Nigeria

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1. Introduction

Nigeria is the most populous country in Africa, and the second largest country by GDP after South Africa It possesses the second largest proved oil reserves, after Libya, and it is the top producer of crude oil in Africa (BP, 2011). Hence it is important to have Nigeria represented by an adequate IOT in the GTAP database. GTAP database version 8 includes a Nigerian IOT for the year 1999, which relies on the official 1990 IOT with 30 sectors and an un-official 1999 IOT including 18 sectors (Horridge and Osakwe, 2006; Horridge, 2008). Therefore, a considerable effort is made to use the most recent reliable sources of data to put together a more detailed (38 sectors) and up to date IOT.

2. Data Sources

The Nigerian IOT described here relies mainly on the latest Social Accounting Matrix (SAM) developed for the Nigerian Economy, which represents the monetary flows in 2006 (Nwafor et al., 2010). In addition, data from different domestic sources in Nigeria are used to reconcile several aspects of the SAM and during the conversion process to an IOT. Major domestic sources include, but are not limited to the Nigerian National Bureau of Statistics (NBS) and the Central Bank of Nigeria (CBN).

The Nigerian SAM of Nwafor et al. (2010) comprises 61 activities, 62 commodities, 12 household groups, 3 production factors (labor, land and capital), and 4 tax accounts. In addition, the SAM also includes accounts for government, enterprises, rest of the world, and trade-margins (one account each). The SAM's sectors include 27 cropping and 6 livestock sectors besides fishery and forestry, 2 mining sectors, 12 manufacturing sectors, and 13 services sectors. The detailed nature of the agricultural sector in the SAM leads to a detailed representation of its sectors in the final IOT. However, for manufacturing, some GTAP sectors had to be aggregated to accord the SAM's sectors (Table 1).

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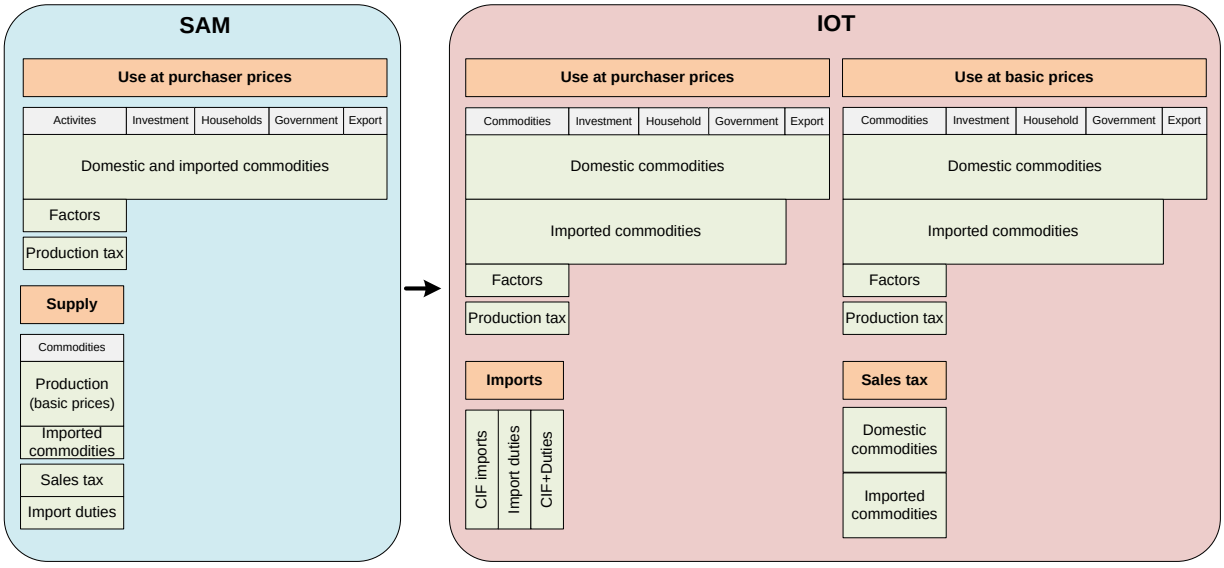
3. Moving from SAM to IOT

SAMs are usually structured in an industry by commodity setup, which implies that the production activities (industries) are separated from their output (commodities). The two accounts are then linked by the make-matrix in which commodities pay activities and the use-matrix where activities pay commodities for intermediate use. Because the required IOT format of the GTAP database is commodity by commodity, conversion was needed in this respect.

Additionally, the procedure of moving from a SAM to an IOT in the from GTAP required form involves generating matrices that distinguish between the use of domestic and imported commodities as well as between the use at basic (tax exclusive) and purchaser (tax inclusive) prices. In the SAM of Nwafor et al. (2010), there is no such distinction. Figure 1 explains the structure of the data in the SAM and the required adjustments to generate the IOT in the format of the GTAP database.

The process depicted in Figure 1 is automatized and coded in GAMS by embedding instructions provided in the GTAP contributor guide (Huff et al., 2000). The GAMS code was developed by McDonald and Lakatos (2009) in collaboration with the GTAP database team. The code is also used for the removal of trade and transport margins, by increasing the consumption of the trade commodity and decreasing consumption of other commodities by the same value.

Figure 1: Moving from the SAM to the IOT database



Source: Own compilation based on Siddig et al. (2012)

4. Special treatments and adjustments

4.1 Mapping and aggregations

The 62 commodities of the SAM are mapped to 38 sectors in the IOT, and the mapping between the two is shown in Table 1. Also the final demand by households is aggregated as the SAM comprises 12 different household groups and the IOT only one. The mapping between the different final demand categories in the SAM and the IOT is shown in Table 2. The three factors of production (labor, capital, land) specified in the SAM are directly included in the IOT without further aggregation or

disaggregation. The same holds true for the enterprises, savings-investments, government and rest of the world accounts.

The submitted IOT of Nigeria for 2006 includes 38 sectors, 8 of which are cropping and 4 livestock activities besides fishery and forestry. The 14 sectors that comprise agriculture and related sectors are results of aggregations from the 32 agricultural sectors of the original SAM (Table 2). On the other side two manufacturing sectors of the standard GTAP aggregation are merged with agricultural activities. c_b (Sugar cane and sugar beet) and sgr (Sugar) were aggregated to one sector, because sugar is represented by only one activity and one commodity in the Nigerian SAM, while it has proven difficult to rely on domestic sources of data to separate them. The same approach is also followed for rmk (Raw milk) and mil (Dairy products).

The Nigerian SAM of Nwafor et al. (2010) is an agricultural-focused SAM, as the agricultural sector is represented by more than half of the total number of activities. On the other hand, the manufacturing sector is relatively aggregated. Therefore ten standard GTAP manufacturing sectors (from 31 to 42) are mapped to two SAM sectors, namely 'Other manufactured products' and 'Fertilizer'. As definitions overlap these two sectors are further aggregated and hence are represented by only one sector in the contributed IOT.

4.2 The Zero-Sectors

Neither the 2006 Nigerian SAM nor the other domestic sources of data provide information on wol (Wool, silk-worm cocoons), gdt (Gas manufacture and distribution) and dwe (Dwellings). Therefore, they are included as zero-sectors in the IOT as suggested by Horridge et al. (2008). Also the GTAP sector, coa (Coal) is included as a zero-sector based on CBN (2012a) and CBN (2012b). The two reports of the CBN show the domestic transactions of coal to be zero during 2010 and 2011 as well as during the first two quarters of 2012.[3]

All remaining 10 manufacturing and 8 service activities are one to one mappings of the standard GTAP sectors or simple aggregates. Because the 2006 Nigerian SAM includes no account for the changes in stock, the resulting IOT provide no information on that as well.

4.3 Mandatory splits

According to Horridge et al. (2008), IOTs contributed to GTAP need to satisfy the condition of the so called 'mandatory splits'. This is the separation of agriculture and food processing, as well as energy, from all other sectors. Except for one case, which is the representation of water distribution and electricity supply by only one utility sector, the SAM of Nwafor et al. (2010) is satisfying the mandatory splits condition.

The approach applied to separate water from electricity, which makes the entire data set compatible to GTAP database by particularly satisfying the mandatory splits condition is described hereafter. Additional data from the Nigerian National Bureau of Statistics (NBS) and the Central Bank of Nigeria (CBN) are used to disaggregate the utility sector of the SAM, which comprises water and electricity in one sector to two separate accounts.

The SAM provides data on the income to the utility commodity from activities (intermediate use). To separate water and electricity, the share of each in the GTAP database version 8 (Narayanan et al., 2012) is used. This assumes that, industries' total consumption of water and electricity changes,

[3] No similar reports were found for the same year of the IOT and SAM, which is 2006.

but the share of each relative to the other is fixed between 1999 (being the base year of the IOT by Narayanan et al. ,2012) and 2006 (the current IOT). Narayanan et al. (2012) also suggests that both commodities are subject to similar tax rate, which is also applied for this IOT. For household's consumption of the two commodities, the share of water in each household group's consumption from NBS (2012) for 2009-2010 is used to calculate water consumption value per household group. This value is then subtracted from the value of the composed utility-consumption to single out electricity consumption value per household group. This assumes that the share of water in total household's expenditure remained the same between 2006 and 2009/10.

4.4 The treatment of taxes

The SAM of Nwafor et al. (2010) includes 4 tax accounts including sales tax and import tax, both are levied on commodities, production tax levied on activities, which is a subsidy in several sectors and income tax on households and enterprises. These 4 accounts are also included in the IOT. More detailed information on the tax accounts and the respective data sources can be found in Nwafor et al. (2010).

5. *Tables of mapping*

Table 1: Mapping between the sectors of the Nigerian SAM, GTAP and IOT sectors

SAM			GTAP			IOT	
No.	**Code**	**Commodity description**	**No.**	**Code**	**Commodity description**	**No.**	**code**
1	crice	Rice	1	pdr	Paddy rice	1	pdr
2	cwhet	Wheat	2	wht	Wheat	2	wht
3	cmaze	Maize	3	gro	Cereal grains nec	3	gro
4	csorg	Sorghum					
5	cmilt	Millet					
6	ccass	Cassava	4	v_f	Vegetables, fruit, nuts	4	v_f
7	cyams	Yams					
8	ccyam	Cocoyams					
9	cpota	Irish potato					
10	cspot	Sweet potato					
11	cplan	Banana and plantain					
16	cveg	Vegetables					
17	cfrt	Fruits					
18	ccoco	Cocoa					
24	cnuts	Nuts					
25	ccash	Cashew					
13	cgnut	Groundnuts	5	osd	Oil seeds	5	osd
14	csoys	Soyabeans					
15	cosed	Beniseed					
21	cpalm	Oil palm					
22	csuga	Sugar and sugar cane	6	c_b	Sugar cane, sugar beet	6	c_b_sgr
			24	sgr	Sugar		
20	ccott	Cotton	7	pfb	Plant-based fibers	7	pfb
12	cbean	Beans	8	ocr	Crops nec	8	ocr
19	ccoff	Coffee					
23	ctoba	Unprocessed tobacco					
26	crube	Rubber					
27	cocrp	Other crops not specified					
28	ccatl	Cattle	9	ctl	Cattle, sheep, goats, horses	9	ctl
29	cgshp	Live goats and sheep					
30	cpoul	Live poultry	10	oap	Animal products nec	10	oap
37	ceggs	Eggs					
31	coliv	Other live animals					
38	cmilk	Milk and dairy products	11	rmk	Raw milk	11	rmk_mil
			22	mil	Dairy products		
Zero sector			12	wol	Wool, silk-worm cocoons	12	wol
33	cfore	Forestry	13	frs	Forestry	13	frs
32	cfish	Fish and fish meat	14	fsh	Fishing	14	fsh
Zero sector			15	coa	Coal	15	coa
47	ccoil	Crude petroleum and natural gas	16	oil	Oil	16	oil_gas
			17	gas	Gas		
49	comin	Other mining	18	omn	Minerals nec	17	omin
34	cbeef	Beef	19	cmt	Meat: cattle, sheep, goats, horse	18	cmt
35	cgsmt	Goat and sheep meat					
39	comet	Other livestock meat	20	omt	Meat products nec	19	omt
36	cpmet	Poultry meat					
41	cofod	Processed food products (excluding beverages)	21	vol	Vegetable oils and fats	20	vol_pcr_ofd
			23	pcr	Processed rice		
			25	ofd	Food products nec		
40	cbevg	Beverages and tobacco products	26	b_t	Beverages and tobacco products	21	b_t
42	ctext	Textiles and leather products	27	tex	Textiles	22	tex_wa

SAM			GTAP			IOT	
No.	**Code**	**Commodity description**	**No.**	**Code**	**Commodity description**	**No.**	**code**
			28	wap	Wearing apparel		p_lea
			29	lea	Leather products		
43	cwood	Wood, wood products, furniture	30	lum	Wood products	23	lum
46	cfert	Fertilizer	33	crp	Chemical,rubber,plastic prods	24	omfc_fert
45	comfc	Other manufactured products	31	ppp	Paper products, publishing		
			34	nmm	Mineral products nec		
			35	i_s	Ferrous metals		
			36	nfm	Metals nec		
			37	fmp	Metal products		
			38	mvh	Motor vehicles and parts		
			40	ele	Electronic equipment		
			41	ome	Machinery and equipment nec		
			42	omf	Manufactures nec		
48	croil	Refined oil	32	p_c	Petroleum, coal products	25	p_c
44	cemfc	Transportation and other equipment	39	otn	Transport equipment nec	26	otn
51	cutil	Electricity and water	43	ely	Electricity	27	ely
			45	wtr	Water	28	wtr
Zero sector			44	gdt	Gas manufacture, distribution	29	gdt
50	ccons	Building and construction	46	cns	Construction	30	cns
54	ctrad	Wholesale and retail trade	47	trd	Trade	31	trd
55	chotl	Hotel and restaurants					
52	crtra	Road transport	48	otp	Transport nec	32	otp
53	cotra	Other transportation	49	wtp	Sea transport	33	atp_wtp
			50	atp	Air transport		
56	ccomm	Telecommunications, Post, broadcasting	51	cmn	Communication	34	cmn
57	cbser	Financial institutions, Insurance, Business service	52	ofi	Financial services nec	35	ofi_isr_obs
			53	isr	Insurance		
			54	obs	Business services nec		
58	crest	Real estate					
62	coser	Private nonprofit organizations, Other services	55	ros	Recreation and other services	36	ros
59	ceduc	Education	56	osg	PubAdmin/Defence/Health/ Education	37	osg
60	cheal	Health					
61	cpser	Public administration					
Zero sector			57	dwe	Dwellings	38	dwe

Table 2: Mapping of final demand between SAM and IOT

SAM		IOT
Description	**Code**	**Code**
Households in rural South South zone	h-rur-ss	hhous
Households in rural South East zone	h-rur-se	
Households in rural South West zone	h-rur-sw	
Households in rural North Central zone	h-rur-nc	
Households in rural North East zone	h-rur-ne	
Households in rural North West zone	h-rur-nw	
Households in urban South South zone	h-urb-ss	
Households in urban South East zone	h-urb-se	
Households in urban South West zone	h-urb-sw	
Households in urban North Central zone	h-urb-nc	
Households in urban North East zone	h-urb-ne	
Households in urban North West zone	h-urb-nw	
Government	GOVT	govt
Savings - Investments	KAP	i_s
Rest of the World	ROW	ROW

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