W Gabon

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This abstract of the construction of a GTAP compatible IOT for Gabon requested by the UN Economic Comission for Africa (ECA). The implementation of the results obtained will help to better assess the effects of trade liberalization policies on the country's economy.

Therefore, the following four main steps were carried out to insert Gabon's national accounts data into the GTAP database. These are:

1. the alignment of the nomenclature of national accounts with that of the GTAP database, including the rule of mandatory splitting between Agriculture and food processing (Afp), Energy (Eng) and other sectors (Oth), and the control of the balance of the SUT symmetric product by product of the year 2017;
2. the conversion into basic prices of the tables of resources, uses as well as those of domestic uses and uses of imports generated from the SUT;
3. the generation of the IOT for domestic uses, in the format of the source SUT, according to the product technology hypothesis (model A) and the applicable processing method known as Almon;
4. obtaining four GTAP-compatible tables designated below, after verifying the accounting identities and non-negativity of the data: UF, UP, OP and MF.

W.1 Introduction

Brief reminder of the context of the mission

The United Nations Economic Commission for Africa (ECA) receives numerous requests either directly from its member states or through the African Union (AU), in particular to carry out analyses of the impact of trade policies on their respective economies, such as those related to the establishment of the African Continental Free Trade Area (AfCFTA), or even in terms of policies to combat the effects linked to climate problems or poverty that the countries want to identify as a prelude to any decision to ratify or negotiate certain agreements.

Among the decision support tools used for this type of evaluation, the ECA implements the "Computable General Equilibrium Models (CGEM)" including the so-called Global Trade Analysis Project(GTAP). This one, although very demanding in sectoral data, remains very limited to 26 African countries.

Gabon, like many other countries, is aggregated into a heterogeneous group referred to as the "rest of Central Africa". This does not allow the GTAP model to generate results specific to the gabonese economy.

Purpose and rationale of the engagement and announcement of the note plan

As already mentioned above, the GTAP database is an EGC model for assessing the effects of trade liberalization policies (case of the AfCFTA) on economic growth, sectoral dynamics and, to some extent, household incomes.

The idea of integrating the specific data of the Gabonese economy into the GTAP database is therefore part of this project. Therefore, the fine and recent data in the Supply – Use Table (SUT) for 2017 have been used. They served as a frame of reference for the generation of data tables to feed the ECA database, based on a corresponding Input-Output Table (IOT).

The inclusion of Gabon in GTAP is justified all the more so because "it is better to be more or less right than exactly wrong." (J.M. Keynes, 1883-1946) . This sentence reflects the desire to help the rulers to base their decisions on undoubtedly questionable but credible bases. Indeed, by modelling the structures of an economy on the basis of available information, national accountants are led to translate the situation of an economy, a much more complex reality, by means of balancing relations between the main economic aggregates. The transition from the TRE to a TES does not evade this difficulty either.

This is why this note, which aims to explain the approach that allowed the construction of a GTAP-compatible IOT, first recalls the data relating to the TRE for the year 2017. It then highlights the mapping of the sectoral classification of the GTAP database and, finally, describes the process of developing the corresponding IOT.

W.2 Reference information for TRE 2017

Concepts and framework of national accounts in Gabon

National accounts are a schematic and quantified representation of a country's economic activity. The delimitation of the latter is based on the criterion of residence. It consists of a measure of money flows representative of a country's economy over a given period, usually the year, and groups them into macroeconomic indicators called aggregates for analysis. The most important of these is the Gross Domestic Product (GDP).

The diagram of the four (4) consolidated accounts (GDP, income and expenditure account, accumulation account, rest of the world account) is based on the equation of global equilibrium in the open economy defined as follows: Y = C + I + (X-M) where: Y income or GDP, C consumption, I investment and (X-M) the balance of trade with X exports and M imports.

With this in mind, national accounts are an indispensable macroeconomic database for analysing and evaluating the performance of an economy. The availability of such data is a prerequisite for the formulation of relevant policies and the making of timely and rational decisions.

In Gabon, the national accounts are drawn up by the Directorate-General for Statistics (formerly the Directorate-General for Statistics and Economic Studies), through its Directorate of

National Accounts (DNA), using the United Nations System of National Accounts of 1993 (SNA 93) implemented in 2002, after the use of SNA 68.

This change has led to qualitative improvements in the approach to the compilation of national accounts. Methodological clarifications have also been made, particularly in the case of the informal sector, which is now better defined, and indirect taxes, which are replaced by taxes on production and imports.

The base year for the preparation of the new series of accounts is 2001 and the end of 2002 marks the start of work to modernise the national accounts using the ERETES module offered by AFRISTAT to its member countries. It isa tool to assist in the compilation of national accounts in accordance with SNA 93 and allowing the comparability of national accounts from one country to another.

In addition to the determination of gross domestic product (GDP), branch accounts and sector accounts, the output formats of the accounts also provide for the publication of SUT corresponding to the synthesis of the work carried out.

At the same time, a technical classification of activities of 43 branches (including a fictitious branch "correction territoriale") and 206 products for the final accounts is used by the DNA. It is based on the Nomenclature of Economic Activities of the AFRISTAT Member States (NAEMA) and the Product Nomenclature of the AFRISTAT Member States (NOPEMA).

The reference period for the preparation of the accounts is the calendar year, which runs from1 January to 31 December. All economic activities carried out (both in the formal and informal sectors) throughout the Gabonese national territory, including those in territorial enclaves, are covered.

Characteristics of the SUT and determination of GDP for the year 2017

In general, the SUT are databases containing series broken down by industry with an equivalent breakdown by product. They are established on the basis of assumptions Industry by Industry, Industry by Product or Product by Product. These data are available at current or constant prices, with a breakdown between domestic production and imports, both at basic and purchasers' prices.

More specifically, the SUT for the year 2017 has 44 sectors and is established at purchase price according to the so-called product-by-product assumption (model A). In this case, each product has its own structure of production regardless of the branch of establishment that manufactures it.

The "Supply" section of this table presents a breakdown of the resources of the economy by product, distinguishing between production (P) of the different branches of activity or intermediate consumption (CI) and imports (M). It thus makes it possible to detect the secondary activities of the branches, that is to say the activities located outside the diagonal.

The "Use" section, on the other hand, details by product the uses of goods and services

by the different branches of activity as well as by category of final demand: final consumption expenditure (C), gross fixed capital formation and change in inventories (I) and exports (X). It also provides details on the components of the value added of the branches.

The above data from SUT 2017 are at current prices and describe in matrix form:

— how the supply of the different types of goods and services (resources of the branches) comes from domestic industries for FCFA 12,685,473 million and imports for FCFA 2,311,327 million, i.e. a total amount of resources of FCFA 15,424,107 million at purchasers' prices taking into account net levies (taxes minus sub) of FCFA 427,307 million;

— how these resources are allocated to the various intermediate uses of the branches for FCFA 5,903,069 million, final consumption for FCFA 4,778,734 million, gross fixed capital formation for FCFA 1,799,535 million and exports for FCFA 2,969,441 million, i.e. global use at purchase prices of FCFA 15,424,107 million with a change in inventories of FCFA -26,672 million;

— the main uses of the value added of the branches, established at FCFA 6,782,404 million, are made between the compensation of employees for FCFA 706,221 million, other taxes net of subsidies on production for FCFA 10,738 million and gross operating surplus for FCFA 6,060,145 million;

— the process of formation of the GDP, established at FCFA 7,209,711 million according to supply and demand optics.

Thus, the SUT 2017 includes a table on supply, uses, the main uses of value added, two tables of calculation of GDP from the supply and demand perspective.

Indeed, at the end of 2017, Gabon's GDP is estimated at FCFA 7,209,711 million divided between Final Consumption (C) for 4,778,734 million, Net Investment (I) for 1,772,863 million, Exports (X) for 2,969,441 million and Imports (M) for 2,311,327 million. Two approaches to GDP have been adopted for the SUT 2017. These are:

— the supply-driven approach where GDP is equal to Output minus Intermediate Consumption plus Taxes on Products minus Subsidies on Products;

— the demand-driven approach, GDP is equal to Final Consumption plus Gross Fixed Capital Formation (GFCF) plus Changes in Inventories plus Exports minus Imports.

Finally, equality between resources and uses is ensured by the following identities by branch and product:

— identity by branch (at basic prices): P = CI+VA = (5,903,069+6,782,404) = FCFA 12,685,473 million;

— identity by product (at purchasers' prices): P+M = CI+C+I+X=((12 685 473+427 307)+2 311 327) = (5 903 069 + 4 778 734 + (1 799 535 – 26 672) + 2 969 441) = FCFA 15 424 107 million.

As a result, the goods and services made available to the economy have two origins: production (P) and imports (M). They can also be used in Intermediate Consumption (CI), Final Consumption (CF), GFCF, Changes in Inventories (VS) or exported (X).

According to these two identities, the total resources at purchasers' prices are therefore equal to the total uses at the purchaser's price. This identity links the "Supply" part and the "Use" part to form the SUT.

The balance between uses and resources is the necessary and sufficient condition for moving to an IOT.

W.3 Mapping of the GTAP sectoral classification and nomenclature of national accounts

Passage table between the two nomenclatures and reminder of the mandatory split rules

According to the terms of reference of the mission, the collection and preparation of recent data necessary for the development of an TRE for Gabon was carried out in order to feed the GTAP database and to carry out impact analyses of economic policies. With this in mind, a table of concordance (or passage) between the GTAP sectoral classification (65 sectors) and the nomenclature of national accounts of Gabon (43 branches) has been established.

To be relevant, the development of this passage table requires compliance with the mandatory splits into three groups formed around the separation of (i) agriculture and food processing (Afp), (ii) energy (Eng) and (iii) other sectors (Oth).

Indeed, the details of agriculture and food products are undoubtedly separated from fisheries and forest products, both in the nomenclature of national accounts and in GTAP where the last two sectors are considered as industrial products. Similarly, the energy sectors differ markedly from 1in industry or services.

However, this splitting requirement is not yet strictly observed in Gabon's national accounts, in view of the operating conditions still prevailing in the Crude Oil and Natural Gas and Water and Electricity branches.

Energy branch: crude products (crude oil and natural gas)

In the current configuration of the Gabonese economy, there is no coal production (15.Col in GTAP). In addition, the same companies produce crude oil and natural gas. The latter was com-

pletely torched until before 2011, the year from which it began to develop. Since then, part of the natural gas has been used to produce electrical energy for the benefit of the cities of Libreville (the political capital), Owendo (port city south of Libreville), Akanda (north of Libreville) and Port-Gentil (economic capital).

No company exploiting these energy resources (TOTAL,PERENCO, ASSALA, MAUREL & PROM, SINOPEC, ADDAX) do not distinguish oil costs from those related to gas production – the level of which is still marginal. It is indeed a reality that the exploitation of crude oil and natural gas is done concomitantly, often by the same companies, in the same wells and with the same resources (human, material, financial). For this reason, sectors 16.Oil and 17.Gas of the GTAP database are both counted in the Petroleum Exploitation branch (B06: Crude oil, natural gas and related services) of Gabon's national accounts.

Energy branch: refined or manufactured products

These are, on the one hand, refined petroleum products (32.p_c in GTAP) and, on the other hand, the manufacture and distribution of manufactured gases (47.gdt in GTAP). They are fully recorded as refined petroleum products in the branch (B13: Refined petroleum) of the national accounts.

Butane gas is a hydrocarbon. It is a product derived from the distillation of crude oil. It is produced by the Société Gabonaise de Raffinage (SOGARA).

In addition to butane gas marketed mainly to households or even catering professionals, SOGARA also produces all other refined petroleum products: kerosene, fuels for cars and aircraft, heavy fuel oils, lubricating oils, bitumen, other refined solid or pasty petroleum products as well as other oil and gas products.

As with the cases mentioned above, SOGARA does not seem to keep cost analysis accounts for each of its products, in particular the specific costs of fuel production and the one dedicated to the production of butane gas. As a result, itis impossible to isolate the accounting data for butane gas production from those for fuel production.

Nevertheless, unlike oil companies, an estimate of the costs of each type of product can be made from the known overall cost and volumes of the products marketed by the Société Gabonaise d'Entreposage des Produits Pétroliers (SGEPP).

Energy branch: electricity

The Société d'Energie et d'Eau du Gabon (SEEG) has a monopoly on the production and marketing of electricity and water in Gabon. This configuration does not allow it, in view of its annual Statistical and Fiscal Declaration, to isolate the costs allocated to the "Electricity" branch from those attributable to the "Water" branch. This does not comply with the requirement of fractionations of GTAP.

In order to establish a table of transition between the nomenclature of national accounts and that of the GTAP sectors, the data on the production and turnover of water and electricity communicated by the SEEG were used. Itis these data that have made it possible to assess the share relative to the respective costs of water and electricity.

In short, in the absence of requiring the economic unit to publish the costs associated with the production of each product, through relevant cost analysis accounting, it would have been desirable to have as many branches as homogeneous products. For example, we would have economic units that only produce and distribute electricity and other companies that do exclusively the production and distribution of water.

Other adjustments to the source table data with GTAP nomenclature

Apart from the various mandatory splits previously presented, the table of passage from the nomenclature of national accounts to the nomenclature of GTAP sectors also required some adjustments. These are summarized as follows:

— in GTAP sector n°26 “Beverages and tobacco products”, in addition to “Beverages”, we had to add “Tobacco products” included among “Agri-food products” in the national accounts nomenclature;

— for GTAP sector n°57 “Other financial intermediation”, the data relating to the “Banking and Insurance Service” are supplemented by “FIIMS”;

— concerning the GTAP branch n°62 “Other services (Government)”, the national accounts branch “Public administration services” is increased by the “Territorial corrections” branch.

W.4 IOT 2017 Development Process

Type and description of IOT 2017

The IOT of the year 2017 is built from the “jobs” part of the SUT. It is a Symmetric Product x Product table, since the number of rows is the same as the number of columns, with the input-output relationships being translated into the products used to produce other products.

As a tool for macroeconomic analysis and simulations, this table makes it possible to model the activities of production, intersectoral exchanges and consumption in an economy. It also serves to identify possible inconsistencies in the balancing of resources and uses.

Indeed, the IOT integrates uses and supplies into a single table: the totals of the rows (total uses) are equal to the totals of the columns (total supplies) and is thus used to carry out impact studies. It is presented in the form of three sub-tables described as follows:

1. the intermediate exchanges table – which contains all the goods and services involved in the manufacturing process of other goods and services, i.e. the components of intermediate consumption. It is the central part of the symmetrical IOT and is in the form of a square table, where each row or column represents a product;

2. the final use table – which contains final uses by product divided between household, general government and NPISH final consumption expenditure, GFCF, changes in inventories and exports;

3. the table of primary inputs – which presents the components of value added by product (compensation of employees, other taxes less subsidies, net operating surplus).

Before implementing IOT, the following operations were carried out: (i) the valuation of supplies and uses at basic prices and (ii) the distinction within the table of uses of domestic production and imports.

Import processing and generation of IOT for domestic production and imports

For economic analysis, it is generally necessary to distinguish the use of goods and services that have been produced in the country from those that have been imported. This is why a table of imported uses and a table of uses of goods and services from domestic production have been generated.

The distribution of uses between the ”imported” content (M) and the ”domestic production” content (P) is made according to a proportional distribution of imports in relation to all resources, namely:

$$r = (Mi/(Pi + Mi))$$

where: r is the ratio of the imported share of the product concerned and i is the product concerned.

The only exception is intermedia consumption (CI), calculated as the balance of all other “imported” uses (prorated as in the box below) on total imports.

Indeed, we started from a total use matrix and a column vector indicating total imports by commodity and created an import matrix in pre-evaluation of totals between uses by applying the structure implicit by the total use matrix.

For each row in this total usage matrix, we first calculated the percentage of the total row allocated to each sector. Then, the import matrix was completed by multiplying each total of products by the appropriate percentage for each sector.

For all intents and purposes, as a consistency mechanism, a consistency check was carried out to ensure that both sets of import data give the same value for total imports.

Ressources (prix de base)			Emplois (prix de base)	Consommation Intermédiaire	Consommation finale ménages	....	Exportation
Production	$P_i + M_i$	=	$CI + ... + X$	CI_i^p	CF_i^p	....	X_i^p
Importation				CI_i^m	CF_i^m	....	X_i^m
				$= CI_i$	$= CF_i$		$= X_i$

où : i = produit concerné
r = M_i / (P_i + M_i), le ratio de la part importé du produit

$CF_i^m = CF_i \times r$ $\quad$ $CF_i^p = CF_i - CF_i^m$

$X_i^m = X_i \times r$ $\quad$ $X_i^p = X_i - X_i^m$

$CI_i^m = M_i - (CF_i^m + ... + X_i^m)$ $\Rightarrow$ $CI_i^p = CI_i - CI_i^m$

Finally, we subtracted the new import matrix from the total use matrix to obtain the national use matrix, the last intermediate consumption equation (CI) in the box above.

It is thus necessary to indicate by product and for each element of the use table the content "imported" and the content "domestic production". This made it possible to draw up the IOT for imports (which details, by product, the intermediate and final consumption of imports and the IOT for products from domestic production – which summarizes the uses of domestic products. The format of the latter is similar to the format of the total IOT.

Processing method applicable to IOT

Model A called Unique Technology by Product (UTP) was chosen in that a product always has the same input structure regardless of the branch in which it is the main or secondary product. It follows that the processing method applicable to IOT is that of Almon (1998).

According to this method, the symmetric IOT is calculated directly without generating a negative element or without going through matrix operations. Indeed, the UTP hypothesis was applied during the line-by-line (product) transformation of the SUT. And this, taking care to deal with any negative values, as soon as they may appear.

If the risk of a negative value becoming obvious, the amounts transferred from secondary product are reduced without affecting the total of the line processed. However, the totals of the affected columns can be changed.

Verification of accounting identities and non-negativity of data

Before the submission of the various tables, we carried out some checks relating to certain accounting relationships. It is indeed a question of ensuring that:

— total sales are equal to total costs for each sector. In this sense, total sales by product are equal to the sum of intermediate sales and sales to the categories of final demand (investment, households, government, stocks and exports) or the sum between UF uses;

— the total costs by sector are equal to the sum of domestic and imported intermediate purchases, value added taxes and taxes on industry or OP;

— the pre-tax values of all flows are not negative. If this is not the case, some adjustment will be necessary. Finally, if pre-tax values are strictly positive, post-tax values should also be strictly positive.

W.5 Key lessons learned

In this concluding section, we return to the main lessons learned from the work carried out. Indeed, in connection with the splitting rule required by the GTAP database, our preliminary work focused in particular on the reorganization of the highly aggregated data of the SUT 2017. It therefore follows the need for disaggregation of data, under certain assumptions.

The aim is certainly not to systematically align the nomenclature of national accounts (already governed by AFRISTAT) with the GTAP nomenclature. But changes in the presentation of certain branches or certain products of the accounts is really desirable. It is still possible to improve the information requested in the Statistical and Fiscal Declaration in order to lead the economic units concerned to present each of the products they manufacture with the associated production costs or intermediate consumption.

Although using the same resources (human, material, financial) to extract or manufacture crude oil or natural gas, car and aircraft fuels, kerosene or butane gas, water and electricity, the companies involved can very well use their operating cost accounting.

If implemented, these amendments should not call into question the existing branches. They would make it possible to associate with each product manufactured the costs (direct or indirect) attributable to it. Therefore, it would be desirable that:

— the company producing both crude oil and natural gas clearly defines the costs attributable to oil production stricto sensu and those related to the extraction of natural gas, since the production of natural gas would be increasingly developed;

— SOGARA specifies the costs associated with the manufacture of each product;

— SEEG determines the cost of intermediate consumption related to the production of water and that attributable to the production of electricity.

W.6 Bibliography

In addition to the source and use table obtained from the Statistics Branch (National Accounts Directorate), we used the following documentation obtained from the GTAP database:

— GTAP Databases: Format Specifications (purdue.edu)

— Contributing Input-Output Tables to the GTAP Data Base (purdue.edu)

— GTAP Databases: Sectors, Mapping and Concordances (purdue.edu)

— GTAP Databases: Domestic and Imported Goods (purdue.edu)

— GTAP databases: How to contribute to GTAP efforts? (purdue.edu)

— Handbook on Supply and Use Tables and Input-Output Tables with Extensions and Applications (un.org)