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Integrating the three Sustainability dimensions: A Social Accounting Matrix approach for Cameroon

Structure and estimation of the 2016 Cameroon SAM

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Contents

Abstract

A Social Accounting Matrix (SAM) is a comprehensive and economy-wide database that records data on all transactions taking place in an economy over a specific period, typically one year. The SAM serves two primary objectives. Firstly, it presents the economic structure and interrelationships among economic agents in the region under analysis. Secondly, it provides a database for analysing the economy's performance and simulating the effects of policy interventions through multisectoral linear models and computable general equilibrium (CGE) models. This paper presents the 2016 SAM for Cameroon, offering a suitable database for implementing and evaluating the country's developmental, social, economic and environmental policies. The paper outlines how to pass from a standard structure of the SAM to a detailed scheme by explaining all the accounts included, and covering key aspects of its construction and estimation. This SAM presents a high level of disaggregation by encompassing labour and household characteristics, along with satellite accounts for employment and emissions. The SAM is used as a database to perform a descriptive analysis of the Cameroonian economy and to obtain results that focus on the three sustainability dimensions: social, economic and environmental.

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Preface

The European Commission is committed to cooperating with developing countries to address issues related to inequality, nutrition and food security. This commitment is carried out through the evaluation of relevant policies and by facilitating access to analytical tools for researchers in these countries, enabling them to conduct their own assessments. In this regard, the Joint Research Centre (JRC), the European Commission's in-house science service, is committed to providing support for the following areas: i) improving information systems on agriculture, nutrition and food security, ii) conducting policy and economic analysis to support the policy decision-making process and iii) offering scientific advice on selected topics concerning sustainable agriculture, food and nutrition security.

The JRC is responsible for developing methodologies and tools to conduct economy-wide analysis related to the sustainability of policies in the agri-food sector, sustainable resources, and address the food and nutrition security issues. These analyses and tools aim to assist the EU institutions and partner countries in formulating and evaluating policies while providing demand-driven technical and scientific advice. Among the possible scientific tools, economic simulation models are used to depict the interrelationships between selected economic variables and provide a simplified representation of economic reality. These models are utilised to quantify the impacts of policy changes through ex-ante policy analysis.

The construction of databases to provide evidence-based policy support to partner countries is one of the objectives of the Pan-Africa Network for Economic Analysis of Policies (PANAP). PANAP is a network that brings together academic/research and institutional partners collaborating with the JRC to develop research on agricultural economics and policy issues, with a focus on Africa. PANAP is aligned with the Action Agenda of the Political Declaration of the 3rd AU-EU Agriculture Ministerial Conference held in Rome on June 21, 2019 (EC Decision C(2019) 4277).

PANAP engages key stakeholders, researchers, data analysts, and policy makers from national and multilateral institutions, in productive discussions on the role of science in supporting policy decision-making in Africa, particularly in the farming and food sectors (Morokong & Ferrari, 2020). The objective of PANAP is to enhance the collaboration between researchers/scientists and policymakers in Africa, including relevant multi-lateral African institutions, and to stimulate their cooperation on selected topics linked to policy priorities in Africa. PANAP also contributes to understanding and addressing scientific issues in the fields of agriculture and food security, with the aim of supporting effective policies and achieving sustainability of the agri-food sectors to enhance food and nutrition security. These efforts are in alignment with the Malabo Declaration Commitment 3, which aims to end hunger in Africa by 2025, as well as Sustainable Development Goal (SDG) 1 and SDG 2.

The primary audience for this paper comprises a diverse spectrum of stakeholders with a shared objective: to foster evidence-based policy decision-making in Africa. This inclusive audience encompasses statistical offices, researchers, modellers, key stakeholders, data analysts, and policy makers from both national and multilateral institutions. While policy makers are part of the intended readership, this paper's main focus lies in presenting and interpreting data rather than providing explicit policy recommendations.

By serving as a robust foundation of data and insights, this paper offers a database which empowers modelling for policy tools addressed to the decision-makers to craft policies that are firmly rooted in empirical evidence, ultimately contributing to the region's socio-economic advancement.

1 Introduction

A Social Accounting Matrix (SAM) is a comprehensive and economy-wide database that records data on all transactions taking place in an economy over a specific period, typically one year. Such a scheme has found extensive application across various research disciplines, policy analysis, and economic modelling in a diverse range of contexts. A notable example of its utility, developed by JRC, lies in the creation of Bioeconomy Social Accounting Matrices, or BioSAMs. Numerous studies have leveraged data from these databases to yield valuable insights into the socio-economic transactions of the EU economy, particularly in the context of the Bioeconomy and its pertinence to the Green Deal (Mainar-Causapé & Philippidis, 2021, El Meligi et al., 2022, Kuosmanen et al., 2020). This scheme have also been extensively used to support research activities related to the implementation of the African Continental Free Trade Area (AfCFTA). The AfCFTA presents a promising platform for increasing intra-African trade and economic growth, which requires also a modelling framework deeply rooted in the national accounts of a country.

Cameroon is a Central African country, member of the Economic Community of Central African States (ECCAS) and of the Economic and Monetary Community of Central Africa (known as CEMAC in French) and it is one of the countries analysed in this context([1]). Cameroon boasts a relatively diversified economy, including agriculture, forestry, raw material extraction, and some processing industries. However, agriculture is a key sector, employing nearly 50% of the active population. Moreover, the labour market in Cameroon is characterised by the predominance of the informal sector, which represents around 85-90% of the employed workforce, with a significant presence in the primary informal sector. The distribution of labour income is characterised by a predominance of low incomes, particularly in the agricultural informal sector, leading to higher poverty rates in rural areas, especially in the North of the country (Institut National de la Statistique, 2015). Consequently, there are remarkable differences in employment and welfare between rural and urban areas across regions.

Given the country's profile, the current SAM scheme has been shaped to provide a robust framework for analysing the economic interconnections prevalent in Cameroon and potentially for future analysis of the different policies at stake. In line with this objective, this paper introduces the 2016 SAM for Cameroon. This SAM has been constructed to serve two primary objectives. Firstly, it presents the economic structure and interrelationships among economic agents in the region under analyses. Indeed, the database will offer comprehensive insights into the economic activities, labour factors, income groups and their interdependencies. Hence, one of the features of the SAM is the breakdown of the household groups by region and rural and urban areas, as well as the disaggregation of labour factors by region, by rural and urban areas, by skill level and considering the informal and formal sectors.

Secondly, it provides a database for analysing the economy's performance and simulating the effects of policy interventions through multisectoral linear models and computable general equilibrium (CGE) models. In this study, we will illustrate the analysis using a linear multipliers approach. In addition to the output and value-added multipliers, the inclusion of external accounts related to employment and emissions data will serve to extend and enhance the scope of the multiplier analysis.

This paper is structured as follows: Section 2 presents the concept, advantages and limitations, along with the description of the accounts of Social Accounting Matrix. Section 3 describes the structure of the 2016 Cameroon SAM, detailing the accounts and data used, as well as the disaggregation procedures, final adjustments and SAM balancing. Section 4 focuses on environmental and social dimensions, demonstrating the construction of satellite accounts for employment and emissions. In Section 5, a description of the Cameroon economy's structure is provided using SAM data, and a type II multiplier analysis is presented to illustrate the usefulness of the SAM linear models in assessing the impact of policies considering the social, economic, and environmental dimensions. Finally, Section 6 includes some conclusions, and the Annexes provide additional tables.

([1]) Similar SAM databases have been constructed for other African countries, for example for Senegal (Boulanger et al., 2017), Kenya (Mainar-Causapé et al., 2018a), Ethiopia (Mengistu et al., 2019), and Cote d'Ivoire (Ferreira et al., 2021). All these SAMs are freely available in the JRC DataM repository.

2 Social Accounting Matrix framework

2.1 General concepts, advantages and limitations

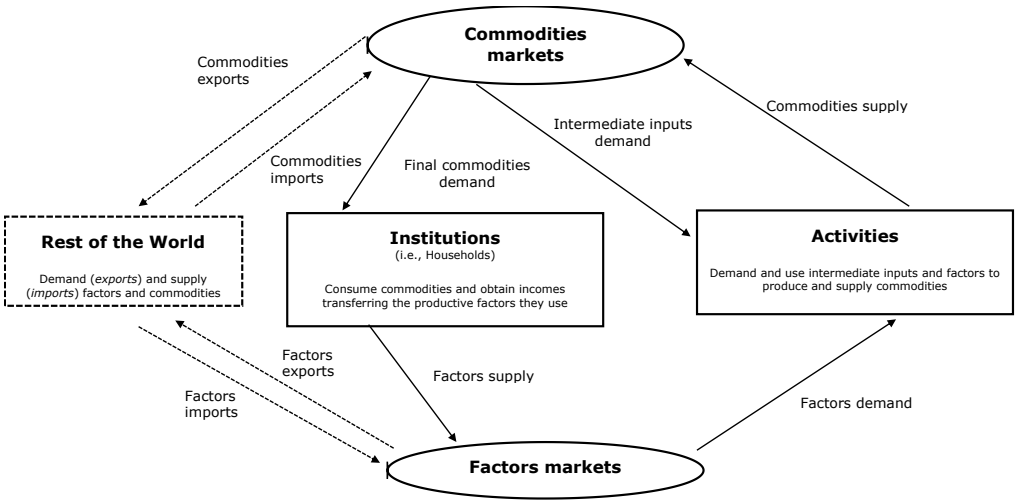
A SAM is a comprehensive and economy-wide database that represents a complete snapshot of the economy, showing the economic and social information on all transactions carried out among economic agents of a specific country or region under analysis over a period of time, typically one year.

The origins of SAMs can be traced back to the pioneering works of Stone (1947) among others, and subsequent advancements in their use as an economic analysis model (Defourny & Thorbecke, 1984; Pyatt & Round, 1985). A SAM expands on the information provided by the Input-Output table by incorporating all economic transactions through a more detailed accounting structure. This enables the closure of the circular flow of income and expenditure, reflecting the interlinkages among production, trade, demand, income generation, and its redistribution among institutional sectors (Pyatt & Round, 1985).

SAMs serve as valuable tools for understanding the structure of an economy and provide a suitable database for economic modelling. As such, they can be used as a database for multisectoral linear models, enabling the calculation of multipliers. Additionally, SAMs can be employed as database for the application of more complex CGE models. This facilitates the analysis of how the economy functions while considering socio-economic issues such as employment, poverty, growth, and income distribution, etc., and to evaluate the impact of different policy interventions.

The concept of the circular flow of income and expenditure forms the foundation of SAM development, as depicted in Figure 1([2]).

Figure 1. The circular flow of income and expenditure (simple version).



Source: Mainar-Causapé et al. (2018a)

The compilation of this accounting scheme is described in the System of National Accounts, which is a consistent, flexible and comprehensive set of macroeconomic accounts internationally agreed upon to meet the needs of policymakers, government, decision-makers, and private sector analysts. Depending on the focus and the level of detail required, developing a SAM involves utilizing various statistical sources, as for example trade data and socio-economic data concerning household income, employment, and expenditure, typically obtained from household budget surveys and labour force surveys. By employing this information, employment and households can be disaggregated based on socio-economic characteristics (such as income, education, regions, rural-urban division, etc.) to analyse income distribution. The specific additional information required will vary depending on the accounts to be disaggregated, according to the type of analysis to be performed.

([2]) It depicts a simple version of the circular flow of income and expenditure, without considering various other flows such as transactions between institutions, taxes, savings and investment.

2.2 Structure of a SAM

The SAM database is a square matrix organized within a logical framework, offering a visual representation of all the transactions occurring among agents in an economy. It reveals how income is generated and expended. To accomplish this, each is depicted as a row displaying the sources of income of each agent, and a column representing the payments made, both in monetary values. Therefore, each cell (i,j) illustrates the transaction between account i and j, where account i receives income from j.

Generally, a Social Accounting Matrix consists of six fundamental groups of accounts:

- Activities or Commodities (or both, separated).
- Factors of production.
- Private Institutions (Households and Corporations/Enterprises).
- Public Institution (Government).
- Capital accounts.
- Accounts for the Rest of the World.

The standard structure of a SAM is presented in Table 1 ([3]); however, the layout of the matrix varies based on the inclusion of specific within the six fundamental groupings and how these accounts are divided. Additionally, the geographical scope of the SAM (national, regional, multi-regional, etc.) is influenced by the type of analysis being conducted.

The interpretation of the SAM states that the production process utilizes inputs to produce goods and services, which are then sold (either as intermediate or final sale) to generate revenue. In order to carry out production, apart from the intermediate consumption, it is necessary to remunerate the factors of production, thereby generating income for institutional sectors (e.g., wages for households). This income is subsequently spent on consumption, transferred to other institutions, or saved. As a result of consumption, there is a need to expand production, and the cycle repeats itself.

The standard structure of the SAM (Table 1) enables a straightforward analysis of GDP using different approaches. Private consumption of goods and services by households is represented by C, government expenditure is denoted as G, gross capital investment is I (investment and changes in inventories), X represents exports, and M signifies imports. Then, W represents factor income payments (including labour and gross operating surplus) and net taxes on production, and $T1$ indicates net taxes on products.

- GDP Production approach: $W1 + T1$
- GDP Income approach: $W2 + WM - WX$
- GDP Expenditure approach: $C + G + I + X - M$

([3]) For more detail of this general structure see Miller & Blair (2009) or Round (2003).

Table 1. A Social Accounting Matrix (SAM) standard structure.

	Commodities	**Margins**	**Activities**	**Factors**	**Households**	**Enterprises / Corporations**	**Government**	**Investment-Saving**	**Rest of the World**	***Total***
Commodities		Transaction costs (trade / transport)	Intermediate (inputs) consumption		Household consumption **(C)**		Government expenditure **(G)**	Investment and stock changes **(I)**	Exports **(X)**	*Demand*
Margins	Transaction costs (trade / transport)									*Margins*
Activities	Domestic production									*Gross output / Production (activity income)*
Factors	Net taxes on products **(T1)**		Remuneration of factors and taxes on production / Factor income **(W1)**						Factor income from RoW **(WX)**	*Factor income*
Households				Factor income distribution to households **(W2)**	*(Inter Household transfers)*	Distribution of enterprise income to households	Government transfers to households		Transfers to Households from RoW	*Household income*
Enterprises / Corporations				Factor income distribution to enterprises **(W2)**			Government transfers to enterprises		Transfers to Enterprises from RoW	*Enterprise income*
Government				Factor income to Government / Factor taxes **(W2)**	Direct Household taxes / Transfers to Government	Direct Enterprise taxes / Transfers to Government			Transfers to Government from RoW	*Government income*
Investment-Saving				*(Depreciation)*	Household saving	Enterprise saving	Government saving	*(Capital accounts transfers)*	Capital transfers from RoW (Balance of Payments)	*Saving*
Rest of the World	Imports **(M)**			Factor income distribution to RoW **(WM)**	Households transfers to RoW	Enterprise income to Row	Government transfers to RoW			*Payments to RoW*
Total	*Supply*	*Margins*	*Costs of production activities*	*Expenditure on factors*	*Household expenditure*	*Enterprise expenditure*	*Government expenditure*	*Investment*	*Incomes from RoW*	

Source: Own elaboration based on Aragie et al. (2017) and Round (2003a).

2.3 Economic agents and accounts

2.3.1 Activities and Commodities

The standard structure of the SAM differentiates between Supply and Use schemes. In Table 1 are portrayed the Activities which produce one or more Commodities (representing goods and services) and the flows are valued at basic prices. The supply of Commodities at purchaser prices is then calculated by encompassing domestic production by Activities, imports from other countries (rest of the world) or regions, trade and transport margins and taxes less subsidies on products (both domestic and imported) (Mainar-Causapé et al., 2018a).

In the second table, flows are valued at market prices (including indirect taxes on products and margins) and the scheme presents the intermediate uses of commodities as for producing final goods and services. The Commodities can be sold domestically (to activities, households, and government) or exported. By columns are illustrated Activities that use inputs and the factors of production (such as labour, capital, land, etc.). The sum of the primary factors plus taxes less subsidies on production represents the value added by Activities. The rows describe the Commodity demand consisting of intermediate consumption (by Activities), final consumption demand by institutional sectors (Household and Government), investment and exports. The sum of the values of commodities produced by each activity gives the gross output value.

For each commodity, the SAM records the associated costs of trade and transport (margins). These transaction costs are linked to the expenses incurred in moving goods among producers, markets, and national borders, whether for domestic consumption, import or export, and are considered part of the supply costs of commodities (Mainar-Causapé et al., 2018b).

2.3.2 Factors

The factors of production refer to the resources employed in the production process (combined with intermediate inputs to produce goods and services). Traditionally, these factors encompass capital and labour, and can also include other types such as land. The specific types and disaggregation of factors of production depend on the purpose of the analysis. For instance, the labour account can be disaggregated based on educational level distinguishing between skilled and unskilled workers. By rows, the production factors accounts for the income received (such as wages, rent, etc.) from the activities and the rest of the world. By columns, these incomes are allocated to the owners of the factors of production (Households, Enterprises and Government), as well as to the rest of the world. In the standard structure, based on the Aragie et al. (2017) and Round (2003a) schemes, factors also include net taxes on production and net taxes on products.

2.3.3 Households

The household sector provides information on the income and expenditure of individuals within an economy. Typically, Households are grouped together into Representative Household Groups (RHGs), which may be categorized based on factors such as income level or geographic location. This information is critical for studying socioeconomic issues such as income inequality and unemployment, as it enables the modeller to examine the distributional impact of an economic shock on different types of households (Burfisher, 2016).

The Household row account records various sources of income, including income from factors of production (as owners of labour, capital, land, or natural resources), transfers from enterprises (such as distributed profits and direct transfers), direct transfers from the Government, transfers from the Rest of the World (usually for labour services and remittances) and transfers from other households (Mainar-Causapé et al., 2018b). By columns, the Household expenditure is detailed, providing a breakdown of how household income is allocated towards the consumption of commodities, payment of direct taxes to the government, transfers to other households (both domestic and foreign), as well as household savings (or financing need if negative).

2.3.4 Enterprises

Enterprises represent the institutional component of the productive sector, typically not consuming inputs like activities. The enterprise accounts, by rows, compile the incomes received from asset ownership (such as capital, land, or natural resources) and income form transfers originating from other institutions. By column, it illustrates the transfer of these revenues to other institutions, e.g., households in the form of dividends, the payment of direct taxes (enterprise tax) or saving.

Within this group, further disaggregation is possible, such as distinguishing between financial and non-financial corporations or public, or categorizing companies as public or private.

2.3.5 Government

The institutional sector of the Government generally differentiates between Local and Central Government. Government income is presented by rows and encompasses revenue from various sources, including taxes, transfers (both domestic and foreign), and remuneration for factors of production (including any assets owned by the government). On the other hand, Government expenditure is displayed by columns, and it is categorized into various components, such as consumption demand for goods and services, transfers to other institutions (including subsidies or benefits to households and enterprises), and payments to other countries (such as debt service payments). The investment-saving cell indicates whether the government is running a trade surplus or deficit (if negative) by showing its saving.

2.3.6 Investment-Saving

The saving generated by all domestic institutions (households, enterprises, and government) as well as the balance of foreign trade on capital account with the rest of the world, is represented by rows in this account. The column displays the capital investment in goods and services, the Gross Fixed Capital Formation (GFCF), and changes in inventories.

2.3.7 Rest of the World

The external balance is comprised of two trade accounts, namely imports and exports, which show the economic interaction between the country (or region) under analysis and the rest of the world. The rest of the world can be represented as a single account or disaggregated to include other regions or countries, depending on the type of analysis being conducted (e.g., ECCAS, African Union and rest of the world).

The income received by the rest of the world account includes imports of goods and services (commodities), transfers to foreign institutions (households, businesses, and government), and the remuneration of factors of production abroad, and are represented by row. On the other hand, the expenditures of the rest of the world are depicted by column, which encompass the purchase of goods and services (exports), payments to domestic factors of production used abroad, and transfers from other economies (such as factor payments, foreign loans and aid, remittances, etc.). The investment-saving cell indicates the surplus or deficit with the rest of the world, indicating the capital inflow (in the case of a negative trade balance) or outflow (in the case of a positive trade balance) between the rest of the world and the country under analysis.

3 The 2016 SAM for Cameroon

3.1 Structure and estimation of the 2016 Cameroon SAM

This study presents the estimation of a new SAM for Cameroon (base year 2016), based on the standard structure and incorporating country-specific factors. The new SAM includes specific accounts for labour and household, which have been further differentiated by region and separated into rural and urban areas. This framework enables the analysis of regional issues, such as income and productivity disparities, with the aim of reducing poverty and inequality within and between regions.

The Cameroon SAM distinguishes between activities and commodities. The structure and a summarized version of the SAM is provided in Table 2. The SAM is regionalized into 12 divisions, consisting of the country's 10 regions and the cities of Douala and Yaoundé (see table 3). The household account is disaggregated into rural and urban zones for each region, except for the cities. Hence, the SAM includes 22 different Representative Household Group (RHG).

Furthermore, the SAM contains 133 production factors (labour and capital), with labour been further disaggregated across regions and rural and urban areas. Moreover, a distinction is made between formal and informal employment, along with three different skill levels: unskilled, semi-skilled and skilled (see table 4).

In summary, the 2016 Cameroon SAM accounts for:

- 48 activities;
- 48 commodities;
- 133 factors of production (132 labour accounts and 1 capital factor);
- Net taxes on products and Net taxes on production;
- Trade margins and Transport margins;
- 22 households (disaggregated by rural/urban and by regions);
- 4 other institutional sectors: Non-Profit Institutions serving Households, Corporations/Enterprises, and Public Institution as the Government;
- Rest of the world;
- Investment-Saving and Change in inventories.

All the accounts considered in the 2016 SAM for Cameroon are detailed in Annex 1.

Table 2. 2016 SAM for Cameroon with aggregated values. Millions of Central African CFA franc (FCFA).

	Commodities	Activities	Value Added	Taxes-subsides	Institutional sectors	Investment/ Saving	Rest of the World	Total
Commodities		13,679,551			16,616,103	3,971,254	3,797,304	38,064,212
Activities	32,083,224							32,083,224
Value Added		18,403,673					53,512	18,457,185
Taxes-subsides	1,634,893							1,634,893
Institutional sectors			18,436,485	1,634,893	3,518,875		470,373	24,060,626
Investment/ Saving					3,262,964		708,290	3,971,254
Rest of the World	4,346,095		20,700		662,684			5,029,479
Total	38,064,212	32,083,224	18,457,185	1,634,893	24,060,626	3,971,254	5,029,479	

Source: Own elaboration for modelling purpose

3.1.1 Data sources and accounts

To construct the 2016 SAM for Cameroon, several statistical sources have been used, including National Accounts statistics such as Supply and Use tables and Integrated Economic Accounts for 2016, as well as data on trade and microdata provided by different surveys conducted by the National Statistical Institute (*Institut National de la Statistique*). Specifically, data from the Fourth Cameroonian Household Survey (2014), the Supplementary Survey to the Fourth Cameroon Household Survey (2016), and the Second Survey on

Employment and the Informal Sector (2010) were considered in the SAM (Institut National de la Statistique, 2017, 2015b, 2011).

3.1.1.1 Activities and Commodities

The list of commodities and activities reflects the one proposed in the Supply and Use tables for the year 2016. The SAM for Cameroon includes a total of 48 activities and 48 commodities, as shown in Table 3. No further disaggregation has been proposed for the agri-food sectors thus far, leaving open the possibility of characterizing the framework at a later stage.

3.1.1.2 Households

The 2016 Cameroon SAM distinguishes between rural and urban households and further disaggregates them by regions, utilizing data from the 2014 Fourth Cameroonian Household Survey conducted by the National Statistical Institute (*Quatrième Enquête camerounaise auprès des menages*: ECAM 4) (INS 2015). As a result, the 2016 Cameroon SAM includes 22 representative household groups (RHG) for the 10 regions, which are additionally divided into rural and urban areas, along with the two main cities (see Table 4). This classification will allow for a more in-depth analysis of redistributive factors and the differential impacts of various policies on different types of household.

3.1.1.3 Factors of production

Depending on the specific objectives of the analysis, the categorization of production factors is crucial. In the 2016 Cameroon SAM, the factors of production are divided into two main groups: labour and capital.

Under the labour factors, the SAM matrix includes a detailed breakdown of employment, taking into account the formal and informal sector, skill levels, and is also regionalized and divided within rural and urban zones. This disaggregation is based on data obtained from the Second Survey on Employment and the Informal Sector (2010) (*Deuxième enquête sur l'emploi et le secteur informel au Cameroun*), and the ECAM4.

For the classification of workers as formal and informal, individuals with documented evidence of wage payment or a contract are considered formal workers. The SAM further classifies the labour factors into three types: skilled, semi- skilled, and unskilled labour (see Table 5).

3.1.1.4 Other accounts

The Cameroon SAM incorporates two distinct types of taxes: tax less subsidies on production (indtax) and taxes less subsidies on products (saltax) which compose part of the government revenue. Taxes on production are levied on production activities based on their output. Taxes on products are imposed on domestic firms for their intermediate input purchases, as well as on consumers and investors for their purchases of final goods and services.

The margins includes the cost related to trade and transport. The trade margins are defined as actual revenue realised on goods purchased for resale, minus cost of purchased products for trade (Eurostat, 2008). The transport margins consist of those transport charges paid separately by the purchaser in taking delivery of the goods at the required time and location (UNSC, 2009).

The Investment-Saving blocks capture by row, the domestic private savings of enterprises and households, as well as the fiscal surplus (or deficit) of the government; and by column, account for the gross fixed capital formation (representing investment in commodities such as machinery and equipment, vehicles, etc.) and the change in inventories. Detailed description and codes for all accounts are provided in Annex 1.

Table 3. Activities and commodities disaggregated in the 2016 Cameroon SAM.

Sector	Activities	Commodities
Primary sector	Agricultural	Agricultural products
	Animal production, hunting and related activities	Live animals and animal products
	Forestry and logging	Forestry and logging products
	Fishery and aquaculture	Fisheries and aquaculture products
Energy and mining	Mining and quarrying	Extraction of hydrocarbons and other energetic products
	Other extraction activities	Other extractive products
Food industry	Processing and preserving of meat and fish	Meat and fish products
	Manufacture of grain mill products, starches, and starch products	Grain mill products, starches, and starch products
	Manufacture of cocoa, chocolate, and sugar confectionery	Cocoa, coffee, tea, sugar products
	Manufacture of oilseeds and prepared animal feeds	Oil seed and animal feed
	Manufacture of other food products	Cereal products
	Processing and preserving of fruit and vegetables and manufacture of dairy products	Milk, fruits and vegetables and other food products
	Manufacture of beverages	Beverages
Manufacturing	Manufacture of tobacco products	Tobacco products
	Manufacture of textiles and wearing apparel	Products from textile and clothing industry
	Manufacture of leather and related products	Leather and shoes products
	Manufacture of wood and wood products, except furniture	Woodworking products except manufacture of furniture
	Manufacture of paper and paper products	Paper and paper products, printed and reproduced products
	Manufacture of coke and refined petroleum products	Products of the refining petroleum and coking products
	Manufacture of chemicals and pharmaceuticals products	Chemical and pharmaceutical products
	Manufacture of rubber and plastics products	Rubber and plastic products
	Manufacture of other non-metallic mineral products	Mineral products non-metallic
	Manufacture of basic metals and metal products	Basic metallic products and metal works
	Manufacture of electrical equipment, machinery, and equipment	Machines, electrical apparatus, and material
	Manufacture of computer, electronic and optical products	Computer, electronic and optical products
	Manufacture of motor vehicles, trailers and semi-trailers and other transport equipment	Transport material
	Manufacture of furniture and other manufacturing	Furniture and products of various industries
	Repair and installation of machinery and equipment	Repair and installation of machines and equipment
Utilities	Electricity, gas, steam, and air conditioning supply	Electricity, gas, and air conditioning
	Water collection, treatment, and supply	Water, sanitation works and waste treatment
Construction	Construction	Construction
Services	Wholesale and retail trade	Wholesale and retail trade
	Repair of motor vehicles and motorcycles	Repair of vehicles
	Transportation and storage	Transportation and warehousing services
	Accommodation and food service activities	Accommodation and food services
	Information and communication activities	Information and communication services
	Financial and insurance activities	Financial and insurance services
	Real estate activities	Real estate agency services
	Professional, scientific, and technical activities	Professional, scientific, and technical services
	Administrative and support service activities	Other collective, social, and personal services
	Public administration and defence; compulsory social security	Public administrations and social security
	Education	Education
	Human health and social work activities	Health and social action
	Arts, entertainment, and recreation	Recreational, cultural and sporting services
	Other service activities	Other services
	Activities of households as employers of domestic personnel	Domestic services
	Activities of extraterritorial organizations and bodies	Services of extraterritorial organizations

Table 4. Regional description in the 2016 Cameroon SAM.

Region in French	Region in English
Adamaoua	Adamawa
Centre (hormis Yaoundé)	Centre (without Yaoundé)
Est	East
Extrême-nord	Far North
Littoral (hormis Douala)	Litoral (without Douala)
Nord	North
Nord-ouest	Northwest
Sud	South
Sud-ouest	Southwest
Ouest	West
Douala	Douala
Yaoundé	Yaoundé

Table 5. Description of labour factor in the 2016 Cameroon SAM.

Education level	***Skill level category***
Preschool	Unskilled labour
Primary	Unskilled labour
Post Primary	Semi-skilled labour
Secondary 1st Cycle	Semi-skilled labour
Secondary 2nd Cycle	Semi-skilled labour
Secondary technical 1st Cycle	Skilled labour
Secondary technical 2nd Cycle	Skilled labour
Higher	Skilled labour

Source: Own elaboration based on ECAM4.

3.1.2 SAM final adjustment and balancing

To construct the SAM presented in this paper, the Supply and Use table and the National Accounts for 2016 were used as a starting point. The integrated economic accounts provided an overview, by account, of the transactions among the institutional sectors (Resources and Uses), organized as double-entry accounts, which encompassed the entire production process and the distribution of income.

Subsequently, the surveys mentioned earlier were employed to further refine the account breakdowns. The household survey (known as ECAM4), was conducted by the National Statistics Institute with the main objective of producing indicators related to the living conditions of the population, enabling the assessment of the impacts of macroeconomic programmes and policies implemented in Cameroon in recent years. To this end, the survey covered various aspects, including socio-demographic characteristics (such as household composition, health, education, and employment of household members), housing characteristics, access to basic infrastructure, economic activities and income, perception of poverty, and household consumption. Given the survey's comprehensive nature, specific subsections relevant to our analysis were selected for a closer examination:

- Section 00: about general information of the households.
- Section 01: including data on the composition and characteristics of the members.
- Section 03: including data related to the education and training of the members of the household.
- Section 04: about the economic activity and income of the members of the household.
- Section 11: about land assets, access to credit for production and household social capital.
- Section 12: including data on households focus on agriculture and rural activities.
- Section 13 and 14: containing data derived from the Retrospective Household Expenditure and Acquisitions Questionnaire and the Daily Household Expenditure and Acquisitions Questionnaire.

The ECAM4 dataset used in this analysis represents a representative sample of the entire country. Initially, the survey included a sample of 12,847 households. However, due to non-response during data collection and the exclusion of households with incomplete questionnaires, the final sample size for analysis was 10,303 households. The data collection took place over the months of October, November, and December in 2014, and it provides a representative picture of the 12 regions of Cameroon (including the cities of Douala and Yaoundé), with a further breakdown into urban and rural areas.

While the household survey offers some information on employment, for a more comprehensive understanding of labour-related data, the Second Employment and Informal Sector Survey (EESI2) was considered. This survey provides and extensive data on labour market participation, job characteristics, informal activities, and the contribution of the informal sector to the national economy, suitable for monitoring and evaluating policy programs focusing on employment issues. More specifically, the questionnaire of the employment survey collects information on the employment status, primary and secondary activities, social security, non-employment income, and usual employment.

To account for regional differences, a distinction was made between the cities of Douala and Yaoundé and the remaining regions. Additionally, the differentiation between urban and rural areas was necessary due to the variations in average consumption, employment, and income levels. As a result, the 2016 national SAM for Cameroon is disaggregated into 12 regions, which are applied to both households and labour factors.

The microdata provided by the surveys is crucial to disaggregate the sub-accounts specified in this SAM. Given that multiple data sources were used in constructing the SAM, techniques such as the RAS method were applied to reconcile and balance the data. The RAS method helps balance the matrix when there is insufficient information by utilizing macroeconomic targets or targets specific to certain accounts, cells or sub-matrices (Bacharach, 1970; Mcdougall, 1999; Robinson et al., 2001).

4 Satellite accounts

Satellite accounts are specialized frameworks closely linked to the central System of National Accounts, designed to focus on specific economic and social aspects, such as the environment, tourism, or unpaid household work. They serve the purpose of adapting the national accounts system to diverse needs and circumstances, not strictly adhering to the same concepts or monetary data. These accounts cater to specific data requirements, offering detailed information, rearranged concepts, or supplementary data, ranging from simple tables to comprehensive sets of accounts, thereby aiding in monitoring areas like community health and environmental conditions and exploring innovative methodologies that may eventually integrate into the main accounting system.

The data utilized and the development of satellite accounts can vary depending on the specific research objectives. One of the key purposes of satellite accounts is to establish a connection between physical data and monetary data within the SAM. This includes incorporating variables related to the environment, such as greenhouse gas emission, water, land use, as well as social variables like employment or income distribution. The main objective of the satellite account is to integrate additional data that can be linked to the SAM accounts, thereby expanding the scope of the analysis.

When focusing on employment, findings from the Second Survey on Employment and the Informal Sector indicate that the labour market in Cameroon is predominantly characterised by the informal sector. Furthermore, the distribution of labour income is heavily skewed towards low incomes, particularly in the agricultural informal sector and rural areas (Institut National de la Statistique, 2011).

According to the International Labour Organization (ILO), climate change is expected to have a negative impact on employment. Extreme weather events, for instance, can lead to job losses, decreased labour productivity, and business disruptions. These events will mostly impact the employed poor (e.g., those in the informal sector), in the least developed countries and in the economic sectors that are most dependent on resources and climate. Conversely, efforts in climate change mitigation and the transition to a low-carbon economy can have a positive effect on employment.

To enhance the utility of the SAM and to incorporate the social and environmental dimensions in Cameron's analysis, this paper outlines the construction of two satellite accounts: Emissions (measured in CO2eq) and Employment (number of workers). These satellite accounts can be used to calculate the corresponding multipliers and provide insights into the amount of CO2eq emissions and the number of jobs generated in Cameroon for each unit of final demand.

4.1 Employment vector

To calculate the employment multiplier, it is necessary to have the employment satellite account, which comprises the employment vector (denoted as $\boldsymbol{e}$) containing the ratios between the number of jobs and the output of each activity. Aggregate data on the number of employees by activity provided by the INS, were used, along with micro-data from the employment survey (EESI2), to disaggregate the employment vector. As a result, the vector $\boldsymbol{e}$ includes detailed information on workers for each activity, disaggregated by rural and urban areas, the 12 mentioned regions, formal or informal work, and educational level categorised into three types: skilled, semi- skilled and unskilled labour.

The employment multiplier calculation using this vector provides the number of jobs (and their characteristics based on the aforementioned disaggregation) that would be generated by an exogenous shock in the final demand. It is important to note that the results do not consider social variables such as employment quality and should not be interpreted as a precise forecast of job creation resulting from exogenous shocks. Nonetheless, they serve as useful indicators of the economy commodities with a greater potential to generate jobs.

4.2 Emissions vector

Similarly, for the CO2eq emissions satellite accounts, a vector $\boldsymbol{g}$ is required, which contains the ratio of the number of emissions per unit of output value. To obtain this vector, data related to the CO2eq emissions were obtained from the non-CO2 greenhouse gas (GHG) emissions database from the GTAP Data Base Version 10. The database provides emissions data for three types of non-CO2 GHGs – CH4 (methane), N2O (nitrous oxide) and the group of fluorinated gases (F-gases), as well as CO2, covering four reference years – 2004, 2007, 2011 and 2014. The data were primarily extracted from FAOSTAT and the EDGAR database (Chepeliev, 2020). By

using this vector to calculate the emissions (in CO2eq) multiplier, it is possible to determine the amount of CO2eq emissions generated by an additional unit of final demand.

5 Economic overview and multiplier analysis

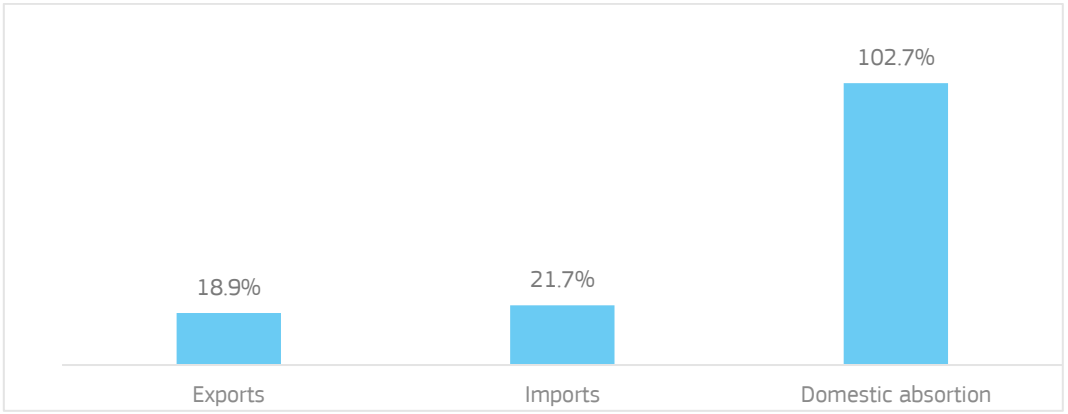
5.1 Analysis of the economic structure of Cameroon

A SAM is a valuable tool for describing the economic structure of a country in detail. By using the 2016 SAM for Cameroon, this section aims to provide an overview of the key characteristics of the Cameroonian economy.

Cameroon is a Central African country, member of the Economic Community of Central African States (ECCAS) and of the Economic and Monetary Community of Central Africa (known as CEMAC in French) and it is one of the countries analysed in this context. It presents a relatively diversified economy, including agriculture, forestry, raw material extraction, and some processing industries. However, agriculture is a key sector, employing nearly 50% of the active population. Moreover, the labour market in Cameroon is characterised by the predominance of the informal sector, which represents around 85-90% of the employed workforce, with a significant presence in the primary informal sector. The distribution of labour income is characterised by a predominance of low incomes, particularly in the agricultural informal sector, leading to higher poverty rates in rural areas, especially in the North of the country (Institut National de la Statistique, 2015). Consequently, there are remarkable differences in employment and welfare between rural and urban areas across regions.

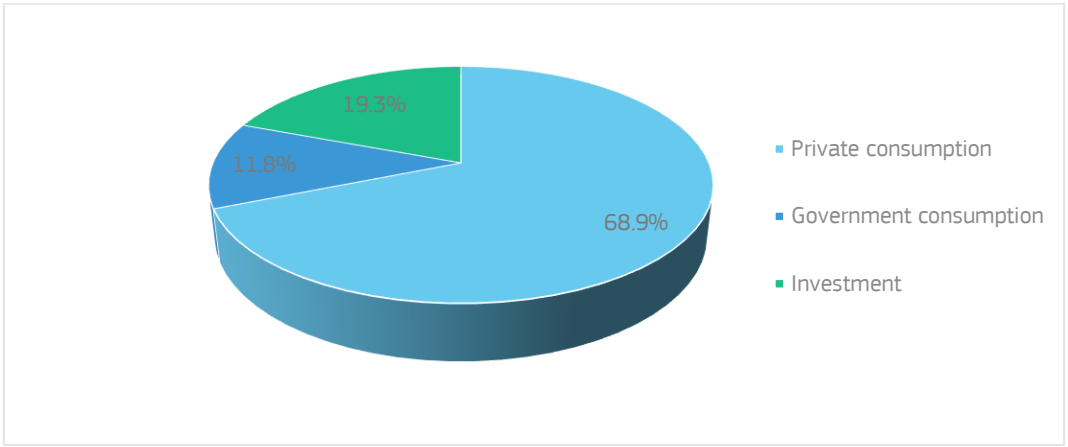
In terms of domestic absorption, it accounts for 102.7% of country's GDP. When considering the foreign sector, exports represent 18.9% of GDP, while imports accounts for 21.7% (Figure 2). Breaking down domestic absorption further, private household consumption represents the largest share at 68.9%, followed by investment at 19.3% and government expenditure at 11.8% (Figure 3).

Figure 2. Domestic absorption, imports, and exports as % of the GDP. Cameroon 2016.



Source: Own elaboration using the 2016 Cameroon SAM.

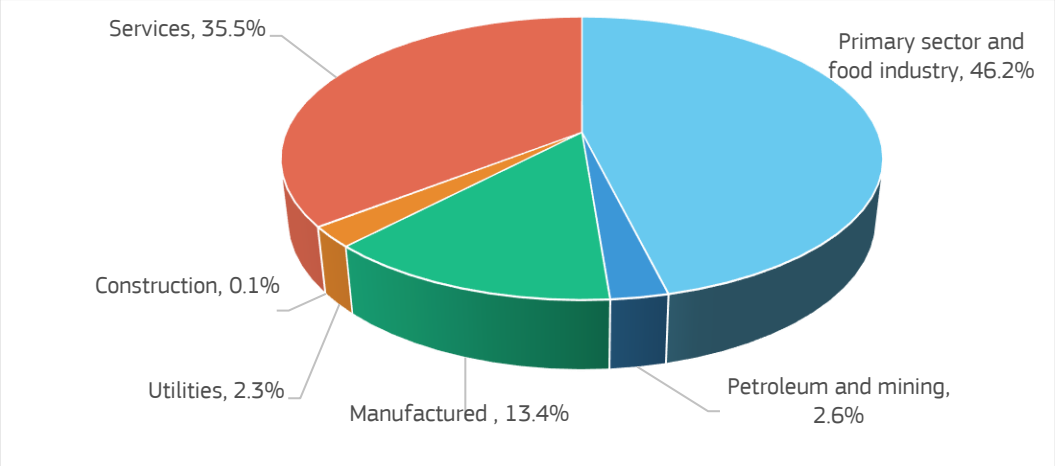
Figure 3. Domestic absorption composition. Cameroon 2016.



Source: Own elaboration using the 2016 Cameroon SAM.

By analysing the households' consumption patterns, it becomes evident that the primary sector and food industry play a prominent role, accounting for 46.2% of total expenditure. Following closer is the services sector, which represents 35.5% of household consumption (Figure 4). Within the services sectors, 14.5% of expenditure is allocated to transport and information and communications services, while 6.9% directed towards restaurants and hotel services. Additionally, expenditure on manufacturing commodities represents 13.4% of the total, with textiles and clothing accounting for 6% and chemicals representing 2.5%.

Figure 4. Household consumption pattern. Cameroon 2016.

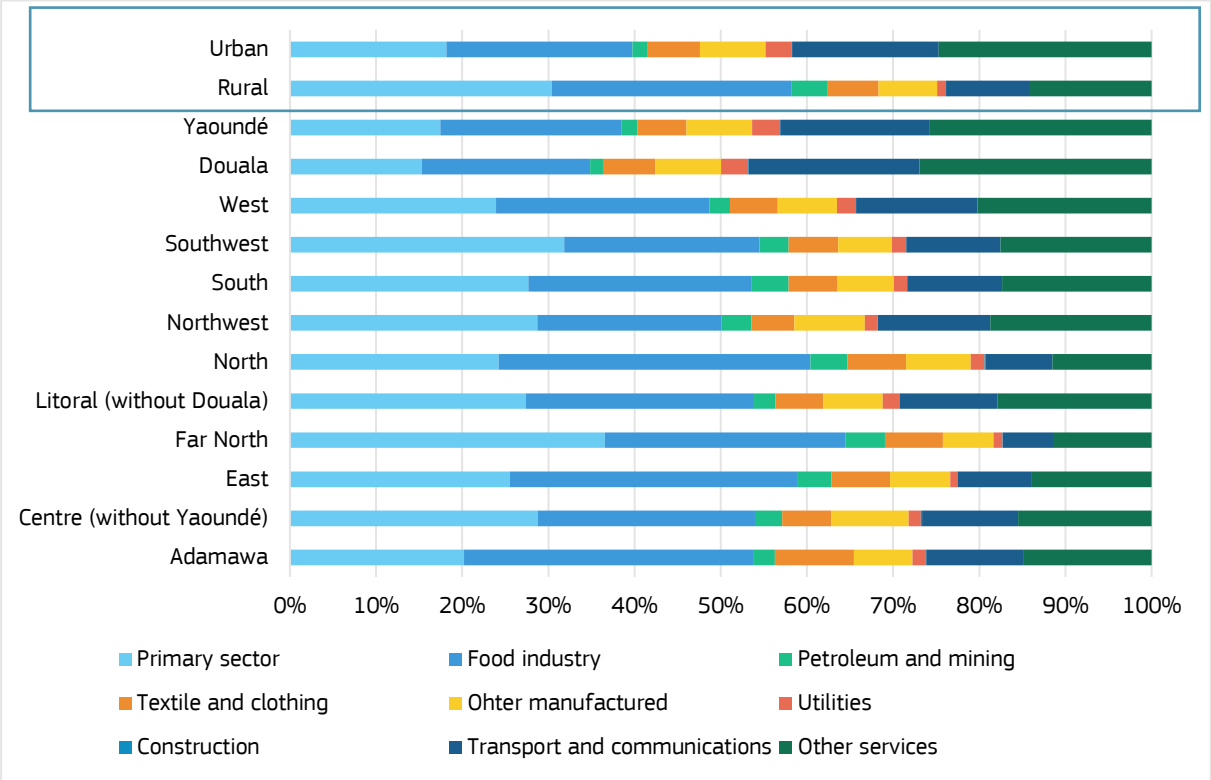


Source: Own elaboration using the 2016 Cameroon SAM.

The breakdown of household consumption of commodities reveals notable disparities between rural and urban areas, with urban households accounting for 65% of the total (Figure 5). Figure 5 allows for an in-depth analysis of household consumption patterns among rural and urban areas, as well as different regions. It illustrates the proportion of each commodity or group of commodities in the consumption of each group. In rural households, there is a higher consumption of commodities from the primary sector and food industry, which constitutes a larger share of their consumption, while in urban households, these sectors account for approximately 40% of consumption, as they also have a higher consumption of services, particularly in the areas of transport and communications.

These differences in consumption are also reflected when analysing the distribution of commodities consumption across regions. The urban areas of Doula and Yaoundé align closely with the consumption patterns observed in other urban areas, emphasizing the significance of sectors such as transport and communications. In the remaining regions, apart from the primary sector and food industry, there is a notable reliance on transport and communication services as well.

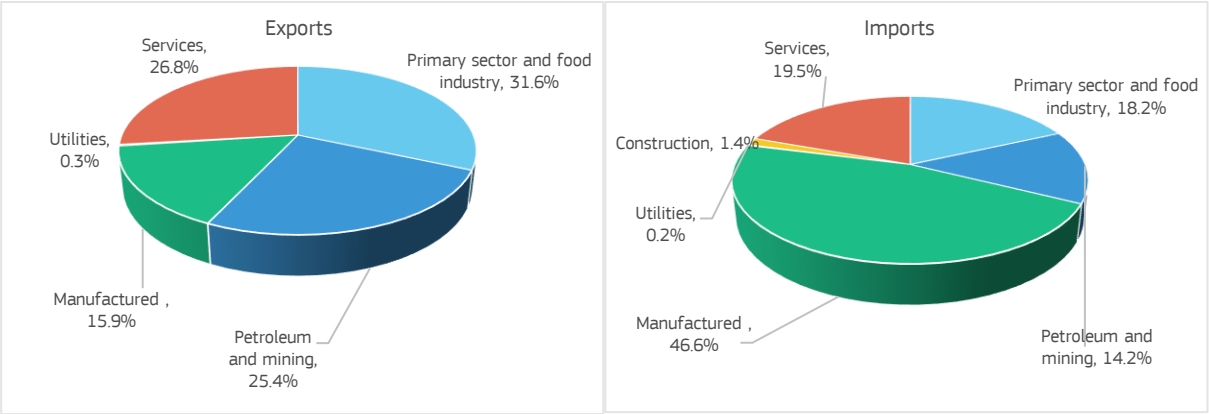
Figure 5. Household consumption patterns (by rural/urban and regions). Cameroon 2016.



Source: Own elaboration using the 2016 Cameroon SAM.

After analysing household consumption pattern, it is crucial to explain the composition of commodities in terms of exports and imports. In the case of exports, the primary sector and food industry represent the 31.6%. Petroleum and mining sectors represent 25.4%, while manufactured products make up 15.9% of the exports. Within the manufactured products, 5.6% corresponds to the manufacture of wood and wood products, and 2.93% to the manufacture of basic metals). For imports, the manufacturing sectors stand out with 46.6%, due to imports of machinery and equipment (10.8%) and chemicals (9.5%) (Figure 6).

Figure 6. Exports and imports composition. Cameroon 2016.



Source: Own elaboration using the 2016 Cameroon SAM.

Focusing on the primary factors, labour and capital represent 44.7%, and 55.3% of the value added, respectively (Table 6). When analysing employment, *unskilled* labour represents nearly 20% of the workforce, with a primary focus on the primary sector and services. On the other hand, both *semi-skilled* and *skilled* labour have a lower representation in the primary sector, but they are prominent in services and to some extent to manufacturing. Regarding capital, services take the lead with 49.7% of the capital allocation, followed by the primary sector (24.5%).

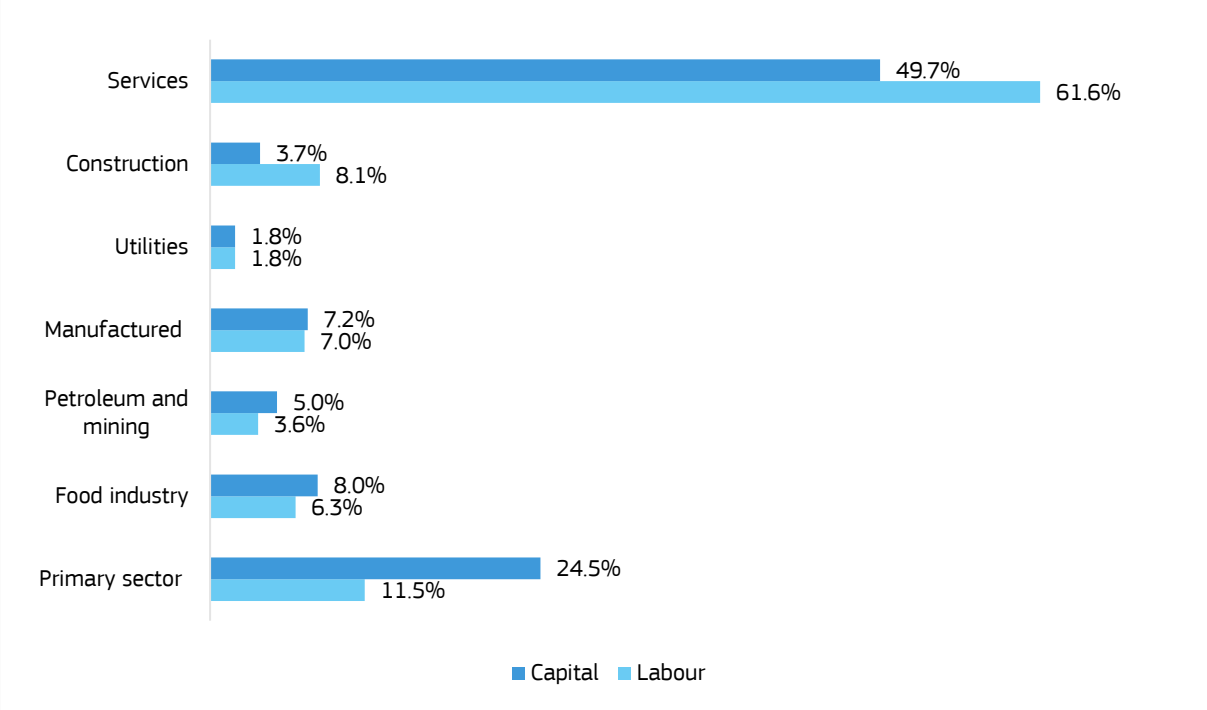
Table 6. Distribution of factors by aggregate activities. Cameroon 2016.

Activity group	Labour			Capital
	Unskilled	Semi-skilled	Skilled	
Primary sector	5.8%	3.7%	2.0%	24.5%
Food industry	1.6%	1.8%	2.9%	8.0%
Petroleum and mining	0.4%	0.8%	2.4%	5.0%
Manufactured	1.1%	2.0%	3.9%	7.2%
Utilities	0.2%	0.4%	1.2%	1.8%
Construction	1.4%	1.4%	5.3%	3.7%
Services	9.5%	20.9%	31.2%	49.7%
Total	20.0%	30.9%	49.1%	100%
% of the Value added	*44.7%*			*55.3%*

Source: Own elaboration using the 2016 Cameroon SAM.

Continuing with the analysis of the labour distribution by activities (Figure 7), services stand out representing 61.6%, followed by the primary sector. As for capital, services play a significant role accounting for 49.7%, followed by the primary sector with 24.5%.

Figure 7. Distribution of factors by aggregate activities. Cameroon 2016.



Source: Own elaboration using the 2016 Cameroon SAM.

Table 7 provides an overview of households' income distribution among the primary factors and the transfers with other institutional sectors, mainly other institutions, the government, and the rest of the world. Approximately 51% of households' income comes from labour compensation, while 40% comes from capital incomes.

Based on the information provided in the SAM, 54% of the income derived from labour compensation and 37% of the income form capital compensation belongs to households in the cities of Yaoundé and Douala.

When focusing on each region, capital represented more than 50% of the incomes in Extrême-nord, Nord-ouest and Nord regions. The transfers received by the government are more concentrated in rural zones.

Table 7. Distribution of households' income. Cameroon 2016.

Area/Region	Income		Transfers		
	Labour	Capital	Other institutions	Government	Rest of the World
Cameroon	**51%**	**40%**	**4%**	**3%**	**2%**
Urban	58.8%	34.0%	3.6%	2.3%	1.3%
Rural	37.8%	51.3%	5.4%	3.5%	2.0%
Adamaoua	43.4%	46.7%	5.0%	3.2%	1.8%
Centre (without Yaoundé)	43.1%	47.0%	5.0%	3.2%	1.8%
Est	46.7%	43.9%	4.7%	3.0%	1.7%
Extrême-nord	36.4%	52.4%	5.6%	3.5%	2.0%
Littoral (without Douala)	56.8%	35.6%	3.8%	2.4%	1.4%
Nord	36.3%	52.6%	5.6%	3.5%	2.0%
Nord-ouest	33.5%	54.8%	5.8%	3.7%	2.1%
Sud	38.7%	50.5%	5.4%	3.4%	2.0%
Sud-ouest	56.5%	35.9%	3.8%	2.4%	1.4%
Ouest	47.1%	43.6%	4.6%	2.9%	1.7%
Douala	58.5%	34.0%	3.8%	2.3%	1.3%
Yaoundé	62.5%	30.8%	3.4%	2.1%	1.2%

Source: Own elaboration using the 2016 Cameroon SAM.

5.2 Multiplier analysis and the three sustainability dimensions.

The SAM database is a valuable tool for applying linear SAM models and calculating multipliers, which help to analyse the linkages between sectors. This information is essential for studying the impact of different policies (Round, 2003b). In this section, the results of the output, value added, employment, and emissions multipliers are presented. A detailed explanation of the multipliers calculation can be found in Annex 2.

Analysing the results of the multiplier effects, it is possible to identify those commodities that have the potential to generate above-average output, employment and value added, as well as those that contribute to higher emissions. Thus, it can serve as an ex-ante policy evaluation tool for identifying commodities suitable for policy promotion. However, it is important to exercise caution when interpreting the results due to the limitations in the model. For instance, when analysing the effects of positive shocks, such as an increase in export demand, the limitations are mainly related to the implicit assumption of excess capacity in all sectors and factors of production, assuming that are either unemployed or underemployed. Additionally, since prices remain fixed, the model does not account for price adjustment or substitution effects at any level or stage (Miller & Blair, 2009; Round, 2003b).

Table 8 presents the multipliers calculated using 2016 Cameroon SAM. The shaded cells allow for easy comparison of values below or above the average. Each output multiplier value indicates the increase in gross output in sectors, resulting from a one-unit exogenous injection into the final demand of a commodity (i.e., an exogenous increase in exports demand). For example, the output multiplier for 'Animal production, hunting and related activities' indicates that a one-unit increase in exogenous demand in this group leads to 2.97 increase in output in the economy. Likewise, the value-added multiplier indicates the new value added created in response to an exogenous shock in demand. Furthermore, the employment and emissions multipliers show the increment in the number of jobs and emissions (tonne of CO2eq) respectively, generated by the exogenous increase in demand.

Considering the multipliers in Table 8, the primary sector group demonstrates a higher capacity for generating output and value-added compared to the economy average. In terms of the employment multiplier, most primary sector products show values above the average, with the highest impact observed in 'agriculture' and below-average values in 'forestry and logging products'. Analysing the agriculture sector, the distribution of the employment generated by the multiplier is primarily informal (94%) and concentrated among "*unskilled workers"* (over 63%), while the impact on "*semi-skilled workers*" represents 30% and the impact on "*skilled workers*" is relatively weak. Moreover, the impact of the agriculture employment multiplier particularly predominant in specific regions, such as Extrême-Nord, Nord, Nord-Ouest, Ouest, and Centre.

The multiplier analysis reveals that many commodities classified under the food industry sector, such as meat and fish, grain milling, dairy, beverages, and tobacco, have low multiplier values in output, value added, and employment. Among these commodities, only 'Cocoa, coffee, tea, and sugar products', 'oilseed and animal feed' and 'cereal products' have multipliers above the average in output, value added, and employment. In the food industry sector, the distribution of jobs generated by an exogenous impact of demand are similar to the agriculture group but with higher the impact on formal employment (14% on average) and a slight increase in the impact on "*skill workers*".

Turning to the manufacturing sector, the analysis of the multipliers highlights the significance of 'Textile and clothing industry products', 'Woodworking products and wooden wares', 'Furniture and products of various industries', and 'Repair and installation of machines and equipment', in terms of output, value added and employment creation. Utility accounts (electricity and energy support and production and distribution of water) and the construction sector have output and value-added multipliers above the average, with the employment multiplier slightly below average. Regarding employment distribution, over 50% of the jobs generated by the multiplier are for "*unskilled workers"*, while the impact on "*semi-skilled workers*" ranges from 31% and 36%, and the impact on "*skilled workers*" is higher compared to the primary sector, accounting for almost 15%. Additionally, the jobs created through the multiplier are concentrated in regions such as Extrême-Nord, Nord, Nord-Ouest, Ouest, as well as in urban areas like the cities of Douala and Yaoundé.

Service sectors show above-average values in terms of output and value-added for transportation, information and communication, finance and insurance, and real estate, but significantly lower in terms of employment. Only 'Professional, scientific, and technical services' have multipliers values below the global average for all types. Other services accounts show above average output, value-added, and employment multipliers.

Table 8. Output, value added, employment and emissions multipliers for Cameroon 2016.

SAM sectorial description	**Output multiplier**	**Value added multiplier**	**Employment multiplier** (1)	**Emissions multiplier** (2)
Agricultural products	2.79	1.95	4.53	2.81
Live animals and animal products	2.97	2.02	2.57	14.36
Forestry and logging products	2.95	2.02	1.83	2.61
Fisheries and aquaculture products	2.89	2.00	2.00	3.17
Extraction of hydrocarbons and other energetic products	2.08	1.37	1.04	8.34
Other extractive products	2.21	1.42	1.33	4.46
Meat and fish products	2.43	1.56	1.69	3.87
Grain mill products, starches, and starch products	2.21	1.44	1.98	1.78
Cocoa, coffee, tea, sugar products	2.61	1.60	2.09	2.13
Oil seed and animal feed	2.80	1.78	2.24	2.25
Cereal products	2.81	1.72	2.23	2.26
Milk, fruits and vegetables and other food products	2.07	1.35	1.62	1.78
Beverages	1.97	1.22	1.31	1.59
Tobacco products	1.30	0.85	1.12	1.11
Products from textile and clothing industry	2.49	1.64	2.07	2.07
Leather and shoes products	2.06	1.32	1.37	2.22
Woodworking products except manufacture of furniture	3.09	2.01	1.98	2.63
Paper and paper products, printed and reproduced products	1.49	0.94	1.04	1.22
Products of the refining petroleum and coking products	1.96	1.07	0.99	9.32
Chemical and pharmaceutical products	1.34	0.83	0.89	1.07
Rubber and plastic products	1.26	0.79	0.94	1.02
Mineral products non-metallic	1.83	1.09	1.14	2.25
Basic metallic products and metal works	1.98	1.16	1.27	2.16
Machines, electrical apparatus, and material	0.57	0.37	0.42	0.49
Computer, electronic and optical products	0.50	0.33	0.36	0.45
Transport material	0.80	0.52	0.62	0.69
Furniture and products of various industries	2.62	1.65	1.96	2.07
Repair and installation of machines and equipment	2.94	1.74	2.12	3.32
Electricity, gas, and air conditioning	2.89	1.75	1.41	3.37

Water, sanitation works and waste treatment	2.81	1.92	1.71	42.81
Construction	2.96	1.81	1.71	2.65
Wholesale and retail trade	3.15	2.05	2.63	2.66
Repair of vehicles	3.02	2.02	2.34	2.90
Transportation and warehousing services	2.79	1.87	1.64	2.88
Accommodation and food services	2.77	1.73	1.91	2.36
Information and communication services	2.70	1.70	1.71	2.17
Financial and insurance services	2.71	1.78	1.49	2.18
Real estate agency services	2.94	2.10	1.53	2.43
Professional, scientific, and technical services	2.23	1.47	1.57	1.99
Other collective, social, and personal services	2.67	1.74	1.88	2.26
Public administrations and social security	3.34	2.09	1.97	2.90
Education	3.04	2.11	2.16	3.49
Health and social action	3.18	2.11	2.08	3.62
Recreational, cultural and sporting services	3.24	2.02	2.21	2.66
Other services	3.17	2.05	2.80	3.49
Domestic services	3.34	2.38	8.27	2.90

([1]) Jobs per million of final demand impact
([2]) In tonne of CO2eq

Source: Own elaboration using the 2016 SAM for Cameroon. Shaded cells: value greater than the average

Focusing on the emissions multipliers, the most CO2eq intensive activity on average is 'production and distribution of water and sanitation and waste collection', followed by 'animal production, hunting and related activities', and 'coke and refined petroleum products', 'mining, quarrying and other extraction products' and 'meat and fish industry products'.

In addition, the analysis is also carried out considering those sectors with above average values but excluding the emissions from the waste treatment sector (due to its high emissions, which can distort the analysis). In this case, 'repair and installation of machines and equipment', 'electricity and energy support' and other services sectors also stand out due to their emissions multiplier.

6 Conclusions

This study has presented the construction of the 2016 SAM for Cameroon, along with satellite accounts related to employment and emissions data. The primary objective of this endeavour is to provide a comprehensive database that supports the implementation and evaluation of the country's social, economic, and environmental policies and initiatives.

This SAM will serve as a foundational resource for implementing advanced economic modelling approaches, such as linear or general equilibrium modelling. This database has been particularly valuable for supporting modelling that assesses the impact of significant initiatives, like the African Continental Free Trade Area (AfCFTA), by simulating various policy scenarios related to trade liberalization across the African continent. Furthermore, in the context of a linear multiplier analysis, the combination of employment and emissions data can facilitate the calculation of new ad-hoc multipliers, providing insights into CO2eq emissions and job generation per unit of final demand. This, in turn, contributes to the policy decision making process, especially in countries like Cameroon.

Moreover, the development of SAM-based modelling approach can provide policy coordination across sectors by highlighting the linkages and spillover effects between different parts of the economy. It helps policymakers identify potential trade-offs and synergies between policy objectives, such as economic growth, environmental sustainability, and social welfare. This supports evidence-based decision-making and aids in designing policies that foster sustainable development, promote inclusive growth, and address socio-economic challenges.

Turning to the results of the multiplier analysis, they portray valuable information for policy formulation. We have identified commodities that have the potential to generate above-average output, value added, and employment as well as those that contribute to higher emissions. This analysis can serve as an ex-ante policy evaluation tool for identifying commodities suitable for policy promotion. Moreover, this framework is the base of the "Jobs calculator" tool featured in the DataM portal, extensively used for calculating jobs creation in both EU and African countries.

In summary, the 2016 Cameroon SAM accounts for 48 activities producing 48 commodities, considering 3 types of labour (skilled, unskilled and semi-skilled) in 12 regions, further disaggregated into rural and urban, and classified by formal and informal employment (132 labour categories) and the capital factor. It also includes 22 household groups (divided into regions, including the cities of Douala and Yaoundé and 10 regions, and into urban and rural areas), other 5 institutional sectors (including Non-Profit Institutions serving Households, Financial and Non-Financial Corporations, and Public Institution as Government), trade margins and Transport margins, net taxes on product, net taxes on production, investment and saving, and change in inventories. Annex 1 provides a detailed overview of the accounts considered in the 2016 Cameroon SAM.

Looking ahead, there are plans to develop the SAM for the year 2019, with a focus on further disaggregation in the agricultural sector, considering the Home Production for Home Consumption (HPHC) approach, whereby non-market (subsistence) production is consumed by the producing household. To achieve this, new data from the 2021-based household survey (ECAM5) and a 2018-based employment survey (EESI3) will be used once available. Additionally, the next general census of the agricultural and livestock sectors will significantly contribute to enhancing the disaggregation of the primary sector.

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List of abbreviations and definitions

A	Activities accounts
C	Commodities accounts
CEMAC	Economic and Monetary Community of Central Africa
CGE	Computable General Equilibrium
DataM	JRC data portal of agro-economic modelling
ENTERP	Enterprise
ECAM	Fourth Cameroonian Household Survey (*Quatrième Enquête camerounaise auprès des menages)*
ECCAS	Economic Community of Central African States
EDGAR	Emission Database for Global Atmospheric Research
ESSI2	Second Survey on Employment and the Informal Sector (*Deuxième enquête sur l'emploi et le secteur*
FAO	Food and Agriculture Organisation of the United Nations
FAOSTAT	Food and Agriculture Organisation of the United Nations Statistics
FCAP	Capital factors
FLAB	Labour factors
GDP	Gross Domestic Product
GFCF	Gross Fixed Capital Formation
GOVERT	Government
HH	Households accounts
INS	Institut National de la Statistique
ILO	International Labour Organization
I-S	Investment- Saving
INDTAX	Tax and subsidy on production
JRC	Joint Research Centre
PANAP	Pan-Africa Network for Economic Analysis of Policies
RoW	Rest of the World accounts
RHG	Representative Household Group
SAM	Social Accounting Matrix
SALTAX	Indirect taxes on products Sales taxes
TRCOST	Margins

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Annexes

Annex 1. Accounts of the 2016 Cameroon Social Accounting Matrix

Factors of production			
flab_USK_inform_ADA_urb	Urban- Informal Unskilled labour Adamaoua	flab_SSK_form_DOU_urb	Urban- Formal Semi-skilled labour Douala
flab_SSK_inform_ADA_urb	Urban- Informal Semi-skilled labour Adamaoua	flab_SKL_form_DOU_urb	Urban- Formal Skilled labour Douala
flab_SKL_inform_ADA_urb	Urban- Informal Skilled labour Adamaoua	flab_USK_form_YAO_urb	Urban- Formal Unskilled labour Yaoundé
flab_USK_inform_CEN_urb	Urban- Informal Unskilled labour Centre*	flab_SSK_form_YAO_urb	Urban- Formal Semi-skilled labour Yaoundé
flab_SSK_inform_CEN_urb	Urban- Informal Semi-skilled labour Centre*	flab_SKL_form_YAO_urb	Urban- Formal Skilled labour Yaoundé
flab_SKL_inform_CEN_urb	Urban- Informal Skilled labour Centre*	flab_USK_inform_ADA_rur	Rural- Informal Unskilled labour Adamaoua
flab_USK_inform_EAS_urb	Urban- Informal Unskilled labour Est	flab_SSK_inform_ADA_rur	Rural- Informal Semi-skilled labour Adamaoua
flab_SSK_inform_EAS_urb	Urban- Informal Semi-skilled labour Est	flab_SKL_inform_ADA_rur	Rural- Informal Skilled labour Adamaoua
flab_SKL_inform_EAS_urb	Urban- Informal Skilled labour Est	flab_USK_inform_CEN_rur	Rural- Informal Unskilled labour Centre*
flab_USK_inform_EXN_urb	Urban- Informal Unskilled labour Extrême-Nord	flab_SSK_inform_CEN_rur	Rural- Informal Semi-skilled labour Centre*
flab_SSK_inform_EXN_urb	Urban- Informal Semi-skilled labour Extrême-Nord	flab_SKL_inform_CEN_rur	Rural- Informal Skilled labour Centre*
flab_SKL_inform_EXN_urb	Urban- Informal Skilled labour Extrême-Nord	flab_USK_inform_EAS_rur	Rural- Informal Unskilled labour Est
flab_USK_inform_LIT_urb	Urban- Informal Unskilled labour Littoral**	flab_SSK_inform_EAS_rur	Rural- Informal Semi-skilled labour Est
flab_SSK_inform_LIT_urb	Urban- Informal Semi-skilled labour Littoral**	flab_SKL_inform_EAS_rur	Rural- Informal Skilled labour Est
flab_SKL_inform_LIT_urb	Urban- Informal Skilled labour Littoral**	flab_USK_inform_EXN_rur	Rural- Informal Unskilled labour Extrême-Nord
flab_USK_inform_NOR_urb	Urban- Informal Unskilled labour Nord	flab_SSK_inform_EXN_rur	Rural- Informal Semi-skilled labour Extrême-Nord
flab_SSK_inform_NOR_urb	Urban- Informal Semi-skilled labour Nord	flab_SKL_inform_EXN_rur	Rural- Informal Skilled labour Extrême-Nord
flab_SKL_inform_NOR_urb	Urban- Informal Skilled labour Nord	flab_USK_inform_LIT_rur	Rural- Informal Unskilled labour Littoral**
flab_USK_inform_NWE_urb	Urban- Informal Unskilled labour Nord-Ouest	flab_SSK_inform_LIT_rur	Rural- Informal Semi-skilled labour Littoral**
flab_SSK_inform_NWE_urb	Urban- Informal Semi-skilled labour Nord-Ouest	flab_SKL_inform_LIT_rur	Rural- Informal Skilled labour Littoral**
flab_SKL_inform_NWE_urb	Urban- Informal Skilled labour Nord-Ouest	flab_USK_inform_NOR_rur	Rural- Informal Unskilled labour Nord
flab_USK_inform_SOU_urb	Urban- Informal Unskilled labour Sud	flab_SSK_inform_NOR_rur	Rural- Informal Semi-skilled labour Nord
flab_SSK_inform_SOU_urb	Urban- Informal Semi-skilled labour Sud	flab_SKL_inform_NOR_rur	Rural- Informal Skilled labour Nord
flab_SKL_inform_SOU_urb	Urban- Informal Skilled labour Sud	flab_USK_inform_NWE_rur	Rural- Informal Unskilled labour Nord-Ouest
flab_USK_inform_SWE_urb	Urban- Informal Unskilled labour Sud-Ouest	flab_SSK_inform_NWE_rur	Rural- Informal Semi-skilled labour Nord-Ouest
flab_SSK_inform_SWE_urb	Urban- Informal Semi-skilled labour Sud-Ouest	flab_SKL_inform_NWE_rur	Rural- Informal Skilled labour Nord-Ouest
flab_SKL_inform_SWE_urb	Urban- Informal Skilled labour Sud-Ouest	flab_USK_inform_SOU_rur	Rural- Informal Unskilled labour Sud
flab_USK_inform_WES_urb	Urban- Informal Unskilled labour Ouest	flab_SSK_inform_SOU_rur	Rural- Informal Semi-skilled labour Sud
flab_SSK_inform_WES_urb	Urban- Informal Semi-skilled labour Ouest	flab_SKL_inform_SOU_rur	Rural- Informal Skilled labour Sud
flab_SKL_inform_WES_urb	Urban- Informal Skilled labour Ouest	flab_USK_inform_SWE_rur	Rural- Informal Unskilled labour Sud-Ouest
flab_USK_inform_DOU_urb	Urban- Informal Unskilled labour Douala	flab_SSK_inform_SWE_rur	Rural- Informal Semi-skilled labour Sud-Ouest
flab_SSK_inform_DOU_urb	Urban- Informal Semi-skilled labour Douala	flab_SKL_inform_SWE_rur	Rural- Informal Skilled labour Sud-Ouest
flab_SKL_inform_DOU_urb	Urban- Informal Skilled labour Douala	flab_USK_inform_WES_rur	Rural- Informal Unskilled labour Ouest
flab_USK_inform_YAO_urb	Urban- Informal Unskilled labour Yaoundé	flab_SSK_inform_WES_rur	Rural- Informal Semi-skilled labour Ouest
flab_SSK_inform_YAO_urb	Urban- Informal Semi-skilled labour Yaoundé	flab_SKL_inform_WES_rur	Rural- Informal Skilled labour Ouest
flab_SKL_inform_YAO_urb	Urban- Informal Skilled labour Yaoundé	flab_USK_form_ADA_rur	Rural-Formal Unskilled labour Adamaoua
flab_USK_form_ADA_urb	Urban- Formal Unskilled labour Adamaoua	flab_SSK_form_ADA_rur	Rural- Formal Semi-skilled labour Adamaoua

flab_SSK_form_ADA_urb	Urban- Formal Semi-skilled labour Adamaoua	flab_SKL_form_ADA_rur	Rural- Formal Skilled labour Adamaoua
flab_SKL_form_ADA_urb	Urban- Formal Skilled labour Adamaoua	flab_USK_form_CEN_rur	Rural-Formal Unskilled labour Centre*
flab_USK_form_CEN_urb	Urban- Formal Unskilled labour Centre*	flab_SSK_form_CEN_rur	Rural- Formal Semi-skilled labour Centre*
flab_SSK_form_CEN_urb	Urban- Formal Semi-skilled labour Centre*	flab_SKL_form_CEN_rur	Rural- Formal Skilled labour Centre*
flab_SKL_form_CEN_urb	Urban- Formal Skilled labour Centre*	flab_USK_form_EAS_rur	Rural-Formal Unskilled labour Est
flab_USK_form_EAS_urb	Urban- Formal Unskilled labour Est	flab_SSK_form_EAS_rur	Rural- Formal Semi-skilled labour Est
flab_SSK_form_EAS_urb	Urban- Formal Semi-skilled labour Est	flab_SKL_form_EAS_rur	Rural- Formal Skilled labour Est
flab_SKL_form_EAS_urb	Urban- Formal Skilled labour Est	flab_USK_form_EXN_rur	Rural-Formal Unskilled labour Extrême-Nord
flab_USK_form_EXN_urb	Urban- Formal Unskilled labour Extrême-Nord	flab_SSK_form_EXN_rur	Rural- Formal Semi-skilled labour Extrême-Nord
flab_SSK_form_EXN_urb	Urban- Formal Semi-skilled labour Extrême-Nord	flab_SKL_form_EXN_rur	Rural- Formal Skilled labour Extrême-Nord
flab_SKL_form_EXN_urb	Urban- Formal Skilled labour Extrême-Nord	flab_USK_form_LIT_rur	Rural-Formal Unskilled labour Littoral**
flab_USK_form_LIT_urb	Urban- Formal Unskilled labour Littoral**	flab_SSK_form_LIT_rur	Rural- Formal Semi-skilled labour Littoral**
flab_SSK_form_LIT_urb	Urban- Formal Semi-skilled labour Littoral**	flab_SKL_form_LIT_rur	Rural- Formal Skilled labour Littoral**
flab_SKL_form_LIT_urb	Urban- Formal Skilled labour Littoral**	flab_USK_form_NOR_rur	Rural-Formal Unskilled labour Nord
flab_USK_form_NOR_urb	Urban- Formal Unskilled labour Nord	flab_SSK_form_NOR_rur	Rural- Formal Semi-skilled labour Nord
flab_SSK_form_NOR_urb	Urban- Formal Semi-skilled labour Nord	flab_SKL_form_NOR_rur	Rural- Formal Skilled labour Nord
flab_SKL_form_NOR_urb	Urban- Formal Skilled labour Nord	flab_USK_form_NWE_rur	Rural-Formal Unskilled labour Nord-Ouest
flab_USK_form_NWE_urb	Urban- Formal Unskilled labour Nord-Ouest	flab_SSK_form_NWE_rur	Rural- Formal Semi-skilled labour Nord-Ouest
flab_SSK_form_NWE_urb	Urban- Formal Semi-skilled labour Nord-Ouest	flab_SKL_form_NWE_rur	Rural- Formal Skilled labour Nord-Ouest
flab_SKL_form_NWE_urb	Urban- Formal Skilled labour Nord-Ouest	flab_USK_form_SOU_rur	Rural-Formal Unskilled labour Sud
flab_USK_form_SOU_urb	Urban- Formal Unskilled labour Sud	flab_SSK_form_SOU_rur	Rural- Formal Semi-skilled labour Sud
flab_SSK_form_SOU_urb	Urban- Formal Semi-skilled labour Sud	flab_SKL_form_SOU_rur	Rural- Formal Skilled labour Sud
flab_SKL_form_SOU_urb	Urban- Formal Skilled labour Sud	flab_USK_form_SWE_rur	Rural-Formal Unskilled labour Sud-Ouest
flab_USK_form_SWE_urb	Urban- Formal Unskilled labour Sud-Ouest	flab_SSK_form_SWE_rur	Rural- Formal Semi-skilled labour Sud-Ouest
flab_SSK_form_SWE_urb	Urban- Formal Semi-skilled labour Sud-Ouest	flab_SKL_form_SWE_rur	Rural- Formal Skilled labour Sud-Ouest
flab_SKL_form_SWE_urb	Urban- Formal Skilled labour Sud-Ouest	flab_USK_form_WES_rur	Rural-Formal Unskilled labour Ouest
flab_USK_form_WES_urb	Urban- Formal Unskilled labour Ouest	flab_SSK_form_WES_rur	Rural- Formal Semi-skilled labour Ouest
flab_SSK_form_WES_urb	Urban- Formal Semi-skilled labour Ouest	flab_SKL_form_WES_rur	Rural- Formal Skilled labour Ouest
flab_SKL_form_WES_urb	Urban- Formal Skilled labour Ouest	fcap	Capital
flab_USK_form_DOU_urb	Urban- Formal Unskilled labour Douala	*Centre (except Yaoundé)	**Littoral (except Douala)

Institutional sectors			
hh_ADA_rur	Rural Adamaoua	hh_EXN_urb	Urban Extrême-Nord
hh_CEN_rur	Rural Centre (except Yaoundé)	hh_LIT_urb	Urban Littoral (except Douala)
hh_EAS_rur	Rural Est	hh_NOR_urb	Urban Nord
hh_EXN_rur	Rural Extrême-Nord	hh_NWE_urb	Urban Nord-Ouest
hh_LIT_rur	Rural Littoral (except Douala)	hh_SOU_urb	Urban Sud
hh_NOR_rur	Rural Nord	hh_SWE_urb	Urban Sud-Ouest
hh_NWE_rur	Rural Nord-Ouest	hh_WES_urb	Urban Ouest
hh_SOU_rur	Rural Sud	hh_DOU_urb	Urban Douala
hh_SWE_rur	Rural Sud-Ouest	hh_YAO_urb	Urban Yaoundé
hh_WES_rur	Rural Ouest	hh_CEN_urb	Urban Centre (except Yaoundé)
hh_ADA_urb	Urban Adamaoua	hh_EAS_urb	Urban Est
hh_ADA_rur	Rural Adamaoua	hh_EXN_urb	Urban Extrême-Nord
hh_CEN_rur	Rural Centre (except Yaoundé)	hh_LIT_urb	Urban Littoral (except Douala)
hh_EAS_rur	Rural Est	hh_NOR_urb	Urban Nord

hh_EXN_rur	Rural Extrême-Nord	hh_NWE_urb	Urban Nord-Ouest
hh_LIT_rur	Rural Littoral (except Douala)	hh_SOU_urb	Urban Sud
hh_NOR_rur	Rural Nord	hh_SWE_urb	Urban Sud-Ouest
hh_NWE_rur	Rural Nord-Ouest	hh_WES_urb	Urban Ouest
hh_SOU_rur	Rural Sud	hh_DOU_urb	Urban Douala
hh_SWE_rur	Rural Sud-Ouest	hh_YAO_urb	Urban Yaoundé
hh_WES_rur	Rural Ouest	NPISH	Non-profit institution serving households
hh_ADA_urb	Urban Adamaoua	enterp	Non-financial corporations
hh_CEN_urb	Urban Centre (except Yaoundé)	fininst	Financial institutions
hh_EAS_urb	Urban Est	govert	Government

Other accounts			
i-s	Gross fixed capital formation	saltax	Trade margins
dstk	Stock variation	tradcost	Transport margins
row	Rest of the world	trancost	Taxes on product - Subsidies
indtax	Taxes on production - Subsidies		

Activities and Commodities			
a_A01	Agricultural	c_A01	Agricultural products
a_A02	Animal production, hunting and related activities	c_A02	Live animals and animal products
a_A03	Forestry and logging	c_A03	Forestry and logging products
a_A04	Fishery and aquaculture	c_A04	Fisheries and aquaculture products
a_B05	Mining and quarrying	c_B05	Extraction of hydrocarbons and other energetic products
a_B06	Other extraction activities	c_B06	Other extractive products
a_C07	Processing and preserving of meat and fish	c_C07	Meat and fish products
a_C08	Manufacture of grain mill products, starches, and starch products	c_C08	Grain mill products, starches, and starch products
a_C09	Manufacture of cocoa, chocolate, and sugar confectionery	c_C09	Cocoa, coffee, tea, sugar products
a_C10	Manufacture of oilseeds and prepared animal feeds	c_C10	Oil seed and animal feed
a_C11	Manufacture of other food products	c_C11	Cereal products
a_C12	Processing and preserving of fruit and vegetables and manufacture of dairy products	c_C12	Milk, fruits and vegetables and other food products
a_C13	Manufacture of beverages	c_C13	Beverages
a_C14	Manufacture of tobacco products	c_C14	Tobacco products
a_C15	Manufacture of textiles and wearing apparel	c_C15	Products from textile and clothing industry
a_C16	Manufacture of leather and related products	c_C16	Leather and shoes products
a_C17	Manufacture of wood and wood products, except furniture	c_C17	Woodworking products except manufacture of furniture
a_C18	Manufacture of paper and paper products	c_C18	Paper and paper products, printed and reproduced products
a_C19	Manufacture of coke and refined petroleum products	c_C19	Products of the refining petroleum and coking products
a_C20	Manufacture of chemicals and pharmaceuticals products	c_C20	Chemical and pharmaceutical products
a_C21	Manufacture of rubber and plastics products	c_C21	Rubber and plastic products
a_C22	Manufacture of other non-metallic mineral products	c_C22	Mineral products non-metallic
a_C23	Manufacture of basic metals and metal products	c_C23	Basic metallic products and metal works
a_C24	Manufacture of electrical equipment, machinery, and equipment	c_C24	Machines, electrical apparatus, and material
a_C25	Manufacture of computer, electronic and optical products	c_C25	Computer, electronic and optical products
a_C26	Manufacture of motor vehicles, trailers and semi-trailers and other transport equipment	c_C26	Transport material
a_C27	Manufacture of furniture and other manufacturing	c_C27	Furniture and products of various industries
a_C28	Repair and installation of machinery and equipment	c_C28	Repair and installation of machines and equipment
a_D29	Electricity, gas, steam, and air conditioning supply	c_D29	Electricity, gas, and air conditioning
a_E30	Water collection, treatment, and supply	c_E30	Water, sanitation works and waste treatment
a_F31	Construction	c_F31	Construction
a_G32	Wholesale and retail trade	c_G32	Wholesale and retail trade
a_G33	Repair of motor vehicles and motorcycles	c_G33	Repair of vehicles
a_H34	Transportation and storage	c_H34	Transportation and warehousing services

a_I35	Accommodation and food service activities	c_I35	Accommodation and food services
a_J36	Information and communication activities	c_J36	Information and communication services
a_K37	Financial and insurance activities	c_K37	Financial and insurance services
a_L38	Real estate activities	c_L38	Real estate agency services
a_M39	Professional, scientific, and technical activities	c_M39	Professional, scientific, and technical services
a_N40	Administrative and support service activities	c_N40	Other collective, social, and personal services
a_O41	Public administration and defence; compulsory social security	c_O41	Public administrations and social security
a_P42	Education	c_P42	Education
a_Q43	Human health and social work activities	c_Q43	Health and social action
a_R44	Arts, entertainment, and recreation	c_R44	Recreational, cultural and sporting services
a_S45	Other service activities	c_S45	Other services
a_T46	Activities of households as employers of domestic personnel	c_T46	Domestic services
a_U47	Activities of extraterritorial organizations and bodies	c_U47	Services of extraterritorial organizations

Annex 2. The linear SAM model and multipliers

SAM are used as databases for linear multiplier models, enabling the linkages between sectors to be analysed which is useful for studying the impact of different policies.

The starting point is the Leontief's equilibrium equation ([4]), applied to the case of a SAM obtaining the SAM Leontief inverse (Pyatt & Round, 1985). The standard representation is as follows: $M = (I - \mathrm{A})^{-1}$, where the matrix A is the coefficient matrix (calculated dividing each element of the SAM by the total of their corresponding column), and each element m_{ij} in M shows the the input requirements of i to produce one unit of j (Mainar-Causapé et al., 2018a). This matrix is used as a tool to evaluate the capacity of each economic sector to generate economic, social, and environmental impact in the rest of the economy through the analysis of multipliers.

Output multiplier

The sum of the multiplier values of the commodities column of $\boldsymbol{M}_a$, shows the output multiplier. This multiplier indicates the increase in output of the economy generated as a result of a unitary exogenous shock in exogenous values for the corresponding commodity. A high value of this multiplier indicates a large backward income expansion influence on the rest of the economy, given that its input requirements to cope with the increase when it receives an exogenous shock are transferred to its upstream input suppliers (Pulido & Fontela, 1993).

Value added multiplier

The Value added multiplier relates the new value added created in each sector in response to the exogenous shock (Miller & Blair, 2009). A vector $\boldsymbol{v}$ is needed for its calculation, which contains the ratios between the value added and the output of each activity. The sum of the remuneration of factors plus taxes les subsidies on production is the value added by Activities. The value-added multiplier indicates the new value added created by the additional production in responses to an exogenous shock in demand.

Employment multiplier

The employment multiplier provides the number of jobs that would be generated by an exogenous shock in final demand. First, it is necessary to have the employment vector $\boldsymbol{e}$, that contains the ratios between the number of jobs and the output of each activity. The employment matrix $\boldsymbol{E}$ is a diagonal matrix whose elements are the vector e and is multiplied by the part of the multiplier matrix ($\boldsymbol{M}_a$) that incorporates the rows corresponding to the productive accounts and the columns corresponding to commodities. The expression of the employment multiplier is given as: $\boldsymbol{M}_e = \boldsymbol{E} \times \boldsymbol{M}_a$. Each element in $\boldsymbol{M}_e$, $\boldsymbol{me}_{ij}$ is the increment in the number of jobs in sector i when there is a unit exogenous injection into the endogenous final demand of j. The sum of the columns in the matrix shows the global effect on employment produced by the exogenous increase in demand. In summary, the multipliers reveal the number of additional jobs per million of additional output from each activity (Mainar-Causapé et al., 2018a). Notably, the results do not take social variables such as the quality of employment into account. Besides, due to the assumptions of the model mentioned above, the results should not be interpreted as an exact forecast of job creation due to exogenous shocks. Nonetheless, they are useful as an indicator of the economy commodities with a greater potential to generate jobs.

Emissions multiplier

Like the employment multiplier, in order to obtain the CO_2 emissions multiplier, a vector $\boldsymbol{g}$ containing the ratios of the number of emissions per unit of output value is required. It is obtained by multiplying the vector by $\boldsymbol{M}_a$, and each element of the matrix indicates how much CO_2 is generated by an additional unit of final demand.

([4]) Assuming Leontief technologies (i.e., with fixed prices and no substitution elasticities), the result should be taken with caution.

Annex 3 – On-line resources.

The 2016 Social Accounting Matrix of Cameroon is available on the public website "EC Data-Modelling platform of resource economics DataM". Links can be also accessed with the QR codes listed in this annex.

Figure A2. QR code – DataM URL:

https://datam.jrc.ec.europa.eu

Source: JRC, 2023.

Bulk download

Using DataM, users can make a bulk download of SAM in a ZIP file containing a CSV file in English or French. The hyperlinks for the direct bulk download are in Figure A2 and Figure A3.

Figure A3. QR Code – direct bulk data download in English:

https://datam.jrc.ec.europa.eu/datam/perm/dataset/29432d77-a82c-495a-99e6-5fe3348a2192/download/Dataset_JRC_-_Social_accounting_matrix_-_Cameroun_-_2016__EN_.zip

Source: JRC, 2023.

Figure A4. QR Code – direct bulk data download in French:

https://datam.jrc.ec.europa.eu/datam/perm/dataset/8a13b99a-cbbf-4127-b49f-58f9a96c2319/download/Dataset_JRC_-_Matrice_de_comptabilit__sociale_-_Cameroun_-_2016__FR_.zip

Source: JRC, 2023.

In the bulk download, the SAM is presented in a standard flat format as CSV file with header row. Conceptually, it contains a column for the spending agent, a column for the receiving agent and a column with values in Millions of FCFA.

Interactive download

DataM includes also a function for interactive download, which allows filtering the only part of interest of the datasets. Find the direct link for the SAM in the figure A4.

Figure A4. QR Code – direct link to the data warehouse page of the dataset in English:

https://datam.jrc.ec.europa.eu/datam/perm/dataset/29432d77-a82c-495a-99e6-5fe3348a2192

Source: JRC, 2023.

Figure A5. QR Code – direct link to the data warehouse page of the dataset in French:

https://datam.jrc.ec.europa.eu/datam/perm/dataset/8a13b99a-cbbf-4127-b49f-58f9a96c2319

Source: JRC, 2023.

Interactive dashboard

Users may explore and analyse the data through an interactive dashboard placed in the "PANAP network" section of the website (Figure A10). This dashboard includes both English and French languages.

Figure A6. QR Code – direct link to the interactive dashboard:

https://datam.jrc.ec.europa.eu/datam/mashup/SAM_CM

Source: JRC, 2023.

The interactive dashboard allows users to undertake their own analysis of the dataset.

It consists of a number of sheets that allow analysing data from different perspectives.

Jobs calculator

The jobs calculator is a tool included in DataM where the user can simulate changes of exports for products or services while dynamic charts will show you real-time the impact on employment in the different activities of the economicy. It includes Cameroon among other African countries.

Figure A7. QR Code – direct link to the interactive dashboard:

https://datam.jrc.ec.europa.eu/datam/mashup/JOBS_CALCULATOR?SAM=CM

Source: JRC, 2023.

Open data portals

In the period subsequent to the publication of this report, the following pages will be gradually activated[5] on relevant open data portals, enabling to easily find this dataset on the web:

1. On the JRC Data Catalogue: https://data.jrc.ec.europa.eu/dataset/2eb5cf24-937a-4c65-9995-3460c8062b81
2. On the EU Open Data Portal: https://data.europa.eu/euodp/data/dataset/2eb5cf24-937a-4c65-9995-3460c8062b81

List of abbreviations and definitions

CSV	Comma separated value
DataM	JRC data-modelling platform of resource economics
QR code	Quick response code
SAM	Social Accounting Matrix
XLSX	Microsoft Excel file format

[5] The time necessary for the activations of these services is beyond the control of the authors.

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