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NON-OIL SECTORS, ECONOMIC DIVERSIFICATION AND GROWTH IN NIGERIA: FURTHER EMPIRICAL EVIDENCE

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Abstract:

The adverse consequences of over-reliance of Nigerian economy on oil has continued to heighten the call and need to diversify the productive base of the economy towards non-oil sectors. To heed the call, successive governments have implemented several economic policies at different periods. However, while the contents of these policies are plausible, the full-anticipated benefits are far from being realized. The disappointing results have been linked to two principal factors: the incoherent implementation of the policies and neglect of the country-specific circumstances. Informed by the need to take cognizance of the country's peculiar circumstances, the question as to which priority sectors that Nigeria should target for diversification efforts has come up in literature. Empirically, in view of the country's natural resource abundance, studies have suggested agricultural, industrial and many others non-oil sectors as plausible options for diversifying the economy. In light of this, the study examines the interactions among non-oil sectors, economic diversification and growth in a multivariate VAR model over the period 1960-2019. Empirical results reveal that while an expansion of economic activities into resource-based sectors is a necessary condition for diversification; however, it is not a sufficient condition as the dimension of the diversification matters.

Key words: *Economic Diversification, Non-Oil Sectors, Innovation Accounting Techniques, Resource-Rich Developing Countries*

1. Introduction

Ever since Nigeria joined the ranks of oil producers in 1958 when its oil field came on stream producing 5,100 barrels per day (Adebayo, 2013), oil has been the mainstay of Nigerian economy. It accounts for nearly 80 percent of the country's revenue and 90-95 percent of its foreign exchange earnings (Agbaeze, Udeh, & Onwuka, 2015), contributes the lion share to Gross Domestic Product (Nwoba & Abah, 2017) and has been a major source of energy (Abomaye-Nimenibo & Samuel, 2020). Undoubtedly, since its discovery in 1956, the country's oil sector has emerged from being merely the supportive economic sector it was in the 1960's (Asagunla, 2018) to the principal source of foreign exchange earnings and most viable access to international investment opportunities (Asagunla, 2018). Regrettably, however, the country extreme/over reliance on oil has triggered: structural difficulties for the economy as earnings from oil fluctuate along with market

trends (Aigbedion & Iyayi, 2007); acute unemployment rate as the sector could only employ limited number of the population and worst still, only experts (Uzonwanne, 2015); high and rising level of poverty (Akinlo, 2012); and poor infrastructural development which are exacerbated by the neglect of other productive sectors of the economy notably the non-oil revenue-earning sectors (Riti, Gubak & Madina, 2016) where the potentials remain great but largely unexploited (Riti et al., 2016). These adverse consequences of over-reliance of the economy on oil has continued to heighten the call and need to diversify the productive base of the economy towards non-oil sectors (Esu & Udonwa, 2015).

In response to the need for diversification, numerous economic reforms programmes, policies, and initiatives were implemented at different periods by successive governments. Notable among these are the National Development Plans of 1962-68, 1970-74, 1975-80, and 1981-85; Structural Adjustment Programme of 1986; Rolling Plan of 1990-98; National Economic Empowerment and Development Strategy of 2004; Subsidy Re-investment and Empowerment Programme of 2012 and; recent Economic Recovery & Growth Plan (ERGP) of 2017-2020. These policies documents have a number of strategic objectives. Paramount among these is the intention to restructure and diversify the productive base of the economy (Eko, Utting, & Onun, 2013; ERGP, 2017) with a view to lessening the country's dependence on oil. However, while the contents of the policies are plausible and positive change was noticed during the implementation, the full-anticipated benefits are far from being realized (Eko et al., 2013) as the dominance of oil still prevails. A number of factors have been identified as possible cause of these policies failure (Obamwonyi & Aibieyi, 2014). Prominent among these are the incoherent implementation of the policies and neglect of the country-specific circumstances which ought to, as a matter of necessity, be considered.

Empirically, informed by the need to take cognizance of the country's peculiar circumstances and enormous potentials as global oil prices continue to dwindle, the question as to which priority sectors that Nigeria should target for diversification efforts has come up in literature. As a follow-up, in view of the country's natural resources abundance, studies such as those by Ayeni (2013); Ayodele, Akongwale & Nnadozie (2013); Omorogiuwa, Zivkovic, & Ademoh (2014); Chris, Amujiri, & Ndibe (2015); Suberu, Ajala, Akande, & Olure-Bank (2015); Kemi (2016); Adeola & Evans (2017); Udoka & Duke (2017); Duru & Ehidiamhen (2018), Ifeakachukwu & Alao (2018); Edeme & Nkalu (2019) have suggested agricultural, industrial and many others sectors, as options plausible for diversifying the economy. In light of this, the study seeks to supplement the discussions. Specifically, the paper examines the interactions among non-oil sectors, economic diversification and growth.

The focus is driven by the fact, recently, there is rapidly increasing body of literature on the relationship between natural resource abundance and economic growth that is held together by Prebisch-Singer's (1950) hypothesis in development economics discourse. This literature has been inspired by two main observations. First, sustainable growth cannot be based on resource-based sectors/products alone. This is because world prices for primary products relative to manufactured commodities decline overtime (Kaulich, 2012). Thus, dependence on primary/resource-based sectors magnifies income volatility, widens current account deficit and negatively affects (Papageorgiou & Spatafora,

2012) short- and long-term growth. Second, the production of primary products and sectors does not result in as many spillovers as the production of manufactured products (Matthee & Naudé, 2008). In the latter, externalities on, for instance, knowledge and new technologies are created (Matthee & Naudé, 2008). These externalities benefit not only other economic activities but also improve the ability of the economy to compete internationally (Chuang, 1998; Al-Marhubi, 2000; Herzer & Nowak-Lehnmann, 2006). Accordingly, though natural resource abundance is good for growth in resource-rich developing countries (RRDCs), no doubt, but then contriving further uses of these resources by means of value-added ventures matters. As such, diversification of an economy involves not only an expansion in the number of resource-based sectors, but also an increase in the value of extant and new products by shifting from primary to secondary/tertiary sectors, or manufactured goods (Lugeiyamu, 2016)

Nigeria is a natural resources abundant economy. The country is endowed with enormous solid-minerals, manufacturing, energy, agricultural deposits & resources. According to the Nigerian Extractive Industries Transparency Initiative (NEITI) audit report published in 2013, the country is enriched with over 40 different kinds of latent solid-minerals and precious metals (including, marble, gold, columbites, silver, iron-ore, gemstones, bitumen, limestone, lead-zinc, manganese, uranium, lithium, granite, barite, bentonite, gypsum, tin-ore, talc) found in more than 450 distinct locations in diverse commercial quantities (Iwayemi, Adenikinju, Adeyemo, Adeniyi, & Omenka, 2014; Edeme & Nkalu, 2019). Besides the manufacturing and solid-minerals wealth, Nigeria has an estimated 200.79 trillion cubic feet of gas (making the country Africa largest and world's seventh largest holder of natural gas reserve), over 36.2 billion barrels of oil, 4 billion metric tonnes of coal and lignite, huge reserves of tar sands, hydropower and solar radiation among others (Adenikinju, 2008; Oyedepo, 2012; Shaaban & Petinrin, 2014). Apart from the enormous energy resources, the country has about 84 million hectares of arable land (of which only about 40% has been cultivated), attractive conditions for agricultural production and is a major global player in a number of crops.

Motivated by the country's abundant natural resources, as well as, the apparent paradox between natural resource abundance and growth this study examines the interactions among non-oil sectors, economic diversification and growth in Nigeria. Albeit, as evinced in the studies cited above and section 2 highlights, the macroeconomic implications of economic diversification have been widely acknowledged and studied. However, an in-depth reading of this literature suggests that, besides the fact that the bulk of these studies focussed on the: compelling need for Nigeria to diversify its economy, imperatives/options for diversifying the productive base of the economy, impacts of non-oil sectors/export diversification on growth, determinants and importance of economic diversification, identification of factors that are responsible for the underperformance of non-oil sectors, how diversification of the economy will enhance stable and viable growth; there is the dearth of econometric evidence examining the said interactions in Nigeria. This study, in furtherance to the discussion, aims to fill this gap.

The present paper contributes to the existing literature in several respects. First, it provides an intuitive insight on the theme as the extant studies lacks comprehensive instincts. Second, it complements prior studies via advanced econometric procedures.

Finally, it demonstrates the empirical validity of Prebisch-Singer's (1950) hypothesis. Following the introduction, the rest of the paper is structured as follows. A brief review of literature is presented in section two. The methodology adopted is discussed in section three. Estimations techniques and empirical results are depicted in section four. The study is then concluded in the fifth section.

2. Literature Review

The adverse consequences of over-reliance of Nigerian economy on oil has continued to heighten the call and need to diversify the productive base of the economy towards non-oil sectors. To heed the call, successive governments have implemented numerous economic policies at different periods. However, while the contents of these policies are plausible, the full-anticipated benefits are far from being realized. The disappointing results have been linked to two principal factors: the incoherent implementation of the policies and neglect of the country-specific circumstances. Informed by the need to take cognizance of the country's peculiar circumstances, the question as to which priority sectors that Nigeria should target for diversification efforts has come up in literature. In light of the country's natural resources abundance, studies have suggested agricultural, industrial, and services sub-sectors including transport, financial (banking and insurance), tourism (hotels/restaurants, resorts/recreation parks, carnivals, movies), and many others, as options for diversifying the economy.

In this section of the study, to provide an excellent starting point for a comparison on data, methodology, and results, a synopsis of the extant studies that have been conducted on the subject is presented in table 1. Further, to retain simplicity and succinctness, attention is given to empirical literatures from the late 2000s. As evidenced in the table, the macroeconomic implications of diversification have been widely studied, generated a sizable body literature. However, a careful reading of this literature suggests that, other than the fact that the bulk of these extant literatures focussed on the: compelling need for Nigeria to diversify its economy, imperatives/options for diversifying the productive base of the economy using descriptive method of analysis, impacts of non-oil sectors/export diversification on growth, determinants and importance of diversification, identification of factors that are responsible for the underperformance of non-oil sectors, how diversification of the economy will enhance stable and viable growth; there is the dearth and paucity of econometric evidence examining the interactions among non-oil sectors, economic diversification and growth in Nigeria. Accordingly, to provide further insights into the aforesaid interactions and related policy issues, this paper aims to fill this gap.

Table 1: A Synopsis of the Extant Literature

S/N	Author(s)	Brief Description	Methodology	Sample Period	Suggested Sectors for Diversification	Findings/Conclusions
1	Aigbedion & Ivavi (2007)	The paper shed light on the imperatives for economic diversification within and outside Nigeria's petroleum industry.	Descriptive method of analysis	1970-2005	Agriculture, Solid minerals, Manufacturing and Service	Diversification of the economy should extend beyond the Petroleum sector so that the country can become a major force in the emergent global economic order.
2	Udeaja & Nwokoye (2007)	This paper analyses the socio-economic conditions in Nigeria, identifies four priority sectors for the purpose of developing non-oil economy.	Descriptive method of analysis	1980-2002	Agriculture, Solid minerals, Manufacturing/Industry and Service/Tourism.	Developing these key sectors would enable the nation to overcome the problems of mass poverty, unemployment and illiteracy.
3	Uzoigwe (2008)	The study explores policy scenarios that can enable Nigeria to achieve rapid economic diversification and development.	Error Correction Model	1970-2005	Agriculture, Industrial, Mining & Quarrying, Education & Health	The analysis of the study indicates that the achievement of a diversified economic development in Nigeria through the transformation of the non-oil sectors will strengthen and broaden the productive base of the country.
4	Odularu & Okonkwo (2009)	This study investigates the relationship between energy consumption and the Nigerian economy.	Ordinary Least Squares	1970-2005	Energy	The results derived reveal that this sector should be given more relevance by exploiting the opportunities laden in the sector to increase economic growth.
5	Awe & Ajayi (2009)	This study seeks to determine the adequacy of non-oil sectors for sustainable economic growth and development in Nigeria.	Ordinary Least Squares	1960-2007	Agriculture, Solid minerals & Manufacturing	Findings from the study revealed that dynamic relationship exists between the revenue from the non-oil sector and economic development.
6	Odeniran & Udeaja (2010)	The paper examines the relationship between financial sector development and economic growth in Nigeria.	Vector Autoregression Model & Granger causality test.	1960-2009	Financial	The empirical results obtained suggest that the development of financial institutions should not be emphasized unilaterally; rather, attention should also be given to the complimentary and coordinated development of reforms in other sectors.
7	Izuchukwu (2011)	This paper attempts to examine the impact of the agricultural sector on the Nigerian economy.	Ordinary Least Squares	1986-2007	Agriculture	The result indicated a positive relationship between Gross Domestic Product (GDP) vis a vis domestic saving, government expenditure on agriculture and foreign direct investment.
8	Ayeni & Ebohon (2012)	This paper critically analyses Nigeria's tourism potentials, focusing on the impacts on the wider economy.	Qualitative	1986-2007	Tourism	The paper concludes that the tourism sector has huge potentials yet unexplored, which if fully supported, can contribute significantly to the economic diversification and poverty alleviation efforts of the government.
9	Ogwumike & Salisu (2012)	This paper examines the short run, long run and the causal relationship between financial sector development and economic growth in Nigeria.	Autoregressive Distributed Lag Model & Granger causality test	1975-2008	Financial	The study suggests that appropriate regulatory and macroeconomic policies that will foster the expansion and development of the Nigerian financial institutions should be pursued by the relevant authority.
10	Odetola & Etumnu (2013)	This paper investigates the contribution of the agriculture sector to economic growth in Nigeria.	Vector Autoregression modelling framework	1960-2011	Agriculture	The study found that the agriculture sector has contributed positively and consistently to economic growth in Nigeria, reaffirming the sector's importance in the economy.
11	Ayeni (2013)	The study investigates the role tourism would play if the Nigerian economy is diversified through tourism.	Quanitative	2010-2012	Tourism	The study concludes that tourism would be of immense benefit to the Nigerian economy.
12	Adenugba & Dipo (2013)	This study empirically examines the performance of non–oil exports over the years as well as the reason for that pattern and level of performance.	Ordinary Least Squares	1981-2010	Agriculture and Solid Minerals	Direct government intervention through minerals exploration is suggested. Besides, encouragement of production and exportation of value added commodities because of its relatively high price and income elasticises of demand, storability and adaptability over primary products such as processed agricultural products or foods is also suggested.
13	Ayodele, Akongwale, & Nnadozie (2013)	This paper examines the structure of the Nigerian economy with a view to X-raying the need for diversification of the economy towards solid mineral development.	Qualitative & Quantitative analysis	1970-2010	Solid Minerals	The paper suggests that the development of the solid mineral sector could help to combat poverty in Nigeria via job creation.
14	Maduaka (2014)	This study analyzes the importance of solid minerals and its impact on economic development.	Vector Autoregression modelling framework & Granger causality.	1970-2012	Solid Minerals	Empirical evidence shows there is a feedback relationship between solid minerals production and RGDP performance in the Nigerian economy
15	Yusuf (2014)	This study explores empirically the 'Energy Sector as a Critical Sector to Nigeria Economic Development: With Perspective to Electricity Subsector'.	Vector Autoregression modelling framework & Granger causality.	1981-2011	Energy	This study concludes that electricity is not just an intermediate input or resources of satisfying domestic needs alone but it is 'a critical sector to economic development most especially to developing country like Nigeria'.
16	Yusuff & Akinde (2015)	The study focusses on empirical investigation of the contribution of the rapidly developing tourism sector to economic growth in Nigeria.	Vector Autoregression modelling framework & Granger causality.	1995-2013	Tourism	The findings reveal a unilateral causality and positive long-run between from tourism development to economic growth.
17	Esu & Udonwa (2015)	The study attempts to answer the question: to what extent can Nigeria gain from diversifying the economy?	Error Correction Model	1980-2011	Industrial	The findings indicate that trade diversification offers Nigeria windows of operating a strong, versatile and stable economy.

18	Feyisayo, Ihuoma, & Ojoko (2015)	This study investigates the impact of the agricultural and industrial sector on the overall economic development of the Nigeria.	Ordinary Least Squares	1981-2012	Agriculture & Industrial	The overall result of the analysis indicates that these sectors have significant positive effect on economic development of Nigeria both in the short-run and in the long-run.
19	Antai, Udo, & Effiong (2016)	This study, seeks to determine the contributions of the different sectors in the Nigerian economy other than the oil and gas sector	Vector Autoregression modelling framework & Granger causality.	1960-2013	Service	The result shows that services sector do not only promote the level of economic growth in the economy but also connect every other sector.
20	Olalekan, Afees, & Ayodele (2016)	The paper empirically investigates the contribution of agricultural and industrial (particularly, mining) sectors to the economic development in Nigeria.	Ordinary Least Squares & Fully Modified Ordinary Least Squares.	1960-2012	Agriculture & Industrial	The results obtained reveal that economic development in the long run and short run is positively associated with value of solid mineral and value of agriculture over the scope of the study.
21	Riti, Gubak, & Madina (2016)	This paper examines the growth of Non-oil sector to act as a key to diversification and performance of the economy	Auto Regressive Distributed Lag Model and VECM Granger causality	1980-2015	Agriculture, Manufacturing & Telecommunication	To achieve inclusive growth there is the need to review and strengthen existing policies and incentives to support the growth of the non-oil sectors
22	Kemi (2016)	This paper attempts to seek out how diversification of the economy will enhance stable and viable economic growth in Nigeria.	Descriptive Statistical Method & Correlation Analysis	1960-2015	Agriculture	Agriculture must cease from being treated as development programme, rather it must be treated as the country's only means of survival. There and then a proper diversification of the economy into agriculture can take place.
23	Mbaegbu (2016)	The study examines the role manufacturing industry can play in achieving the diversification of the Nigerian economy.	Ordinary Least Squares	1999-2015	Manufacturing	The paper recommends that all industrialization strategies, to wit, import substitution, export substitution, small/medium industries participation and the Big push strategy should be adopted to make manufacturing the arrow head for achieving the diversification of the Nigerian economy for sustainable development.
24	Adeola & Evans (2017)	This study empirically examines the impact of financial development and financial inclusion on economic diversification in Nigeria.	Fully modified least square	1981-2014	Financial	Financial inclusion is a potent accelerator of economic diversification, and can help realize the national objectives of building shared prosperity and abolishing extreme poverty in Nigeria.
25	Ewetan, Fakile, Urhie, & Odunatan (2017)	This paper examines the long run relationship between agricultural output and economic growth in Nigeria.	Vector error correction model & Granger causality test.	1981-2014	Agriculture	The study recommends that government should further strengthen agricultural policies in the area of funding, storage facilities, and market access to enhance agricultural production.
26	Udoka & Duke (2017)	The study empirically examines the effect of diversity management for nation building in a three sector economic management approach.	Descriptive method of analysis & Ordinary Least Squares Regression	1981-2014	Agriculture, Solid Minerals, & Tourism	The study recommends that government should undertake a deliberate enforcement and implementation of the compulsory minimum credit allocation by banks (mostly the commercial banks) to these multi-cultural productive sectors in Nigeria.
27	Evans & Saibu (2017)	The paper evaluates the impact of monetary and exchange rate policies on economic diversification in Nigeria.	Auto Regressive Distributed Lag Model	1981-2014	Financial	Monetary and exchange rate policies are potent tools for accelerating economic diversification from oil to non-oil economic activities in Nigeria.
28	Olusoji & Odeleye (2018)	This paper empirically examines the service sector potentials in the transformation of Nigerian economy.	Ordinary Least Squares Regression	1981-2015	Service	The study recommends that there should be increase in the investment in the service sector with more focus on utilities, transport and education to boost the growth of the GDP
29	Chukwuma (2018)	This study examines the diversification of the Nigeria's economy through agriculture and solid minerals in the face of dwindling economy.	Correlation, cointegration, & Ordinary Least Square Regression	1982-2015	Agriculture & Solid Minerals	Empirical evidence shows there is a feedback relationship between agriculture/solid minerals production and RGDP performance in the Nigerian economy.
30	Inusa, Daniel, Dayagal, & Chiya (2018)	This study investigates the impact of agriculture on Nigeria's Economic Recovery and Growth Plan (ERGP)	Ordinary Least Squares Regression	1970-2017	Agriculture	An increase in government allocation to the sector is necessary, but currently not sufficient to ensuring that an improvement is realized.
31	Olushola & Uzoma (2018)	This study empirically investigates the relationship between financial sector development and economic growth in Nigeria.	Error correction model	1981-2017	Financial	The study concluded that to achieve a steady economic growth, the financial intermediation should be strengthened through expansion in the capital market, bank consolidation and improvement in the insurance sector.
32	Adesoye, Adelowokan, Maku, & Salau (2018)	This study examines how enhancing the agricultural value chain can contribute to rapid economic diversification in Nigeria.	Autoregressive Distributed Lag Model	1981-2015	Agriculture	The study concluded that agricultural value chain contributed significantly to the diversification of the Nigerian economy.
33	Matthew, Ede, Osabohien, Ejemeyovwi, Ayanda, & Okunbor (2018)	This study examines the interaction effect of tourism and foreign exchange earnings from the tourism industry on economic growth in Nigeria	Fully Modified Ordinary Least Squares (FMOLS) & Johansen cointegration	1980-2016	Tourism	The study recommended that as a matter of priority, the Nigerian government should encourage diversification through tourism promotion to achieve the desired level of economic growth
34	Sule & Inedu (2018)	The study examines industrialization and the quest for economic diversification in Nigeria	Descriptive and Analytical tools as well as Vector Error Correction Model	1970-2017	Industrial	The study recommends that the government should go into partnership with private investors (either domestic or foreign) to bring in their technological know-how and financial capability to develop these sub-sector for a diversified economy as against the current mono-economy.
35	Omodero (2019)	The need for economic diversification as Nigeria's economic crisis heightens and the apparent neglect of the hospitality and tourism sector jointly motivate this study.	Ordinary Least Squares Regression	1981-2017	Tourism	The results show evidence of a positive and strong relationship between the contribution of the sector and real gross domestic product in Nigeria.
36	Edeme & Nkalu (2019)	This study predicts the effects of economic diversification on solid mineral development in the attainment of Nigerian sustainable development.	Ordinary Least Squares Regression	1970-2017	Solid Minerals	Empirical findings revealed that solid mineral development would be of immense benefit to the diversification of Nigerian economy in the area of employment creation, infrastructural development and improved internally generated revenue
37	Oyeleke & Akinlo (2019)	The study examines the impact of energy generation on economic growth in Nigeria by explicitly focusing on the two signifcant sources of energy generation.	Error Correction Model	1980-2017	Energy	More improvement is needed on energy generation in Nigeria so that industrial frms can reach their full potential and the desired economic expansion can be achieved.
38	Ishola & Olusoji (2020)	The paper empirically investigates service-industrial sector interactions and their impact on economic growth in Nigeria.	Vector error correction model & Granger causality test.	Q12010-Q42016	Service & Industrial	For Nigeria's economic outlook to turn around there is need to strengthen service and industrial growth and success, in a bid to promote a non-oil export culture.

Source: Prepared by the author

3. Methodology

3.1. Econometric Model

Based on the theoretical framework of neoclassical growth model, to empirically examine the interactions among non-oil sectors, economic diversification and growth, this study employs the growth accounting framework as utilized in Odetola & Etumnu (2013) in which aggregate output is determined by the contributions of each sector and dimension of diversification of the economy. Specifically, to model the underlying dynamic interactions among the series the study, takes after the works of Akinlo (2012) and, adopts Vector Autoregression (VAR) modelling framework. This procedure is adopted against other possible methods for numerous reasons. First, no a priori assumption of exogeneity of variables is required (Akinlo, 2012). Second, it allows each variable in the system to impact not only on itself but also on other without the need for theoretical structures on the estimates. Further, besides data description and forecasting, the technique affords us the opportunity of knowing how a given variable impact on itself and also on others through the use of variance decomposition and impulse response functions.

In the econometric literature, there are different extensions of VAR model developed to capture the underlying statistical properties of the series under consideration: VAR model in the level data, VAR model in the first-differenced data, Vector Error Correction (VECM) and Toda-Yamamoto-Dolado-Lutkepohl-TYDL approach. This study employs TYDL approach (Toda & Yamamoto, 1995; Dolado & Lutkepohl, 1996). The paper considered the framework suitable for its empirical exercise because of the following reasons. One, the method is applicable irrespective of the integration and cointegration properties of the model. Two, it better controls the type 1 error probability. Moreover, aside the fact that the results are more intuitive to interpret, the Yamada and Toda (1998) simulation results reveal that it is the most stable method of all the procedures. The basic principles behind TYDL is to augment the correct VAR order p with the maximum likely order of integration of the series, $d_{\max}$, in the system (Hundie, 2014).

Further, although the main objective is to empirically ascertain the interactions among non-oil sectors (notably, agricultural and industrial sectors), economic diversification and growth, to strengthen the robustness of this analysis, the study found it desirable to include other sectors of the economy, namely: building & construction, wholesale & retail trade, and services. Besides, to retain simplicity, the industrial sector is further divided into solid-minerals, manufacturing, energy subsectors. Keeping the above theoretical arguments in view, an econometric representation of the augmented VAR model estimated is as follows:

$$\begin{bmatrix} \ln gdp_t \\ \ln agr_t \\ \ln som_t \\ \ln man_t \\ \ln eng_t \\ \ln buc_t \\ \ln war_t \\ \ln ser_t \\ ecd_t \end{bmatrix} = \begin{bmatrix} \alpha_0 \\ \beta_0 \\ \lambda_0 \\ \eta_0 \\ \sigma_0 \\ \rho_0 \\ \psi_0 \\ \theta_0 \\ \pi_0 \end{bmatrix} + \sum_{i=1}^{p} \begin{bmatrix} \alpha_{1i}\alpha_{3i}\alpha_{5i}\alpha_{7i}\alpha_{9i}\alpha_{11i}\alpha_{13i}\alpha_{15i}\alpha_{17i} \\ \beta_{1i}\beta_{3i}\beta_{5i}\beta_{7i}\beta_{9i}\beta_{11i}\beta_{13i}\beta_{15i}\beta_{17i} \\ \lambda_{1i}\lambda_{3i}\lambda_{5i}\lambda_{7i}\lambda_{9i}\lambda_{11i}\lambda_{13i}\lambda_{15i}\lambda_{17i} \\ \eta_{1i}\eta_{3i}\eta_{5i}\eta_{7i}\eta_{9i}\eta_{11i}\eta_{13i}\eta_{15i}\eta_{17i} \\ \sigma_{1i}\sigma_{3i}\sigma_{5i}\sigma_{7i}\sigma_{9i}\sigma_{11i}\sigma_{13i}\sigma_{15i}\sigma_{17i} \\ \rho_{1i}\rho_{3i}\rho_{5i}\rho_{7i}\rho_{9i}\rho_{11i}\rho_{13i}\rho_{15i}\rho_{17i} \\ \psi_{1i}\psi_{3i}\psi_{5i}\psi_{7i}\psi_{9i}\psi_{11i}\psi_{13i}\psi_{15i}\psi_{17i} \\ \theta_{1i}\theta_{3i}\theta_{5i}\theta_{7i}\theta_{9i}\theta_{11i}\theta_{13i}\theta_{15i}\theta_{17i} \\ \pi_{1i}\pi_{3i}\pi_{5i}\pi_{7i}\pi_{9i}\pi_{11i}\pi_{13i}\pi_{15i}\pi_{17i} \end{bmatrix} \begin{bmatrix} \ln gdp_{t-i} \\ \ln agr_{t-i} \\ \ln som_{t-i} \\ \ln man_{t-i} \\ \ln eng_{t-i} \\ \ln buc_{t-i} \\ \ln war_{t-i} \\ \ln ser_{t-i} \\ ecd_{t-i} \end{bmatrix} + \sum_{j=p+1}^{P+d_{max}} \begin{bmatrix} \alpha_{2j}\alpha_{4j}\alpha_{6j}\alpha_{8j}\alpha_{10j}\alpha_{12j}\alpha_{14j}\alpha_{16j}\alpha_{18j} \\ \beta_{2j}\beta_{4j}\beta_{6j}\beta_{8j}\beta_{10j}\beta_{12j}\beta_{14j}\beta_{16j}\beta_{18j} \\ \lambda_{2j}\lambda_{4j}\lambda_{6j}\lambda_{8j}\lambda_{10j}\lambda_{12j}\lambda_{14j}\lambda_{16j}\lambda_{18j} \\ \eta_{2j}\eta_{4j}\eta_{6j}\eta_{8j}\eta_{10j}\eta_{12j}\eta_{14j}\eta_{16j}\eta_{18j} \\ \sigma_{2j}\sigma_{4j}\sigma_{6j}\sigma_{8j}\sigma_{10j}\sigma_{12j}\sigma_{14j}\sigma_{16j}\sigma_{18j} \\ \rho_{2j}\rho_{4j}\rho_{6j}\rho_{8j}\rho_{10j}\rho_{12j}\rho_{14j}\rho_{16j}\rho_{18j} \\ \psi_{2j}\psi_{4j}\psi_{6j}\psi_{8j}\psi_{10j}\psi_{12j}\psi_{14j}\psi_{16j}\psi_{18j} \\ \theta_{2j}\theta_{4j}\theta_{6j}\theta_{8j}\theta_{10j}\theta_{12j}\theta_{14j}\theta_{16j}\theta_{18j} \\ \pi_{2j}\pi_{4j}\pi_{6j}\pi_{8j}\pi_{10j}\pi_{12j}\pi_{14j}\pi_{16j}\pi_{18j} \end{bmatrix} \begin{bmatrix} \ln gdp_{t-j} \\ \ln agr_{t-j} \\ \ln som_{t-j} \\ \ln man_{t-j} \\ \ln eng_{t-j} \\ \ln buc_{t-j} \\ \ln war_{t-j} \\ \ln ser_{t-j} \\ ecd_{t-j} \end{bmatrix} + \begin{bmatrix} u_{1t} \\ u_{2t} \\ u_{3t} \\ u_{4t} \\ u_{5t} \\ u_{6t} \\ u_{7t} \\ u_{8t} \\ u_{9t} \end{bmatrix} \quad (1)$$

where gdp_t is economic growth (proxied by real GDP); $agr_t, som_t, man_t, eng_t, buc_t, war_t, ser_t,$ are agricultural, solid-minerals, manufacturing, energy, building & construction, wholesale & retail trade, services sectors respectively; and ecd_t depicts the dimension of economic diversification (proxied by economic diversification index). All the variables (except diversification index) were transformed to their natural logarithm form to minimize the scale effect. Following the TYDL approach, the augmented VAR model was then estimated to ascertain the direction of causality among the series. The rejection of null hypotheses $\alpha_{3i} = 0$, $\alpha_{5i} = 0$, $\alpha_{7i} = 0$, $\alpha_{9i} = 0$, $\alpha_{11i} = 0$, $\alpha_{13i} = 0$, $\alpha_{15i} = 0$, and $\alpha_{17i} = 0$ implies that agricultural, solid-minerals, manufacturing, energy, building & construction, wholesale & retail trade, services sectors, and economic diversification respectively Granger-cause growth. Equally, the rejection of null hypotheses $\beta_{1i} = 0$, $\lambda_{1i} = 0$, $\eta_{1i} = 0$, $\sigma_{1i} = 0$, $\rho_{1i} = 0, \psi_{1i} = 0$, $\theta_{1i} = 0$, and $\pi_{1i} = 0$ indicates that Granger-causality runs from growth to agricultural, solid-minerals, manufacturing, energy, building & construction, wholesale & retail trade, services sectors, and economic diversification, respectively. Thus, suggesting bidirectional causality.

3.2. Data

Annual time-series secondary data of real GDP, GDP indices of all the sectors and economic diversification index were utilized in setting up the VAR model. The data were compiled from the publications of International Monetary Fund (IMF, 2020), Central Bank of Nigeria (CBN) Statistical Bulletin (2020), and World Development Indicators (WDI, 2020). The specific source, definitions and measures for each variable employed in the study are depicted in table 2. Re the specification of measure of dimension of economic diversification, numerous studies have used different variables as proxies for economic diversity. The key reason for this, aside the difference in conceptualizing economic diversification, has been the paucity of comprehensive and reliable data particularly for developing countries including Nigeria.

Usually, however, the conventional standard often used to measure the variable has largely been categorised into three distinct measures: employment-, export concentration-, and income- based measures (United Nations, 2016). For simplicity this

study, following Ajibola Isiaka, Nnoli, & Abimbola (2019), approximates it by means of measure of export concentration which is by far the most reliable and widely used measure in the literature. Moreover, several indices including the well-known Finger-Kreinin index (Finger & Kreinin, 1979) of export diversification, Normalized Herfindahl-Hirschman index of market concentration, Gini index of inequality, have been the most frequently used indices of export concentration.

In this study, however, the Theil index- measures of export diversification and product quality- developed by the IMF is incorporated as proxy for export concentration. This index is adopted against other possible indices for two reasons. One, the index comprises of two indices: extensive and intensive margins. As argued in Gylfason (2016), while the intensive margin relates to changes in diversification for a set of products that has been sold by a country over a period of time, the extensive margin relates to expanding exports to new products and new markets. Basically, unlike all other indices, it is designed to reflect diversity within as well as among sectors and groups (Gylfason, 2016). Two, it is a common measure of inequality, segregation, export diversification, product quality, and other forms of diversity. Vis-à-vis the specification of other variables, the study uses: real GDP, agricultural sector output, solid-minerals sector output, manufacturing sector output, energy sector output, building & construction sector output, wholesale & retail trade sector output, services sector output to measure growth, agricultural, solid-minerals, manufacturing, energy, building & construction, wholesale & retail trade, services sectors, respectively. While data on Theil index for 1962-2010 were compiled from IMF database, those of 1960-1961 and 2011-2019 were obtained using linear forecasting method.

Table 2: Variable definitions, Measures and Sources of Data

Variable	Description	Source of Data
Economic growth	Real GDP (constant 2010 US$)	World Development Indicators (2020)
Agricultural Sector	Agricultural Sector Output (₦' Billion)	Central Bank of Nigeria Statistical Bulletin (2020)
Solid Mineral Sector	Solid Mineral Sector Output (₦' Billion)	Central Bank of Nigeria Statistical Bulletin (2020)
Manufacturing Sector	Manufacturing Sector Output (₦' Billion)	Central Bank of Nigeria Statistical Bulletin (2020)
Energy Sector	Energy Sector Output (₦' Billion)	Central Bank of Nigeria Statistical Bulletin (2020)
Building & Construction Sector	Building & Construction Sector Output (₦' Billion)	Central Bank of Nigeria Statistical Bulletin (2020)
Wholesale & Retail Trade Sector	Wholesale & Retail Trade Sector Output (₦' Billion)	Central Bank of Nigeria Statistical Bulletin (2020)
Services Sector	Services Sector Output (₦' Billion)	Central Bank of Nigeria Statistical Bulletin (2020)
Economic Diversification	IMF Theil Index	International Monetary Fund (2020)

Source: Prepared by the author

4. Estimation Techniques and Empirical Results

4.1 Stationarity, Lag Length Selection and Bounds Test Results

As a first step, before detailed analysis of the augmented VAR model (1) was undertaken, to ascertain the stationary properties of the series employed, the study applied two types of formal tests: the Augmented Dickey-Fuller (Dickey & Fuller, 1979, 1981) and Phillips and Perron (Philips & Perron, 1988) tests. Both tests were conducted for two alternative specifications at 1%, 5% and 10% level of significance. It was tested with intercept but no trend, and then with both intercept and trend. Results of these tests are presented in tables 3 and 4 respectively. As can be observed, at 5% level of significance, all the variables (except energy sector which is stationary at level) are integrated of order one, (1).

Further, a vital element in the specification of VAR is the determination of the lag-length of the VAR (Ozcicek & Douglas Mcmillin, 1999). Braun & Mittnik (1993), Lutkepohl (1993) posited that variance decomposition and impulse response functions derived from the estimated VAR are inconsistent when the lag-length differs from the true-length. Thus, to select the suitable lag length, the VAR lag order selection criteria attributed to Akaike information criteria (AIC) and Final Prediction Error (FPE) criteria were considered. As can be seen from table 5, the optimal lag length p is two.

Moreover, as all the variables are stationary at first difference (except energy sector), a test of possible long-run cointegrating relationship among the series was performed using Autoregressive Distributed Lag model (ARDL) bounds testing technique. The paper considered the framework appropriate because the set of variables employed in the exercise is a mix of I(0) and I(1) series. Thus, following Pesaran, Shin, & Smith (2001) and Shahbaz & Rahman (2012), the ARDL model of order (a,b,c,d,e,f,g,h,j) estimated is specified as follows:

$$\Delta \ln gdp_t = \alpha_0 + \sum_{t=1}^{a} \alpha_{1i} \Delta \ln gdp_{t-i} + \sum_{t=0}^{b} \alpha_{2i} \Delta \ln agr_{t-i} + \sum_{t=0}^{c} \alpha_{3i} \Delta \ln som_{t-i} + \sum_{t=0}^{d} \alpha_{4i} \Delta \ln man_{t-i} +$$
$$\sum_{t=0}^{e} \alpha_{5i} \Delta \ln eng_{t-i} + \sum_{t=0}^{f} \alpha_{6i} \Delta \ln buc_{t-i} + \sum_{t=0}^{g} \alpha_{7i} \Delta \ln war_{t-i} + \sum_{t=0}^{h} \alpha_{8i} \Delta \ln ser_{t-i} + \sum_{t=0}^{j} \alpha_{9i} \Delta ecd_{t-i} + \quad (2)$$
$$\delta_1 (\ln gdp_{t-1}) + \delta_2 (\ln agr_{t-1}) + \delta_3 (\ln som_{t-1}) + \delta_4 (\ln man_{t-1}) + \delta_5 (\ln eng_{t-1}) + \delta_6 (\ln buc_{t-1}) + \delta_7 (\ln war_{t-1}) +$$
$$\delta_8 (\ln ser_{t-1}) + \delta_9 (ecd_{t-1}) + \varepsilon_t$$

where Δ depicts the first difference operator, α_0 is the drift component, and, ε_t is white noise residual. The $\delta' s$ depict to the long run effects whereas $\alpha' s$ capture the short-run dynamics of the model. Having estimated the ARDL model, to find out the existence of cointegration, the study tested the null hypothesis of no cointegration $\left(H_0 : \alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = \alpha_6 = \alpha_7 = \alpha_8 = \alpha_9 = 0\right)$ against the alternative hypothesis $\left(H_0 : \alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq \alpha_5 \neq \alpha_6 \neq \alpha_7 \neq \alpha_8 \neq \alpha_9 \neq 0\right)$. The Wald test based on the standard *F*-statistic was computed to establish the co-integration

relationship among the variables. As evidenced in the results presented in table 6, at 5% percent level of significance, the study rejects the null hypothesis of no long-run cointegration among the examined variables.

Table 3: Result for the Augmented Dickey-Fuller Root Test

ADF Test (With Intercept only)

Variable	Level						First Diff					
	Test Statistic	Critical Values			P-Values	Remarks	Test Statistic	Critical Values			P-Values	Remarks
		1%	5%	10%				1%	5%	10%		
lngdp	-0.502548	-3.548208	-2.912631	-2.594027	0.8828	NS	-4.81219	-3.548208	-2.912631	-2.594027	0.0002	I(1)
lnagr	-0.918889	-3.546099	-2.91173	-2.593551	0.7755	NS	-7.194187	-3.548208	-2.912631	-2.594027	0.0000	I(1)
lnsom	-1.477623	-3.546099	-2.91173	-2.593551	0.5380	NS	-5.972771	-3.548208	-2.912631	-2.594027	0.0000	I(1)
lnman	-1.880974	-3.546099	-2.91173	-2.593551	0.3389	NS	-6.281435	-3.548208	-2.912631	-2.594027	0.0000	I(1)
lneng	-3.325030	-3.546099	-2.91173	-2.593551	0.0189	I(0)	***	***	***	***	***	I(0)
lnbuc	-1.484410	-3.546099	-2.91173	-2.593551	0.5346	NS	-6.586848	-3.548208	-2.912631	-2.594027	0.0000	I(1)
lnwar	-1.191194	-3.546099	-2.91173	-2.593551	0.6727	NS	-6.310110	-3.548208	-2.912631	-2.594027	0.0000	I(1)
lnser	-1.274218	-3.546099	-2.91173	-2.593551	0.6359	NS	-6.987580	-3.548208	-2.912631	-2.594027	0.0000	I(1)
ecd	-2.513715	-3.546099	-2.91173	-2.593551	0.1174	NS	-6.12114	-3.548208	-2.912631	-2.594027	0.0000	I(1)

ADF Test (With Trend and Intercept)

Variable	Level						First Diff					
	Test Statistic	Critical Values			P-Values	Remarks	Test Statistic	Critical Values			P-Values	Remarks
		1%	5%	10%				1%	5%	10%		
lngdp	-2.117401	-4.124265	-3.489228	-3.173114	0.5253	NS	-4.770852	-4.124265	-3.489228	-3.173114	0.0015	I(1)
lnagr	-1.711716	-4.121303	-3.487845	-3.172314	0.7337	NS	-7.163090	-4.124265	-3.489228	-3.173114	0.0000	I(1)
lnsom	-1.559253	-4.121303	-3.487845	-3.172314	0.7971	NS	-5.986942	-4.124265	-3.489228	-3.173114	0.0000	I(1)
lnman	-1.081500	-4.121303	-3.487845	-3.172314	0.9234	NS	-6.470735	-4.124265	-3.489228	-3.173114	0.0000	I(1)
lneng	-8.272251	-4.124265	-3.489228	-3.173114	0.0000	I(0)	***	***	***	***	***	I(0)
lnbuc	-1.393536	-4.121303	-3.487845	-3.172314	0.8528	NS	-6.649317	-4.124265	-3.489228	-3.173114	0.0000	I(1)
lnwar	-1.386265	-4.121303	-3.487845	-3.172314	0.8550	NS	-6.328153	-4.124265	-3.489228	-3.173114	0.0000	I(1)
lnser	-1.455065	-4.121303	-3.487845	-3.172314	0.8338	NS	-7.038727	-4.124265	-3.489228	-3.173114	0.0000	I(1)
ecd	-1.297203	-4.121303	-3.487845	-3.172314	0.8790	NS	-6.625944	-4.124265	-3.489228	-3.173114	0.0000	I(1)

Note: NS denotes Not Stationary at level

*** depicts Not Applicable

Source: Author's Computation using E-view 10 (2020)

Table 4: Result for the Phillips-Perron Unit Root Test

PP Test (With Intercept only)

Variable	Level						First Diff					
	Test Statistic	Critical Values			P-Values	Remarks	Test Statistic	Critical Values			P-Values	Remarks
		1%	5%	10%				1%	5%	10%		
lngdp	-0.151871	-3.546099	-2.91173	-2.593551	0.9382	NS	-4.826627	-3.548208	-2.912631	-2.594027	0.0002	I(1)
lnagr	-0.901019	-3.546099	-2.91173	-2.593551	0.7812	NS	-7.208485	-3.548208	-2.912631	-2.594027	0.0000	I(1)
lnsom	-1.478604	-3.546099	-2.91173	-2.593551	0.5375	NS	-5.969717	-3.548208	-2.912631	-2.594027	0.0000	I(1)
lnman	-1.832516	-3.546099	-2.91173	-2.593551	0.3615	NS	-6.221974	-3.548208	-2.912631	-2.594027	0.0000	I(1)
lneng	-5.048101	-3.546099	-2.91173	-2.593551	0.0001	I(0)	***	***	***	***	***	I(0)
lnbuc	-1.451359	-3.546099	-2.91173	-2.593551	0.5510	NS	-6.582114	-3.548208	-2.912631	-2.594027	0.0000	I(1)
lnwar	-1.198126	-3.546099	-2.91173	-2.593551	0.6698	NS	-6.217051	-3.548208	-2.912631	-2.594027	0.0000	I(1)
lnser	-1.344664	-3.546099	-2.91173	-2.593551	0.6030	NS	-6.965727	-3.548208	-2.912631	-2.594027	0.0000	I(1)
ecd	-2.379144	-3.546099	-2.91173	-2.593551	0.1519	NS	-6.151473	-3.548208	-2.912631	-2.594027	0.0000	I(1)

PP Test (With Trend and Intercept)

Variable	Level						First Diff					
	Test Statistic	Critical Values			P-Values	Remarks	Test Statistic	Critical Values			P-Values	Remarks
		1%	5%	10%				1%	5%	10%		
lngdp	-1.648166	-4.121303	-3.487845	-3.172314	0.7614	NS	-4.742693	-4.124265	-3.489228	-3.173114	0.0017	I(1)
lnagr	-1.697408	-4.121303	-3.487845	-3.172314	0.7401	NS	-7.213333	-4.124265	-3.489228	-3.173114	0.0000	I(1)
lnsom	-1.783729	-4.121303	-3.487845	-3.172314	0.7001	NS	-5.986942	-4.124265	-3.489228	-3.173114	0.0000	I(1)
lnman	-1.154230	-4.121303	-3.487845	-3.172314	0.9104	NS	-6.411620	-4.124265	-3.489228	-3.173114	0.0000	I(1)
lneng	-17.01157	-4.124265	-3.489228	-3.173114	0.0000	I(0)	***	***	***	***	***	I(0)
lnbuc	-1.531144	-4.121303	-3.487845	-3.172314	0.8075	NS	-6.644382	-4.124265	-3.489228	-3.173114	0.0000	I(1)
lnwar	-1.500161	-4.121303	-3.487845	-3.172314	0.8186	NS	-6.223971	-4.124265	-3.489228	-3.173114	0.0000	I(1)
lnser	-1.338564	-4.121303	-3.487845	-3.172314	0.8683	NS	-7.112338	-4.124265	-3.489228	-3.173114	0.0000	I(1)
ecd	-1.361249	-4.121303	-3.487845	-3.172314	0.8621	NS	-6.625944	-4.124265	-3.489228	-3.173114	0.0000	I(1)

Note: NS denotes Not Stationary at level

*** depicts Not Applicable

Source: Author's Computation using E-view 10 (2020)

Table 5: VAR Lag Order Selection Criteria Results for Models 1 & 2

LAG	LR	FPE	AIC	SC	HQ
0	NA	1.06E-14	-6.635674	-6.31595	-6.511135
1	849.2192	3.71E-21	-21.53464	-18.33740*	-20.28925
2	195.7729*	4.86e-22*	-23.76135*	-17.6866	-21.39511*

* 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: Author's Computation using E-view 10 (2020)

Table 6: Bounds Test Result for Models 1 & 2

Significance	Critical Values		F Statistics
	Lower Bond	Upper Bond	
10%	1.85	2.85	***7.544007***
5%	2.11	3.15	
2.5%	2.33	3.42	
1%	2.62	3.77	

Source: Author's Computation using E-view 10 (2020)

4.2 Causal Relationship among Non-Oil Sectors, Economic Diversification and Growth

As noted in the literature, the existence of cointegrating relationship between two or more time-series variables suggests that the variables are causally related at least in one direction (Engle & Granger, 1987; Tang, 2009). To obtain information on the direction of causal relationship among the series, a $p + d_{\max}\,(\text{i.e. } 2+1)$ lagged expanded VAR model (1) was estimated. Before the results were utilized for Granger-causality and related tests, a number of diagnostic tests were conducted to verify the adequacy of the model. First, in testing the stability conditions of the model, the study employed the graphical root characteristic polynomial. The results of this technique indicated that all the roots of the characteristic polynomial for the model were inside the unit circle signifying that the defined VAR model was stable as depicted in figure 1. Next, the VAR residual serial correlation Lagrangean Multiplier (LM) test was utilized to check the serial correlation problem. This was followed by Jarque-Bera (JB) test to check normality. After, White's heteroskedasticity test with no cross terms for observing the variance constancy of the residuals was applied. The results reveal that the model passed all diagnostic tests. However, to conserve space the results are not presented here, but are available upon request.

Given the appropriateness and stability of the model, the study proceeded to ascertain whether there is causality or not by applying modified Wald test (MWALD test) statistic to the first pth order of the VAR (i.e. the coefficients of the last lagged $d_{\max}$ vector are ignored). Results of the Granger-causality tests (chi-square X^2-test statistic obtained together with estimated *p*-values) are depicted in table 7. As revealed in the table, no

evidence of causality was found between growth to building & construction sector $[gdp \neq buc]$. Moreover, a bidirectional causality was found between economic growth and agricultural sector $[gdp \Leftrightarrow agr]$, growth and manufacturing sector $[gdp \Leftrightarrow man]$, growth and energy sector $[gdp \Leftrightarrow eng]$, growth and wholesale & retail trade sector $[gdp \Leftrightarrow war]$. Further, as can be seen from the table, there is evidence of unidirectional causality running from solid-minerals sector to growth $[som \Rightarrow gdp]$, services sector to growth $[ser \Rightarrow gdp]$, growth to diversification $[gdp \Rightarrow ecd]$. In line with the objective of the study, an insight from these findings obviously suggests that while an extension of economic activities into primary-/resource-based sectors as plausible options for diversifying the economy is good for growth, no doubt; however, an increase in the value of extant and new products by shifting from primary to secondary/tertiary sectors is of particular importance for RRDCs like Nigeria.

4.3 Innovation Accounting Techniques.

Recent studies have pointed out the drawbacks inherent in Granger-causality tests especially for policy purposes (Rahman & Shahbaz, 2013; Grbić, 2020). One, apart from showing the causal direction among variables (Onafowara, Owoye, & Huart, 2011), Granger-causality tests do not provide information on the time paths of the variables beyond the selected sample period and their responses to shocks from other variables in the system (Onafowara et al., 2011). Two, causality results can be interpreted as within-sample tests that may provide little information on the dynamic interdependence of the system and the nature of the causal effects (Onafowara et al., 2011; Grbić, 2020). To overcome these drawbacks, impulse response functions (IRF hereafter) and variance decomposition (VDC hereafter) were simulated. Given the focus of the study, to retain brevity, progressing from the analysis of Granger-causality discussed, within a 10-year forecasting horizon, the results of IRF and VDC of growth are presented in figure 2 and table 8.

4.3.1 Impulse Response Function of Economic Growth

Beginning with the response of economic growth to innovation occasioned by its own shock, the response was positive in first-year, though declining gradually but still positive in second-year. Afterwards, fluctuates at the negative level from year three to eight, but levels out thereafter to maintain a steady positive response. Regarding the response growth to agricultural sector, a one standard innovation shock to the sector did not have an immediate impact on growth in first- and second-year period. It became negative from year three to six. However, this negative effect was reversed from seventh year and thereafter continue to increase. Likewise, as can be seen from the figure, a one standard deviation shock to solid-minerals sector did not produce any effect on growth in first-year. It became negative from year two to seven. This negative effect was reversed from eighth year and afterwards continue to increase. Equally, a one standard innovation

shock to manufacturing sector did not have an immediate effect on economic growth in first-year. Hereafter, growth maintained a positive response to shock in manufacturing sector. Also, on economic growth response to a shock in energy sector, like shocks discussed earlier, a one standard innovation shock to sector did not have an immediate impact on growth until after year one. It fell slightly from year three but stabilized thereafter approaching zero in year ten.

With respect to the objective of the study, the implications of the above findings clearly suggest that the responses of growth to shocks in agricultural, solid-minerals, manufacturing and energy sectors do appear to be very sensitive. The shocks appear to have short- (but negative, other than manufacturing with positive), medium- and long-run positive impacts on growth. These findings are line with the results from Granger-causality tests where causality was found between these sectors and growth. As for the response growth to a shock in building & construction sector, the first notable impact on growth occurred after year one and results in decrease in real GDP. However, it was reversed from year two to three after the shock, as there was substantial increase in growth, but thereafter became negative and diminish for the rest of the period. This finding is consistent with the result of Granger-causality tests where no causality was found. Vis-à-vis the response of growth to innovation in wholesale & retail trade sector, a shock in the sector only impacts growth after year one. It became negative from year two to three. Nevertheless, this negative impact was reversed from year four and thereafter continue to increase till year eight. After this, it assumed negative values through the remaining time horizons suggesting that innovation to the sector would have only a short-run positive effect on growth. Concerning the response of growth to shock in services sector, as evinced in the figure, a one-unit shock to the sector did not have an immediate impact on growth in year one. It became negative from year three to six. Afterwards, stabilized and maintained a positive response all through the remaining time horizons.

Finally, as regards the response of growth to shock occasioned by Theil index, a one standard deviation disturbance originating from the index did not have an immediate impact on growth in year one. Afterward, growth maintained a positive response to shock in the index. These results further reinforced the fact that the findings in the preceding sections are of policy significance. In effect, the implications of the findings, in light of the objective of the study, evidently suggest that an expansion of economic activities into primary/resource-based sectors is a necessary condition for diversification as it provides opportunity for the economy to grow more quickly by lessening dependence on a few sectors and neutralizing the volatility of global commodities prices; however, it is not a sufficient condition, as the dimension of diversification also matters and is of particular importance not only for the country's current but also for the future level of growth. This result is consistent with Prebisch-Singer's (1950) hypothesis and the findings of Lugeiyamu, (2016) and Munir & Javed (2018).

4.3.2 Variance Decomposition of Economic Growth

The VDC analysis results depicted in table 8 reveals that all the variations experienced by real GDP were due to its own shocks in the first period. This suggests that

variation in growth is hardly affected by other variables in the first period. However, in subsequent years, the situation is quite different as innovations in agricultural, solid-minerals, manufacturing, energy, services sectors and Theil index contributions as sources of VDC of real GDP rose from 1.13 to 31.95, 4.78 to 8.74, 1.75 to 10.09, 0.27 to 3.09, 0.27 to 9.93 and 2.28 to 5.00 percent from period two to period ten, respectively. The percentage that was attributable to shocks in building & construction sector was shown to be very close to wholesale & retail trade sector ranging from 0.73 to 1.10 and 0.89 to 2.32 percent respectively. Basically, in line with the objective of the study, after 10-year forecast horizon, variations in growth was explained by approximately 32% changes in agricultural sector, 22% changes in industrial sector, 9% changes in the dimension of economic diversification, 5% changes in services sector, 2% changes in wholesale & retail trade and 1% change in building & construction sector. These findings further corroborate the TYDL Granger-causality test results and IRF analysis obtained in the preceding sections.

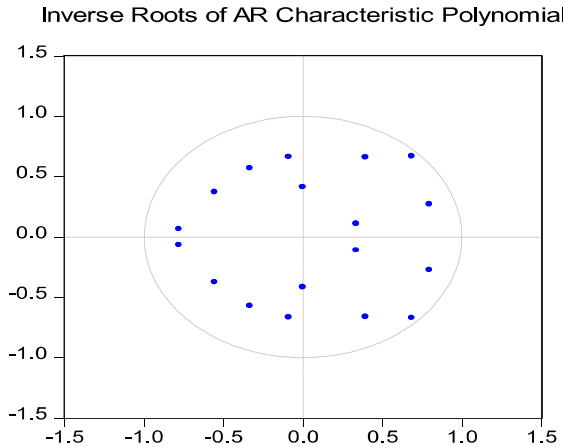


Figure 1: Inverse Roots of AR Characteristic Polynomial of the VAR Model

Table 7: Results of TYDL Granger Causality Tests

Dependent Variables \ Source of Causation	lngdp	lnagr	lnsom	lnman	lneng	lnbuc	lnwar	lnser	ecd
lngdp	****	(6.245715)* {0.0040}	(8.794307)* {0.0123}	(5.557152)* {0.0021}	(6.917742)* {0.0315}	(1.916319) {0.3836}	(4.884765)* {0.0080}	(10.76393)* {0.0046}	(5.543747) {0.2500}
lnagr	(7.977391)* {0.0185}	****	(2.074588) {0.3544}	(13.88158)* {0.0010}	(4.890330)* {0.0067}	(1.443893) {0.4858}	(6.890473)* {0.0319}	(2.226471) {0.3285}	(7.768773)* {0.0206}
lnsom	(3.187024) {0.2032}	(5.501957) {0.0639}	****	(12.94516)* {0.0015}	(6.607747)* {0.0127}	(2.447714) {0.2941}	(5.083065) {0.0787}	(5.607992) {0.7196}	(5.759787)* {0.0061}
lnman	(7.978137)* {0.0185}	(8.373287)* {0.0152}	(5.842422)* {0.0039}	****	0.316881* {0.0035}	(0.044687) {0.9779}	(12.05622)* {0.0024}	(2.376740) {0.3047}	(2.857903)* {0.0096}
lneng	(32.43574)* {0.0000}	(0.766454) {0.6817}	(0.224455) {0.8938}	(23.77598)* {0.0000}	****	(4.759785) {0.0926}	(12.49780)* {0.0019}	(18.33632)* {0.0001}	(17.51281)* {0.0002}
lnbuc	(7.770373) {0.2005}	(4.413893)* {0.0004}	(2.198339) {0.3111}	(14.15639)* {0.0008}	(0.031822) {0.9842}	****	(5.092532)* {0.0084}	(1.049959) {0.9278}	(2.479932)* {0.0094}
lnwar	(3.692331)* {0.0078}	(4.912315) {0.0858}	(1.383320) {0.5007}	(15.49561)* {0.0004}	(6.193543)* {0.0452}	(8.033433) {0.0.6592}	****	(6.701080) {0.6835}	(6.890473)* {0.0319}
lnser	(4.584958) {0.1010}	(3.676702)* {0.0091}	(1.102138) {0.5763}	(14.21784)* {0.0008}	(1.995599)* {0.0087}	(1.273851) {0.5289}	(4.423201) {0.1095}	****	(2.799417) {0.2467}
ecd	(9.777522)* {0.0075}	(3.457831)* {0.0050}	(11.39100)* {0.0058}	(2.191466)* {0.0043}	(10.43636)* {0.0057}	(0.062007) {0.9695}	(5.811999)* {0.0061}	(6.118488)* {0.0469}	****

Note: The Chi-Square $\chi 2$ and probability values are enclosed in parenthesis () and {} respectively, while * denotes significance at 5%
**** depict Not Applicable

Source: Author's Computation using E-view 10 (2020)

Table 8: Variance Decomposition of Economic Growth (LNGDP)

Period	S.E.	LNGDP	LNAGR	LNSOM	LNMAN	LNBUC	LNWAR	LNSER	LNENG	ECD
1	0.049088	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.094342	88.60156	1.130219	4.785194	1.753450	0.003488	0.891039	2.289660	0.271586	0.273801
3	0.134890	78.29273	3.418181	4.544520	1.322528	0.016185	1.165459	4.778642	2.763606	3.698154
4	0.165346	66.09890	8.042923	7.231706	3.438031	0.730073	0.837332	3.748174	3.767900	6.104959
5	0.188783	53.38510	14.14830	10.53510	6.317448	1.333620	0.713516	2.999062	4.675363	5.892490
6	0.211062	42.71242	21.52291	12.96375	8.659851	1.535360	0.701094	2.402134	4.771474	4.731003
7	0.234966	34.86831	27.89732	12.52878	10.33858	1.241797	1.379456	2.139551	4.238661	5.367554
8	0.258820	29.56269	31.28531	11.07899	10.98585	1.191419	2.257174	2.412922	3.503945	7.721700
9	0.278188	27.04057	32.67845	9.729218	10.86188	1.224960	2.482745	3.252949	3.122100	9.607130
10	0.293488	27.74752	31.95251	8.742144	10.09007	1.107145	2.321240	5.002822	3.096924	9.939629

Cholesky Ordering: LNGDP LNAGR LNSOM LNMAN LNBUC LNWAR LNSER LNENG ECD
Source: Author's Computation using E-view 10 (2020)

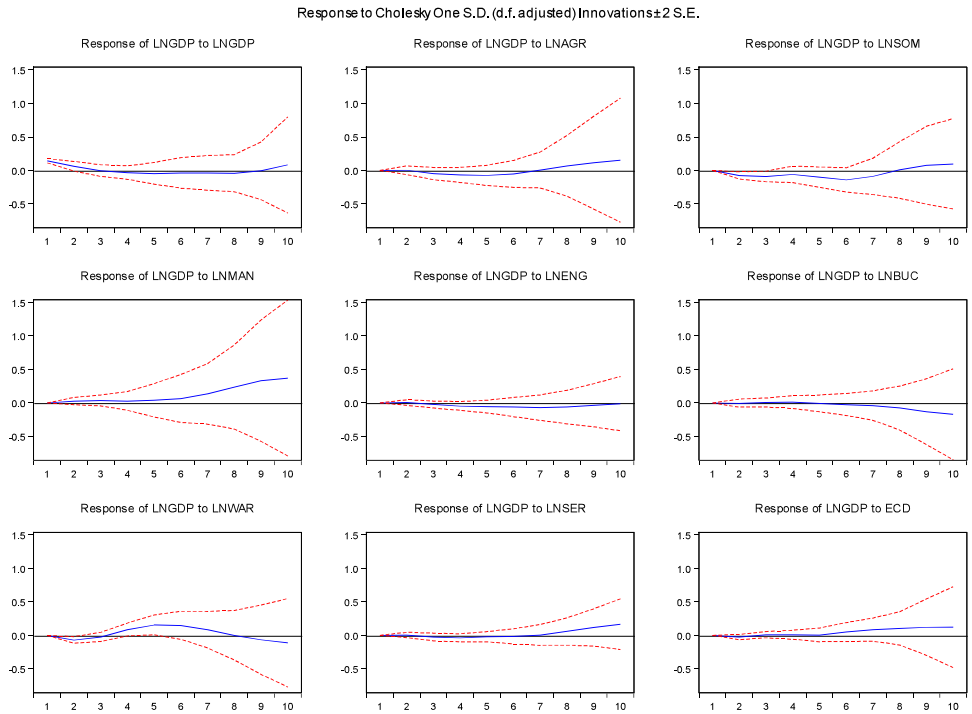


Figure 2: Impulse Response Function of Economic Growth

5. Conclusion and Managerial implications

The study examines the interactions among non-oil sectors, economic diversification and growth in Nigeria in a multivariate VAR model over the period 1960-2019. ARDL approach to cointegration, TYDL procedure to Granger-causality and Innovation Accounting Techniques were applied. Empirical results reveal that while an extension of economic activities into resource-based sectors is a requisite condition for diversification; however, it is not a sufficient condition as the dimension of the diversification matters. In line with the findings, several wide-ranging managerial implications are deduced. One, to lessen the economy's vulnerability to macroeconomic risks, there is the need for policy makers to develop the nation's vast resources, particularly, in the agricultural and industrial sectors where the potentials remain great but largely unexploited. Thus, extant policies and initiatives should be reviewed and strengthened to facilitate rapid expansion of non-oil sectors. Two, in the coming decades,

for non-oil sectors to become a major player in Nigerian economy with value addition and value-chain, targeted efforts should be directed towards industrialization.

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