Role of income distribution and consumption expenditure in agriculture output: Case of Nigeria

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Abstract

This study quantifies empirically the induced impact of income distribution and consumption expenditure on the structure of agriculture production of Nigerian economy. The study calibrates a multi-sector and multi-factor input-output model on a social accounting matrix (SAM) for Nigeria for the year 2010. Dispersion analysis is conducted to identify the key agriculture sectors/subsectors both in exogenous and endogenous setup. Findings of the study confirm the active role of income distribution and consumption expenditure of institutional sectors on the structure of agriculture production.

Keywords: Income distribution, consumption expenditure, agriculture output, social accounting matrix, extended input-output analysis

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1. Introduction

Knowledge of inter-industry connections is vital in policy implications since the policy makers prefer strongly interconnected sectors to enclave sectors or sectors with poor industry connections. These connections are computed in terms of backward and forward linkages which provide indices to set the criteria for key sectors identification (Cai & Leung, 2004). Input-output multiplier analysis is widely used to study the structure of production and inter-industry linkages of the single as well as multiple economies (e.g, Su, Yang & Lin, 2017; Wiebe & Lenzen, 2017). However, the exclusion of income distribution and consumption expenditure in the traditional linkage analysis can be detrimental since endogenous income-expenditure impacts the inter-industry connections (Harada, 2015; Roland-Holst, 1990). Social accounting matrix (SAM) provides an accounting framework to endogenize the income and expenditure of the institutional sectors namely households, firms and government into the traditional input-output model thereby making it an extended input-output model (Ciaschini, Pretaroli & Socci, 2009).

While induced income-expenditure is imperative, it is more important to quantify how much the structure of production is influenced by income distribution and consumption expenditure. The primary objective of this study is to empirically establish the endogeneity impact on the structure of agriculture production in Nigerian economy. Agriculture is the main source of livelihood for most Nigerians. However being the largest sector of Nigerian economy, it faces many challenges that have considerably choked the progressive agricultural productivity with high postharvest losses and waste.

To harness the combined impediments, Nigeria's government has set a vision 2020 which

aims at reforming the agriculture sector that would, ultimately, ensure the food security[2]. Several policy options are underway among them is increasing the production of selected value chain commodities[3] naming few: rice, wheat, cassava, fisheries etc. Implementation of said policies leads to the questions as what is the structure of production of Nigerian economy, which are the key sectors that represent the strong backward and forward linkages within that structure and how the induced income distribution and consumption expenditure impacts the structure of production.

This study identifies the structure of production with exogenous and endogenous income-expenditure of the institutional sectors. The comparison of both findings determines how structure of production is influenced with income-expenditure. The agriculture sector is studied first as a single aggregated sector and then as a disaggregated sector; includes all subsectors. The study uses a social accounting matrix (SAM) for Nigeria for the year 2010 which is elaborated in section 3. Section 2 portrays the snapshot of literature review. An extended input-output model is presented in section 4 followed by the findings of dispersion analysis in section 5. Finally the study concludes in section 6.

2. Literature Review

At the outset, it is important to mention that the term structure of production has been defined differently by different researchers. Some definitions of structure of production are based on technology or behavior while some other refer to the importance of the sectors in the economy in terms of output or factor utilization (Soofi 1992). The sine qua non of the studies on structure of production is the interactions among different sectors of the economy. Following is the montage on the extant literature hitherto on structure of production.

[2] Professor Chinedum Nwajiuba, Nigeria's Agriculture and Food Security Challenges. Available at: https://us.boell.org/sites/default/files/downloads/4_Green_Deal_Nigeria_AGRICULTURE.pdf
[3]FAOSTAT

Studies on structure of production date back to the early twentieth Century. The pioneer work includes the seminal studies of Leontief (1953) and Rasmussen (1956). Leontief studied the internal structure of inter-industry transactions using the input-output tables of USA. He developed an analytical framework to identify the inter-dependence and circularity of industries. Similarly, Rasmussen developed a method to study the industrial nexus of Denmark using open static input-output model. He measured the changes in the structure of production in Denmark covering the period from 1947 to 1949. Several other individual countries studies in the last century include the studies by Forssell (1988) on Finnish economy for the period 1960-1970, Urata (1988) on Soviet economy between 1959 and 972, Skolka (1989) on Austrian economy, Lee (1990) on US economy for 192-82, Khan (1991) on Pakistan's economy.

Besides, some cross-country comparative studies have also been conducted. To mention a few, a comparative study by Chenery & Watanabe (1958) concludes the uniformity in the structure of production of Finland, Italy, Japan, and the USA. While, Several other comparative studies include the work of Simpson & Tsukui (1965), Robinson & Markandya (1974), Kubo et al. (1986a, b).

A condensed list of studies on structure of production and linkages analyses is present hitherto representing different economies and different approaches. To name a few, Hoen (2002) used cluster-based methodology to identify the inter-industry linkages. While Cai & Leung (2004) used archival approach to present refined backward and forward linkage indices using practical exercise on Hawaii's agriculture sectors. On the hand, Peters & Herwich (2006) conducted the structural path analysis on Norwegian economy to identify the linkages between the global production networks and domestic production and consumption. Moreover, some other prominent studies include a work by Leung & Secrieru (2012) on

Canadian economy, Harada (2015) on Japanese economy, and Chang & Lahr (2016) on Chinese economy. The seminal studies on African economies are done by Soofi (1992) who compared the production structures of Egypt, Morroco and Zambia and by Poops and Mattallah (1992) who presented the production structure and linkage analysis of Algerian economy.

The aforementioned studies employed input-output tables for structure and linkage analysis. The exclusion of income distribution and consumption expenditure may leave the inter-industry analysis with incomplete information about the economy. SAM provides a comprehensive framework for the inter-industry analysis as well as the income-expenditure linkages (Roland-Host, 1990). The theoretical underpinnings of endogenizing income distribution and consumption expenditure in the structure of production lie at the seminal works of Miyazawa (1960), Miyazawa & Masegi (1963), Miyazawa, (1976), Pyatt et al. (1973) and Pyatt (2001). Moreover, a prominent study with the use of SAM and macro-multiplier (MM) model for inter-industry interactions is done by Ciaschini & Socci (2007). In this study, the authors employed an MM analysis on Italian bi-regional SAM to obtain the backward and forward linkages and identify the key groups of industries and sectors. Notwithstanding, no prominent study has been done on African economy which quantifies the induced impact of income-expenditure on the structure of production.

3. Social Accounting Matrix

Social Accounting Matrix (SAM) integrates the detailed data on production, income and expenditure, thereby allowing a systematic recording of economic transactions for the study of growth and its distribution in a country (Doukali and Lejars, 2015). It presents a data framework to explain the income circular flow that stems from the market interactions among the institutions (Ciaschini and Socci, 2006; Ciaschini et.al. 2009; Ciaschini et al., 2012). The

final demands determine total outputs which, in turn, generate value added by commodity. The value added gives rise to domestic incomes by factors which create disposable income by institutional sectors. Finally these domestic incomes bring about the final demands thereby closing the loop. The matrix representation of SAM encompasses a consistent nucleus that can be extended accordingly in the development of economy-wide policy models (Pyatt and Round, 1977; Pyatt, 1999). This matrix integrates the flows of disaggregated accounts for value added generation, primary and secondary income distribution and capital formation.

The development of SAM is obtained in two steps. Firstly, the official macro national accounts of Nigeria for the year 2010 are arranged in the National Accounting Matrix (NAM), table 1, as a general referring framework. Secondly, a disaggregated SAM is derived which is presented in table 2. In this vein, the information on national accounts and other statistical data has been collected from National Bureau of Statistics (NBS) Nigeria, Central Bank of Nigeria (CBN), Joint Tax Board (JTB), Food and Agriculture Organization (FAO), General Household Survey (2010-2011), and World Bank, etc. Moreover, information from previous Nigerian SAM for 2006, developed by International Food Policy Research Institute (IFPRI) in 2010 (Nwafor, Diao & Alpuerto, 2010), has also been used. It is important to mention here that the SAM contains multiple classes of households and labor for simulating different policy options. The current study maintains the same structure and hence the SAM includes the following accounts:

- 66 commodities[4]
    - 27 Agriculture commodities
- 66 activities
    - 27 Agriculture activities
- 8 primary factors[5]
- 26 institutional sectors[6]
- Rest of the world

[4] See table A1 in Appendix
[5] These include 6 labor categories and 1 category of capital.
[6] These include 24 categories of households, 1 category of firms and 1 category of government.

- Capital formation

3.1 Description of National Accounting Matrix for Nigerian Economy

The NAM, also called as a macro SAM, serves the purpose of reference framework for the construction of disaggregated SAM. It is composed of a set of rows and columns headed to the commodities, industries, primary factors and institutional sectors. Table 1 presents the aggregate structure of NAM which includes commodities, activities, factors, households, firms, government, taxes, capital formation and rest of the world.

In NAM, commodities refer to goods and services that are produced by the firms and activities refer to entities such as firms and farms that produce the goods and services (Breisinger, Thomas and Thurlow, 2009). The activities produce commodities by employing the other commodities and services as intermediate consumption and also the factors of production such as land, labor and capital. The activities pay owners of factors in the form of: wages [R4-C3] to households and profits [R6-C3] to government. The profits of firms [R5-C3] may also be used as payment to hired factors.

The first column of Table 1 presents the domestic supply [R2-C1], taxes on products [R7-C1] and imports [R9-C1]. Adding them together, the sum of first column gives the total supply of goods and services available in the market. On the other hand, the intermediate consumption [R1-C2], in second column, is a payment from activities to commodities for the goods and services in the domestic market used in the production process. Column 2 also registers the value added [R3-C2] and production taxes [R7-C2]. Adding them together, the sum of column C2 gives the total output by activities in the economy.

Column C3 is heading to the wages [R4-C3], profits of firms [R5-C3], and government share of profits [R6-C3]. The sum of column C3 gives the total of factor income. Whereas, column

C4 presents the total expenditure of households in terms of household consumption [R1-C4], personal income tax [R7-C4], and household savings [R8-C4]. On the other hand, column C5 gives the total expenditure of firms as the sum of transfers to households [R4-C5], company income tax [R7-C5], firms' savings [R8-C4], and payment to rest of the world [R9-C5]. The government expenditure is depicted by column C6 summing up government consumption [R1-C6], transfers to households [R4-C6], and government savings [R8-C6]. Columns C7 is heading towards direct and indirect taxes [R6-C7] received by the government from all the economic agents. The investment demand [R1-C8] is described by column C8 whereas column C9 summarizes the exports [R1-C9], foreign remittances [R4-C9], government income from abroad [R6-C9], and current account balance [R8-C9]. Adding them together, column C9 gives the total foreign exchange inflow.

The column sums of NAM present the expenditures whereas the corresponding row sums give the incomes of the economic entities. The accounts of NAM can be used to find the GDP both at factor cost and by final demand. GDP at factor cost is determined with the sum of value added [R3-C2], production taxes [R7-C2], and taxes on products [R7-C1]. Likewise, GDP by final demand is computed by the sum of final consumption expenditures of households [R1-C4] and government [R1-C6] plus investment demand [R1-C8] plus exports [R1-C9] minus imports [R9-C1]. Given the simple aggregate structure, the NAM for Nigeria for 2010 is derived by integrating the accounts and other statistical data mentioned earlier. The final NAM is depicted in table 2.

Table 1. National Accounting Matrix Framework

		Commodities	**Activities**	**Factors**	**Households**	**Firms**	**Government**	**Taxes**	**Capital Formation**	**ROW**	**Total**
	n.	C1	C2	C3	C4	C5	C6	C7	C8	C9	
Commodities	R1		Intermediate consumption		Household consumption		Government consumption		Investment demand	Exports	Total demand
Activities	R2	Domestic supply									Total output
Factors	R3		Value added								Factor income
Households	R4			Wages		Transfers to households	Transfers to households			Foreign remittances	Household income
Firms	R5			Profits							Firms income
Government	R6			Government share of profits				Direct and indirect taxes		Government income from abroad	Government income
Taxes	R7	Taxes on products	Production taxes		Personal income tax	Company income tax					Taxes
Capital Formation	R8				Household savings	Firms savings	Government savings			Current account balance	Total savings
ROW	R9	Imports				Payment to ROW					Foreign outflow
Total		Total supply	Total output	Factor income	Household expenditure	Firms expenditure	Government expenditure	Taxes	Total investment	Foreign inflow	

Table 2. National Accounting Matrix for Nigerian Economy for 2010 – Million Naira

		Commodities	**Activities**	**Factors**	**Households**	**Firms**	**Government**	**Taxes**	**Capital Formation**	**ROW**	**Total**
	n.	C1	C2	C3	C4	C5	C6	C7	C8	C9	
Commodities	R1		38,757,838		37,203,508		5,056,628		9,591,049	13,472,905	104,081,928
Activities	R2	93,370,093									93,370,093
Factors	R3		54,315,992								54,315,992
Households	R4			30,817,402		7,117,884	3,732,813			3,184,842	44,852,941
Firms	R5			20,098,908							20,098,908
Government	R6			3,399,682				3,981,152		411,639	7,792,473
Taxes	R7	857,085	296,263		225,804	2,602,000					3,981,152
Capital Formation	R8				7,423,629	6,993,513	-996,968			-3,829,125	9,591,049
ROW	R9	9,854,750		0		3385511					13,240,261
Total		104,081,928	93,370,093	54,315,992	44,852,941	20,098,908	7,792,473	3,981,152	9,591,049	13,240,261	

Source: Elaborated from NBS official statistical data

4. Extended Input-Output model

The current study employs a multi-factor, multi-sector and multi-industry model to endogenize the income distribution and consumption expenditure in to the structure of production. The distribution of income here includes both the primary income distribution and secondary income distribution. The primary income distribution is the factorial distribution, i.e. the distribution of primary income generated in production activities among the various factors of production. Whereas the secondary income distribution is the distribution of current income among various institutions of the economy vis-à-vis firms, households and government. The study follows the presentation of income circular flow with SAM scheme as presented by Ciaschini and Socci, (2007a; 2007b). The current model assumes fixed prices and constant technical coefficients and shares. Veritably, the SAM characterizes the extended income circular flow wherein the interactions between industries and institutions could be specified and evaluated.

Figure 1 portrays the fundamental mechanism of production and distribution in terms of interaction among industries, institutional sectors and factors of production. The arrows in figure 1 identify the expenditure flow while the boxes present the transformation of a flow variable into another. The extended input-output loop is identified in figure 1 that allows the extended study of the propagation. Starting from top, the inter industry demand is characterized. Depending on the policy options, the selection of variables can be made that undergo the unit shock and the impact is observed. To each flow variable, an order of magnitude, such as the scale and a composition, is specified. For instance, to study the impacts of unit shock on final demand and its propagation on domestic output, an equation of the reduced form of the model is referred whereas other arrangements of structural matrices are easily found if a shock on income redistribution is observed on value added by factor.

As evidenced in figure 1, the whole income distribution process creates a feedback loop, with arrow, between industry output and final demand. It presents several logical phases. Starting from production process that takes place at industry level leads to the total output, x, and generates a gross value added, v(*x*), (Gross value added generation). Value added by *m* I-O industry is then allocated to the *c* value added components, $v^c(x)$, (Gross value added allocation). The loop further continues to the allocation of value added by components to *s* institutional sectors, $v^s(x)$ (Primary distribution of income). The primary income is further redistributed among the institutional sectors through taxation to generate disposable incomes by the *s* institutional sectors, y(*x*), (Secondary distribution of income). Finally the disposable income identifies the final demand by institutional sectors which characterize the final demand by I-O industries, f(*x*), (Final demand formation).

The extended input-output model can be elaborated with the following fundamental equation.

(1) $$X + m = B.i + f$$

where x is the output vector of industry, m is imports vector, matrix B is intermediate consumption and f is the final demand vector. This study employs large part of final demand as endogenous. For this reason, the distributive structural matrices are determined to analyze the exogenous final demand.

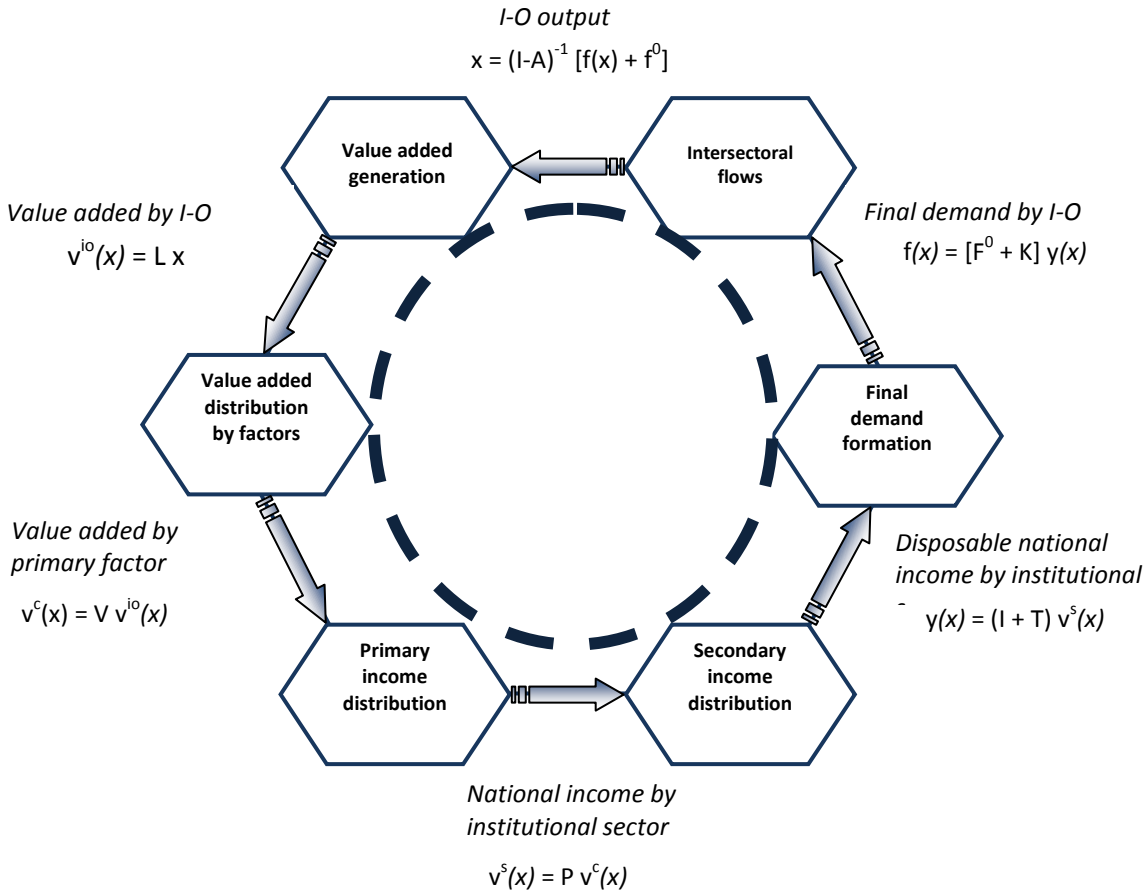
The figure 1 distinguishes:

Gross value added generation (by industry)

(2) $$v(x) = L.\ x$$

where L[*m*,*m*] gives the value added shares by industry originating from the output vector and technical coefficients matrix.

Figure 1. Extended input-output model



Gross value added allocation (by VA components)

(3) $$v^c(x) = V.v(x)$$

where V[*c*,*m*] refers to the allocation of value added to the value added components.

Primary distribution of income (by institutional sectors)

(4) $$v^s(x) = P.v^c(x)$$

Where P[*s*,*c*] represents the distribution of factors' value added income to the institutional

sectors.

Secondary distribution of income (by Institutional sectors)

(5) $$y(x) = (I+T).v^{s}(x)$$

where T[*s*,*s*] refers to the net income transfers among the institutional sectors.

Final demand formation (by industry)

(6) $$f(x) = F^{0}.y(x) + K.y(x) + f^{0}$$

where F^{0} comprises of the consumption demand structure by industry and is given by the product of two matrices, $F^{0} = F^{1}.C$, where $F^{1}[m,s]$ transforms the consumption expenditure by institutional sector into consumption by industry and C[*s*,*s*] represents the consumptions propensities by institutional sector.

The matrix K represents the investment demand shares and is given by $K = K^{1}.s.(I-C)$ where $K^{1}[m,s]$ characterizes the investment demands to I-O industry and scalar *s* represents the share of private savings which is transformed into investment referred to as 'active savings.' f^{0} is a vector of *m* elements which characterizes exogenous demand. Using $F = [F^{0} + K]$, equation 6 becomes

(7) $$f(x) = F.y(x) + f^{0}$$

Substituting through the equations 2-6 in equation 7, we have

(8) $$f(x) = F.[I+T].P.V.L.x+f^{0}$$

The output generation process exhibited by equation 1 is given as

Output generation

(9) $x + m = A.x + f(x)$

where m represents imports, A is technical coefficient matrix and f(*x*) refers to the demand vector.

Substituting the equation 8 in equation 9, we have;

(10) $x = [I - A - F(I + T)\ P.V.L]^{-1}.(f^{0}-m)$

5. Dispersion analysis

From equation 10 we have the structural matrix R which helps quantify the direct and indirect effects of final demand on total output.

(11) $R = [I - A - F\ (I + T)\ P.V.L]^{-1}$

It is easy to describe the structure of production of an economy by constructing two indices of dispersion namely index of power of dispersion and index of sensitivity dispersion (Socci et. al., 2014, 2015). The index of power of dispersion presents backward linkages and indicates the change in the i^{th} good when a unit final demand shock is performed in other commodities. Whereas, the index of sensitivity dispersion gives forward linkages and appreciates the relevance of a change in unit final demand in the i^{th} commodity in terms of a change in the output of all other commodities.

The power of dispersion index, $\pi_{.j}$, can be defined mathematically as follows:

$$\pi_{.j} = \frac{\frac{1}{m} \cdot r_{.j}}{\frac{1}{m^2} \cdot \sum_{j=1}^{m} r_{.j}}$$

where $r_{.j}$ is the j^{th} sector's backward linkage, $\sum_{j=1}^{m} r_{.j}$ is the sum of all backward linkages and m is the total number of commodities. Likewise, the index of sensitivity dispersion, $\tau_{i.}$, is defined as:

$$\tau_{i.} = \frac{\frac{1}{m} \cdot r_{i.}}{\frac{1}{m^2} \cdot \sum_{i=1}^{m} r_{i.}}$$

where $r_{i.}$ is the i^{th} sector's forward linkage, $\sum_{i=1}^{m} r_{i.}$ is the sum of all forward linkages and m is the total number of commodities.

5.1 Results of dispersion analysis – aggregated agriculture sector

It is possible to arrange all commodities according to their ranks in power and sensitivity of dispersion. In the first step, the results of backward and forward linkages of agriculture sector are depicted in table 3. The table also presents the indices of agriculture sector for comparison from previous studies on other African economies namely Egypt, Morroco, Zambia and Algeria. The study on Egypt, Morroco and Zambia is conducted by Soofi (1992) whereas the study on Algeria is carried out by Matallah and Proops (1992). It is assumed here that the structure of production of African economies remain unchanged in the last two decades. This study performs dispersion analysis on Nigerian economy first with incomes and final demand as exogenous variables and then with the same as endogenous variables.

The results show that with exogenous final demand, the index value in backward dispersion is 0.72 (rank 39) whereas it is increased to 0.95 (rank 36) with endogenous final demand. However,

it is remained below the mean index value (i.e. 1). In other words, the endogeniety has improved somehow the backward linkage of agriculture sector from poor to weak level but not to strong level[7]. Comparing with other African economies, the structure, with exogenous incomes and final demand, is consistent with Zambian and Algerian structure having index values less than one, and inconsistent with the structures of Egypt and Zambia presenting strong backward linkage with index values greater than one.

Table 3. Agriculture sector dispersion analysis

	Backward dispersion				**Forward dispersion**			
	Idx-ExIFD	**Rk**	**Idx-EnIFD**	**Rk**	**Idx-ExIFD**	**Rk**	**Idx-EnIFD**	**Rk**
Nigerian Economy	0.72	39	0.95	36	1.57	5	7.42	1
Egyptian Ecoomy	1.24	9			12.34	4		
Moroccon Economy	1.29	6			12.03	6		
Zambian Economy	0.54	15			0.45	14		
Algerian Economy	0.86	12			0.97	6		

Note: The total number of sectors of Nigerian, Egyptian, Moroccon, Zambian and Alegerian economies is 40, 24, 33, 30 and 12 respectively.
Idx-ExIFD = Index Exogenous Income & Final Demand; Idx-EnIFD = Index Endogenous Income & Final Demand; Rk = Rank

Findings of forward dispersion analysis depict that the index value of agriculture sector in Nigerian economy changes significantly from 1.57 (rank 5) in exogenous setup to 7.42 (rank 1) with endogenous incomes and final demand. This finding confirms the significant impact of endogenising the incomes and consumptions of institutional sectors into the structure of production of agriculture sector albeit it has a strong backward linkage in exogenous setup. To compare with previous findings, the forward linkage finding, with exogenous setup, of Nigerian agriculture sector is consistent with those of Egyptian and Morrocon economies and inconsistent with the structures of Zambian and Algerian economies.

[7] Strong linkage includes index value equals to or greater than 1. Weak linkage includes index value equals to o greater than 0.80 and less than 1.00. Poor linkage includes index value less than 0.80.

5.2 Results of dispersion analysis – disaggregated agriculture sector

Tables 4 and 5 present the results of backward and forward dispersion analysis of agriculture sectors respectively. There are 27 agriculture sectors under study. The sectors with indices equal to or above unity have strong linkages whereas the sectors with indices less than one have weak or poor linkages. The index values are obtained both with exogenous incomes and final demand and with endogenous incomes and final demand. The difference between the two is also depicted. The detail tables are presented in appendices 4a and 5a.

5.2.1 Backward Dispersion – Results

Tables 4 depicts that the agriculture commodities with index value one or greater, in exogenous setup, are 'Wheat unprocessed, index value 1.083(Rk 26)' 'Oranges, index value 1.23(Rk 7)' 'Soya beans, index value 1.21(Rk 10),' Cassava unprocessed, index value 1.49(Rk 1),' 'Other crops, index value 1.03(Rk 31),' 'Fish-unprocessed-capture, index value 1.03(Rk32),' and 'Fish-unprocessed-aqua, index value 1.03(Rk 32)'. Among them the index values of 'Fish-unprocessed-capture' and 'Fish-unprocessed-aqua' have been increased to 8 percent, in endogenous setup, with their new values and ranks as 1.11(Rk 5) and 1.11(Rk 6) respectively. On the other hand, the rest of these commodities have undergone a decline in the index values. The significant decline is observed in 'Cassava unprocessed' with index value changed from 1.49(Rk 1) to 0.96(Rk 57) presenting 36 percent decrease. This means that the commodity 'Cassava unprocessed' shifts from strong backward linkage zone to weak backward linkage zone after endogenizing the income and final demand in the structure of production. The other commodities which had index value one or more also evidence a decline after enogeniety but they remain in the zone of strong backward linkage except 'Soya beans' with 18 percent

decrease from index value 1.21(Rk 10) to 0.99(Rk 44).

Table 4: Backward Dispersion – Agriculture subsectors

	Idx-ExIFD	Rank	Idx-EnIFD	Rank	Diff
AGRICULTURE					
Rice unprocessed	0.95	45	0.97	47	2%
Wheat unprocessed	1.08	26	1.05	39	-3%
Maize	0.63	61	0.91	60	45%
Sorghum	0.93	46	0.97	49	4%
Millet	0.61	64	0.91	64	48%
Other Cereals	0.74	56	0.95	54	28%
Vegetables	0.73	57	0.94	55	29%
Bananas	0.85	49	0.97	50	14%
Plantains and others	0.55	65	0.90	65	63%
Pineapples	0.86	48	0.97	48	13%
Oranges	1.24	7	1.04	41	-16%
Other Fruits and nuts	0.82	53	0.96	52	17%
Soya beans	1.21	10	0.99	44	-18%
Groundnuts	0.62	63	0.91	63	47%
Oilseeds and oleaginous fruits	0.73	58	0.92	61	26%
Cassava unprocessed	1.49	1	0.96	57	-36%
Yams	0.79	54	0.95	53	20%
Potatoes	0.65	60	0.93	56	43%
Sweet potatoes	0.88	47	0.98	46	10%
Edible roots and tubers	0.62	62	0.92	58	49%
Stimulant and spice etc.	0.55	66	0.91	62	66%
Pulses	0.83	51	0.96	51	15%
Other Crops	1.03	31	1.00	45	-3%
Livestock & poultry	0.84	50	1.12	15	34%
Forestry	0.78	55	1.16	1	49%
Fish-unprocessed-capture	1.03	32	1.11	5	8%
Fish-unprocessed-aqua	1.03	33	1.11	6	8%

Idx-ExIFD = Index Exogenous Income & Final Demand; Idx-EnIFD = Index Endogenous Income & Final Demand

All the other commodities with previous index values less than unity evidence an appreciation in endogenous setup albeit they remain in weak backward linkage zone except ‘Live stock and poultry’ and ‘Forestry.’ The percentage increase in ‘Live stock and poultry’ is 34 percent, shifting index value from 0.84(Rk 50) to 1.12(Rk 15), whereas in ‘Forestry’ is 49 percent, moving it from poor linkage (0.78, Rk 55) to a strong linkage (1.16, Rk 1). These are very

important findings as they confirm the role of income distribution and final demand in the structure of production of the economy.

5.2.2 Forward Dispersion - Results

Table 5 shows that the only agriculture commodity with strong forward linkage in exogenous setup is ‘Cassava unprocessed’ with index value 1.47 and rank 9. However, after endogenizing incomes and finals demand, it evidences a significant decline of 67 percent and lies in poor forward linkage zone with index value 0.48 and rank 28. Few agriculture commodities with weak forward linkage in exogenous setup are ‘Rice unprocessed,’ ‘Sorghum,’ ‘Oranges,’ ‘Soya beans,’ ‘Oilseeds and oleaginous fruits,’ ‘Other crops,’ ‘Livestock & poultry,’. All of these commodities except ‘Livestock & poultry’ undergo a decrease in index values in the endogenous and lie in the zone of poor forward linkage. The commodity ‘Livestock & poultry’ has a 1 percent increase in index value in endogenous setup and remained in weak linkage zone with new value 0.93 (Rk 18).

The remaining agriculture commodities had poor forward linkages in exogenous setup and they observe further decline in endogenous setup except ‘Vegetables,’ ‘Plantains and other,’ and ‘Yams.’. It is obvious from table 5 that the commodities ‘Vegetables’ and ‘Yams’ evidence a significant increase in index values with 240 percent and 401 percent respectively. These commodities are shifted from poor linkage zone to strong linkage zone. The new index values and of ‘Vegetables’ and ‘Yams’ are 2.25 (Rk 11) and 3.28 (Rk 7) respectively. The findings of forward linkage analysis confirm the impact of institution’s income and final demand on the structure of production.

Table 5: Forward Dispersion –Agriculture sectors

	Idx-ExIFD	Rank	Idx-EnIFD	Rank	Diff
AGRICULTURE					
Rice unprocessed	0.88	23	0.53	26	-40%
Wheat unprocessed	0.75	34	0.22	44	-71%
Maize	0.63	53	0.55	24	-13%
Sorghum	0.92	19	0.59	23	-36%
Millet	0.63	54	0.38	36	-40%
Other Cereals	0.62	55	0.05	63	-92%
Vegetables	0.66	47	2.25	11	240%
Bananas	0.67	45	0.16	51	-76%
Plantains and others	0.59	59	0.65	19	11%
Pineapples	0.68	42	0.43	32	-37%
Oranges	0.86	25	0.33	37	-62%
Other Fruits and nuts	0.67	46	0.18	49	-73%
Soya beans	0.84	26	0.09	58	-89%
Groundnuts	0.75	35	0.18	48	-76%
Oilseeds and oleaginous fruits	0.93	18	0.33	40	-65%
Cassava unprocessed	1.47	9	0.48	28	-67%
Yams	0.65	49	3.28	7	401%
Potatoes	0.56	62	0.32	39	-42%
Sweet potatoes	0.66	48	0.07	59	-89%
Edible roots and tubers	0.57	61	0.10	57	-82%
Stimulant and spice etc.	0.60	56	0.11	55	-82%
Pulses	0.64	50	0.27	46	-58%
Other Crops	0.87	24	0.27	43	-68%
Livestock & poultry	0.92	20	0.93	18	1%
Forestry	0.73	37	0.16	50	-78%
Fish-unprocessed-capture	0.60	60	0.28	42	-53%
Fish-unprocessed-aqua	0.58	57	0.11	53	-80%

Idx-ExIFD = Index Exogenous Income & Final Demand; Idx-EnIFD = Index Endogenous Income & Final Demand

6. Conclusion

The preference for sectors with strong direct and indirect connections is based on the following factors. First, the sectors with strong linkages give rise to the wider amplitude of the cyclical fluctuations of sectors. This is because the changes in the demand of commodities lead to amplified changes in the demand of goods used in producing them thereby accelerates the cycle

of production. Second, sectors with strong industry connections are likely to generate higher output and employment per unit of the final demand than sectors with weak or poor industry ties. Third, the enclave sectors tend to generate a skewed income distribution. This happens in developing countries where these geographically and technologically isolated industries produce primarily for exports or for the domestic population that is connected to the enclave enterprises. Fourth, the input-output table and SAM present the flows or information flows wherein an order to a sector to supply its output also serves as an information flow of demand for that sector. Therefore, large measures of inter-industry ties imply extensive information flows among the sectors of the economy. Fifth, inter-industry transactions are vital sources of technology transfer and productivity growth.

The SAM provides an accounting framework for modeling the income circular flow. The SAM multipliers are used for multi-industry and multi-sectoral analyses in different policy implications. This study presents an empirical analysis of propagation in the structure of production particularly in the structure of agriculture sector. It combines the aggregate and the disaggregated levels of analysis and identifies the key sectors/subsectors both in the exogenous and endogenous setup. The comparison of both findings confirm that the composition of income distribution and consumption expenditure significantly influences the composition and the aggregated and disaggregated order of structure of agriculture production.

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Table A1. Sectors/Subsectors in the Nigeria SAM

Sr	Sectors/Subsectors	Sr	Sectors/Subsectors
	AGRICULTURE	34	Cement, stone, plastic, Quarrying and Other Minerals
1	Rice unprocessed	35	Oil Refining
2	Wheat unprocessed	36	Textile, Leather, Apparel and Footwear
3	Maize	37	Wood and Wood Products
4	Sorghum	38	Pulp, Paper And Paper Products
5	Millet	39	Fertilizers, pesticides, chemical and pharmaceutical Products
6	Other Cereals	40	Non-Metallic Products
7	Vegetables	41	Plastic and Rubber products
8	Bananas	42	Basic metal , Iron and Steel
9	Plantains and others	43	Motor vehicles & assembly
10	Pineapples	44	Other Manufacturing
11	Oranges		**MINING**
12	Other Fruits and nuts	45	Coal Mining
13	Soya beans	46	Crude Petroleum and Natural Gas
14	Groundnuts	47	Metal Ores
15	Oilseeds and oleaginous fruits		**SERVICES**
16	Cassava unprocessed	48	Electricity, Water Supply and Waste Mgt
17	Yams	49	Construction
18	Potatoes	50	Trade
19	Sweet potatoes	51	Accommodation and food services
20	Edible roots and tubers	52	Transport Road, Water, Air and Rail etc.
21	Stimulant, spice and aromatic crops, n.e.c.	53	Telecommunications
22	Pulses	54	Motion Pictures, Sound recording and Music production
23	Other Crops	55	Publishing
24	Livestock, poultry, meat and animal products	56	Post
25	Forestry	57	Broadcasting
26	Fisheries unprocessed capture	58	Arts, Entertainment and Recreation
27	Fisheries unprocessed aqua	59	Financial Institutions, Insurance etc.
	MANUFACTURING	60	Real Estate
28	Processed Cassava	61	Professional, Scientific and technical services
29	Processed Rice	62	Administrative & Support Services
30	Processed Wheat	63	Public Administration
31	Other Processed Food, Beverage and Tobacco	64	Education
32	Processed Fisheries capture	65	Human Health and social services
33	Processed Fisheries aqua	66	Other Services

Table 4a. Backward dispersion

	Idx-ExIFD	Rank	Idx-EnIFD	Rank	Diff
AGRICULTURE					
Rice unprocessed	0.95	45	0.974	47	2%
Wheat unprocessed	1.08	26	1.050	39	-3%
Maize	0.63	61	0.912	60	45%
Sorghum	0.93	46	0.968	49	4%
Millet	0.61	64	0.905	64	48%
Other Cereals	0.74	56	0.946	54	28%
Vegetables	0.73	57	0.939	55	29%
Bananas	0.85	49	0.967	50	14%
Plantains and others	0.55	65	0.903	65	63%
Pineapples	0.86	48	0.967	48	13%
Oranges	1.24	7	1.041	41	-16%
Other Fruits and nuts	0.82	53	0.959	52	17%
Soya beans	1.21	10	0.994	44	-18%
Groundnuts	0.62	63	0.905	63	47%
Oilseeds and oleaginous fruits	0.73	58	0.917	61	26%
Cassava unprocessed	1.49	1	0.959	57	-36%
Yams	0.80	54	0.953	53	20%
Potatoes	0.65	60	0.928	56	43%
Sweet potatoes	0.88	47	0.975	46	10%
Edible roots and tubers	0.62	62	0.921	58	49%
Stimulant and spice etc.	0.55	66	0.911	62	66%
Pulses	0.83	51	0.962	51	15%
Other Crops	1.03	31	1.001	45	-3%
Livestock & poultry	0.84	50	1.124	15	34%
Forestry	0.78	55	1.160	1	49%
Fish-unprocessed-capture	1.03	32	1.111	5	8%
Fish-unprocessed-aqua	1.03	33	1.111	6	8%
MANUFACTURING					
Processed Cassava	1.44	2	1.132	4	-22%
Processed Rice	0.98	40	1.132	3	16%
Processed Wheat	0.98	41	1.149	2	18%
Other Processed Food & Beverage etc.	1.21	12	0.992	40	-18%
Fish-processed-capture	1.14	20	1.091	9	-4%
Fish-processed-aqua	1.14	19	1.091	10	-4%
Cement, Plastic and Minerals etc.	1.13	22	1.043	20	-7%
Oil Refined	1.21	11	1.035	22	-15%
Textile, Leather, Apparel and Footwear	1.22	9	1.004	30	-18%
Wood and Wood Products	1.16	14	1.031	23	-11%
Pulp, Paper and Paper Products	1.13	21	1.083	14	-4%
Fertilizers & chemical products etc	1.34	3	1.011	33	-25%
Non-Metallic Products	1.30	4	1.047	19	-20%
Plastic and Rubber products	1.28	5	1.031	31	-19%

Table 4a. Continued

Basic metal , Iron and Steel	1.145	16	1.073	16	-6%
Motor vehicles & assembly	1.089	25	1.095	8	1%
Other Manufacturing	1.117	23	1.087	13	-3%
MINING					
Coal Mining	1.078	27	0.610	59	-43%
Crude Petroleum and Natural Gas	0.980	39	1.004	32	2%
Metal Ores	0.983	38	1.023	25	4%
SERVICES					
Electricity, Water Supply and Waste Mgt	1.051	30	0.526	66	-50%
Construction	1.249	6	1.083	12	-13%
Trade	1.139	18	1.090	11	-4%
Accommodation and food services	1.173	13	1.076	17	-8%
Transport Road, Water, Air and Rail etc.	1.143	17	1.041	21	-9%
Telecommunications	1.075	29	0.985	36	-8%
Motion Pictures and Music production	0.970	43	1.006	29	4%
Publishing	1.227	8	1.025	27	-16%
Post	0.829	52	0.892	43	8%
Broadcasting	1.151	15	0.982	37	-15%
Arts, Entertainment and Recreation	1.113	24	1.057	18	-5%
Financial Institutions, Insurance etc.	1.027	35	1.029	24	0%
Real Estate	0.688	59	1.007	28	46%
Professional, Scientific and technical services	0.983	37	1.101	7	12%
Administrative & Support Services	0.969	44	0.965	38	0%
Public Administration	1.028	34	0.905	42	-12%
Education	1.021	36	0.989	35	-3%
Human Health and social services	1.075	28	0.992	34	-8%
Other Services	0.974	42	1.020	26	5%

Table 5a. Forward dispersion

	Idx-ExIFD	Rank	Idx-EnIFD	Rank	Diff
AGRICULTURE					
Rice unprocessed	0.88	23	0.53	26	-40%
Wheat unprocessed	0.75	34	0.22	44	-71%
Maize	0.63	53	0.55	24	-13%
Sorghum	0.92	19	0.59	23	-36%
Millet	0.63	54	0.38	36	-40%
Other Cereals	0.62	55	0.05	63	-92%
Vegetables	0.66	47	2.25	11	240%
Bananas	0.67	45	0.16	51	-76%
Plantains and others	0.59	59	0.65	19	11%
Pineapples	0.68	42	0.43	32	-37%
Oranges	0.86	25	0.33	37	-62%
Other Fruits and nuts	0.67	46	0.18	49	-73%
Soya beans	0.84	26	0.09	58	-89%
Groundnuts	0.75	35	0.18	48	-76%
Oilseeds and oleaginous fruits	0.93	18	0.33	40	-65%
Cassava unprocessed	1.47	9	0.48	28	-67%
Yams	0.65	49	3.28	7	401%
Potatoes	0.56	62	0.32	39	-42%
Sweet potatoes	0.66	48	0.07	59	-89%
Edible roots and tubers	0.57	61	0.10	57	-82%
Stimulant and spice etc.	0.60	56	0.11	55	-82%
Pulses	0.64	50	0.27	46	-58%
Other Crops	0.87	24	0.27	43	-68%
Livestock & poultry	0.92	20	0.93	18	1%
Forestry	0.73	37	0.16	50	-78%
Fish-unprocessed-capture	0.60	60	0.28	42	-53%
Fish-unprocessed-aqua	0.58	57	0.11	53	-80%
MANUFACTURING					
Processed Cassava	0.98	16	1.22	15	25%
Processed Rice	0.76	33	0.07	61	-91%
Processed Wheat	0.90	21	0.59	45	-35%
Other Processed Food & Beverage etc.	0.80	29	4.39	3	450%
Fish-processed-capture	0.80	30	0.15	54	-81%
Fish-processed-aqua	0.79	31	0.08	60	-90%
Cement, and Minerals etc.	0.63	52	0.37	35	-41%
Oil Refined	1.44	10	0.73	20	-50%
Textile, Leather, Apparel and Footwear	0.73	38	0.43	38	-42%
Wood and Wood Products	0.90	22	0.33	41	-64%
Pulp, Paper and Paper Products	0.68	43	0.46	30	-32%
Fertilizers & chemical products etc	1.54	7	0.56	29	-64%
Non-Metallic Products	0.84	28	0.42	33	-49%
Plastic and Rubber products	1.23	13	0.46	30	-63%

Table 5a. Continued

Basic metal , Iron and Steel	0.71	41	0.62	21	-13%
Motor vehicles & assembly	1.27	12	1.73	13	36%
Other Manufacturing	1.48	8	2.62	10	77%
MINING					
Coal Mining	0.60	58	0.10	56	-84%
Crude Petroleum and Natural Gas	5.44	1	5.04	2	-7%
Metal Ores	0.55	66	0.03	66	-94%
SERVICES					
Electricity, Water Supply and Waste Mgt	0.93	17	0.40	34	-57%
Construction	1.09	15	4.08	4	275%
Trade	0.55	64	0.05	62	-91%
Accommodation and food services	0.84	27	0.52	25	-38%
Transport Road, Water, Air and Rail etc.	1.61	6	2.15	12	33%
Telecommunications	2.72	3	7.08	1	160%
Motion Pictures and Music production	0.72	40	0.59	22	-18%
Publishing	0.55	63	0.04	65	-92%
Post	0.55	65	0.05	64	-92%
Broadcasting	1.43	11	0.94	17	-34%
Arts, Entertainment and Recreation	0.67	44	0.13	52	-80%
Financial Institutions, Insurance etc.	1.14	14	3.55	5	211%
Real Estate	3.09	2	3.40	6	10%
Professional, Scientific and technical services	2.56	4	2.79	9	9%
Administrative & Support Services	0.73	39	0.20	47	-73%
Public Administration	0.78	32	3.27	8	320%
Education	0.64	51	1.13	16	77%
Human Health and social services	0.74	36	0.47	31	-36%
Other Services	1.63	5	1.42	14	-13%