

A *Angola*

Henrique Nsingui

A.1 Introduction

This document describes the adaptation of the 2015 Angolan input-output (I-O) table for input to the Global Trade Analysis Project (GTAP). The paper is organized as follows. Section 2 briefly describes the source data. Section 3 discusses strengths and limitations of the published input-output (I-O) data. Section 4 discusses the processing to correct anomalies in the raw data. Section 5 presents the mapping between the 145 Angolan I-O sectors, 52 GTAP sectors, and the more aggregated 52 sectors of the submitted table.

A.2 Data Sources

The primary raw input was 145-sector input-output data published by Department of National Account and Statistical Coordination (DNASC) from Account National Statistics Office of Angola (NSO)⁹. The 2015 I-O data was measured in thousands of 2015 Angolan kwanzas. We converted this to millions of kwanzas. First of all, the 2015 DNA raw input-output data satisfy the sectoral balance condition, and contain most of the data ready for conversion to the GTAP format. These data include:

1. Supply and Use tables at purchasers' prices for 145 sectors. The Supply table shows the total outputs of 145 domestic commodities, total imports, transport and trade margins, and taxes on domestic and imported goods, by commodity. The Use table shows the demand for those commodities by industries, private households, government, investment, changes in inventories, and exports.
2. A MAKE matrix of domestic production at basic prices, commodity by activity. The matrix shows the output of 38 activities by 145 commodities. Many industries produce more than one commodity, and many commodities are produced by more than one industry.
3. An Absorption matrix at basic prices showing the use of 145 domestically-produced commodities by 38 industries and by five final users (private consumption, government consumption, investment, exports, and changes in stocks). The matrix also contains the values of compensation of employees and operating surplus, by industry.
4. An Absorption matrix at basic prices showing the use of 145 imported commodities by 38 industries and by five final users (private consumption, government consumption, investment, exports, and changes in stocks).
5. An Absorption matrix of domestic production at market prices, commodity by activity.

⁹Input-output tables Angola 2015, Department of National Accounts and Statistical Coordination, May 2015.

In addition, we have the following data from the Department of National Accounts and Statistical Coordination:

1. Two matrices for trade and transport margins on domestic and imported commodities, 2015.
2. Two matrices of commodity taxes on domestic and imported commodities, 2015.
3. Detailed government revenues by revenue sources for the year 2015¹⁰.
4. Data on the composition of the workforce, by type of employment (namely, wage workers, own-account workers, and non-paid family members), 2015.
5. Data on the composition of the labor force, capital (namely, compensation of employees, gross operating surplus and mixed income), 2015.
6. Data on depreciation, land rentals and capital rentals for ten aggregate sectors, 2015.

A.3 Strengths and Limitations of the Original Input- Output Data

We have conducted a number of checks on the data. They include checks of the non-negativity condition and the balancing conditions of the tables. We also check the plausibility of tax rates, margin rates implied in the data, and the structure of industries' costs and sales. This section discusses the strengths and limitations of the data. The procedures that we used to address these limitations are discussed in the next section.

Strengths

1. As can be seen from the previous section, the original data contain detailed supply and use data for 145 commodities and 38 activities. They provide most of the data, specifically:
 - (a) There are separate domestic and import matrices at basic values;
 - (b) There are separate trade and transport margins on domestic and imported commodities; and
 - (c) There are separate tax data for domestic and imported commodities.
2. The tables are balanced.

Limitations

1. There is no negative signal in the inventory flows in the use matrix.

¹⁰These data are reported by budget statistical from Ministry of Finance, Angola, 2015.

2. There are non-zero flows for changes in inventories of services, and there are margins and taxes on them. In overall, flows should be zeros, because services cannot be stored.
3. NPIHS was not considered as one indicator. It was aggregate in the household consumption. At the industry level, 38 out of 145 sectors in the IO tables 2015 have labour share of less than 20%. Some examples include fruit and vegetable preservation and processing, dairy products, oils and fats, confectionery, etc.
4. The majority of employees are allocated in the Agricultural industry at least 52% and the minimum is oils and fats 0.01% Discussions with DOS reveal that one of the reasons for the low shares is that the labour payment only includes payment to employed workers, not those on self-employment, or unpaid family workers. We will use additional data on these workers to reallocate value added in the economy. We also reduce the level of variability of the industry factor shares.
5. We have negative values in tax minus subsidies because most of the taxes are higher than subsidies in that period.
6. There are no separate values for capital and land rentals. They are grouped in only one vector of operating surplus.
7. There are no data on production taxes.
8. There are no separate data for tariffs or export taxes.
9. There is a value for household consumption of “domestic services,” but these services, it’s one of the industry we used to estimate it.

A.4 Data Processing

In this section we discuss the adjustments procedures, the additional data sources, and the assumptions that we adopted to address the data issues described in the previous section.

1. With regard to some negative values in the tables: because they are very small, we replaced them with zeros.
2. We removed all the non-zeros values of inventories of services in the basic, tax and margin tables. Inventories, taxes and margins for other commodities would be scaled in a later RAS to restore the aggregate inventories, tax and margin values in the original I-O tables.
3. We set the entire export column in the absorption matrix for imports to zeros, and then deduct the same amount from the export column of the absorption matrix for domestically produced goods¹¹. This procedure ensures that the balance of trade remains unchanged. Again, other exports and imports will be scaled later in a RAS to restore their aggregate values in the original I-O tables.

¹¹This procedure is recommended in the Handbook of Input-Output Table Compilation and Analysis, United Nations, New York, 1999.

4. In concerning a commodity Domestic Service to accommodate the value of 7.808,3 million of Kwanzas consumed by households in the original I-O tables. As this industry essentially represents services by domestic servants, we use the following assumption to create the industry's sales and costs structure: All output of the sector is consumed by households (7.808,3 akz million).
5. The indicators as GVA, Compensation of employees, Other Taxes minus subsidies on production and Operating Surplus and Mixed Income are not allocated to Household consumption, Households and NPISH Final Consumption Expenditure, General Government Final Consumption Expenditure, Gross Fixed Capital Formation costs in the sector is payment to labour, and 5% of costs are intermediate inputs. The inputs used in the sectors include soap and detergents, rubber gloves, textile products, motor vehicle, land transport, air transport, business services, public administration, education, and health. They are used in the same proportion as in household consumption bundle.
6. We adjusted the labour payment data for each sector to account for the income of the own account workers and unpaid family workers (non-wage labour). In the original I-O tables, this income of non-wage labour – normally a mix of capital and labour income – was treated as a form of business income. This means that the values of compensation of employees are underestimated, while the values of capital rentals are overestimated. One of the remedies that can be employed in addressing this problem is to impute labour compensation for those workers who are self-employed. To do that, we use the data on sectoral composition of the workforce in Angola in 2015, as reported in Table 1. The data is classified into 1 broad sectors.

Table 8.3 shows that self-employed and unpaid family members comprise over a fifth of the workforce. The shares of self-employed and unpaid family members can be as high as over 70% in the Fishing sector, and more than a half in Agriculture and Forestry sectors. Therefore, there is clearly a need to impute the payment to them to correctly account to the contribution of labour in industry value added.

The adjusted compensation of employees of each sector can be implemented via the following formula¹²:

$$AdjustedCOE_i = OriginalCOE_i \times \frac{TW_s}{NOE_s} \quad (8.1)$$

where COE_i is the compensation of employees in industries i within sector s ; NOE_s is the number of wage employees in sector s , calculated from Table 1; TW_s is the total workforce in sector s , calculated from Table 1.

In the above formula, $\frac{TW_s}{NOE_s}$ is the ratio of the total number of workers to the number of wage workers in sectors. We recalculate the COE values of I-O industries by assuming that:

- (a) All industries within each sector have the same $\frac{TW_s}{NOE_s}$ ratio; and

¹²This formula the ratio of the total number of workers to the number of wage workers in sectors

Table 8.3: Composition of Angolan workforce in 2015 (unit: thousand persons)

Sector	Wage workers Employees	Non-wage workers Own Account Worker	Unpaid Family Workers	Non-wage workers in total workforce
Agriculture, Hunting & Forestry	133.1	723.5	537.7	41.9%
Fishing	180.7	5.06	2.4	2.4%
Mining & Quarrying	149.4	0.46	0.92	3.8%
Manufacturing	135.3	0.83	8.8	47.3%
Electricity, Gas & Water Supply	12.6	0	0	0%
Construction	177.4	2.7	0.4	0.8%
Wholesale & Retail Trade	56.8	2.11	2.7	3.7%
Hotels & Restaurants	129.4	2.57	1.1	2%
Transport, Storage	174.1	0.1	0.03	0.1%
Communications	9.5	0	0.04	0.4%
Financial Intermediation	21.9	0	0	0%
Real Estate, Renting & Business activities	2.2	0	0	0%
Public Admin & Defense	627.9	0.97	1.71	3.3%
Other Service	249.2	0.33	0.4	0.9%
Total	2059.5	738.63	556.2	22.7%

Source: Department of National Accounts and Statistical Coordination

- (b) The average wage rate of non-wage workers is the same as that for the wage workers.

Assumption (b) was later relaxed for eight IO industries for which the formula led to labour payment values that exceeded the industries' total value added. The industries included paddy, food crops, vegetables, fruits, oil palm, flower plants, and restaurants. For these industries, we assumed that the share of capital in total value added was half of their original share in the I-O tables, and recalculated the wage rate of the non-wage workers. This led to the result that non-wage workers received about 50-70% of wage workers in these sectors, which seems plausible.

We adopted the new labour payment figures for manufacturing and services industries, and then recalculated the payment to capital as the difference between the industries value added and payment to labour.

For primary industries (i.e. agriculture and mining industries), we split the value added not only to labour and capital, but also to land. The concept of land includes not only cultivated land area, forest land, and water surface for aquaculture, but also natural resources, such as mines and oil fields, livestock area. Therefore, all the primary industries (i.e. agriculture, forestry, fishery, and mining) must have non-zero values for land. The National Accounts of Angola has provided us with data for capital rental and land rental for all industries. However, in our model, we recognise as land users only agricultural and mining industries. As a result, we allocated operating surplus to land rentals only in those industries.

1. Because of the implausibility of many commodity tax rates, and because there is no data on production taxes in the original I-O tables, we used additional data on government revenues¹³ and tax legislation to re-create matrices for 6 types of commodity taxes and 2 types of production taxes¹⁴. The main procedure is: for each of the tax type,
 - (a) we identify the tax rates and tax payers (tax bases) based on Angolan tax legislation. For items where no specific tax payers can be identified, such as "other indirect taxes", all goods and services are assumed to bear the tax;
 - (b) we multiply the tax rates on the bases (e.g. commodity flows in IO tables) to get the expected value for the tax revenue on each of the commodity flows. Because of compliance issue, the total expected tax revenues often differ from the total actual revenue reported in government revenue book. We then
 - (c) scale the expected tax revenue so that they sum to the reported actual revenue.
2. After making the above adjustment, we used the SUT procedure to rebalance all sectors and to set GDP expenditure items to the officially published values.

Table 8.4 reports some summary data from our final input-output table.

¹³Ministry of Finance Angola (2015).

¹⁴Because GTAP does not require detailed tax data by tax types, in the submitted data we aggregate them to only one commodity tax and one production tax.

Table 8.4: Macro Aggregates from the 2015 Angolan IO table

GDP components on the expenditure side			GDP components on the income side		
Item	Levels, MYR m	Share (%)	Item	Levels, MYR m	Share
1 Consumption	8 488 054	53.7	1 Labor	4 186 175	26.5
2 Investment	4 595 522	29.1	2 Capital	11 269 868	71.3
3 Government	2 768 769	17.5	3 Subsidies	-227 626	-1.4
4 Stocks	5 768	0	Indirect Tax	578 900	3.7
5 Exports	4 160 173	26.3			
6 Negative Imports	- 4 210 969	-26.6			
GDP	15 807 317	100	GDP	15 807 317	100

A.5 Converting the Angolan IO table into GTAP Format

Converting the IO Table From COM x IND to COM x COM

GTAP prefers commodity by commodity input-output tables. Our initial I-O table is commodity by industry. To convert it to a commodity by commodity table, we use the technology assumption and the procedure described in Horridge et al. 2008.

Putting Margins into Respective Rows for Margin Commodities

There were eight margin services in the initial I-O data. The data contained separate values for direct usage and margin usage of these margin commodities. The GTAP Data Base does not distinguish these uses. Therefore, for each margin commodity, we summed total usage (margin and direct) by each user and allocated that usage to the respective row for the margin commodity.

Mapping Between Angolan I-O Sectors and GTAP Sectors

The 145 sectors of the Angola I-O table were aggregated to a set of 52 sectors that best correspond to elements of GTAP's standard 65 commodities. The mappings from 145 and 52 sectors are reported in Table 8.5.

Table 8.5: Concordance between 145 Angola I-O sectors and 52 sectors in the Contributed table

No.	52 Sectors	145 Angolan I-O Sectors
1	gro	Milho
2	wht	Trigo
3	pdr	Arroz
4	gro	Outros cereais
5	v_f	Feijão
6	v_f	Amendoim

Continued ...

... Continued

No.	52 Sectors	145 Angolan I-O Sectors
7	osd	Soja
8	v_f	Mandioca
9	v_f	Batata rena
10	v_f	Batata doce
11	v_f	Outros legumes, raízes e tubérculos
12	v_f	Banana
13	v_f	Manga
14	v_f	Ananas
15	v_f	Abacate
16	v_f	Citrinos
17	v_f	Outras frutas e nozes
18	ocr	Outros produtos agrícolas
19	ctl	Gado bovino
20	ctl	Gado caprino
21	oap	Gado suino
22	oap	Aves domésticas
23	oap	Outros gados e animais vivos
24	rmk	Leite
25	oap	Ovos
26	oap	Outros produtos de origem animal
27	frs	Lenha
28	ocr	Outros produtos relacionados com agricultura, produção animal, caça e floresta
29	obs	Serviços relacionados com a agricultura, produção animal, caça e floresta
30	fsh	Peixe vivo, fresco e refrigerado do mar e águas interiores
31	fsh	Outros produtos do mar e águas interiores, e Serviços de apoio à pesca do mar e águas interiores
32	fsh	Peixe vivo e fresco e refrigerado da Aquacultura
33	fsh	Outros produtos da aquacultura e Serviços de apoio à aquacultura
34	oil	Petróleo bruto e gás associado
35	oil	Serviços petrolíferos
36	coa	Diamantes
37	coa	Sal Terrestre e marinho
38	coa	Pedra, areia e argila
39	coa	Minerais metálicos, outros minerais e Serviços relacionados com a exploração de outras indústrias extractivas
40	cmt	Carne de gado bovino e miudezas comestíveis
41	cmt	Carne de gado caprino e miudezas comestíveis
42	omt	Carne de porco e miudezas comestíveis
43	cmt	Carne de outros gados e miudezas comestíveis
44	omt	Carne de aves e miudezas comestíveis
45	omt	Outros produtos à base de carne
46	omt	Produtos preparados e congelados da pesca e da aquacultura
47	omt	Produtos das pescas conservados, secados e salgados
48	vol	Óleos e gorduras animais e vegetais
49	mil	Leite e derivados
50	mil	Outros Produtos Lácteos
51	ofd	Farinha e fuba de milho
52	ofd	Farinha e fuba de mandioca
53	ofd	Farinha de Trigo
54	ofd	Outros produtos de transformação de cereais e leguminosas, de amidos e féculas e de produtos afins

Continued ...

... Continued

No.	52 Sectors	145 Angolan I-O Sectors
55	ofd	Pães e Outros produtos afins de padaria
56	ofd	Produtos de pastelaria, bolachas e biscoitos
57	ofd	Vegetais, legumes e batatas preparados ou em conserva
58	ofd	Frutas e nozes preparações e em conservas
59	sgr	Açúcar e melaço de açúcar
60	ofd	Alimentos para animais (rações)
61	ofd	Outros produtos alimentícios (Inclui pratos y comidas preparadas (nao restaurantes))
62	b.t	Cerveja e malte
63	b.t	Outras bebidas alcoólicas, excepto cerveja e malte
64	b.t	Bebidas não alcoólicas
65	b.t	Produtos de tabaco
66	tex	Produtos têxteis
67	wap	Produtos de vestuário
68	lea	Couro curtido, couro artificial e artigos de couro
69	lea	Calçado e suas partes em diferentes matérias
70	lum	Madeira Serrada, folheada e contraplacados laminados
71	lum	Produtos de madeira, cortiça, de espartaria e de cestaria, excepto mobília
72	ppp	Pasta para papel, papel, cartão, outros artigos de papel e cartão
73	ppp	Impressão e edição de jornais, livros e outras publicações
74	p.c	Gasóleo
75	p.c	Fuel Oil
76	p.c	Gasolina para aviões
77	p.c	Outras Gasolinas
78	p.c	Petróleo Iluminante
79	p.c	LPG, gás butano e propano
80	p.c	Outros oleos e lubrificantes
81	p.c	Outros produtos derivados do petróleo e produtos de combustiveis nuclear
82	chm	Produtos químicos de base
83	chm	Adubos, compostos azotados, e pesticidas
84	chm	Tintas, vernizes e produtos similares, tintas de impressão e mastiques
85	chm	Sabões, sabonetes, detergentes e produtos de limpeza
86	chm	Outros produtos químicos diversos, matérias plásticas, borracha sintética sob formas primárias e fibras sintéticas ou artificiais
87	bph	Produtos farmacêuticos
88	rpp	Produtos de Borracha
89	rpp	Produtos de Plástico
90	nmm	Vidro e Produtos de Vidro
91	nmm	Produtos cerâmicos não estruturais
92	nmm	Produtos refratários e produtos estruturais de argila não refratários
93	nmm	Cimento e clínquer; cal e gesso
94	nmm	Outros produtos minerais não metálicos
95	fmp	Produtos metálicos básicos e elaborados, excepto maquinaria e equipamento
96	ome	Maquinaria para usos gerais, partes e peças
97	ome	Maquinaria para usos especiais e outras maquinarias e equipamento, partes e peças
98	omf	Eletrodomésticos e suas partes e peças
99	otn	Equipamentos de transporte, partes e peças
100	omf	Mobiliários e Colchões
101	omf	Outros bens manufacturados
102	omf	Desperdícios e sucata

Continued ...

... Continued

No.	52 Sectors	145 Angolan I-O Sectors
103	trd	Serviços de reparação, manutenção e instalação de máquinas e equipamentos
104	omf	Serviços de fabricação
105	ely	Energía Electrica
106	ely	Distribuição de energía eléctrica, comercialização e serviços de apoio a la distribuição de electricidade
107	ely	Tranporte de Electricidade e serviços de apoio ao transporte de electricidade
108	ely	Gás da cidade, vapor e água quente, gelo e neve
109	ely	Água natural captada, tratada e distribuída
110	ely	Recolha, drenagem e tratamento de resíduos e águas residuais, valorização de materiais e descontaminação
111	cns	Edifícios residenciais
112	cns	Edifícios não residenciais
113	cns	Obras de engenharia civil e outras construções
114	cns	Serviços especializados e gerais de construção
115	trd	Serviços de comércio
116	trd	Manutenção e reparação de veículos automóveis
117	afs	Serviços de alojamento
118	afs	Serviços de restauração
119	otp	Serviços de transporte ferroviário
120	otp	Serviços de transporte rodoviário
121	wtp	Serviços de Transporte por água
122	atp	Serviços de Transporte aereo
123	whs	Armazenagem e serviços de apoio aos transportes
124	cmn	Serviços Postais e Correios
125	cmn	Telecomunicações
126	cmn	Actividade de Televisão, Rádio, Cinema, Videos e Produções afins
127	cmn	Consultoria, Programação informatica, serviços de informação e outras relacionadas
128	ofi	Serviços de Banco Central
129	ofi	Outros serviços financieros e serviços de banca de investimento
130	ofi	Serviços de intermediação financeira indirectamente medidos (SIFIM)
131	ins	Serviços de seguros, resseguros e fundos de pensões
132	ins	Serviços auxiliares de intermediação financeira, de seguros e de fundos de pensões
133	dwe	Serviços de aluguer de vivendas
134	rsa	Serviços de arrendamento ou aluguer de edificios nao residenciais e Outros serviços imobiliários
135	obs	Serviços profissionais, científicos, técnicos e similares
136	osg	Serviços administrativos e de apoio
137	osg	Serviços administrativos do governo e de segurança social obrigatória
138	edu	Serviços de educação pública
139	hht	Serviços de saúde Pública
140	edu	Serviços de educação privada
141	hht	Serviços de saúde e serviços de acção social privados
142	ros	Serviços artísticos, de espectáculos, desportivas e recreativas
143	ros	Reparação de computadores e de bens de uso pessoal e doméstico
144	obs	Outros serviços
145	ros	Serviços domésticos

A.6 Checking Sectoral Balance and Non-negativity Conditions

After converting the Angolan I-O tables to the format required by GTAP Data Base, we conducted the sectoral balance and non-negativity checks. The new data base passed the sectoral balance check and non-negativity conditions.

References

Horridge, Mark et al. (2008). *Exercises in Contributing I-O Tables to the GTAP Data Base*. Department of Agricultural Economics, Purdue University, West Lafayette, IN: Global Trade Analysis Project (GTAP). URL: https://www.gtap.agecon.purdue.edu/resources/res_display.asp?RecordID=2850.