Agriculture and intersectoral linkages and their contribution to Nigerian economic growth

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Abstract: This study investigates the contributions of the agricultural sector to Nigeria's economy by estimating a macroeconometric model which is a system of simultaneous equations that seeks to explain the behaviour of key economic variables at the aggregate level, based on the received theories of economics. Within the context of the inter-linkages of the various sectors of the real economy, the estimates incorporate the linkages among agriculture, manufacturing, oil and gas and the service sectors, especially how the affect of the other sectors influence the growth of agriculture. The findings is that inter sectoral relationships are complicated and multi-directional. The spill-over effects and externalities generated by the interactions and linkages between the different sectors attest to the dynamic nature of the economy. Also, the economic role of the agricultural sector is a one-way path as the flow of capital is mainly towards the industrial, oil and gas and the tertiary services sectors. This study establishes that sectoral linkages are not always beneficial especially between agriculture and the oil sector and recommends the modernization of the industrial and services sectors in order to generate increase in local content value addition to agriculture.

Keywords: Agriculture, Intersectoral Linkage, Economic Growth, Macroeconometric Model

1. Introduction

The Neoclassical Theory postulated by [1] and [2] has the basic assumptions of closed economy with competitive markets, identical rational individuals and a production technology that exhibits diminishing returns to capital and labour separately and constant returns to both inputs jointly. Reference [3] suggests that the structural change is not an important side effect of the economic development. On the other hand, new growth economists [4] and [5] posit that the changes in an economy's sectoral composition is a critical determinant of growth.

In developing the theory of development, [6] and [7] employ the classification of countries into developed and less developed status on the basis of the distinction between primary, secondary and tertiary productions. The rationale being that when the basic necessities of life are met, a primary commodity producing nation graduates to secondary activities (manufacturing). When the demand for industrial goods becomes saturated, resources are move into tertiary activities with a higher income elasticity of demand. A country in the classification of [8], becomes economically developed when the productivity of the agricultural sector approximately matches those of the industrial and service sectors.

Developing countries are beset with the malaise of varying degrees including high proportion of consumption relative to savings and investment, population growth, chronic unemployment and underemployment. These are in addition to the predicament of low levels of GDP per capita and productivity, large income inequalities, dependence on primordial agricultural practices, backward industrial and technological structure, and economic dualism [9]. Given the afore stated symptoms, Nigeria qualifies as a developing country. Indeed, the size of her economy marked by the Gross National Income per capita is put by the [10] at $1,190. In 2011, [11] reports that the economy suffers from stagflation. In addition, the structure of the economy makes it vulnerable to external shocks.

Nigeria is overly dependent on revenue from crude oil export. Reference [12] reports that oil accounts for over 95 per cent of export earnings and about 40 per cent of government revenues. The country is trou bled by the 'Resource curse' or 'Dutch disease' which is the co-existence of vast wealth in natural resources and extreme personal poverty leading to unbalanced growth [13].

Agriculture has been sidelined with the discovery and export of crude oil in Nigeria. The country is, however, largely agrarian with agriculture accounting for 40 percent of the *GDP* as of 2011. Other sectoral contributions as reported by [14] were services (30 percent), manufacturing (15 percent) and oil (14 percent). Unbalanced growth scenario is therefore, manifest.

The panacea recommended for promoting economic development and amelioration the afflictions of unbalanced growth by [15], [16], is the use of backward and forward linkages. As opined by [15], the sectors with the highest linkages are most likely to stimulate rapid growth of production, income, and employment. An in-depth understanding of inter-sectoral dynamics is crucial for economic development. It is therefore essential to study inter-linkages among the constituent sectors of Nigeria's economy so that the positive growth pulsation emerging among the sectors could be identified and cultivated in order to sustain the growth momentum.

Several studies have made useful contributions to understanding the links between different sectors in the economy and economic growth. The methodology applied include input-output relationships [17], [18] and [19], export-based sectoral relatedness [20], Vector Error Correction Model [21], Social Accounting Matrix [22] and Macroeconomic Simulation [23]. The significant gap in the literature is the need to capture the spill-over effects and externalities generated by these sectors in their interactions which this study attempts to bridge since the omission of the sectoral multiplier effects may lead to biased and inefficient results [24]. The main contribution of this paper is the development of a macroeconometric model to remove such biases.

The working hypothesis is that the output of manufacturing, oil and services sectors significantly impact the agricultural sector in Nigeria. The second supposition is that investment on agriculture, given its linkages with the other sectors has significant impact on economic growth in Nigeria. The first hypothesis tests the inter-sectoral causal relationship between agriculture and the other sectors of interest. The second objective is concerned about the nature of impact of the agricultural sector on the macro economy. The third objective is to determine the mechanisms, through which the impact of agriculture is transmitted to economic growth.

The remaining part of the paper is organized as follows: Section 2 reviews the relevant literature and the theoretical underpinning the study. In section 3, the data and methodology employed are presented. Section 4 covers the findings and analysis of the results and section 5 provides the concluding aspects of the study.

2. Theoretical Framework and Literature Review

2.1. Theoretical Underpinning

The literature on the interaction between agriculture and economic growth has commanded considerable attention and interest. The Reference [25] provides one of the pioneering theoretical pedestals on interaction between agriculture and the industrial sectors of the economy. The model which is applicable to developing countries manifests economic duality where both the technically advanced and primitive sector exist. In the dual economy, advanced technology is applied for industrial production and to extract minerals resources while at the same time, significant sections of the country operate at subsistence level [26].The dual economic theory suggests that agriculture plays an important role at the early stages in development by providing important resource as inputs to the industrial sector. Since the wage rate in the agricultural sector are likely to be less than that of the industry, resources are transferred from the sector to the manufacturing sector. Furthermore, the industrial value marginal product of labour (VMPL) which is higher than what obtains in the agricultural sector propels the rural agricultural workers to migrate to urban areas where manufacturing sectors are concentrated. This exacerbates the economic gulf.

The Neo-Classical economic theory suggests that increases in income will lead to increased demand for normal goods; the magnitude of which depends largely on the income elasticities of goods as a result of shift in demand. The income elasticities are smaller for agricultural products than manufactured goods because the creation of primary products directly depends upon uncertain natural climatic conditions. Inadequate rainfall for example, may lead to low agricultural yield and consequential price increase. However, the production of manufactured goods which depend on more assured machinery output engender greater production availability and therefore, prices. Where a greater share of additional income is spent on manufactured goods, the industrial sector will grow faster than the agricultural sector leading to further dichotomy necessitating structural adjustment in the economy. The spill-over effects of such structural transformation arising from increased income is expected to rub off on the agricultural sector thereby ensuring positive linkage between the two sectors.

On the basis of the law of comparative advantage however, a deleterious link between industrialization and agricultural productivity emerges when the manufacturing sector competes with the latter for scarce labour. Under the perfect competition, marginal manufacturing firms are attracted to the market thereby increasing the demands for land, labor and capital. This may lead to transfer of resources away from the less marginally profitable agricultural sector. In order to reverse the harmful impact,

the productivity of the agricultural sector is increased through better yielding seedlings, improved technology, labour skills among others.

The income elasticities for service are greater than those for food and manufacturing goods as the economy enters into a higher level of development [27]. The value marginal product of labour which could be enhanced in the agricultural sector in reaction to the invasion of the industrial sector cannot be replicated at the same level in the service sector. This is as a result of the greater proportion of human intervention required in most of the service sector jobs. Therefore, productivity of labour cannot grow at the same speed as those of the agricultural and manufacturing sectors. This accounts for the continuous labour growth in the service sector while the employment in other sectors slows as a result of technological progress.

Similar to the manufacturing sector, the impact of the service sector could be damaging to the growth in the agricultural sector due to changes in productivity and differences in income elasticities. It can be inferred from the leading sector / political revolution thesis propounded by [28] that service sector has replaced the manufacturing sector as the leading sector in most industrial economies. Consequently, as the economy grows, the ever increasing demand for service jobs will attract more and more resources from the manufacturing and agricultural sectors. This could create a negative linkage to the other sectors.

The alternative contention is that the growth in the service sectors (banking, telecommunication and transport, for instance) could allow other sectors to take advantage of the benefits of economies of scale and make positive linkages to rest of the economy. Unlike the agricultural and manufacturing jobs, most of the service jobs cannot be fully substituted by machines, and therefore, the need for quality service personnel will continually increase, further reinforcing positive externalities to the rest of the economy.

The extent of the international openness of economies, as explicated by [29] accounts for the mixed linkage-effects between agriculture and industrialisation. An economy endowed with rich arable land would *ceteris paribus* generate high productivity and output in the agricultural sector. Combined with favourable terms of trade, the world market influences the prices in an open economy without offsetting the changes in relative prices and squeezing out manufacturing output. The reliance on importation of agricultural products, in an open economy on the other hand, may in the absence of arable land, stifle agriculture.

The linkage impact between the oil and gas industry and agriculture can also be mixed. The exploration and exploitation of oil and gas have led to deleterious effect on agriculture as a result of serious damages to the eco-system. Oil spills have culminated into damaged farm lands and polluted waters, making fishing and other aquatic professions inoperable. The Niger Delta area of the Nigerian federation is a veritable case [30]. On the other hand, petroleum derivatives including non-organic fertilizers are critical to and have proved beneficial to agro-

business. Reference [31] report that strong linkages between manufacturing and the oil and gas sector enhance the growth of industrial firms through improved technology, managerial capabilities and production efficiency. The foreign oil firms also benefit from domestic outsourcing which improves their flexibility, cut costs, and improves operational efficiency.

From the discussions so far, the linkages between the different sectors is complicated and multi-directional. The equilibrium is attained when the value of marginal product of resources is equalized among the sectors. At this higher equilibrium level, the average wage rates and the productivity of resources will be increased across the sectors. The technological changes will lead to higher profits in the short run with the consumers also enjoying lower prices in the long run. The consequential economy will record higher growth rate [27].

2.2. Empirical Review

The macroeconomic linkage between the agricultural and industrial sectors has been widely investigated in the development literature [25] and [32]. Reference [33] establishes a symbiotic relationship between the agricultural sector and the industry wherein the former provides both the resource input and the requisite market for industrial outputs. Beyond the manufacturing sector where processing, mechanizing and storage activities are carried out, [34] highlights the contributions of agriculture in engendering the development of the service sector by providing the impetus for specializations in distribution, transporting and financing practices. The consequential import of these backward and forward linkages activities is the creation and development of entrepreneurship in the form of suppliers, processors, distribution middlemen importers, exporters, merchandisers, advertisers and finance experts among others. [35] contends that the engine of Nigeria's economic growth can be fired by improved investment in agricultural sector.

The use of the input-output framework is common in the literature. One of the early empirical study of the sectoral inter-linkages in Nigeria by [19] utilised an input/output model of the Nigerian economy in 1970. Their findings show that low level of inter-sectoral linkages exists because of high direct consumer oriented nature and the high import content of locally produced and traded goods. Reference [36] applied this technique in the study of inter-sectoral connectivity in Israel and came to similar conclusions.

In Africa, the research by [37] reviewed the relationship subsisting among manufacturing, agriculture and service sectors in Cote d'Ivoire, Ghana and Zimbabwe utilizing cointegration technique and found empirical evidence of inter-linkages externalities / spillovers amongst the sectors in the long-run. The long run positive relationship between agricultural growth and other sectors of the economy (manufacturing, transportation, tourism, telecommunication, commerce and service) was also confirmed in the case of

Tunisia by [38] using the Co-integration and Granger causality techniques. In 2010, [23] examined the impact of market reform on the agricultural sector in Poland, Romania, Bulgaria and Hungary using time-series analysis. The study investigated the inter-sectoral linkages among the agricultural, industrial and service sectors using a Vector Error Correction Model (VECM). The research which scrutinized how a distress in the agricultural sector was soaked up by the other sectors in the economy and vice versa, found that the existence of a negative linkage in the short run amongst the sectors do not rule out negative linkage in the long-run.

A comparative study of two former command economies - Poland and Romania using the same method to estimate the inter-linkages subsisting between agriculture, manufacturing, service and trade sectors was also conducted by [29]. Although the growth rates of the two countries were found to be interdependent, the study ascertained the existence of a long-run relationship of industrial, service, trade and the agricultural sector. In Poland, the role of agriculture in the short-run was found to be insignificantly related to the other sectors, but it made a positive impact on the industrial sector in Romania.

Some of the studies from the Indian sub-continent show different results. Reference [39] using the autoregressive distributed lag model (ARDL), finds bi-directional long run relationship between agriculture and industrial output in Pakistan. The findings of the study indicate that the agricultural output adjusted more quickly from a shock in industrial output both in the short and long run. Using the input-output framework, [18] investigates the inter-sectoral linkages among three of the major sectors of the Indian economy (agriculture, industry and service). The findings reveal strong inter connectivity. A similar study in India by [40] using both input-output approach and econometric co-integration and state-space models shows that primary, secondary and tertiary sectors exhibit strong long-run equilibrium relationship amongst each other.

Reference [32] adopted the [41] cointegration technique in addition to [42] causality test and [43] procedures in investigating the agricultural-industrial sectors relationship in Malaysia from 1970 to 2009. The study finds evidence of cointegrated agricultural and industrial sectors in the long run. The causal relationship also shows that there is a one-way causality direction from industrial to agricultural sectors both in the short run and long run.

Using a Social Accounting Matrix, [22] investigated the possible relationship between agriculture and manufacturing in developing countries and reports strong backward linkages to non-agricultural production at lower levels of development. Reference [44] in a four-sector macroeconomic simulation model of Ethiopia's economy obtains the following growth multipliers resulting from income jolts to industry: agriculture (1.5), manufacturing (1.3), services (1.8) and traditional industry (1.2). These multipliers cut the picture of discordant and irregular inter-sectoral linkages. Reference [45] in their research on Iran,

used autoregressive distributed lag model (ARDL) and variance decomposition analysis on time series data for the period 1959-2010. The results indicate that in the long run, one percent increase in agricultural value added, industrial value added, services value added and oil and gas value added will cause the GDP to increase by 0.22, 0.09, 0.43 and 0.16 percent respectively.

Reference [46] in recommending the use of more than one method in order to achieve a more robust result, apply four methods to establish the inter sectoral linkages of key sectors in China from 1987-1997. These are the Chenery-Watanabe method, the Rasmussen method, the Pure Linkage method, and the Dietzenbacher and van der Linden method. The main findings of the study are that the inter-sectoral interdependence which is positive also exhibits an increasing trend. Reference [47] examine the impact of oil discovery on sectoral performance in Nigeria. The study which utilized the time series data from 1975 to 2010 applied a combination of econometric estimation techniques. The result confirms the existence of Dutch disease in Nigeria as manifested by the deleterious impact of the oil and gas sector on the agricultural export of the country. The next discussion therefore focuses on the methodology of research.

3. Research Methodology

3.1. Methodology

In the quest to determine the impact of the agricultural sector on the Nigerian economy, there is the need to consider the inter-sectoral linkages in the real sector of the economy. These sectors no doubt spew externalities which the spill-over results are transmitted throughout the economy. Theoretically, ignoring these sectoral multiplier effects when in fact they exist, may lead to biased and inefficient results arising from omitted variable bias [24].

The paper deploys the three stage least squares (3SLS), an estimator which combines Two Stage Least Squares (2SLS) with SURE (Seemingly Unrelated Regression). It generalizes the 2SLS method to take account of the correlations between equations in the same way that SURE generalizes OLS. It is also a more robust technique for estimating a hybrid simultaneous equation system [48]. The benefit of 3SLS in addition to taking care of any probable occurrence of non-stationarity and consequential possibility of spurious regressions also addresses the correction of contemporaneous correlation of error terms. This is because 3SLS incorporates lag terms of both the dependent and independent variables in the estimation process. There is, therefore, no need to test for stationarity. In the estimated model of this study, the equations are all over-identified and 3SLS is therefore more appropriate.

3.2. Model Specification

The simultaneous equation regression is applied in the model specification of the paper. This approach has been

recommended by many scholars including [49] and [50]. The method is considered appropriate especially when a dependent (endogenous) variable in one equation also appears as explanatory variable in another equation which may lead to feedback distortion between the variables [51]. The structure of the macroeconometric model which is fashioned after the national accounting identity focuses on the IS portion of the IS-LMBOP model. The model reflects the inter-linkages between agriculture and manufacturing, oil and gas, and services in the real sector of Nigeria's economy.

The model consists of 16 behavioural equations and 4 identities and is made up of four major blocks: supply (Output), private demand (Household and firm expenditure), government expenditure and the external sectors. The model is presented as follows:

Supply Block

$$Y_{AGRIC}=a_{10} + a_{11}GCR_{AGRIC} +a_{12}FDI_{AGRIC} + a_{13}K_{AGRIC} + a_{14}RAIN + a_{15}P_{AGRIC} + a_{16}Y_{MFG} +a_{17}Y_{OIL} + a_{18}Y_{SERV}+ a_{19}Y_{AGRIC-1} + e_2 \tag{1}$$

$$Y_{MFG} = a_1+ a_2GCR_{MFG} + a_3FDI_{MFG} +a_4K_{MFG}+ a_5P_{MFG} + a_6Y_{AGRIC} +a_7Y_{OIL} +a_8Y_{SERV} + a_9Y_{MFG-1} +e_1 \tag{2}$$

$$Y_{OIL} = a_{20} + a_{21}GCR_{OIL} + a_{22}FDI_{OIL} + a_{23}K_{OIL} + a_{24}P_{OIL} + a_{25}OPEC+a_{26}Y_{AGRIC}+ a_{27}Y_{MFG} +a_{28}Y_{OIL} + a_{29}Y_{SERV}+ a_{30}Y_{OIL-1} + e_3 \tag{3}$$

$$Y_{SERV} = a_{31} + a_{32}FDI_{SERV} + a_{33}K_{SERV} + a_{34}P_{SERV} +a_{35}Y_{MFG} +a_{36}Y_{AGRIC}+ a_{37}Y_{OIL} +a_{38}Y_{SERV-1} + e_4 \tag{4}$$

Private Demand Block

$$C_F = a_{39}+ a_{40}P_F +a_{41}YDc + a_{42}IR + a_{43}C_{F-1} + e_5 \tag{5}$$

$$C_{NF} = a_{44} + a_{45}P_{NF} +a_{46}YDc + a_{47}W +a_{48}C_{NF-1} + e_6 \tag{6}$$

$$INV_{MFG} = a_{49}+ a_{50}Y_{MFG} +a_{451}IR + a_{52}FDI_{MFG} +a_{53}GCR_{MFG} + a_{54}P_{MFG} + a_{55}Y_{AGRIC}+ a_{56}Y_{OIL} + a_{57}Y_{SERV} + a_{58}INV_{MFG-1} + e_7 \tag{7}$$

$$INV_{AGRIC} = a_{59}+ a_{60}Y_{AGRIC} +a_{61}IR+ a_{62}YD + a_{63}GCR_{AGRIC} + a_{64}P_{AGRIC} + a_{65}Y_{MFG} + a_{66}Y_{OIL} + a_{67}Y_{SERV} +a_{68}INV_{AGRIC-1} + e_8 \tag{8}$$

$$INV_{OIL} = a_{69} + a_{70}Y_{OIL} +a_{71}FDI_{OIL} +a_{72}GCR_{OIL} + a_{73}P_{OIL} + a_{74}Y_{AGRIC}+ a_{75}Y_{MFG} + a_{76}Y_{SERV} +a_{77}INV_{OIL-1} + e_9 \tag{9}$$

$$INV_{SERV} = a_{78} + a_{79}Y_{SERV} + a_{80}FDI_{SERV}+ a_{811}GCR_{SERV} + a_{82}P_{SERV+} a_{803}Y_{MFG} + a_{84}Y_{MFG} +a_{85}Y_{AGRIC} + a_{86}Y_{SERV-1} +e_{10} \tag{10}$$

Government Block

The government demand is given by equations (11) to (13):

$$GE = a_{87} +a_{88}GRV +a_{89}CG+ a_{90}EDS+a_{91}DDS+a_{92}Y + a_{93}FD+ a_{94}GE + e_{11} \tag{11}$$

$$GRV = a_{95}+ a_{96}FDI +a_{97}NX + a_{98}GRV_{-1} + e_{117} \tag{12}$$

$$FDF =a_{99}+ a_{100}FD + a_{101}NFA +a_{102}EXR + a_{103}FDF_{-1}+e_{13} \tag{13}$$

External Block

The external block is depicted by equations (14) to (16):

$$X =a_{104} + a_{105}Y +a_{106}TOT + a_{107}EXR + a_{108}X_{-1} + e_{14} \tag{14}$$

$$M = a_{109} + a_{110}TAR +a_{111}Y+ a_{112}TOT+a_{113}EXR + a_{114}M +e_{15} \tag{15}$$

$$RES =a_{115} +a_{116}Y + a_{117}NFA + a_{118}EXR + a_{119}RES-1 + e_{16} \tag{16}$$

The system is closed by a set of identity equations listed as equations (17) to (20).

$$PDD = C +INV \tag{17}$$

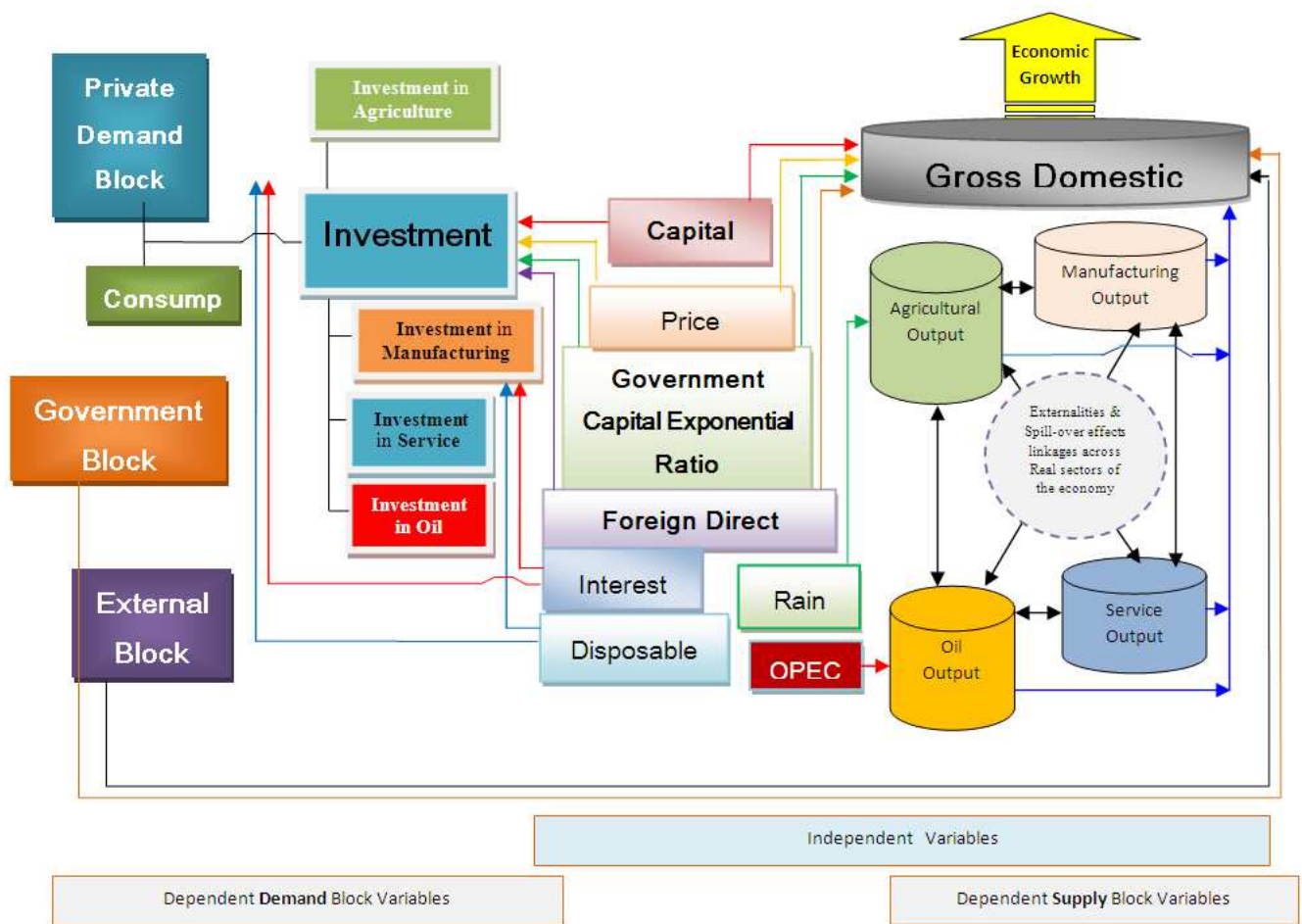$$GE = FDF + GRV \tag{18}$$

$$NX = X - M \tag{19}$$

$$AGD = PDD + GE + NX \tag{20}$$

The Schematic diagram (Fig. 1) simplifies the complex algebraic relationships hitherto represented in the system of simultaneous equations 1 through 20. In the demand block, private demand consists of investment (firms) and consumption (households). Both the external and government blocks also have impact on the supply and the private demand block. The study utilized the time series dataset from 1970 to 2010. The E-Views[TM] (version 6.1) statistical package was used for the analysis

Source: Author's design (2013)

Fig. 1: *Conceptual Framework of the Macroeconometric Model*

percent reduction in the output of the agricultural sector.

4. Findings and Discussions

This section examines the estimation results of the inter-sectoral relationships in both the supply and the private demand blocks which are of interest to this study. The independent variables in equation 1 account for 99 percent ($\overline{R^2} = 0.99$) of the variation in the output of agriculture. This attests to the high degree of the model specifications. The recommended Durbin-Watson Statistics (DW) to validate the regression result shows that the DW statistic for each of the regression is higher than the $\overline{R^2}$. The results can therefore be considered dependable [52] and [53].

The research findings in Table 1 show that the output of the agricultural sector (Y_{TIF}) is positively related to each of the outputs of manufacturing (Y_{MFG}), and services (Y_{SERV}) sectors. They are all statistically significant at 1 percent level. This means that one percent increase in each of Y_{MFG} and Y_{SERV} sectors will respectively lead to about 0.44 percent and 0.05 percent increase in the output of the agricultural sector. The relationship with the oil (Y_{OIL}) sector although significant at 1 percent level, is negative. One percent increase in Y_{OIL} sector will lead to about 0.41

Table 1: *System Estimation Report: Inter-Sectoral Linkages in the Supply Block*

	Y_{AGRIC}	Y_{MFG}	Y_{OIL}	Y_{SERV}
Y_{AGRIC}		0.44 $(3.85)^a$	-0.41 $-(5.42)^a$	0.05 $(0.62)^a$
Y_{MFG}	0.04 (0.38)		0.28 $(5.00)^a$	0.33 $(4.58)^a$
Y_{OIL}	6.70 (0.31)	4.16 (0.25)		0.04 (0.18)
Y_{SERV}	0.13 (0.32)	-0.79 (-1.47)	0.17 (0.77)	

Note: a, imply 1 percent significance level. t-statistic in parenthesis:

In the reverse direction however, the agricultural sector output is recorded as being exogenous and so exerts no influence on the output of the other sectors. As earlier discussed, it is influenced by the output of the manufacturing, oil and services sectors. This mono directional impact supports the findings of [54, p.86] in a sample study of 85 developed and developing countries that "with the possible exception of countries with highly

competitive agriculture, the farm sector does not drive the growth process in developed countries." The relevance of the agricultural sector is explained in part by the fact that most of raw materials required for the industrial and oil industries are imported. The imported agricultural raw materials measured as a percentage of merchandise for example rose from 0.6 in 2003 to a peak of 1.19 in 2008 to 0.78 in 2010 [56].

The results with respect to the sectoral investment vis a vis output is presented in Table 2.It shows that the output of each of the sectors is both positively related to investments in each of the corresponding sectors. Moreover, the incentive for investing in agriculture is self reinforcing. The output significantly explains agricultural investment at 1 percent level. Indeed, one percent increase in the output of the agricultural sector will lead to about 0.12 percent increase in investments in agriculture. The variations in agricultural investment are also significantly explained by the output of the manufacturing and services sectors at 5 percent level each. It can therefore be inferred that 0.4 and 0.2 percent increase in the industrial output and services respectively will be achieved from one percent increase in agricultural investments.

The agricultural sector which tends to be more responsive to GDP growth in manufacturing than services can be ascribed to two factors. Firstly, most innovations in production and managerial technology originate from the industrial sector before being transmitted to agriculture. Secondly, there is usually a lag in time before the spill-over and externality effects permeate through the economy. Therefore, the impact resulting from these reinforcing inter-linkages plays a more significant function in the long run.

However, the output of the oil sector is negatively related in addition to being statistically insignificant in influencing the investment in agriculture.

Table 2: System Estimation Report: Inter-Sectoral Linkages in the Private Demand Block

	Y_{AGRIC}	Y_{MFG}	Y_{OIL}	Y_{SERV}
INV_{AGRIC}	0.12 (2.00)[a]	0.38 (1.89)[b]	-0.03 (-3.86)	*0.24* (3.18)[b]
INV_{MFG}	0.44 (2.69)[a]	0.31 (4.09)[a]	*0.28* (1.98)[b]	0.49 (6.03)[a]
INV_{OIL}	- 0.62 (-4.21)[a]	0.57 (5.15)[a]	0.18 (4.54)[a]	0.48 (10.47)[a]
INV_{SERV}	0.74 (6.92)[a]	0.02 (6.10)	0.47 (6.05)[a]	0.50 (6.25)[a]

Note: a, b imply 1 percent and 5 percent significance levels. t-statistic in parenthesis

The next consideration is the reverse causality relationship from the output of the agricultural sector to the investments in the other sectors. The output of agriculture is positively and significantly related to the investments in agriculture (INV_{AGRIC}), manufacturing (INV_{MFG}), and services (INV_{SERV}) at one percent levels. It is however negatively but significantly related to the investment in oil

(INV_{OIL}) also at one percent level. The results also indicate bi-causal relationships between the investment in and output of all the sectors except oil. The gross output in the real sector of the economy and the sectoral contributions are trended in the same direction as an indication of the positive contribution of the sectors to overall growth of the economy**.** This supports the findings by [38] in a similar study on Tunisia which point out that in the long run, all the sectors (agriculture, industrial and services sector), tend to move together in their contribution to growth.

The various sectoral investments are related both positively and significantly to the output of the agricultural sector. The noticeable exemption is the oil sector.

The Nigerian economy is heavily dependent on the oil sector, which accounts for over 95 percent of export earnings and about 40 percent of government revenues (Energy Information Administration, 2012). The prominence of the oil sector has had a deleterious impact on the agriculture production. This is consistent with the claim of the Nigerian Association of Chambers of Commerce, Industry, Mines and Agriculture (NACCIMA) that the oil sector has failed to add real value to business in the country and the oil sector and is the root cause of the decline in agricultural exports (*Nigeria: NACCIMA Says Oil Sector is Killing Economy*, Africa: AllAfrica.com, 2013). The symptoms of the Dutch disease is manifest [14].

The import of these findings is that the inter-sectoral relationships are complicated and multi-directional. The spill-over effects and externalities generated by the interactions and linkages between the different sectors attest to the dynamic nature of the economy. As the results show, the economic role of the agricultural sector is a one-way path as the flow of capital is mainly towards the industrial, oil and gas and the tertiary services sectors with consequences for urbanization, employment and foreign trade stability. The results also confirm the working hypothesis that investment on agriculture has significant impact on economic growth in Nigeria.

5. Conclusion

The need to account for the spill-over effects and externalities generated by reinforcing sectoral linkages which have largely been omitted in literature has been addressed by this study. The findings suggest that increases in manufacturing and services output both impact positively on productivity in agriculture. This is consistent with the contention of the neoclassical theory that agriculture benefits from spillover effect of the higher productivity techniques in the industrial sector with consequential convergent tendencies across all sectoral productivity levels. The theoretical supposition on the significance of industrialization and the tertiary sector role making agriculture more efficient through improved technologies and the benefits of large economies of scale is also substantiated.

Furthermore, the positive association subsisting amongst

the agricultural, industrial and service sectors is consistent with the cost disease of stagnant services model of [55] in which as in osmosis, there is a tendency for demand to shift in favor of goods produced in the progressive sector from the sluggish sector. The importance of this for the Nigerian economy is that the cost per unit of the stagnant sector (agriculture) will increase without limitation leading to the migration of more labor and other resources to the other sectors. This has implications for rural to urban migration unbridled urbanization, unemployment and other malaise besetting a developing economy.

As earlier mentioned, the story is different for the oil sector. This study also establishes that sectoral linkages are not always beneficial especially between agriculture and the oil sector. The Nigerian economy which is over dependent on the crude oil export is vulnerable to fluctuations in international oil prices. There is the need to further structurally transform the economy in view of its dependence on crude oil export with attendant possible shocks in the international market.

In order to achieve balanced economic growth and the transformation of a predominantly agrarian into an industrial Nigerian economy, surplus production in the agricultural sector should be encouraged through capital intensive technologies, and practices. These include the provision of innovative technology, high-tech inputs (seedlings, machinery and fertilizers), better transportation, communications, storage or financial services in this sector. The modernization of the industrial and services sectors is therefore recommended in order to further ensure the transfer of resources from the agricultural sector and increase in local content value addition to these sectors.

The Bank of Industries should be further capitalised to enhance the ability of entrepreneurs in the manufacturing sector, to invest at high enough levels so as to absorb a growing urban labour force. The excess labour which is employed in the industrial sector enlarges the domestic market for agricultural products. This positive linkage further generates greater productivity in the use of resources and sustainable economic growth.

Appendix 1

Description of Variables and their Sources

S/N	Notation	Definition	Source (S)
1	AGD	Aggregate Demand	Central Bank of Nigeria Statistical Bulletin December, 2007 Pg. 132-134 Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 91-93 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS /STATISTICS/2010/PartD/PartD.html Table B. 1.1
2	C	Total Consumption	Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS/STATISTICS/2010/PartC/PartC.html Table C.1.6
3	C_F	Food Consumption	National Bureau of Statistics, Sector Statistics of Price & Price index. Available at: http://www.nigerianstat.gov.ng/index.php//sectorStatistics/ facts and figures about Nigeria 2010/ Pg. 33-35
4	C_{NF}	Non –food Consumption	National Bureau of Statistics, Sector Statistics of food consumption Available at: http://www.nigerianstat.gov.ng/index.php//sectorStatistics / facts and figures about Nigeria 2010/ Pg. 36-41
5	CG	Credit to the government	Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS/STATISTICS/2010/PartB/PartB.html
6	EXR	Exchange rate	Central Bank of Nigeria Statistical Bulletin December, 2007 Pg. 228-229 Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 248 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS/STATISTICS /2010/PartD/PartD.html Table D.3.4.3
7	DS	Debt Service	Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS/STATISTICS/2010/PartC/PartC.html Table B.1.6
8	FD	Fiscal Deficit	Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS/STATISTICS/2010/PartB/PartB.html

S/N	Notation	Definition	Source (S)
9	FDF	Fiscal deficit financed by the CBN	Table B.1.6 GE-GRV (Total Government Expenditure –Government Revenue) Central Bank of Nigeria Statistical Bulletin December, 2007 Pg. 101-104 Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 91-93 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS/STATISTICS/2010/PartB/PartB.html Table B.1.1
10	FDI	Foreign Direct Investment	Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 253-255 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2010/PUBLICATIONS/STATISTICS BULLENTINS/INDEX.html Table D.5.4
11	FDI_{AGRIC}	Foreign Direct Investment in agriculture	Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 263 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2010/PUBLICATIONS/STATISTICS BULLENTINS/INDEX.html Table D.5.4
12	FDI_{MFG}	Foreign Direct Investment in manufacturing	Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 263 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2010/PUBLICATIONS/STATISTICS BULLENTINS/INDEX.html Table D.5.4
13	FDI_{OIF}	Foreign Direct Investment in other infrastructure	Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 263 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2010/PUBLICATIONS/STATISTICS BULLENTINS/INDEX.html Table D.5.4
14	FDI_{OIL}	Foreign Direct Investment in oil	Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 263 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2010/PUBLICATIONS/STATISTICS BULLENTINS/INDEX.html Table D.5.4
15	FDI_{SERV}	Foreign Direct Investment in service	Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 263 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2010/PUBLICATIONS/STATISTICS BULLENTINS/INDEX.html Table D.5.4
16	FDI_{TIF}	Foreign Direct Investment in telecommunications infrastructure	Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 263 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2010/PUBLICATIONS/STATISTICS BULLENTINS/INDEX.html Table D.5.4
17	GCR_{AGRIC}	Government capital expenditure ratio in agriculture	Central Bank of Nigeria Statistical Bulletin, December, 2007 Pg. 113-114 Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 91-93 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS/STATISTICS/2010/PartB/PartB.html

S/N	Notation	Definition	Source (S)
18	GCR_{MFG}	Government capital expenditure in manufacturing	Table B.1.2 (Investment in agric divided by Total government exp) Central Bank of Nigeria Statistical Bulletin, December, 2007 Pg. 113-114 Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 91-93 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS/STATISTICS/2010/PartB/PartB.html Table B.1.2 (Investment in manufacturing divided by Total government expenditure)
19	GCR_{OIF}	Government capital expenditure in other infrastructure	Central Bank of Nigeria Statistical Bulletin, December, 2007 Pg. 113-114 Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 91-93 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS/STATISTICS/2010/PartB/PartB.html Table B.1.2 (Investment in other infrastructure divided by Total government expenditure)
20	GCR_{OIL}	Government capital expenditure ratio in oil	Central Bank of Nigeria Statistical Bulletin, December, 2007 Pg. 113-114 Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 91-93 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS/STATISTICS/2010/PartB/PartB.html Table B.1.2 (Investment in oil divided by Total government exp)
21	GCR_{TIF}	Government Capital Exponential ratio in telecommunications infrastructure	Central Bank of Nigeria Statistical Bulletin, December, 2007 Pg. 113-114 Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 91-93 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS/STATISTICS/2010/PartB/PartB.html Table B.1.2 (Investment in telecommunications infrastructure divided by Total government expenditure)
22	GCR_{SERV}	Government capital expenditure ratio in agriculture	Central Bank of Nigeria Statistical Bulletin, December, 2007 Pg. 113-114 Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 91-93 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS/STATISTICS/2010/PartB/PartB.html Table B.1.2 (Investment in service divided by Total government expenditure)
23	GE	Total Government Expenditure	Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 91-93 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS/STATISTICS/2010/PartB/PartB.html Table B.1.1
24	GRV	Government Revenue	Central Bank of Nigeria Statistical Bulletin December, 2007 Pg. 101-104 Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 91-93 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS/STATISTICS/2010/PartB/PartB.html Table B.1.1
25	INV	Total Investment	Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 119 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS/STATISTICS/2010/PartC/PartC.html Table C.1.3
26	INV_{AGRIC}	Investment in	Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008

S/N	Notation	Definition	Source (S)
		Agriculture	Pg. 119 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS/STATISTICS/2010/PartC/PartC.html Table C.1.3
27	INV_{IF}	Investment in infrastructure	Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 119 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS/STATISTICS/2010/PartC/PartC.html Table C.1.3
28	INV_{MFG}	Investment in manufacturing	Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 119 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS/STATISTICS/2010/PartC/PartC.html Table C.1.3
29	INV_{NIF}	Investment in non-infrastructure	Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 119 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS/STATISTICS/2010/PartC/PartC.html Table C.1.3
30	INV_{OIF}	Investment in other infrastructure	Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 119 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS/STATISTICS/2010/PartC/PartC.html Table C.1.3 (Road transportation, Rail transport and pipelines, Water transportation, Air transportation, transport services , Electricity and Water)
31	INV_{TIF}	Investment in telecommunications infrastructure	Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 119 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS/STATISTICS/2010/PartC/PartC.html Table C.1.3 (Telecommunications, post and broadcasting)
32	INV_{SERV}	Investment in Service	Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 119 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS/STATISTICS/2010/PartC/PartC.html Table C.1.3 (Insurance, real estate, business services, public administration, education, health , private non profit organisation. Social and Community services)
33	INV_{OIL}	Investment in Oil	Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 119 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS/STATISTICS/2010/PartC/PartC.html Table C.1.3 (Crude, petroleum , natural gas and oil refining)
34	IR	Interest rate	Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 43 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS/STATISTICS/2010/PartA/PartA.html Table A.2.4.1
35	K_{AGRIC}	Capital Stock in Agriculture	Central Bank of Nigeria Statistical Bulletin, December, 2007 Pg. 113-114 Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 263 http://www.cenbank.org/OUT/2011/PUBLICATIONS/STATISTICS/2010/PartC/PartC.html Table C.1.3

S/N	Notation	Definition	Source (S)
36	K_{MFG}	Capital Stock in manufacturing	Identity: $K_{AGRIC} = INV_{AGRIC} + FDI_{AGRIC}$ Central Bank of Nigeria Statistical Bulletin, December, 2007 Pg. 113-114 Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 263 http://www.cenbank.org/OUT/2011/PUBLICATIONS/STATISTICS/2010/PartC/PartC.html Table C.1.3
37	K_{OIL}	Capital Stock in oil	Identity: $K_{MFG} = INV_{MFG} + FDI_{MFG}$ Central Bank of Nigeria Statistical Bulletin, December, 2007 Pg. 113-114 Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 263 Identity: $K_{OIL} = INV_{OIL} + FDI_{OIL}$ http://www.cenbank.org/OUT/2011/PUBLICATIONS/STATISTICS/2010/PartC/PartC.html Table C.1.3 (Crude , petroleum , natural gas and oil refining)
38	K_{OIF}	Capital Stock in Other infrastructure	Central Bank of Nigeria Statistical Bulletin, December, 2007 Pg. 113-114, 263 http://www.cenbank.org/OUT/2011/PUBLICATIONS/STATISTICS/2010/PartC/PartC.html Table C.1.3 (Road transportation, Rail transport and pipelines, Water transportation, Air transportation, transport services , Electricity and Water)Identity: $K_{OIF} = INV_{OIF} + FDI_{OIF}$ Central Bank of Nigeria Statistical Bulletin, December, 2007 Pg. 113-114
39	K_{TIF}	Capital Stock in telecommunications infrastructure	Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 263 http://www.cenbank.org/OUT/2011/PUBLICATIONS/STATISTICS/2010/PartC/PartC.html Table C.1.3 (Telecommunications, post and broadcasting)Identity: $K_{TIF} = INV_{TIF} + FDI_{TIF}$
40	K_{SERV}	Capital stock in service	Central Bank of Nigeria Statistical Bulletin, December, 2007 Pg. 113-114 Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 263 http://www.cenbank.org/OUT/2011/PUBLICATIONS/STATISTICS/2010/PartC/PartC.html Table C.1.3 (Insurance, real estate, business services, public administration, education, health , private non profit organisation. Social and Community services)Identity: KSERV = INVSERV + FDISERV
41	NFA	Net foreign Assets	Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 233-234 Central Bank of Nigeria Statistical Bulletin December, 2010http://www.cenbank.org/OUT/2011/PUBLICATIONS /STATISTICS/2010/PartD/PartD.html Table D.2.3
42	NX	Net Export	Central Bank of Nigeria Statistical Bulletin December, 2007 Pg. 101-104 Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 205-207 Central Bank of Nigeria Statistical Bulletin December, 2010http://www.cenbank.org/OUT/2011/PUBLICATIONS /STATISTICS/2010/PartD/PartD.html Table D.1.1
43	M	Import	Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 205-207 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS /STATISTICS/2010/PartD/PartD.html Table D.1.1
44	PDD	Private Deduction	C+ INV (Total Consumption + Total Investment) Central Bank of Nigeria Statistical Bulletin, December, 2007 Pg. 113-114 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS /STATISTICS/2010

S/N	Notation	Definition	Source (S)
45	P_{MFG}	Price of manufacturing	For 2008-2010 Data, See Update value for C AND INV (2008-2010) Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 121-124 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS /STATISTICS/2010/PartC/PartC.html Table C.1.4
46	P_F	Food price	National Bureau of Statistics, Sector Statistics of Price and Price index Available at: http://www.nigerianstat.gov.ng/index.php//sectorStatistics/ facts and figures about Nigeria 2008/ Pg. 33-35 Central Bank of Nigeria Statistical Bulletin December, 2010http://www.cenbank.org/OUT/2011/PUBLICATIONS /STATISTICS/2010/PartC/PartC.html Table C.1.4 Note: Value not available from 2009- 2010. The value for four years before 2009 was summed together and divided by four. Thereafter, the remaining years were extrapolated
47	P_{NF}	Price of Non food	National Bureau of Statistics, Sector Statistics of Price and Price index Available at: http://www.nigerianstat.gov.ng/index.php//sectorStatistics/ sectorStatistics / facts and figures about Nigeria 2008/ Pg. 36-41 Central Bank of Nigeria Statistical Bulletin December, 2010http://www.cenbank.org/OUT/2011/PUBLICATIONS /STATISTICS/2010/PartC/PartC.html Table C.1.4
48	P_{SERV}	Price of Service	Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 121-124 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS /STATISTICS/2010/PartC/PartC.html Table C.1.4
49	OPEC	OPEC	1.Central Bank of Nigeria Statistical Bulletin, December, 2007 Pg. 173 2. United States Energy Information Administration Independent Statistics and Analysis. International Petroleum Monthly (IPM), February 2010 edition. Available at http://www.eia.doe.gov/emeu/ipsr/source4.html 3. Energy Information Administration, February 2010 International Petroleum Monthly Available at http://www.eia.doe.gov/emeu/ipsr/appc.html
50	P_{AGRIC}	Price of Agriculture	4.http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=5&pid=53&aid=1 . Date accessed May 26, 2012 Output given in days for each year. This was multiplied by 365 to get total output for the year Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 121-124 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS /STATISTICS/2010/PartC/PartC.html Table C.1.4
51	P_{OIF}	Price of other infrastructure	Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 121-124 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS /STATISTICS/2010/PartC/PartC.html Table C.1.4
52	P_{OIL}	Price of oil	Energy Information Administration, February 2010 International Petroleum Monthly Available at http://www.eia.doe.gov/emeu/ipsr/appc.html
53	P_{MFG}	Price of manufacturing	Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 121-124

S/N	Notation	Definition	Source (S)
54	P_{TIF}	Average price of telecommunications infrastructure	Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS /STATISTICS/2010/PartC/PartC.html Table C.1.4 Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 121-124 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS /STATISTICS/2010/PartC/PartC.html Table C.1.4
55	RAIN	Annual Rainfall	Central Bank of Nigeria Statistical Bulletin, December, 2007 Pg. 205-207 Note: The value for four years before 2008 was summed together and divided by four. Thereafter, the remaining years were extrapolated
56	TAR	Implicit Tariff	Central Bank of Nigeria Statistical Bulletin, December, 2007 Pg. 143-146 Note: Value not available from 2008- 2010. The value for four years before 2008 was summed together and divided by four. Thereafter, the remaining years were extrapolated
57	TOT	Terms of Trade	Central Bank of Nigeria Statistical Bulletin December, 2007 Pg. 101-104, 211 Central Bank of Nigeria Statistical Bulletin December, 2010 .http://www.cenbank.org/OUT/2011/PUBLICATIONS /STATISTICS/2010/PartC/PartC.html Table D.4.3 Export divided by Import
58	W	Wealth	Central Bank of Nigeria Statistical Bulletin, December, 2007 Pg. 192 Note: Value not available from 1998- 2010. The value for four years before 1998 was summed together and divided by four. Thereafter, the remaining years was extrapolated
59	X	Export	Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 205-207 Central Bank of Nigeria Statistical Bulletin December, 2007 Pg. 132-134
60	Y	Overall Output	Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 118 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS /STATISTICS/2010/PartC/PartC.html Table C.12
61	YDc	Per Capita Income	Central Bank of Nigeria Statistical Bulletin, December, 2007 Pg. 192 Note: Value not available from 1970-1984. The value for four years after 1984 was summed together and divided by four. Thereafter, the remaining years were interpolated.
63	Y_{AGRIC}	Output of Agriculture	Central Bank of Nigeria Statistical Bulletin December, 2007 Pg. 132-134 Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 115 – 118 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS /STATISTICS/2010/PartC/PartC.html Table C.1.2 (Crops, Livestock , forestry and Fishing)
64	Y_{IF}	Output of infrastructure	Central Bank of Nigeria Statistical Bulletin December, 2007 Pg. 132-134 Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 115 – 118 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS /STATISTICS/2010/PartC/PartC.html Table C.1.2(Building , construction)
65	Y_{MFG}	Output of manufacturing	Central Bank of Nigeria Statistical Bulletin December, 2007 Pg. 132-134 Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 115 – 118 Central Bank of Nigeria Statistical Bulletin December, 2010
S/N	Notation	Definition	Source (S)

S/N	Notation	Definition	Source (S)
66	Y_{NIF}	Output of non infrastructure	http://www.cenbank.org/OUT/2011/PUBLICATIONS /STATISTICS/2010/PartC/PartC.html Table C.1.2 (Coal mining, metal ores, quarrying , cement and other manufacturing) Central Bank of Nigeria Statistical Bulletin December, 2007 Pg. 132-134 Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 115 – 118 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS /STATISTICS/2010/PartC/PartC.html Table C.1.2
67	Y_{OIF}	Output of other infrastructure	Central Bank of Nigeria Statistical Bulletin December, 2007 Pg. 132-134 Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 115 – 118 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS /STATISTICS/2010/PartC/PartC.html Table C.1.2 (Road transportation, Rail transport and pipelines, Water transportation, Air transportation, transport services , Electricity and Water) Central Bank of Nigeria Statistical Bulletin December, 2007 Pg. 132-134 Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 115 – 118
68	Y_{OIL}	Output of Oil	Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS /STATISTICS/2010/PartC/PartC.html Table C.1.2 (Crude , petroleum , natural gas and oil refining) Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 115 – 118
69	Y_{SERV}	Output of service	Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS /STATISTICS/2010/PartC/PartC.html Table C.1.2 (Insurance, real estate, business services, public administration, education, health , private non profit organisation. Social and Community services)
70	Y_{TIF}	Output of telecommunications infrastructure	Central Bank of Nigeria Statistical Bulletin December, 2009 Pg. 132-134 Central Bank of Nigeria Statistical Bulletin Golden Jubilee Edition December, 2008 Pg. 115 – 118 Central Bank of Nigeria Statistical Bulletin December, 2010 http://www.cenbank.org/OUT/2011/PUBLICATIONS /STATISTICS/2010/PartC/PartC.html Table C.1.2

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