surpasses the R-squared value, suggesting that the results are not spurious.

The f-test confirms that the collective impact of the independent variables in the model is statistically significant, given that the probability value is lower than the 5% significance level. To assess the model's stability, the CUSUM and CUSUMSQ plots were examined, showing that they remain within the critical limits at a 5% significance level, signifying a stable model. The normality test reveals that the errors follow a normal distribution. Both the Breusch-Godfrey serial correlation LM test and the linearity test support the null hypothesis of no serial correlation. Furthermore, the assessment of multicollinearity indicates the absence of multicollinearity among the independent variables, supported by variance inflation factors (VIF) values below 10. Lastly, the error correction model's outcome indicates long-term convergence among the series.

Test of Hypotheses

The results of the long-run ARDL model estimation indicated that trade openness has a positive and statistically significant effect on RGDP at a 5% level of significance. However, both foreign remittances and gross fixed capital formation, while negatively related to RGDP, do not show a significant impact, suggesting that their coefficients are not different from zero.

Conclusion

The findings from the long-run ARDL model estimation reveal important insights into the relationship between economic variables and RGDP in the context of Nigeria. Notably, trade openness emerges as a significant driver of economic growth, demonstrating a positive impact on RGDP at a 5% level of significance. On the other hand, foreign remittances and gross fixed capital formation, while negatively related to RGDP, do not exhibit a statistically significant effect, indicating that their coefficients are not significantly different from zero.

The overall goodness of fit of the model is demonstrated by an R-squared value of 0.445986, indicating that 45% of the variation in RGDP can be explained by the independent variables. Additionally, the adjusted R-squared value of 0.384429, considering the number of variables and degrees of freedom, accounts for 38% of the variation, further supporting the model's reliability. Furthermore, the statistical tests conducted to assess the model's efficiency and stability yield encouraging results. The Durbin-Watson statistic falls within an acceptable range of 1.948098, implying the absence

of serial autocorrelation, which enhances the model's credibility. The f-test confirms the collective significance of the independent variables at a probability value lower than the 5% significance level.

The examination of CUSUM and CUSUMSQ plots indicates that the model remains stable, as the plots consistently lie within the critical limits at a 5% significance level. Additionally, the normality test shows that the errors follow a normal distribution, further validating the model's reliability. Both the Breusch-Godfrey serial correlation LM test and the linearity test support the null hypothesis of no serial correlation, adding confidence to the model's robustness. The assessment of multicollinearity among the independent variables reveals its absence, supported by variance inflation factors (VIF) values below 10, which ensures the independence of the predictors in the model.

Recommendations

1. Based on the findings, it is evident that trade openness plays a crucial role in promoting economic growth in Nigeria. Policymakers should consider measures that enhance trade liberalization, encourage international partnerships, and facilitate access to global markets. This could involve negotiating favorable trade agreements, reducing trade barriers, and promoting export-oriented industries.
2. While foreign remittances and gross fixed capital formation did not show significant impacts in the long run, it is essential to monitor their trends and consider policy measures to attract foreign remittances and encourage domestic savings and investments. Policymakers may explore incentives for foreign remittances and create a conducive environment for domestic entrepreneurs and businesses to invest in productive sectors.
3. Continued monitoring of the stability and efficiency of the model is crucial. Regularly evaluating the model's performance through additional data points and sensitivity analyses can provide policymakers with timely insights into economic trends and potential areas of concern.
4. Additionally, policymakers should focus on sustaining macroeconomic stability, promoting financial inclusion, and implementing sound fiscal and monetary policies to support long-term convergence among the economic series. A stable economic environment can encourage investors and businesses to plan for the future, leading to sustained economic growth and poverty reduction in Nigeria.
5. Overall, a comprehensive and evidence-based approach, considering the interplay of various economic factors, will be essential in formulating effective policies that foster economic growth and improve the welfare of the Nigerian population.

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APPENDIX1

ARDL long run model

Dependent Variable: RGDP
Method: Least Squares
Date: 07/20/23 Time: 10:09
Sample (adjusted): 1982 2022
Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	21.55237	11.68041	1.845173	0.0733
RGDP(-1)	0.117468	0.183102	0.641543	0.5252
LFREM(-1)	-0.801966	0.434923	-1.843928	0.0734
GFCF(-1)	-0.172420	0.086634	-1.990204	0.0542
TOP(-1)	0.133808	0.062751	2.132380	0.0399

R-squared	0.445986	Mean dependent var	3.494878
Adjusted R-squared	0.384429	S.D. dependent var	4.732741
S.E. of regression	3.713230	Akaike info criterion	5.575531
Sum squared resid	496.3709	Schwarz criterion	5.784503
Log likelihood	-109.2984	Hannan-Quinn criter.	5.651627
F-statistic	7.245076	Durbin-Watson stat	1.948098
Prob(F-statistic)	0.000218		