Report on the 2015 Social Accounting Matrix (SAM) for Ghana

Produced in collaboration between

Ghana Statistical Services (GSS), Accra, Ghana,

Institute of Statistical, Social and Economic Research (ISSER), University of Ghana, Legon, Ghana

and

International Food Policy Research Institute, Washington D.C., USA

16 November 2017

Foreword

Social Accounting Matrices (SAMs) capture all market transactions and transfers that take place in a country between productive activities, factors of production, domestic institutions (such as households, the corporate sector, and government) and the rest of the world during a given period. As such SAMs serve as comprehensive accounting frameworks capturing the full circular flow of income in an economy. SAMs also form the basis of multi-sectoral economywide models that are used to support policy analysis.

The launch of the new 2015 national and regional SAMs for Ghana is both timely and important, because it will allow policy analysts to better inform policy decision-making in Ghana as the country emerges from a prolonged economic slump and now contemplates several large-scale programs to address development challenges. Such development programs are complex in their design, and their potential impact and socio-economic tradeoffs may be hard to anticipate. By providing a detailed picture of the structure of the Ghanaian economy, the new national and regional SAMs will help analysts and policymakers better understand these intricacies and improve policy design.

Building developing country SAMs is challenging due to data availability, quality, consistency, and timeliness issues. It is therefore hard to find efficient and cost-effective ways of incorporating data from various sources and reconciling those into a single SAM database. In recognition of this, the International Food Policy Research Institute (IFPRI) has been building capacity and supporting developing countries to develop SAMs for several years. In Ghana, this has resulted in a close collaboration between the Ghana Statistical Services (GSS), the Institute of Statistical, Social and Economic Research (ISSER), and IFPRI's Ghana Strategy Support Program (GSSP) to build capacity and develop the Ghana 2015 national and regional SAMs with support from the United States Agency for International Development (USAID).

The Ghana 2015 SAMs adhere to the common data standards, procedures and classification systems for constructing and updating SAMs as prescribed by IFPRI's Nexus Project, a multi-country program aimed at ensuring greater transparency and consistency in SAM construction and model-based research and policy analysis in developing countries. This also supports more robust cross-country comparisons of economic structure and policy. Although SAMs have been used in policy analysis in Ghana since the 1990s, it is our hope that by being part of the Nexus Project Ghana will be able to produce more frequent updates and further enhance capacity not only to develop good quality SAMs but also to utilize them in their policy analysis and design.

Shashi Kolavalli

Ghana Country Program Leader
International Food Policy Research Institute

Abbreviations

BOPS	Balance of Payments Statistics
BPM6	Balance of Payments Manual, Sixth Edition
CGE	Computable General Equilibrium
COMTRADE	Commodity Trade Statistics Database
FAO	Food and Agriculture Organization
FAOSTAT	Food and Agriculture Organization's Statistical Database
GDP	Gross Domestic Product
GFCF	Gross Fixed Capital Formation
GFS	Government Finance Statistics
GFSM	Government Finance Statistics Manual
GOS	Gross Operating Surplus
IMF	International Monetary Fund
IOT	Input-Output Table
ISIC	International Standard Industrial Classification
SAM	Social Accounting Matrix
SNA	System of National Accounts
SUT	Supply-Use Table
TRAINS	Trade Analysis Information System

Table of Contents

1 Introduction

This report introduces a national and regional 2015 Social Accounting Matrix (SAM) for Ghana. A SAM is an organized matrix representation of all transactions and transfers between different production activities, factors of production, and institutions (i.e. households, corporate sector, and government) within the economy and with respect to the rest of the world. It therefore serves as a comprehensive accounting framework within which the full circular flow of income is captured. The 2015 SAM for Ghana—both a national and regionally-disaggregated version of the SAM has been produced—utilize the most recent data available for the country and therefore provide a summary of the current structure of the Ghana economy.

The development of the Ghana SAMs is a joint initiative between the Ghana Statistical Service (GSS), the Institute of Statistical, Social and Economic Research (ISSER) at the University of Ghana, and the Ghana Strategy Support Program (GSSP) of the International Food Policy Research Institute (IFPRI). Ghana's national accounts were rebased in 2010 using a new 2004 Supply Use Table (SUT).

The Ghana SAM forms part of the larger Nexus Project. The Nexus Project, a collaboration between various international organizations, national statistical agencies and research institutions, aims to improve the quality of SAMs used for country-level computable general equilibrium (CGE) modeling. The Nexus Project therefore establishes common data standards, procedures and classification systems for constructing and updating SAMs. The Nexus Project addresses the need for greater transparency and consistency in SAM construction in order to strengthen model-based research and policy analysis in developing countries. It also supports more robust cross-country comparisons of economic structure and policy. The guiding principle of the Nexus Project is that all SAM data should be traceable to its original sources and/or assumptions.

The project is led by IFPRI. Participating organizations include the Food and Agriculture Organization (FAO), the International Fund for Agricultural Development (IFAD), the European Community's Institute for Prospective Technological Studies (JRC-IPTS), the World Bank, the United Nations University's World Institute for Development Economics Research (UNU-WIDER) and national statistical agencies. The CGIAR Research Program (CRP) on "Policies, Institutions and Markets" funds IFPRI's participation in the Nexus Project (PIM). Nexus SAMs are freely available online or from collaborating organizations and statistical agencies. The African Growth and Development Policy Modeling (AGRODEP) network helps disseminate Nexus SAMs to African researchers.

2 The 2015 National Ghana SAM

The 2015 national Ghana SAM is an economy-wide data framework that captures the detailed economic structure of the country. It is a square matrix in which each account is represented by a row and a column.[1] Each cell reflects a payment from the column account to the row account, i.e., incomes appear along rows and expenditures along columns. Double-entry

---

[1] For a lengthier discussion on SAMs, see Pyatt and Round (1985) and Reinert and Roland-Holst (1997).

accounting requires that, for each account, total revenue (row total) equals total expenditure (column total). The 2015 national Ghana SAM includes detailed information on 55 production sectors, 56 commodities, 13 factors of production, income and expenditures of rural and urban households by quintile, the government budget, and the balance of payments. Table 1 shows an aggregate version of the 2015 national Ghana SAM and Table 2 provides a summary of the data sources used in the construction of the 2015 national Ghana SAM.

Table 1. Aggregate 2015 National Ghana SAM

	Activities	Commodities	Labour	Land	Capital	Enterprises	Households	Government	Taxes	Savings/ Investment	Stocks	Rest of the World	Total
Activities	-	242 429	-	-	-	-	6 974	-	-	-	-	-	249 403
Commodities	127 563	44 879	-	-	-	-	81 672	22 341	-	35 964	2 540	55 912	370 870
Labour	43 196	-	-	-	-	-	-	-	-	-	-	-	43 196
Land	8 387	-	-	-	-	-	-	-	-	-	-	-	8 387
Capital	70 258	-	-	-	-	-	-	-	-	-	-	781	71 038
Enterprises	-	-	-	-	63 966	-	-	9 020	-	-	-	-	72 986
Households	-	-	43 196	8 387	4 177	59 256	-	1 571	-	-	-	5 025	121 612
Government	-	-	-	-	-	6 101	289	-	22 455	-	-	2 762	31 607
Taxes	-	15 063	-	-	-	3 826	3 566	-	-	-	-	-	22 455
Savings/ Investment	-	-	-	-	-	3 804	29 111	(3 053)	-	-	-	8 643	38 504
Stocks	-	-	-	-	-	-	-	-	-	2 540	-	-	2 540
Rest of the World	-	68 499	-	-	2 895	-	-	1 729	-	-	-	-	73 123
Total	249 403	370 870	43 196	8 387	71 038	72 986	121 612	31 607	22 455	38 504	2 540	73 123	

Table 2. Summary of Data Sources for the Ghana SAM

Data needs	Data year	Country data sources	Reference
Macroeconomic structure			
National accounts	2015	2006 rebased series	GSS (2016a)
IOT/SUT	2004	2004 SUT	GSS (2010)
Government finance	2015	Official fiscal statistics	MOF (2016b)
Balance of payments	2015	BPM6 online database	IMF (2017)
Exchange rate	2015	World Development Indicators	World Bank (2017)
Disaggregating activities			
Crops	2015	Production statistics	MOFA (2016c)
	2014	FAOSTAT online database	FAO (2016)
Price			
Livestock	2015	Production statistics	MOFA (2016c)
Mining	2015	2006 rebased series	GSS (2016a)
Manufacturing	2004	2004 SUT	GSS (2010)
	2006	Producer price index	GSS (2015)
Services	2015	2006 rebased series	GSS (2016a)
Disaggregating commodities			
Private consumption	2012/13	2012/13 GLSS	GSS (2014a)
Own consumption share	2012/13	2012/13 GLSS	GSS (2014a)
Public consumption	2004	2004 SUT	GSS (2010)
Gross fixed capital formation	2013	2006 rebased series	GSS (2015b)
Goods trade	2013	COMTRADE online database	UNCTAD (2016)
Services trade	2015	BPM6 online database	IMF (2017)
Indirect tax rates	2004	2004 SUT	GSS (2010)
Import tariff rates	2013	TRAINS	UNCTAD (2015)
Transaction cost margins	2004	2004 SUT	GSS (2010)
Disaggregating labor	2012/13	2012/13 GLSS	GSS (2014a)
Disaggregating households	2012/13	2012/13 GLSS	GSS (2014a)

2.1 Activities and commodities

The Ghana SAM distinguishes between "activities" (entities that carry out production) and "commodities" (representing markets for goods and non-factor services). SAM flows are valued at producer prices in activity accounts and at market prices in commodity accounts, i.e., inclusive of indirect taxes and transactions cost margins. Commodities consist of activity outputs, either exported or sold domestically, and imports. In the activity columns, payments are made to commodities (intermediate demand) and factors of production (value-added, equal to operating surplus and compensation of employees). In the commodity columns, payments are made to domestic activities, the rest of the world, and various tax accounts (for domestic and import taxes).

The 2015 Ghana SAM separates domestic production into 55 activities (see Table 3). Each activity represents a group of industries from the International Standard Industrial Classification system (ISIC Revision 4) (UNDESA 2008). National accounts provide updated GDP estimates for 21 sectors. These were further disaggregated using production and producer price data for crops and livestock from official statistics, supplemented with FAOSTAT (see Table A2); and gross output value weights for 3 mining products and 28 manufacturing subsectors from the producer price index report. Information on production technologies comes

the 2004 SUT. Ghana's national accounts were rebased in 2010 using a new 2004 SUT that distinguished between 139 activities (industries) and 175 commodities (products). The SUT was aggregated to activities presented in Table 3 using the ISIC Revision 4 concordance (see Table A1 in the appendix).

Activities and commodities have a one-to-one mapping based on a concordance between ISIC industries and Harmonized System products (HS Version 2007).[2] National accounts report GDP by expenditure group, i.e., private and public consumption, investment demand, and exports and imports. For 2015, however, this data was unavailable. The data is estimated by applying five year average contribution to GDP shares to production-based estimates of GDP for 2015. The expenditure groups were then disaggregated across the commodities presented in Table 3 using:

- Trade: Six-digit COMTRADE and itemized IMF BOPS data to disaggregate international goods and services trade, respectively.
- Private consumption: 2012/13 Ghana Living Standards Survey (GLSS6). Survey also used to separate marketed and non-marketed commodities (see 2.3).
- Public consumption: The 2004 SUT provided information on the breakdown of public consumption spending across public administration, health and social work, and education. This was adjusted to reflect changes in public production of administrative, education and health services.
- Indirect tax rates: Estimated from the 2004 SUT and then scaled uniformly to match total revenues by tax instrument. TRAINS data were used to update the SUT's import tariff rates prior to scaling.
- Transaction cost margins (as a share of commodity supply): Estimated from the 2004 SUT.

---

[2] The concordance between Nexus SAM commodities and HS 2007 codes are available upon request.

Table 3. Ghana SAM Activities and Commodities

Code*	Description	Code*	Description
maiz	Maize	Sref	Sugar refining
sorg	Sorghum and millet	Food	Other foods
rice	Rice	beve	Beverages
ocer	Other cereals	ptob	Tobacco processing
puls	Pulses	text	Textiles
gnut	Groundnuts	clth	Clothing
oils	Other oilseeds	leat	Leather and footwear
cass	Cassava	wood	Wood and paper
root	Other roots	petr	Petroleum
vege	Vegetables	chem	Chemicals
sugr	Sugar cane	nmet	Non-metal minerals
toba	Tobacco	metl	Metals and metal products
cott	Cotton and fibers	mach	Machinery and equipment
frui	Fruits and nuts	oman	Other manufacturing
coco	Cocoa	elec	Electricity, gas and steam
coff	Coffee and tea	watr	Water supply and sewage
ocrp	Other crops	cons	Construction
catt	Cattle	trad	Wholesale and retail trade
poul	Poultry	tran	Transportation and storage
oliv	Other livestock	hotl	Accommodation and food services
fore	Forestry	comm	Information and communication
fish	Fishing	fsrv	Finance and insurance
coil	Crude oil	real	Real estate activities
omin	Other mining	bsrv	Business services
meat	Meat, fish and dairy	padm	Public administration
fveg	Fruit and vegetable processing	educ	Education
foil	Fats and oils	heal	Health and social work
gmll	Grain milling	osrv	Other services

2.2   Factors of production

The Ghana SAM separates factors into three broad categories: labor, land and capital. Labor is further disaggregated across rural and urban areas and into four education-based categories, as shown in Table 4. The Ghana SAM follows official definitions of "rural" and "urban" areas, which is consistent with the definitions used in national and international statistics.[3] Information on total labor value-added as a share of sectoral gross domestic product (GDP) is drawn from the 2004 SUT. Labor value-added was disaggregated using sector-level worker and household income shares derived from the 2012/13 GLSS6. This includes wage earnings, as well as farm and non-farm enterprise revenues. The latter were apportioned equally to individual household members based on their reported employment status and sector of employment.

Capital is disaggregated into four subcategories: crops, livestock, mining, and other. Crop capital in each crop-based agricultural activity is the portion of gross operating surplus (GOS) and mixed income that is reported in 2004 SUT and that is not assigned to either labor or land factors (i.e., it is a residual). Livestock capital is the total GOS generated in the three livestock activities (i.e., cattle, poultry, and other livestock), and mining capital is the total GOS earned

---

[3] Rural and urban status is based on workers' reported place of residence, rather than their place of work. This is consistent with most household and labor force surveys, and hence with most official statistics.

in the four mining activities (i.e., coal and lignite, crude oil, natural gas, and other mining). Crop and livestock capital are separated from mining and other capital, since, in the Ghana SAM, the former are paid directly to households while the latter are paid to enterprises. Mining capital is separated from "other" capital because its earnings are often subject to mining-specific taxes and royalties, and they are more likely to be repatriated to foreign-based companies.

Table 4. Ghana SAM Factors

Code	Description	Notes
flab-rn	Labor - rural uneducated	0-6 years of formal schooling
flab-rp	Labor - rural primary	7-11 years of formal schooling
flab-rs	Labor - rural secondary	12+ years of formal schooling and/or incomplete tertiary education
flab-rt	Labor - rural tertiary	Completed tertiary education (e.g., degree, certificate, diploma)
flab-un	Labor - urban uneducated	0-6 years of formal schooling
flab-up	Labor - urban primary	7-11 years of formal schooling
flab-us	Labor - urban secondary	12+ years of formal schooling and/or incomplete tertiary education
flab-ut	Labor - urban tertiary	Completed tertiary education (e.g., degree, certificate, diploma)
flnd	Land - agricultural crops	Harvested crop land
fcap-c	Capital – crops	For agricultural crops (e.g., tractors, irrigation infrastructure)
fcap-l	Capital - livestock	For livestock (e.g., live animals, paddocks, beehives)
fcap-m	Capital - mining	For mining (e.g., mineral resources, mining equipment)
fcap-o	Capital – other	For all other sectors, including forestry and fisheries

2.3 Households

The Ghana SAM separates national populations into 15 representative household groups, as shown in Table 5. As with labor, the SAMs distinguish between rural and urban households using the country's official definition of these areas. Rural households are further disaggregated into those households that earn crop and/or livestock incomes (i.e. farm households) and those households that do not earn incomes from either of these sources (i.e.. nonfarm households). The Ghana SAM does not distinguish between urban farm and nonfarm households, because urban farmers are a small share of the total urban population and farming often generates only a small share of total urban incomes.

Households are further disaggregated into per capita expenditure quintiles. Quintiles are defined at the national level, meaning that rural and urban quintiles are comparable and the combined population of each quintile is a fifth of the national population. Per capita expenditure groups are not adjusted for adult-equivalency and include all consumption expenditure items reported in national household surveys. The latter implies that the definition of quintiles in Nexus SAMs may deviate slightly from those based on poverty-oriented consumption measures, which may exclude "nonessential" nonagricultural expenditure items (e.g., airplane tickets or gambling).

The Ghana SAM distinguishes between home (own) consumption of activities and marketed consumption of commodities by households. Home consumption, which appears in the SAM as payments from household accounts to activity accounts, is valued at producer prices, i.e., without marketing margins and sales taxes that may be levied on marketed commodities. Final household consumption of marketed commodities appears as payments from household

accounts to commodity accounts, valued at consumer prices including marketing margins and taxes.

Household incomes and expenditures were disaggregated across representative household groups using information from the 2012/13 GLSS6. Households receive factor incomes based on reported earnings of individual household members. The value-added generated by cropland and livestock capital was paid to household groups based on their reported farm enterprise revenues. Direct tax payments were assumed to be proportional to tertiary-educated workers' wage and non-farm enterprise earnings. Finally, transfers received from the government and the rest of the world is assigned to households using information from the GLSS6. More specifically, the ratio of transfer earnings to total household consumption was used to estimate initial transfer incomes, and these were then scaled uniformly across all households in order to match the total value of transfers appearing in government and balance of payments statistics.

Table 5. Ghana SAM Households

Code	Description	Notes
hhd-f1	Rural farm - quintile 1	Rural households with crop and/or livestock incomes
hhd-f2	Rural farm - quintile 2	separated into national per capita expenditure quintiles
hhd-f3	Rural farm - quintile 3	
hhd-f4	Rural farm - quintile 4	
hhd-f5	Rural farm - quintile 5	
hhd-n1	Rural nonfarm - quintile 1	Rural households without crop and/or livestock incomes
hhd-n2	Rural nonfarm - quintile 2	separated into national per capita expenditure quintiles
hhd-n3	Rural nonfarm - quintile 3	
hhd-n4	Rural nonfarm - quintile 4	
hhd-n5	Rural nonfarm - quintile 5	
hhd-u1	Urban - quintile 1	Urban households with or without crop and/or livestock incomes
hhd-u2	Urban - quintile 2	separated into national per capita expenditure quintiles
hhd-u3	Urban - quintile 3	
hhd-u4	Urban - quintile 4	
hhd-u5	Urban - quintile 5	

2.4   Other accounts

2.4.1   Government income and payments

The government in the Ghana SAM is disaggregated into a core government account and various tax collection accounts. Tax accounts are necessary since otherwise the economic interpretation of certain payments becomes ambiguous. Direct payments between the government and other domestic institutions are reserved for transfers. Payments from the government to factors are captured in the government services activity. Government consumption demand is a purchase of the output from the government services activity, which in turn, pays labor.

2.4.2   Domestic nongovernment institutions

Domestic nongovernment institutions consist of households and enterprises. Enterprises earn factor incomes (reflecting their ownership of capital) and receive transfers from other institutions. Enterprise incomes are used for corporate taxes, enterprise savings, and transfers to other institutions. Unlike households, enterprises do not demand commodities. In the SAM,

enterprises are an aggregation of financial and nonfinancial corporations, as defined within the System of National Accounts (SNA).

The remaining accounts in the Nexus SAMs are shown in Table 6. These include the transaction costs of moving goods between producers, domestic markets, and national borders, as well as the various indirect taxes imposed on marketed commodities.

Table 6. Other Accounts in the Ghana SAM

Code	Description	Notes
trc	Transaction costs	From moving goods between producers, markets and/or borders
ent	Enterprises	Financial and non-financial corporations
gov	Government	Government as an institution, not as a producing activity
atax	Taxes - activity	Indirect taxes on producers
dtax	Taxes - direct	Direct taxes on enterprises and households
etax	Taxes - export	Indirect taxes on exports
ftax	Taxes - factor	Direct taxes on factor incomes
mtax	Taxes - import	Indirect taxes on imports (import duties)
stax	Taxes - sales	Indirect taxes on domestic sales (VAT, GST and excise duty)
s-i	Savings-investment	Investment is gross fixed capital formation
dstk	Change in stocks	Inventory accumulation or depletion
row	Rest of world	All foreign countries and economies
total	Total	Row and column totals

3 2015 National Ghana SAM Entries

The previous section outlined the broad structure of the 2015 national Ghana SAM, including its standardized classification of accounts. This section describes the information included in each row and column entry following the numbered sequence shown in Table 7.

1. Intermediate demand   **(Commodities | Activities)**

Definition: Intermediate demand includes payments by activities for the commodities used as non-factor inputs in production processes. For example, payments by the maize activity to the chemical commodity for the fertilizer inputs used to grow maize.

Estimation: Intermediate demand for each activity is estimated in three steps. First, the ratio of total intermediate demand to total value-added in each activity is derived from the 2004 SUT and updated using more recent national accounts and agricultural and industrial survey data. Second, this ratio is used to derive the absolute level of total intermediate demand based on the estimated level of activity value-added (see Entry 2 below). Third, total intermediate payments are disaggregated across individual commodities using shares derived from the 2004 SUT.

Table 7. Numbered Entries in the National Ghana SAM

	Activities	Commodities	Factors	Enterprises	Households	Government	Taxes	Investment	Rest of the World
Activities		4			17				
Commodities	1	5			18	23		29	31
Factors	2								32
Enterprises			8			24			33
Households			9	12		25			34
Taxes	3	6	10	13	19				
Government				14	20		28		35
Savings				15	21	26		30	36
Rest of the World		7	11	16	22	27			

2. Value-added   (Factors | Activities)

Definition: Value-added is the returns earned by factors during the production process, such as labor wages and salaries, land rents, and capital profits. Land and capital includes gross operating surplus (GOS).

Estimation: Total value-added by activity is estimated in two steps. First, national accounts report the level of gross domestic product (GDP measured in basic prices) for aggregate sectors and these are assigned to groups of SAM activities. Second, aggregate GDP estimates are disaggregated to the level of the SAM activities using information on sub-sectoral production from sources beyond national accounts. The value of activity level agricultural production is estimated using production quantity and producer price data from the national Ministry of Food and Agriculture and from the FAO's FAOSTAT database (FAO 2016). Total value-added in each agricultural sector is estimated by multiplying the ratio of GDP to gross output (derived from the 2004 SUT) by the estimated value of activity gross output. Similarly, information on activity-level industrial production is derived from manufacturing or industrial surveys.

Labor value added is disaggregated across the worker categories in Table 3 using the GLSS6. Workers in this survey report their sector and location of employment, their remuneration levels, and their education levels. Earnings from farm and non-farm enterprises are reported at the household level, and these are assigned to individual household members based on their reported employment status and sector of employment. It is assumed that paid and unpaid family members earn equal shares of household enterprise incomes (net of input costs).

3. **Taxes on producers**   **(Taxes | Activities)**

Definition: Net taxes on production (or net subsidies if SAM value is negative).

Estimation: The total value of activity taxes (atax) is taken from the official financial statistics and includes "taxes on payroll and workforce". This is disaggregated across activities using information from the 2004 SUT. For the latter, tax rates are derived from the SUT and then applied to the sectoral value of GDP and intermediate payments (see Entries 1 and 2). This provides an initial estimate of net activity tax payments, which are then scaled to match the total value of activity tax collections.

4. **Marketed output**   **(Activities | Commodities)**

Definition: Value of domestically produced goods and services that are supplied to markets, either for domestic use or for export. Marketed output is net non-marketed or home produced and consumed goods and services (see Entry 18).

Estimation: This is a residual balancing item for activities. The value of gross output less the value of non-marketed consumption is paid from each activity to its corresponding commodity, thereby balancing activity rows and columns.

5. **Transaction costs**   **(Commodities | Commodities)**

Definition: Trade and transport costs associated with moving goods between producers, markets and national borders, either for domestic, import or export trade. For example, exporters incur transport fees when moving goods from their factories to the national border, whereas importers incur fees when delivering goods to domestic markets.

Estimation: Margin payments as a share of total demand are estimated using the 2004 SUT. These rates are then applied to total demand estimates in the SAM to derive new transaction costs. Finally, transaction cost margins generate income for trade and/or transport activities.

6. **Taxes on products**   **(Taxes | Commodities)**

Definition: All indirect taxes imposed on goods and services (or net subsidies if SAM value is negative).

Estimation: Nexus SAMs separate taxes on products into three categories: sales taxes (stax), export taxes (etax), and import tariffs (mtax) (see Table 4). The total value of tax collections is taken from the government financial statistics (GFS). Tax revenues are disaggregated across commodities using tax rates estimated from the 2004 SUT. Weighted import tariff rates are taken from the United Nations Conference on Trade and Development's Trade Analysis and Information System (TRAINS) (UNCTAD 2015). Tax rates are applied to the level of domestic sales, imports or exports (see Entries 7 and 32). This provides an initial estimate of commodity level tax payments, which are then scaled to match the total value of each tax revenue category, as estimated above.

7. **Imports**   **(Rest of World | Commodities)**

Definition: Value of goods and services imported from abroad, less the cost of carriage, insurance and freight.

Estimation: The total value of imports is taken from national accounts, and this is then disaggregated into total goods and total services using current account data from the IMF's BOPS (i.e., BPM6 codes BMG for "goods, debit" and BMS for "services, debit"). BOPS provides detailed information on services imports by commodity and this is used to assign imports to service commodities in the SAM (see Table A4 in the appendix). Goods imports are disaggregated across commodities using 6-digit HS gross import flows from the United Nations Commodity Trade Statistics (COMTRADE) database (UNSD 2015).

8. **Factor income to enterprises**   **(Enterprises | Factors)**

Definition: Mining and "other" capital payments to enterprises, after paying factor taxes and making transfers to the rest of the world (see Entries 10 and 11). These payments equal gross operating surplus, which includes the value of consumption of fixed capital during the production process.

Estimation: This is a residual balancing item for the mining and other capital accounts. Total capital income less capital taxes and foreign transfers is paid to the enterprise account, thereby balancing mining and other capitals' rows and columns.

9. **Factor income to households**   **(Households | Factors)**

Definition: Labor, land and agricultural capital payments to households, after paying factor taxes and making transfers to the rest of the world (see Entries 10 and 11). These payments equal compensation to workers and returns to land and agricultural capital.

Estimation: This is a residual balancing item for labor, land and agricultural capital accounts (i.e., crop and livestock capital). Total factor incomes less factor taxes and foreign transfers are paid to individual household accounts, thereby balancing these factors' rows and columns. Labor payments to households are disaggregated across household and labor categories using information from national household or labor force surveys (see Entry 2 on treatment on workers' shares of household enterprise incomes). Land and agricultural capital payments to households are disaggregated using survey households' reported incomes from agricultural crops and livestock.

10. **Factor taxes**   **(Taxes | Factors)**

Definition: Direct taxes paid by mining and "other" capital to the government.

Estimation: The value of capital tax collections is taken from the official financial statistics. Factor taxes are "taxes on property", which is a summation of various taxes, including wealth and estate taxes and capital levies.

11. **Factor payments abroad**   **(Rest of World | Factors)**

Definition: Labor, land and capital incomes paid to foreign households or enterprises. . For example, workers belonging to foreign households may earn some or all of their labor incomes in domestic industries and this income may be repatriated back to these workers' home countries. Similarly, some profits generated by foreign-owned mining companies may be repatriated to company headquarters in another country.

Estimation: Factor transfers to the rest of the world are from the IMF's BOPS. Labor transfers are "compensation of employees, debit" (BPM6 code BMIPCE). Capital transfers are "investment income, debit" (BPM6 BMIPI), which includes, amongst others, payments on equity and investment funds to foreign investors.

12. Enterprise transfers to households　　　　　　　(Households | Enterprises)

Definition: Indirect capital payments by enterprises to households, after paying corporate taxes and saving and making transfers to government and the rest of the world (see Entries 13, 14, 15 and 16). This includes indirect gross operating surplus paid from the earnings of household nonfarm enterprises.

Estimation: This is a residual balancing item for the enterprise account. Total enterprise income less taxes and transfers is paid to households, thereby balancing the enterprise row and column. Enterprise earnings are paid to households based on households' earnings from nonfarm enterprises, dividends and private pension funds as reported in national household surveys.

13. Corporate taxes　　　　　　　　　　　　　　(Taxes | Enterprises)

Definition: Corporate and other direct taxes paid by enterprises to the government.

Estimation: The total value of taxes collected from enterprises is taken from the GFS. This includes taxes "payable by corporations and other enterprises" and "other taxes on income, profits, and capital gains".

14. Enterprise transfers to government　　　　　　(Government | Enterprises)

Definition: Transfers from enterprises to governments, other than direct tax payments (see Entry 13). For example, domestic banks may provide loans to the government, or parastatal enterprises may pay dividends or repay loans to the general government. Enterprises may also contribute to public social welfare schemes on behalf of their employees.

Estimation: Transfers received by the government from financial and non-financial corporations are taken from the official financial statistics. This is "property income", which includes, amongst others, interest and dividend payments and payments for rented public property. Transfers from enterprises also include "other taxes", which are either paid by business or are unidentifiable. Finally, enterprises include employer contributions to social security and other social schemes.

15. Enterprise savings　　　　　　　　　　　　　(Savings | Enterprises)

Definition: Domestic private savings by enterprises. This includes reinvested earnings as well as the value of the consumption of fixed capital (i.e., provision for capital depreciation).

Estimation: Total domestic private savings is back-calculated by subtracting public and foreign savings from the value of gross capital formation (see Entries 21, 26, 29 and 36). Unfortunately, few developing countries have the detailed national accounts data needed to disaggregate domestic private savings across enterprises and households. Accordingly, in the absence of detailed information, the Ghana SAM assume that enterprises and

households have similar savings rates, after enterprises have subtracted their allowance for the depreciation of working capital.

16. Enterprise payments abroad **(Rest of World | Enterprises)**

Definition: Secondary income transfers from domestic financial and non-financial enterprises to the rest of the world.

Estimation: The value of enterprise foreign payments comes from the IMF's BOPS. This includes "other transfers, debit" (BPM6 code BMISOOT).

17. Private non-marketed consumption **(Activities | Households)**

Definition: Activity output that is both produced and consumed within the household, i.e., "own" or "home" consumption.

Estimation: Non-marketed consumption is estimated in three steps. First, the share of total private consumption for each SAM commodity is estimated using aggregate private consumption from national accounts and commodity-level consumption from the. Second, the share of home consumption in total consumption of each commodity is estimated using the GLSS6, and this share is then used to separate total commodity consumption into marketed and non-marketed components. Third, home consumption is disaggregated across household groups using household survey data. Home consumption is defined as any products not purchased in markets, including the consumption of both home-produced products and products received "in-kind" from other households (i.e., without monetary payment).

18. Private marketed consumption **(Commodities | Households)**

Definition: Commodities that are purchased in markets and consumed by households.

Estimation: Marketed consumption is estimated in three steps. First, the share of total private consumption for each SAM commodity is estimated using aggregate private consumption from national accounts and commodity-level consumption from the GLSS6. Second, the share of home consumption in total consumption of each commodity is estimated using the GLSS6, and this share of then used to separate total commodity consumption into marketed and non-marketed components. Third, marketed consumption is disaggregated across household groups using the GLSS6. Marketed consumption is defined as any products purchased in markets, i.e., not home produced or received "in-kind" from other households.

19. Household taxes **(Taxes | Households)**

Definition: Direct income or personal taxes paid by households. For example, households often "pay as you earn" (PAYE) taxes to the government based on their wages and salaries.

Estimation: Total tax collection is taken from the official financial statistics. It includes taxes on income, profits and capital gains that are "payable by individuals". This is disaggregated across the household groups in the SAM using personal income tax rates reported by households in the national household survey. If tax data is not available or is

poorly captured in the survey, then incomes from secondary and tertiary educated labor is used as a proxy for disaggregating total direct tax collections (see Table 3).

20. Household transfers to government **(Government | Households)**

Definition: Payments by household to the government other than for direct taxes (see Entry 19). For example, households may contribute to public social welfare schemes, including retirement and healthcare funds.

Estimation: The total value of transfers is taken from the official financial statistics. This is social security and other social contributions, including payments by employees, self-employed and unemployed people, and unallocable and imputed contributions. Household transfers to government also include various other revenue sources, including from sales of goods and services, and fines penalties and forfeits.

21. Household savings **(Savings | Households)**

Definition: Domestic private savings by households.

Estimation: Total domestic private savings is back-calculated by subtracting public and foreign savings from the value of gross capital formation (see Entries 21, 26, 29 and 36). Unfortunately, few developing countries have the detailed national accounts data needed to disaggregate domestic private savings across enterprises and households. Accordingly, in the absence of detailed information, the SAM assume that enterprises and households have similar savings rates, after enterprises have subtracted their allowance for the depreciation of working capital. Household savings are then disaggregated across household groups in the SAM using information from the GLSS6. Although survey households often report the value of deposits made into bank accounts or the amount of savings during the year, including private pension contributions, this information is often poorly captured. In such cases, proxy indicators are derived from household earnings from enterprises and incomes from higher educated labor.

22. Household payments abroad **(Rest of World | Households)**

Definition: Secondary income transfers from households to the rest of the world.

Estimation: The value of household foreign payments comes from the IMF's BOPS. This includes "personal transfers, debit" (BPM6 code BMISOPT). Transfers are disaggregated across household groups in the SAM using information from national household surveys that capture the amount of remittances households sent abroad.

23. Government consumption **(Commodities | Government)**

Definition: Government recurrent spending on goods and services. Public consumption demand by the government institution is the primary source of demand for services produced by government activities, which consist of public administration, education, and health and social work.

Estimation: The total value of government consumption is take from a country's national accounts data. This is cross-checked against recurrent expenditures in the official financial statistics, which reports government's "compensation of employees", "use of goods and

services", and "consumption of fixed capital". Total consumption is disaggregated across commodities using budget shares derived from the 2004 SUT, and then adjusted to reflect changes in the composition of supply of public administration, education, and health and social work services.

24. Government transfers to enterprises   (Enterprises | Government)

Definition: Transfers from the government to enterprises. For example, the government may pay interest or repay the principal on a loan from a domestic bank, or the government may lend money to parastatal companies.

Estimation: Transfers paid by the government to financial and non-financial corporations are taken from the GFS. This is interest payments to nongovernment residents subsidies to public corporations and private enterprises and "other expenses". The latter includes property expenses like dividend and rental payments.

25. Government transfers to households   (Households | Government)

Definition: Payments by the government to households. For example, governments may pay households from a public pension or cash transfer scheme.

Estimation: The total value of transfers is taken from the GFS. This is social benefits, which includes social security, social assistance, and other employment-related social benefits, each of which may be paid in cash or in-kind.

26. Government savings   (Savings | Government)

Definition: Recurrent fiscal surplus for the government (of deficit if cell entry is negative). Note that this is the difference between revenues and recurrent expenditures, i.e., before public capital investment. Recurrent expenditures include public consumption spending (see Entry 25) and transfers to domestic and foreign institutions (see Entries 24, 25 and 27).

Estimation: This is the residual balancing item for the government account, although it cross-checked against the difference between total revenues and total recurrent expenses in the GFS. Any deviation from the data is due to the SAM giving preference to statistics from national accounts (for indirect tax collections and government consumption spending, see Entries 3, 6 and 23) and to the IMF's BOP database (for foreign transfers, see Entries 27 and 35).

27. Government payments abroad   (Rest of World| Government)

Definition: Transfers from the government to the rest of the world. For example, government may provide foreign aid to other countries, or must pay interest or repay loans to foreign governments and financial enterprises.

Estimation: The value of government foreign payments comes from the IMF's BOPS, and is cross-checked against the IMF's GFS. BOPS-based payments include "general government transfers, debit" under secondary income (BPM6 code BMISG). GFS-based payments include interest payments to nonresidents (GFSM code 241), and grants paid to foreign governments and international organizations (GFSM 26).

28. Tax revenues paid to government   **(Government | Taxes)**

Definition: Revenues transferred from individual tax accounts to the government account.

Estimation: This is a residual balancing item for the tax accounts in the SAM. The distinction between taxes and the government account allows the SAM to disaggregate indirect taxes on commodities, i.e., sales taxes, export taxes, and import tariffs (see Entry 6).

29. Gross capital formation   **(Commodities | Investment)**

Definition: Combination of gross fixed capital formation (GFCF) and changes in stocks or inventories. GFCF is the spending on commodities involved during the investment in capital stock. For example, investment typically involves the purchase of machinery, vehicles and equipment, as well as payments for constructing new factories and storage facilities. Changes in stocks occur when businesses carry-over stock for sale in subsequent years, or when they sell products in the current year that were produced in previous years. Positive values in the SAM indicate an accumulation of stocks and negative values indicate a depletion of stocks. Finally, note that the SAM combines private, public and foreign investment, just as they combine private, public and foreign savings (see Entries 15, 21 and 26).

Estimation: The SAM distinguishes between GFCF (s-i) and changes in stocks (dstk). SAM entries are determined in two steps. First, the total value of GFCF and stock changes are taken from official national accounts data. Second, these total values are disaggregated across commodities using expenditure shares from the 2004 SUT.

30. Inventory or stock change adjustment   **(Savings | Investment)**

Definition: The accumulation of stocks for sale in subsequent years are added to the amount of savings available in the country (and a depletion of stocks reduces savings). For example, if an activity produces a machine this year for sale next year then they are effectively saving the value of the machine (or investing in future sales). This transfer of total stock changes to the savings account was not shown in Table 1, because it nets to zero in SAMs that aggregate gross fixed capital formation (GFCF) and changes in stocks.

Estimation: This is a residual balancing item for the change in stocks account (see Entry 29). The total value of stock changes is paid to the savings account. A positive value means a net accumulation of stocks and a negative value means a net depletion.

31. Exports   **(Commodities | Rest of World)**

Definition: Value of goods and services exported abroad.

Estimation: The total value of exports is taken from national accounts, and this is then disaggregated into total goods and total services using current account data from the IMF's BOPS (i.e., BPM6 codes BXG for "goods credit" and BXS for "services credit"). BOPS provide detailed information on services exports by commodity and this is used to assign exports to service commodities in the SAM (see Table A4 in the appendix). Goods exports

are disaggregated across commodities using 6-digit HS gross export flows from the United Nations Commodity Trade Statistics (COMTRADE) database (UNSD 2015).

32. Foreign transfers to factors   **(Factors | Rest of World)**

Definition: Labor, land and capital incomes received from the rest of the world. For example, workers belonging to domestic households may earn some or all of their labor incomes working in a foreign country and this income may be repatriated. Similarly, domestically-owned companies may repatriate profits earned abroad.

Estimation: Factor transfers from the rest of the world are from the IMF's BOPS. Labor receipts are "compensation of employees, credit" (BPM6 code BXIPCE). Capital receipts are "investment income, credit" (BPM6 BXIPI), which includes, amongst others, income on foreign equity and investment funds.

33. Foreign transfers to enterprises   **(Enterprises| Rest of World)**

Definition: Secondary income transfers from the rest of the world to domestic financial and non-financial enterprises.

Estimation: The value of enterprise foreign receipts comes from the IMF's BOPS. This includes "other transfers, credit" (BPM6 code BXISOOT).

34. Foreign transfers to households   **(Households| Rest of World)**

Definition: Secondary income transfers from households to the rest of the world. For example, households may receive remittance incomes from family members working abroad.

Estimation: The value of household foreign incomes comes from the IMF's BOPS. This includes "personal transfers, credit" (BPM6 code BXISOPT). Transfers are disaggregated across household groups in the SAM using information from national household surveys that capture the amount of remittances households received from abroad.

35. Foreign transfers to government   **(Government| Rest of World)**

Definition: Transfers from the rest of the world to the government. For example, government may receive foreign aid from other countries.

Estimation: The value of government foreign receipts comes from the IMF's BOPS, and this is cross-checked against the GFS. BOPS-based receipts include "general government transfers, credit" under secondary income (BPM6 code BXISG). GFS include grants received from foreign governments and international organizations.

36. Foreign savings   **(Savings | Rest of World)**

Definition: Current account balance equal to total foreign capital or savings inflows.

Estimation: This is the residual balancing item for the rest of world account, although it cross-checked against the current account balance reported in the IMF's BOPS (BPM6 code 1). Any deviation from BOPS data – and this is usually small – is due to the Nexus SAM giving preference to total the value of imports and exports reported in national accounts (see Entries 7 and 31).

4 Balancing the 2015 National Ghana SAM

The Ghana SAM is constructed according Nexus SAM building framework as such it is constructed in three stages using the IFPRI SAM Building Toolkit. The toolkit uses a standardized template in Microsoft-Excel® to construct and export an unbalanced SAM to a compilation and balancing program that is executed in the General Algebraic Modeling System (GAMS).

During the first stage of the SAM Toolkit, a Macro SAM is constructed using the data described in previous sections. The three main data sources for the Macro SAM are national accounts, GFS, and BOPS. Unfortunately, in many developing countries, these three data sources are not fully reconciled. For example, the total value of exports and imports in national accounts may not exactly match the values appearing in BOPS. Preference is given to certain data sources. For instance, Nexus SAMs always use national accounts data instead of trade data from BOPS or government consumption spending estimates from GFS. Similarly, preference is given BOPS over GFS when estimating transfers between the government and the rest of the world. Row and column totals in the Macro SAM are reconciled manually through various residual balancing items, as listed below:

- Marketed supply balances the activity accounts (see Entry 4)
- Transfers to households or enterprises balances the factor accounts (see Entry 8 and 9)
- Transfers to households balances the enterprise account (see Entry 12)
- Household and government savings balance the household and government accounts (see Entries 21 and 26)
- Foreign savings balances the rest of world account (see Entry 36).

During the second stage, income and expenditure shares derived from surveys and other sources are used to disaggregate the Macro SAM entries across detailed activities, commodities, factors and households. Sectoral and product data is used to disaggregate production and trade, and survey data is used to disaggregate factor and household incomes and consumer demand. There are always imbalances between the level of supply and demand for commodities and between household incomes and expenditures. These imbalances are manually checked for misclassification issues and logical errors in data collection and reporting. However, imbalances invariably remain, and so Nexus SAMs use cross-entropy estimation techniques to reconcile row and column totals at the detailed commodity and household level. For more information on cross-entropy-based reconciliation of SAM accounts, see Robinson et al. (2001).

Finally, in the third stage, Standard Nexus SAM entries are further disaggregated to include gender-disaggregated and regional information. As above, separating activities, factors and households always introduces new imbalances, and these are reconciled using a second round of cross-entropy estimation.

5   A Regional SAM for Ghana

Distinct differences in employment and welfare exist between the southern and northern regions of Ghana. Promoting development in Ghana and progressing toward meeting sustainable development goals (SDGs) require a conscious effort in government planning to address the stark inequalities between the regions through the development of the northern region. The government of Ghana is interested in understanding what policies could assist in reducing these contrasts and improve equity among the southern and northern regions. The National Development Planning Commission (NDPC) in Ghana and the Savannah Accelerated Development Authority (SADA) are currently in the process of developing the next medium- to long-term plans for the country and Northern Savannah Ecological Zone respectively.

To inform the development of these plans a regional policy analysis tool is required to assess the macro- and socio-economic impact of policy options available to the government of Ghana. To address this objective, the 2015 national SAM for Ghana—described in the preceding sections—is disaggregated into distinct northern and southern regions, such that it provides a more detailed description of the regional economies as well as the interlinkages between the regions. The aggregate structure of the regional SAM is presented in Table 8. The northern region includes the Northern, Upper West and Upper East administrative divisions. Although parts of the Brong-Ahafo and Volta regions are officially part of SADA, these regions will in future not be part of the Northern Development Authority (NDA), which is set to replace SADA soon. The Brong-Ahafo, Volta, Ashanti, Western, Central, Eastern and Greater Accra administrative divisions define the "southern region" in the SAM.[4]

Given government and SADA interest in the agriculture, fishing and forestry sectors (reported as the agriculture sector), this exercise focused on disaggregating this sector specifically. The SAM therefore contains specific agriculture sub-sectors for these regions. Sub-sectors within each region produce a homogenous commodity which forms part of national supply. For example, maize farms within the northern and southern regions each produce maize that contributes to the national supply, which is exported, consumed in final consumption and/or used by other industry as an intermediate input.

Labor, land and agriculture capital supply is also disaggregated between the northern and southern regions to capture region specific resource availability. Households are differentiated based on location as this will assist in analyzing the differential welfare impacts of proposed policies and indicate the ability of these policies to reduce inequality within and between regions.

The 2015 two-region SAM for Ghana was developed from the 2015 National SAM. National blocks within the SAM where disaggregated based on available information such that the account totals for two-region SAM add up to the matching accounts in the national SAM.

---

[4] Future updates will further disaggregate the southern region in the SAM to distinguish the regions that form part of the Middle Belt Development Authority (MBDA) and the Coastal Development Authority (CDA), which are soon to be established.

Table 8. Two region SAM for Ghana

	Agriculture Activity Northern Region	Agriculture Activity Southern Region	Non-agriculture Activity	Agriculture Commodity	Non-agriculture Commodity	Labour Southern Region	Labour Northern Region	Land Northern Region	Land Southern Region	Agriculture Capital Northern Region	Agriculture Capital Southern Region	Non-agriculture Capital	Enterprises	Households Northern Region	Households Southern Region	Government	Taxes	Savings/Investment	Stocks	Rest of the World	Total
Agriculture Activity Northern Region	-	-	-	7 099	-	-	-	-	-	-	-	-	-	991	-	-	-	-	-	-	8 090
Agriculture Activity Southern Region	-	-	-	16 756	-	-	-	-	-	-	-	-	-	-	4 182	-	-	-	-	-	20 938
Non-agriculture Activity	-	-	-	-	217 366	-	-	-	-	-	-	-	-	804	1 002	-	-	-	-	-	219 172
Agriculture Commodity	223	576	10 318	-	-	-	-	-	-	-	-	-	-	1 545	11 710	-	-	-	1 249	5 574	31 194
Non-agriculture Commodity	1 357	2 972	111 232	4 939	39 707	-	-	-	-	-	-	-	-	4 796	63 221	22 471	-	36 010	1 251	50 448	338 405
Labour Southern Region	-	5 938	31 714	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	37 653
Labour Northern Region	2 565	-	2 875	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5 440
Land Northern Region	2 329	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2 329
Land Southern Region	-	6 044	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6 044
Agriculture Capital Northern Region	1 610	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 610
Agriculture Capital Southern Region	-	2 357	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2 357
Non-agriculture Capital	6	3 051	63 032	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	782	66 870
Enterprises	-	-	-	-	-	-	-	-	-	-	-	-	63 980	-	-	8 932	-	-	-	-	72 913
Households Northern Region	-	-	-	-	-	-	5 440	2 329	-	1 610	-	-	26 626	-	-	423	-	-	-	2 332	38 761
Households Southern Region	-	-	-	-	-	37 653	-	-	6 044	-	2 357	-	32 540	-	-	1 147	-	-	-	2 702	82 443
Government	-	-	-	-	-	-	-	-	-	-	-	-	6 119	273	16	-	22 435	-	-	2 782	31 625
Taxes	-	-	-	714	14 326	-	-	-	-	-	-	-	3 827	3 411	157	-	-	-	-	-	22 435
Savings/Investment	-	-	-	-	-	-	-	-	-	-	-	-	3 800	26 942	2 153	(3 069)	-	-	-	8 683	38 510
Stocks	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2 500	-	-	2 500
Rest of the World	-	-	-	1 685	67 006	-	-	-	-	-	-	2 890	-	-	-	1 721	-	-	-	-	73 302
Total	8 090	20 938	219 172	31 194	338 405	37 653	5 440	2 329	6 044	1 610	2 357	66 870	72 913	38 761	82 443	31 625	22 435	38 510	2 500	73 302	

5.1 Activities and Commodities

To disaggregate the agriculture activity, official production statistics from the Ministry of Food and Agriculture (MOFA 2015) are used in combination with information from the 2012/13 Ghana Living Standards Survey (GLSS6) (GSS 2014). The GLSS6 provides information on own consumption by household and location for each activity. Regional activity expenditure profiles are assumed to be the same as the national activity. National activity shares are therefore applied to regional total outputs to obtain expenditure numbers (i.e. technology vectors). National profiles were used due to the limited availability of information. Where information is not available for specific agriculture sub-sectors, expert knowledge is used to inform the production levels in the northern versus southern regions.

The GLSS6 also provides detailed information on household income and expenditure sources and patterns, by region, household location, and quintile.

5.2 Labor, land and capital

Agriculture: The technology vectors obtained above provide the shares of labor, land and agriculture capital used by each activity within the northern and southern regions. These values are distributed to respective recipients (i.e. households and enterprise) using national profile shares; i.e., we assume that in the northern and southern regions the same household groups receive the same share of income from labor, for example.

Non-agriculture: For non-agriculture sectors, information from the GLSS6 survey is used to determine the shares of northern and southern labor used by these activities. Land and agriculture capital is specific to the agriculture sector only and therefore did not need to be considered here. As with agriculture activities, returns from factors used by non-agriculture sectors are distributed to respective recipients (i.e. households and enterprise) using national profile shares.

5.3 Households

Regional household incomes from production factors, namely government, enterprises and foreign income, is split between northern and southern regions using information from the GLSS6. Regional household own consumption estimates as per the national SAM are disaggregated between northern and southern regions using information from the GLSS6.

Other household expenditure, specifically spending on government taxes and savings, is calculated by taking total income less expenditure on own consumption and marketed consumption, multiplied by the national share of spending on the specific item by household group. Again, this assumes homogenous behavior between the northern and southern regions.

6 References

Amanor-Boadu, V., F.K. Nti and K. Ross. Structure of Ghana's Chicken Industry in 2015, Manhattan, KS: Department of Agricultural Economics, Kansas State University, 2016. ISBN: 978-0-9898866-2-8.

Andam, K. (accessed 2017), "Personal Communication – Values for agriculture production by region: collated from literature, IFPRI-Ghana.

EC, IMF, OECD, UN and World Bank. 2009. System of National Accounts 2008. New York NY, USA: European Commission, International Monetary Fund, Organization for Economic Cooperation and Development, United Nations, and World Bank.

FAO. 2015. FAO Statistical Databases (FAOSTAT). Rome, Italy: Food and Agriculture Organization of the United Nations.

GSS. 2010. Rebasing of Ghana's National Accounts to the Reference Year 2006. Accra, Ghana: Ghana Statistical Services.

GSS. 2014. 2012/13 Ghana Living Standards Survey Round 6 (GLSS6): Main Report. Accra, Ghana: Ghana Statistical Services.

GSS. 2015. Producer Price Index (PPI): December 2015. Accra, Ghana: Ghana Statistical Services.

GSS. 2016a. Revised 2015 Annual Gross Domestic Product. Accra, Ghana: Ghana Statistical Services.

IMF. 2014a. BPM6 Compilation Guide: Companion Document to the Sixth Edition of the Balance of Payments and International Investment Position Manual. Washington DC, USA: International Monetary Fund.

IMF. 2014b. Government Finance Statistics Manual 2014. Washington DC, USA: International Monetary Fund.

MOF. 2016b. Provisional Fiscal Data: January-December 2015. Accra, Ghana: Ministry of Finance.

MOFA. 2016c. 2015 Agricultural Sector Annual Progress Report. Accra, Ghana: Monitoring and Evaluation Directorate, Ministry of Food and Agriculture.

MOFA (Ministry of Food and Agriculture). October 2016. Facts and Figures, 2015. Ministry of Food and Agriculture, Statistics, research and Information Directorate: Accra, Ghana.

Pyatt, G. and J. Round. 1985. Social Accounting Matrices: A Basis for Planning. Washington DC, USA: World Bank.

Reinert, K.A., and D.W. Roland-Holst. 1997. Social Accounting Matrices. In Francois, J.F., and K.A. Reinert (eds.) *Applied Methods for Trade Policy Analysis: A Handbook*. New York NY, USA: Cambridge University Press.

Robinson, S., A. Cattaneo and M. El-Said. 2001. Updating and Estimating a Social Accounting Matrix Using Cross Entropy Methods. *Economic Systems Research* 13(1): 47-64.

UNCTAD. 2015. Trade Analysis Information System (TRAINS). Geneva, Switzerland: United Nations Conference on Trade and Development.

UNDESA. 2002. International Standard Industrial Classification of All Economic Activities (ISIC): Revision 3.1. Statistical Papers, Series M No. 4 Rev. 3.1. New York NY, USA: Statistics Division, United Nations Department for Economic and Social Affairs.

UNDESA. 2008. International Standard Industrial Classification of All Economic Activities (ISIC): Revision 4. Statistical Papers, Series M No. 4 Rev. 4. New York NY, USA: Statistics Division, United Nations Department for Economic and Social Affairs.

UNSD. 2015. Commodity Trade Statistics Database. New York NY, USA: United Nations Statistics Division.

World Bank. 2017. World Development Indicators. Washington DC, USA.

7 Annex

Table A1. Detailed Classification of Nexus Activity Accounts

	Nexus Activity		International Standard Industrial Classification (ISIC) Revision 4	
Code	**Description**	**Code**	**Description**	
maiz	Maize	0111	Growing of cereals (except rice), leguminous crops and oil seeds	
sorg	Sorghum and millet	0111	Growing of cereals (except rice), leguminous crops and oil seeds	
rice	Rice	0112	Growing of rice	
ocer	Other cereals	0111	Growing of cereals (except rice), leguminous crops and oil seeds	
puls	Pulses	0111	Growing of cereals (except rice), leguminous crops and oil seeds	
gnut	Groundnuts	0111	Growing of cereals (except rice), leguminous crops and oil seeds	
oils	Other oilseeds	0111	Growing of cereals (except rice), leguminous crops and oil seeds	
cass	Cassava	0113	Growing of vegetables and melons, roots and tubers	
root	Other roots	0113	Growing of vegetables and melons, roots and tubers	
vege	Vegetables	0113	Growing of vegetables and melons, roots and tubers	
sugr	Sugar cane	0114	Growing of sugar cane	
toba	Tobacco	0115	Growing of tobacco	
cott	Cotton and fibers	0116	Growing of fiber crops	
frui	Fruits and nuts	0121	Growing of grapes	
		0122	Growing of tropical and subtropical fruits	
		0123	Growing of citrus fruits	
		0124	Growing of pome fruits and stone fruits	
		0125	Growing of other tree and bush fruits and nuts	
		0126	Growing of oleaginous fruits	
coco	Cocoa	0127	Growing of beverage crops	
coff	Coffee & tea	0127	Growing of beverage crops	
ocrp	Other crops	0119	Growing of other non-perennial crops	
		0128	Growing of spices, aromatic, drug and pharmaceutical crops	
		0129	Growing of spices, aromatic, drug and pharmaceutical crops	
		0161	Support activities for crop production	
		0163	Post-harvest crop activities	
		0164	Seed processing for propagation	
catt	Cattle	0141	Raising of cattle and buffaloes	

poul	Poultry	0146	Raising of poultry
oliv	Other livestock	0142	Raising of horses and other equines
		0143	Raising of camels and camelids
		0144	Raising of sheep and goats
		0145	Raising of swine/pigs
		0149	Raising of other animals
		0162	Support activities for animal production
		0170	Hunting, trapping and related service activities
fore	Forestry	02xx	Forestry and logging
fish	Fishing	03xx	Fishing and aquaculture
coal	Coal and lignite	05xx	Mining of coal and lignite
coil	Crude oil	061x	Extraction of crude petroleum
ngas	Natural gas	062x	Extraction of natural gas
omin	Other mining	07xx	Mining of metal ores
		08xx	Other mining and quarrying
		09xx	Mining support service activities
meat	Meat, fish and dairy	101x	Processing and preserving of meat
		102x	Processing and preserving of fish, crustaceans and mollusks
		105x	Manufacture of dairy products
fveg	Fruit and vegetable processing	103x	Processing and preserving of fruit and vegetables
foil	Fats and oils	104x	Manufacture of vegetable and animal oils and fats
gmll	Grain milling	106x	Manufacture of grain mill products, starches and starch products
sref	Sugar refining	1072	Manufacture of sugar
food	Other foods	107x	Manufacture of other food products (excl. sugar: 1072 above)
		108x	Manufacture of prepared animal feeds
beve	Beverages	11xx	Manufacture of beverages
ptob	Tobacco processing	12xx	Manufacture of tobacco products
text	Textiles	13xx	Manufacture of textiles
clth	Clothing	14xx	Manufacture of wearing apparel
leat	Leather and footwear	15xx	Manufacture of leather and related products
wood	Wood and paper	16xx	Manufacture of wood and of products of wood and cork,
		17xx	Manufacture of paper and paper products
		18xx	Printing and reproduction of recorded media

petr	Petroleum	19xx	Manufacture of coke and refined petroleum products
chem	Chemicals	20xx	Manufacture of chemicals and chemical products
		21xx	Manufacture of basic pharmaceutical products and
		22xx	Manufacture of rubber and plastics products
nmet	Non-metal minerals	23xx	Manufacture of other non-metallic mineral products
metl	Metals and metal	24xx	Manufacture of basic metals
		25xx	Manufacture of fabricated metal products, except machinery
mach	Machinery and	26xx	Manufacture of computer, electronic and optical products
		27xx	Manufacture of electrical equipment
		28xx	Manufacture of machinery and equipment n.e.c.
		29xx	Manufacture of motor vehicles, trailers and semi-trailers
		30xx	Manufacture of other transport equipment
oman	Other manufacturing	31xx	Manufacture of furniture
		32xx	Other manufacturing
		33xx	Repair and installation of machinery and equipment
elec	Electricity, gas and	35xx	Electricity, gas, steam and air conditioning supply
watr	Water supply and	36xx	Water collection, treatment and supply
		37xx	Sewerage
		38xx	Waste collection, treatment and disposal activities; materials
cons	Construction	41xx	Construction of buildings
		42xx	Civil engineering
		43xx	Specialized construction activities
trad	Wholesale and retail	45xx	Wholesale and retail trade and repair of motor vehicles and
		46xx	Wholesale trade, except of motor vehicles and motorcycles
		47xx	Retail trade, except of motor vehicles and motorcycles
tran	Transportation and	49xx	Land transport and transport via pipelines
		50xx	Water transport
		51xx	Air transport
		52xx	Warehousing and support activities for transportation
		53xx	Postal and courier activities
hotl	Accommodation and	55xx	Accommodation
		56xx	Food and beverage service activities
com	Information and	58xx	Publishing activities
		59xx	Motion picture, video, TV program production, sound and
		60xx	Programming and broadcasting activities
		61xx	Telecommunications
		62xx	Computer programming, consultancy and related activities
		63xx	Information service activities
fsrv	Finance & insurance	64xx	Financial service activities, except insurance and pension
		65xx	Insurance, reinsurance and pension funding, except
		66xx	Activities auxiliary to financial service and insurance
real	Real estate activities	68xx	Real estate activities
bsrv	Business services	69xx	Legal and accounting activities
		70xx	Activities of head offices; management consultancy activities
		71xx	Architectural and engineering activities; technical testing and
		72xx	Scientific research and development
		73xx	Advertising and market research
		74xx	Other professional, scientific and technical activities

		75xx	Veterinary activities
		77xx	Rental and leasing activities
		78xx	Employment activities
		79xx	Travel agency, tour operator, reservation service and related
		80xx	Security and investigation activities
		81xx	Services to buildings and landscape activities
		82xx	Office administrative, office support and other business
padm	Public administration	84xx	Public administration and defense; compulsory social
educ	Education	85xx	Education
heal	Health and social work	86xx	Human health activities
		87xx	Residential care activities
		88xx	Social work activities without accommodation
osrv	Other services	90xx	Creative, arts and entertainment activities
		91xx	Libraries, archives, museums and other cultural activities
		92xx	Gambling and betting activities
		93xx	Sports activities and amusement and recreation activities
		94xx	Activities of membership organizations
		95xx	Repair of computers and personal and household goods
		96xx	Other personal service activities
		97xx	Activities of households as employers of domestic personnel
		98xx	Undifferentiated goods/service activities of private
		99xx	Activities of extraterritorial organizations and bodies

Table A2. Detailed Classification of Nexus Agricultural Activity Accounts

Code	Description (FAOSTAT crop and livestock product codes in parentheses)
maiz	Maize (56)
sorg	Millet (79); Sorghum (83)
rice	Paddy rice (27)
ocer	Wheat (15); Barley (44); Rye (71); Oats (75); Buckwheat (89); Quinoa (92); Fonio (94); Triticale (97); Canary seed (101); Mixed grain (103); Cereals not elsewhere specified (108)
puls	Dry beans (176); Dry broad beans and horse beans (181); Dry peas (187); Chick peas (191); Dry cow peas (195); Pigeon peas (197); Lentils (201); Bambara beans (203); Vetches (205); Lupins (210); Pulses not elsewhere specified (211)
gnut	Groundnuts with shell (242)
oils	Soybeans (236); Palm oil fruit (254); Palm kernels (256); Palm oil (257); Olives (260); Karite nuts (sheanuts) (263); Castor oil seed (265); Sunflower seed (267); Rapeseed (270); Tung nuts (275); Jojoba seed (277); Safflower seed (280); Sesame seed (289); Mustard seed (292); Poppy seed (296); Melonseed (299); Tallowtree seed (305); Vegetable tallow (306); Stillingia oil (307); Cottonseed (329); Linseed (333); Hempseed (336); Oilseeds not elsewhere specified (339)
cass	Cassava (125)
root	Potatoes (116); Sweet potatoes (122); Yautia (cocoyam) (135); Taro (cocoyam) (136); Yams (137); Roots and tubers not elsewhere specified (149)
vege	Cabbages and other brassicas (358); Artichokes (366); Asparagus (367); Lettuce and chicory (372); Spinach (373); Tomatoes (388); Cauliflowers and broccoli (393); Pumpkins, squash and gourds (394); Cucumbers and gherkins (397); Eggplants (aubergines) (399); Chilies and peppers, green (401); Green onions and shallots (402); Dry onions (403); Garlic (406); Leeks and other alliaceous vegetables (407); Green beans (414); Green peas (417); Leguminous vegetables not elsewhere specified (420); String beans (423); Carrots and turnips (426); Okra (430); Green maize (446); Mushrooms and truffles (449); Chicory roots (459); Carobs (461); Fresh vegetables not elsewhere specified (463)
sugr	Sugar cane (156); Sugar beet (157); Sugar crops not elsewhere specified (161)
toba	Unmanufactured tobacco (826)
cott	Kapok fruit (310); Seed cotton (328); Flax fiber and tow (773); Hemp tow waste (777); Jute (780); Bastfibers, other (782); Ramie (788); Sisal (789); Agave fibers not elsewhere specified (800); Manila fiber (abaca) (809); Fiber crops not elsewhere specified (821)
frui	Brazil nuts with shell (216); Cashew nuts with shell (217); Chestnut (220); Almonds with shell (221); Walnuts with shell (222); Pistachios (223); Kola nuts (224); Hazelnuts with shell (225); Areca nuts (226); Nuts not elsewhere specified (234); Coconuts (249); Bananas (486); Plantains (489); Oranges (490); Tangerines, mandarins, clementines and satsumas (495); Lemons and limes (497); Grapefruit (including pomelos) (507); Citrus fruit not elsewhere specified (512); Apples (515); Pears (521); Quinces (523); Apricots (526); Sour cherries (530); Cherries (531); Peaches and nectarines (534); Plums and sloes (536); Stone fruit not elsewhere specified (541); Pome fruit not elsewhere specified (542); Strawberries (544); Raspberries (547); Gooseberries (549); Currants (550); Blueberries (552); Cranberries (554); Berries not elsewhere specified (558); Grapes (560); Watermelons (567); Other melons (including cantaloupes) (568); Figs (569); Mangoes, mangosteens and guavas (571); Avocados (572); Pineapples (574); Dates (577); Persimmons (587); Cashew apple (591); Kiwi fruit (592); Papayas (600); Fresh tropical fruit not elsewhere specified (603); Fresh fruit not elsewhere specified (619)
coco	Cocoa beans (661)
coff	Green coffee (656); Tea (667); Mata (671); Tea not elsewhere specified (674)
ocrp	Hops (677); Pepper (piper spp.) (687); Dry chilies and peppers (689); Vanilla (692); Cinnamon (canella) (693); Cloves (698); Nutmeg, mace and cardamoms (702); Anise, badian, fennel and coriander (711); Ginger (720); Spices not elsewhere specified (723); Peppermint (748); Dried pyrethrum (754); Natural rubber (836); Natural gums (839)

catt	Cattle meat (867); Whole fresh cow milk (882); Indigenous cattle meat (944); Live weight cattle
poul	Chicken meat (1058); Hen eggs in shell (1062); Duck meat (1069); Indigenous duck meat (1070); Live weight duck meat (1071); Goose and guinea fowl meat (1073); Indigenous goose meat (1077); Live weight goose meat (1078); Turkey meat (1080); Indigenous bird meat not elsewhere specified (1084); Other live weight poultry meat (1085); Indigenous turkey meat (1087); Live weight turkey meat (1088); Bird meat not elsewhere specified (1089); Other bird eggs in shell (1091); Indigenous chicken meat (1094); Live weight chicken meat (1095)
oliv	Buffalo meat (947); Whole fresh buffalo milk (951); Indigenous buffalo meat (972); Live weight buffalo meat (973); Sheep meat (977); Whole fresh sheep milk (982); Greasy wool (987); Indigenous sheep meat (1012); Live weight sheep meat (1013); Goat meat (1017); Whole fresh goat milk (1020); Indigenous goat meat (1032); Live weight goat meat (1033); Pig meat (1035); Indigenous pig meat (1055); Live weight pig meat (1056); Horse meat (1097); Ass meat (1108); Mule meat (1111); Indigenous horse meat (1120); Live weight horse meat (1121); Indigenous ass meat (1122); Live weight ass meat (1123); Indigenous mule meat (1124); Live weight mule meat (1125); Camel meat (1127); Whole fresh camel milk (1130); Indigenous camel meat (1137); Live weight camel meat (1138); Rabbit meat (1141); Indigenous rabbit meat (1144); Live weight rabbit meat (1145); Other rodent meat (1151); Indigenous rodent meat (1154); Live weight rodent meat (1155); Other camelid meat (1158); Indigenous other camelid meat (1161); Live weight other camelids meat (1162); Game meat (1163); Meat not elsewhere specified (1166); Snails (1176); Natural honey (1182); Beeswax (1183); Silk-worm cocoons (1185)

Table A3. Detailed Classification of the Government Account

Government Financial Statistics Manual (IMF GFSM 2014)		Nexus SAM Entries*	
Code	Description	Row	Column
1	Revenue		
11	Taxes		
111	Taxes on income, profits, and capital gains		
1111	Payable by individuals	dtax	hhd-__
1112	Payable by corporations and other enterprises	dtax	ent
1113	Other taxes on income, profits, and capital gains	dtax	ent
112	Taxes on payroll and workforce	ftax	flab-__
113	Taxes on property	ftax	fcap-_
114	Taxes on goods and services	stax	c____
115	Taxes on international trade and transactions		
1151	Customs and other import duties	mtax	c____
1152	Taxes on exports	etax	c____
1153	Profits of export or import monopolies	mtax	c____
1154	Exchange profits	mtax	c____
1155	Exchange taxes	mtax	c____
1156	Other taxes on international trade and transactions	mtax	c____
116	Other taxes	dtax	ent
12	Social contributions		
121	Social security contributions		
1211	Employee contributions	gov	hhd-__
1212	Employer contributions	gov	ent
1213	Self-employed or unemployed contributions	gov	hhd-__
1214	Unallocable contributions	gov	hhd-__
122	Other social contributions		
1221	Employee contributions	gov	hhd-__
1222	Employer contributions	gov	ent
1223	Imputed contributions	gov	hhd-__
13	Grants	gov	row
14	Other revenue		
141	Property income	gov	ment
142	Sales of goods and services	gov	hhd-__
143	Fines, penalties, and forfeits	gov	hhd-__
144	Transfers not elsewhere classified	gov	hhd-__
145	Premiums, fees, and nonlife insurance claims	gov	ment
2	Expense		
21	Compensation of employees	c____	gov
22	Use of goods and services	c____	gov
23	Consumption of fixed capital	c____	gov
24	Interest		
241	To nonresidents	row	gov
242	To residents other than general government	ent	gov
243	To other general government units	ent	gov
25	Subsidies	ent	gov
26	Grants	row	gov
27	Social benefits	hhd-__	gov
28	Other expense	ent	gov

Note: Table 3 to Table 6 describe the Nexus SAM codes.

Table A4. Detailed Classification of the Rest of World Account

Balance of Payments (IMF BOP6)		Nexus SAM Entries*	
Code	Description	Row	Column
BCA	Current account		
BGS	Goods and services		
BG	Goods		
BXG	Credit	c	row
BMG	Debit	row	c
BS	Services		
BXS	Credit	c	row
BXSR	Maintenance and repair services n.i.e.	ctrad	row
BXSTR	Transport	ctran	row
BXSTV	Travel	chotl	row
BXSOCN	Construction services	ccons	row
BXSOIN	Insurance and pension services	cfsrv	row
BXSOFI	Financial services	cfsrv	row
BXSORL	Charges for the use of intellectual property n.i.e.	cbsrv	row
BXSOTC	Telecommunication, computer, and information services	cbsrv	row
BXSOOB	Other business services	cbsrv	row
BXSOPCR	Personal, cultural, and recreational services	cosrv	row
BXSOGGS	Government goods and services n.i.e.	cpadm	row
BMS	Debit	row	c
BMSR	Maintenance and repair services n.i.e.	row	ctrad
BMSTR	Transport	row	ctran
BMSTV	Travel	row	chotl
BMSOCN	Construction services	row	ccons
BMSOIN	Insurance and pension services	row	cfsrv
BMSOFI	Financial services	row	cfsrv
BMSORL	Charges for the use of intellectual property n.i.e.	row	cbsrv
BMSOTC	Telecommunication, computer, and information services	row	cbsrv
BMSOOB	Other business services	row	cbsrv
BMSOPCR	Personal, cultural, and recreational services	row	cosrv
BMSOGG	Government goods and services n.i.e.	row	cpadm
BIP	Primary income		
BXIP	Credit		
BXIPCE	Compensation of employees	flab-__	row
BXIPI	Investment income	fcap-_	row
BXIPO	Other primary income	fcap-_	row
BMIP	Debit		
BMIPCE	Compensation of employees	row	flab-__
BMIPI	Investment income	row	fcap-_
BMIPO	Other primary income	row	fcap-_
BIS	Secondary income		
BXIS	Credit		
BXISG	General government	gov	row
BXISO	Financial and nonfinancial corporations, households, and NPISHs		
BXISOPT	Personal transfers	hhd-__	row
BXISOOT	Other current transfers	ent	row
BMIS	Debit		
BMISG	General government	row	gov
BMISO	Financial and nonfinancial corporations, households, and NPISHs		
BMISOPT	Personal transfers	row	hhd-__
BMISOOT	Other current transfers	row	ent

Note: Table 3 to Table 6 describe the Nexus SAM codes.