Studies in Economics and International Finance
ISSN: 2583-1526
Vol. 2, No. 2, 2022, pp. 205-223

https://DOI:10.47509/SEIF.2022.v02i02.05

ARF INDIA
Academic Open Access Publishing
www.arfjournals.com

THE NEXUS BETWEEN REAL SECTOR DIVERSIFICATION AND SUSTAINABLE ECONOMIC GROWTH IN NIGERIA: ARDL-ECM APPROACH

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ARTICLE HISTORY

Received : 12 September2022
Revised : 29 September 2022
Accepted : 18 October 2022
Published : 27 December 2022

TO CITE THIS ARTICLE

Deebom, Zorle Dum, Lekara-Bayo Ifeoma Better & Da-Wariboko, Asiki Yvonne (2022). The Nexus between Real Sector Diversification and Sustainable Economic Growth in Nigeria ARDL-ECM approach. *Studies in Economics & International Finance*, Vol. 2, No. 2, pp. 205-223. *https://DOI: 10.47509/SEIF.2022.v02i02.05*

Abstract: The purpose of this study is to explore the relationship between real sector diversity and sustainable economic growth in Nigeria using the ARDL-ECM approach between 1981 and 2021. To know the impact of real sector activities on economic growth, the study assesses the long-term relationship between real sector variables and economic growth with ARDL-ECM approach. The Data used in the study include; GDP, Agriculture, manufacturing and services extracted from the Central Bank of Nigeria's online statistical database. The study's time series data ranged from 1981 to 2021. The results of the data analysis confirmed the long-term positive effect of agriculture And the Services on economic growth using the ARDL -ECM approach. The results showed that agriculture and services play an important role in driving economic growth in Nigeria in the short and long term. It was observed that the coefficients of agriculture, manufacturing and services were positive and statistically significant in both long and short moments. The use of the ARDL-ECM method in investigating the effect of short term and the long-term real sector activities on sustainable economic growth in Nigeria make this study special. Therefore, it was recommended that the government ensure the establishment of real sector activities to meet the growing demand of the population and other economic activities at different levels. In doing so, diversifying the real sector will enhance the sustainability of Nigeria's economic growth.

Keywords: Sector, Diversification, Sustainable, Economic, Growth, ARDL

1. INTRODUCTION

The real sector is one of the important parts of the Nigerian economy. It consists of agriculture, manufacturing and other service sectors. The real sector plays a strategic role in the economy, it is the driving to have to behind economic growth and the development. The Center Bank of Nigeria (2021) listed in their statistical bulletin the real sector of Nigeria to be included; crop and livestock production, forestry, fishing, and industry such as mining and quarrying, crude oil and natural gas, coal mining, minerals, quarrying, and other minerals (Central Bank of Nigeria, 2021) including manufacturing; Petroleum refining, cement, food and beverages, tobacco, textiles, clothing, footwear, wood and wood products, pulp and paper products, paper and paper products, chemicals and pharmaceuticals, non-metallic products, plastic, rubber , electrical and electronic products (Central Bank of Nigeria, 2021) basic metals, iron and steel, automobiles and assembly (Sanusi, 2011) , among others Manufacturing, electricity, gas, steam, air conditioning, water supply, sanitation, waste management waste, construction and services to include; Commerce, accommodation, restaurant services, transport, storage, etc(Sanusi, 2011). The challenge facing many countries in the world is not only the development of labor-intensive manufacturing Industries but how value can be added to agricultural business and the other service sectors to simultaneously boost economic growth (Sanusi, 2011). Additionally, other challenges include; Lack of real diversification in the sector to promote sustainable economic growth, and failure to promote private sector growth so that it can boast economic activities and job creation (Central Bank of Nigeria, 2021).

Although Sanusi, (2011), revealed that the Central Bank of Nigeria has been making efforts in real sector development to enhance job creation, however, this can only be maximized and sustained if complementary efforts are made by the government and other stakeholders to overcome these challenges (Meto, 2021). This is due to the need for the government and other stakeholders whose activities depend on the real sector for their livelihood to accelerate action through well-designed public investments and effective policy reforms that will support a more diversified economy (Joseph & Nwankwo, 2019).

The role of real sector diversification in Nigeria's economic growth and development cannot be emphasis. According to Folarin, (2020), real sector diversification remains a challenge for most developing countries and is likely to be higher for low-income countries, as well as countries with small, landlocked, and/or small economies. or dominated by dependence on primary products. This study is carried out to empirically investigates the complexity associated with real sector diversification and economic growth in Nigeria. This is necessary because the true diversification of the sector is an essential component of sustainable economic development as the country moves towards a more

diversified productive and commercial structure (Adesoye, Adelowokan; Maku, & Shakirat, 2018). The lack of diversification in the real sector is often associated with increased vulnerability to external shocks that can undermine long-term economic growth prospects (Joseph & Nwankwo, 2019).

Diversification is helpful in managing volatility and provides a more stable path to equitable growth and development (Adesoye, *et al.,* 2018). Successful diversification is more important now in light of slowing global growth and the need to increase the number and quality of jobs in Nigeria. It is necessary to create new higher productivity jobs, creating jobs that facilitate growth through structural transformation and thus displacing employment from low productivity jobs, especially in the real sector, as the main areas of crop and livestock production, forestry, fishing, and industry, such as mining and quarrying, crude oil and natural gas, and mining Coal, minerals, quarrying, and other minerals, and manufacturing to enhance high-productivity jobs (Joseph and Nwankwo, 2019), promoting Sustainable Economic Growth in Nigeria Using Automatic Error-Correcting Distributed Regression (ARDL-ECM) for Data Analysis and so, the current study differs from other studies for several reasons. First, the time frame of the data used in this study has been expanded to include recent data that may better explain the cointegration relationship between the variables under investigation.

2. LITERATURE REVIEW

2.1. Theoretical Background

Bazhal, (2016) said that the endogenous growth theory was initially called AK theory and was developed by Frankl in 1962. The endogenous growth theory combined capital and technical progress. However, Romer improved on AK theory, as it was previously called in 1990 (Schumpeter, 2005). The endogenous growth theory proposes that sustainable growth is determined by forces within the system. The forces within the system are the growth rate of total factor productivity (TFP) which is determined by the rate of technical progress. Also, sustainable economic growth on the other hand is measured by the growth rate of output per capita.

Endogenous growth theory suggests that innovation mechanism in the form of growth, processes and markets are important economic factors affecting sustainable economic growth. Moreover, Schumpeter's growth model is an extension of endogenous growth theory. There is consensus on a two-way causal flow between real development and economic development, contrary to neoclassical models and economic theories development who - which Take on the inside the account knowledge of the activities of the really section and the external economic system" (Asongu and Le Roux, 2016). Asongu and Le Roux (2016) have also shown that new economic growth depends on both endogenous explanations and new

Schumpeterian visions of economic development. So, this theory is relevant for this study because recent literature has shown that real sector activities are of great importance to Nigeria's economic growth and can giving an endogenous explanation.

2.2. Overview of the development of the real sector in Nigeria

Mainly, the Nigerian economy can be classified into three main areas: primary, secondary and tertiary. As noted by the Central Bank of Nigeria (2013), the core area includes agriculture and natural resources; the secondary sector is mainly industry, which is transformed for change and industrialization as well as for construction and development; While services, wholesale and retail trade constitute the tertiary sector. In addition, the real sector is grouped into oil and non-oil areas. While the oil sector consists of the production of crude oil and gas, the non-oil sector consists of Agriculture, industry, wholesale and retail trade and services.

The oil sector is the main currency concern benefits _ In any case, their contributions to GDP have decreased since the change Millennium. The oil sector contributed about 30.8% of GDP in 1999, which expanded to 32.5% in 2000 and decreased to 31.5% in 2001 and steadily contracted to 14.8% in 2011 (Central Bank of Nigeria, 2021). For the period from 1999 to 2011, oil contributed an average of 23.3%. Although the commitment to GDP was in a state of collapse while the development implementation was integrated. The oil business development rate decreased by 7.5% in 1999, but developed by 11.1% in 2000 and peaked in 2003 with a development of 23.9% (Central Bank of Nigeria, 2021).

In general, the oil region developed by 1.6 percent for the period from 1999 to 2011 (Sanusi, 2011). The typical non-oil GDP ratio during 1999-2011 was 76.7, going from 69.2% in 1999 to 85.2% in 2011 (Central Bank of Nigeria, 2021). The implementation of its further development follows a similar trend. It grew by 4.4% in 1999 and exceeded 9.4% in 2006, and in 2011 it grew by 8.9%, with a usual rate of 7.2% in this period. Examination of the sectoral commitments to GDP for the horticultural portion of GDP revealed the average value of 40.3% during the period 1999-2011 (Sanusi, 2011). It reached 36.7% in 1999; It peaked at 43.9% in 2000 and leveled off at 40.2% in 2011. The rural area is supposed to do its part in the usual capacity to meet the health requirements of a large population (Central Bank of Nigeria, 2021). The needs of the unrefined components required by the modern region and the disposal of the natural surplus of trade, thus creating a trade unknown to them, work in the balance of the installation conditions (Central Bank of Nigeria, 2021). That is, the nature of agribusiness is described by the unfortunate reception of innovation, insufficient use of fertilizers, and gentrification that has reduced the efficiency of the area. Furthermore, the lack of acceptance of sufficient assets to put resources into the region has been recognized as a major impediment to further development efficiency (Central Bank of Nigeria, 2021). The meeting area in Nigeria consists of mega, medium, small and micro-organizations. To achieve freedom, the

public power has allowed the country to go from a general horticultural nature, to a modern economy through various approaches and projects defined in its progressive plans (Central Bank of Nigeria, 2021).

The improvement in the modern field found the mean value of 27.9 percent during the review time, with sectoral commitment falling to 35.4 percent in 1999 - 19.3 percent in 2011. The decline in sectoral commitment of the modern region with GDP as included in other components including irregularities and several of the strategies, as well as fundamental bottlenecks. The typical portion of the collection area was 4.0% at the time of examination. Despite this, the lack of cooperation in the modern region, particularly in the aggregation region, is of concern as this has exacerbated unemployment conditions in Nigeria. The sub-mining area consists of crude oil, gas and solid minerals. Hard metals, for example coal and tin were the main business and raw material mining. Stuff to Nigeria before the discovery of crude oil. However, this changed after the oil revelations, which ruled that the mining movement was the main source of government income and producer profits.

The oil and gas region accounted about 23.3 percent of the total share of GDP during the period under evaluation, which is indicative of a comparative disposition. It decreased with the fall of the modern area from 30.8 percent in 1999 to 14.8 percent in 2011 (Sanusi, 2011). The construction and development portion of GDP changed about 1.8 percent during the review period. As a level of GDP, the share of wholesalers and retailers found the average value of 14.8% during 1999- 2011. The share during the review period from 13.6% in 1999 to 19.4% in 2011. Essentially, the typical departmental share of GDP was 15.5% during the survey period, up from 12.3% in 1999 to 19.1% in 2011 (Sanusi, 2011).

2.2.2. The relationship between the real sector and economic growth in Nigeria

In general, the real sector has experienced some fluctuations in wealth given the history of the Nigerian economy over the years. Non-oil growth averaged 8.9% in 2006-2010 and grew from 4.4% in 1999 to 8.9% in 2011 (Abiodun & Sheu, 2010). The sector analyzes showed that the growth of the agricultural sector stabilized around 6.0% during the analysis period. Agriculture accounted for, on average, around half (3.7%) of the non-oil sector's GDP growth (7.9%) in 1999- 2011(Abiodun & Sheu, 2010). In agriculture, the evidence is that yields are declining and productivity has declined for both cash crops and food over the last few decades. In the case of commercial crops, production levels have also decreased. However, production levels of food crops have increased, and the development can largely be attributed to the steady and significant expansion of cultivated area as productivity, measured by productivity per hectare, has declined. Other important drivers of growth at the subsector level during this period included services, wholesale and retail trade, and building and construction, which posted growth

rates of 4.3% to 13.3%, 2.5% to 11.3%, and 3.8% to 12.3% in 1999 and 2011 (Obilor, 2013). In the services subsector, telecommunications recorded the highest growth rate of about 73.0 percent on average during the period. The growth rate of this sector was supported by the continued liberalization and expansion of telecommunications services. GDP growth rates during 2003 and 2010 were largely attributed to the development of the non-oil sector, which grew from 5.17% in 2003 to 9.5% in 2007 and reached 8.5% in 2010. Growth non-oil average (GDP) was 8.9 percent in 2006-2010 (Obilor, 2013). Sector analyzes showed that agriculture grew marginally from 6.4 percent in 2003 to 7.4 percent in 2006 but was 5.7 percent in 2010 . On average, agriculture accounted for more than a quarter (2.8 percentage points) of the sector's GDP growth (Abiodun & Sheu, 2010) . Non-oil materials (8.9 percentage points) in 2006-2010 (Abiodun & Sheu, 2010) . In agriculture, evidence shows that yields have declined and productivity has declined for both cash crops and food over the past few decades. In the case of commercial crops, production levels have also decreased. However, production levels of food crops have increased, and productivity, measured in productivity per hectare, has been discounted as a development largely attributable to the continued significant expansion of cultivated area (Schaffnit-Chatterjee, 2014). Other important drivers of the sub-segment during this period include services, building and construction, wholesale and retail trade with growth rates recorded from 0.41% to 11.9%, from 8.75% to 12.2% and from 5.76% to 11.2% in 2003 and 2010 (Obelor, 2013) . Telecommunications registered the highest percentage in the services sector, with a growth rate of around 31.97 percent on average during the period. The growth rate in this sector has been supported by the continued liberalization and expansion of telecommunications services.

Sectoral GDP growth, agriculture, manufacturing and services (1981-20 22Q1) Constant basic prices (in percent) are shown in Figure 2.1 below

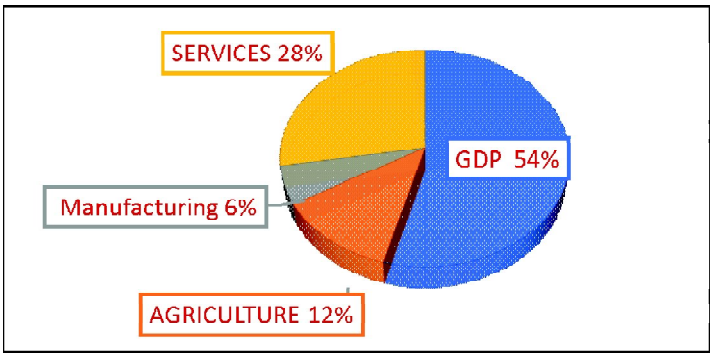

Figure 2.1: Sectoral growth rates of GDP, agriculture, industry and services (FIRST QUARTER 1981-2022) constant basic prices (percent)

Source: Researcher's calculation based on data extracted from the electronic statistical bulletin of

Some of the studies reviewed for insights into relevant empirical and methodological constructions of the interrelationship between real sector diversification and economic growth in Nigeria using the ARDL-ECM approach include; Mito, (2021), Folarin , (2020) , Ubong, (2020), Joseph and Nwankwo, (2019), Adesoye, Adelowokan; Mako and Shakirat (2018) Luqman, Oelami and Oleg (2018), Eugene (2017), Suberu, Ajala, Akande,& Olure-Bank,(2 0 1 5), Qamruzzaman & Jianguo, (2017 **) and** Narayan & Narayan, (2005). However, some of these studies were bewildered with one limitation or the other. some of the limitations identified are no proper methodology. Some of the studies, the co-integration techniques were wrongly applied, estimated and interpreted. One of these techniques is the Autoregressive Distributed Lag (ARDL) cointegration technique or bound cointegration technique. To resolve these challenges, this study reviewed issues surrounding the way co-integration techniques how it is properly applied, estimated and interpreted within the setting of ARDL cointegration framework. Also, these studies produced dissimilar results even though they used similar modelling technique and timeframe of the data used in the study in addition to their measures of variables.

3. MATERIALS AND METHODS

3.1. Specification Model

The generalized ARDL model (p, q) is defined as:

$$GDP_t = \gamma_{0j} + \sum_{i=1}^{P} \delta_j InGDP_{t-1} + \sum_{i=1}^{q} \phi_j^1 InAGRIC_{t-1} + \sum_{i=1}^{q} \varphi_j In\text{MANU}_{t-1} + \sum_{i=1}^{q} \vartheta_j In\text{SERV}_{t-1} + \varepsilon_t \tag{3.1}$$

The generalized error correction model (ECM) to estimate short-range links can be formulated as follows;

$$\Delta InGDP_t = \alpha_0 + \sum_{i=1}^{P-1} \alpha_{1i} \Delta InGDP_{t-1} + \sum_{i=1}^{q-1} \alpha_{2i} \Delta InAGRIC_{t-1} + \sum_{i=1}^{q-1} \alpha_{3i} \Delta In\,\text{MANU}_{t-1} + \sum_{i=1}^{q-1} \alpha_{4i} \Delta In\,\text{SERV}_{t-1} + \lambda ECT_{t-1} + \varepsilon_t \tag{3.2}$$

The negative and statistically significant sign of the ECT_{t-1} coefficient (λ) indicates that any long-term imbalance between the dependent variables and a series of independent variables will converge again with the long-term equilibrium correlation (Abbas & Yuansheng, 2019). Notes: $\lambda = (1 - \sum_{i=1}^{p-1} \delta_i)$ The speed of the

adjustment parameter is with a negative sign. $ECT = (InGDP_{t-1} - \theta X_t)$, the error correction term for the extracted residuals obtained from the long-term regression equation. where $\theta = \frac{\sum_{i=0}^{q} \beta_i}{\alpha}$ the long-term parameter, α_0 the intercept of the model, represents $\alpha_{1,i,}\ \alpha_{2,i,}\ and\ \alpha_{3,i,}$ the short-term dynamic coefficients of the adjustment model for the long-term equilibrium (Abbas & Yuansheng 2019)

4. DATA ANALYSIS AND RESULTS

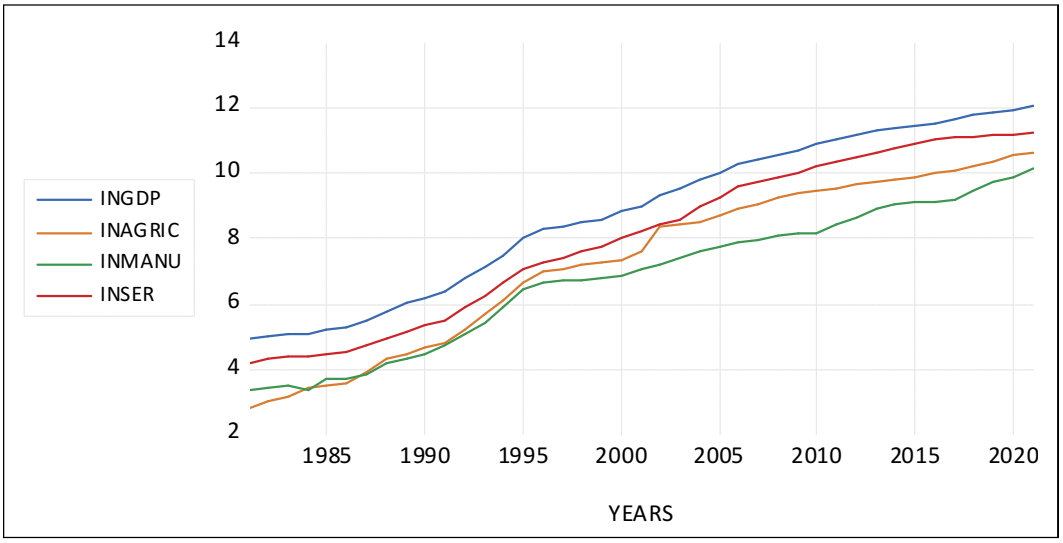

Figure 4.1: Graph of the variables under investigation.

Figure 4.1 shows the trend of the study variables (GDP, agriculture, manufacturing and service sector) under study, with an upward trend from 1981 to 2020. From the visual investigations, the variables certainly trend significantly upward. The results of the descriptive statistics and the correlation matrix are shown in Table 4.1.

Table 4.1 provides a summary of descriptive statistics for log-transformed and raw series on the real sector, economic growth, and the correlation matrix for raw data. The series for the real sector and economic growth have been altered using the natural logarithm to try not to have biased estimates and to ensure that all variables measured in different units are converted to the same units. Furthermore, this is done in accordance with the statement of Kenneth (2011). Kenneth (2011)

Table 4.1: Summary of descriptive statistics for raw and log-transformed series in the real sector and economic growth with the correlation matrix for raw data

	GDP	*AGRIC*	*MANU*	*SERV*	*LNGDP*	*LNAGRIC*	*LNMANU*	*LNSER*
Mean	37119.15	8511.762	3879.583	18918.49	8.786	7.300	6.785	8.022
Median	8150.020	2015.420	1146.680	3806.190	9.006	7.609	7.045	8.244
Max	173527.7	41126.06	25725.87	77100.63	12.064	10.624	10.155	11.253
Min	137.930	17.050	28.230	66.200	4.927	2.836	3.340	4.193
Std. Dev.	49833.52	11183.50	5860.414	25476.36	2.435	2.536	2.124	2.483
Skewness	1.282	1.378	2.100	1.133	-0.274	-0.404	-0.276	-0.201
Kurtosis	3.447	4.007	7.126	2.767	1.638	1.735	1.806	1.575
Jarque-Bera	11.570	14.718	59.215	8.869	3.681	3.848	2.956	3.741
Probability	0.003	0.001	0.000	0.012	0.159	0.146	0.228	0.154
Sum	152	348982.2	159062.9	775658.3	360.207	299.316	278.191	328.90
Sum Sq. Dev.	9.93E+10	5.00E+09	1.37E+09	2.60E+10	237.203	257.156	180.382	246.56
Observations	41	41	41	41	41	41	41	41
INGDP	1.000							
INAGRIC	0.997***	1.000						
	(0.000)	——-						
INMANU	0.995***	0.994***	1.000					
	(0.000)	(0.000)	——-					
INSER	0.999***	0.994***	0.992***	1.000				
	(0.000)	(0.000)	(0.000)	——-				

Source: Researcher's Extract from EViews output
Note: Max-presents maximum; min - presents minimum; Std. Dev.- Standard Deviation
*, **, and *** represents 1%, 5% and 10% level of Significance

stated that strings are usually transformed in modeling to avoid having to deal with a heavily biased variable. This is done on the basis that highly biased variables are approximately normal and biased in estimation. The rationale for examining descriptive statistics for both raw and natural log data on GDP, agriculture, manufacturing, and the service sector is to gain background information on the variables and to understand the possible potential relationships that may exist between the variables (Okoye, Essi, Tuaneh & Deebom, 2022).

However, the results show that the trait averages for the raw time series variable over GDP (37119.15), AGRIC (8511.762), manufacturing (3879.583) and services (18918.49) are higher in contrast to those of the natural logarithmic variable revealing LNGDP data (8.786), LNAGRIC (7,300), LNMANU (6,785) and LNSERV (8,022). The median estimate for all variables was a positive median return. This is consistent with the financial theory that asset prices and historical returns eventually return to their long-run average or intermediate level after exceeding their break- even points (Okoye, Essi, Tuaneh, & Deebom, 2022). The result of the asymmetric statistical estimates shows that GDP is (1.282), AGRIC (1.378), manufacturing (2.100) and services (1.133), while the transformation of the natural logarithm reveals, LNGDP (-0.274), LNAGRIC (-0.404), LNMANU (-0.276) and

LNSERV (-0.201). The results of the deviation statistic for the raw series are positive. This just means that the deviance statistics for the raw series definitely shifted to the right tail with the greatest advantage (Okoye, Essi, Tuaneh, & Deebom, 2022). In addition, all the transformed natural logarithm series show a negatively biased result. The implication of skewed statistics having a negative sign is that the outliers in the series will certainly move to the left tail with a severe loss. (Okoye, Essi, Tuaneh, and Deebom, 2022). The negative qualities displayed by these estimates are normal features of financial time series data (Deebom & Essi, 2017). In addition, raw data comparative kurtosis and transformed natural logarithm include; GDP (3,447), agriculture (4,007), manufacturing (7,126) and services (2,767) while the transformed natural logarithm reveals LNGDP (1,638), LNAGRIC (1,735), LNMANU (1,806), and LNSERV (1,575) independently. These features represent the shape of the data distribution for each variable (Deebom & Essi, 2017). Likewise, the Jarque-Bera Test (JB) test insights for the normality of the data with estimated probability values to include; GDP (11,570), AGRIC (14,718), manufacturing (59,215), and services (8,869), while the data converted from the normal log are LNGDP (3,681), LNAGRIC (3,848), LNMANU (2,956), and LNSERV (3,741). Each JB test is measurably test statistics, indicating that the estimated p-values are not statistically significantly different from the traditional probability value (0.05). This means that the raw data is not normally distributed. Therefore, the null hypothesis of normality is rejected while the alternative hypothesis that these indices are normally distributed while the log-transformed data are not normally distributed is accepted. Table 4.1 also shows the peer review, where real sector support activities are closely related to economic growth. There is a positive and critical relationship between agriculture and GDP (0.997), manufacturing and GDP (0.995), and services and GDP (0.999).

4.2.2. Unit root test

The variables under investigation differed and the results are shown in Table 4.1 below;

Table 4.2 : Augmented Dickey Fuller (ADF) Unit Root Test

Variables	*Augmented Dickey Fuller Test (ADFT)*			*Phillip Perron Test (PPT)*		
	(1(0))	*(1(1))*	*Remarks*	*(1(0))*	*(1(1))*	*Remarks*
LNGDP	-1.402191	-3.446724***	1(1)	-1.050486***	-	1(0)
LNAGRIC	-2.175101	-4.009390***	1(1)	-2.175101	-4.061048***	1(1)
LNMANU	-0.628978	-2.990130**	1(1)	-0.379737	-0.379737***	1(1)
LNSERV	-1.442478	-5.880693***	1(1)	-1.019526	-2.796727***	1(1)

Source: Researcher's Extract from Eviews output

Note: *, **, and *** represents 1%, 5% and 10% level of Significance

This study investigates the relationship between real sector activities and economic growth in Nigeria using the ARDL-ECM approach. Before applying the ARDL-ECM approach; It is a preliminary condition to know the order of integration of the variables (Abbas & Abdul, (2009). The most important assumption of the ARDL-ECM approach is that the chain must be integral in I(0) or I (1).) (Okoye, Essi, Tuaneh, and Deebom, 2022). Therefore, in this study we use two types of unit root tests, for example, the Dickey and Fuller 1979 unit root tests and the Phillips and Byron 1988 booster (Adesoye; Adelowokan; Maku & Salau, 2018). Results of the Dickey and Fuller Unit Root Tests given in Table 4.2 above Table 4.2 contains the results of the Dickey Fuller, Phillips and perron tests for the GDP, agriculture, manufacturing and service sectors. The results showed that the logarithmic form for GDP (LNGDP), agriculture (LNAGRIC), manufacturing (LNMANU) and service (LNSERV) corresponds to 1 (1). The results indicated that the logarithmic variables are constant I (1) except where this is quite different for Phillips and perron.

However, it is well established in Adesoye *et al*, (2018) that the ARDL model can be applied to stationary chains in I(0) or I(1).

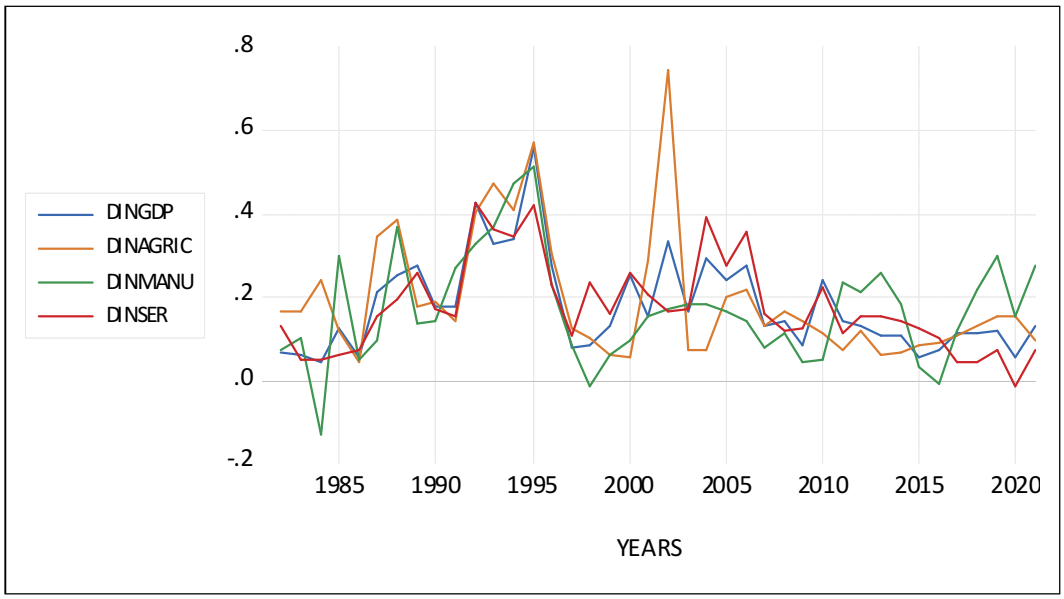

Figure 4.2: Time Plot of the Differenced Series Variables Under investigations

From visual investigations, Figure 4.2 clearly shows the variation of the natural logarithm series. The variables vary around the zero mean, showing that they are stationary with evidence of massive variance with continuous variance (Okoye, Essi, Tuaneh, & Deebom, 2022).

4.2.3. VAR Lag Order Selection Criteria

Later, after verifying the unit root test, the next stage is to use the ARDL-ECM approach for cross- chain communication investigations. It is important to choose the proper delay length before applying the ARDL-ECM approach. Furthermore, the decision on the length of the delay should be made carefully, as an inappropriate delay can lead to biased results. Then, to confirm that the length of the delay was chosen correctly, we use the Schwarz Information Criteria (SIC) to represent the total length of the delay. The SIC scale gives reliable results (Okoye, *et al.,* 2022). His exposition contrasts strikingly with the Akaike Data Scale (AIC) and others. This is because it punishes the model for losing a degree of freedom (Deebom and Essi, 2017). The result of specifying a VAR delay request is found in Table 4.4. We found that the difference is suitable for the study.

Table 4.4: VAR Lag Order Selection Criteria

Lag	*LogL*	*LR*	*FPE*	*AIC*	*SC*	*HQ*
0	-2.802259	NA	1.70e-05	0.367690	0.541843	0.429087
1	176.0653	309.3925	2.57e-09	-8.435960	-7.565193*	-8.128974
2	201.7451	38.86682*	1.57e-09*	-8.959196*	-7.391816	-8.406621*
3	214.3734	16.38259	2.05e-09	-8.776939	-6.512946	-7.978775
4	224.5452	10.99655	3.34e-09	-8.461902	-5.501296	-7.418149

4.2.4. Johansen Cointegration Test

To validate the long-term relationship or equilibrium that exists, this study uses the Johansen cofusion technique (Pesaran *et al.* 2001). The Johansen cointegration test is performed using trace and max-eigen test statistics. The results of the Johansen cointegration test are shown in Table 4.2 below.

Table 4.4 contains the results of the Johansen test for the cointegration between GDP and the agriculture, manufacturing and services sector. null parameter results * (5Ø_Ü = 0). It showed that the estimated probability value (0.0019) and (0.0037) for each of the tracers and the maximum eigenvalues of the variables investigated are considered significant at the 5% level of significance. The null hypothesis of no cointegration is rejected and the alternative hypothesis is accepted. Therefore, there is a long-term equilibrium (relationship) between the variables. There is only one common integration equation.

4.2.5. Bound test approach

This study used SIC to choose the delay duration for the ARDL-ECM approach. Our disclosures for the cointegration tests considering the ARDL-ECM approach are shown in Table 4.5. The results show that the calculated F stat is 17,433, 7,896,

Table 4.4: Results of the Johansen Co-integration Test

Hypothesized No. of CE(s)	*Eigenvalue*	*Trace Statistic*	*0.05 Critical Value*	*Prob.***	*Eigenvalue*	*Max-Eigen Statistic*	*0.05 Critical Value*	*Prob.***
$r = 0$	0.599545	60.90716	47.85613	0.0019***	0.599545	35.69097	27.58434	0.0037***
$r \leq 1$	0.384552	25.21619	29.79707	0.1539	0.384552	18.93076	21.13162	0.0989
$r \leq 2$	0.139035	6.285422	15.49471	0.6618	0.139035	5.838348	14.26460	0.6341
$r \leq 3$	0.011398	0.447074	3.841465	0.5037	0.011398	0.447074	3.841465	0.5037

*Notes: *, **, and *** represents the probability and level of Significance 1%, 5% and 10% respectively "r" represents the number of co-integrating equation.*

and 9,889, which are more notable than UCB at the 1 and 5 percent significance levels when GDP, agriculture, and services are considered as the dependent variable but while manufacturing is used as the dependent variable. Just the opposite happens. The results of the limit test assume that there are three cointegration vectors that agree that there is a long-run relationship between GDP, agriculture, and services in Nigeria. Table 4.5 shows that there are three cointegration vectors between GDP, agriculture, and services in Nigeria, confirming the robustness of the long-run correlation

Table 4.5: Results of ARDL Co-Integration Test

Variables	*LNGDP*		*LNAGRIC*		*LNMANU*		*LNSERV*	
Optimal Lag Structure	(1,0,1,1)		(2,1,2,0)		(1,1,0,2)		(2,0,2,0)	
R^2	1.000		0.999		0.999		1.000	
Adjusted R^2	1.000		0.999		0.998		1.000	
F-statistics*AIC*	41734.44**-4.033		3791.74***-1.905		2967.28***-1.875		1986.00***-3.445	
F-Bounds Test*Asymptotic*	1000		1000		1000		1000	
F - statistics	17.433		7.896		4.139		9.889	
Critical Bounds Value	1(0)	1(1)	1(0)	1(1)	1(0)	1(1)	1(0)	1(1)
10%	2.72	3.77	2.72	3.77	2.72	3.77	2.72	3.77
5%	3.23	4.35	3.23	4.35	3.23	4.35	3.23	4.35
2.5%	3.69	4.89	3.69	4.89	3.69	4.89	3.69	4.89
1%	4.29	5.61	4.29	5.61	4.29	5.61	4.29	5.61
Actual sample Size	40		40		40		40	
F-statistic	-7.290		-5.244		-1.507		-6.195	
Critical Bounds Value	1(0)	1(1)	1(0)	1(1)	1(0)	1(1)	1(0)	1(1)
10%	-2.57	-3.46	-2.57	-3.46	-2.57	-3.46	-2.57	-3.46
5%	-2.86	-3.78	-2.86	-3.78	-2.86	-3.78	-2.86	-3.78
2.5%	-3.13	-4.05	-3.13	-4.05	-3.13	-4.05	-3.13	-4.05
1%	-3.43	-4.37	-3.43	-4.37	-3.43	-4.37	-3.43	-4.37
Diagnostic Tests								
χ2 *Normality*	0.640[0.726]		5.023[0.081]		0.095[0.954]		1.933[0.380]	
χ2 *serial*	0.136[0.089]		0.010[0.004]		0.946[0.941]		0.613[0.523]	
χ2 *ARCH*	0.021[0.023]		0.241[0.23]		0.180[0.114]		0.415[0.393]	
χ2*White*	0.031[0.151]		0.241[0.227]		0.744[0.490]		0.116[0.303]	

Notes: "()" represents the ARDL Optimal Lag Structure, while *, **, and *** represents the level of Significance at 1%, 5% and 10% respectively, [] represents the associated estimated probability value.

4.2.6. Long-run and short-run analysis

This study confirmed the existence of a cointegration between real sector diversification and GDP in Nigeria. This applies when GDP is used as the dependent variable, as shown in Table 4.6. Here, the study investigates the

relationship in the short and long run using the models in equations (3.1) and (3.2).

Table 4.6 shows the short-term and long-term results of the ARDL-ECM model. For the extended results (see Table 4.5, Panel A and B), all the explanatory variables are positive and have a significant impact on GDP. A one (1) percent increase in agriculture increases GDP by 23.1 percent. Likewise, the manufacturing subsector is positive and has a significant impact on GDP, since the 1% increase in manufacturing and the first delay will cause an increase of 21.4 and 14.0 % and a decrease in GDP. Similarly, a 1 % increase in service and its first delay would result in an increase of 61.1 and 22.0 percent and a decrease in GDP. The adjusted values of R2 and R2 were estimated at 100%, which confirmed that the model is very suitable. This explained that the differences in economic growth in the current year were largely explained by the activities of the real sector in the previous years in the years in which everything was equal. The calculated F-statistic is 41738.44. The results obtained in this study are in line with Narayan and Narayan, (2005); Qamaruzzaman

Table 4.6: Results of long-run and short-run coefficients employing the ARDL approach

Dependent Variable is LNGDP: ARDL(1, 0, 1, 1) selected based on SIC				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Panel A: Long run Estimation				
$INGDP_{t-1}$	0.297***	0.096	3.084	0.004
$INAGRIC_t$	0.231***	0.031	7.456	0.000
$INMANU_t$	0.214***	0.042	5.058	0.000
$INMANU_{t-1}$	-0.140**	0.054	-2.604	0.014
$INSER_t$	0.611***	0.066	9.315	0.000
$INSER_{t-1}$	-0.220**	0.077	-2.842	0.008
C	0.829***	0.103	8.057	0.000
R-squared	1.00	F-statistic		41738.44
Adjusted R-squared	1.00	Prob(F-statistic)		0.000
Panel B: Short-run Estimation				
$\Delta INAGRIC_t$	0.210*	0.112	1.870	0.070
$\Delta INMANU_t$	0.277*	0.134	2.068	0.046
$\Delta INSER_t$	0.513***	0.138	3.722	0.001
ECM(-1)	-0.598***	0.208	-2.878	0.007
Diagnostic Tests				
χ^2 *Normality*	1.386[0.500]			
χ^2 *serial*	0.183[0.148]			
χ^2 *ARCH*	0.824[0.811]			
χ^2 *White*	0.216[0.212]			

Notes: *"()" represents the ARDL Optimal Lag Structure, while *, **, and *** represents the level of Significance at 1%, 5% and 10% respectively, [] represents the associated estimated probability value.*

and Jianguo (2017) and Adesoye *et al.,* (2018) findings in a study on agricultural value chain enhancement of economic diversification in Nigeria using ARDL model. In Adesoye *et al,* (2018), it was revealed that agricultural spending had a positive and significant impact on productivity Agricultural sector in Nigeria.

The short-run results in Table 4.6, Panel B above, show that the effect of real sector diversification has a significant positive effect on economic growth, such that a 1% increase in agricultural output leads to an increase in 21.0% in GDP. Meanwhile, the short-term estimate shows that manufacturing has a significant positive impact on GDP economic growth with 27.7% of GDP attributable to 1% growth in manufacturing activities. Service activities have a positive and significant impact on GDP, and this is additional support as the 1% increase in service activities

led to a 51.3% increase in GDP. The error coefficient of the correction term (ECTt -1) is -0.598. This is important on the traditional level of importance. This shows that almost any form of imbalance can be modified by 5.9% in a single period. The results obtained in this study are synonymous with those of Adesoye *et al* (2018) in their study on strengthening the agricultural value chain for economic diversification in Nigeria using the ARDL model. In Adesoye *et al,* (2018) studied, it was revealed that agricultural production had a positive and significant impact on the productivity of the agricultural sector in Nigeria. Thus, we estimate the robustness of the model by using various diagnostic tests such as the Jarque-Bera test, the LM test, the ARCH test and the White test as suggested in previous research (e.g. Paul, 2014) . The results of the diagnostic tests are presented in Table 4.6. The results of this pilot study reveal that the diagnostic tests for the ARDL-ECM model are adequate. Meanwhile , Pesaran and Shin (1999) suggested that stability tests should be investigated using CUSUM and CUSUMSQ. These were used to investigate the long-term and short-term stability of the parameters and the results are shown in Fig. 4.4 and 4.5 respectively.

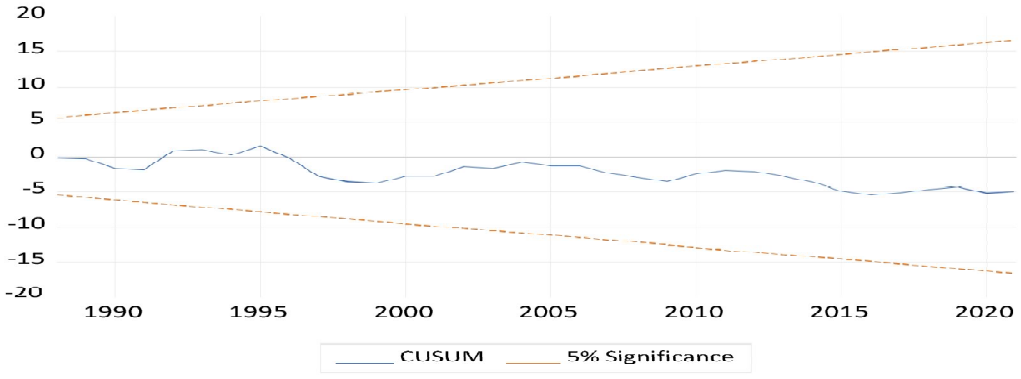

Figure 4.4: Plot of the cumulative sum of recursive residuals

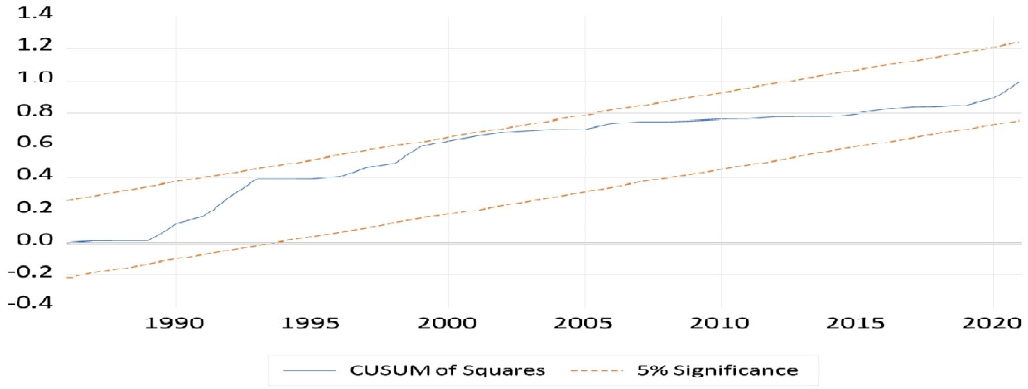

Figure 4.5: Plot of the cumulative sum of squares for the remaining recursive values.

The stability tests shown in Figures 4.4 and 4.5 confirm the robustness of the model since the critical limits are within the significance level of 5%. This confirmed the accuracy of the short- term and long-term impact of real sector activities during the period from January 1981 to December 2020. Similarly, the correlation scheme statistics for autocorrelation and partial correlation of the ARDL-ECM model are shown in Table 4.7 below.

Table 4.7: Statistical results of the correlation plot for autocorrelation and partial correlation

Date: 10/18/22 Time: 21:14
Sample (adjusted): 1984 2021
Q-statistic probabilities adjusted for 4 dynamic regressors

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
		1	0.121	0.121	0.6041	0.437
		2	-0.075	-0.091	0.8414	0.657
		3	-0.148	-0.130	1.7872	0.618
		4	-0.158	-0.136	2.9089	0.573
		5	-0.301	-0.306	7.0690	0.216
		6	-0.038	-0.034	7.1370	0.308
		7	0.166	0.087	8.4946	0.291
		8	0.055	-0.082	8.6503	0.373
		9	-0.036	-0.117	8.7170	0.464
		10	0.116	0.071	9.4433	0.491
		11	0.005	-0.018	9.4444	0.581
		12	0.021	0.101	9.4699	0.662
		13	-0.047	-0.049	9.6066	0.726
		14	-0.140	-0.198	10.853	0.698
		15	-0.014	0.088	10.865	0.762
		16	-0.014	-0.012	10.878	0.817

*Probabilities may not be valid for this equation specification.

Table 4.7 contains the results of the correlation plot statistics for autocorrelation and partial correlation. The estimated p-value of the statistics for the two tests is not statistically significant at the conventional 5% significance level. The results of this study were synonymous with those of several previous investigations, such as Metu, (2021), Folarin, (2020), Ubong, (2020), Joseph and Nwankwo, (2019),

Adesoye, Adelowokan; Mako and Shakirat (2018). A large number of them and other similar studies use the Solow development model, the Johansen cointegration approach, and Pareto model analysis in their data analysis; However, this pilot study uses monthly time series data from January 1981 to December 2021 using the Automatically Distributed Delayed Error Correction Model (ARDL-ECM) to study the short-term and long-term association in the desired variables with a point of view to determine the relationship between them.

5. CONCLUSION

This study investigates the short-term and long-term relationship between real sector diversification and economic growth in Nigeria during the period from January 1981 to December 2021 using the ARDL-ECM approach. The order of integration of the study variables was tested using the ADF and PP unit root tests. The F tests on the ARDL confirmed the presence of cointegration between the variables. Thus, it is found that there is a relationship between the diversifications of the real sector and long-term economic growth. The resilience of agriculture, manufacturing and services towards economic growth was found to have a significant positive impact on economic growth in the short and long term. Furthermore, it is noted that with the timely intervention of the government and other stakeholders in the real sector, economic growth in Nigeria can be enhanced. Therefore, it is necessary for the government to pay attention to the activities of the real sector to ensure that it can boast of meeting the growing demand of the population and other economic activities at various levels. In doing so, the diversification of the real sector will enhance the sustainability of Nigeria's economic growth.

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