Research Note

FINANCIAL LINKAGES IN THE NIGERIAN ECONOMY: AN EXTENDED MULTISECTORAL MODEL ON THE SOCIAL ACCOUNTING MATRIX

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This study constructs a social accounting matrix for Nigeria for 2010. An extended multisectoral model is calibrated to analyze the backward (power) and forward (sensitivity) dispersion to identify the key industries in the economy and their importance to other industries in the economy. The study identifies financial services as one of the key industries of the Nigerian economy, highlighting its greater importance and role in boosting economic growth. Several policy options may be simulated to investigate the spillover effects in the whole economy.

1. Introduction

Nigeria's financial services industry has risen to a peak over the last decade, but it is by no means certain that this boom will transfer into economic growth – not until empirical evidence proves this to be consistent growth. Recent years have shown major consolidation in banking

activity, with the number of banks reduced from 89 to 20 and a considerable increase in capitalization.[1] This consolidation has significantly increased the financial intermediation level by doubling the number of bank branches, introduced new banking activities, and included infrastructure and oil project financing.

The global financial crisis and large swings in oil prices have hit the Nigerian economy heavily, resulting in increased general government deficit, reduced public spending, and increased deficit in the current account. The current scenario has also weakened corporate balance sheets and lowered the banks' resilience.[2] On the other hand, the depreciation of the Naira and drop in investor confidence has led to growing pressure on the financial sector; however, the banks appear resilient though nonperforming loans have risen in the fragile economy (Fig. 1).

The ongoing situation calls for prudent policies to boost the economy as a whole and the key products that play an important role in economic growth. Notwithstanding that financial services are an important industry to the economy, it is imperative to find linkages with other activities in the economy, as the interdependence of different activities helps to enact different policy options to improve efficiency as well as increase the economic growth.

This study conducts extended multisectoral analysis to identify the key products of Nigeria's economy generally and financial services specifically. To this end, a social accounting matrix (SAM) was constructed for the Nigerian economy for 2010, which is elaborated in the next section. An extended multisectoral model is discussed in section 3, followed by dispersion analysis in section 4. The study concludes in section 5.

2. Social accounting matrix

A SAM integrates 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. A SAM presents the data framework to describe the circular income flow that stems from market interactions among institutions (Ciaschini & Socci 2006, 2007a,b). The final demands determine total outputs, which in turn generate the value added by commodities. The value added gives rise to domestic incomes by primary factors that create disposable income by institutional sectors. Finally, these domestic incomes bring about the final demands, thereby closing the loop. The SAM matrix representation encompasses a consistent nucleus that can be extended accordingly in the development of economy-wide policy models (Pyatt & 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 the SAM is obtained in two steps. First, the official national accounts of Nigeria for 2010 are arranged in the national accounting matrix (NAM) as a general reference framework. Second, a disaggregated SAM is derived, consistent with the objective of the project.

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[1] Making Finance Work for Africa. Retrieved from https://www.mfw4a.org/nigeria/financial-sector-profile.html #c11153. Accessed November 1, 2016

[2] International Monetary Fund. Retrieved from https://www.imf.org/external/pubs/ft/scr/2016/cr16101.pdf. Accessed on December 12, 2016

Figure 1.   Nigeria's financial soundness indicators, 2011–2015 (%)
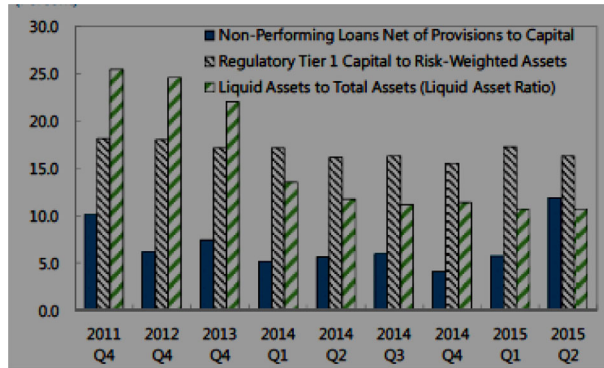
Source: Central Bank of Nigeria and International Monetary Fund.

The NAM describes economic flows within the Nigerian economy. It integrates national accounts and other sources of information with economic theory. To obtain a NAM, the information on national accounts and other statistical data was collected from the National Bureau of Statistics Nigeria, the Central Bank of Nigeria, the Joint Tax Board, the Food and Agriculture Organization, the General Household Survey (2010–2011), and the World Bank. Moreover, information from a previous Nigerian SAM for 2006 developed by the International Food Policy Research Institute in 2010 was also used (Nwafor *et al*. 2010).

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

In the NAM, commodities refer to the goods and services that are produced by firms, while activities refer to the entities, such as firms and farms, that produce goods and services (Breisinger *et al.* 2009). The activities produce commodities by employing other goods and services as intermediate consumption and 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 (R6-C1), and imports (R8-C1). The sum of first column gives the total supply of goods and services available in the market. Intermediate consumption (R1-C2) in the second column is a payment from activities to commodities for goods and services in the domestic market used in the production process. Column 2 also registers the value added (R3-C2) and production taxes (R6-C2). The sum of column C2 gives the total output by activities in the economy.

Column C3 contains wages (R4-C3), profits of firms (R5-C3), and government share of profits (R6-C3). The sum of column C3 gives the total factor income. Column C4 presents the total expenditure of households in terms of household consumption (R1-C4), personal income tax (R6-C4), and household savings (R7-C4). Column C5 gives the total expenditure of firms as the sum of transfers to households (R4-C5), company income tax (R6-C5), firms' savings

Table 1. National accounting matrix framework

	n.	Commodities C1	Activities C2	Factors C3	Households C4	Firms C5	Government C6	Capital Formation C7	ROW C8	Total
Commodities	R1		Intermediate consumption		Household consumption		Government consumption	Gross investment	Exports	T1
Activities	R2	Domestic supply								T2
Factors	R3		Value added							T3
Households	R4			Wages and salaries		Transfers to households	Transfers to households		Foreign remittances	T4
Firms	R5			Gross operating surplus						T5
Government	R6	Taxes on products	Production taxes	Gross operating surplus	Personal income tax	Company income tax			Transfers from abroad	T6
Capital Formation	R7				Household savings	Firms savings	Government savings		Current account balance	T7
ROW	R8	Imports				Payment to ROW				T8
Total		T1	T2	T3	T4	T5	T6	T7	T8	

ROW, rest of world.

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(R7-C4), and payment to rest of the world (R8-C5). Government expenditure is shown in column C6, summing up government consumption (R1-C6), transfers to households (R4-C6), and government savings (R7-C6). Columns C7 lists direct and indirect taxes (R6-C6) received by the government from all economic agents. Investment demand (R1-C7) is described in column C7, and column C8 summarizes exports (R1-C8), foreign remittances (R4-C8), government income from abroad (R6-C8), and the current account balance (R7-C8). Column C8 gives the total foreign exchange inflow.

The column sums of the NAM present the expenditure, while the corresponding row sums provide the incomes of the economic entities. NAM accounts can be used to find the gross domestic product (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 (R6-C2), and taxes on products (R6-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-C7) plus exports (R1-C8) minus imports (R8-C1). Given the simple aggregate structure, the NAM for Nigeria for 2010 is derived by integrating the accounts and other statistical data. The final NAM developed in the current study is shown in Table 2.

The disaggregation of commodities and activities is done using supply and use tables provided by the Nigerian National Bureau of Statistics. The symmetric input–output (I–O) tables have been developed from supply–use tables following the procedure used by Miller and Blair (2009). Table 3 presents the list of commodities/activities and their respective share of the country's GDP. The aggregate agriculture sector share of GDP is 23.6%, of which yams has the highest share at 6%. The aggregate manufacturing sector has a 7% share of GDP, the highest of which is occupied by other processed food, beverages, and tobacco. The mining sector comprises 15.4% of GDP share with crude petroleum and natural gas the highest at 15.3%. The highest share of Nigerian GDP is presented by the aggregate service sector with 54%, of which trade has the highest share at 16.5%. The financial sector occupies 3.5% of the total GDP.

Classification of primary factors and households is made using information from the 2010–2011 General Household Survey for Nigeria. The disaggregated SAM includes the following accounts: 66 commodities;[3] 66 activities;[4] 8 primary factors;[5] 26 institutional sectors;[6] ROW; and capital formation.

3. Extended multisectoral model

The current study employs a multi-industry, multi-factor, and multi-sector model with underpinnings that lie in a Miyazawa approach with the generalization of Keynesian consumption function (Miyazawa & Masegi 1963; Miyazawa 1968; Miyazawa 1976; Bulmer-Thomas 1982; Miller & Blair 2010). The distribution of income according to Miyazawa and Masegi (1963) is a factorial distribution that refers to the distribution of income among various

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[3] See Table A1 in appendix

[4] See Table A1 in appendix

[5] These include six labor categories, one category of land and one of capital. See Table A2 for labor categories.

[6] These include 24 categories of households, one of firms, and one of government. See Table A3 for household categories.

Table 2. National accounting matrix for Nigerian economy for 2010 (million naira)

	n.	Commodities C1	Activities C2	Factors C3	Households C4	Firms C5	Government C6	Capital Formation C7	ROW C8	Total
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	857,085	296,263	3,399,682	225,804	2,602,000			411,639	7,792,473
Capital Formation	R7			0	7,423,629	6,993,513	−996,968		−3,829,125	9,591,049
ROW	R8	9,854,750				3,385,511				13,240,261
Total		104,081,928	93,370,093	54,315,992	44,852,941	20,098,908	7,792,473	9,591,049	13,240,261	

Source: Elaborated from NBS official statistical data. ROW, rest of world.

Table 3.   Commodities in the Nigeria SAM and their shares of GDP and agricultural GDP

Commodities	GDP Million Naira	Share of GDP in 2010 (%)
TOTAL GDP	**54,315,992**	
AGRICULTURE	**12,824,341**	**23.6**
Rice unprocessed	360,699	0.7
Wheat unprocessed	23,894	0.0
Maize	708,074	1.3
Sorghum	421,175	0.8
Millet	491,695	0.9
Other cereals	15,321	0.0
Vegetables	2,524,023	4.6
Bananas	104,995	0.2
Plantains and others	961,026	1.8
Pineapples	345,187	0.6
Oranges	98,603	0.2
Other fruits and nuts	150,223	0.3
Soya beans	14,244	0.0
Groundnuts	200,195	0.4
Oilseeds and oleaginous fruits	429,391	0.8
Cassava unprocessed	226,105	0.4
Yams	3,282,060	6.0
Potatoes	382,266	0.7
Sweet potatoes	30,917	0.1
Edible roots and tubers	238,893	0.4
Stimulant, spice and aromatic crops	100,834	0.2
Pulses	216,099	0.4
Other crops	133,462	0.2
Livestock, poultry, meat, and animal products	979,539	1.8
Forestry	135,717	0.2
Fisheries unprocessed capture	187,278	0.3
Fisheries unprocessed aqua	62,426	0.1
MANUFACTURING	**3,797,556**	**7.0**
Processed cassava	230,021	0.4
Processed rice	13,869	0.0
Processed wheat	331,108	0.6
Other processed food, beverage, and tobacco	1,897,360	3.5
Processed fisheries capture	10,690	0.0
Processed fisheries aqua	3,564	0.0
Cement, stone, plastic, quarrying, and other minerals	266,832	0.5
Oil refining	255,152	0.5
Textile, leather, apparel, and footwear	351,801	0.6
Wood and wood products	122,531	0.2
Pulp, paper, and paper products	23,441	0.0
Fertilizers, pesticides, chemical and pharmaceutical products	24,802	0.0
Non-metallic products	57,136	0.1
Plastic and rubber products	30,346	0.1
Basic metal, iron and steel	44,292	0.1
Motor vehicles and assembly	20,151	0.0
Other manufacturing	114,460	0.2
MINING	**8,343,745**	**15.4**
Coal mining	41,333	0.1
Crude petroleum and natural gas	8,300,470	15.3

Table 3. Continued.

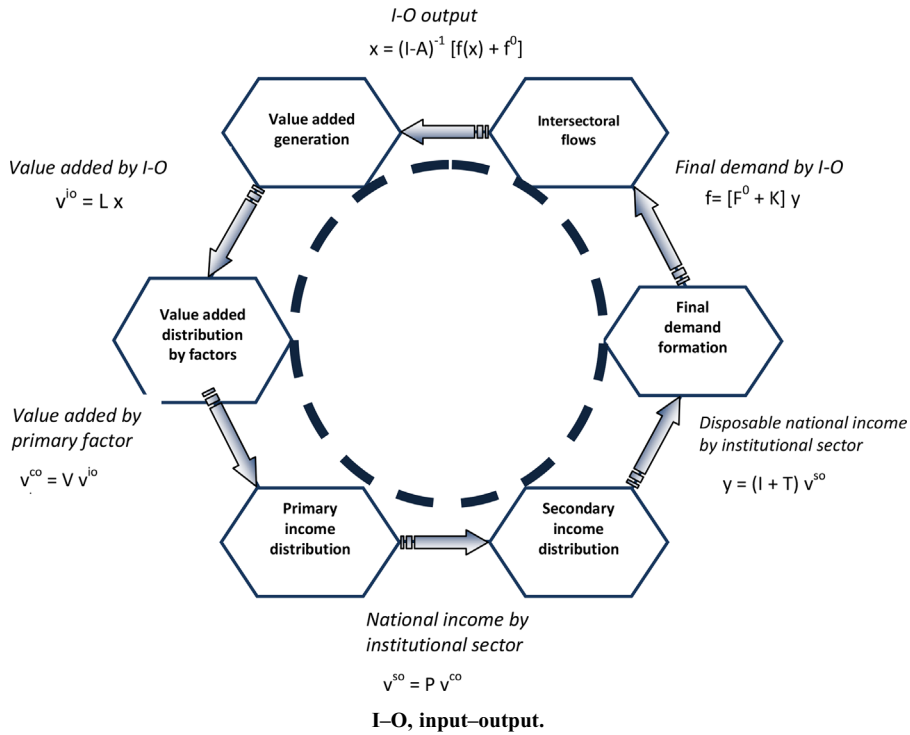| Commodities	GDP Million Naira	Share of GDP in 2010 (%)
Metal ores	1,942	0.0
SERVICES	**29,350,350**	**54.0**
Electricity, water supply, and waste management	1,127,638	2.1
Construction	659,512	1.2
Trade	8,965,416	16.5
Accommodation and food services	227,973	0.4
Transport: Road, water, air, rail, etc.	669,230	1.2
Telecommunications	4,927,129	9.1
Motion pictures, sound recording, and music production	479,181	0.9
Publishing	8,527	0.0
Post	15,536	0.0
Broadcasting	533,236	1.0
Arts, entertainment, and recreation	30,935	0.1
Financial institutions, insurance, etc.	1,908,804	3.5
Real estate	4,127,988	7.6
Professional, scientific, and technical services	1,686,897	3.1
Administrative and support services	13,139	0.0
Public administration	1,998,470	3.7
Education	782,142	1.4
Human health and social services	330,123	0.6
Other services	858,474	1.6

GDP, gross domestic product; SAM, social accounting matrix.

production factors. In contrast, distribution according to Pyatt and Round (1979) refers to institutional distribution, which is the distribution of current income among the various institutions of the economy.[7] However, the model is based on a SAM scheme presenting the extended income circular flow, which incorporates income generation, primary income distribution, and secondary income distribution (Ciaschini & Socci 2007a,b). 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 2 portrays the fundamental mechanism of production and distribution in terms of interaction among industries, primary factors of production, and institutional sectors. The arrows in Figure 2 identify the expenditure flow, while the boxes present the transformation of a flow variable into another. The extended IO loop, which allows extended study of propagation, is identified. Starting from the 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.

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[7] See Pyatt (2001) for a discussion of the works of Miyazawa and Pyatt on income distribution.

Figure 2. Extended input–output model

I-O output
$$x = (I-A)^{-1} [f(x) + f^0]$$

Value added generation

Intersectoral flows

Value added by I-O
$$v^{io} = L x$$

Final demand by I-O
$$f = [F^0 + K] y$$

Value added distribution by factors

Final demand formation

Value added by primary factor
$$v^{co} = V v^{io}$$

Disposable national income by institutional sector
$$y = (I + T) v^{so}$$

Primary income distribution

Secondary income distribution

National income by institutional sector
$$v^{so} = P v^{co}$$

I–O, input–output.

As shown in Figure 2, the whole income distribution process creates a feedback loop, with an arrow, between industry output and final demand. It presents several logical phases. The production process that takes place at industry level leads to the total output, x, and generates a gross value added, v^{io} (gross value added generation). Value added by I–O industry is then allocated to the c value added components, v^{co} (gross value added allocation). The loop further continues to the allocation of value added by components to s institutional sectors, v^{so} (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 (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 (final demand formation).

The extended I–O model can be elaborated with the following fundamental equation:

$$x + z = B i + f \tag{1}$$

where x is the output vector of industry, z is the imports vector, and f is the final demand vector. The matrix B[m,m] is intermediate consumption presented by the 66×66 matrix of R1-C2 in Table 2. This study employs a large part of final demand as endogenous. For this reason, the distributive structural matrices are determined to analyze the exogenous final demand. Figure 2 distinguishes:

Gross value added generation (by industry)

$$v^{io} = L \, x \tag{2}$$

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

Gross value added allocation (by value added components)

$$v^{co} = V \, v^{io} \tag{3}$$

where V[*h,m*] is an 8×66 matrix and refers to the allocation of value added to eight factors of production and the total is presented by R3-C2 in Table 2.

Primary distribution of income (by institutional sectors):

$$v^{so} = P \, v^{co} \tag{4}$$

where P[*s,h*] is a 26×8 share matrix represents the distribution of factors' value added income to 26 institutional sectors.

Secondary distribution of income (by institutional sectors):

$$y = (I + T) \, v^{so} \tag{5}$$

where T[*s,s*] refers to the transfers shares among the institutional sectors and is represented by 26×26.

Final demand formation (by industry):

$$f = F^0 \, y + K \, y + f^0 \tag{6}$$

where F^0 comprises the consumption demand structure by industry and is given by the product of two matrices, $F^0 = F^1 C$, where $F^1(66 \times 26)$ transforms the consumption expenditure by institutional sector into consumption by industry and $C(26 \times 26)$ represents the consumption propensities by institutional sector.

The matrix K represents the investment demand shares and is given by $K = K^1 s(I\text{-}C)$, where $K^1[66 \times 26]$ characterizes the investment demands to the 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, demand by ROW. Using $F = (F^0 + K)$, Equation 6 becomes:

$$f = F \, y + f^0 \tag{7}$$

Substituting through Equations 2–6, in Equation 7, we have:

$$f = F \, [I + T] \, P \, V \, L \, x + f^0 \tag{8}$$

The output generation process exhibited by Equation 1 is given as:

Output generation

$$x + z = A x + f \qquad (9)$$

where z represents imports, A is a 66×66 technical coefficient matrix, and f refers to the final demand.

Substituting Equation 8 in Equation 9, we have:

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

4. Dispersion analysis

From Equation 10 we have the structural matrix R, which helps to quantify the direct, indirect, and induced effects of final demand on total output:

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

It is easy to build two types of indices of dispersion that help to identify the role of products in terms of backward and forward linkages following the Rasmussen (1957) approach, respectively, called indices of power of dispersion and sensitivity dispersion, in the economy (Socci *et al.* 2015). The index of power of dispersion indicates the change in the ith good when a unit final demand shock is performed in other commodities. On the other hand, the index of sensitivity dispersion appreciates the relevance of a change in unit final demand in the ith industry 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:

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

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

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

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

It is possible to arrange all commodities with their ranks in power and sensitivity of dispersion. For comparison, the indices are calculated first with a simple I–O model. The final demand section, the final demand by households, government, and ROW, is exogenous. On the other hand, the multisectoral and multi-industry extended model mentioned above includes final demand by ROW as exogenous, whereas final demand by households and government is endogenous.

Table 4 shows the ranking of industries in the index of power of dispersion in both I–O and extended multisectoral models. The unity is the average value of the index. The commodities with indices > 1 have strong backward linkages, whereas the commodities with indices < 1 have weak or poor backward linkages. Table 4 demonstrates that the financial activity has an index value of 1.03 in both exogenous and endogenous setups. The only change is in its rank, which is 35 in the exogenous and 24 in the endogenous setup. This infers that financial activity has strong backward linkage with other industries of the economy, regardless of whether the final demand is exogenous or endogenous in the structure of production.

The index of sensitivity dispersion is portrayed in Table 5 with the commodities arranged with their index values and rankings. It is obvious from Table 5 that the financial sector has an index value above unity in both I–O and extended multisectoral models. Moreover, the industry shows a significant increase in index value and rank with a shift from 1.14 (rank 14) to 3.55 (rank 5). The finding of index of sensitivity of dispersion predicts that the financial sector is strongly linked with other sectors of the economy in a forward direction, which means that it depends significantly on other sectors of the economy. Moreover, the indices of power of dispersion and sensitivity dispersion demonstrate that financial activity is a key industry in the structure of production and income distribution in the Nigerian economy, because it has an index value above unity in both backward and forward dispersion, and the activity lying above unity in both indices is said to be a key industry of the economy (Miller & Blair 2010).

Table 5 also depicts that the there are few sectors that show a significant change from exogenous to endogenous indices. Two that undergo a high jump are other processed food and beverages, etc., which jumps from index 0.80 (rank 29) to 4.39 (rank 3) and telecommunications, which changes from index 2.72 (rank 3) to 7.08 (rank 1).

Although the forward and the backward linkages of financial services are the same or less than those of other processed food and beverages, etc. and telecommunication, the economic ripple effect on the growth of the Nigerian economy through the linkage of the financial sector is recognized as similar to that of the processed food and communication sectors from the viewpoint of fund circulation that cannot be incorporated in the SAM framework.

Tables 6 and 7 present a comparison of multipliers of Leontief I–O and extended I–O models for financial services, other processed food and beverages, etc., and telecommunication. Table 6 demonstrates the rows of multiplier matrices that present the contribution of output of a particular industry to all other industries of the economy. Alternatively, the row shows the demand of particular industry's output by all other industries of the economy. It is obvious from the multipliers that the induced income and expenditure accounts significantly impact the structure of the economy as the multipliers of all three industries jump to higher values after endogenizing the income–expenditure.

On the other hand, Table 7 presents the columns of multiplier matrices for financial services, other processed food and beverages, etc., and telecommunication, both in exogenous and endogenous setups. The column of multiplier matrix posits the additional outputs required by other industries for a dollar of new final demand for the output of particular sector. Table 7 shows a significant jump from exogenous to endogenous values in vegetables, yams, other processed food and beverage, etc., other manufacturing, construction, financial institutions, insurance, etc., transport: road, water, air, rail, etc., telecommunications, real estate, professional, scientific, and technical services, and public administration.

Table 4. Backward dispersion – Index of power of dispersion

	I–O Model (Leonfief)	Rank	Extended Multisectoral Model	Rank
AGRICULTURE				
Rice unprocessed	0.95	45	0.97	47
Wheat unprocessed	1.08	26	1.05	39
Maize	0.63	61	0.91	60
Sorghum	0.93	46	0.97	49
Millet	0.61	64	0.91	64
Other cereals	0.74	56	0.95	54
Vegetables	0.73	57	0.94	55
Bananas	0.85	49	0.97	50
Plantains and others	0.55	65	0.90	65
Pineapples	0.86	48	0.97	48
Oranges	1.24	7	1.04	41
Other fruits and nuts	0.82	53	0.96	52
Soya beans	1.21	10	0.99	44
Groundnuts	0.62	63	0.90	63
Oilseeds and oleaginous fruits	0.73	58	0.92	61
Cassava unprocessed	1.49	1	0.96	57
Yams	0.79	54	0.95	53
Potatoes	0.65	60	0.93	56
Sweet potatoes	0.88	47	0.97	46
Edible roots and tubers	0.62	62	0.92	58
Stimulant and spice, etc.	0.55	66	0.91	62
Cement, plastic, and minerals etc.	1.13	22	1.04	20
Oil refined	1.21	11	1.03	22
Textile, leather, apparel, and footwear	1.22	9	1.00	30
Wood and wood products	1.16	14	1.03	23
Pulp, paper, and paper products	1.13	21	1.08	14
Fertilizers and chemical products, etc.	1.34	3	1.01	33
Non-metallic products	1.30	4	1.05	19
Plastic and rubber products	1.28	5	1.03	31
Basic metal, iron, and steel	1.15	16	1.07	16
Motor vehicles and assembly	1.09	25	1.10	8
Other manufacturing	1.12	23	1.09	13
MINING				
Coal mining	1.08	27	0.61	59
Crude petroleum and natural gas	0.98	39	1.00	32
Metal ores	0.98	38	1.02	25
SERVICES				
Electricity, water supply, and waste management	1.05	30	0.53	66
Construction	1.25	6	1.08	12
Trade	1.14	18	1.09	11
Accommodation and food services	1.17	13	1.08	17
Transport: road, water, air, rail, etc.	1.14	17	1.04	21
Telecommunications	1.07	29	0.98	36

(*continued.*)

Table 4. Continued.

	I–O Model (Leonfief)	Rank	Extended Multisectoral Model	Rank
Pulses	0.83	51	0.96	51
Other crops	1.03	31	1.00	45
Livestock and poultry	0.84	50	1.12	15
Forestry	0.78	55	1.16	1
Fish-unprocessed-capture	1.03	32	1.11	5
Fish-unprocessed-aqua	1.03	33	1.11	6
MANUFACTURING				
Processed cassava	1.44	2	1.13	4
Processed rice	0.98	40	1.13	3
Processed wheat	0.98	41	1.15	2
Other processed food and beverage, etc.	1.20	12	0.99	40
Fish-processed-capture	1.14	20	1.09	9
Fish-processed-aqua	1.14	19	1.09	10
Motion pictures and music production	0.97	43	1.01	29
Publishing	1.23	8	1.02	27
Post	0.83	52	0.89	43
Broadcasting	1.15	15	0.98	37
Arts, entertainment, and recreation	1.11	24	1.06	18
Financial institutions, insurance, etc.	1.03	35	1.03	24
Real estate	0.69	59	1.01	28
Professional, scientific, and technical services	0.98	37	1.10	7
Administrative and support services	0.97	44	0.96	38
Public administration	1.03	34	0.91	42
Education	1.02	36	0.99	35
Human health and social services	1.07	28	0.99	34
Other services	0.97	42	1.02	26

I–O, input–output.

Table 5. Forward dispersion – Index of sensitivity dispersion

Sector	I-O Model (Leonfief)	Rank	Extended Multisectoral Model	Rank
AGRICULTURE				
Rice unprocessed	0.88	23	0.53	26
Wheat unprocessed	0.75	34	0.22	44
Maize	0.63	53	0.55	24
Sorghum	0.92	19	0.59	23
Millet	0.63	54	0.38	36
Other Cereals	0.62	55	0.05	63
Vegetables	0.66	47	2.25	11
Bananas	0.67	45	0.16	51
Plantains and others	0.59	59	0.65	19
Pineapples	0.68	42	0.43	32
Oranges	0.86	25	0.33	37
Other fruits and nuts	0.67	46	0.18	49
Soya beans	0.84	26	0.09	58
Groundnuts	0.75	35	0.18	48
Oilseeds and oleaginous fruits	0.93	18	0.33	40
Cassava unprocessed	1.47	9	0.48	28
Yams	0.65	49	3.28	7
Potatoes	0.56	62	0.32	39
Sweet potatoes	0.66	48	0.07	59
Edible roots and tubers	0.57	61	0.10	57
Stimulant and spice, etc.	0.60	56	0.11	55
Pulses	0.64	50	0.27	46
Cement and minerals, etc.	0.63	52	0.37	35
Oil Refined	1.44	10	0.73	20
Textile, leather, apparel, and Footwear	0.73	38	0.43	38
Wood and wood products	0.90	22	0.33	41
Pulp, paper, and paper products	0.68	43	0.46	30
Fertilizers and chemical products, etc.	1.54	7	0.56	29
Non-metallic products	0.84	28	0.42	33
Plastic and rubber products	1.23	13	0.46	30
Basic metal, iron, and steel	0.71	41	0.62	21
Motor vehicles and assembly	1.27	12	1.73	13
Other manufacturing	1.48	8	2.62	10
MINING				
Coal mining	0.60	58	0.10	56
Crude petroleum and natural gas	5.44	1	5.04	2
Metal ores	0.55	66	0.03	66
SERVICES				
Electricity, water supply, and waste management	0.93	17	0.40	34
Construction	1.09	15	4.08	4
Trade	0.55	64	0.05	62
Accommodation and food services	0.84	27	0.52	25
Transport: Road, water, air, rail, etc.	1.61	6	2.15	12
Telecommunications	2.72	3	7.08	1
Motion Pictures and Music	0.72	40	0.59	22

(*continued.*)

Table 5. Continued.

	I–O Model (Leonfief)	Rank	Extended Multisectoral Model	Rank
Other Crops	0.87	24	0.27	43
Livestock & poultry	0.92	20	0.93	18
Forestry	0.73	37	0.16	50
Fish-unprocessed-capture	0.60	60	0.28	42
Fish-unprocessed-aqua	0.58	57	0.11	53
MANUFACTURING				
Processed cassava	0.98	16	1.22	15
Processed fice	0.76	33	0.07	61
Processed wheat	0.90	21	0.59	45
Other processed food and beverage, etc.	0.80	29	4.39	3
Fish-processed-capture	0.80	30	0.15	54
Fish-processed-aqua	0.79	31	0.08	60

	I–O Model (Leonfief)	Rank	Extended Multisectoral Model	Rank
production				
Publishing	0.55	63	0.04	65
Post	0.55	65	0.05	64
Broadcasting	1.43	11	0.94	17
Arts, entertainment, and recreation	0.67	44	0.13	52
Financial institutions, insurance, etc.	1.14	14	3.55	5
Real estate	3.09	2	3.40	6
Professional, scientific, and technical services	2.56	4	2.79	9
Administrative and support services	0.73	39	0.20	47
Public administration	0.78	32	3.27	8
Education	0.64	51	1.13	16
Human health and social services	0.74	36	0.47	31
Other services	1.63	5	1.42	14

I–O, input–output.

Table 6. Output multiplier of financial services, other processed food, and telecommunication by total final demand

	Financial Services		Other Processed Food		Telecommunication	
	I–O Model (Leontief)	Extended Multisectoral Model	I–O Model (Leontief)	Extended Multisectoral Model	I–O Model (Leontief)	Extended Multisectoral Model
AGRICULTURE						
Rice unprocessed	0.01	1.63	0.00	2.17	0.05	3.15
Wheat unprocessed	0.02	1.81	0.00	2.21	0.09	3.66
Maize	0.00	1.51	0.00	2.17	0.01	2.77
Sorghum	0.01	1.62	0.00	2.18	0.05	3.10
Millet	0.00	1.50	0.00	2.17	0.00	2.72
Other cereals	0.01	1.59	0.00	2.18	0.03	2.99
Vegetables	0.01	1.57	0.00	2.18	0.03	2.94
Bananas	0.01	1.63	0.00	2.18	0.05	3.12
Plantains and others	0.00	1.49	0.00	2.17	0.00	2.71
Pineapples	0.01	1.63	0.00	2.18	0.05	3.13
Oranges	0.02	1.78	0.00	2.19	0.10	3.58
Other fruits and nuts	0.01	1.61	0.00	2.18	0.04	3.07
Soya beans	0.02	1.68	0.00	2.11	0.08	3.36
Groundnuts	0.00	1.50	0.00	2.16	0.00	2.72
Oilseeds and oleaginous fruits	0.00	1.51	0.00	2.17	0.00	2.75
Cassava unprocessed	0.00	1.50	0.00	2.17	0.00	2.74
Yams	0.01	1.60	0.00	2.18	0.04	3.02
Potatoes	0.00	1.55	0.00	2.17	0.02	2.90
Sweet potatoes	0.01	1.65	0.00	2.18	0.05	3.18
Edible roots and tubers	0.00	1.53	0.00	2.18	0.01	2.83
Stimulant and spice, etc.	0.00	1.51	0.00	2.18	0.00	2.76
Pulses	0.01	1.62	0.00	2.18	0.04	3.10
Other crops	0.01	1.69	0.00	2.17	0.03	3.33
Livestock and poultry	0.00	1.99	0.00	2.32	0.02	4.07
Forestry	0.00	2.08	0.00	2.35	0.02	4.33
Fish-unprocessed-capture	0.01	1.96	0.00	2.25	0.05	4.07
Fish-unprocessed-aqua	0.01	1.96	0.00	2.25	0.05	4.07
MANUFACTURING						
Processed cassava	0.03	1.97	0.00	2.24	0.12	4.12
Processed rice	0.01	2.01	0.00	2.29	0.05	4.18
Processed wheat	0.01	2.04	0.00	2.31	0.05	4.26
Other processed food and beverage, etc.	0.01	1.69	1.46	3.53	0.05	3.41
Fish-processed-capture	0.02	1.92	0.00	2.20	0.10	3.99
Fish-processed-aqua	0.02	1.92	0.00	2.20	0.10	3.99
Cement and minerals, etc.	0.02	1.82	0.00	2.13	0.09	3.77
Oil refined	0.02	1.80	0.00	2.11	0.10	3.72
Textile, leather, apparel, and footwear	0.01	1.72	0.00	2.05	0.05	3.53
Wood and wood products	0.02	1.79	0.00	2.10	0.07	3.69
Pulp, paper, and paper	0.03	1.91	0.00	2.19	0.14	3.99

(*continued.*)

Table 6. Continued.

	Financial Services		Other Processed Food		Telecommunication	
	I–O Model (Leontief)	Extended Multisectoral Model	I–O Model (Leontief)	Extended Multisectoral Model	I–O Model (Leontief)	Extended Multisectoral Model
products						
Fertilizers and chemical products, etc.	0.01	1.72	0.00	2.07	0.03	3.49
Non-metallic products	0.02	1.81	0.00	2.12	0.09	3.74
Plastic and rubber products	0.01	1.76	0.00	2.11	0.03	3.58
Basic metal, iron, and steel	0.02	1.88	0.00	2.17	0.09	3.91
Motor vehicles and assembly	0.03	1.94	0.00	2.22	0.14	4.06
Other manufacturing	0.03	1.92	0.00	2.20	0.14	4.01
MINING						
Coal mining	0.02	0.95	0.00	1.42	0.09	1.82
Crude petroleum and natural gas	0.02	1.76	0.00	2.08	0.07	3.61
Metal ores	0.01	1.79	0.00	2.10	0.04	3.67
SERVICES						
Electricity, water supply, and waste management	0.02	0.78	0.00	1.28	0.07	1.42
Construction	0.02	1.89	0.00	2.18	0.10	3.93
Trade	0.03	1.93	0.00	2.21	0.15	4.04
Accommodation and food services	0.02	1.87	0.00	2.19	0.09	3.88
Transport: Road, water, air, rail, etc.	0.07	1.87	0.00	2.12	0.07	3.74
Telecommunications	0.01	1.70	0.00	2.03	1.18	4.62
Motion pictures and music production	0.01	1.75	0.00	2.08	0.03	3.59
Publishing	0.01	1.76	0.00	2.09	0.03	3.59
Post	0.01	1.54	0.00	1.90	0.04	3.12
Broadcasting	0.01	1.69	0.00	2.02	0.04	3.44
Arts, entertainment, and recreation	0.05	1.88	0.00	2.15	0.09	3.84
Financial institutions, insurance, etc.	1.13	2.92	0.00	2.11	0.08	3.72
Real estate	0.00	1.78	0.00	2.10	0.01	3.65
Professional, scientific, and technical services	0.05	1.99	0.00	2.23	0.04	4.03
Administrative and support services	0.01	1.67	0.00	2.01	0.08	3.45
Public administration	0.01	1.55	0.00	1.91	0.06	3.15
Education	0.02	1.73	0.00	2.05	0.11	3.57
Human health and social services	0.01	1.72	0.00	2.05	0.04	3.50
Other services	0.02	1.79	0.00	2.10	0.09	3.70

I–O, input–output.

Table 7. Output multiplier by final demand of financial services, other processed food and telecommunication

	Financial Services		Other Processed Food		Telecommunication	
	I–O Model (Leontief)	Extended Multisectoral Model	I–O Model (Leontief)	Extended Multisectoral Model	I–O Model (Leontief)	Extended Multisectoral Model
AGRICULTURE						
Rice unprocessed	0.00	0.24	0.08	0.31	0.00	0.23
Wheat unprocessed	0.00	0.09	0.01	0.09	0.00	0.09
Maize	0.00	0.25	0.02	0.27	0.00	0.24
Sorghum	0.00	0.25	0.10	0.35	0.00	0.24
Millet	0.00	0.17	0.02	0.18	0.00	0.16
Other cereals	0.00	0.01	0.00	0.01	0.00	0.01
Vegetables	0.00	1.15	0.01	1.08	0.00	1.09
Bananas	0.00	0.06	0.00	0.06	0.00	0.06
Plantains and others	0.00	0.32	0.00	0.30	0.00	0.30
Pineapples	0.00	0.21	0.00	0.19	0.00	0.20
Oranges	0.00	0.15	0.00	0.14	0.00	0.14
Other fruits and nuts	0.00	0.07	0.00	0.07	0.00	0.07
Soya beans	0.00	0.02	0.00	0.02	0.00	0.02
Groundnuts	0.01	0.08	0.00	0.07	0.00	0.07
Oilseeds and oleaginous fruits	0.01	0.15	0.01	0.14	0.00	0.14
Cassava unprocessed	0.00	0.21	0.01	0.21	0.00	0.20
Yams	0.00	1.64	0.00	1.56	0.00	1.56
Potatoes	0.00	0.15	0.00	0.14	0.00	0.15
Sweet potatoes	0.00	0.02	0.00	0.02	0.00	0.02
Edible roots and tubers	0.00	0.03	0.00	0.03	0.00	0.03
Stimulant and spice, etc.	0.00	0.04	0.00	0.04	0.00	0.04
Pulses	0.00	0.08	0.00	0.10	0.00	0.08
Other crops	0.00	0.12	0.00	0.11	0.00	0.11
Livestock and poultry	0.01	0.43	0.02	0.43	0.00	0.41
Forestry	0.00	0.06	0.00	0.06	0.00	0.06
Fish-unprocessed-capture	0.00	0.13	0.00	0.12	0.00	0.12
Fish-unprocessed-aqua	0.00	0.04	0.00	0.04	0.00	0.04
MANUFACTURING						
Processed cassava	0.00	0.61	0.00	0.57	0.00	0.58
Processed rice	0.00	0.00	0.00	0.01	0.00	0.00
Processed wheat	0.00	0.04	0.00	0.21	0.00	0.10
Other processed food and beverage, etc.	0.00	2.11	1.46	3.53	0.00	2.03
Fish-processed-capture	0.00	0.03	0.00	0.05	0.00	0.03
Fish-processed-aqua	0.00	0.01	0.00	0.02	0.00	0.01
Cement and minerals, etc.	0.00	0.17	0.00	0.16	0.01	0.18
Oil refined	0.01	0.29	0.02	0.32	0.01	0.29
Textile, leather, apparel, and footwear	0.00	0.15	0.00	0.18	0.00	0.15
Wood and wood products	0.00	0.14	0.00	0.13	0.00	0.14
Pulp, paper, and paper	0.00	0.22	0.00	0.20	0.00	0.20

(*continued.*)

Table 7.   Continued.

	Financial Services		Other Processed Food		Telecommunication	
	I–O Model (Leontief)	Extended Multisectoral Model	I–O Model (Leontief)	Extended Multisectoral Model	I–O Model (Leontief)	Extended Multisectoral Model
products						
Fertilizers and chemical products, etc.	0.01	0.19	0.01	0.22	0.00	0.19
Non-metallic products	0.00	0.20	0.00	0.18	0.01	0.20
Plastic and rubber products	0.01	0.24	0.01	0.23	0.01	0.22
Basic metal, iron, and steel	0.00	0.30	0.00	0.28	0.00	0.29
Motor vehicles and assembly	0.02	0.88	0.01	0.81	0.03	0.84
Other manufacturing	0.03	1.35	0.02	1.25	0.04	1.29
MINING						
Coal mining	0.00	0.03	0.00	0.03	0.00	0.03
Crude petroleum and natural gas	0.18	2.57	0.09	2.36	0.19	2.47
Metal ores	0.00	0.00	0.00	0.00	0.00	0.00
SERVICES						
Electricity, water supply, and waste management	0.01	0.18	0.00	0.17	0.00	0.17
Construction	0.01	2.14	0.01	1.96	0.13	2.13
Trade	0.00	0.01	0.00	0.01	0.00	0.01
Accommodation and food services	0.01	0.25	0.01	0.23	0.00	0.23
Transport: Road, water, air, rail, etc.	0.03	1.08	0.03	1.02	0.04	1.03
Telecommunications	0.08	3.72	0.05	3.41	1.18	4.62
Motion pictures and music production	0.01	0.30	0.00	0.27	0.02	0.29
Publishing	0.00	0.01	0.00	0.01	0.00	0.01
Post	0.00	0.01	0.00	0.01	0.00	0.01
Broadcasting	0.03	0.47	0.02	0.43	0.01	0.43
Arts, entertainment, and recreation	0.00	0.05	0.00	0.05	0.00	0.05
Financial institutions, insurance, etc.	1.13	2.92	0.01	1.69	0.01	1.70
Real estate	0.09	1.74	0.06	1.61	0.16	1.73
Professional, scientific, and technical services	0.07	1.41	0.04	1.31	0.04	1.31
Administrative and support services	0.01	0.08	0.00	0.08	0.00	0.08
Public administration	0.00	1.65	0.00	1.54	0.00	1.54
Education	0.00	0.56	0.00	0.52	0.00	0.52
Human health and social services	0.00	0.22	0.00	0.21	0.00	0.21
Other Services	0.09	0.76	0.02	0.65	0.04	0.67

I–O, input–output.

The findings of multipliers confirm the induced impact, and hence the importance, of the income–expenditure phenomenon into the structure of production of the economy and are consistent with the conclusions made by Ronald-Host and Sancho (1992) who stated that detailed SAM analysis is imperative to understand the composition of economy-wide income effects. These findings also inherit the positive effect of Nigeria's policy of increasing capital on the growth of economy as the activities are strongly linked with financial services.

5. Conclusion

This study builds an SAM for Nigeria for 2010 and an extended multisectoral model is calibrated. The backward and forward dispersions are presented to identify the key industries of the Nigerian economy and their importance relative to other sectors of the economy.

The study identifies financial services as one of the key industries of the Nigerian economy, which highlights its greater importance and its role in boosting the economic impact of final demand change. Empirical analysis also confirms that the extension of the income–expenditure phase into the traditional I–O model through the SAM database shows a significant impact on the structure of production of the economy and output multipliers. The role of financial services increases with the primary and secondary income distribution phase. Households, firms, and public administration behavior allow financial services to increase their relevance for final demand activation and formation.

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Appendix

Table A1. Commodities and activities in Nigerian SAM for year 2010

	AGRICULTURE
1	Rice unprocessed
2	Wheat unprocessed
3	Maize
4	Sorghum
5	Millet
6	Other cereals
7	Vegetables
8	Bananas
9	Plantains and others
10	Pineapples
11	Oranges
12	Other fruits and nuts
13	Soya beans
14	Groundnuts
15	Oilseeds and oleaginous fruits
16	Cassava unprocessed
17	Yams
18	Potatoes
19	Sweet potatoes
20	Edible roots and tubers
21	Stimulant, spice and aromatic crops, n.e.c.
22	Pulses
23	Other crops
24	Livestock, poultry, meat, and animal products
25	Forestry
26	Fisheries unprocessed capture
27	Fisheries unprocessed aqua
	MANUFACTURING
28	Processed cassava
29	Processed rice
30	Processed wheat
31	Other processed food, beverage, and tobacco
32	Processed fisheries capture
33	Processed fisheries aqua
34	Cement, stone, plastic, quarrying, and other minerals
35	Oil Refining
36	Textile, leather, apparel, and footwear
37	Wood and wood products
38	Pulp, paper, and paper products
39	Fertilizers, pesticides, chemical and pharmaceutical products
40	Non-metallic products
41	Plastic and rubber products
42	Basic metal, iron, and steel
43	Motor vehicles and assembly
44	Other manufacturing
	MINING
45	Coal mining
46	Crude petroleum and natural gas
47	Metal Ores

	SERVICES
48	Electricity, water supply, and waste management
49	Construction
50	Trade
51	Accommodation and food services
52	Transport: Road, water, air, rail, etc.
53	Telecommunications
54	Motion pictures, sound recording, and music production
55	Publishing
56	Post
57	Broadcasting
58	Arts, entertainment, and recreation
59	Financial institutions, insurance, etc.
60	Real estate
61	Professional, scientific, and technical services
62	Administrative and support services
63	Public administration
64	Education
65	Human health and social services
66	Other services

Note: For symmetry the names of corresponding commodities and activities are the same.

SAM, social accounting matrix.

Table A2.   List of labor categories

Sr	Labor Categories	Explanation of Labor Categories
1	Hired labor agriculture	Hired labor is labor employed by a person who works for someone not a member of household, for example; an enterprise, company, the government, or any other individual
2	Hired labor industry	
3	Family labor agriculture	Family labor means labor employed by a person who works on a farm owned or rented by a member of household. This labor may include cultivating crops, other farming tasks, or caring for livestock that belongs to household or a member of the household.
4	Family labor industry	
5	Self-employed agriculture	Self-employed implies the labor employed by the person who works on their own account or in a business enterprise belonging to the household or someone in the household, such as trader, shopkeeper, barber, dressmaker, carpenter, or taxi driver.
6	Self-employed industry	

Table A3.   List of household categories

Sr	Household Categories
1	North-Centre Urban Food Secure Households
2	North-Centre Urban Food In-Secure Households
3	North-Centre Rural Food Secure Households
4	North-Centre Rural Food In-Secure Households
5	North-East Urban Food Secure Households
6	North-East Urban Food In-Secure Households
7	North-East Rural Food Secure Households
8	North-East Rural Food In-Secure Households
9	North-West Urban Food Secure Households

Table A3. Continued.

Sr	Household Categories
10	North-West Urban Food In-Secure Households
11	North-West Rural Food Secure Households
12	North-West Rural Food In-Secure Households
13	South-East Urban Food Secure Households
14	South-East Urban Food In-Secure Households
15	South-East Rural Food Secure Households
16	South-East Rural Food In-Secure Households
17	South-South Urban Food Secure Households
18	South-South Urban Food In-Secure Households
19	South-South Rural Food Secure Households
20	South-South Rural Food In-Secure Households
21	South-West Urban Food Secure Households
22	South-West Urban Food In-Secure Households
23	South-West Rural Food Secure Households
24	South-West Rural Food In-Secure Households