HUMBOLDT-UNIVERSITÄT ZU BERLIN
Faculty of Life Sciences
Department of Agricultural Economics

No. 101/2022

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WORKING PAPER

Imprint: Department of Agricultural Economics, Faculty of Life Sciences, Humboldt-Universität zu Berlin
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https://www.agrar.hu-berlin.de/de/institut/departments/daoe/publ/wp

A 2019 Social Accounting Matrix for Benin with Detailed Representation of Agriculture and Food Processing Sectors

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Abstract

This paper presents a detailed 2019 Social Accounting Matrix (SAM) for Benin as a basis for policy analysis with a focus on agriculture, food processing and energy generation from by-products. It is based on official statistics collected from national and international institutions (national statistical office, ministry of agriculture and related research institutions, central bank, World Bank, United Nations) and complemented with data collected from stakeholders within the domestic processing sector and NGOs supporting agriculture and food processing. A top-down approach was followed starting with national accounts data to build a consistent macro-SAM. The values in the macro-SAM were used as macro-totals while disaggregating a prior micro-SAM (with minor imbalances), which is estimated using the Cross-Entropy method. The micro-SAM contains 127 accounts: 47 activities (19 agricultural, 12 food processing, 9 non-food industries, construction and 6 service sectors); 51 commodities (21 agricultural, 13 food processing, 10 non-food industries, construction and 6 service commodities); 3 margins; 4 production factors; 10 household groups (rural and urban income quintiles), the government as well as 6 tax accounts; enterprises, 2 savings/investment accounts (private and public) and 2 foreign accounts (Nigeria and the rest of the world). The estimated SAM reflects total GDP at factor cost at FCFA 7.7 trillion (about US$ 13.1 billions). Services, agriculture, construction, non-food industry and food industry contribute 60.3%, 29.1%, 5.2%, 2.7% and 2.6% respectively to GDP. Labour and land are the most important income sources for low income households while capital and labour provide most of the income of high-income households.

Keywords: SAM, agriculture, food processing, green-energy, Computable General Equilibrium (CGE) model, developing country

JEL: C6, C8, D1, D5, D6, E16, E2, F1, F2, H2

Acknowledgements

The first author gratefully acknowledges the financial support provided by Deutscher Akademischer Austauschdienst (DAAD). The authors thank the "Institut National de la Statistique et de l'Analyse Economique (INSAE)" (current “Institut National de la Statistique et de la Démographie (INStaD)”) of Benin and its head and staff members for data provision and background information. The authors are grateful to the “Banque Centrale des Etats de l'Afrique de l'Ouest" (Central Bank of West-African States) for making available macro-data for Benin, the Programme Analyse de la Politique Agricole (PAPA) and the Ministry of Agriculture (MAEP) for providing us with cost structures of agricultural activities, and food processors in Benin who provided data on the food processing sector. We are also grateful to Benin-Caju and its staff members for data on cashew processing.

The SAM is a snapshot of the Benin economy in 2019. Any miscalculation/interpretation of the official statistics should be attributed to the authors, not the institutions/individuals providing the data.

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List of acronyms

$US	United States dollar
BCEAO	*Banque Centrale des Etats de l'Afrique de l'Ouest* (Central Bank of West African States)
BoP	Balance of Payments
CGE	Computable General Equilibrium
CNS	Cashew Nut Shell
COVID 19	Coronavirus Disease 2019
EDEN	*Entrepôt de Données Economiques et fiNancières* (Economic and Financial Data Store)
EMICoV	*Enquête Modulaire Intégrée sur les Conditions de Vie des ménages* (Integrated Modular Survey on Livelihoods of Households)
FCFA	*Franc de la Communauté Francaise d'Afrique* (Franc of the French Community of Africa)
GDP	Gross Domestic Production
INSAE	*Institut National de la Statistique et de l'Analyse Economique* (National Institute of Statistics and Economic Analysis)
INStaD	*Institut National de la Statistique et la Démographie* (National Institute of Statistics and Demography)
MAEP	*Ministère de l'Agriculture, de l'Elevage et de la Pêche* (Ministry of Agriculture, Husbandry and Fishing)
MEF	*Ministère de l'Economie et des Finances* (Ministry of Economy and Finance)
MMI	Main Macroeconomic Indicators
NA	National Accounts
PAPA	*Programme Analyse de la Politique Agricole* (Agricultural Policy Analysis Programme)
RoW	Rest of the World
SAM	Social Accounting Matrix
UN	United Nations
VAT	Value Added Tax
WAEMU	West-African Economic and Monetary Union
WB	World Bank
WDI	Word Development Indicators

1 Introduction

This chapter introduces the paper in four sections. First, we provide background information on Social Accounting Matrices (SAMs) and motivate the development of a SAM for Benin. Second, we present the structure of the SAM. Third, we summarize the main features of the SAM and in the last section, we give an overview on the structure of this paper.

1.1 Background

Providing a snapshot of all monetary transactions in an economy (between sectors and institutions), generally during one year (Breisinger *et al.*, 2009), a SAM is a squared matrix representing an economy in equilibrium. SAM rows contain the incomes of accounts while the columns present expenditures. For each account, the column total (total expenditure) is equal to the row total (total income) because of the equilibrium condition (total demand equals total supply; total expenditure equals total income). A SAM can be built for any economic (administrative) unit (village, region of a country, country, group of countries) (Pyatt & Round, 1985). Every SAM contains data about (economic/productive) activities, commodities (markets), production factors, institutions (households, enterprises, government and the rest of the world) and savings/investment (Breisinger *et al.*, 2009). A SAM can be highly aggregated (macro-SAM) or disaggregated (micro-SAM). A SAM is generally used as a benchmark for policy simulations using Computable General Equilibrium (CGE) Models and SAM multiplier models (Breisinger *et al.*, 2009). Hence, the degree of disaggregation depends on potential research questions.

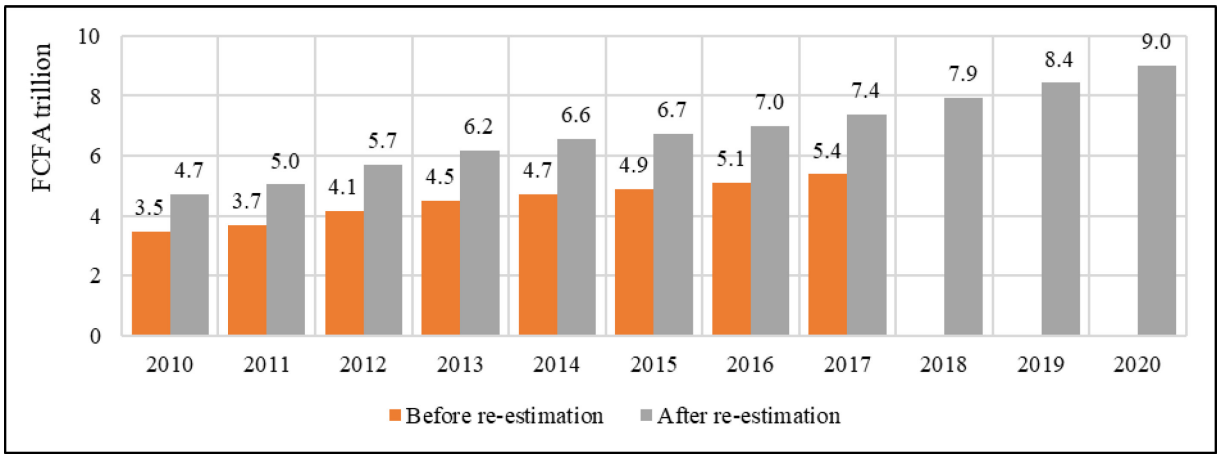
Benin is a west-African, agriculture-based lower middle income country with around 70% of employment provided by agriculture, accounting for about 30% of its GDP (MAEP, 2017). SAMs have been developed for Benin for the years 2007, 2010, 2013, and 2015. Most of these SAMs are not accompanied by detailed documentation. Thus, most of the time it is not possible for the user to trace the underlying assumptions and data sources. The most recent SAM produced by the national statistical office of Benin is for 2013 and is documented (INSAE, 2018). However, more disaggregation would be required for targeted policy simulations for specific sectors such as agriculture and food processing. There is a 2015 SAM built for Benin by Grethe *et al. (2020)* which is highly disaggregated for agriculture and households but not well-documented. The current SAM is a development starting from that SAM. The following reasons motivate us to develop the current SAM for Benin.

– Beninese institutions re-estimated between 2016 and 2020 economic aggregates, resulting in higher values for indicators such as Gross Domestic Production (GDP) (Figure 1), which is not reflected in the existing SAMs (INSAE, 2018; Grethe *et al.*, 2020).
– For agriculture-based economies such as Benin, agriculture and related sectors need particular attention to facilitate sector-specific policy analyses. Hence, this SAM provides more detailed representation of agricultural and food processing sectors as well as their by-products.

– Some sectors were not explicitly presented in the previous SAMs but interesting from an agricultural development perspective. For instance, the cashew apple which is produced together with cashew nut by the cashew sector (Houssou *et al.*, 2016; Zoumarou Wallis *et al.*, 2016; Benin Caju, 2017; Houssou *et al.*, 2018) is a commodity of a high nutritional and economic value and integrated in this SAM.
– Some important agricultural activities such as poultry husbandry which is an important income source for most of rural households (Sodjinou *et al.*, 2015; Kulla *et al.*, 2021) were aggregated in a single animal-husbandry sector. In this SAM they are disaggregated.
– Most of previous SAMs did not provide household disaggregation according to income level. Such disaggregation is needed, however, to simulate changes in the distribution of income and welfare among households. For that reason, this SAM provides disaggregation of households according to their income quintiles (Q1= poorest and Q5= richest) and their location (rural or urban).

As the year 2020 was heavily affected by the Coronavirus Disease (COVID 19) leading to economic disruptions all over the world, we chose 2019 as the most recent year before COVID 19. Despite the national elections in Benin in 2019 and the Nigerian border closing during the last quarter of that year, the official data do not show any drastic changes compared to previous years (BCEAO, 2021; INSAE, 2021; World Bank, 2021). We, therefore, consider 2019 as a "quite normal" economic year for Benin.

Figure 1. Benin GDP in the last decade



Source: Own compilation.

1.2 Structure of the SAM

Figure 2 summarizes the circular flow of income in the Beninese economy. Goods and services transactions, as the physical counterpart of monetary transactions, follow the opposite direction. Activities combine intermediate inputs (from commodity markets) and production factors (from factor markets) to produce commodities that are sold on markets and pay production taxes to the government. In addition to domestically produced commodities, imports (from Nigeria or the Rest of the World) satisfy private household and government consumption as well as investment and export demand. Commodities pay taxes (tariffs on imports and exports, value added tax, sales tax) to the government and margins reflecting trade cost to the trade sector. Apart from the domestic factors employed domestically, factor markets collect factor income from abroad (factors employed abroad). Net factor income is distributed to factor owners (households, enterprises, government, abroad).

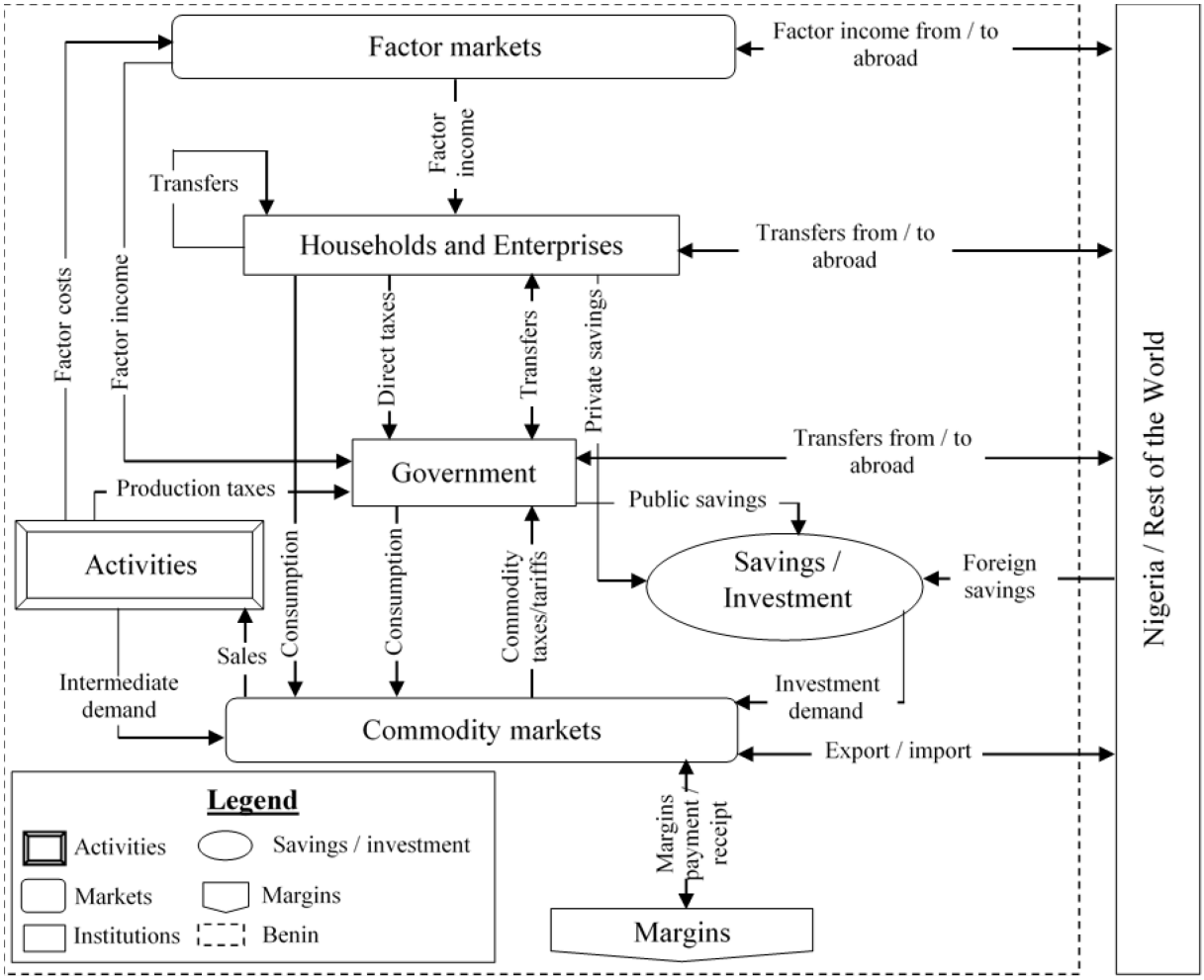
The government collects direct taxes from households and enterprises, investment profits from enterprises and grants and loans from abroad. It transfers part of its income to households (social transfers, pensions and interest on domestic debt from households), enterprises (operating subsidy and interest on domestic debt from enterprises) and abroad (interest on international debt). The difference between government income and expenditures is government savings (deficit or surplus).

Next to consumption expenditure, households spend income on inter-households' transfers (from higher to lower income households), send remittances to household members abroad and save the residual. Enterprises pay dividends to their owners (households, government and abroad). They also transfer some income to support poor households and save the residual. Foreign savings (from abroad: current account balance) complement domestic savings and together account for total investment.

This circular flow is the basis for the structure of the 2019 SAM for Benin summarized as an aggregated SAM in Table 1. The columns show the expenditures (outgoings of the accounts), representing at the same time the incomes for the rows (incomings of the accounts). To allow easy referencing of each cell, the columns are labelled with letters (A to O) and the rows are numbered (1 to 15). Accordingly, Table 1 contains 14 aggregated accounts and the totals (in its last column and last row).

Each filled cell in Table 1 briefly describes the concerned transaction and corresponds to a sub-matrix of the micro-SAM. For instance, the payment from activity to commodity in cell (1, C) of Table 1 corresponds to the intermediate demand sub-matrix in the micro-SAM, where several activities pay to several commodities. Likewise, private consumption (1, G) corresponds to a sub-matrix in the micro-SAM (several household groups, several commodities). A detailed description of the different sub-matrices is provided in chapter 2.

Figure 2. Circular flow of income in Benin and transactions with the rest of the world



Source: Own compilation.

Table 1. SAM structure

Outgoings / Incomings			A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
			Commodities	**Margins**	**Activities**	**Factors**			**Households**	**Government**	**Indirect taxes**	**Direct taxes**	**Enterprises**	**Investment**	**Rest of the World**		**Total**
						Labour	**Capital**	**Land**							**Nigeria**	**Other**	
1	**Commodities**			Margins	Intermediate inputs				Private consumption	Government consumption				Investment demand	Export to Nigeria	Export to the RoW	Total demand
2	**Margins**		Margins														Total margins
3	**Activities**		Domestic output														Total output
4	**Factors**	**Labour**			Labour compensation										Labour income from Nigeria	Labour income from RoW	Labour income
5		**Capital**			Capital compensation												Capital income
6		**Land**			Land compensation												Land income
7	**Households**					Labour income to household	Unincorporated capital income	Rent to household	Inter-Household transfers	Government transfers to households			Transfers and dividends		Remittances from Nigeria	Remittances from the RoW	Household income
8	**Government**						Capital return to government				Indirect tax revenue	Direct tax revenue	Investment profit		Grants from Nigeria	Grants from the RoW	Government income
9	**Indirect taxes**		Indirect taxes		Production taxes												Indirect tax revenue
10	**Direct taxes**								Income tax				Corporate tax				Direct tax revenue
11	**Enterprises**						Capital return to enterprises	Land income to enterprises		Government transfers to enterprises					Income to enterprises from Nigeria	Income to enterprises from the RoW	Corporate income
12	**Savings**								Households savings	Government savings			Enterprises savings		Current account balance	Current account balance	Total savings
13	**Rest of the World**	**Nigeria**	Imports from Nigeria			Labour payment to Nigeria			Households transfers to Nigeria	Government payment to Nigeria			Enterprises payment to Nigeria				Foreign exchange outflow
14		**Other**	Imports from the RoW			Labour payment to RoW			Households transfers to the RoW	Government payment to the RoW			Enterprises payment to the RoW				Foreign exchange outflow
15	**Total**		Total supply	Total margins	Gross output	Labour costs	Capital expenditure	Land expenditure	Households expenditure	Government expenditure	Net indirect tax	Net direct tax	Enterprise expenditure	Total investment	Foreign exchange inflow	Foreign exchange inflow	

Source: Own compilation.

1.3 Features of the 2019 SAM for Benin

Several features distinguish this 2019 SAM from previous SAMs for Benin.

i) It is the first SAM considering the macro-indicators of Benin after their re-estimation between 2016 and 2020.

ii) The cost structure of agricultural activities is based on information collected from the economic accounts of agriculture (Adégbola *et al.*, 2013a, 2013b), agricultural research institutions (Houssou *et al.*, 2016; Houssou *et al.*, 2018), institutions supporting the sectors (Benin Caju, 2016, 2017; Houngbédji, 2020) and food processors (key informants).

iii) It has a detailed representation of agricultural sectors including:
   a. Three poultry husbandry activities: "bicycle"[1] (traditional) poultry husbandry, broiler husbandry and laying hens. Bicycle poultry husbandry – a traditional chicken production which is practiced by almost all rural and even some urban households in Benin – produces "bicycle poultry". This is available everywhere every time for human consumption. Due to its quality, it is also used by indigenous religions for sacrifices. The broiler husbandry produces "broiler chicken", which is mostly available in the big cities during celebration periods (Christmas, Sylvester, Easter, Ramadan, etc.) and less available in ordinary times. Laying hens produce eggs.
   b. The "cashew apple" commodity produced by the cashew production activity. This juicy fruit which is about 9 times heavier than the cashew nut (Zoumarou Wallis *et al.*, 2016; Houssou *et al.*, 2018) was not considered in the previous SAMs as it is so far also rarely used. However, it is a valuable commodity for its nutritional potential (Dedehou *et al.*, 2015; Benin Caju, 2017). Cashew apple processing is currently emerging in Benin to better valorise this commodity (Gbaguidi, 2020). Thus, cashew apple could become an important commodity in the close future.

iv) It has a disaggregated food processing sector according to the technological level:
   a. Bicycle poultry slaughtering and broiler poultry slaughtering. While the broiler meat is a conventional chicken meat, the bicycle poultry meat could be considered of uncertified organic quality. These activities are emerging and facing competition from low-priced imported chicken parts from high income countries (Kulla *et al.*, 2021);
   b. Two pineapple processing activities (artisanal and industrial), both producing pineapple juice. Artisanal juice is almost exclusively sold domestically while a large share of industrial juice is exported to neighbouring countries and to Europe.
   c. Cashew processing is disaggregated into three activities: (1) industrial cashew nut processing, producing industrial cashew kernel (mostly exported) and cashew nut shell (CNS) (can be used as an energy source to make the

[1] A traditional chicken breed, short and resistant. The word "bicycle" refers to their ability to run fast and a sales practice that consists of hanging them on the handlebars of bicycles to bring them to the market.

processing more competitive and more sustainable and can also be sold to other factories for further processing into energy); (2) artisanal cashew nut processing, which produces artisanal cashew kernel (mostly consumed domestically); and (3) cashew apple processing, producing cashew apple juice. The latter is an emerging activity with a high potential due to the availability of the raw material (cashew apple which so far is largely neglected and most of it spoiled under the trees) and its nutritional potential.

v) Its electricity sector is disaggregated into bio-electricity produced from CNS (Benin Caju, 2017) either at the cashew processing factory level or at the national level by special CNS processing factories and into conventional electricity produced at the national level by a conventional electricity activity.

1.4 Structure of this paper

Besides this introduction, this paper contains four chapters. The second chapter, entitled "Developing the macro-SAM", guides the reader through the different steps of macro-SAM development. The third chapter, entitled "Developing the micro-SAM and SAM-estimation", provides information on the disaggregation and ends by explaining the estimation process, discussing data quality and a comparison between the estimated and the prior macro-SAM. The fourth chapter describes the Beninese economy in 2019 based on the estimated SAM. The concluding chapter presents some highlights from the SAM and draws implications from the content of the SAM.

2 Developing the macro-SAM

We started the process of 2019 SAM construction by developing a 2019 prior macro-SAM based on available data and then estimated a balanced version using the cross-entropy method (Robinson & McDonald, 2006). This chapter describes the stepwise construction of the macro-SAM.

2.1 Data sources

The "*Banque Centrale des Etats de l'Afrique de l'Ouest (BCEAO)*" (Central Bank of West African States) is the main data source used to build the 2019 macro-SAM for Benin. The 2019 National Accounts (NA) for Benin, the Main Macroeconomic Indicators (MMI) and the Balance of Payments (BoP) were obtained from the BCEAO data bank named "*Entrepôt de Données Economiques et fiNancières (EDEN)*" (BCEAO, 2021). We also obtained some data from the Word Development Indicators (WDI) database (World Bank, 2021). The 2019 Benin Government budget implementation report (MEF, 2020) was used to extract data regarding government income and expenditure. Another data source we used was the "*Institue Nationale de la Statistique et de l'Analyse Economique (INSAE)*" (National Statistical Office of Benin). From INSAE we used the data set of a 2011 household survey (Enquête Modulaire

Intégrée sur les Conditions de Vie des ménages: EMICoV) (INSAE, 2012). INSAE provided us as well with a 2013 SAM for Benin (INSAE, 2018) from which we used some shares and ratios. We also identified another 2013 SAM, two 2015 SAMs for Benin and a 2010 SAM. These SAMs (more detailed than INSAE 2013 SAM) were built by consultants, and we could not establish a contact with all of them. There are no detailed documentations on these SAMs, however they are similar in terms of structure and shares for several accounts. In some cases we use shares and ratios derived from these SAMSs. We got the trade (import and export) data from an INSAE online database (INSAE, 2021) and the UN comtrade website (UN, 2021).

2.2 Compiling the prior macro-SAM

Table 2 presents the compiled prior macro-SAM. In this sub-section, we focus on how the value in each cell of the prior macro-SAM was obtained. We present the information following the income of each SAM account as shown in Table 1. Thus, a top-down approach is used to present the different data row by row from row number 1 to 14. For each row, data is presented from the left (column A) to the right (column N). Row 15 and column O are omitted because they contain the totals, which are most of the time calculated as residuals.

Margins payment to commodity (1, B)

The trade and transport margins in cell (1, B) are calculated using the share of margins in total supply and the total supply value. Based on the undocumented 2015 SAMs (Grethe *et al.*, 2020) and up-to-date empirical evidences from Benin (Miassi *et al.*, 2018; Ogouvide *et al.*, 2021), we assumed that margins represent 7.9% of total supply. We applied this share to the total supply value (cell 15, A) to calculate the 2019 margins assuming that it would be constant in relative terms over time. First, the gross output was calculated. Second, knowing the value of commodity taxes and the value of imports, margins were the last element of total supply.

Intermediate inputs (1, C)

The value of intermediate inputs is calculated by multiplying the ratio of total intermediate inputs divided by total GDP at factor cost (0.8) from the 2013 INSAE SAM (INSAE, 2018) by 2019 GDP at factor cost from the NA for Benin (BCEAO, 2021).

Private consumption (1, G)

Private household consumption is directly taken from the 2019 NA data for Benin (BCEAO, 2021).

Government consumption (1, H)

Government consumption is obtained directly from the 2019 NA data for Benin (BCEAO, 2021).

Investment demand (1, L)

The value of investment demand is directly taken from the 2019 NA data for Benin (BCEAO, 2021).

Export to Nigeria and to the Rest of the World (RoW) (1, M; 1, N)

The Beninese total export value in 2019 is obtained from the 2019 NA data for Benin (BCEAO, 2021). The shares of exports to Nigeria and to the RoW were calculated from the 2019 trade data for Benin from INSAE and UN comtrade (INSAE, 2021; UN, 2021).

Commodity payment to margins (2, A)

This value is equal to the trade and transport margins in cell (1, B).

Domestic output (3, A)

Domestic output is the payment from commodities to the activities producing them. This value is exactly equal to gross domestic output.

Labour compensation (4, C)

Labour compensation is part of GDP at factor cost, calculated using data from the 2019 NA for Benin (BCEAO, 2021). The activity payment to labour was calculated multiplying the average of the shares of activity payment to labour in GDP at factor cost from the previous undocumented SAMs for Benin (47.7%) by 2019 GDP at factor cost.

Table 2. Unbalanced prior macro-SAM for 2019 (billion FCFA)

			A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
			comdty	margn	activity	flabour	fcapit	fland	househ	gov	tindtax	tdirtax	enterpr	sav-inv	rownig	rowoth	total
1	Commodities	comdty		1,490.4	6,537.0				5,715.9	872.1				2,161.2	184.7	1,859.0	18,820.2
2	Margins	margn	1,490.4														1,490.4
3	Activities	activity	14,304.2														14,304.2
4	Factor labour	flabour			3,666.1										4.3	7.9	3,678.3
5	Factor capital	fcapit			3,282.9												3,282.9
6	Factor land	fland			742.5												742.5
7	Households	househ				3,664.0	2,319.5	487.3	124.8	253.8			77.3		8.9	109.2	7,044.8
8	Government	gov					11.5				740.8	194.8	8.1		3.8	246.2	1,205.2
9	Indirect tax	tindtax	665.1		75.7												740.8
10	Direct tax	tdirtax							89.5				105.3				194.8
11	Enterprises	enterpr					951.9	255.2		108.0					18.3	36.7	1,370.1
12	Saving-investment	sav-inv							1,025.0	-41.6			860.8		-18.9	335.8	2,161.2
13	Nigeria	rownig	49.9			4.7			10.7	8.0			89.1				162.3
14	Rest of the world	rowoth	2,315.7			9.6			42.9	24.6			263.9				2,656.7
15	Total	total	18,825.2	1,490.4	14,304.2	3,678.4	3,282.9	742.5	7,008.9	1,224.9	740.8	194.8	1,404.5	2,161.2	201.1	2,594.7	
Balance (row total - column total)			-5.0	0.0	0.0	0.0	0.0	0.0	35.9	-19.7	0.0	0.0	-34.4	0.0	-38.8	62.0	

Source: Own compilation.

Labour income from Nigeria and from the Rest of the World (4, M; 4, N)

We calculated the total labour payment from abroad based on the value of the 2013 labour payment from abroad (FCFA 9.6 billion) from the 2013 SAM (INSAE, 2018). This value was updated to 2019 using the inflation rate between 2013 and 2019 from the 2019 NA data for Benin (BCEAO, 2021). In addition, the labour growth rate between 2013 and 2019 (0.21) from the WDI (World Bank, 2021) was considered to calculate the total labour payment from abroad assuming that total labour growth would induce a similar growth in labour working abroad. The obtained value is FCFA 12.2 billion. The shares of the labour payments from Nigeria and the RoW were calculated from the 2013 SAM (INSAE, 2018) and used to split the total labour payment from abroad.

Capital compensation (5, C)

Capital compensation is part of GDP at factor cost (BCEAO, 2021). Based on the previous undocumented SAMs for Benin (excluding the INSAE 2013 SAM, which did not provide such details), we assumed that capital compensation represents 42.7% of GDP at factor cost.

Land compensation (6, C)

Land compensation is the last part of GDP at factor cost (apart from the activities' payments to labour and capital). We calculated it as a residual deducting the calculated labour and capital compensation from total 2019 GDP at factor cost (BCEAO, 2021).

Labour income to households (7, D)

To calculate household income from labour, we first calculated the payment for labour from abroad based on its share in GDP at factor cost (0.2%) from the 2013 SAM (INSAE, 2018). We multiplied this share by 2019 GDP at factor cost to calculate the labour payment abroad (FCFA 14.3 billion). We deducted this value from total labour income obtaining labour income of domestic households as a residual.

Unincorporated capital income (7, E)

We first calculated capital income to the government from the 2019 budget implementation report (MEF, 2020). Deducting this value from capital compensation, we obtained total capital income to households and enterprises. Afterwards, based on the previous undocumented SAMs for Benin (excluding the INSAE 2013 SAM, which does not provide such details), we assumed that 70.9% of capital income to households and enterprises is to households.

Land rent to households (7, F)

Household income from land was calculated based on 2011 EMICoV data (INSAE, 2012) and the 2011 Benin population data from the World Population Prospect (UN, 2019). The 2011 household income from land in the sample for each household group was extrapolated to Benin using the sample size and the population data (UN, 2019). The calculated values were

updated to 2019 using real agricultural GDP growth and the inflation rate between 2011 and 2019 from 2019 NA and MMI data for Benin (BCEAO, 2021). The final values for the 10 household groups were aggregated as total rent to households.

Inter-household transfers (7, G)

In Benin, wealthier households assist lower income households by paying inter-household transfers. To calculate its value in 2019, we calculated first, the share of inter-household transfers in total household consumption from the 2013 SAM (INSAE, 2018). Subsequently, this share of 2.2% was multiplied by 2019 private consumption from NA (BCEAO, 2021) to obtain the 2019 inter-household transfers of FCFA.

Government transfers to households (7, H)

The value of government transfers to households was calculated based on the 2019 government budget implementation report (MEF, 2020). It includes social transfers, interest paid by the government on domestic debt (based on the share of household savings in savings from enterprises and household from the INSAE 2013 SAM (INSAE, 2018), we assume that 60% of the total interest paid by the government on domestic debt is to households) and pensions to retired workers.

Transfers and dividends from enterprises to households (7, K)

Enterprise transfers to households include social transfers (some enterprises have foundations or work to assist low income households) and dividends. Its value is calculated using the value of enterprise savings and the ratio of household income from enterprises divided by enterprise savings from the previous undocumented SAMs for Benin (0.1).

Remittances to households (7, M; 7, N)

Total remittances received from abroad were calculated based on WDI (World Bank, 2021). According to this database, Beninese households received 1.4% of total GDP as remittances from abroad. The corresponding value was split into remittances from Nigeria reported in cell (7, M) and remittances from the RoW reported in cell (7, N). The share of each region in total remittances from the 2013 SAM (INSAE, 2018) is used to calculate remittances from each region.

Capital return to government (8, E)

Government income from capital was calculated based on the 2019 budget implementation report (MEF, 2020). It is the sum of income from government property rent and income (interest) from financial products.

Indirect tax revenue (8, I)

The value of indirect tax revenue is obtained from 2019 NA (BCEAO, 2021).

Direct tax revenue (8, J)

Total tax revenue is obtained from 2019 NA (BCEAO, 2021). The direct tax revenue is calculated subtracting indirect tax revenue (8, I) from total tax revenue.

Investment profit to the government (8, K)

Enterprise transfers to the government (investment profits) are calculated based on the 2019 budget implementation report (MEF, 2020). In 2019, the Beninese government received a partial income of FCFA 10.2 billion as investment profit and transfers from the West-African Economic and Monetary Union (WAEMU). Based on the fact that the share of support of African low income countries among each other is low, we assume that 80% of this amount is from investment profit (FCFA 8.1 billion) and the remainder (20%) is from WAEMU.

Foreign grants (8, M; 8, N)

Knowing total government income and tax revenue from 2019 NA (BCEAO, 2021) and other income sources (capital, enterprise) from the budget report (MEF, 2020), we calculated foreign grants as a residual. Based on the previous undocumented SAMs for Benin, we assume the share of foreign grants from Nigeria to be 1.5% to calculate the grants from Nigeria reported in cell (8, M) and the grants from RoW reported in cell (8, N).

Indirect taxes on commodities (9, A)

This includes sales tax, value added tax, tariffs, export tax and other taxes on commodities. The value was calculated from the government budget report (MEF, 2020).

Production tax (9, C)

Knowing total indirect tax revenue from NA (BCEAO, 2021), production tax revenue was calculated as a residual by deducting commodity tax revenue.

Income tax (10, G)

The income tax is the direct tax paid by households. Its value is calculated from the government budget implementation report (MEF, 2020). We assumed that 90% of property tax revenue is from private households. We thus added 90% of property tax revenue to the tax revenue on labour income to calculate the value of income tax revenue from households.

Corporate tax (10, K)

The corporate tax is the direct tax paid by enterprises. Its value is calculated by deducting income tax revenue from total direct tax revenue.

Capital return to enterprises (11, E)

We obtained capital income to be distributed between private households and enterprises by deducting government capital income from total capital compensation. Based on the previous

undocumented SAMs for Benin, we assume that 29.1% of capital income to households and enterprises is to enterprises.

Land income to enterprises (11, F)

We deducted the value of the households' income from land from the total activities' payment to land to calculate enterprises' income from land.

Government transfers to enterprises (11, H).

The value of government transfers to enterprises is calculated from the 2019 government budget implementation report (MEF, 2020). It includes operating subsidies to enterprises and 40% of the interest on domestic debt. We assume that the share of households in credits to the government is higher because there are not many formal enterprises. And as explained in the paragraph on investment profit to the government, we supposed that 40% of the loans are from enterprises and 60% from households.

Income to enterprises from abroad (11, M; 11, N)

The transfers that enterprises received from abroad are calculated based on remittances to households (cells 7, M and 7, N). In fact we used, the ratio of transfers to enterprises from abroad divided by remittances to households (0.5) of the 2013 SAM (INSAE, 2018) and the 2019 remittances to households from WDI (World Bank, 2021) to calculate total transfers to enterprises from abroad. Finally, we used the shares of transfers from Nigeria (33.2%) and the RoW (76.8%) from the 2013 SAM (INSAE, 2018) to split transfers to enterprises from Nigeria recorded in cell (11, M) and from the RoW reported in cell (11, N).

Household savings (12, G)

Total domestic savings and the government deficit are obtained from the 2019 MMI for Benin (BCEAO, 2021). We calculated the total of domestic savings by households and enterprises as total domestic saving minus government savings (12, H). We used the share of household savings in household and enterprise savings (54.4%) from the 2013 SAM (INSAE, 2018) to calculate household savings.

Government savings (12, H)

Government savings are represented here by the government deficit. Its value is obtained from the 2019 MMI for Benin (BCEAO, 2021).

Enterprises savings (12, K)

The value of enterprise savings is calculated based on the government deficit, total domestic savings from the 2019 MMI for Benin (BCEAO, 2021) and the share of enterprise savings in household and enterprise savings (45.6%) from the 2013 SAM (INSAE, 2018), as explained in the paragraph on household savings.

Current account balance (12, M; 12, N)

The current account balance is calculated as a residual deducting total domestic savings from total investment (BCEAO, 2021). Its value is FCFA 316.9 billion. Afterwards, we calculated the ratio of the current account balance with Nigeria divided by exports to Nigeria" in 2013 (-0.6) from the 2013 SAM (INSAE, 2018). The undocumented SAMs report a ratio of -0.3 and a ratio of -0.1 for 2015. Based on this information, we set the ratio for 2019 at -0.1. We used this ratio and exports to Nigeria in 2019 to calculate the 2019 current account balance with Nigeria (12, M). Deducting this from the current account balance allows estimating the current account balance with the RoW, recorded in the cell (12, N).

Imports (13, A; 14, A)

Knowing the value of total imports from 2019 NA for Benin (BCEAO, 2021), we calculated the imports from Nigeria (13, A) using the 2019 share of imports from Nigeria in total imports from 2019 trade data for Benin (INSAE, 2021). Likewise, we used the 2019 share of imports from the RoW (excluding Nigeria) in total imports from 2019 trade data for Benin (INSAE, 2021) to calculate the value of imports from the RoW (14, A).

Labour payment abroad (13, D; 14, D)

We calculated the total labour payment abroad using GDP at factor cost from 2019 NA for Benin (BCEAO, 2021) and the payment to labour from abroad as a share of GDP at factor cost from the 2013 SAM (INSAE, 2018). The obtained value for the total labour payment was FCFA 14.3 billion. Using the share of labour payment to Nigeria (32.8%) in the total labour payment abroad (INSAE, 2018), we calculated the labour payment to Nigeria (13, D) and to the RoW (14, D).

Household transfers abroad (13, G; 14, G)

We derived total household transfers abroad from 2019 WDI for Benin (World Bank, 2021), which reports data until 2018, using the trend from 2016 to 2018 to calculate the 2019 value at FCFA 53.6 billion. Knowing the transactions and people movement between Nigeria and Benin, especially in the border villages/cities, we assume that a fifth of this amount is transfers to Nigeria (13, G) while the remainder is transfers to the RoW (14, G) including other neighbouring countries. Nigeria shares almost 800 kilometers of border with Benin allowing large movement of population into both directions. We then suppose that a fifth of Benin household members abroad are in Nigeria.

Government transfers abroad (13, H; 14, H)

Total Government transfers abroad are taken from the 2019 budget implementation report (MEF, 2020). It is the interest paid by the government abroad (FCFA 32.6 billion). Based on the share of government transfers to Nigeria in total government transfers abroad from the 2013 SAM (INSAE, 2018) and knowing the relationship between the two countries and that Nigeria is the largest economy in West-Africa and one of the two largest in Africa, we assume

that FCFA 8.0 billion (24% of total government transfers abroad) are transferred to Nigeria (13, H) accordingly to the lending capacity of Nigeria in the west African and African community. The remainder is considered government transfers to the RoW (14, H).

Enterprise payments to Nigeria (13, K) and to the RoW (excluding Nigeria) (14, K)

There is no readily available information on enterprise transfers abroad. As enterprise savings are one of the most trustworthy indicators calculated on enterprises and the payment abroad should depend on the total profit which drives the savings as well, we calculated the ratio of total enterprise payments abroad divided by enterprise savings (0.4) from the INSAE 2013 SAM (INSAE, 2018). This ratio and the value of enterprise savings were used to calculate the total payment abroad from enterprises (FCFA 352.9 billion). Based on the 2013 SAM (INSAE, 2018), we assume that 25.2% of this amount is transferred to Nigeria (13, K) and the remainder to the RoW (14, K).

2.3 Imbalances in accounts of the prior macro-SAM

Because of the different data sources (macro-indicators, surveys), which are not necessarily consistent and the assumptions made, the prior macro-SAM is not balanced (Table 2). The fact that the imbalances are minor show, that our data and assumptions on the Beninese economy are reasonably consistent.

Foreign, households, enterprises and government accounts are with the highest imbalances in absolute terms. However, these imbalances are small in relative terms for households, government and RoW (excluding Nigeria) accounts (0.5%, -1.6%, -2.5% and 2.3% of the row total respectively). Total household income is higher than total household expenditure while total government income is lower than government expenditure. The Nigerian account's imbalance is -23.9% of the foreign exchange outflow with Nigeria. Although this imbalance is relatively high in relative terms, it is not big in absolute terms. It is due to the estimation procedures to split the data on foreign accounts between Nigeria and the RoW. Finally, a balanced SAM is estimated econometrically.

3 Developing the micro-SAM and SAM-estimation

This chapter presents the stepwise construction of the 2019 micro-SAM for Benin. The disaggregation of the prior micro-SAM is guided by the macro-SAM. A balanced micro-SAM is estimated from the prior micro-SAM using the cross-entropy method (Robinson & McDonald, 2006).

3.1 Micro-SAM accounts

The 2019 micro-SAM for Benin contains 127 accounts (Table 3). Two of the activities (Conventional Fuel, Gas and other Petroleum and Chemical Fertilizer) do not produce at all. The concerning commodities are imported. We left the activities in for convenience and to

make aware of them. In the next sub-sections, we provide details on the disaggregation of each macro-SAM account to obtain the micro-SAM.

Table 3. Micro-SAM accounts

Account	Description
almaize	Cultivation of local maize
aimaize	Cultivation of improved maize
arice	Cultivation of rice
acassav	Cultivation of cassava
ayam	Cultivation of yam
apineap	Cultivation of pineapple
avegspi	Cultivation of fresh vegetables and spices
aofcrcx	Other food crops for local consumption or export
acotton	Cultivation of cotton
acashe	Cultivation of cashew
apalm	Cultivation of palm nut
aocrinx	Cultivation of other crops for industry or export
abicpoul	Bicycle poultry husbandry
abropoul	Broiler poultry husbandry
aolivani	Other animal husbandry
armilk	Raw milk
aeggoth	Eggs and other husbandry activities
ahunsyl	Hunting and silviculture
afisch	Fishing
amin	Mining
abicpsl	Slaughtering of bicycle poultry
abropsl	Slaughtering of broiler poultry
aoslmfip	Other slaughtering, meat and fish processing
aoilfat	Manufacture of oils and fats
apineapij	Pineapple industrial processing (juice)
apineapaj	Pineapple artisanal processing (juice)
acashnik	Cashew nut industrial processing (kernel)
acashnak	Cashew nut artisanal processing (kernel)
acashaj	Cashew apple processing (juice)
aofrvegp	Other manufacture of canned fruit and vegetables
aofooin	Other food industry
abevera	Beverages production
acotgin	Cotton ginning
aclothing	Manufacturing of textiles, fibres, clothing, fur, leather and skins
afgasop	Conventional fuel, gas and other petroleum
aeln	National electricity
acnspbef	Cashew nut processing (kernel) residues (cns) processing at factory level
acnspn	Cashew nut processing (kernel) residues (cns) processing at national level
afertil	Chemical fertilizer
awoin	Water and other artisanal and modern industries
aconstr	Construction
atrade	Trade
ahotres	Accommodation and food services
atracom	Transport and communication services

Account	Description
cbropoul	Broiler poultry
colivani	Other living animals
crmilk	Raw milk
ceggoth	Eggs and other livestock products
cmanure	Manure from husbandry
chunsyl	Hunting and silviculture
cfisch	Fishing products
cmin	Mining
cbicpmeat	Bicycle poultry meat
cbropmeat	Broiler poultry meat
coslpmfi	Other slaughtering, processing of meat and fish
coilfat	Oil and fat
cpineapij	Industrial pineapple processing (juice)
cpineapaj	Artisanal pineapple processing (juice)
ccashnik	Industrial cashew nut processing (kernel)
ccashnak	Artisanal cashew nut processing (kernel)
ccashnikr	Industrial cashew nut processing (kernel) residues (cns)
ccashaj	Cashew apple processing (juice)
cofrvegp	Canned fruit and vegetable products
cofooin	Other food industry products
cbevera	Beverages
ccotgin	Cotton ginning products
cclothing	Textiles and fibres, clothing, fur, leather and skins
cfgasop	Conventional fuel, gas and other petroleum
celnn	National electricity
cbelcnsf	Bio-electricity from cns at factory level
ccnsl	Cnsl from cashew nut industrial processing residues (cns)
ccnsc	Bio char from cashew nut industrial processing residues (cns) for fertilization
cfertil	Chemical fertilizer
cwoin	Water and other artisanal and modern industry products
cconstr	Construction
ctrade	Trade
chotres	Accommodation and food services
ctracom	Transport and communication services
cfinanc	Financial services
cedhncs	Education, health and non-commercial services
coservi	Other services
funskla	Unskilled labour
fskilla	Skilled labour
fcapit	Capital
fland	Land
enterpr	Enterprises
hruraq1	Rural quintile1 (poorest)
hruraq2	Rural quintile2

Account	Description
afinanc	Financial services
aedhncs	Education, health and non-commercial services
aoservi	Other services
mtd	Margins domestic trade
mte	Margins trade of exports
mtm	Margins trade of imports
cmaize	Maize
crice	Rice
ccassav	Cassava
cyam	Yam
cpineap	Pineapple
cvegspi	Fresh vegetables and spices
cofcrc	Other food crops for local consumption
cofcrx	Other food crops for export
ccotton	Cotton
ccashen	Cashew nut
ccashea	Cashew apple
cpalm	Palm nut
cocrinx	Other agricultural crops for industry or export
cbicpoul	Bicycle poultry

Account	Description
hruraq3	Rural quintile3
hruraq4	Rural quintile4
hruraq5	Rural quintile5 (richest)
hurbaq1	Urban quintile1 (poorest)
hurbaq2	Urban quintile2
hurbaq3	Urban quintile3
hurbaq4	Urban quintile4
hurbaq5	Urban quintile5 (richest)
gov	Government
tdirtax	Direct taxes
tptax	Production taxes net of subsidies
tvat	Value added tax (vat)
tctax	Other commodity taxes net of subsidies
tmtax	Customs duties on imports excluding VAT
textax	Export taxes
invpriv	Savings-investment private
invpub	Savings-investment public
rownig	Nigeria
rowoth	Rest of the world
total	Total

Note: Account names starting with “a” are activities, with “c” are commodities, with “f” are factors, with “h” are households and with “t” are taxes.
Source: Own compilation.

3.1.1 Activities and commodities

The 2019 SAM includes 47 activity accounts depicting sectors with economic relevance in Benin. These activities produce 51 commodities (Table 4), where most activities are single commodity producers. Some activities are multiple commodity producers, while some commodities are produced by more than one activity. Commodities are classified into main (production objective) and secondary (by-product). Based on the structure of the Beninese economy, the activity-commodity combinations were grouped into five aggregated sectors: agriculture, food industry, non-food industry (including mining), construction and services.

The agricultural sector includes 19 activities producing 21 commodities. The maize commodity is produced by two activities (local maize and improved maize). The activity “cashew” produces two commodities (cashew nut and cashew apple). The cashew apple valorisation is one of the important contributions of this SAM. Despite its high economic and nutritional value, the cashew apple is so far neglected by economic actors because of conservation and processing constraints (Dedehou *et al.*, 2015; Houssou *et al.*, 2016; Zoumarou Wallis *et al.*, 2016). The activity “other crops for local consumption or export” (aofcrcx) produces two commodities (other crops for local consumption and other crops for export). Three husbandry activities produce manure as a secondary commodity.

There are 12 food industry activities in the SAM producing 13 commodities. The activity industrial processing of cashew nut produces a main commodity (cashew kernel) and a

secondary commodity (cashew kernel residues: cashew nut shell (CNS)) with the latter being an important contribution of this SAM.

The non-food industry (including mining) and the service sectors include nine and six activities, respectively, linked to commodities in one-to-one relationships. Construction is represented by one activity producing one commodity. This sector is single because of its relatively high contribution to the GDP.

Table 4. Mapping of the activity and commodity accounts

Aggregated Sectors	Activities	Main Commodities	Secondary Commodities
Agriculture	almaize, aimaize	cmaize	
	arice	crice	
	acassav	ccassav	
	ayam	cyam	
	apineap	cpineap	
	avegspi	cvegspi	
	aofcrcx	cofcrc, cofcrx	
	acotton	ccotton	
	acashe	ccashen	ccashea
	apalm	cpalm	
	aocrinx	cocrinx	
	abicpoul	cbicpoul	cmanure
	abropoul	cbropoul	
	aolivani	colivani	
	armilk	crmilk	
	aeggoth	ceggoth	
	ahunsyl	chunsyl	
	afisch	cfisch	
Food industry	abicpsl	cbicpmeat,	
	abropsl	cbropmeat	
	aoslmfip	coslpmfi	
	aoilfat	coilfat	
	apineapij	cpineapij	
	apineapaj	cpineapaj	
	acashnik	ccashnik	ccashnikr
	acashnak	ccashnak	
	acashaj	ccashaj	
	aofrvegp	cofrvegp	
	aofooin	cofooin	
	abevera	cbevera	
Non-food industries including mining	amin	cmin	
	acotgin	ccotgin	
	aclothing	cclothing	
	afgasop	cfgasop	
	aeln	celnn	
	acnspbef	cbelcnsf	
	acnspn	ccnsl, ccnsc	
	afertil	cfertil	
	awoin	cwoin	

Aggregated Sectors	Activities	Main Commodities	Secondary Commodities
Construction	aconstr	cconstr	
Services	atrade	ctrade	
	ahotres	chotres	
	atracom	ctracom	
	afinanc	cfinanc	
	aedhncs	cedhncs	
	aoservi	coservi	

Source: Own compilation.

3.1.2 Margins, factors, institutions, taxes and savings/investment

Margins are represented by three accounts in the SAM, namely, domestic trade, import and export margins.

The labour factor in the macro-SAM is disaggregated into unskilled and skilled labour based on the education level of the workers. Skilled labour is characterised by at least secondary school level while unskilled labour is either without any formal education or with primary education level at most. Hence, together with land and capital, the SAM includes four production factors.

Four types of institutions are included in the SAM: government, enterprises, foreign institutions (Nigeria and the RoW) and households. Households are represented by 10 groups. First, all households were classified according to income quintiles from Q1 (poorest) to Q5 (richest). Second, each income quintile is classified into rural and urban according to the location of the population. Therefore, the total population of each quintile is 20% of the total Beninese population while the population of each of the 10 household groups is not equal (Table 5).

Six tax-accounts collect taxes for the government. These are direct, production, value added, import, export and other commodity taxes.

There are two savings/investment accounts (public and private). The government saves only in the public savings account and households only in the private savings account, while enterprises save in both accounts.

Table 5. Representativity of each household group in Benin population

Household groups	Rural households					Urban households				
	Q1	Q2	Q3	Q4	Q5	Q1	Q2	Q3	Q4	Q5
Share in Benin population (%)	15.51	15.15	15.00	14.01	9.10	4.49	4.85	5.00	5.99	10.90

Source: Own compilation.

3.2 Data sources for the prior micro-SAM

Both secondary and primary data were used to build the micro-SAM. The primary data were collected from processors for the disaggregation of the food industry. Also, we collected data from key informants working in cotton sector for some specificities regarding the production tax for the sector.

3.2.1 Secondary data

The construction of the 2019 prior micro-SAM for Benin was based on several secondary data sources. Regarding agricultural data, we used the economic accounts of agriculture (Adégbola *et al.*, 2013a, 2013b) for the cost structure of production activities. Some particularities like the production tax on cotton (local development tax) which was not considered in the economic accounts were included based on the reality in the field collected from key informants working in the cotton sector. For non-food industry as well as construction and services, production cost structures were taken from existing SAMs such as the 2013 INSAE SAM (INSAE, 2018) and other undocumented SAMs.

The production cost structure and the commodity demand of cashew nut processing as well as its by-products processing were taken from different studies conducted in Benin on the sector (Benin Caju, 2016, 2017; Gbaguidi, 2020; Houngbédji, 2020). The data regarding the cashew apple processing are also from different studies conducted in Benin (Dedehou *et al.*, 2015; Houssou *et al.*, 2016; Benin Caju, 2017; Houssou *et al.*, 2018). Data on the distinction between total export and total domestic use of pineapple fruit/juice as well as the different domestic uses are obtained from European Commission (2020).

The total output values of cashew, pineapple and cotton were calculated based on 2019 production and price data (ABePEC, 2010; Houssou *et al.*, 2016; Zoumarou Wallis *et al.*, 2016; 2020; INSAE, 2020a; Aguehounde, 2020). The other agricultural output values were calculated based on the economic accounts of agriculture (Adégbola *et al.*, 2013a, 2013b). For the electricity sector, the calculations are based on the 2019 electricity production status in Benin (Akinocho, 2019). For the other non-agricultural activities, that are not addressed either in detail in this sub-section or in the sub-section on primary data, the macro-totals from the macro-SAM and the existing SAMs such as 2013 INSAE SAM (INSAE, 2018) and other SAMs (Grethe *et al.*, 2020) were used for the estimation.

In general, the household consumption structure is based on the EMICoV 2011 household survey (INSAE, 2012). For some specificities, updated knowledge is used. For example, the poultry demand structure in urban areas is based on a study on poultry in Benin (Kulla *et al.*, 2021). For processed food, we collected and used primary data.

The estimation of income from land to household groups is based on EMICoV 2011 (INSAE, 2012). The government consumption structure is based on the government budget implementation report (MEF, 2020). The trade structure is based on 2019 trade data from both

UN comtrade and the statistical office (INSAE, 2021; UN, 2021). These two databases are complementary regarding the details.

3.2.2 Primary data

The focus on food processing activities is a major contribution of this SAM. Primary data on the processing cost structure, output and demand sources for poultry slaughtering and pineapple processing were collected via an online survey among key informants between November 2020 and April 2021.

The first round of data collection was on the processing cost structure and output of the sectors. A second round of data collection focused on the commodity (poultry meat and pineapple juice) demand side to clarify the distribution of final products among consumers.

Regarding the production tax of the cotton activity (agriculture), not considered in the secondary data, key informants were contacted in the same period to collect such data.

3.3 Compiling the prior micro-SAM

As explained in section 3.2, we used available secondary data, the previous SAMs and primary data for the disaggregation. The use of previous SAMs was strictly reserved for cases where other data sources are not available because most of these SAMs did not have clear documentation to allow understanding sufficiently their origins. In cases we had to use previous SAMs, we checked the consistency of shares throughout different SAMs. The data sources to build the micro-SAM and their references being described in section 3.2, we focus here on the description of how each sub-matrix is disaggregated. The percentage of 0.00% in the tables should not be understood as a zero share. In some cases, entries with less than half of 0.01% would also be rounded to 0.00%. Zero shares are indicated by empty cells in the tables.

3.3.1 Activity disaggregation

This sub-section presents the disaggregation of each activity sub-matrix. The shares here are column shares (production cost structure). We also include at the end of each table, the total output to allow replication.

Table 6 presents production cost structures and total output for agricultural activities. In general, these shares are based on Beninese economic accounts of agriculture. However, the cotton production tax is calculated based on primary data. The share of this tax is calculated as almost 2% of the cotton production cost (Table 6). Outputs were calculated based on production and price data for 2019 but also based on shares from Beninese economic accounts of agriculture in cases that 2019 production and price data were not available.

Production cost structures and total outputs used to disaggregate the food industry are presented in Table 7. Total outputs are calculated based on available production and price data for most of the activities (poultry slaughtering, pineapple processing, cashew processing). However, some outputs were calculated based on shares in previous SAMs. Regarding the production cost structure, primary data (survey) are used for some food industry sectors where secondary data were not available (pineapple juice, poultry slaughtering) and available secondary data were used for the remainder.

Table 8 presents the details of production cost structures and total outputs for the other economic activities in Benin in 2019. The output of cotton ginning is based on the output of cotton farming (almost all produced cotton is ginned) and electricity production is based on the status of this sector in 2019. Data on cashew by-products processing activities (acnspbef, acnspn) are derived from primary data. Remaining data in Table 8 were calculated based on previous SAMs.

Table 6. Agricultural activity cost structure

Items		almaize	aimaize	arice	acassav	ayam	apineap	avegspi	aofcrcx	acotton	acashe	apalm	aocrinx	abicpoul	abropoul	aolivani	armilk	aeggoth	ahunsyl	afisch
Shares in production cost (%)	cmaize	2.18	37.34											0.00	0.00	2.22	2.07		0.01	
	crice			2.70																
	ccassav				11.40											0.00			0.42	
	cyam					53.42														
	cpineap						2.71													
	cvegspi							14.75	2.63				0.04			0.01	0.00			
	cofcrc								8.45					0.00	0.00					
	cofcrx								3.62											
	ccotton															0.00	0.01			
	ccashen										0.72									
	cpalm											0.38								
	cocrinx												19.75			0.14	0.08	0.00		
	cbropoul														10.89			0.09		
	colivani															0.71	1.64			
	ceggoth																		1.03	
	cmanure	0.07	0.20	0.40	0.09	0.10	0.12	0.03	0.00	0.01	0.00	3.00								
	chunsyl															4.07	3.97		2.77	
	coslpmfi																		0.43	
	coilfat																		0.37	
	ccashnikr															0.02	0.00			
	cofrvegp																		0.08	
	cbevera																		0.11	
	cofooin													3.19	16.23	1.49	0.01	15.48	2.04	
	ccotgin									2.98										
	cclothing																		0.05	1.00
	cfgasop	1.85	0.88	0.88	2.01	1.07	0.37	0.37	0.37	2.00	1.56	3.40	0.37	2.40	2.49	1.34	1.81	2.01	2.02	2.06
	celnn													0.66	0.82	0.37	0.50	0.55		0.57
	cfertil	8.31	21.07	3.74			9.29	1.21	0.48	14.37	0.21		0.21							
	cwoin	2.10	3.98	1.61	0.59	0.54	0.24	2.82	1.93	17.87	2.55	5.48	3.53	0.50	3.26	14.19	16.62	2.16	7.96	6.38
	cconstr									0.02									0.01	0.02
	chotres																		0.00	
	ctracom													0.47	0.02	0.67	0.32	0.02	2.73	8.19

Items		almaize	aimaize	arice	acassav	ayam	apineap	avegspi	aofcrcx	acotton	acashe	apalm	aocrinx	abicpoul	abropoul	aolivani	armilk	aeggoth	ahunsyl	afisch
	coservi	1.25	1.43	1.00	1.43	2.00	0.15	0.15	0.15	1.52	1.09	1.79	0.23	0.40	0.70	22.47	3.35	0.66	2.50	0.05
	funskla	42.60	13.39	45.18	43.17	22.25	45.29	40.72	41.62	29.34	49.04	46.16	40.46	42.93	18.14	24.19	32.39	36.00	36.05	36.83
	fskilla	2.54	1.13	2.66	2.72	1.46	3.35	3.16	2.67	0.70	3.21	3.02	2.69	2.82	14.04	1.38	2.12	2.36	2.36	2.41
	fcapit	2.45	1.09	2.56	2.62	1.40	5.49	3.06	3.46	0.67	3.10	2.91	2.59	2.84	21.12	1.98	2.05	3.90	2.27	42.39
	fland	36.66	19.49	39.28	35.97	17.76	32.99	33.74	34.62	28.63	38.53	33.87	30.12	43.79	12.28	24.75	33.08	36.75	36.80	
	tptax									1.88									0.01	0.11
	total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Total output (FCFA		151.2	37.6	26.3	397.0	410.4	25.7	371.9	171.1	211.7	51.5	29.6	231.3	94.2	3.9	195.7	86.4	55.7	398.9	160.2

Source: Own compilation based on above mentioned data sources.

Table 7. Food industry activity cost structure

Items		abicpsl	abropsl	aoslmfip	aoilfat	apineapij	apineapaj	acashnik	acashnak	acashaj	aofrvegp	aofooin	abevera
Shares in production cost (column shares in %)	cmaize										0.38	2.08	1.52
	crice										0.31	1.25	0.18
	ccassav											22.28	2.28
	cyam											16.35	
	cpineap					26.42	25.39						
	cvegspi										28.60	0.62	
	cofcrc										18.70	0.79	
	cofcrx										8.02	0.34	
	ccashen							70.45	62.11				
	ccashea									6.92			
	cpalm				7.24								
	cocrinx				28.74							0.05	
	cbicpoul	74.33											
	cbropoul		74.33										
	colivani			32.69	0.03						0.05	0.24	
	crmilk			0.06	0.03						9.54	2.30	
	ceggoth			0.90	0.00						0.19	1.02	
	chunsyl			16.56	0.02		1.05				0.09	2.72	
	cfisch			12.09	0.02						0.38	3.04	
	cmin							0.60			1.51	0.36	0.01
	coslpmfi			1.14	1.05						0.27	2.34	
	coilfat			1.23	1.13			0.66	0.68		0.30	2.40	
	ccashnak								0.00				
	ccashnikr			0.04				0.00				0.03	
	cofrvegp			0.23	0.21						0.06	0.34	1.44
	cofooin				20.15			0.86	0.77	2.77	0.05	3.50	41.82
	cbevera			0.26	0.24						0.04	0.39	0.64
	ccotgin				6.32							0.00	
	cclothing			0.10	0.26			0.12			0.26	0.13	0.67
	cfgasop	0.88	0.88	0.51	0.43	4.46	0.42	0.83		12.96	0.17	0.21	1.15
	celnn	1.07	1.07	0.62	0.52	1.82	0.21	2.26		0.26	0.28	0.35	1.92
	cbelcnsf							0.01					
	cwoin	1.88	1.88	2.64	4.11	7.81	23.65	0.79	1.96	52.57	0.67	0.83	4.60
	cconstr			0.03	0.05	0.02		0.07			0.11	0.05	0.31
	chotres			0.08	0.13	0.24		0.30			0.22	0.16	0.26
	ctracom	2.14	2.14	2.89	2.62	1.00	5.23	0.96			1.00	2.41	3.84
	cfinanc			0.26	0.60			0.33			0.71	0.36	2.41
	cedhncs			1.31									
	coservi			1.03	1.73	0.24		0.44	0.45	0.04	0.70	0.92	3.98
	funskla	4.26	4.26	6.31	5.29	5.59	14.09	6.91	24.24	7.31	6.64	7.98	5.92
	fskilla	10.51	10.51	2.25	1.93	22.31	22.64	4.23	0.00	4.87	6.94	2.90	2.16
	fcapit	4.93	4.93	16.78	14.28	30.08	7.33	10.18	9.80	12.28	13.62	21.21	16.44
	tptax				2.87						0.22	0.05	8.44
	total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Total output (FCFA billion)		0.6	0.2	145.2	141.6	42.1	16.7	28.0	2.4	5.8	8.8	497.1	127.3

Source: Own compilation based on above mentioned data sources.

Table 8. Non-food industry, construction and service activity cost structure

Items		amin	acotgin	aclothing	aeln	acnspbef	acnspn	awoin	aconstr	atrade	ahotres	atracom	afinanc	aedhncs	aoservi
Shares in production cost (column shares in %)	cmaize										0.04			0.03	0.01
	ccassav										1.52				
	cyam										4.60				
	cpineap										0.10				
	cvegspi										2.16				
	cofcrc										2.66				
	cofcrx										1.14				
	ccotton		67.32												
	cocrinx							4.02							
	cbicpoul										2.62				
	cbropoul										0.14				
	colivani										5.45				
	ceggoth										1.58			0.00	0.00
	chunsyl	7.13			1.13			6.66	0.65		2.74			0.00	0.00
	cfisch										2.21				
	cmin				0.86			1.97	4.44		0.77				
	cbicpmeat										0.01			0.00	
	cbropmeat										1.20			0.02	
	coslpmfi	0.03	0.00	5.92				0.02			8.29			0.13	0.12
	coilfat	0.03	0.00	0.44	0.02			0.02			2.15			0.13	0.10
	cpineapij										0.07				
	cpineapaj										0.22				
	ccashnik										0.12				
	ccashnak										0.13				
	ccashnikr					99.19	18.95	0.04							
	ccashaj										0.07				
	cofrvegp	0.01		0.09				0.00			1.61			0.03	0.02
	cofooin	0.13	0.01	2.81				0.07			14.20			0.82	0.53
	cbevera	0.01		0.13				0.01			10.26			0.69	0.03
	ccotgin			1.30											
	cclothing	0.53		39.54				0.41	0.73	0.69	0.28	1.47	0.00	0.40	1.27
	cfgasop	1.41	0.41	0.24	65.54			7.18	9.28	1.17	0.28	13.46	0.72	0.59	4.03
	celnn		0.68	0.40	0.83			3.99	0.21	0.65	0.16	0.28	0.40	0.99	2.24
	cwoin	18.32	1.64	0.96	3.33		20.95	28.76	25.98	2.35	0.57	1.26	1.45	4.14	8.07
	cconstr	0.11	0.00		0.84		0.35	0.09	6.55	0.01	0.02	0.06	0.02	0.07	1.76
	chotres	0.39	0.07		0.43			0.47	0.67	1.27	0.02	1.41	1.22	2.20	1.70
	ctracom	6.71	7.74	10.80	1.41		4.96	8.71	3.68	43.18	1.72	9.54	6.19	2.58	15.00
	cfinanc	1.89	1.14		1.87		1.72	2.06	1.92	6.43	0.02	4.19	54.80	0.05	0.26
	coservi	3.42	5.69	0.22	5.18			4.79	4.18	5.08	0.87	17.22	7.33	2.42	4.11
	funskla	14.63	1.94	10.27	0.98		14.90	7.75	10.24	12.00	9.83	14.10	9.89		14.08
	fskilla	5.09	0.68	3.57	2.67		29.81	2.48	3.56	4.14	3.35	4.87	3.41	63.27	4.86
	fcapit	39.82	12.69	23.32	11.28	0.81	8.35	19.56	27.10	22.22	16.81	31.26	13.88	21.22	41.56
	tptax	0.37		0.00	3.63			0.93	0.82	0.81	0.00	0.88	0.68	0.20	0.26
	total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Total output (FCFA billion)		42.8	442.6	77.4	47.3	0.0014	0.7	508.9	609.2	1931.8	1121.5	2,092.4	436.4	1,470.5	1,889.3

Source: Own compilation based on above mentioned data sources

3.3.2 Household and government consumption disaggregation

In general, household consumption was disaggregated based on EMICoV 2011. However, some specificities are based on primary or other secondary data. Table 9 shows the mapping between EMICoV data and the current SAM commodity accounts. We classified the SAM commodity accounts following the commodities in the survey. For some commodities the distinction is not clear. The hunting and silviculture commodity (chunsyl) in the current SAM includes game which is food, but also wood, which belongs to "housing, water, electricity, gas, other fuels" category in the survey. Knowing that hunting is very limited, we assume that 2% of chunsyl is food. Therefore, we separated the estimation of consumption for two commodities (chunsyl-food and chunsyl-non-food), before putting them again together in one commodity. Since it was not clear for us how to share "commodity water and other industry (cwoin)" in the SAM between "housing, water, electricity, gas, other fuels" and "furniture, house items and maintenance", we merge these two commodities in the survey to calculate the consumption for cwoin. We also merged "transport" and "communication" from the survey together and "education" and "health" from the survey together for the estimation for "commodity transport and communication (ctracom)" and "commodity education health and non-commercial services (cedhncs)" of the SAM. Combining all data sources as explained in section 3.2, we produced the household consumption matrix shares in Table 10 that was used for the disaggregation of household consumption. All shares for household groups in the table sum up to 100%. Row totals show the demand of each commodity as a share in total private consumption while column totals show the consumption share of each household group in total private consumption.

Table 9. Mapping between commodities in household survey and SAM commodity accounts

Commodities in EMICoV	Commodities in the SAM	Comments
Food and zero alcohol drinks	cmaize, crice, ccassav, cyam, cpineap, cvegspi, cofcrc, cofcrx, ccotton, ccashen, ccashea, cpalm, cocrinx, cbicpoul, cbropoul, colivani, crmilk, ceggoth, chunsyl (a share supposed to be 2%), cfisch, cmin, cbicpmeat, cbropmeat, coslpmfi, coilfat, cpineapij, cpineapaj, ccashnik, ccashnak, ccashnikr, ccashaj, cofrvegp, cofooin	Same consumption structure as in the survey
Alcohol, tobacco and drug	cbevera	In the survey, tobbaco and drugs are included. We aggregated as beverages.
Clothes and shoes	cclothing	
Housing, water, electricity, gas, other fuels	chunsyl (a share supposed to be 98%), cconstr, cfgasop, celnn, cwoin (a share)	Merged together in the survey consumption matrix share for cwoin share estimation
Furniture, house items and maintenance	cwoin (a share)	
Restaurant and hotel	chotres	
Transport	ctracom	Merged together in the survey matrix share estimation
Communication		
Education	cedhncs	Merged together in the survey matrix share estimation
Health		
Leisure and culture	coservi	
Other goods and services	cfinanc	

Source: Own compilation based on above documented data sources.

Table 10. Households consumption matrix shares (%)

Commodities	Household groups										Total
	hruraq1	hruraq2	hruraq3	hruraq4	hruraq5	hurbaq1	hurbaq2	hurbaq3	hurbaq4	hurbaq5	
cmaize	0.11	0.15	0.19	0.20	0.15	0.04	0.07	0.10	0.18	0.46	1.64
crice	0.02	0.03	0.04	0.04	0.04	0.01	0.02	0.02	0.05	0.10	0.38
ccassav	0.47	0.23	0.28	0.30	0.22	0.04	0.07	0.11	0.19	0.50	2.41
cyam	0.21	0.31	0.37	0.40	0.58	0.06	0.10	0.15	0.25	0.67	3.11
cpineap	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.02	0.10
cvegspi	0.41	0.59	0.72	0.79	0.57	0.12	0.19	0.29	0.49	1.29	5.47
cofcrc	0.11	0.16	0.19	0.21	0.15	0.03	0.05	0.08	0.13	0.35	1.46
cofcrx	0.05	0.07	0.08	0.09	0.06	0.01	0.02	0.03	0.06	0.15	0.62
ccashen	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ccashea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
cpalm	0.03	0.04	0.05	0.06	0.04	0.01	0.01	0.02	0.03	0.07	0.35
cocrinx	0.05	0.07	0.09	0.10	0.07	0.01	0.02	0.03	0.04	0.12	0.59
cbicpoul	0.10	0.14	0.18	0.19	0.14	0.02	0.04	0.06	0.10	0.27	1.24
cbropoul	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.05
colivani	0.04	0.05	0.06	0.07	0.05	0.01	0.01	0.02	0.04	0.10	0.45
crmilk	0.06	0.09	0.11	0.12	0.09	0.02	0.03	0.04	0.07	0.18	0.80
ceggoth	0.03	0.05	0.06	0.06	0.04	0.01	0.02	0.02	0.04	0.10	0.43
chunsyl	0.13	0.10	0.12	0.13	0.28	0.02	0.10	0.05	0.42	0.22	1.56
cfisch	0.09	0.13	0.15	0.17	0.12	0.03	0.04	0.07	0.11	0.29	1.20
cmin	0.01	0.02	0.02	0.03	0.02	0.00	0.00	0.01	0.02	0.05	0.19
cbicpmeat	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
cbropmeat	0.00	0.00	0.00	0.00	0.00	0.04	0.06	0.09	0.16	0.64	1.00
coslpmfi	0.28	0.40	0.49	0.53	0.38	0.06	0.10	0.16	0.26	1.06	3.73
coilfat	0.15	0.21	0.26	0.28	0.20	0.05	0.09	0.13	0.23	0.59	2.21
cpineapij	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.05	0.10
cpineapaj	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.03	0.05	0.16	0.30
ccashnak	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.03
ccashaj	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.09
cofrvegp	0.10	0.14	0.17	0.19	0.13	0.02	0.04	0.06	0.09	0.20	1.14
cofooin	1.07	1.54	1.88	2.04	1.48	0.38	0.64	0.96	1.63	4.21	15.84
cbevera	0.13	0.14	0.19	0.20	0.19	0.04	0.07	0.10	0.18	0.58	1.81
cclothing	0.29	0.35	0.45	0.50	0.45	0.10	0.19	0.27	0.51	1.65	4.76
cfgasop	0.03	0.08	0.10	0.12	0.10	0.02	0.04	0.06	0.13	0.53	1.20
celnn	0.01	0.04	0.05	0.05	0.04	0.01	0.02	0.03	0.06	0.24	0.54
cwoin	0.47	0.52	0.67	0.78	0.65	0.13	0.23	0.39	0.83	3.47	8.13
cconstr	0.04	0.06	0.08	0.09	0.08	0.02	0.03	0.05	0.10	0.21	0.76
chotres	0.27	0.49	0.67	0.90	0.78	0.10	0.21	0.40	0.94	4.75	9.51
ctracom	0.39	0.72	1.05	1.26	1.20	0.16	0.30	0.54	1.20	5.61	12.43
cfinanc	0.12	0.18	0.22	0.23	0.17	0.04	0.06	0.09	0.16	0.49	1.77
cedhncs	0.48	0.76	0.97	1.13	1.17	0.19	0.32	0.54	1.07	4.60	11.22
coservi	0.07	0.11	0.14	0.16	0.12	0.03	0.05	0.08	0.16	0.49	1.40
Total	5.82	7.99	10.15	11.46	9.79	1.83	3.29	5.07	10.00	34.60	100.0

Source: Own compilation based on above documented data sources.

Regarding government consumption, the 2019 government budget report allows us to calculate the government consumption matrix shares (a column vector) at 1.12%, 0.51%, 5.53%, 54.29% and 38.56% for cfgasop (fuels), celnn (electricity), cwoin (water and other industry), cedhncs (education and health services) and coservi (other services including security and defence). Fuels, electricity, water and other industry commodities (computers,

papers, etc.) are utility commodities that the government consumes to be able to provide services to the population.

3.3.3 Land rent to households

As explained in the paragraph on land rent to households in section 2.2, we calculated these values from EMICoV 2011. First, 2011 income from land was calculated for each of the 10 household groups. Second, we used the change in real agricultural GDP from 2011 to 2019 to upgrade these values to 2019. Finally, we used the inflation rate between 2011 and 2019 to take the 2019 economic environment into account. At the end, total household income from land was FCFA 93.9, 101.8, 68.9, 67.9 and 23.5 billion respectively for rural households Q1-5. Regarding urban households, it was FCFA 13.5, 14.7, 22.3, 65.6 and 15.2 billion respectively for households Q1-5.

3.3.4 Trade and investment demand disaggregation

Trade disaggregation was based on trade data for 2019 as explained in section 3.2. Table 11 presents trade matrices shares obtained based on this data. All shares for export add up to 100% and all shares for import add up to 100%. Row totals show the share of each commodity in total trade and column totals show the trade share with each region.

Table 11. Trade matrices shares (%)

Commo-dities	Export			Import		
	rownig	rowoth	Total	rownig	rowoth	Total
cmaize	0.54	3.18	3.72		0.00	0.00
crice	0.15	0.00	0.15		0.00	0.00
ccassav	0.49	1.22	1.70			
cyam	0.09	0.64	0.73			
cpineap	0.95	0.11	1.06			
cvegspi	0.07	0.48	0.54	0.00	1.04	1.04
cofcrc	0.04	0.72	0.76	0.00	0.54	0.54
cofcrx	0.02	0.31	0.33	0.00	0.36	0.36
ccotton		0.02	0.02			
ccashen	0.00	2.16	2.16			
cpalm	0.24	0.15	0.39			
cocrinx	0.02	1.38	1.40	0.00	0.05	0.05
cbicpoul	0.06	0.15	0.21			
cbropoul					0.01	0.01
colivani	0.18	0.44	0.63		0.00	0.00
crmilk					0.04	0.04
ceggoth					0.00	0.00
chunsyl	0.13	1.02	1.15	0.01	0.01	0.02
cfisch		0.00	0.00		0.00	0.00
cmin		0.03	0.03	0.00	0.38	0.38
cbropmea	0.59		0.59		2.62	2.62

Commo-dities	Export			Import		
	rownig	rowoth	Total	rownig	rowoth	Total
coslpmfi	0.99	3.41	4.40		7.16	7.16
coilfat	0.92	10.25	11.18		7.78	7.78
cpineapij	0.11	1.57	1.69			
ccashnik	0.00	1.32	1.32			
cofrvegp		0.02	0.02	0.00	1.73	1.73
cofooin		1.92	1.92	0.00	1.86	1.86
cbevera	2.29	0.84	3.14	0.01	20.59	20.60
ccotgin	0.00	16.64	16.65	0.00	0.00	0.00
cclothing	0.51	0.59	1.10	0.00	6.71	6.71
cfgasop				0.01	10.71	10.72
celnn					3.48	3.48
cfertil					2.72	2.72
cwoin	0.16	9.84	10.00	1.90	20.40	22.30
cconstr		0.24	0.24		0.25	0.25
ctrade						
chotres	0.10	9.15	9.25	0.01	2.15	2.17
ctracom	0.30	10.99	11.29	0.03	3.51	3.54
cfinanc	0.04	0.73	0.77	0.02	2.96	2.98
cedhncs						
coservi		11.46	11.46	0.01	0.94	0.94
Total	8.99	91.01	100.0	2.00	98.00	100.0

Source: Own compilation based on above documented data sources.

Investment demand was disaggregated based on previous SAMs. Table 12 shows the final shares we used based on these sources. All shares in the table add up to 100%. Row totals show the share of each commodity in total investment demand while column totals show the share of each investment type.

Table 12. Investment matrix shares (%)

Commodities	invpriv	invpub	Total
cbicpoul	0.09		0.09
cbropoul	0.04		0.04
colivani	1.75		1.75
chunsyl	0.92		0.92
cmin	0.27		0.27
cclothing	0.05		0.05
cfgasop	3.29		3.29
celnn	0.22		0.22
cwoin	25.29	7.61	32.90
cconstr	47.85	8.39	56.24
coservi	3.37	0.85	4.23
Total	83.15	16.85	100.0

Source: Own compilation based on above documented data sources.

3.3.5 Tax and margin disaggregation

Four commodity tax categories were disaggregated: VAT (tvat), other commodity tax (tctax), import tariff (tmtax) and export tax (textax). As tariffs are collected on imports and export taxes on exports, their shares depend on the value of trade (if ad valorem tariffs; the quantity otherwise) as well as the commodity-specific tax rates. We used previous SAMs to calculate the tax rates for each commodity and applied these rates to the trade value to calculate the tariffs and export taxes by commodity.

Because of the infrastructure in Benin, the government collects VAT mostly on imported commodities. We used the same process as for tariffs to calculate product specific VAT. Deducting the calculated VAT, tariffs and export tax from total commodity taxes, we obtained total other commodity tax revenue that we disaggregated based on the rates calculated from previous SAMs. The final commodity tax matrix shares are presented in Table 13 (all shares for commodity taxes add up to 100%). Most of the agricultural commodities do not pay or pay relatively small taxes.

Final margins matrix shares are also presented in Table 13 (all shares for margins add up to 100%). We calculated the margin rates for each commodity and each margin category from previous SAMs. We applied these rates to the volume of each transaction category: domestic margins (mtd) on domestic transactions, import margins (mtm) on imports and export margins (mte) on exports. This allows estimating the margins from which we calculated the matrix shares (Table 13).

Table 13. Commodity tax and trade margin matrices shares (%)

Commodities	Commodity taxes					Margins			
	tvat	tctax	tmtax	textax	Total	mtd	mte	mtm	Total
cmaize			0.00		0.00	1.83	0.59	0.01	2.42
crice			0.00		0.00	0.16	0.00	0.00	0.16
ccassav						5.15			5.15
cyam						6.95	0.36		7.31
cpineap				0.04	0.04	1.15	0.00		1.16
cvegspi	0.01		0.01		0.02	8.37	0.42	0.83	9.62
cofcrc	0.16		0.23		0.39	2.18	0.35	0.35	2.88
cofcrx	0.11		0.15		0.26	0.65	0.11	0.16	0.93
ccotton						0.49	0.00		0.49
ccashen		0.06		0.81	0.87	0.24	0.50		0.73
ccashea						0.00			0.00
cpalm						0.38			0.38
cocrinx	0.02		0.00		0.02	2.39	0.03	0.02	2.44
cbicpoul		0.01			0.01	0.85			0.85
cbropoul		0.00			0.00	0.04			0.04
colivani		0.02	0.00		0.02	1.75	0.14	0.00	1.89
crmilk			0.01		0.01	0.04		0.00	0.04
ceggoth	0.00		0.00		0.00	0.59		0.00	0.59
chunsyl	0.00		0.01		0.01	1.68	0.21	0.02	1.91
cfisch	0.00		0.00		0.00	1.10	0.00	0.00	1.10
cmin	0.28	0.00	0.06		0.33	0.07	0.00	0.01	0.07
cbicpmeat		0.00			0.00	0.00			0.00
cbropmeat	0.52	0.00	0.63		1.15	0.15			0.15
coslpmfi	1.43		1.71		3.14	3.23	4.47	1.50	9.20
coilfat	1.14	0.39	0.80		2.33	0.88	3.09	0.85	4.82
cpineapij		0.08		0.03	0.11	0.04	0.10		0.14
cpineapaj		0.20			0.20	0.10			0.10
ccashnik		0.00		0.03	0.03		0.08		0.08
ccashnak						0.05			0.05
ccashnikr						0.00			0.00
ccashaj		0.00			0.00	0.03			0.03
cofrvegp	1.42		0.44		1.87	0.06	0.00	0.13	0.19
cofooin	4.95	0.38	1.10	0.04	6.48	5.84	3.77	2.27	11.87
cbevera	5.06	3.00	0.34		8.40	1.60	0.18	0.37	2.15
ccotgin			0.00	0.65	0.65	0.02	0.48	0.00	0.50
cclothing	4.88		4.04		8.92	1.32	1.12	2.94	5.38
cfgasop	7.80	0.60	3.21		11.60	0.88		4.06	4.94
celnn	2.48				2.48	0.70			0.70
ccnsl						0.00	0.00		0.00
ccnsc	0.00			0.01	0.02	0.00			0.00
cfertil						0.26		0.43	0.69
cwoin	13.40	1.60	8.54	0.04	23.57	7.12	1.36	10.38	18.86
cconstr	6.05				6.05				
chotres	0.04	0.14			0.18				
ctracom	14.01	0.71			14.71				
cfinanc	0.22	3.30			3.52				
cedhncs	0.03	0.04			0.08				
coservi	2.27	0.24			2.51				
Total	66.28	10.77	21.29	1.65	100.0	58.32	17.36	24.33	100.0

Source: Own compilation based on above documented data sources

3.4 Estimation process and reliability

3.4.1 Estimation process

Since we use several different data sources to produce the prior micro-SAM, it was with some imbalances at the end. The final micro-SAM was estimated using the cross-entropy method (Robinson & McDonald, 2006).

The macro values from 2019 NA, the MMI and WDI (BCEAO, 2021; World Bank, 2021) for Benin were fixed (0 standard errors) during the estimation process. These comprise imports, exports, government consumption, savings, total income, direct and indirect tax revenues, investment demand, household consumption, household transfers abroad, remittances received from abroad and the current account balance, total GDP at market price and at factor cost. In addition, the government transfer abroad obtained from the government budget implementation report was fixed. Moreover, land income to households was fixed with specified standard error of 5% as it was calculated from a survey. The demand for intermediate inputs was also fixed with 5% of standard error allowed as we calculated it based of GDP at factor cost. Total exports to Nigeria and the RoW and imports from Nigeria and the RoW were also fixed with 5% standard error allowed as we calculated them based on shares from trade data and imports and exports while the total import was fixed and only 1% of deviation was allowed for total export. Agricultural and industrial GDP at factor cost were fixed. All other macro-aggregates were fixed with 5% standard error allowed and for all other entries a standard error of 25% was allowed.

During the estimation process, constraints were stepwise implemented to produce an estimated micro-SAM fitting all macro-totals. We had to flex some hard constraints such as those related to investment demand (allowing a standard error of 1%) and total export (allowing a standard error of 1%) to give some operation flexibility to the model. When needed, we gave flexibility to these two macro indicators because with the informal sector in Benin, some exports and investments usually pass the data recording system. So, slight modification of these indicators would not necessarily conflict with reality. In addition, we had to adjust slightly some values of the intermediate demands manually to make the estimation process successfully reproducing the macro-totals. The final estimated macro-SAM is presented in Table 14.

Table 14. Estimated macro-SAM for 2019 (billion FCFA)

			A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
			comdty	margn	activity	flabour	fcapit	fland	househ	gov	tindtax	tdirtax	enterpr	sav-inv	rownig	rowoth	total
1	Commodities	comdty		1,550.3	6,267.9				5,715.9	872.1				2,102.8	169.5	1,937.5	18,615.9
2	Margins	margn	1,550.3														1,550.3
3	Activities	activity	14,029.4														14,029.4
4	Factor labour	flabour			3,568.2										4.3	7.9	3,580.4
5	Factor capital	fcapit			3,267.2												3,267.2
6	Factor land	fland			856.1												856.1
7	Households	househ				3,567.0	2,291.1	490.8	121.9	237.9			80.8		8.8	109.7	6,908.0
8	Government	gov					11.5				740.8	194.8	8.0		3.8	246.3	1,205.2
9	Indirect tax	tindtax	670.7		70.0												740.8
10	Direct tax	tdirtax							102.2				92.7				194.8
11	Enterprises	enterpr					964.6	365.3		104.0					26.7	42.0	1,502.6
12	Saving-investment	sav-inv							907.5	-41.6			920.0		-19.7	336.6	2,102.8
13	Nigeria	rownig	57.7			4.0			12.3	8.1			111.3				193.4
14	Rest of the world	rowoth	2,307.8			9.4			48.2	24.7			289.8				2,680.0
15	Total	total	18,615.9	1,550.3	14,029.4	3,580.4	3,267.2	856.1	6,908.0	1,205.2	740.8	194.8	1,502.6	2,102.8	193.4	2,680.0	

Source: Own compilation.

3.4.2 Data quality

As far as data quality is concerned, we first assess the quality and the reliability of each dataset used for building this SAM. Table 15 presents the reliability of the data for each sub-matrix on scales of A (highly reliable), B (reliable) and C (driven by estimation). All data from the NA, MMI, WDI and the government budget are considered highly reliable. The data estimated based on the existing databases (previous SAMs or household survey) are considered as reliable (B).

It appears that while the estimation of land income to households is based on a reliable database, the total land income is driven by the estimation process because of the land income to enterprises which was calculated. Further data are needed on land distribution between households and enterprises to improve that part of the SAM in particular and the enterprise account in general because the enterprise account is the one with the least macro-data available.

Table 15 Data confidence matrix

			A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
			comdty	margn	activity	flabour	fcapit	fland	househ	gov	tindtax	tdirtax	enterpr	sav-inv	rownig	rowoth	total
1	Commodities	comdty		**B**	**B**				**A**	**A**				**A**	**A***	**A***	**A**
2	Margins	margn	**B**														**B**
3	Activities	activity	**A**														**A**
4	Factor labour	flabour			**B**										**A***	**A***	**A**
5	Factor capital	fcapit			**B**												**B**
6	Factor land	fland			**C**												**C**
7	Households	househ				**B**	**B**	**B**	**B**	**B**			**B**		**A***	**A***	**B**
8	Government	gov					**A**				**A**	**A**	**B**		**A***	**A***	**A**
9	Indirect tax	tindtax	**A**		**A**												**A**
10	Direct tax	tdirtax							**A**$^{+}$				**A**$^{+}$				**A**
11	Enterprises	enterpr					**B**	**C**		**B**					**B**	**B**	**B**
12	Saving-Investment	sav-inv							**B**	**A**			**B**		**A***	**A***	**A**
13	Nigeria	rownig	**A***			**B***			**B***	**A***			**B***				**A***
14	Rest of the world	rowoth	**A***			**B***			**B***	**A***			**B***				**A***
15	Total	total	**A**	**B**	**A**	**A**	**B**	**C**	**B**	**A**	**A**	**A**	**B**	**A**	**A***	**A***	

Note: **A**= highly reliable, **B**= reliable, **C**= derived from the estimation process, *=applies to the aggregate of both foreign accounts, += applies to the total direct tax.

Source: Own compilation.

3.5 The estimated versus the prior macro-SAM

As explained at the beginning of chapter 2, we first compiled and estimated a 2019 macro-SAM for Benin. Second, we built a prior micro-SAM based on the estimated macro-SAM and finally, we estimated the micro-SAM. Hence, the final macro-SAM (which is an aggregation of the estimated micro-SAM) is slightly different from the intermediate macro-SAM at some points. This is due to the high amounts of constraints imposed during the micro-SAM estimation. The savings-investment account is an example of this difference. This account shows a 2.7% difference between the final and the intermediate macro-SAMs. In this section, we focus on differences between the final and the prior macro-SAMs.

Table 16 presents these differences. In most cases, the differences are small. For some entries, there are no differences because these entries are fixed (0 standard error) as constraints during the estimation. There are two very high[2] differences (+46.5% and +43.1%) concerning Nigerian transfers and the land factor payment to enterprises. The difference in the land factor payment to enterprises can be explained by the low confidence we had in the estimation of land factor payments to enterprises at the beginning (see data confidence matrix in section 3.4). We allowed less flexibility for data in which we were more confident such that other parts of the SAM like land payments to enterprises had to adjust more. The enterprise income from Nigeria was a small value in absolute terms. It was therefore highly sensitive to adjustments expressed in relative terms. Another difference which is high[3] concerns enterprise transfers to Nigeria (+25.0%). The changes in enterprise income from Nigeria and enterprise transfers to Nigeria allow adjusting the enterprise account. The increase in transfers to Nigeria contributed to increase the foreign exchange outflow with Nigeria by 19.0% to balance this account.

Another difference which captures the attention is the activity payment to land (+15.3%). In fact, in 2019, agricultural GDP in Benin contributed more to overall GDP than in the SAMs we used as data sources, and land is a factor that is only used by agriculture. Thus, the increase in the share of agriculture implies higher payments to land, also explaining the big difference in land payments to enterprises as the land payment to households was set with less flexibility to adjust.

[2] Difference greater than 25%.

[3] Difference between 20% and 25%

Table 16. Differences between the prior and the estimated macro-SAM for 2019 (% of the value in the prior macro-SAM)

		A comdty	B margn	C activity	D flabour	E fcapit	F fland	G househ	H gov	I tindtax	J tdirtax	K enterpr	L sav-inv	M rownig	N rowoth	O total
1	Commodities	comdty		4.0	-4.1				0.0	0.0				-2.7	-8.2	4.2	-1.1
2	Margins	margn	4.0														4.0
3	Activities	activity	-1.9														-1.9
4	Factor labour	flabour			-2.7										-0.8	0.3	-2.7
5	Factor capital	fcapit			-0.5												-0.5
6	Factor land	fland			15.3												15.3
7	Households	househ				-2.6	-1.2	0.7	-2.3	-6.3			4.5		-1.3	0.5	-1.9
8	Government	gov					-0.1				0.0	0.0	-1.1		-1.3	0.1	0.0
9	Indirect tax	tindtax	0.9		-7.5												0.0
10	Direct tax	tdirtax							14.1				-12.0				0.0
11	Enterprises	enterpr					1.3	43.1		-3.7					46.5	14.3	9.7
12	Saving-investment	sav-inv							-11.5	0.0			6.9		4.4	0.2	-2.7
13	Nigeria	rownig	15.7			-14.7			12.9	2.2			25.0				19.0
14	Rest of the world	rowoth	-0.3			-2.2			12.9	0.3			9.8				0.9
15	Total	total	-1.1	4.0	-1.9	-2.7	-0.5	15.3	-1.4	-1.6	0.0	0.0	7.0	-2.7	-3.8	3.3	

Source: Own compilation.

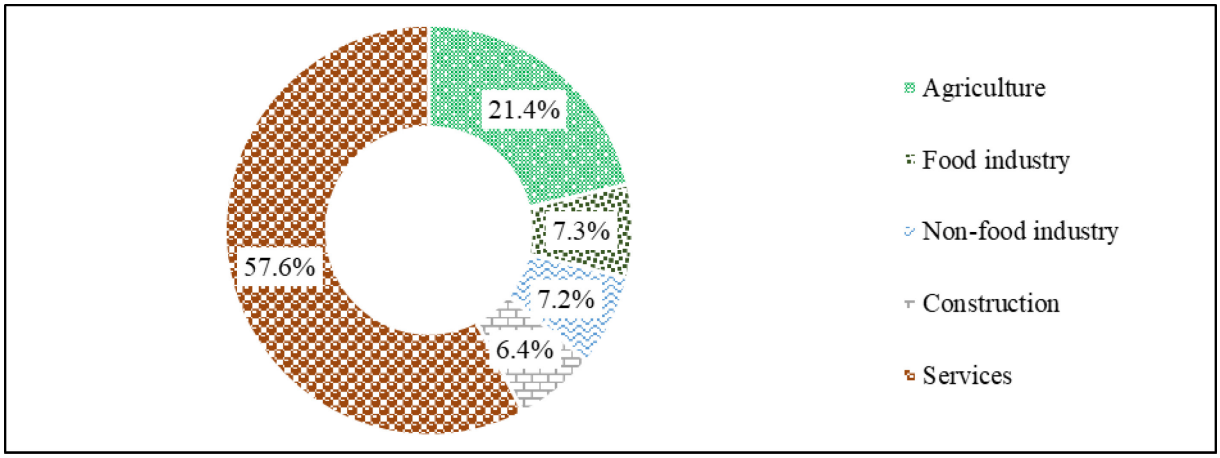
4 Benin's economy based on the 2019 SAM

This chapter describes the Beninese economy based on the estimated 2019 SAM.

4.1 Domestic production, output composition and intermediate input demand

The total domestic production (output) of 2019 in Benin was estimated at FCFA 14,029.4 billion (about US$ 23.9 billion). With the sector grouped in five aggregates (Figure 3), services is the biggest sector with 57.6% of domestic production. Agriculture is the biggest sector in terms of Goods (21.4% of total domestic output) and food industry is the second (7.3% of total domestic output).

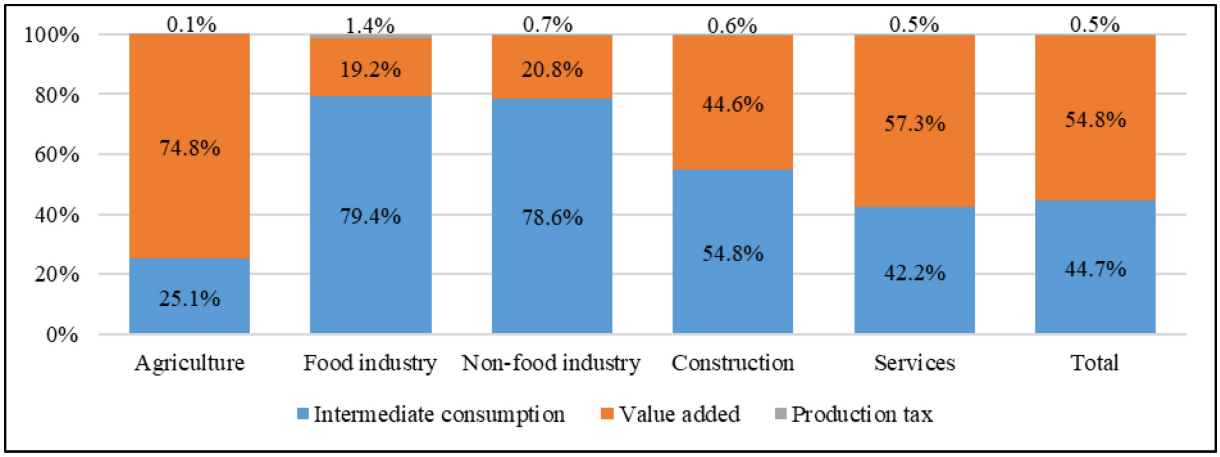
Figure 3. Share of total output by aggregated sector



Source: Own compilation.

Regarding the composition of production cost, almost 45% of total production cost is intermediate input demand and almost 55% is value added while the production tax share is very small (Figure 4). Agriculture is the most value-added intensive sector. Only 25% of the production cost is paid to intermediate inputs and almost 75% is value added. The food industry is paying only 19% as value added, reflecting the high share of agricultural inputs in total cost.

Figure 4. Output composition by aggregated sector

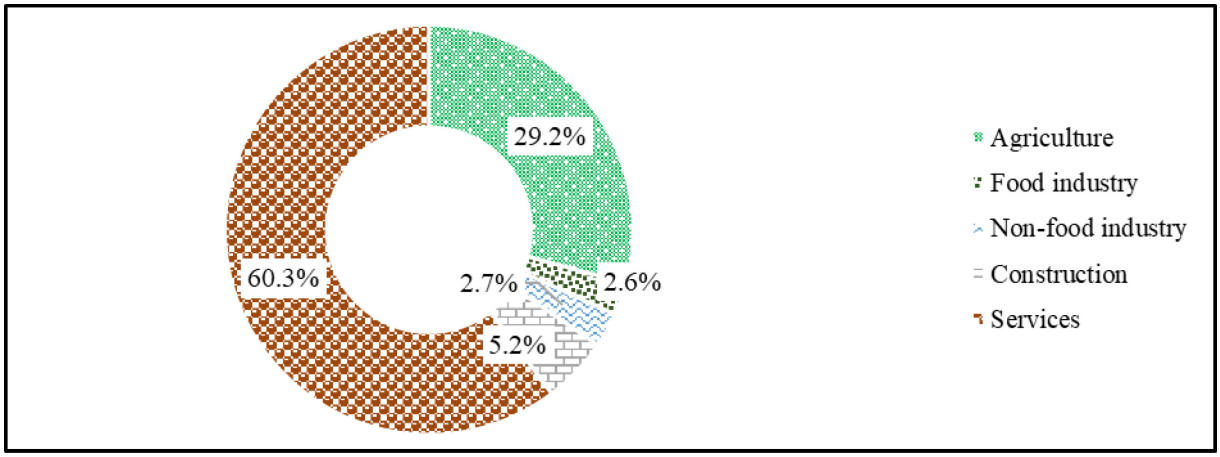


Source: Own compilation.

4.2 Value added, factor use and compensation

GDP at factor cost in 2019 in Benin is FCFA 7,691.5 billion, which is equivalent to about US$ 13 billion (BCEAO, 2021). Consistent with national account data (BCEAO, 2021), almost 30% of GDP is produced by agriculture (Figure 5). This is higher than the agricultural contribution to the GDP in WAEMU (24%) in 2019 (BCEAO, 2021). In this country group, only Mali and Niger have higher agricultural contributions to GDP (37%) than Benin. This shows that Benin is a strongly agriculture-based country. In Nigeria, the contribution of agriculture to GDP (30%) is slightly higher than in Benin. The contribution of agriculture to GDP in Benin is comparable with countries in other parts of Africa. For example, Sudanese agriculture, similarly to Benin, contributes more than 30% to GDP (Siddig *et al.*, 2018).

Figure 5. Shares of aggregated sectors in total value added



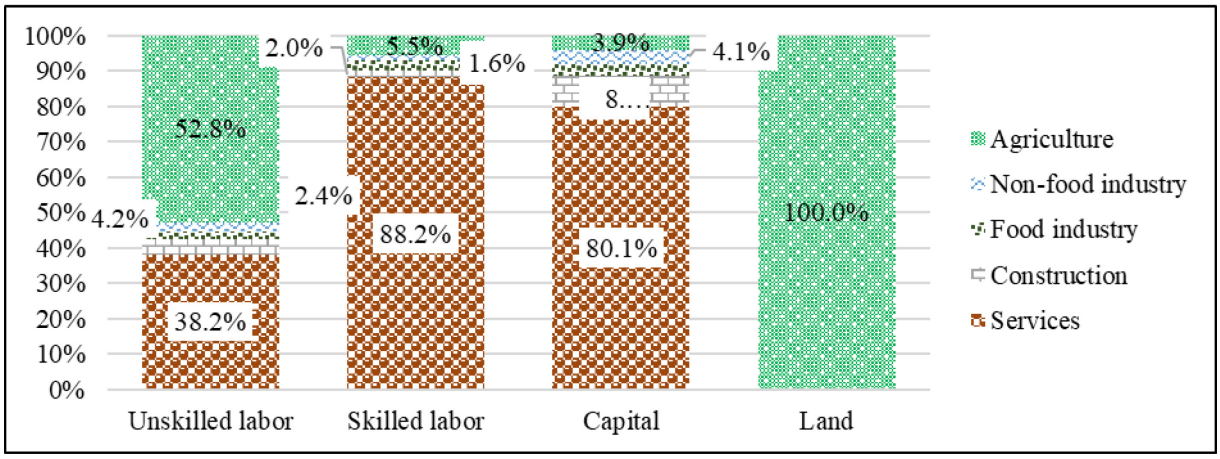
Source: Own compilation.

As in WAEMU where services contribution is 55% to total GDP (BCEAO, 2021), services are the biggest contributor to GDP in Benin (60%) while the food industry contributes 2.6% to total GDP at factor cost (Figure 5).

Services employ most of the skilled labour and capital while agriculture employs all the land and most of the unskilled labour (all in value terms: Figure 6). Skilled labour and capital are used sparsely in agriculture. The food industry employs only 2-3% of total labour and capital.

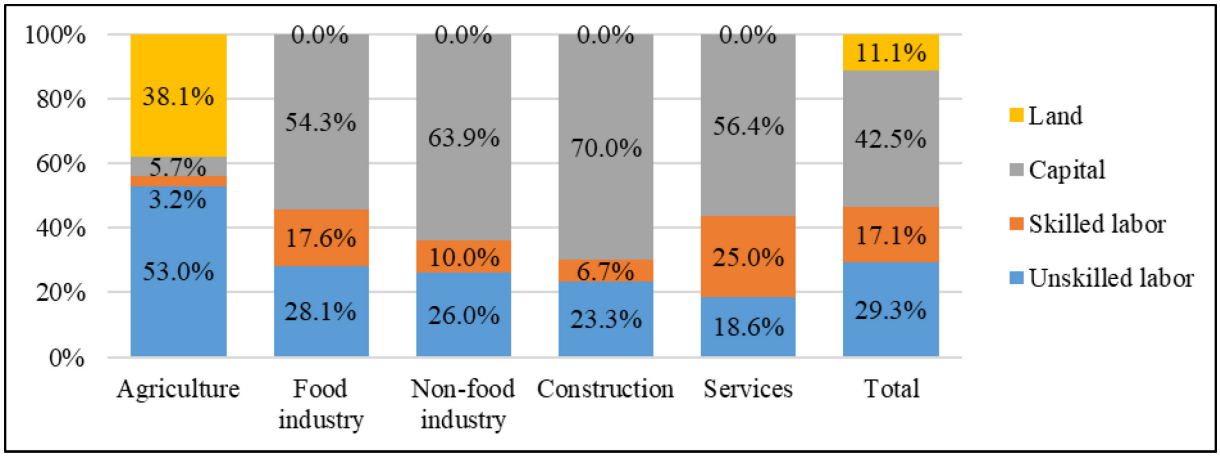
In the Beninese economy, 46.4 % of the total value added is paid to labour (29.3% for unskilled and 17.1% for skilled labour), 42.5% to capital, and 11.1% to land (Figure 7). This shows that Benin is more abundant in labour. Payments to unskilled labour (53%) and land (38%) constitute the highest shares of agricultural value added showing the high unskilled labour intensity of agriculture. The food industry pays the highest share (54%) of its value added to capital and the lowest share (18%) of this value added is paid to skilled labour. The composition of value added in the non-food industry is similar, though the share of skilled labour is substantially less. Services spend the highest share of value added on skilled labour (25%) while construction pays the highest share to capital (70% of value added).

Figure 6. Factor use by aggregated sector



Source: Own compilation.

Figure 7. Intensity of factor use

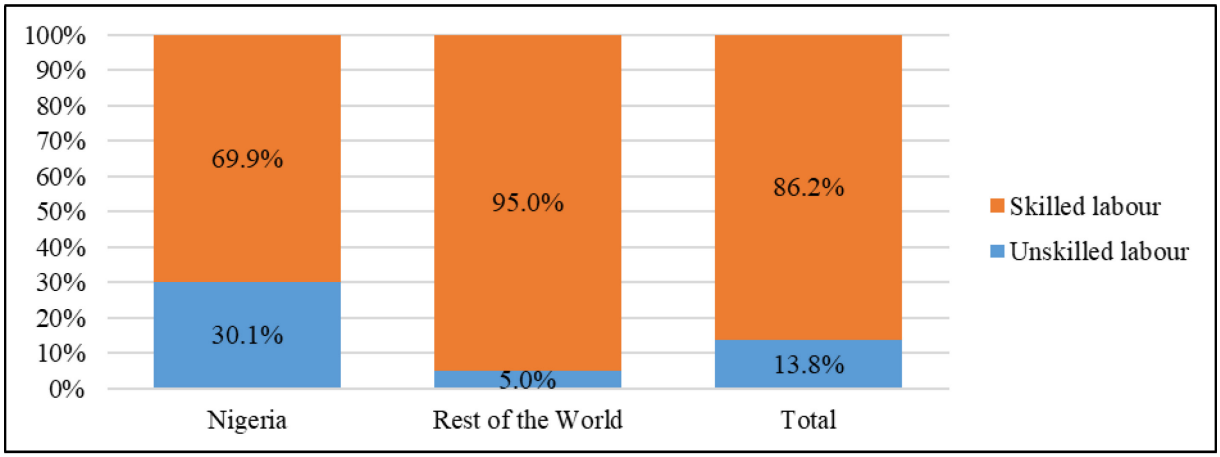


Source: Own compilation.

Comparing factor intensities among sectors (Figure 7) shows that construction, non-food industry and services have the highest capital intensity in Benin while services, food and non-food industries have the highest skilled labour intensity. Agriculture, food and non-food industries have the highest unskilled labour intensity. Agriculture has the lowest skilled labour intensity (3.2%). This shows the lack of well-trained labour in agriculture. Knowing that good education of the labour force is positively correlated with productivity, we can deduct that a better performance of the agricultural sector in Benin would benefit from a better education of those working in this sector.

Labour is a factor which is also exported. With a total of FCFA 12.2 billion (about $US 20.9 million), 35.2% of which from Nigeria, the labour payment from abroad represents 0.3% of total labour compensation. Most of the exported labour (86% of total labour payment from abroad) is skilled (Figure 8), showing that Beninese skilled labour has more exporting opportunities compared to unskilled labour.

Figure 8. Factor payments from abroad



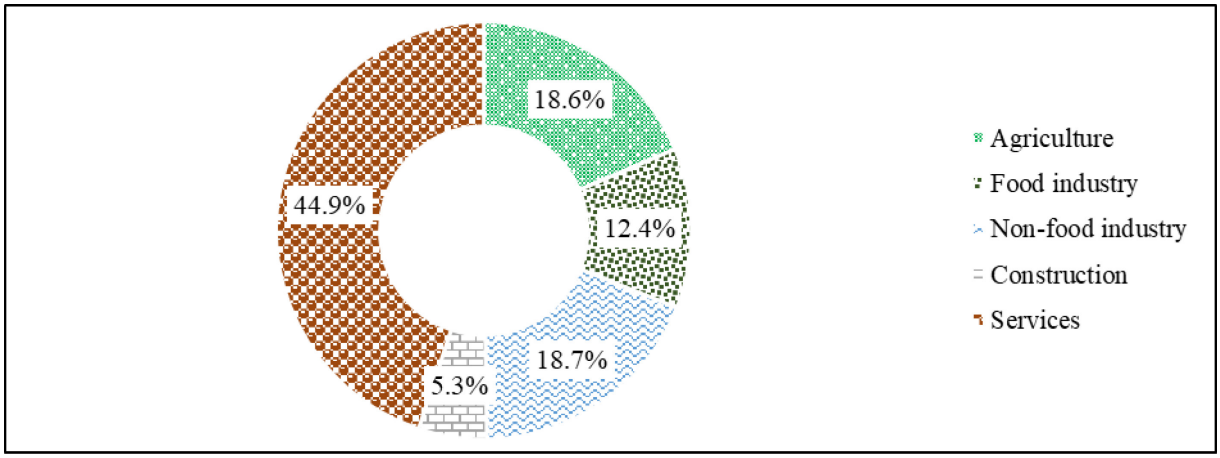
Source: Own compilation.

4.3 Commodity supply composition

4.3.1 Supply

Total supply of Benin in 2019 was FCFA 18,615.9 billion (about $US 32 billion) with 88% as net supply (domestic output + import) and 12% as margins and commodity taxes. Services account for the highest share (almost 45%) of total supply while agriculture and the food industry supply 18.6% and 12.4%, respectively, of total supply (Figure 9).

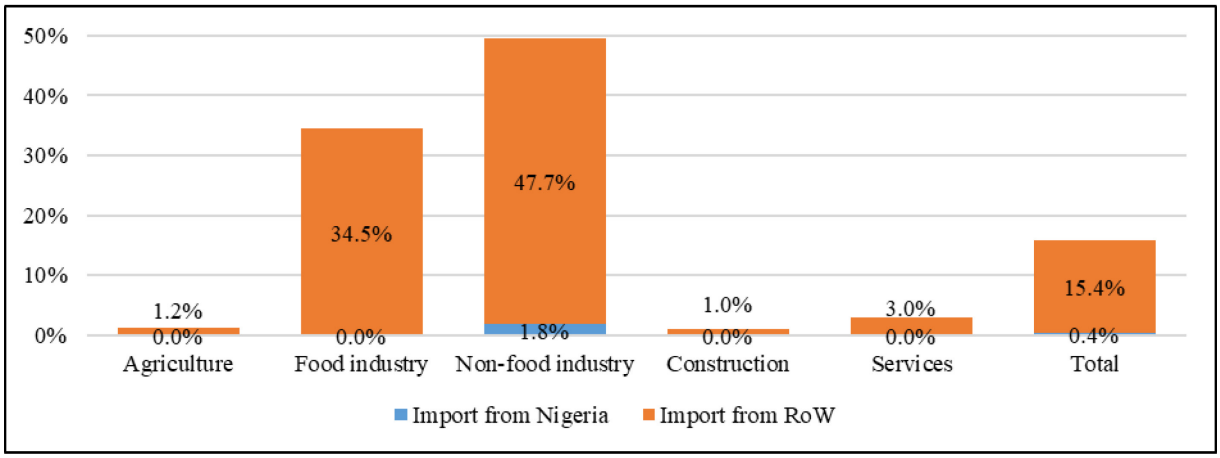
Figure 9. Share of total supply by aggregated sector



Source: Own compilation.

Regarding the net supply, more than 85% is produced domestically. Agriculture and construction are the sectors for which Benin is the most self-sufficient (almost 99% of net supply produced domestically). The industrial sector is the most dependent on imports with an import penetration of almost 35% in the food industry and 50% in the non-food industry (Figure 10). Only a small share of Beninese supply is imported from Nigeria (Figure 10).

Figure 10. Import penetration by aggregated commodity

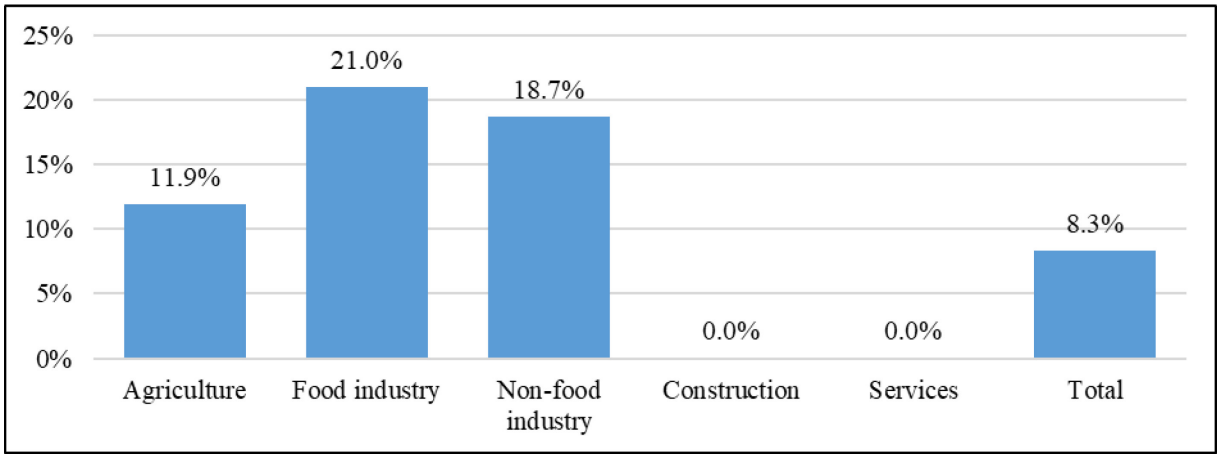


Source: Own compilation.

4.3.2 Margins and taxes

In 2019 in Benin, 50.6% of the trade margins are derived from domestic trade while 31.3% are from imports and 18.2% from exports. These margins represent 8.3% of total supply (Figure 11). Agriculture, the food and the non-food industry pay these margins with agriculture paying the least (12%).

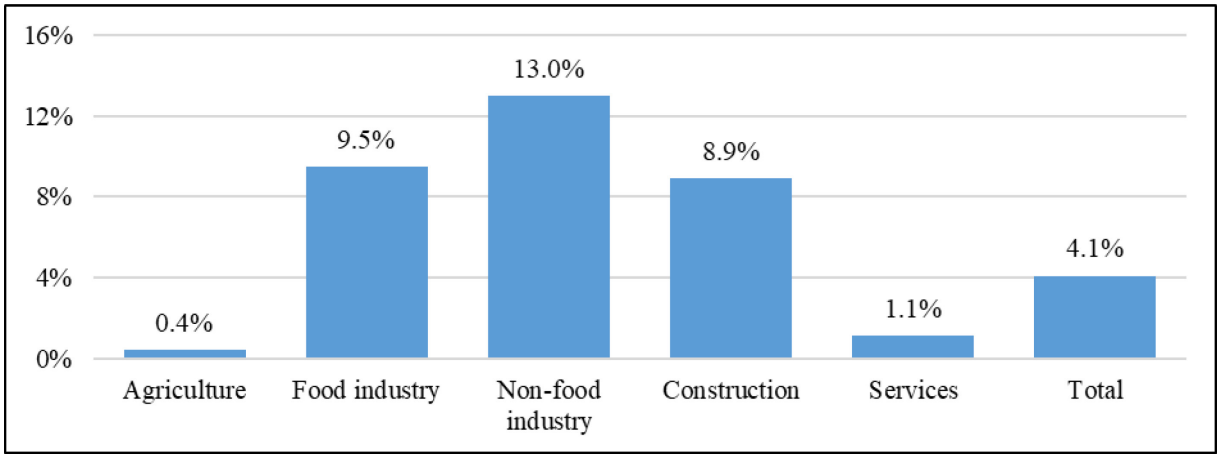
Figure 11. Share of trade margins in total supply by aggregated sector



Source: Own compilation.

In general, only 4.1% of net supply (value before tax) is paid as commodity taxes to the government (Figure 12). Agriculture and services have the lowest tax rates (0.4% and 1.1%). Non-food industry pays the highest tax rate (13%). Although the tax rate on processed food is 9.5%, the average tax rate on food (agriculture and food industry) is only 3.6% (Figure 12). Tax rates on food commodities are lower in Benin in comparison to high income countries such as most countries of the European Union where VAT only is typically higher than 3.6% (Bánociová & Ťahlová, 2018).

Figure 12. Commodity tax rates by aggregated sector

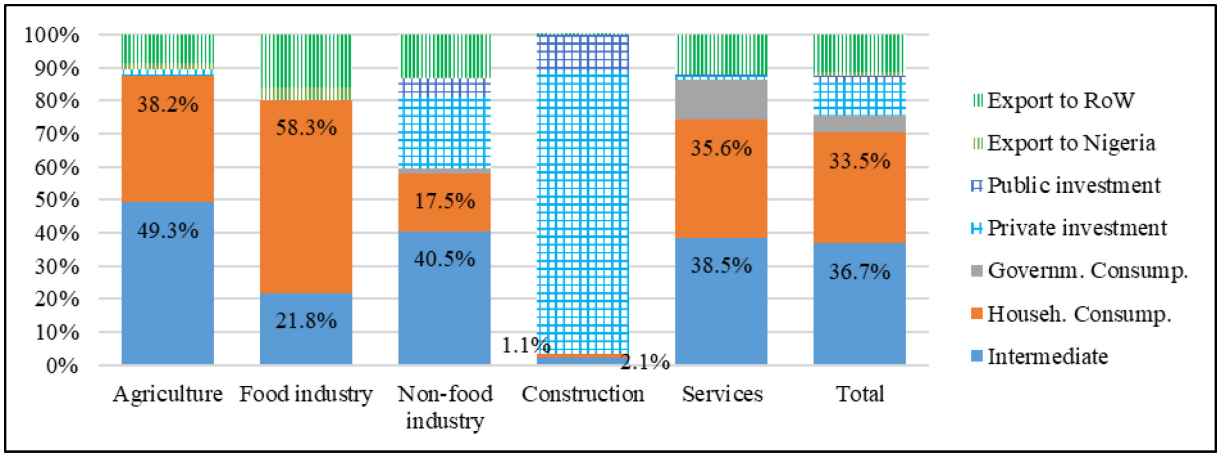


Source: Own compilation.

4.4 Commodity demand

Apart from the margins which are collected on commodities and are paid to the trade sectors (8.3% of total supply), remaining supply is demanded by final consumers (households, 33.5% and government, 5.1%) and productive activities (36.7%) in addition to exports (12.3%, 1.0% of which to Nigeria) and investment demand (12.2%) (Figure 13). Agricultural commodities are processed most in relative terms (almost 50% of demand is intermediate inputs), while about 42% of the total demand for intermediate inputs stems from services, 27% from agriculture, 22.5% from the non-food industry and 8% from the food industry (Figure 14). Construction and non-food industrial commodities are demanded the most for investment purposes, which make up for 97% and 27.5% of their total demand, respectively (Figure 13), corresponding together to 91% of private and 93% of total public investment demand (Figure 14).

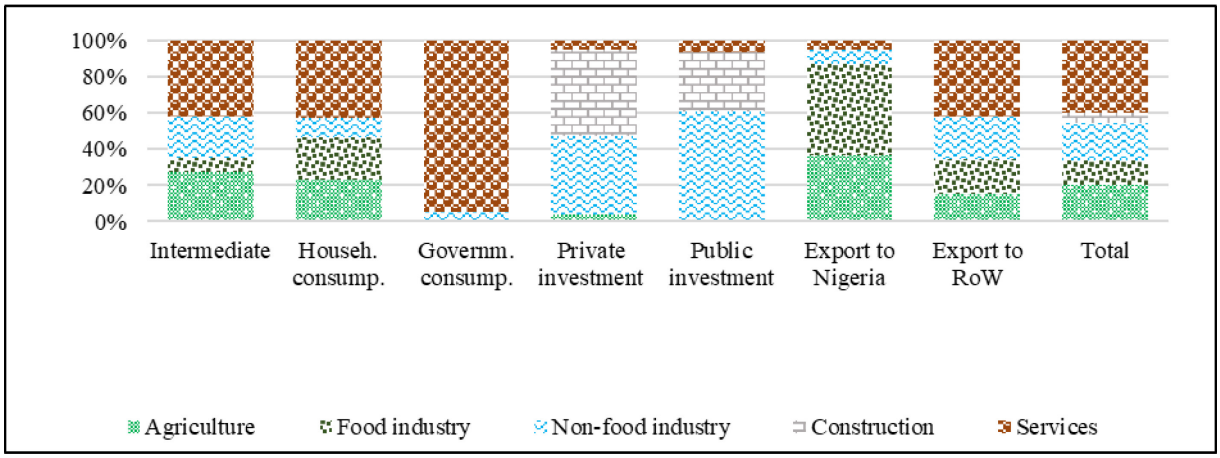
Figure 13. Share of demand type by aggregated commodity



Source: Own compilation.

Households consume mostly food and services while services constitute 95% of government consumption (Figure 14). This shows the high expenditure of the Beninese government for health, education and security services to the population.

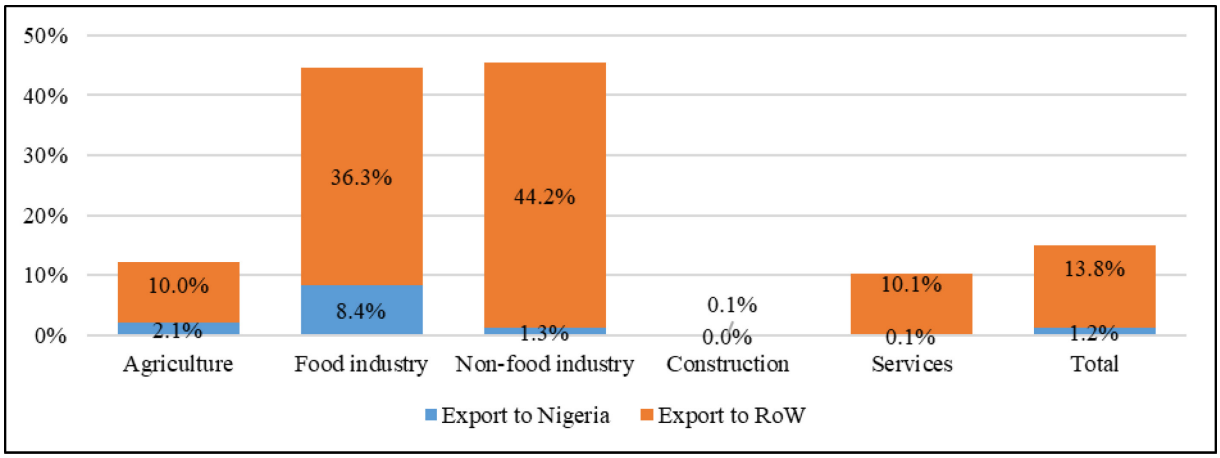
Figure 14. Shares of aggregated sectors in type of demand



Source: Own compilation.

The export intensity of the economy of Benin is at 15%. It is highest (around 45 - 46%) for industrial commodities, around 10-12% for agriculture and services and close to zero for construction (Figure 15). Nigeria imports a high share of agricultural and processed food commodities (almost 90% of export to Nigeria and 2-8% of export intensity) from Benin (Figures 14 & 15).

Figure 15. Export intensity by aggregated commodity



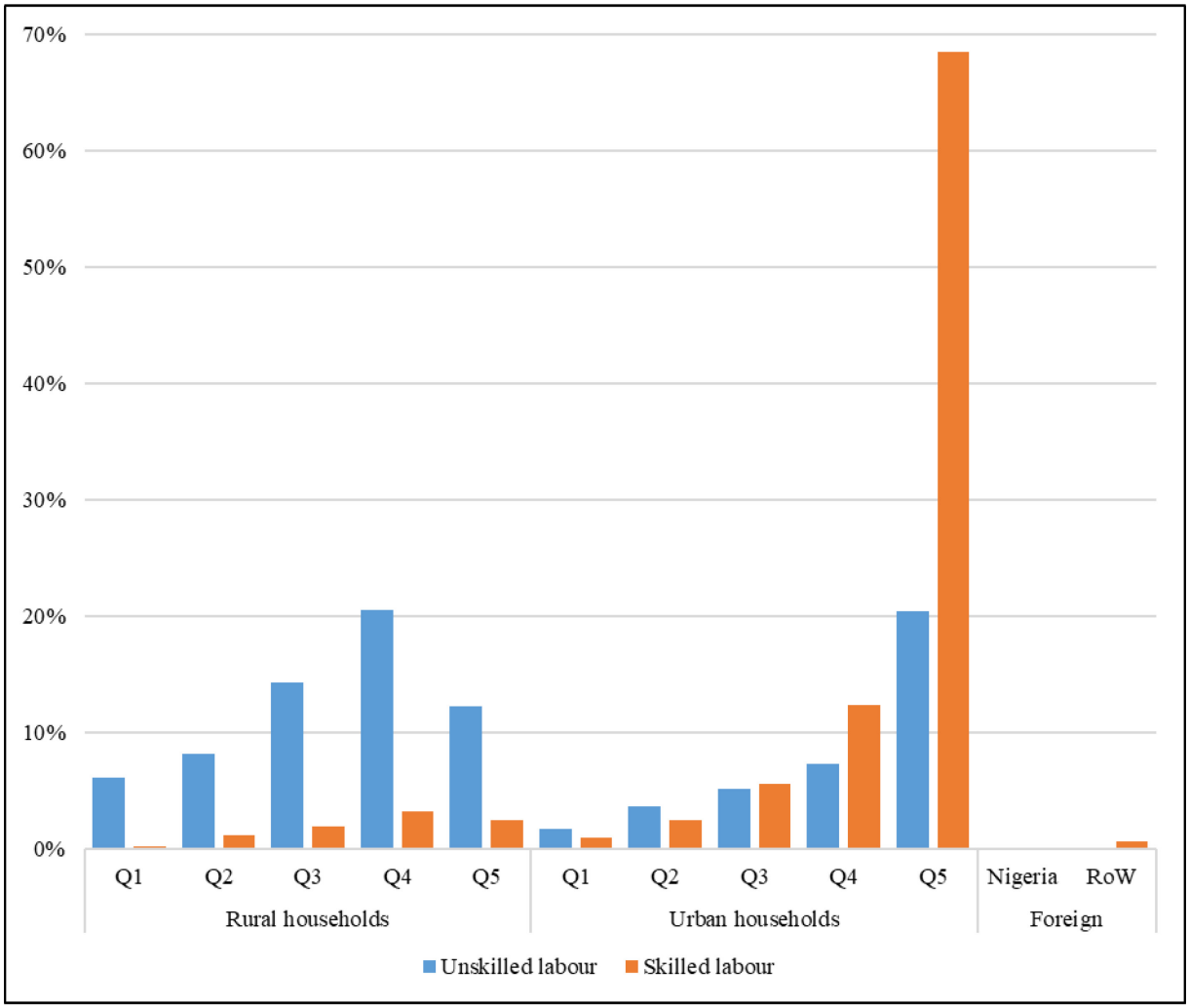
Source: Own compilation.

4.5 Factor income distribution

Labour income is distributed to households and foreigners working in Benin (Figure 16). The latter receive only 0.2% of unskilled and 0.8% of skilled labour income. Among household groups, the share in total labour is higher in urban areas, the higher the income is. The disparities are much higher for skilled labour, showing that high income urban households own most of skilled labour in Benin (more than 80% for urban households Q 4 and Q5) (Figure 16). Most income from unskilled labour occurs to households in rural areas. Among

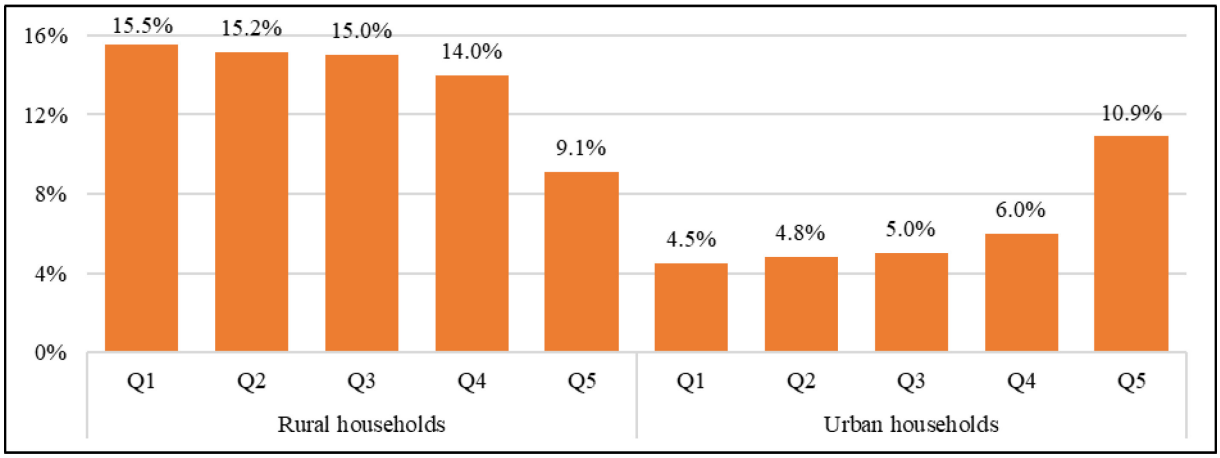
rural households, Q4 receives most income from unskilled and skilled labour. However, this distribution is also influenced by the different size of household groups (Figure 17). Figure 17 shows that rural population is larger than urban population in Benin. Furthermore, urban households Q1 to Q4 are especially small and comprise of between 4.5 and 6% of the population while other household groups make up for 9 to 16% of the population each. Q5 in rural area is smaller than the other quintiles, which explain the decreasing of the labour income between Q4 and Q5.

Figure 16. Labour income distribution (% of total labour income)



Source: Own compilation.

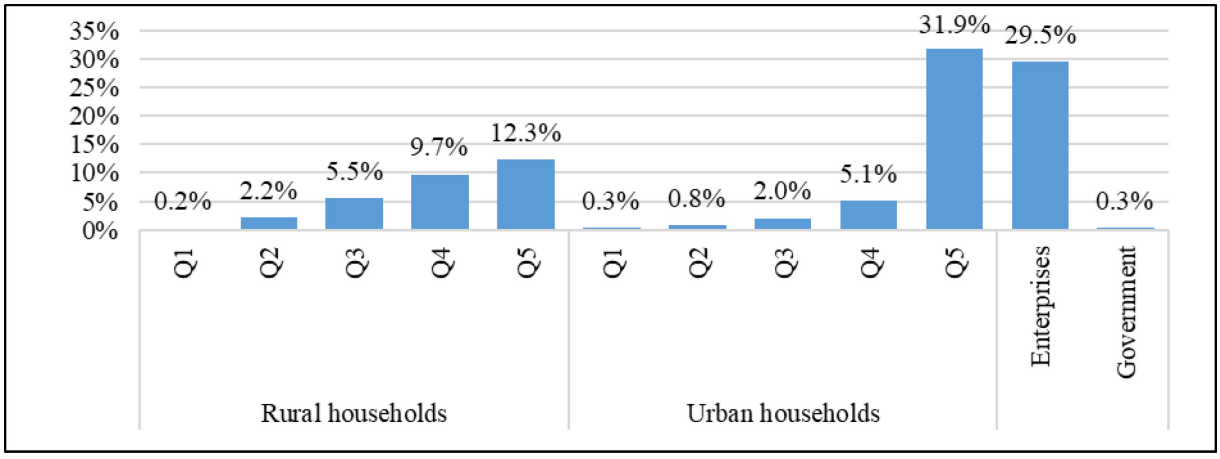
Figure 17. Population share of each household group (% of Benin population)



Source: Own compilation.

Figure 18 shows the distribution of capital income. About 30% of capital income accrues to each, enterprises and rural households, and about 40% accrues to urban households. Only a minor share of capital income accrues to the government. The capital distribution pattern shows that higher income households own more capital than lower income households in both rural and urban areas. The disparity is stronger in urban than in rural areas, with the highest income urban households (Q5) owning more than 30% of total capital, leaving only about 8% to other urban household groups.

Figure 18. Capital income distribution (%of total capital income)

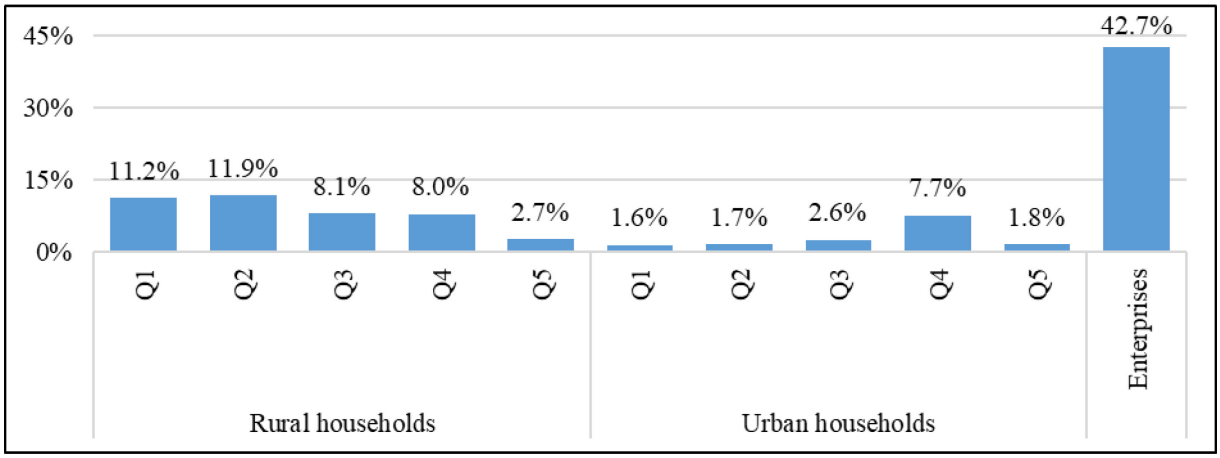


Source: Own compilation.

Enterprises own more than 40% of land (Figure 19). This could be explained by the increasing numbers of large-scale companies and cooperatives running large farms in the country. An increasing number of people invests in corporate agricultural enterprises owning a large amount of land in Benin. The high share of enterprises may also be biased upward by the estimation procedure (see sub-section 3.4.2 above). The distribution of land income among households does not follow a clear pattern reflecting the wealth level. However, rural

households earn more (42%) than urban ones (15%). In fact, the inheritance of the land does not depend on wealth, but on the filiation, and agricultural land is more relevant in rural than in urban areas. Furthermore, rural areas are larger (in terms of both surface and population) than urban areas.

Figure 19. Land income distribution (%of total land income)



Source: Own compilation.

4.6 Households

4.6.1 Income sources

Apart from returns to owned production factors, households receive transfers from enterprises, government and higher income households, and remittances (Table 17). In rural areas, most of the income to low income (Q1 & 2) households comes from unskilled labour and land while most income to high income households (Q4 & 5) is from capital and unskilled labour. In urban areas however, unskilled and skilled labour are the most important income sources for low income households (Q1 & 2), while skilled labour and capital are the most important income sources for high income households (Q4 & 5).

Low income households (Q1 & 2) receive less of their income from remittances and transfers from enterprises compared to high income households (Q4 & 5) in both rural and urban areas. A relatively small share of enterprise transfers to households is social support to poor households while the major part is profits, accruing mostly to high income households.

Higher income households (Q3-5 in urban areas and Q4 & 5 in rural areas) support lower income households (Q1-2 in urban areas and Q1-3 in rural areas) through inter-household transfers. In rural areas, poorest households (Q1) have a lower share of income from inter-household transfers than Q2 & 3. This can be explained by the fact that poorest households have less supporters for inter-household transfers. In fact, wealth levels of parents are most of the time correlated with those of their descendants. So, transfers from higher income households are not predominantly going to lowest income (Q1) households.

Government transfers to low income households are predominantly social transfers while the transfers to high income households are predominantly interest payments on domestic debt and pensions. In rural area, Q1 receives a lower income share from the government than Q2, demonstrating better access to the government for Q2. This can also be explained by government transfers mechanisms, which may privilege Q2 over Q1 (e.g. food subsidies: higher income households can buy more and thus gain more transfers).

Table 17. Share of household income by source in total income (%)

Households		Factor income				Transfers from			Remittances from		Total
		Unskilled labour	Skilled labour	Capital	Land	Enterprises	Richer households	Government	Nigeria	RoW	
Rural	Q1	50.5	1.1	2.9	34.9	0.1	5.4	5.1	0.0	0.0	100.0
	Q2	40.0	3.5	15.9	22.0	0.7	9.4	8.3	0.0	0.2	100.0
	Q3	47.4	3.8	26.3	10.1	1.2	5.6	5.3	0.0	0.4	100.0
	Q4	50.4	4.7	34.6	7.4	1.6	0.0	0.5	0.1	0.7	100.0
	Q5	36.5	4.3	53.3	3.1	1.4	0.0	0.5	0.1	0.8	100.0
Urban	Q1	40.8	14.6	10.3	14.2	0.4	15.7	1.8	0.2	2.0	100.0
	Q2	47.2	19.1	14.8	8.3	0.5	6.0	2.1	0.1	1.8	100.0
	Q3	39.3	24.9	22.4	7.5	0.8	0.0	2.9	0.2	2.1	100.0
	Q4	27.8	27.6	27.9	11.1	0.8	0.0	2.7	0.2	1.9	100.0
	Q5	17.4	34.2	39.3	0.6	1.3	0.0	4.2	0.2	2.7	100.0

Source: Own compilation.

4.6.2 Income per capita and poverty level

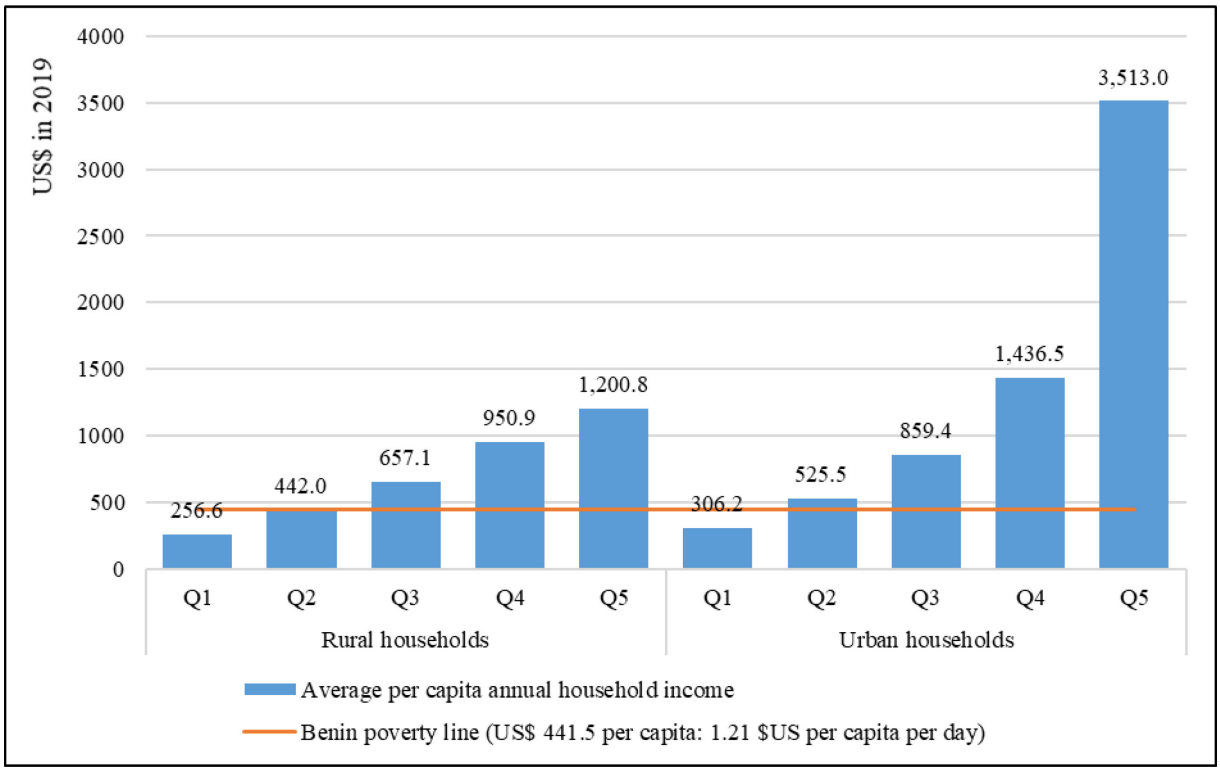
Figure 20 shows income per capita levels in 2019 for all household groups. The disparity between low (Q1 and Q2) and high income (Q4 and Q5) households is smaller in rural (Q5 earns 4.7 times as much as Q1) than in urban areas, where per capita income in Q5 is 11.5 times higher than in Q1. This can be explained by two reasons. First, the household size is higher in rural than in urban areas. Second, within the same income quintile households' group, urban households have a higher income than rural households.

In rural and urban areas, households in Q1 are on average below the Benin poverty line[4] (US$ 1.21 per capita per day) while Q2 households in rural areas are on average just slightly above this line. Assuming an equal income distribution within quintiles, the poverty rate (share of the population below the poverty line) is 34% in rural areas and 21% in urban areas in 2019 while the rate for the whole of Benin is 30%. These rates are lower than those calculated for 2019 by the Benin statistical office (INSAE, 2020b): 44% in rural areas, 31% in urban areas and 38% for Benin. The differences could be due e.g. to different sampling and data

[4] The current poverty line by the United Nations is US$ 1.9 per capita per day. However, in 2019 a study on the WAEMU defined specific poverty lines for each country. The poverty line for Benin was set at US$ 441.5 per capita and year, corresponding to US$ 1.21 per capita per day (INSAE, 2020b).

collection procedures as we used different databases for the calculation. In fact we used income distribution patterns from 2011, while the Gini index of income distribution for Benin increased between 2003 and 2015 (World Bank, 2021). The increasing Gini index shows an increasing disparity, which would partially explain the differences between the poverty rates implicit in the SAM and those calculated based on a 2019 database.

Figure 20. Household income per capita and poverty line



Source: Own compilation.

4.6.3 Household expenditure

Household expenditure data shows that the share of food expenditure declines with increasing income in rural as well as in urban areas (Table 18). Q1 & 2 in rural and in urban areas pay no direct taxes, do not save, and do not transfer anything. In contrast, higher income households (Q4 & 5) pay direct taxes at moderate rates of up to 3%, save high shares of their income, especially in rural areas where savings are close to 30%, and transfer some income to lower income households and abroad. In relative terms, Q4 (rural and urban together) households spend more of their income on transfers than Q5 (rural and urban together) households. However, in absolute terms, Q5 households transfer to poorer households and abroad more than the double the amount of Q4 households.

Table 18. Share of household expenditure on each expenditure item (%)

Households		Commodities						Taxes and savings		Transfers		Total
		Unprocessed food	Non-food agriculture	Processed food	Non-food industry	Construction	Services	Direct taxes	Savings	Inter-household	Abroad	
Rural	Q1	35.7	2.7	25.3	12.3	0.2	23.7	0.0	0.0	0.0	0.0	100.0
	Q2	27.8	1.2	30.7	10.9	0.2	29.2	0.0	0.0	0.0	0.0	100.0
	Q3	23.3	1.0	23.8	9.1	0.2	26.7	0.0	14.9	0.0	1.0	100.0
	Q4	18.6	0.8	17.6	7.3	0.1	23.4	0.5	27.9	2.8	1.0	100.0
	Q5	18.0	2.3	15.1	7.6	0.1	25.4	0.6	28.3[5]	2.0	0.7	100.0
Urban	Q1	23.2	1.1	32.8	14.3	0.5	28.2	0.0	0.0	0.0	0.0	100.0
	Q2	21.8	3.2	31.3	13.7	0.3	29.6	0.0	0.0	0.0	0.0	100.0
	Q3	19.8	0.9	28.0	12.6	0.2	31.8	1.2	2.0	2.5	1.0	100.0
	Q4	17.4	4.9	21.7	11.5	0.2	34.3	1.5	5.8	1.9	0.8	100.0
	Q5	11.7	0.5	15.0	7.5	0.1	47.5	3.0	11.1	2.4	1.2	100.0

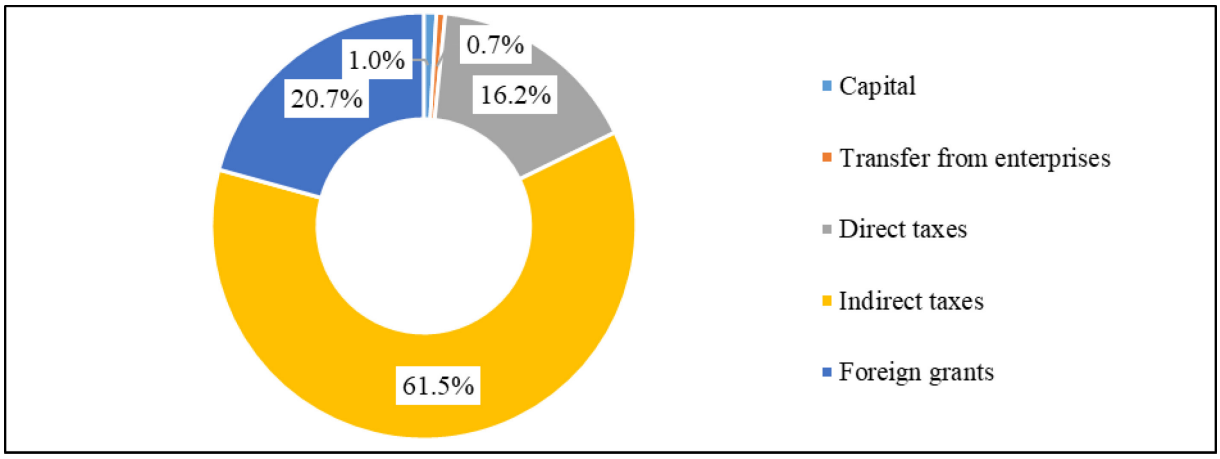
Source: Own compilation.

4.7 Other institutions

4.7.1 Government

The main source of government revenue (77.7%) is taxes (Figure 21), with indirect taxes being the dominant form of taxation. Besides, foreign grants represent 20.7%, while capital and enterprise income provide together 1.7%.

Figure 21. Share of government income by source

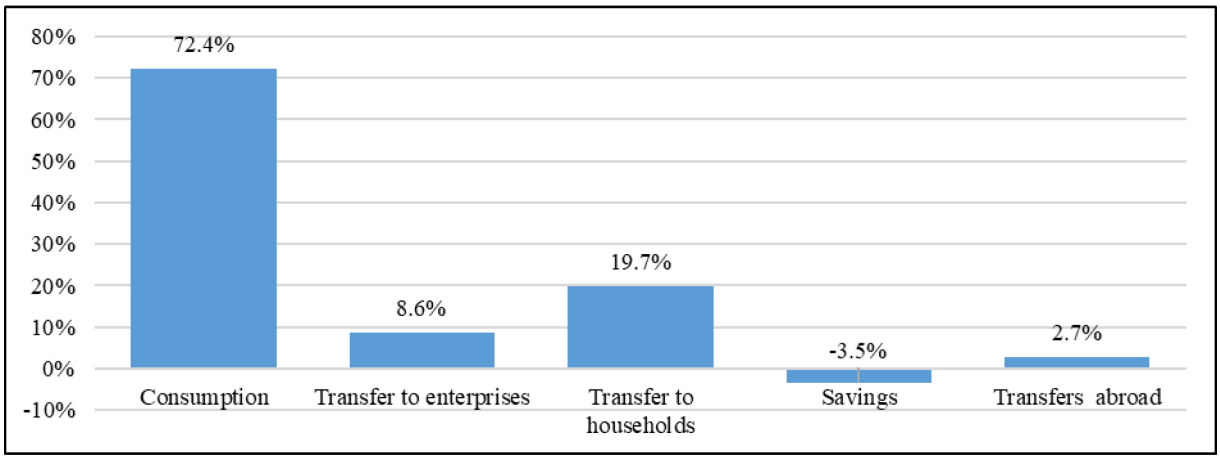


Source: Own compilation.

[5] Savings rates of higher income household groups in rural areas are relatively high. The order of size is supported e.g. for China by Dorfman *et al.* (2013), who find rural savings rates higher than urban savings rates over the period 1987 to 2007. In 2007, these rates were about 20, 30 and 40% for Q3, Q4 and Q5, respectively, in rural areas. These rates are even higher than in Benin as shown in Table 18.

At the expenditure side (Figure 22), the government spends almost three quarters of its income on public consumption, mainly on public services and utility commodities such as electricity and fuel. While running a budget deficit (-3.5% savings), 19.7% of government income is spent on transfers to households (social transfers, pensions and interest on public debts). The government transfers also income to enterprises (operating subsidies and interest on public debts) and abroad to pay interest on foreign debts (Figure 22).

Figure 22. Share of government expenditure by expenditure item

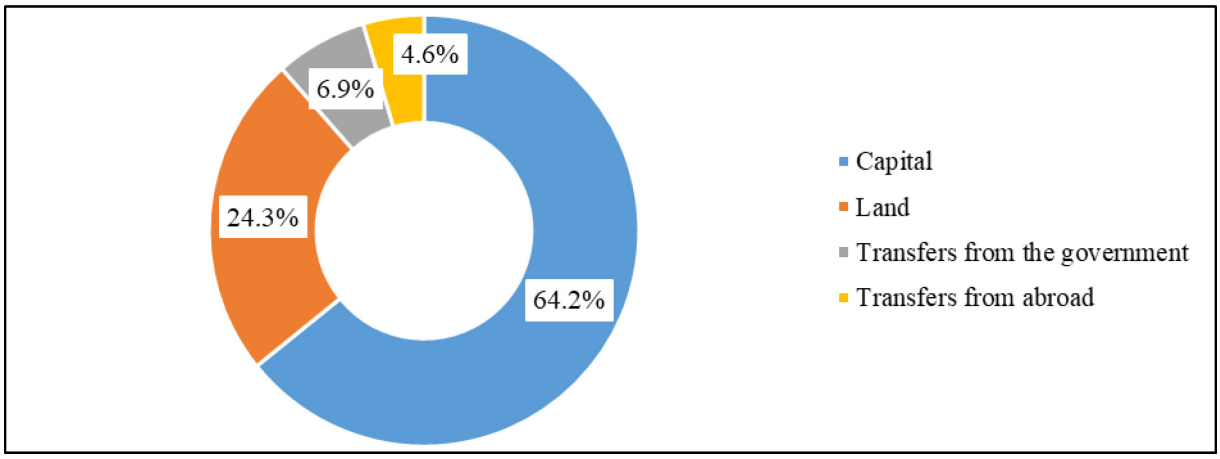


Source: Own compilation.

4.7.2 Enterprises

Two production factors (capital and land) provide most (88.5%) of enterprise income (Figure 23). The remainder is from transfers either from the government (operating subsidies) or from abroad (profits from Beninese enterprises operating abroad or other support).

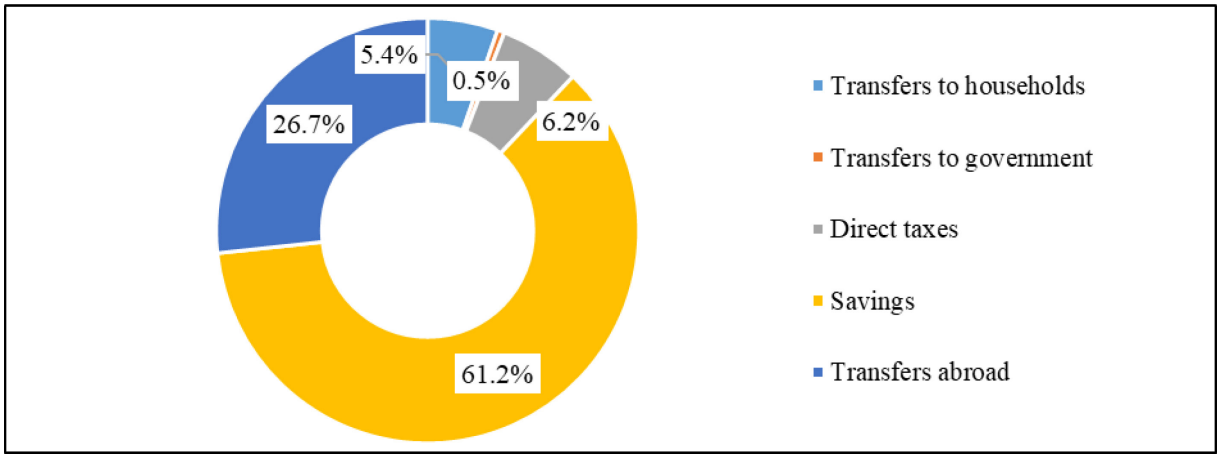
Figure 23. Share of enterprise income by source (% of total enterprise income)



Source: Own compilation.

Enterprise expenditures show that almost two third of the income is saved for investments (Figure 24). Tax payments consume 6.2% of income. The remainder is shared between owners abroad, the government and private households as dividends and social support to low income households.

Figure 24. Share of enterprise expenditure by item (in % of total enterprise expenditure)



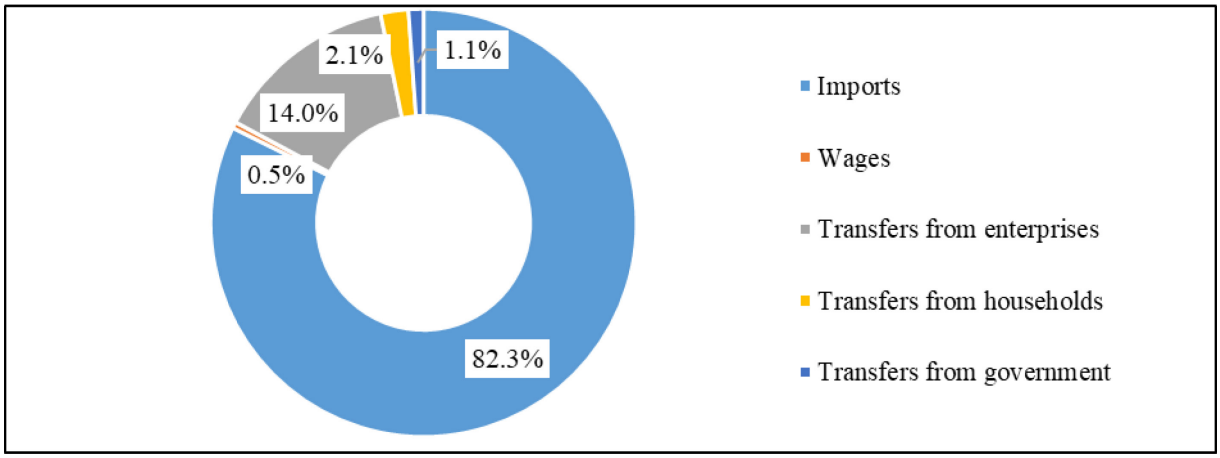
Source: Own compilation.

4.7.3 Foreign accounts

Imports are the most important (82%) foreign exchange outflow from Benin (Figure 25) while exports are the most important (73%) inflow of foreign exchange to Benin (Figure 26). Their values show that the trade balance of Benin was in deficit in 2019.

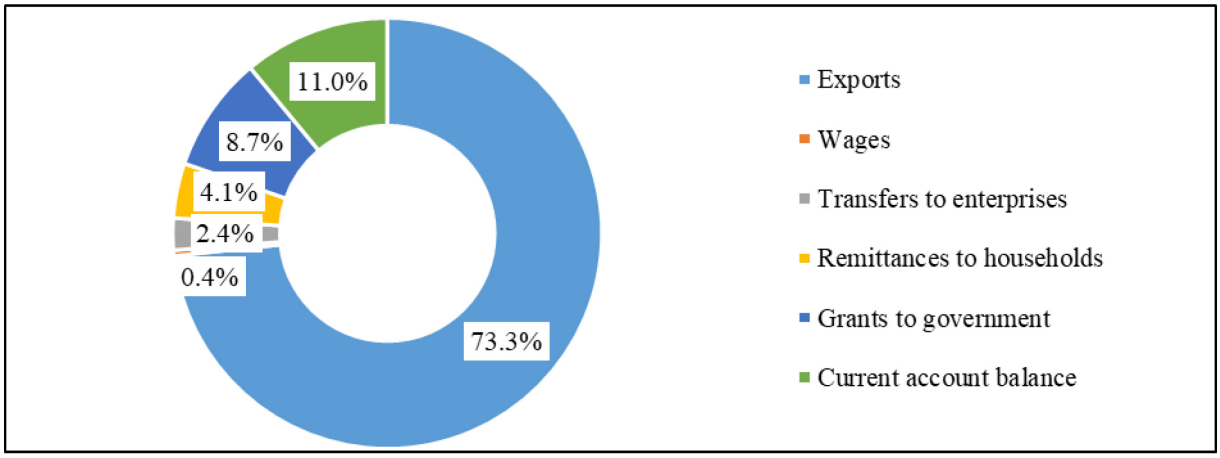
Transfers from enterprises in Benin to institutions abroad constitute 14% of the foreign exchange outflow showing a relatively high share of foreign direct and indirect investment in Benin (Figure 26). Foreign grants to the Beninese government and remittances to households together constitute about 13% of total foreign exchange inflow (Figure 26). The current account balance is 11% of the total inflow of foreign exchange. This constitutes an increase in foreign debt.

Figure 25. Share of foreign exchange outflow by source (%)



Source: Own compilation.

Figure 26. Share of foreign exchange inflow by source (%)



Source: Own compilation.

5 Conclusion and implications

The objective of this paper was to present the data sources we used, describe the estimation process, and highlight the content of the 2019 SAM for Benin. Compared to previous SAMs for Benin, this SAM is distinguished by being in accordance with the re-estimated macroeconomic indicators of Benin and including detailed representation of food processing sectors and animal husbandry accounts.

Services and agriculture are the most important sectors in the Beninese economy in terms of their contribution to GDP. Agriculture has the highest value-added share (share of primary factors in output value) and within value-added, it has the highest unskilled labour intensity. The services sector has the highest skilled labour intensity while construction is the most capital-intensive sector in the economy. Regarding the food industry, about 19% of its total output is value-added and almost 80% is intermediate demand, mostly from agriculture. This shows that food industry development is important for agricultural and general development in Benin.

Tax rates levied on agriculture and agricultural commodities are relatively small, while the industrial and the construction sectors are facing the highest tax rates. With respect to trade, industrial commodities make up for the highest shares in im- and exports. The construction sector is receiving most of private and public investment.

While households spend most of their income on food consumption (with a higher share for low income compared to high income households) and services (with a higher share for high income compared to low income households), the government spends most on services. The lowest income quintile (Q1) of private households in rural and Q1 of urban households have average income levels below the poverty line (US$ 441.5 per capita corresponding to US$ 1.21 per capita per day). As these households are receiving most of their income from unskilled labour and land, which are mostly used in agriculture, one can conclude that the agricultural development is of central importance for their livelihood improvement.

References

ABePEC (2010) *Analyse de l'offre et de la demande de l'ananas Bénin*, Cotonou, Benin.

Adégbola, Y.P., Oloukoï, L., Houessionon, P., Kinkpé, A.T., Adjovi, G. & Bankolé, A.B. et al. (2013a) *Comptes Economiques de l'Agriculture du Bénin; Volume 2: comptes économiques des branches de l'agriculture*, Cotonou, Bénin.

Adégbola, Y.P., Oloukoï, L., Houessionon, P., Kinkpé, A.T., Adjovi, G. & Bankolé, A.B. et al. (2013b) *Comptes Economiques de l'Agriculture du Bénin; Volume 1: Rapport synthèse*, Cotonou, Bénin.

Aguehounde, A.P. (2020) Cajou: La campagne de commercialisation 2019-2020 lancée. La Nation, 20 March. Available from: https://lanationbenin.info/cajou-la-campagne-de-commercialisation-2019-2020-lancee/ [Accessed 2 December 2020].

Akinocho, G.J. (2019) *Bénin: 50% de la demande electrique desormains satisfaite par les centrales locales*. Available from: https://www.agenceecofin.com/production [Accessed 27 July 2020].

Bánociová, A. & Ťahlová, S. (2018) Do reduced VAT rates on foodstuffs in EU affect consumers? *Potravinarstvo Slovak Journal of Food Sciences*, 12(1), 775–781. Available from: https://doi.org/10.5219/992.

BCEAO (2021) *Entrepôt de Données Economiques et FiNancières (EDEN)*. Central Bank of West African States (Banque Centrale des Etats de l'Afrique de l'Ouest: BCEAO): Available at: https://edenpub.bceao.int/tableauPredefini.php, checked on: 18/01/2021.

Benin Caju (2016) *Examen de la compétitivité de la transformation du Cajou au Bénin et revue des politiques sectorielles.* Benin Caju, 2016 [Accessed 2020].

Benin Caju (2017) *Sous Produits de l'anacarde: Sources importantes de valeur ajoutée*, Cotonou, Bénin.

Breisinger, C., Thomas, M. & Thurlow, J. (2009) *Social accounting matrices and multiplier analysis An Introduction with Exercises*. International Food Policy Research Institute.

Dedehou, E., Dossou, J. & Soumanou, M.M. (2015) Etude diagnostique des technologies de transformation de la pomme de cajou en jus au Bénin. *International Journal of Biological and Chemical Sciences*, 9(1), 371. Available from: https://doi.org/10.4314/ijbcs.v9i1.32.

Dorfman, M.C., Holzmann, R., O'Keefe, P., Wang, D., Sin, Y. & Hinz, R. (Eds.) (2013) *China's Pension System*. The World Bank.

European Commission (2020) *Analyse de la chaîne de valeur ananas au Benin*, Bruxelles, Belgium. VCA4D: 22. Available from: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjNoN39wLvtAhWDLewKHbUXDQIQFjABegQIBBAC&url=https%3A%2F%2Feuropa.eu%2Fcapacity4dev%2Ffile%2F103107%2Fdownload%3Ftoken%3DJwUGEFB8&usg=AOvVaw0a1sLMarM0DZSrlwYUFYTB.

Gbaguidi, I. (2020) *Commerce et chaînes de valeur dans les activités porteuses d'emplois (TRAVERA): Cas de l'anacarde au Bénin*. Otganisation International du Travail: Génève, Suisse.

Grethe, H., Luckmann, J., Siddig, K. & Kinkpe, T. (2020) *Ex-ante Analysis of the "National Investment Plan for Agriculture, Food and Nutritional Security" of Benin: Is the Envisaged Productivity Growth Pro-Poor?*

Houngbédji, A. (2020) *Un regard analytique sur l'état de la transformation des noix cajou : quelles chances pour le Bénin de transformer 150.000 tonnes de noix cajou localement* [Accessed 2020].

Houssou, P., Dansou, V., Hotegni, A.B., Ahounou, J.-L. & Djivoh, H.Y. (2018) *Catalogue des innovations technologiques et équipements développés par le PTAA*. Porto-Novo, Benin.

Houssou, P., Padonou, S.W., Dansou, V., Todohoue, C., Agbobatinkpo, P. & N'djolosse, K. et al. (2016) *Production du jus de pomme d'anacardede bonne qualité au Bénin*. Porto-Novo, Benin.

INSAE (2012) *Enquête Modulaire Intégrée sur les Conditions de Vie des ménages: EMICoV*. National Statistical Office of Benin (Institue Nationale de la Statistique et de l'Analyse Economique: INSAE): Cotonou, Benin.

INSAE (2018) *Matrice de Comptabilité Sociale 2013 du Bénin*. National Statistical Office of Benin (Institue Nationale de la Statistique et de l'Analyse Economique: INSAE): Cotonou, Benin.

INSAE (2020a) *Monographie de la filière de l'ananas au Bénin*. Institue Nationale de la Statistique et de l'Analyse Economique: INSAE (National Statistical Office of Benin): Cotonou, Bénin.

INSAE (2020b) *Note synthèse sur la pauvreté en 2019*. Institue Nationale de la Statistique et de l'Analyse Economique: INSAE (National Statistical Office of Benin): Cotonou, Bénin.

INSAE (2021) *Statistiques annuelles des échanges extérieurs*. National Statistical Office of Benin (Institue Nationale de la Statistique et de l'Analyse Economique: INSAE): Available at: https://insae.bj/statistiques/statistiques-economiques, checked on: 04/04/2021.

Kulla, D., Amoussou, J., Dognon, A.Y., Gbede, T.R., Glele, I.T. & Grase, M. et al. (2021) *Le secteur avicole béninois face aux importations occidentales de viande de poulet*, Berlin, Germany.

MAEP (2017) *Plan Stratégique de Développement du Secteur Agricole (PSDSA) : Orientations stratégique 2025 et Plan National d'Investissements Agricoles et de Sécurité Alimentaire et Nutritionnelle (PNIASAN) 2017 - 2021*. Cotonou, Benin.

MEF (2020) *Rapport d'execution au 31 décembre du budget de l'Etat, gestion 2019*. Ministry of Economy and Finance, Benin Republic (Ministère de l'Economie et des Finances (MEF), Republique du Bénin): Cotonou, Benin.

Miassi, Y., Dossa, F. & Banzou, K. (2018) ETUDE DES MARGES DANS LES CIRCUITS DE COMMERCIALISATION DE CÉRÉALES AU SUD-BÉNIN : CAS DU MAÏS (ZEA MAYS), 6(7), 1162–1174. Available from: https://hal.archives-ouvertes.fr/hal-01860891/document.

Ogouvide, F.T., Hinnou, L.C. & Ahoyo-Adjovi, R.N. (2021) Analyse de la rentabilité économique du warrantage des produits vivriers au Bénin. *International Journal of Biological and Chemical Sciences*, 15(5), 2008–2022. Available from: https://doi.org/10.4314/ijbcs.v15i5.25.

Pyatt, G. & Round, J. (1985) *Social Accounting Matrices: A Basis for Planning*. The World Bank: Washington, D.C., USA.

Robinson, S. & McDonald, S. (2006) *SAM estimation program. Version 3.30*. November 2006.

Siddig, K., Elagra, S., Grethe, H. & Mubarak, A. (2018) *A post-separation Social Accounting Matrix for the Sudan*, Washington, DC. Middle East and North Africa Regional Program Working Paper series: 08. Available from: https://doi.org/10.2499/1024320695.

Sodjinou, E., Henningsen, A., KoudandÉ, D.O., Biaou, G. & Mensah, G.A. (2015) Consumers' preferences for "bicycle poultry" in Benin: Implications for the design of breeding schemes. *Revue d'Études en Agriculture et Environnement*, 96(03), 389–409. Available from: https://doi.org/10.4074/S196696071500301X.

UN (2019) *World Population Prospect 2019*. Available at: https://population.un.org/wpp/Download/Standard/Population/, checked on: 29/10/2019: United Nations. Available at: https://population.un.org/wpp/Download/Standard/Population/, checked on: 29/10/2019.

UN (2021) *Comtrade*. United Nations, Available at: https://comtrade.un.org/data, checked on: 06/02/2021: United Nations, Available at: https://comtrade.un.org/data, checked on: 06/02/2021.

World Bank (2021) *World Development Indicators (WDI)*. World Bank (WB): Available at: https://databank.worldbank.org/source/world-development-indicators#, checked on: 19/01/2021.

Zoumarou Wallis, N., Bagnan, M.A., Akossou, A.Y.J. & Kanlindogbe, C.B. (2016) Caractérisation morphologique d'une collection de fruits d'anacardier provenant de la commune de Parakou (Bénin). *International Journal of Biological and Chemical Sciences*, 10(6), 2413–2422. Available from: https://doi.org/10.4314/ijbcs.v10i6.1.