A 2005 Social Accounting Matrix (SAM) For Ghana

Ghana Statistical Services (GSS)

and

International Food Policy Research Institute (IFPRI)

under the

Ghana Strategy Support Program (GSSP)

October, 2007

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List of Acronyms

BOG	Bank of Ghana
CEPA	Centre for Policy Analysis
GLSS5	Ghana Living Standards Survey Round Five 2005/06
GSS	Ghana Statistical Services
GSSP	Ghana Strategy Support Program
IFPRI	International Food Policy Research Institute
IMF	International Monetary Fund
MOFA	Ministry of Food and Agriculture
MOFEP	Ministry of Finance and Economic Planning
SAM	Social Accounting Matrix

Acknowledgements

1. Introduction

This paper outlines a 2005 social accounting matrix (SAM) for Ghana. A SAM is a consistent data framework that captures the information contained in the national income and product accounts and the input-output table, as well as the monetary flows between institutions. A SAM is an ex-post accounting framework since, within its square matrix, total receipts must equal total payments for each account contained within the SAM. Since the required data is not drawn from a single source, information from various sources must be compiled and made consistent. This process is valuable since it identifies inconsistencies among Ghana's statistical sources and highlights areas where data reliability is weakest. SAMs are economy-wide databases which are typically used in conjunction with analytical techniques to strengthen the evidence underlying policy decisions. The construction of the 2005 SAM was a collaborative initiative between Ghana Statistical Services (GSS) and the International Food Policy Research Institute (IFPRI).

The SAM outlined in this paper is an updated and extended version of a previous 'provisional' 2004 SAM (GSS, 2006). The update and extension was made possible by the release of new data, including the 2005/06 Ghana Living Standard Survey (GLSS5), the 2003 Industrial Survey, and revised agricultural data from the Ministry of Food and Agriculture (MOFA). The SAM's macroeconomic structure is defined by GSS national accounts (GSS, 2006). Information on government revenues and expenditures was provided by the Ministry of Finance and Economic Planning (MOFEP). The final Ghana SAM presented in this paper thus uses the most recent data to estimate the structure of the Ghanaian economy in 2005. A 13-sector version of the Ghana SAM can be found in the Table A7 of the appendix. A more detailed version that includes 56 sectors of the Ghanaian economy is available as a MS Excel file.

Section 2 reviews the general structure of SAMs. The first step in constructing a SAM is to compile information from various sources into a SAM format or framework. This is known as the 'prior SAM'. The construction of the prior SAM takes place in two stages. A 'macro SAM' is first constructed using aggregate information from national accounts and other macroeconomic databases. This SAM is then disaggregated across sectors, factors and households to derive a more detailed 'micro SAM'. Given the diversity of its data sources, the prior SAM is invariably

inconsistent (i.e., there are inequalities between receipts and payments). Section 3 describes the data sources used to construct the prior SAM.

The second step in constructing a SAM is reconciling receipts and payments so that row and column totals are equal (i.e., 'balancing the SAM'). This is also done in two stages. The reliability of the various data sources is first assessed based on the observed inequalities between row and column accounts. The SAM is then balanced using cross-entropy econometrics. The cross-entropy approach is described in Section 4 together with a description of the constraints imposed during the estimation procedure. The complete national SAM can be found in the annex of this paper. The Microsoft Excel file that accompanies this paper contains the national SAM.

2. The Structure of a Social Accounting Matrix

A SAM is an economy-wide data framework that usually represents the real economy of a single country.[1] More technically, a SAM is a square matrix in which each account is represented by a row and a column. Each cell shows the payment from the account of its column to the account of its row – the incomes of an account appear along the rows and the expenditures along the columns. The underlying principle of double-entry accounting requires that, for each account in the SAM, total revenue (row total) equals total expenditure (column total). Table 1 shows an aggregate SAM (with verbal explanations in place of numbers).

Activities and Commodities

The SAM distinguishes between 'activities' (the entities that carry out production) and 'commodities' (representing markets for goods and non-factor services). SAM flows are valued at producers' prices in the activity accounts and at market prices (including indirect commodity taxes and transactions costs) in the commodity accounts. The commodities are 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 comprising of operating surplus and compensation of employees). In the commodity columns, payments are

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[1] For general discussions of SAMs see Pyatt and Round (1985), and Reinert and Roland-Holst (1997); for perspectives on SAM-based modeling see Pyatt (1988), and Robinson and Roland-Holst (1988).

made to domestic activities, the rest of the world, and various tax accounts (for domestic and import taxes). This treatment provides the data needed to model imports as perfect or imperfect substitutes vis-à-vis domestic production.

Government Income and Payments

The government is disaggregated into a core government account and different tax collection accounts, one for each tax type. This disaggregation is necessary since otherwise the economic interpretation of some payments is often ambiguous. In the SAM, direct payments between the government and other domestic institutions are reserved for transfers. Finally, payments from the government to factors (for the labor services provided by public sector employees) 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.

Domestic Non-Government Institutions

The domestic non-government institutions consist of households and enterprises. The enterprises earn factor incomes (a reflection of ownership of capital and/or land) and may also receive transfers from other institutions. Their incomes are used for corporate taxes, enterprise savings, and transfers to other institutions. Unlike households, enterprises do not demand commodities. It is possible to disaggregate the enterprise sector in a manner that captures differences across enterprises in terms of tax rates, savings rates, and the shares of retained earnings that are received by different household types.

Home and Final Household Consumption

The 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.

Table 1: Basic Structure of the Ghana SAM

	Activities	Commodities	Factors	Households	Government	Taxes	Investment	Rest of the World	Total
Activities		marketed outputs							activity income
Commodities	intermediate inputs	transaction costs		private consumption	government consumption		investment, change in stocks	exports	total demand
Factors	value-added								factor income
Households			factor income to households		transfers to households			transfers to households from RoW	household income
Taxes	activity taxes	sales taxes, import tariffs		direct household taxes					tax income
Government			factor income to government			tax revenue		transfers to government from RoW	government income
Savings				household savings	government savings			foreign savings	savings
Rest of the World		imports			government transfers to RoW				foreign exchange outflow
Total	activity expenditures	total supply	factor expenditures	household expenditures	government expenditures	tax payments	investment	foreign exchange inflow	

3. Constructing the Unbalanced Prior Social Accounting Matrix

The initial task in building a SAM involves compiling data from various sources into the SAM framework (cf. Section 2). This information is drawn from national accounts, household surveys, industrial surveys, foreign trade statistics, government budgets, balance of payments, agricultural production data, and various other publications. This information often uses (i) different disaggregation of sectors, production factors, and socio-economic household groups, (ii) different years and/or base-year prices, and (iii) different data collection and compilation techniques. Consequently, the initial or *prior* SAM inevitably includes imbalances between row and column account totals.

The prior macro SAM is based on national accounts and balance of payments (see Tables A4-A6 in the appendix).[2] The disaggregated SAM is built so that the totals from the macro SAM are preserved (i.e., shares are used from other sources not actual numbers). This section explains how each macro SAM entry is derived and disaggregated to arrive at the prior micro SAM. Table 2 shows the 2005 macro SAM for Ghana. Each entry in the SAM is discussed below. The notation for SAM entries is (row, column) and the values are in billions of 2005 Cedis. The final disaggregated SAM is included at the end of this documentation (cf. Table A8 in the appendix).

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[2] Note that the entries in Table 2 may not exactly match national accounts since the values in the macro SAM are 'post-reconciliation' results (i.e., estimated using cross-entropy outlined in the next section). In other words, national accounts are used to construct the prior macro SAM. Although these values are preserved during the balancing procedure, they deviate marginally from reported values. The differences between actual and estimated values are shown in the tables in the appendix.

Table 2. 2005 Macro SAM for Ghana (Billions of Cedis)

	Activities	Commodities	Factors	Households	Taxes	Government	Investment	Rest of the World	Total
Activities		173,352							173,352
Commodities	84,761	5,693		85,091		15,473	28,207	35,098	254,324
Factors	88,986								88,986
Households			84,875			4,759		2,008	91,642
Taxes	-395	15,312	4,111	3,182					22,210
Government					22,210			5,714	27,924
Savings				3,369		6,776		18,062	28,207
Rest of the World		59,967				915			60,882
Total	173,352	254,324	88,986	91,642	22,210	27,924	28,207	60,882	

Labor is further disaggregated into incomes from wages and self-employed labor. Wage income is split across two education groups: 'Low-educated' labor includes workers with at most primary schooling, while 'high-educated' are workers with more than primary schooling, including those with technical training under Ghana's previous two-track schooling system. Workers' education levels and incomes from wage and self-employment are drawn from the GLSS5. Capital is split into agricultural capital, other capital, and land. Returns to agricultural capital and land are estimated from farm budget data. Returns to capital in industry and mining are derived from the industrial survey.

      i.   (Commodities, Activities)… 84,761

This is the value of intermediate inputs used in the production process. The aggregate value is derived at the sectoral level using the sectoral GDP estimates described above and the updated technical coefficients (see Box 1).

      ii.   (Factors, Activities)… 88,987

This is the value of gross domestic product (GDP) at factor cost or alternatively, total value-added generated by labor and capital. Sectoral GDP is drawn from national accounts (see Table A2 in the appendix) and is disaggregated across 56 sectors (i.e., 26 agriculture, 20 industry, and 10 services) (see Table A1 in the appendix). Sectoral value-added is further divided into the returns to labor, capital and land using updated technical coefficients (see Box 1).

      iii.   (Taxes, Activities)… -395

These are producer taxes paid to the government. Negative entries represent producer subsidies. The -395 bil cedis are subsidies for the cocoa sector.

      iv.   (Activities, Commodities)… 173,352

This is the value of total marketed output. Since all output is assumed to be supplied to markets, this value is equivalent to gross output, where gross output is the sum of intermediate demand and GDP at factor cost. The SAM distinguishes between activities and commodities, and thus facilitate interactions between single/multiple activities and single/multiple commodities.

Therefore the disaggregation of this cell in the National Micro SAM results in single entries along the main diagonal of the activity-commodity sub-matrix (i.e., a one-to-one mapping).

Box 1. Updating the Technical Coefficients in the 2005 SAM

       The 2005 Ghana SAM uses updated technical coefficients that capture the unique production technology of individual sectors in the SAM. In other words, it estimates the cost of different factor and non-factor inputs used in the production process. This is the input matrix in a typical input-output matrix and defines the scale and nature of backward linkages in the SAM. These linkages are expected to change as an economy expands and undergoes structural transformation. In this regard, Ghana's significant growth during the 1990s has led to the emergence of new businesses and production technologies. Accordingly, the technical coefficients used in the 1993 Ghana SAM will undoubtedly have changed during 1993-2005, especially in the industrial sectors. In 2003, Ghana conducted an Industrial Census of both small and large-scale producers in the mining, manufacturing and energy sectors. The census provides new estimates of the labor and capital-intensity of individual sub-sectors and their intermediate input usage.

       For the agricultural sectors, we use farm budget data provided by MOFA to estimate I-O coefficients for crop and livestock production. Farm budget data includes detailed information on labor costs, land rents, intermediate inputs such as fertilizer, chemicals, transport services etc., and estimates on fixed costs by crop and agro-ecological zone. We also use the 2003 Energy Report conducted by the Centre for Policy Analysis (CEPA), to calculate detailed energy use coefficients for three types of fossil fuels, and electricity (CEPA,2003). This information was combined with service sector coefficients from the 1993 SAM to derive the final coefficients used in the 2005 SAM.

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       v.   (Taxes, Commodities)… 15,312

While the macro SAM in Table 2 shows only a single row and column for taxes, this account actually consists of a number of distinct tax accounts. These include specific accounts for direct, indirect and trade taxes as reported in government accounts. The commodity tax entry can

therefore be disaggregated to include indirect taxes (10,304), import tariffs (3,524), and export taxes (1,090). These aggregate values of individual taxes were taken from government accounts (see Table A4 in the appendix). For sales taxes on domestically produced goods, the aggregate tax revenue was disaggregated across commodities using information on the distribution of value-added tax collections and the value of final demand for each commodity (i.e., output minus exports). Sales taxes on imported goods were similarly distributed using commodity import values. Petroleum taxes were assigned to the fuel sector, while the health levy was distributed across all commodities according to final demand (i.e., output minus exports plus imports). The reported export tax only applies to cocoa. Import tariffs were disaggregated using collection data reported in the United Nation's Comtrade database (UNCTAD, 2006).

      vi.   (Rest of World, Commodities)… 59,967

The value of total imports of goods and services was initially taken from national accounts (Table A3 in the appendix). The disaggregation between goods and services was taken from the balance of payments (see Table A6 in the appendix). Goods imports were disaggregated using data from the United Nation's Comtrade database (UNCTAD, 2006) and MOFA (MOFA, 2007), while detailed service imports come from the Bank of Ghana as reported in the balance of payments (IMF, 2005). We use the difference between F.O.B. and C.I.F. import prices to derive the domesic transaction costs related to imported goods (trc in the SAM).

      vii.   (Commodities, Households)… 85,091

The payment from households to commodities is equal to household consumption of marketed production. The total level of private consumption is taken from national accounts (see Table A3 in the appendix). In the national SAM, total private consumption was distributed across all commodities using information from GLSS5 and attributed to rural and urban households using GLSS5. Expenditure on own produced commodities is also included here and amounts to 8,128 billion cedis.

      viii.   (Commodities, Government)… 15,473

The total value of government consumption spending is taken from government accounts (see Table A5 in the appendix). All of government spending is for the purchase of administrative

services, education and health. In this way the government is treated as a sector producing government services as well as a demander of these services. Therefore, there is an inconsistency in the level of government consumption expenditure reported in national and government accounts. The 2005 SAM chooses to preserve the actual expenditures reported by the government.

ix.   (Commodities, Investment)… 28,207

The aggregate value of investment demand is taken from national accounts (see Table A3 in the appendix) and is disaggregated across commodities using demand shares from the 1993 SAM. Note that this aggregate value includes both public and private investment. Public investment is made equal to the reported level of capital expenditures in government accounts (see Table A5 in the appendix).

x.   (Commodities, Rest of World)… 35,098

The aggregate value of export demand is taken from national accounts (see Table A3 in the appendix). The disaggregation between goods and services was taken from the balance of payments (see Table A6 in the appendix). Goods exports were then disaggregated using data from the United Nation's Comtrade database (UNCTAD, 2006), trade data from balance of payments (BOG, 2007), and agricultural trade data (MOFA, 2007), while service exports come from the Bank of Ghana as reported in the IMF Statistical Annex (IMF, 2005).

xi.   (Household, Factors)… 84,875

This is the total factor income that accrues to households, including labor and capital income. By assumption, all capital value-added (i.e., gross operating surplus or profits) is directly paid to households. It is capital income, or alternatively, post-tax profits earned by households according to their capital endowments. Enterprise payments are distributed across all rural and urban households based on information from the GLSS5. The information, which acts as a proxy for the distribution of indirect capital earnings, included profits earned from operation of farm and non-farm enterprises and from the renting of land and equipment. The distribution of labor income across households is determined using household labor income shares as reported in the GLSS5. The labor value-added is equivalent to the compensation paid to labor and the value of

own farm and enterprise profits. Its aggregate value is derived at the sectoral level using the labor-capital shares from the input matrix.

xii. (Households, Households)…333 - 333

The SAM includes inter-household transfers as reported in GLSS5. The survey provides information on transfers received and remitted among all households. These incomes and expenditures from transfers are assigned to the two household groups in the SAM. Netting out incomes and expenditures from transfers for the two household groups results in a 2x2 matrix that maps all net receipts between the households.

xiii. (Taxes, Factors)… 4,111

Total transfers paid by enterprises to the government are taken from government accounts and are equal to non-tax revenues (see Table A4 in the appendix). Also, it includes corporate taxes paid by enterprises to the government and are derived from government accounts (see Table A4 in the appendix).

xiv. (Households, Government)… 4,759

Transfers from the government to households are taken from government accounts (see Table A5 in the appendix). This includes pensions, gratuities, social security, and other benefits and subsidies. They are distributed across all rural and urban households according to the pensions and social grants that households reported receiving in the GLSS5.

xv. (Households, Rest of World)… 2,008

Household income from the rest of the world is taken from GLSS5, which reports cash and in-kind remittances received from abroad.

xvi. (Taxes, Households)… 3,182

The value of direct taxes on households is equivalent to P.A.Y.E. taxes and is taken from government accounts (see Table A4 in the appendix). Tax payments are distributed across the two households using information from GLSS5.

xvii.   (Savings, Households)… 3,369

Rural and urban household savings are initially taken using savings rates from the provisional 2004 SAM, and then scaled, together with household savings, to match total domestic savings. Since savings and investment are equal *ex post*, total domestic savings is estimated by subtracting the current account balance from the balance of payments and the fiscal deficit from government accounts from the total level of investment demand.

xviii.   (Government, Taxes)… 22,210

The tax accounts in the micro SAM are separated into import tariffs, export taxes, sales taxes and direct taxes. Each account sums tax revenue from all sources and then transfers these funds to the government. The entries correspond to government accounts (see Table A4 in the appendix).

xix.   (Government, Rest of World)… 5,714

Government income from the rest of the world is equivalent to the value of foreign grants (see Table A4 in the appendix).

xx.   (Savings, Government)… 6,776

This is the sum of the fiscal deficit from government accounts and the value of public investment or capital expenditure (see Tables A4 and A5 in the appendix).

xxi.   (Rest of World, Government)… 915

Government payments to the rest of the world are equivalent to the value of foreign interest payments (see Table A5 in the appendix).

xxii.   (Savings, Rest of World)… 18,062

This is the current account deficit or the total value of foreign savings. It is derived from the balance of payments (see Table A6 in the appendix).

4. The Balancing Procedure

The previous section outlined the construction of the prior micro SAM. The range of datasets used during this procedure implies that the prior micro SAM will inevitably be unbalanced (i.e.,

row and column totals are unequal). Cross-entropy econometrics was used to reconcile accounts in the 2005 Ghana SAM (see Robinson *et al.*, 2001). This approach begins with the construction of the prior SAM, which as explained in the previous section, used a variety of data from a number of sources of varying quality. This prior SAM provided the initial 'best guess' for the estimation procedure. Additional information is then brought to bear, including knowledge about aggregate values from national accounts and technology coefficients. A balanced Ghana SAM was then estimated by minimizing the entropy 'distance' measure between the final SAM and the initial unbalanced prior SAM, taking into account of all additional information.

Table 3 summarizes the equations defining the SAM estimation procedure. Starting from an initial estimate of the SAM, additional information is imposed in the form of constraints on the estimation. Equation 1 specifies that row sums and corresponding column sums must be equal, which is the defining characteristic for a consistent set of SAM accounts. Equation 2 specifies that sub-accounts of the SAM must equal control totals, and that these totals are assumed to be measured with error (Equation 3). An example would be the estimate of GDP provided by national accounts, which is the total value of the Factor-Activity matrix in the prior SAM. The matrix G is an aggregator matrix, with entries equal to 0 or 1. The index k is general and can include individual cells, column/row sums, and any combination of cells such as macro aggregates. Equation 4 allows for the imposition of information about column coefficients in the SAM rather than cell values, also allowing for error (Equation 5).

The error specification in Equations 2 and 3 describes the errors as a weighted sum of a specified 'support set' (the V parameters). The weights (W) are probabilities to be estimated, starting from a prior on the standard error of measurement of either aggregates of flows (Equation 8) or coefficients (Equation 9). The number of elements in the error support set (w) determines how many moments of the error distribution are to be estimated. The probability weights must be non-negative and sum to one (Equations 8 and 9). The objective function is the cross-entropy distance between the estimated probability weights and their prior for the errors in both coefficients and aggregates of SAM flows. It can be shown that this minimand is uniquely appropriate, and that using any other minimand introduces unwarranted assumptions (or information) about the errors.

Various constraints were imposed on the model according to the perceived reliability of the Ghana data. Certain values that appeared in national accounts were maintained in order to remain consistent with the overall macro structure of the Ghanaian economy. The macro economic aggregates that were maintained in the micro-SAM include: total labor value-added; total capital value-added; household final demand; government spending; investment demand; exports; government borrowing/saving; current account balance; sales taxes; import tariffs; direct taxes on households; and direct taxes on enterprises.

The final and balanced SAM is presented in the appendix (Table A7) and in an Excel file that is attached to this documentation. The SAM in the appendix is aggregated to 13 sectors, two households, and two factors of production, while the full SAM is available online or from the authors upon request.

Table 3. Cross Entropy SAM Estimation Equations

Index	Definition
i, j	row (i) and column (j) entries
k	set of constraints
w	set of weights

Symbol	Definition
$T_{i,j}$	SAM in values
$A_{i,j}$ and $\overline{A_{i,j}}$	SAM in column coefficients
$G_{k,i,j}$	aggregator matrix for each constraint k
γ_k and $\overline{\gamma}_k$	aggregate value for constraint k
e_k	error on each constraint k
$e_{i,j}^A$	error on each cell coefficient
W and $\overline{W}$	weights and prior on error term for each constraint k or cell coefficient i,j
$\overline{V}$	error support set indexed over w for each constraint k or cell coefficient i,j

Equations

$$\sum_i T_{i,j} = \sum_j T_{i,j} \tag{1}$$

$$\sum_i \sum_j G_{k,i,j} \cdot T_{i,j} = \gamma_k \tag{2}$$

$$\gamma_k = \overline{\gamma}_k + e_k \tag{3}$$

$$A_{i,j} = \frac{T_{i,j}}{\sum_i T_{i,j}} \quad \text{with} \quad \sum_i A_{i,j} = 1 \, \forall \, i \tag{4}$$

$$A_{i,j} = \overline{A}_{i,j} + e_{i,j}^A \text{ for some i, j} \tag{5}$$

$$e_k = \sum_w W_{k,w} \cdot \overline{V}_{k,w} \tag{6}$$

$$e_{i,j}^A = \sum_w W_{i,j,w}^A \cdot \overline{V}_{i,j,w}^A \tag{7}$$

$$\sum_w W_{k,w} = 1 \quad \text{with} \quad 0 \le W_{k,w} \le 1 \tag{8}$$

$$\sum_w W_{i,j,w}^A = 1 \quad \text{with} \quad 0 \le W_{i,j,w}^A \le 1 \tag{9}$$

$$\min \left[\sum_k \sum_w W_{k,w} \cdot \left(\ln W_{k,w} - \ln \overline{W}_{k,w} \right) + \sum_i \sum_j \sum_w W_{i,j,w}^A \left(\ln W_{i,j,w}^A - \ln \overline{W}_{i,j,w}^A \right) \right] \tag{10}$$

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Appendix: Supplementary Tables

Table A1. Micro SAM Accounts (Detailed national SAM and 13-sector aggregate SAM)

Category	Account (in detailed SAM)	Description	Account (in 13-sector SAM)	Description
Activities	amaiz	Maize	aagr	Agriculture & livestock
	arice	Rice		
	asorg	Sorghum and Millet		
	acass	Cassava		
	ayams	Yam		
	acyam	Cocoyam		
	acpea	Cowpea		
	asbea	Soybean		
	apoil	Palm oil		
	agnut	Groundnuts		
	aonut	Other nuts		
	afrud	Domestic fruits		
	afrue	Export fruits		
	avegd	Domestic vegetables		
	avege	Export vegetables		
	aplan	Plantain		
	acoco	Cocoa	acoco	Cocoa
	aocro	Other crops	aagr	Agriculture & livestock
	aoexp	Other export crops		
	achik	Chicken broiler		
	aeggs	Eggs		
	abeef	Beef		
	agoat	Goat and sheep		
	aoliv	Other livestock		
	afore	Forestry	afore	Forestry
	afish	Fishery	afish	Fishery
	amine	Mining	amine	Mining
	aforf	Formal food processing	amanu	Manufacturing & Industry
	alocf	Local food processing		
	acopr	Cocoa processing		
	adair	Dairy products		
	ameat	Meat processing		
	atext	Textiles		
	aclth	Clothing		
	afoot	Footwear		
	awood	Wood products		
	apapr	Pulp and paper		
	apetr	Petrol		
	adies	Diesel		
	afuel	Other fuel		
	achem	Chemicals		
	ametl	Metals		
	acapt	Capital goods (machinery etc)		

Table A1. Micro SAM Accounts - continued

Category	Account (in detailed SAM)	Description	Account (in 13-sector SAM)	Description
	acons	Construction	acons	Construction
	awatr	Water	awatr	Water & electricity
	aelec	Electricity		
	atrad	Trade	atrad	Trade, restaurants, hotels
	aosrv	Other services		
	atran	Transport	atran	Transport & communication
	acomm	Communication		
	abusi	Business services	abusi	Business, real estate
	areal	Real estate		
	acsrv	Community services	acsrv	Community services
	aadmn	Public administration	apubl	Public services
	aeduc	Education		
	aheal	Health		
Commodities	cmaiz	Maize	cagr	Agriculture & livestock
	crice	Rice		
	csorg	Sorghum and millet		
	cogrn	Other grains		
	ccass	Cassava		
	cyams	Yam		
	ccyam	Cocoyam		
	ccpea	Cowpea		
	csbea	Soyabean		
	cpoil	Palm oil		
	cgnut	Groundnuts		
	conut	Other nuts		
	cfrud	Domestic fruits		
	cfrue	Export fruits		
	cvegd	Domestic vegetables		
	cvege	Export vegetables		
	cplan	Plantain		
	ccoco	Cocoa	ccoco	Cocoa
	cocro	Other crops	cagr	Agriculture & livestock
	coexp	Other export crops		
	cchik	Chicken broiler		
	ceggs	Eggs		
	cbeef	Beef		
	cgoat	Goat and sheep		
	coliv	Other livestock		
	cfore	Forestry	cfore	Forestry
	cfish	Fishery	cfish	Fishery
	cmine	Mining	cmine	Mining
	cforf	Formal food processing	cmanu	Manufacturing & Industry
	clocf	Local food processing		
	ccopr	Cocoa processing		
	cdair	Dairy products		

Table A1. Micro SAM Accounts - continued

Category	Account (in detailed SAM)	Description	Account (in 13-sector SAM)	Description
	cmeat	Meat processing		
	ctext	Textiles		
	cclth	Clothing		
	cfoot	Footwear		
	cwood	Wood products		
	cpapr	Pulp and paper		
	coils	Oil		
	cpetr	Petrol		
	cdies	Diesel		
	cfuel	Other fuel		
	cfert	Fertilizer		
	cchem	Chemicals		
	cmetl	Metals		
	ccapt	Capital goods		
	ccons	Construction	ccons	Construction
	cwatr	Water		Water & electricity
	celec	Electricity	celec	
	ctrad	Trade	ctrad	Trade, restaurants, hotels
	cosrv	Other services		
	ctran	Transport	ctran	Transport & communication
	ccomm	Communication		
	cbusi	Business services	cbusi	Business, real estate
	creal	Real estate		
	ccsrv	Community services	ccsrv	Community services
	cadmn	Public administration	cpubs	Public services
	ceduc	Education		
	cheal	Health		
Factors	labself	Self-employed labor	labself	Labor
	labunsk	Unskilled labor		
	labskll	Skilled labor		
	capa	Agriculture-specific capital	cap	Capital
	capn	Other capital		
	land	Land		
Households	hrur	Rural households	hhd	Households
	hurb	Urban households	hurb	
Government	gov	Government	gov	Government
Taxes	dtax	Direct taxes	tax	Taxes
	stax	Sales and other indirect taxes		
	mtax	Import tariffs		
	etax	Export taxes		
	s-i	Savings and investment	s-i	Savings and investment
	row	Rest of world	row	Rest of world

Table A2. Gross Domestic Product (GDP) by Industry, 2005

	Billions of Cedis		Share of GDP (%)	
	Actual	Estimate	Actual	Estimate
Agriculture	**36,427**	**34,413**	**40.9**	**38.7**
Agriculture and livestock	20,831	22,071	23.4	24.8
Cocoa production and marketing	7,864	5,573	8.8	6.3
Forestry and logging	3,795	4,845	4.3	5.4
Fishing	3,937	1,924	4.4	2.2
Industry	**24,437**	**24,832**	**27.5**	**27.9**
Mining and quarrying	4,472	4,437	5.0	5.0
Manufacturing	8,418	8,444	9.5	9.5
Electricity and water	2,669	2,522	3.0	2.8
Construction	8,877	9,428	10.0	10.6
Services	**28,123**	**29,742**	**31.6**	**33.4**
Transport, storage and communication	4,369	4,313	4.9	4.8
Wholesale and retail trade, restaurants and hotels	6,937	5,427	7.8	6.1
Finance, insurance, real estate, and business services	4,230	3,630	4.8	4.1
Government services	9,319	11,395	10.5	12.8
Community and other services	3,268	4,977	3.7	5.6
GDP at factor cost	**88,987**	**88,986**	**100.0**	**100.0**
Indirect taxes	14,917	10,304		
GDP at market prices	**103,904**	**99,290**		

Source: National Accounts (Ghana Statistical Services) and 2005 SAM estimate after cross-entropy.

Table A3. Gross Domestic Product (GDP) by Expenditure Category, 2005

	Billions of Cedis		Share of GDP (%)	
	Actual	Estimate	Actual	Estimate
Consumption expenditure	**93,922**	**100,565**	**96.6**	**96.8**
Central Government	14,889	15,473	15.3	14.9
Other sectors	79,033	85,091	81.3	81.9
Gross capital formation	**28,208**	**28,207**	**29.0**	**27.1**
Gross fixed capital formation	28,208	28,207	29.0	27.1
Changes in inventories	0	0	0.0	0.0
Foreign balance	**-24,869**	**-24,869**	**-25.6**	**-23.9**
Exports of goods and services	35,098	35,098	36.1	33.8
Imports of goods and services	59,967	59,967	61.7	57.7
GDP at market prices	**97,261**	**103,903**	**100.0**	**100.0**

Source: National Accounts (Ghana Statistical Services) and 2005 SAM estimate after cross-entropy.

Table A4. Central Government Revenues and Grants, 2005

	Billions of Cedis	
	Actual	Estimate
Total revenue and grants	**27,925**	**27,924**
Tax revenue	**21,152**	**21,151**
Direct taxes	**6,235**	**6,235**
Individual	3,182	3,182
Corporate and other taxes	3,053	3,053
Indirect taxes	**10,304**	**10,304**
Sales tax	5,125	
Sales tax on domestic goods	1,804	
Sales tax on imported goods	3,321	
Petroleum tax	3,595	
Other indirect tax	662	
Health levy	921	
Trade taxes	**4,614**	**4,613**
Import taxes	3,524	3,524
Export (cocoa)	1,090	1,089
Non-tax revenue	**1,059**	**1,059**
Foreign grants	**5,714**	**5,714**

Source: Government Accounts (Ministry of Finance) and 2005 SAM estimate after cross-entropy.
Note: Indirect taxes are assigned to specific commodities in the SAM (e.g. petroleum taxes) and are then combined to form an aggregate indirect tax.

Table A5. Central Government Expenditures, 2005

	Billions of Cedis	
	Actual	Estimate
Total expenditure	**33,583**	**33,483**
Current expenditure	**21,148**	**20,845**
Non-interest expenditure	17,446	17,731
Wages and salaries	9,179	9,196
Goods and services	3,507	3,776
Transfers to households	4,759	4,759
Interest	**3,703**	**3,114**
Domestic	2,788	2,199
External	915	915
Capital expenditure (investment)	**12,435**	**12,638**
Domestic	5,870	5,861
Foreign	6,564	6,776
Savings	**-5,658**	**-5,559**

Source: Government Accounts (Ministry of Finance) and 2005 SAM estimate after cross-entropy.

Table A6. Balance of Payments, 2005

	Billions of Cedis	
	Actual	Estimate
Current account balance	-19,075	-21,040
Trade	-26,225	-28,762
Net goods	-23,094	-24,209
Exports	25,427	27,606
Imports	48,522	51,815
Net services	-3,130	-4,553
Transfers	7,149	7,722
Private transfers	2,005	2,008
Official transfers	5,144	5,714

Source: Bank of Ghana and 2005 SAM estimate after cross-entropy.
Note: Private transfers are taken from GLSS5.

Table A7. Aggregate 2005 Ghana SAM (13 sectors)

	aagr	acoco	afore	afish	amine	amanu	aelec	acons	atran	atrad	abusi	apubs	acsrv
aagr													
acoco													
afore													
afish													
amine													
amanu													
aelec													
acons													
atran													
atrad													
abusi													
apubs													
acsrv													
cagr	3,701					3,337				691			
ccoco		402				931							
cfore	11					1,314							
cfish	53					315				151			
cmine						72		246					
cmanu	1,585	1,089	773	1,283	2,166	9,756	4,037	3,222	9,644	3,109	438	356	154
celec	96		123	0	598	2,275	255	1	45	261	58	40	74
ccons								323		81	196		
ctran	1,652	335	412	130	154	252		482	380	4,790	407	918	290
ctrad	4,113	517	545	387	202	3,977				1,880			
cbusi			251	139	305				662	652	589		
cpubs												5,043	
ccsrv	22												2,011
trc													
lab	14,910	4,715	3,674	1,634	1,447	5,599	1,118	6,169	2,747	4,317	1,914	11,647	1,142
cap	7,161	858	1,171	289	2,990	2,846	1,404	3,259	1,566	1,110	1,716	2,869	714
hrur													
hurb													
gov													
dtax													
stax													
mtax													
etax		-395											
s-i													
row													
total	33,303	7,521	6,950	3,864	7,863	30,674	7,137	13,379	15,125	16,961	5,317	20,873	4,385

Table A7. Aggregate 2005 Ghana SAM (13 sectors) - continued

	cagr	ccoco	cfore	cfish	cmine	cmanu	celec	ccons	ctran	ctrad	cbusi	cpubs	ccsrv
aagr	33,303												
acoco		7,521											
afore			6,950										
afish				3,864									
amine					7,863								
amanu						30,674							
aelec							7,137						
acons								13,379					
atran									15,125				
atrad										16,961			
abusi											5,317		
apubs												20,873	
acsrv													4,385
cagr													
ccoco													
cfore													
cfish													
cmine													
cmanu													
celec													
ccons													
ctran													
ctrad													
cbusi													
cpubs													
ccsrv													
trc	205					2,642							
lab													
cap													
hrur													
hurb													
gov													
dtax													
stax						7,885	74	19	343	1,755	228		
mtax	588					2,936							
etax		1,484											
s-i													
row	3,995					52,968	65			2,939			
total	38,091	9,005	6,950	3,864	7,863	97,104	7,276	13,399	15,468	21,655	5,545	20,873	4,385

Table A7. Aggregate 2005 Ghana SAM (13 sectors) - continued\

	lab	cap	hrur	hurb	gov	dtax	stax	mtax	etax	s-i	row	total
aagr												33,303
acoco												7,521
afore												6,950
afish												3,864
amine												7,863
amanu												30,674
aelec												7,137
acons												13,379
atran												15,125
atrad												16,961
abusi												5,317
apubs												20,873
acsrv												4,385
cagr			17,087	11,933							1,340	38,091
ccoco											7,672	9,005
cfore											5,625	6,950
cfish			1,246	1,172							927	3,864
cmine											7,544	7,863
cmanu			17,972	21,616						15,408	4,497	97,104
celec			1,122	2,327								7,276
ccons										12,799		13,399
ctran			940	2,315								15,468
ctrad			606	1,099							7,492	21,655
cbusi			865	2,082								5,545
cpubs			169	187	15,473							20,873
ccsrv			830	1,522								4,385
trc												2,847
lab												61,033
cap												27,953
hrur	28,223	13,502		-333	2,283						410	44,085
hurb	32,810	10,340	333	0	2,476						1,598	47,557
gov						7,293	10,304	3,524	1,089		5,714	27,924
dtax		4,111	807	2,375								7,293
stax												10,304
mtax												3,524
etax												1,089
s-i			2,108	1,261	6,776						18,062	28,207
row					915							60,882
total	61,033	27,953	44,085	47,557	27,924	7,293	10,304	3,524	1,089	28,207	60,882	