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Performance of Total Factor Productivity and Trade Openness on Economic Growth: An Empirical Evidence for Nigeria

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Abstract

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1. Introduction

The discussion of trade openness and economic growth takes its root from the classical economists like Adam Smith and David Ricardo who in their respective submission postulated that when countries undertake in the division of labour based on absolute advantage (Smith) and comparative advantage (Ricardo), it leads to tremendous increase in the world output. Trade openness which is all about the total or partial removal of trade barriers has become a prospective and promising idea adopted in policy making of both developed and developing economies. neoclassical The growth model assumes capital stocks and

Nigeria adopted a macroeconomic model that relied on inward orientation and import substitution strategy of urban industrial development since its emergence as an independent nation in 1960. After the introduction of structural adjustment programme (SAP) in 1986, Nigerian economy has been relatively more open as a result of the policy measure applied by the government. This study employs Autoregressive Distributed Lag (ARDL) model in order to examines the impact of total factor productivity and trade openness on economic growth in Nigeria using ARDL model from 1980 – 2023. After conducting empirical analysis, the result shows that TFP and trade openness have positive effects on economic growth in Nigeria and highlights the significant role that total factor productivity and trade openness play in driving economic growth in the economy. The study recommends for the promotion of innovation through incentives by the Government and private sector in order to enhance research and development that will provide stable business environment and stimulate economic growth and development.

> population growth as the determinants of economic growth. Since endogenous capital stocks and population are subject to decreasing returns to scale, their impact on economic growth is relatively less when the economy growth approximates stable balanced equilibrium in the long run. Solow, (1956), noted that, in the long run, exogenous total factor productivity (TFP) is widely adopted as the main determinant of economic growth which also denotes the level of technological development. Endogenous growth theories also confirm that TFP is the main endogenous factor of economic growth, since technological change is specifically designated by own

economic dynamics (Lucas, 1988; Romer, 1986). In this context, both neoclassical and endogenous growth theories point out that sustainable growth may be achieved in the long run if growth performance is mainly based on TFP, which is commonly calculated within the scope of the growth-accounting approach introduced by Solow (1956). This approach relies on an assumption that the unexplained growth measure is interpreted as technological development after the increase in economic growth by fixed capital formation and employment is excluded (Kolsuz & Yeldan, 2014).

Gürsel, (2011), noted that, TFP includes output productivity, level of human capital, entrepreneurial climate. level of competitiveness, technological development and innovation capabilities and corporate efficiency. Earlier empirical research (Baier, Dwyer & Tamura, 2006; Bosworth & Collins, İsmihan & Metin-Özcan 2003: 2006: McCombie, 2000; Saygılı Abasız, 2008) in particular found the existence of a significant positive relationship between TFP and economic growth. Consequently, the rates of economic growth in developed countries were associated with TFP, whereas fixed capital stocks and an increase in the labour force have been addressed as determinants of economic growth rates in emerging countries. However, this methodology has been criticized, since average annual country data are used and the coefficients in the production function (output production elasticity of factors) are hypothesized. Ejike, Anah, & Onwuchekwa, (2015) postulated that, the ultimate goal of trade liberalization is to enhance free trade by the removal of all trade barriers and restrictions. This is believed to promote the growth of the economy by capturing the static and dynamic benefits from trade through a more robust and efficient allocation of resources, healthy competition among nations, increase in the flow and exchange of technological advancement and investment, and of course, a faster pace of technological progress and capital accumulation.

Different scholars studied the relationship between openness and productivity growth using developed countries' aggregate economywide data, but few studies considered causal link between productivity and economic growth in developing economies. In fact, many studies used partial productivity measures in their analysis which is widely been criticized for their incomplete picture on the role of TFP and economic performance. Looking at the Nigerian context, most of the past empirical studies did not estimate Total Factor Productivity (TFP) in Nigeria to ascertain the technology efficiency of Nigeria. Those that estimated TFP in Nigeria only estimated TFP in Nigerian manufacturing sector and this might not capture technology sufficiency of the whole economy. Therefore, this study aims to extend the existing literature relating to Performance of Total Factor Productivity and Trade Openness on Economic Growth from 1980 - 2023 in Nigerian, using ARDL model. The ARDL approach was used for statistical inferences because of several benefits over other techniques. The time-series data used in the study is longer than those of previous studies on developing economies like Nigeria, which enables the study to use estimation techniques that are more appropriate in the study. The study also analyses the short run-long run relationship between total factor productivity, trade openness and economic growth in Nigeria by decomposing the magnitude of the relationship which has significant impact for policy making.

In recognition of the crucial role of trade openness and TFP for economic growth and development, this study provides relevant information for designing effective policies that help to achieve desired goal and attract the desired inflow of capital and investment into the economy.

2. Literature Review

2.1 Theoretical review

The concept of total factor productivity was introduced for the first time by Solow (1956) and Abramovitz (1956) and was theoretically formalized in the seminal paper of Solow (1957) according to exogenous economic growth theory and measured through "Growth accounting approach". Bouhia, (2000) noted that, although methodological differences in the literature remain, there has been broad consensus among scholars like Denison (1972) - Jorgenson (1967) - Griliches (1967) – Solow (1957) conceptual framework for measuring aggregate total factor productivity growth.

This paper is based on Heckscher and Ohlin (1919), model (H-O model or 2x2x2 model), which is a mathematical theory used in international trade to evaluate the export pattern of a country relative to the natural resources at its disposal. According to this model, countries export items they can produce in abundance given their natural, land, labor and capital endowments. The model maintains that the specific natural resources that a country has would give it an advantage in producing related goods, this is coupled with land, capital, and human resources. The model is based on three principles; (i) Comparative advantage: which suggests that countries should specialize in the production and export of goods and services in which they have a comparative advantage. (ii) Factor endowments: which emphasizes the importance of a country's factor endowments, such as technology, labor and capital, in determining its comparative advantage. (iii) Trade and employment: which highlights the relationship between trade and employment, as countries that specialize in certain goods and services will have a greater demand for certain types of labor. The Heckscher-Ohlin model framework provides а relevant for understanding the relationship between TFP and Trade Openness, as it highlights the importance of comparative advantage, factor endowments, and trade in determining labour and capital outcomes.

2.2 Concept of productivity

Productivity in economics, measures output per unit of input, such as labor, capital, or any other resource. It is often calculated for the economy as a ratio of gross domestic product (GDP) to hours worked. Labor productivity may be further broken down by sector to examine trends in labor growth, wage levels, and technological improvement. Corporate profits and shareholder returns are directly linked to productivity growth. At the corporate level, productivity is a measure of the efficiency of a company's production process, it is calculated by measuring the number of units produced relative to employee labor hours or by measuring a company's net sales relative to employee labor hours, (Will Kenton, 2023). A country's ability to improve its standard of living depends almost entirely on its ability to raise its output per worker (i.e., producing more goods and services for a given number of hours of work). Economists use productivity growth to model the productive capacity of economies and determine their capacity utilization rates. This, in turn, is used to forecast business cycles and predict future levels of GDP growth. In addition, production capacity and utilization are used to assess demand and inflationary pressures. One of the most important measure of productivity is Total Factor Productivity.

2.3 Concept of total factor productivity

Total factor productivity, commonly referred to as TFP, is an equation used in economics to measure impact technological the of advancements and changes in worker knowledge. It attempts to measure the effects that these changes have on the long-term output of an economic system. Solow (1956) based his idea of total factor productivity to the invention of the Solow Residual concept. His ideas regarding Solow Residual the were monumental, as they pointed to multiple social factors regarding economic growth. During his research, Robert Solow found that in order to capture the role of productivity growth, these factors are important to include economic analysis. In growth theory, changes in output and gross domestic product (GDP) convey changes in production factors. Economists consider the residual, or the unexplainable changes in output and production, as total factor productivity. Total factor productivity is determined through dividing the output by the weighted geometric average of labor. The formula uses the standard weight of 0.7 for

labor and the standard weight of 0.3 for capital. Economists, strategists and other financial experts use this formula to study company behaviour and the behaviour of consumers, along with large-scale economic trends and variables like inflation, national income and GDP. Economists also use total factor productivity when attempting to interpret the changing economic fortune of national economies. For example, if the economic growth of a foreign or emerging market were to slow or expand rapidly, financial analysts could use elements of total factor productivity to assess changes in size, cultural environment or availability of resources. Doing this could help economists uncover the reason for the unstable trajectory, and may even help identify a more efficient use of capital or labor.

2.4 Economic growth

Economic growth refers to the ability of the economy to increase the production of goods and services with the stock of capital and other factors of production within the economy (Nnanna, Englama & Odoko, 2004). Thus, it entails increases in per capita income that leads to the attainment of a high standard of living equivalent to that of industrial countries (Todaro & Smith, 2011; Ughulu & Ajayi, 2020). The concept of economic growth has been used in a similar manner with economic development and is associated with such things as growth in population, development of resources, technological advancement and increasing capital formation. Economic growth means growth in the level of output produced by a country over a certain period of time. It is a useful measure of economic performance of a country. Performance here means the degree of correspondence between actual output and the maximum output that could be realized if, given the pattern of demand, all there sources and the most advanced technology available were used to full advantage. In other word, economic growth is defined as long-term change in an economy's productive capacity. The productive capacity of the economy is the output that could be yielded if all of the economy's resources were fully and efficiently employed.

2.5 Trade openness

According to Mishra (2007), trade openness refers to how integrated a country's economy is with the international trading system. In simpler terms, it reflects how open a country is to foreign goods and services. However, a highly trade-open country actively participates in international trade, meaning it exports and imports a significant amount of goods and services relative to its overall economy, which reflects its Level of engagement in global trade. Therefore, trade openness is also influenced by government policies like tariffs and quotas. A country with fewer restrictions on imports and exports is considered more trade-open which implies its status for Restrictions on trade.

Lane and Milesi-Ferretti (2008), state that bilateral equity investment is strongly correlated with underlying patterns of trade. Investors are better able to attain accounting and regulatory information on foreign markets through trade and thereby invest in foreign assets. Default risk is also ameliorated by tighter trade integration. Finally, trade transactions may directly generate cross-border financial flows including trade credits, export insurance, payment facilitation. The data on Trade Openness are from World Bank's World Development Indicators

Nevertheless, there is a strong positive correlation between trade openness and bilateral equity investment. This means that countries with higher trade openness tend to attract more foreign investment in their stock markets, (Mishra, 2007). This study refers trade openness is not just a measure of a country's involvement in international trade, but also plays a role in attracting foreign investment. By fostering transparency, reducing risks, and enabling financial flows, trade openness can create a more attractive environment for bilateral equity investment.

2.2 Empirical review

Iyoko & Eboreime (2009) investigated the causal relationship between globalization (characterized by FDI and openness) and economic growth using co-integration techniques on time series data in Nigeria. The

result of the study shows a unidirectional causality between FDI and Growth with FDI Granger causing growth while there was no causality between openness and growth, rather, openness Granger causes external debt in Nigeria. Similarly, Eriemo (2015) examines the extent to which globalization influences the balance of payments in the Nigerian economy covering the period from 1980 to 2013. The study used Error Correction Model (ECM) to assess the data. The parsimonious ECM result shows that openness of the Nigerian economy through globalization has been beneficial to the balance of payments in Nigeria. The negative sign attached to import provides an indication that the high level of imports in Nigeria has been detrimental to the balance of payments in Nigeria. In another strand, Kalu et al (2016), examine the effect of trade and financial investment openness on economic growth in Nigeria between 1960n – 2011 using dynamic regression model. Their result indicates that trade openness and foreign investment exert positive and negative effect on economic growth. The study further showed a long-run relationship among trade openness, foreign investment, and economic growth in Nigeria within the period under study.

Kalu, Chuke & Nwonye (2016) analyse the relationship between trade openness and economic growth in Nigeria with a dataset covering 23 year period. Using ordinary Least Square Regression method to represents the principal method of estimation combined with an array of other standard and diagnostic tests, the motivation was to evaluate whether there is a significant contribution from trade openness proxied by net export (NEXP) to economic growth in Nigeria proxied by (GDP). The R² of the result explains that 97.7% of variation in GDP in the model is explained by the principal explanatory variable NEXP, IMP (import) and EXP (export) which were used mainly as control variables or moderators. Export was found to be positive and significant function of GDP but Import was positive and nonsignificant. This is consistent with the trade theory as economies grow from exporting more than they import all things being equal.

Muhammad & Benedict (2018), examined the impact of openness on economic growth in Nigeria using GDP as the dependent variable and degree of openness, foreign exchange and per capita income as independent variables from 1981-2017. Their study shows that openness is linked to economic growth. The data analysis of the study also revealed that relationship exists between openness and economic growth, and all the components of trade exerted positive and significant effect on growth. Furthermore, the result shows that all the regressors were statistically significant at 5% level of significance. This implies that degree of openness within the period of study has impacted positively on economic growth. Zahonogo (2017) investigated how trade affects economic growth in developing countries of sub-Saharan Africa (SSA). The study employed a dynamic growth model with data from SSA countries covering 1980 to 2012. The Pooled Mean Group estimation technique was considered and the result indicates that a trade threshold exists below which greater trade openness has beneficial effects on economic growth and above which the trade effect on growth declines. The evidence also indicated an inverted U-curve (Curve of Trade) to changes in trade openness measures and to alternative model specifications suggesting a non-fragility linkage between economic growth and trade openness for sub Saharan African countries. These findings support the view that the relation between trade openness and economic growth is not linear for SSA.

Iyoha and Okim (2017), examined the impact of trade on economic growth on ECOWAS member countries with panel data from 1990 to 2013. Using four estimators; pooled OLS, Fixed effects model, Random effects model, and dynamic panel regression model, the study found that exports, exchange were rate and investment significant determinants of per capita real income growth and that exports were consistently positively related to growth, suggesting that trade has a significant positive impact on economic growth in ECOWAS member countries. This study however fell short in terms of the scope covered

for the analysis and the conditions for choosing between Pooled Mean Group estimator and Mean Group estimator through the application of Hausman test. The test would have determined whether the differences in estimated coefficients are systematic or not. In contrast, Kim, Lin and Suen (2016) analyzed the relationship between trade, economic growth and growth volatility using the Chudik and Pesaran (2013)**Cross-Sectional** Augmented Autoregressive Distributed Lag (CS-ARDL) panel data approach covering the period 1960 to 2011. The study used a sample of developing and developed countries to account for the potential dynamic heterogeneity and cross section dependency in the effects of trade. The results showed that greater international trade promotes economic growth and amplifies growth volatility in the long run. The study also found that there is large heterogeneity in the effects of trade, depending upon a country's development level, financial system, macroeconomic policies, human capital, corruption, and labor regulation. However, it could not capture most of the ECOWAS member countries where it is assumed that the effect may differ due to market and institutional imperfections.

In an attempt to close the gap on the freetrade-growth link, Manwa and Wije weera (2016) conducted a study on five Southern African countries; Botswana, Lesotho, Namibia, South Africa, and Swaziland covering 1980 to 2011. The Auto-Regressive Distributed Lag (ARDL) was used to obtain short-run and long run impacts of trade liberalization policies on economic growth. The study used the average tariff rate as a proxy for trade liberalization in model 1 and trade ratios in Model 2. The results from the two models suggest that Southern Africa has clearly benefited from its trade liberalization policies both in short-run and long-run. However, the study is limited in scope as it fails to cover ECOWAS member states.

3. Methodology

This study uses autoregressive Distributed Lag (ARDL) approach introduced by Pesaran and Shin (1997) and further extended by Pesaran, Shin and Smith (2001). The study analyses the data collected in three stages. First the data have been subjected to stationarity test by checking the properties of the data using the Augmented Dickey-Fuller (ADF) test and the Phillips-Perron test. Second. Autoregressive Distributed Lag (ARDL) model is used to examine the short run and long run relationship among the variables. Finally, the study conducts Granger causality test to determine the direction of causality between the variables using various diagnostic checks.

3.1 Model Specification

Considering the empirical modification from the work of Olushola and Uzoma, (2018), the study adopts the following equations to achieve its objectives;

$$\Delta Y_{t} = \alpha Y_{t-1} + X + \beta_{1} \Delta Y_{t-1} + \beta_{2} \Delta Y_{t-2}$$

$$+\ldots+\beta_P\Delta Y_{tP}+\varepsilon_t \qquad \qquad 1$$

Therefore, the dependent variable (RGDP) and the independent variables (TFP, TRDOP, INF) follows in equation (2) as;

$$RGDP = f(TFP, TRDOP, INFR)$$
 2

Putting equation (ii) into equation (i) into we have;

$$RGDP = \beta_0 + \beta_1 TFP_t + \beta_2 TRDOP_t +$$

$$\beta_3 INFR_t + \mu$$
 3

whereby

RGDP = real gross domestic product; TFP= Total factor productivity; TRDOP = Trade openness] and INFR = Inflation. β_1 , β_2 , β_3 = vectors of the coefficients of the first difference lagged values of the variables. β_0 = the constant parameter, μ = error term and t = time period

Putting equation (iii) into an econometric model we have:

$$\Delta RGDP_{t} = \beta_{o} + \beta_{1}TFP_{t-1} + \sum_{t=1}^{m} \beta_{2}TRDOP_{t-1} + \sum_{t=1}^{m} \beta_{3}INFR_{t-1} + \mu_{t} \qquad 4$$

whereby; m = the optimal lag length which is determined using the Akaike Information Criteria (AIC) and the Schwartz Information Criteria (SIC), $\Delta =$ the difference operator.

The null hypothesis of the above model is given as H_0 : $\beta_1 = \beta_2 = \beta_3 = 0$ which states no cointegration (no existence of long run relationship) among the variables under consideration. While the alternative hypothesis is given by H_1 : $\beta_1 \neq \beta_2 \neq \beta_3 \neq 0$ which signifies the existence of cointegration (presence or evidence of long run relationship (Pesaran, Shin, & Smith 2001). Once the cointegrating relationship is established, the short run dynamic is also analyzed.

3.2 Data Source and Scope

The study examines the impact of total factor productivity and trade openness on economic growth in Nigeria using secondary data sourced from the Statistical Bulletin of the Central Back of Nigeria (CBN) and the National Bureau of statistics (NBS) from 1980 to 2022.

3.3 Estimation Procedures

This study conducts the Augmented Dickey-Fuller (1997; 1981) (ADF) and the Phillips Perron (1988) (PP) unit root tests for stationarity test and to ensure that the results of the regression analysis are not spurious. The ARDL long run is also conducted in order to absorb the long run relationship among the variables. In order to check for Diagnostic Test, Breusch-Godfrey LM Test for Autocorrelation is conducted. Therefore, the null hypothesis will be rejected if P-Value of F-statistics is lower than the level of significance, α . Another test in the study, is Jarque-Bera (JB) Test for Normality which is used to determine whether the error term is normally distributed. The null hypothesis for JB test in error term is normally distributed and vice versa in alternative hypothesis. The study also examines the Breusch-Pagan-Godfrey Heteroscedasticity Test in order to ensure whether the residuals are randomly dispersed throughout the range of the dependent variable.

4. Result and discussion of findings

The summary of the data statistics is presented in Table 1 above, as observed from the table Trade Openness (TRDOP) has the lowest mean value of 12.450446 while GDP (GDP) has the highest mean value of 37.92057 where the mean value of Total Factor Productivity (TFP) and Inflation (INFR) are 31.98811 and 18.73792 respectively. Furthermore, the table shows the maximum and minimum of GDP as 72094.09 and 16211.49, while the maximum and minimum of TFP are found to be 85.43120 and -30.18459 respectively. The maximum and minimum of TRDOP are 22710351 and 3576132 and INF is found 72.83550 and 5.388008. The analysis was also fortified by the value of the skewness and kurtosis of all variables involved in the models. The skewness is a measure of the symmetry of the histogram while the kurtosis is a measure of the tail shape of the histogram. The bench mark for symmetrical distribution i.e. for the skewness is how close the variable is to zero while in the case of kurtosis, when it is three is called mesokurtic but value lower them that is called platykurtic and above is referred to as leptokurtic. The descriptive statistics table shows that GDP, TRDOP and INFR are positively skewed while TFP is negatively skewed.

From the Table 2 above, the stationarity test of the variables shows that RGDP, TFP and TRDOP are stationary at first difference I(1) while INF is stationary at level I(0).

	GDP	TFP	TRDOP	INFLATION
Mean	37.920.57	3198811	12.450446	18.73792
Median	26935.32	41.35671	13301437	12.87658
Maximum	72094.09	85.43120	22710351	72.83550
Minimum	16211.49	-30.18459	3576132.	5.388008
Std. Dev.	20300.02	26.99626	6010867.	16.31539
Skewness	0.525015	-0.600967	0.122366	1.914109
Kurtosis	1.635729	2.519981	1.613127	5.588784
Jarque-Bera	5.310135	3.001153	3.553430	38.26471
Probability	0.070294	0.223002	0.169193	0.000000
Sum	1630585.	1375.489	5.35E+08	805.7304
Sum Sq. Dev.	1.73E+10	30609.52	1.52E+15	11180.06
Observations	43	43	43	43

Table 1: Descriptive Statistics

Source: Authors' Computation using E-views 13 (2024)

Table 2. Unit Kool Test

Variable/	Level		First Difference		Order of
Series				Integration	
	ADF	PP	ADF	PP	
RGDP	-0.910525	-0.710643	-6.486353**	-4.476353**	I(1)
TFP	-1.721087	-1.526543	-8.224757**	-6.234553**	I(1)
TRDOP	-1.700361	-1.845365	-5.606523**	-6.476074**	I(1)
INFR	-3.618563	-2.437631	-6.537022**	-4.743286**	I(1)

Note that ** indicate significant at 5% level.

Source: Authors' Computation using E-views 13 (2024)

Table 4.2 BDS Test

Variable	Dimension	BDS Stat.	Std. Error	z-Statistics	Probability	Remarks
RGDP	2	0.028133	0.007270	3.869832	0.0001	Linearity
TFP	2	-0.012108	0.011321	-1.069471	0.2849	Linearity
TRDOP	2	0.024352	0.007159	3.401708	0.0007	Linearity
INFR	2	-0.011276	0.009850	-1.144845	0.2523	Linearity
a 1.1	20	· · · ·	12 (2024)			

Source: Authors' Computation using E-views 13 (2024)

From the above BDS test, the variables under investigation exhibit a linear dependence in their series while the unit root test indicates that the series are I(1) process. Hence the adoption of ARDL model however, the study adopts VAR model for the objective as used by Blanchard and Perotti (2002), Fatas and Mihov (2001), Kablan Alkhtani (2013), Sai Ding et al (2017) and particularly Kilian and Vigfusson (2011) for the US economy. In order to empirically achieve the objective, the variables under the study were investigated for their stochastic properties, using a lag-length based on the sequential modified Likelihood Ratio (LR), Final Prediction Error (FPE), Akaike Information Criteria (AIC), Schwarz information criterion (CIC) and Hannan-Quinn information criterion (HQIC) test statistics. The major advantage of the LR test is that it facilitates cross equation restrictions to test shorter versus longer lags. AIC is relatively better than the Schwartz Bayesian Criterion (SBC) when selecting lags for models that the true data generating process is one of the long lags (Ozcicek & McMillin, 1999). The AIC and FPE are superior to other criteria in the case of small sample (60 observation and below) for estimating autoregressive lag length, in that

they minimize the chance of underestimation and maximize the chance of recovering the true lag length (Liew, 2004).

As presented in table 3 above, the maximum lag for the model is selected and shows that SC and HQ agreed at lag1, all the remaining agrees at lag 2. Hence, the study adopted 2 lags as the maximum for the model.

Table 4 above shows that the F statistics of 16.17062 is greater than the upper bound value of 3.67 and the lower bound value of 2.79 at 5% significant level, hence there is existences of cointegration among the variables under study. K = 3 represent the number of independent variables. Therefore, since the bound test has revealed evidence of long run cointegration among the variables there is a need to test for the long run relationship of ARDL

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1510.289	NA	1.41 <i>e</i> ²⁷	73.86775	74.03493	73.92863
1	-1446.210	112.5285	1.36e ²⁶	71.52244	72.35833*	71.82683*
2	-1428.320	27.92655*	1.27 <i>e</i> ²⁶ *	71.43023*	72.93483	71.97812

Table 3: Optimum lag Test Result

* indicates lag order selected by the criterion. LR: sequential modified LR test statistic (each test at 5% level). FPE: Final prediction error, AIC: Akaike information criterion. SC: Schwarz information criterion, HQ: Hannan-Quinn information criterion *Source: Authors' Computation using E-views 13 (2024)*

Table 4: Cointegration Bound Test Estimation Results

Value Sign	ificance	I(0)	I(1)
16.17062	10%	2.37	3.2
3	5%	2.79	3.67
	2.5%	3.15	4.08
	1%	3.65	4.66
	Value Sign 16.17062 3	Value Significance 16.17062 10% 3 5% 2.5% 1%	Value Significance I(0) 16.17062 10% 2.37 3 5% 2.79 2.5% 3.15 1% 3.65

Note: k = no of observation, lower bound = 1(0), upper bound = 1(1) Source: Authors' Computation using E-views 13 (2024)

Table 5 ARDL Long run Coefficient Estimation Result

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
TFP	166.9719	83.88663	1.990448	0.0544
TRDOP	0.000600	0.000292	2.056586	0.0472
INFL	-46.29113	101.6039	-0.455604	0.6515
С	-2894.162	6389.541	-0.452953	0.6534

Source: Authors' Computation using E-views 13 (2024)

Table 5 above shows that there is a long run significant positive relationship between TFP, TRDOP and RGDP in Nigeria throughout the study period at 5% respectively. However, a 1% increase in TFP and TRDOP, will lead to about 1.66% and 0.06% increase in economic growth in Nigeria. The result further reveals

statistically insignificant negative relationship between real RGDP and inflation rate in Nigeria. Meaning that 1% increase in interest will result in about 0.46% decrease in real RGDP in Nigeria. The estimates finally show that holding all variables constant, RGDP will be -2894.162 which is insignificant at 5% level.

Test	Coefficient	prob.*			
Jerque-bera residual normality test	547.6189	0.00000			
Serial correlation Lm test	4.030000	0.0272			
Residual heteroscedasticity test	1.246802	0.3086			
Source: Authors' Computation using E views 13 (2024)					

Table 6: Diagnostic test result for ARDL

Source: Authors' Computation using E-views 13 (2024)

From table 6 above, the model passes the normality test through the joint Jarque Bera statistics. The result from the test shows that the residuals have normal and identical distribution. This prove the normality of the series variables, the ARDL residual normality test confirmed rejection of null hypothesis of normality properties given the significant pvalue of tests conducted (0.00000) This provides some support for the hypothesis that residuals from our ARDL model does not have a normal distribution. ARDL residual serial correlation LM test shows that we can reject the null hypothesis of no autocorrelation up to lag 2, given significant p-value of (0.0272). This proved that there is serial correlation of residual among the selected lag. Lastly, heteroskedasticity test was carried out and the result confirm the acceptance of null hypothesis going by its insignificant p value (0.3086). This proved the adequacy of the selected ARDL model.



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The decision rule is that we cannot reject the null hypothesis if the cumulative sum (CUSUM) and cumulative sum of squares test line lies between two critical lines at 5% significance level. Hence the null hypothesis would be accepted. Therefore, this study cannot reject the null hypothesis which implies that the ARDL model is structurally stable over the study period.

The ARDL CUSUM (Cumulative Sum) test is used to examine the stability of the estimated parameters in a NARDL model over time. It helps to determine whether the model exhibits structural instability or if the coefficients remain stable within acceptable bounds.

When conducting the ARDL CUSUM test, two sets of bounds are established: the upper bound and the lower bound. If the cumulative sum of the estimated coefficients falls within these bounds, it suggests that the model parameters are stable over time. However, if the cumulative sum exceeds the bounds, it indicates potential structural instability.

Since our ARDL CUSUM test falls within the upper and lower bounds, it suggests that the estimated coefficients in your model are stable over time. This is a desirable outcome as it indicates that the relationship between the variables in the model remains consistent.

In summary, the ARDL CUSUM test falls within the established bounds, it indicates that the estimated parameters in the model are stable, providing confidence in the reliability of the model's results over time.

5. Conclusion

The study investigated the impact of total factor productivity (TFP) and trade openness on economic growth in Nigeria. TFP measures the efficiency of combining inputs to produce outputs, while trade openness reflects the degree to which a country engages in international trade. The research employed quantitative analysis and found that TFP and trade openness both have positive effects on economic growth in Nigeria. Conclusively, the study highlights the significant role of total factor productivity and trade openness in driving economic growth in Nigeria. A wellbalanced approach that addresses both factors can lead to sustained economic expansion. However, continuous monitoring and adjustments of policies are essential to ensure that the benefits of increased TFP and trade openness are maximized for the overall development of the country's economy.

Based on the findings, it is recommended that developing economies like Nigeria should focus on enhancing both TFP and trade openness to foster economic growth. Policies that promote technological innovation, research and development, and efficient resource allocation are very essential to improve TFP. Simultaneously, measures to reduce trade barriers, encourage exports, and attract foreign investments are necessary to boost trade openness, which in turn may stimulate economic expansion. The government and the private sector must invest in education and training, in order to improve the quality of the workforce and boost productivity. Improvement in infrastructure is also essential to make it easier for businesses to operate and for trade expansion which will lead to increased efficiency. Government must reduce trade barriers to make it easier for Nigerian businesses to compete in the global market. Government and private sector must promote innovation by providing incentives for research and development, and by creating a supportive environment for start-up businesses. Lastly, government must strengthen institutions that will help to create a more predictable and stable business environment in the economy.

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