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Construction and Updating of a Ugandan CGE Database

by

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The Centre of Policy Studies (COPS) is a research centre at Monash University devoted to economy-wide modelling of economic policy issues.

Construction and updating of a Ugandan CGE database

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This paper documents (1) the structure of a CGE database; (2) the data manipulation steps in creating such a database from published data; (3) updating a SAM; and (4) describe features of the updated SAM. The database is constructed for a Ugandan CGE model.[1] The building blocks for creating a database for a CGE model are official data from an Input/output (IO) table, or from a Supply Use Table (SUT), or from a SAM. Often the structure of the published data is not in the required format of a CGE database, and so a major task is to transform the official data into a form required by a CGE database. The first step in this task is typically a review of the primary source of data. We then proceed by identifying any implausible, unusual and negative values. We adjust these elements and rebalance the database to ensure that the balancing conditions hold. We then proceed to create the matrices required by the CGE model. Typically we create (1) a source dimension for all user-specific matrices, (2) user and source-specific margin matrices, (3) user and source-specific tax matrices and (4) industry-specific land rentals. It is likely that as we adjust data and create the required matrices, we violate the balancing conditions. Therefore in each step in the database construction stage, we check the balancing conditions and when appropriate we rebalance the database to ensure that the balancing conditions hold. Having constructed the 2002 database that conforms to the CGE structure, we update the database to 2009. We then proceed to create an additional sector namely, *RawOil* sector. In terms of the database, we create an additional industry and an additional commodity. Our final task is to create, based on the 2009 database, an updated SAM. The CGE database does not provide information on transfers between economic agents. We therefore adjust the transfer elements based on shares estimated for 2002.

Key words: CGE modelling, database construction, Uganda,
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LIST OF ABBREVIATIONS

AD	Aggregate Demand
AS	Aggregate Supply
CGE	Computable General Equilibrium
COE	Compensation of Employees
GOS	Gross operating surplus
GTAP	Global Trade Analysis Project
IO	Input-Output
LES	Linear Expenditure System
MOFPED	Ministry of Finance Planning and Economic Development
ROW	Rest of the world
SAM	Social Accounting Matrix
ST	Supply Table
SUT	Supply Use Table
UBOS	Ugandan Bureau of Statistics
UgAGE	Ugandan Applied General Equilibrium model
UT	Use Table

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1. INTRODUCTION

The aim of this paper is to document the steps taken in constructing a database for a Ugandan CGE model. The building blocks for creating a database for a CGE model are official data from an Input/output (IO) table, or from a Supply Use Table (SUT), or from a SAM.[2] Often the structure of the published data is not in the required format of a CGE database, and so a major task is to transform the official data into a form required by a CGE database. The first step in this task is typically a review of the primary source of data. For Uganda, the primary data source is a SUT for 2002. We check the balancing conditions. The conditions include (1) confirming whether commodity-specific demand is equal to supply valued at purchasers' price; (2) industry-specific costs are equal to industry output; (3) domestic commodity supply is equal domestic use valued at basic price and (4) GDP from the income and expenditure side is equal. We then proceed by identifying any implausible, unusual and negative values. We adjust these elements and rebalance the database to ensure that the balancing conditions hold. We then proceed to create the matrices required by the CGE model. Typically we create (1) a source dimension for all user-specific matrices, (2) user and source-specific margin matrices, (3) user and source-specific tax matrices and (4) industry-specific land rentals. It is likely that as we adjust data and create the required matrices, we violate the balancing conditions. Therefore in each step in the database construction stage, we check the balancing conditions and when appropriate we rebalance the database to ensure that the balancing conditions hold. In this paper we begin to describe the structure of the CGE database followed by a description of the primary data made available to us. We clearly note the differences between the required database and the data. Thereafter we proceed to transform the data (i.e. SUT) into the required database format.

For this study we require a dataset for the latest possible year, 2009. Thus, having constructed the 2002 database that conforms to the CGE structure, we update the database to 2009. We then proceed to create an additional sector, namely a *RawOil* sector. In terms of the database, we create an additional industry and an additional commodity.[3] Our final task is to create, based on the 2009 database, an updated SAM. The CGE database does not provide information on transfers between economic

[2] For a review of IO Tables, we recommend the United Nations *Handbook of Input-Output Table Compilation and Analysis, 1999*. For the structure and compilation of the latest Ugandan SUT and SAM, we refer to reader to the reports by Alarcon *et al.*, (2006) and IMF (2005).

[3] We only create 1 additional commodity, *Oil*, because the commodity Petroleum is already included in the database.

agents. We therefore adjust the transfer elements based on shares estimated for 2002. As noted above, once the official 2009/10 SAM is finalised we will use it to create a new CGE database.

The remainder of this paper is set out as follows; Section 2 describes the structure of UgAGE's input-output (IO) database. The official data sources that underlie the model's 2002 IO database are reviewed in Section 3. Section 4 describes the steps taken to transform the official data into the correct database format, while Section 5 describes the process by which we update the database from 2002 to 2009. The creation of the Oil and Refinery sectors is explained in Section 6. In Section 7, we present a summary of selected results while Section 8 describes the SAM which underlies the updated UgAGE database.

2. CGE database structure

2.1. Basic structure of the input-output database

The structure of the model's IO database is illustrated in Figure 1. More detail is given in Table 1. The Ugandan model requires a database with separate matrices for basic, tax and margin flows for both domestic and imported sources to domestic and foreign users, as well as matrices for the factors of production.

The first three rows shown in Figure 1 form the absorption matrix. In the absorption matrix, users are identified in the column headings. Users are denoted by a number:

1. domestic producers divided into i industries;
2. investors divided into i industries;
3. a single representative household;
4. an aggregate foreign purchaser of exports;
5. government demand; and
6. changes in inventories.

The matrices in the first row, i.e. V1BAS to V6BAS, represent direct flows of commodities, from all sources, to users valued at basic prices. The first matrix, V1BAS, can be interpreted as the direct flow of commodity c, from source s, used by industry i as an input into current production. V2BAS shows the direct flow of commodity c, from source s, used by industry i as an input to capital formation. V3BAS shows the flow of commodity c from source s that is consumed by a representative household. V4BAS is a column vector and shows the flow of

commodity *c* to exports. V5BAS and V6BAS show the flow of commodity *c* from source *s* to the government and change in inventories respectively. In the input-output database, no imported commodity is exported without being processed in a domestic industry. Hence, V4BAS has no import dimension.

The matrices contain only direct flows valued at basic prices. The basic price of a domestic commodity is the price the producer receives and excludes margin costs and sales taxes. The basic price of an imported commodity is the duty-paid price, i.e. the price at the port of entry just after the commodity has cleared customs. It excludes all sales taxes and margin costs but includes tariffs. We assume that the

basic price is the same for all users. The row sums are the total direct usage of a commodity from all sources. It should be noted that all the values, with the exception of V6BAS, are positive. V6BAS records the *change in inventories,* and thus can be positive or negative.

Figure 1. The Ugandan input-output database

			Absorption Matrix					
			1	2	3	4	5	6
			Producers	Investors	Household	Export	Government	Change in Inventories
		Size	← I →	← I →	← 1 →	← 1 →	← 1 →	← 1 →
1	Basic Flows	↑ C×S ↓	V1BAS	V2BAS	V3BAS	V4BAS	V5BAS	V6BAS
2	Margins	↑ C×S×M ↓	V1MAR	V2MAR	V3MAR	V4MAR	V5MAR	n/a
3	Taxes	↑ C×S ↓	V1TAX	V2TAX	V3TAX	V4TAX	V5TAX	n/a
4	Labour	↑ CLS ↓	V1LAB					
5	Capital	↑ 1 ↓	V1CAP					
6	Land	↑ 1 ↓	V1LND					
7	Production Taxes	↑ 1 ↓	V1PTX					
8	Other Costs tickets	↑ 1 ↓	V1OCT					

C = Number of commodities
I = Number of industries
S = Sources (domestic, imported)
OCC = Number of occupation types
M = Number of commodities used as margins

	Joint production matrix
Size	← I →
↑ C ↓	MAKE

	Tariffs
Size	← 1 →
↑ C ↓	V0TAR

Adapted from Horridge, 2005:9

V1MAR to V5MAR, represents the value of commodities used as margins to facilitate the basic flows i.e. V1BAS to V5BAS. UgAGE includes 3 margin commodities, road

freight (*TransGoodRd)*, rail freight (*TransRail)* and retail and wholesale trade services (*Trade)*. It is assumed that all margins are produced domestically. V1MAR is a 4 dimensional matrix and shows the cost of margin service m used to facilitate the flow of commodity c, from source s to industry i for use in current production. V2MAR is a similar dimensioned matrix showing the cost of margin service m used to facilitate the flow of commodity c, from source s to industry i for used in

investment. V3MAR and V5MAR are 3 dimensional and show the cost of margin service m that facilitates the flow of commodity c from source s to the representative household and the government respectively. V4MAR is a 2 dimensional matrix and shows the cost of margin service m that facilitates commodities flows to exporters. There are flows that do not require any margins and therefore the values in these matrices are zero. This is mainly for services and inventories (unsold commodities) (UN, 1993:33).

The third row in Figure 1 represents the tax matrices; V1TAX to V5TAX. These matrices show the taxes paid in the delivery of domestic and imported commodities to the different users. Taxes will have a positive value and subsidies will be negative. For example, a positive element in V1TAX and V2TAX can be interpreted as the tax associated with the delivery of commodity c from source s used by industry i as an input into current production and capital formation respectively. A negative value is interpreted as a subsidy paid on commodity c, from source s, used by industry i V3TAX and V5TAX are interpreted as the taxes associated with the delivery of commodity c from source s used by households and government. V4TAX is associated with the taxes paid for the delivery of commodities to exporters. Taxes are not paid on inventories and therefore there is no V6TAX matrix. It should be noted that tax rates may differ between users and sources.

Rows 4 to 6 contain matrices that provide a breakdown of the cost of primary factors used by industry in current production. These matrices include the inputs of three factors of production: class-specific labour (V1LAB), fixed capital (V1CAP) and agricultural land (V1LND). For example, V1LAB shows the purchase of labour of class (or occupation) o by industry i that is used as an input into current production. V1CAP contains the rental value of each industry's fixed capital and V1LND shows the rental value of agricultural land used by each industry. Industry also pays production taxes such as business licenses, payroll taxes and stamp duties (UN, 1999:26). These taxes are contained in V1PTX in row 7. Other cost tickets are contained in matrix V1OCT in row 8. This is a useful device that allows for cost of holding liquidity, cost of

holding inventories and other miscellaneous production costs (Dixon *et al.*, 1982:70). The database shows that labour, capital, land, production costs and other cost tickets are only used in current production and therefore these matrices are absent from entries in the capital formation, household consumption, exports, government and change in inventories columns.

Table 1. Contents of the Ugandan Input-Output data files

TABLO name	Name	Dimension
1. Sets		
COM	Set COM commodities	83 Commodities
IND	Set IND industries	83 Industries
SRC	Set SRC sources	2 Sources
MAR	Set MAR margin commodities	4 Margin
OCC	Set OCC occupations	16 Occupations
2. Coefficients in the core database		
V1BAS	Intermediate basic	COM*SRC*IND
V2BAS	Investment basic	COM*SRC*IND
V3BAS	Household basic	COM*SRC
V4BAS	Exports basic	COM
V5BAS	Government basic	COM*SRC
V6BAS	Inventories basic	COM*SRC
V1MAR	Intermediate margins	COM*SRC*IND*MAR
V2MAR	Investment margins	COM*SRC*IND*MAR
V3MAR	Household margins	COM*SRC*MAR
V4MAR	Export margins	COM*MAR
V5MAR	Government margins	COM*SRC*MAR
V1TAX	Intermediate tax	COM*SRC*IND
V2TAX	Investment tax	COM*SRC*IND
V3TAX	Household tax	COM*SRC
V4TAX	Export tax	COM
V5TAX	Government tax	COM*SRC
V1CAP	Capital Rentals	IND
V1LAB	Labour	IND*OCC
V1LND	Land Rentals	IND
V1PTX	Production tax	IND
V1OCT	Other costs	IND
MAKE	Multi-product matrix	COM*IND
V0TAR	Tariff revenue	COM

The satellite matrices illustrate the multi-production matrix (MAKE) and tariff matrix. Each element in the MAKE matrix refers to the basic value of commodity c produced by industry i. In principal there are two different types of MAKE matrices. The first is where the entries in the matrix are diagonal i.e. an industry can only produce one commodity and a commodity can only be produced by one industry. All non-diagonal values are zero. The second type of matrix is a joint production matrix where an industry can produce more than one commodity and a commodity can be produced by more than one industry. Therefore, a number of the off-diagonal values are non-zero. UgAGE includes the second type of MAKE matrix.

The implication of a joint production matrix is that a producer will now choose to produce a combination of output commodities that will maximise their revenue. For example, as the market price of commodity 1 increase relative to the commodity 2,

producers will shift their resource in producing more of commodity 1 and away from commodity 2.

The final matrix, Tariffs (V0TAR), contains tariff revenue by imported commodity. The tariff matrix is separate from the absorption matrix because the values of tariff revenues are already included in the basic price of imports, i.e. they are included in the basic flows in row 1. It enables calculation of ad valorem rates as the ratio between tax revenues and the relevant basic flows of commodities on which the taxes are levied.

2.2. Requirements for an IO database

The following *basic conditions* must be satisfied by the database:

- *non-negativity*: except matrices relating to taxes and the change in inventories, matrices should not contain negative numbers. Note that in some years some industries might experience negative profit, which would be revealed in the official statistics as a negative entry in the cost-of-capital vector (V1CAP). Negative profit, however, is not allowed in the modelling.
- *zero-pure profit*: for each industry the value of output must equal the total production cost. That is, the column sums of the MAKE matrix should equal the sums corresponding to industry (producer) demand for inputs into current production. This is because the columns of the Absorption matrix recognise all input costs that form part of production costs at basic price, including the profits earned by owners of the fixed factors employed in each industry.
- *market clearing*: the value of output of domestically produced commodities must equal the total value of the demand for these commodities. That is, for all non-margin commodities the sum of all inputs used in an industry should equal the sum of all basic values of the direct use of the corresponding commodities. For margin commodities the sum of all inputs to the production of margin m should equal the sum of all direct usage of m plus the sum of all usage of m as a margin. This reflects two features of the database: firstly, the valuation basis of the MAKE matrix and the absorption

  matrix are the same, i.e. basic price; and secondly, the columns of the absorption matrix identify all possible uses of domestically produced commodities; and
- *GDP identity*: by definition, total value added plus indirect taxes (GDP from the income side) must equal the value of final demand at market prices (GDP from the expenditure side).

From a practical and modelling point of view, the following *additional conditions* should also hold:

- Tax revenues and associated tax rates must reflect the actual taxation law and actual collection situation in the economy. The tax data is implied by the data in the tax matrix and the use matrix. We would expect the tax rates on any commodity to be equal or lower then the rates stipulated by the tax legislation. The tax rates can be lower than the official rates if the compliance rate is less than 100%. We further expect tax rates on the same commodity not to differ too much between users of the commodity;
- Margin rates on commodity flows should be plausible. For example, it is likely that the rates of trade margin on commodities sold to producers are not higher than those on the same commodities sold to households. This is because the former is often traded via wholesale trade, whereas the latter is often traded via retail trade. Transport margin rates on bulky items (such as mining products) are expected to be higher than those on lighter items (such as consumer goods);
- Factor shares should not differ too much among sectors with similar activities, e.g. between cultivation industries, or between food processing industries.

3. DATA SOURCES

3.1. Note on the valuation of the tables

The 1993 SNA recommends three ways to value production (output) of goods and services (UN, 1999:55). These are:

Basic price: "The basic price is the amount receivable by the producer from the purchaser for a unit of a good or service produced as output, minus any tax payable (i.e. VAT and excise duties), and plus any subsidy receivable , on that unit as a consequence of its production or sale. Basic prices exclude any transport charges involved separately by the producer."

Producers' price: "The producers' price is the amount receivable by the producer from the purchaser for a unit of a good or service produced as output, minus VAT,

or similar deductible tax, invoiced to the producer. It excludes any transport charges invoiced separately by the producer."

Purchasers' price: "The purchasers' price is the amount paid by the producer, excluding any deductible VAT or similar deductible tax, in order to take delivery of a unit of good and service at the time and place required by the purchaser. The purchasers' price includes any transport charges paid separately by the purchaser to take delivery at the required time and place."

3.2. Basic structure of the Supply-Use Tables for Uganda (2002)

In this section we briefly describe the SUT, published for 2002, provided to us.[4] We chose the SUT as our primary source for two reasons:

- The Supply Table (ST) contains information on the commodity-specific supply from domestic and imported sources whereas the Use Table (UT) shows the final users of these commodities;
- the ST includes columns indicating the commodity-specific margins and taxes. With the UT valued at purchasers' price it allows us to create the basic-, tax- and margin matrices (rows 1 – 3 in Figure 1).

3.2.1. The Supply Table (ST)

Figure 2 is a simplified illustration of the Supply table. The first column lists the commodities as they appear in the ST. Column 2 lists the total supply of all commodities at purchasers' price. In theory, the values in this column should be equal to the commodity-specific use, valued at purchasers' price. Column 3 lists the

value of commodity-specific imports and Column 4 lists the commodity-specific cif/fob adjustments. Columns 6 and 7 list the commodity-specific taxes, that is import duties and VAT payments. Column 8 lists the commodity-specific trade and transport margins. Column 9, the MAKE matrix, shows the domestic production of 142 commodities (rows) by 241 domestic industries (columns) at basic price. The MAKE matrix is not diagonal, implying that an industry may produce more than one product and a product may be produced by more than one industry. Column 5 shows the value of the domestic supply of commodities valued at basic price, that is, the MAKE matrix summed over industries ($\text{Column } 5 = \sum_{i \in IND} MAKE_{(c,i)}$).

[4] We chose the SUT because it is valued at purchasers' price whereas the SAM is valued at producers' price.

Figure 2. The format of the published Supply table

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Size	1	1	1	1	1	1	1	IND 1..241
COM 1 . . 142	**Total supply at purchasers price**	Imports of goods and services	Cif/Fob Adjustments	**Total domestic supply**	Import duties/VAT on imports	VAT – domestic (VAT)	Trade and transport margins	MAKE

Total supply valued at basic prices is calculated by adding the domestically produced commodities (Column 5) with the imported commodities after taking into account the cif/fob adjustment (Column 3 and 4). Total supply valued at basic price is transformed into producers' price by adding the taxes on commodities (Columns 6 and 7). By adding Column 8 (trade and transport margins), total supply at purchasers' prices is calculated. In principle the total supply of commodities at purchases' price (Column 2) is equal to the total use at purchases' price.

3.2.2. Use Table (UT)

The Use table, illustrated in Figure 3, contains information on the value of commodities purchased by different users.[5] Commodities may be used for intermediate consumption by industries or final demand. For example, the intermediate use matrix, V1PUR, is a 142*241 matrix and records the flow of commodity *c* used by industry *i* in current production. The final demand vectors are made up of investors (V2PUR), private household (V3PUR) and public consumption (V5PUR) and change in inventories (V6PUR). Each vector is disaggregated by 142 commodities and valued at purchasers' prices.

Figure 3. The format of the published Use table

		Size	(1) Producers	(2) Investors	(3) House-holds	(4) Exports	(5) Government	(6) Inventories
		IND 1 … 241	1	1	1	1	1	1
(1)	Flows	COM 1 . . 142	V1PUR_SUT	V2PUR_ SUT	V3PUR_ SUT	V4PUR_ SUT	V5PUR_SUT	V6PUR_ SUT
(2)	COE	1	COE_SUT					
(3)	Net taxes on production	1	PTX_SUT					
(4)	Consumption of fixed capital	1	DEPR_SUT					
(5)	Operating surplus/mixed income m, gross	1	OS_SUT					

[5] The users identified in the Uganda model are listed in Section 2.1.

The components of value added include, compensation of employees, COE_SUT and records the value of each industry's wagebill, NOS_SUT records the operating surplus/mixed income of each industry, DEPR_SUT records the value of depreciation on the capital stock of each industry and PTX_SUT records the aggregate value of all production taxes paid by each industry. Each row is disaggregated by 241 industries.

The published SUT tables are converted into the required database format in 11 steps. Some steps required additional data. Apart from the obvious gap between the format of the data in Figures 2 and 3 and that required by Figures 1, we identified many apparently implausible data items in the SUT. We discuss these issues in the relevant sections in this paper.

3.3. Other data sources

In addition to the data provided in the SUT, we also used the following data sources to build the UgAGE database:

1. *The Social Accounting Matrix for the year 2002 for Uganda*. The SAM was compiled from the SUT for 2002 and is valued at producer's price. However, it includes labour payments by 16 class dimensions and includes mixed income by industry. We adopt the factor payment from the SAM because it contains more detail in terms of factor payments.

2. *GTAP database for Uganda* (Narayanan and Walmsley, 2008). This database includes payments for natural resources in agricultural industries. This was used in creating the land rentals for these industries in UgAGE.
3. *Additional revenue data.* This data was provided in Excel format and shows tax revenues for fiscal years from 2000/01 to 2009/10. Of interest to us is the data on VAT on imports and import duty. We use the share of these taxes to split column 6 in Figure 2 into 2 columns.

3.4. Comments on the data

It should be noted that the following discussion is based on data after the SUT commodities and industries are aggregated to the number of commodities and industries in the SAM. The aggregation and mapping of commodities and industries are described in Section 4, Step 1.

3.4.1. Strengths of the data

One of the strengths of the latest SUT for 2002 is that it contains detailed supply and use data for 142 commodities and activities. The SUT provide most of the data needed to create the database.

3.4.2. Issues with the data

Clearly, the format of the data contained in the SUT differs substantially from the format required by UgAGE. The main differences are:

- The tax matrix records commodity-specific taxes paid on domestic and imported goods. However, there is no information on who pays these taxes, i.e. there is no explicit indication of taxes paid by the different users. Instead, the taxes paid are included in the purchasers' value of the commodity flows in the UT. This tax matrix will need to be split into user-specific tax matrices (Row 3, Figure 1);
- The import matrix records imports of commodity *c*. We use this matrix to disaggregate the users use of commodity *c*, valued at purchasers' price, into two source dimensions;
- The margin matrix records margins on composite good *c*. It will be disaggregated into margins attached to flows of domestic and imported goods;

- There are no matrices representing the flow of commodity *c*, from source *s* to user *u* valued at basic price;
- In the UT, the payments to labour are not distinguished by labour class (OCC = 1 in row 4, Figure 1). For UgAGE we need to create a labour class dimension, identifying wages paid to 16 class levels;
- Factor payments are represented by labour payments and operating surplus. There is no data on land rentals. Factor payments will need to be reallocated to identify payments to labour, capital and land. We use a separate set of data on factor payment to create land rentals.
- There are no detailed data on the structure of capital creation for each of the industries. There is only one column for investment. This single column will need to be disaggregated into 83 columns, representing the investment activity of each of the industries in the model;
- In the database all values, except for taxes and change in inventories, has to be positive. However, there are some negative values present in the original SUT data. Firstly, in the UT, a number of industries reports negative value added and/or negative capital rentals. Secondly, also in the UT, there are a

number of negative values for commodities used by industries during the production process. Thirdly, in the ST, the MAKE matrix reports a negative flow. For modelling purposes these negative values have to be adjusted; and

- In the UT, the inventories column includes values for service commodities. We assume that there are no stocks for service commodities and therefore these values will be removed.

3.4.3. Issues with data plausibility

- Capital-labour ratios

At the industry level, 2 industries employ no labour[6] and 7 industries register negative capital rentals.[7] The SUT further suggests that the share of labour in total factor payment is 32 per cent. We find this share too low compared to other African countries. In terms of industries, 32 have a labour share of less than 25 per cent. Some examples include cocoa, dairy farming, leather and foot, ceramic and hotel and restaurants. Possible reasons for the low shares are that (1) the labour payments only includes payments to employed workers and not those who are self-

employed or unpaid family workers and (2) all of the mix income seems to be added to capital rentals. We have been advised by the Policy Advisory Committee that we should use the capital-labour split represented in the SAM and SUT, that is, mixed income is added to capital rental.

- Production taxes

The ST includes data for production taxes (row 7, Figure 1). Of the 83 industries in the SAM, 47 pay production tax. The data further suggests that more than 61 per cent of all production taxes are paid by the *WoodProducts* industry. We find this implausible because this industry is relatively small and contributes approximately 1 per cent to total domestic output.

4. THE DATABASE CREATION PROCESS

The format of the database required by UgAGE is described in Section 2 and illustrated in Figure 1. The database has 83 commodities, 83 industries, 16 occupational groups, 4 margin commodities and 2 sources (domestic and imported).

[6] Industries with no labour payments are MilletSorg and CivilEng.
[7] Industries with negative capital rentals are OilsFats, CoffeeProc, MeatProcess, WoodProducts, Petroleum, Paints,ElecEquip, OthManuf, MotorSaleRep, FinServices and Recreational.

The elements of the different dimensions (sets) are listed in Appendix A. The following steps were taken to convert the official data into the required format.

4.1. Step 1: Data mapping, aggregation and checking of conditions

The commodities and industries, as they appear in the SUT, are mapped to 82 commodities and 82 industries.[8] The mapping for industries and commodities is listed in Appendix B and C.

We then add the commodity-specific cif/fob adjustment (column 4, Figure 2) to commodity-specific imports (column 3, Figure 2). Gross operating surplus is calculated by adding operating surplus (row 5, Figure 3) and depreciation (row 4, Figure 3).

Then we proceed to check for balance and the presence of inappropriate negative values. The initial input database met the balancing conditions. However, we identified many negative flows in the UT. The main findings from this check have

been discussed in Section 3.4. Irregularities in the database are adjusted in the remaining steps of the database compilation process.

Table 2. Summary of main outputs based on SUT data

Expenditure components	**Value**	%
Household consumption	9,018,277	76.4
Investments	2,085,681	17.7
Stocks	334,575	2.8
Government	1,808,819	15.3
Exports	1,514,286	12.8
Imports	2,950,101	-25
GDP at market price	**11,811,537**	100

Income components	**Value**	%
Compensation of employees	3,390,467	28.7
Gross operating surplus	7,192,780	60.9
Tax on production	352,639	3.0
Tax on commodities	875,651	7.4
GDP at market price	**11,811,538**	100.0

4.2. Step 2: Splitting industry-specific factor payments into payments to labour, capital and land

The SUT contains industry-specific data on labour payments (COE) and operating surplus/mixed income (GOS) (Figure 3, rows 2 and 5). We use these data and additional data described below to recalculate the shares of payment to labour, capital and land.

As discussed in Section 3.4, there are a number of issues with the factor payment data in the SUT. These issues are:

[8]The creation of the commodity and industry called "RawOil" is explained in Section 6.

- for some industries, no labour payments are recorded;
- there is no occupational/class dimension in the labour payment data recorded in the SUT;
- some industries recorded negative capital rental and/or value added values; and
- there is no payment to land in any industry.

In this section we discuss the procedure with which we adjusted the industry-specific factor payment data in the SUT to address these issues.

4.2.1. Adjusting negative capital rentals

For modelling purposes all flows, except stocks and subsidies, should be positive. Although it is possible for industries to generate a loss during a given year, negative capital rental values are not appropriate for modelling purposes. The SUT data suggests that for some industries, the gross operating surplus (GOS) and/or value added (VA) is negative. These industries are shown in Table 3, along with SUT data for labour-cost, GOS and production tax.

Table 3. Summary of labour payments, GOS, production taxes for selected industries

Industry	Labour	GOS	Production Tax	Value added
OilsFats	1,858	-10,210	877	-7,475
CoffeeProc	14,294	-23,914	138	-9,482
MeatProcess	1,046	-14,060	143	-12,871
WoodProducts	15,981	-217,649	216,426	14,758
Petroleum	11	-14	0	-3
Paints	963	-7,764	932	-5,869
ElecEquip	672	-9,122	13,248	4,798
OthManuf	1,103	-5,825	9,808	5,086
MotorSaleRep	91,779	-2,790	33,374	122,363
FinServices	230,684	-141,229	0	89,455
Recreational	27,031	-21,016	24	6,039

We do not have additional industry-specific data to correct the negative GOS values summarised in Table 3. To correct for the negative GOS values, we simply set these negative values to zero. We then redistribute the labour payments between GOS and labour based on the industry-specific capital-labour shares captured in the Ugandan database from GTAP 7.0 (Narayanan and Walmsley, 2008). Where GTAP data are not available, we assume a 50/50 split between labour and GOS.

The industry-specific production tax data suggests that 47 industries pay production tax. Of the total production tax, the industry *WoodProducts* contributes 61.4% of all production taxes, leaving the majority of industries to contribute the remainder of the tax. We found this implausible because based on the industry output data, the

WoodProducts industry contributes approximately 1% of total industry output. In the absence of additional industry-specific data we assume that the production tax paid is 4 per cent.

After the adjustments to the affected industries listed above are made, the factor payments for all industries are rescaled so that they add to the total value of the factor payments as given in the SUT.

4.2.2. Creating land rentals

UgAGE distinguishes between 3 types of factors of production, namely labour, capital and land. The Use table includes information on compensation of employees (COE), gross operating surplus (GOS) and indirect taxes. There are no values for land rentals. We therefore need to allocate some part of the gross operating surplus

to land-using industries.[9] We adopt the factor shares, as it appears in the GTAP 7.0 database, to reallocate the total factor payments over labour, capital and land for all agricultural, forest and mining industries in the UgAGE database. The factor shares are summarised in Appendix D.

$$\text{ProdFact}_{(i,v)}^{scaled} = \text{ProdFact}_{(i,v)}^{SUT} * \text{GTAP}_{(i,v)} \text{ for all } i \in \text{Land-using industries}, \; v \in \text{Labour, capital and land} \quad \text{(E1)}$$

where
- $\text{ProdFact}_{(i,v)}^{scaled}$ is the scaled production factors for each of the land-using industries;
- $\text{ProdFact}_{(i,v)}^{SUT}$ is the production factors after mixed income is distributed; and
- $\text{GTAP}_{(i,v)}$ is the factor shares for the land-using industries adopted from GTAP.

For non-land using industries, none of the gross operating surplus was allocated to land.

4.2.3. Labour payment adjustments

Our final review of the factor payments suggests that 2 industries record no labour payments and 6 industries records only 1 labour class is being employed.

We noticed that the industries *CivilEng* and *MilletSorg* report no labour payments. On

[9] Land refers to cultivated land area, forests and natural resources such as minerals, coal, gold and oil.

the advice of UBOS, we allocate for *CivilEng* 10 per cent of capital rentals to labour payments. We also adopt the labour payment distribution over labour class from the *Building* industry. For the industry *MilletSorg* we adopt the average labour class shares calculated for the agricultural sector.

For the *LeatherFoot*, *Petroleum, RubPlastic, TransGoodRd* and *OthCompAct* industries only 1 type of labour is employed. For example, the *LeatherFoot* industry only employs highly skilled rural males (HSRM) and *RubPlastic* only skilled employs skilled urban males (SUM). We find this implausible and adopt the average labour class share of the manufacturing sector for these industries.

For the *TransGoodRd* and *OthCompAct* industries only 1 type of labour is employed. The data suggests that *TransGoodRd* only employs semi-skilled urban males (SSUM) and the *OthCompAct* industry only employs highly skilled urban males (HSUM). For these industries we adopt the labour class share calculated for the services sector.

4.2.4. Balancing the factor payments matrices

Our final task is to ensure that total factor payments are scaled to the official aggregate value for factor payments as it appears in the SUT. The aggregate factor payments are summarised in Table 4.

Table 4. Summary of the factor payments after the adjustments

	Value	**Share (%)**
Labour	3,390,470	32.04
Capital	6,506,470	61.48
Land	686,297	6.48
Total	10,583,237	100

It should be noted that at this stage we violate the industry-specific zero profits condition. This is because we recalculated the industry-specific factor payments while holding industry output unchanged. We correct this by using the RAS procedure and scale industry cost to equal industry output.

4.3. Step 3: Adjustments to the MAKE matrix

Each element in the MAKE matrix refers to the basic value of commodity c produced by industry i. The initial MAKE matrix supplied in the SUT showed a high level of multi-production in the economy, implying that an industry can produce more than one commodity and a commodity can be produced by more than one industry. For example, we found the *RealEstDwl* commodity produced by 38 different industries, and the *WoodProduct* industry producing 17 different commodities. Our inquiries with UBOS about the high level of multi-production suggest that this feature of the MAKE

matrix was probably results of misprints and classification problems. As such, we make a number of corrections to the MAKE matrix in Step 3.

Table 5. Examples of multi-production in the original MAKE table

Production of commodities				Outputs of industries		
Ranked by number of producing industries				Ranked by number of commodities produced		
COM	Max % produced by a single commodity	No. of producing industries		IND	Max % output of a single industry	No. of commodities produced
RealEstDwl	91.7	38		WoodProducts	73.7	17
Building	97.7	19		RepairOthSer	34.2	15
BusService	95.2	13		AnimalFarm	91.4	14
TransGoodRd	95.1	12		Trade	97.4	14
Trade	98.8	11		BusService	81.5	14
RepairOthSer	77.3	11		GrainProd	95.3	11
MachEquip	43.9	10		Textiles	88.9	11

Our aim in this step is two-fold:

- remove all flows that constitute less than 1 percent of the commodity and/or industry flows; and
- remove all implausible flows of commodities produced by all industries.

In the MAKE matrix we identified 188 elements that have a share of less or equal to 1 per cent of commodity or industry output. Most cells in the MAKE matrix adopt their old values, and the tiny flows turned to zero. The values of the tiny flows are then added to the diagonal elements.[10]

Our second task at hand is to remove all implausible elements in the MAKE matrix. Based on the advice from UBOS, a number of commodity flows by industry were identified as implausible. The implausible elements/flows were set to zero and the values of the elements were either added to the diagonal element or to the element suggested by UBOS.

For agricultural commodities, UBOS advised that these commodities should be produced by a single unique industry. For example, the commodity *Maize* should be produced by only the *Maize* industry. However, the MAKE matrix, after the tiny flows were removed, suggests that the commodity *Maize* is produced by the *Maize* (96.9%) and *GrainProd* (3.1%) industry. To adjust this flow, we remove the value of *Maize* produced by the *GrainProd* industry and add it to the *Maize* industry. After the adjustment, the commodity *Maize* is produced only by the *Maize* industry. The following elements are identified as implausible and added to the diagonal element:

- the commodity *Maize* produced by industry *GrainProd*;

[10] The total value of the tiny flows that are moved between industries in the MAKE matrix is 81,346. This is 0.44 per cent of the aggregate MAKE value that is 83,170/18,710,606 = 0.43%.

- the commodity *Cassava* produced by industry *OthFruitVeg*;
- the commodity *Cotton* produced by industry *Textiles*;
- the commodity *Beans* produced by industry *FlowerSeed;*;
- the commodity *Coffee* produced by industry *Trade*;
- the commodity *FishProd* produced by industry *Fishing;*
- the commodity *WoodProducts* produced by industry *Trade*;
- the commodity *Petroleum* produced by industry *WoodProducts;*
- the commodity *PulpPapPrint* produced by industry *Trade;*
- the commodity *OthManuf* produced by industry *GrainProd*;
- the commodity *Electricity* produced by industry *Ceramic*;
- the commodity *Building* produced by industry *FishProd;*
- the commodity *TransGoodRd* produced by industry *TeleCom*;
- the commodity *OthTransAct* produced by industry *TransAir;*
- the commodity *Mining* produced by industry *Petroleum;*

The MAKE matrix suggests that 14% of the commodity *FabMetalProd* is produced by the *SoftDrink* industry. UBOS advised that this percentage is too high. UBOS suggested that this percentage be reduced to 5 % and the remainder of the value added to the *FabMetalProd* industry.

All of these adjustments preserved total commodity outputs (i.e. row sums of the MAKE matrix), but altered total industry outputs (i.e. column sums of the MAKE matrix). We accepted the new MAKE matrix as our target matrix and RAS'd the USE matrix so as to retain commodity and industry balances across the two tables.

4.4. Step 4: Removing the remaining negative flows

In this step we identify any other negative flows in the SUT. Upon inspection we identified negative flows in the following matrices:

- the matrix capturing the use of a commodity *c* by industry *i* in the production process (V1PUR_SUT in Figure 3); and
- the matrix capturing commodity-specific stocks (V6PUR_SUT in Figure 3).

4.4.1. Removing negative flows in the intermediate use matrix

In the matrix representing the use of commodity *c* by industry *i* in the production process, we identified 15 elements containing negative flows. These flows are:

- The commodity *Water* used by the *DairyProd* industry (-16), *BakeryProd* (-675), *Tabacco* industry (-15), *Textiles* (-41), *PulpPapPrint* industry (-88), *Paints* (-348), *HotelRest* (-408) and the *Textiles* industry (-20).
- The commodity *Electricity* used by the *DairyProd* (-50), *BakeryProd* (-2125), *PulpPapPrint* industry (-94) and *Paints* (-1094).
- the commodity *Textiles* used by industry *PulpPapPrint* (-945).
- the commodity *RubPlastic* used by industry *PulpPapPrint* (-85).
- the commodity *MetalProduct* used by industry *PulpPapPrint* (-130).

The values of these flows are relatively small and therefore set to zero.

4.4.2. Eliminating inventories of services commodities

The second matrix containing negative values is the changes in inventories (stocks) matrix (column 6 in Figure 3). The stocks matrix shows changes in commodity-specific inventories. In the database we do allow this matrix to include negative values for all non-service commodities. We do not allow values for service commodities because services usually cannot be stored, and hence cannot be put into inventories. The original SUT data contains stock entries for 5 service commodities. These commodities are listed in Table 8.

Table 6. Service commodities for which inventories are held

Service commodity	Value
Electricity	
Water	
Building	26,079
CivilEng	
MotorSaleRep	
Trade	
RepairOthServ	
HotelRest	25
TransRail	
TransPasRd	4
TransGoodRd	
TransAir	
OthTransAct	
PostService	
TeleCom	
FinService	
RealEstDwl	
OthCompAct	
BusService	
Government	
Education	
Health	364
ComSocWork	
Recreational	
OthActivity	107
Total	26,580

We remove these flows from the database. To restore the aggregate inventories value to

the original SUT value, inventories for all non-service commodities are scaled to the original aggregate value of stocks.

As a consequence of the adjustments to V1PUR and V6PUR, commodity-specific aggregate demand does not equal aggregate supply and industry cost does not equal industry output. We therefore use the RAS procedure to ensure that the balancing conditions holds.

4.5. Step 5: Splitting total flows into sources

UgAGE requires the VBAS, VMAR and VTAX flow matrices, the first 3 rows in Figure 1, to be split into domestic and imported flows. The task at hand is to distribute imports across users. This task is made difficult because:

- we only know the commodity-specific import value; and
- the basic price of imported goods are the price received by importers, excluding transport and other margin costs involved in transferring imports to final users. The basic price of imported goods is therefore the c.i.f. price plus the tariff. The import duties are included with the *VAT on imports* column in the SUT (Column6 Figure 2).

We split the *Import duties/VAT on imports* (column 6 in Figure 2) into 2 columns; (1) VAT on imported goods and (2) tariffs. To split this column we use additional revenue data provided to us. The data is summarised in Table 10.

Table 7. Import duty and VAT on imports for the 2002/03

	Value	**Share (%)**
Vat on imports	251.06	65
Import duty	133.07	35
Total	384.13	100

To split the column, we assume that the share of VAT on imports and the import duty is the same for all commodities, that is:

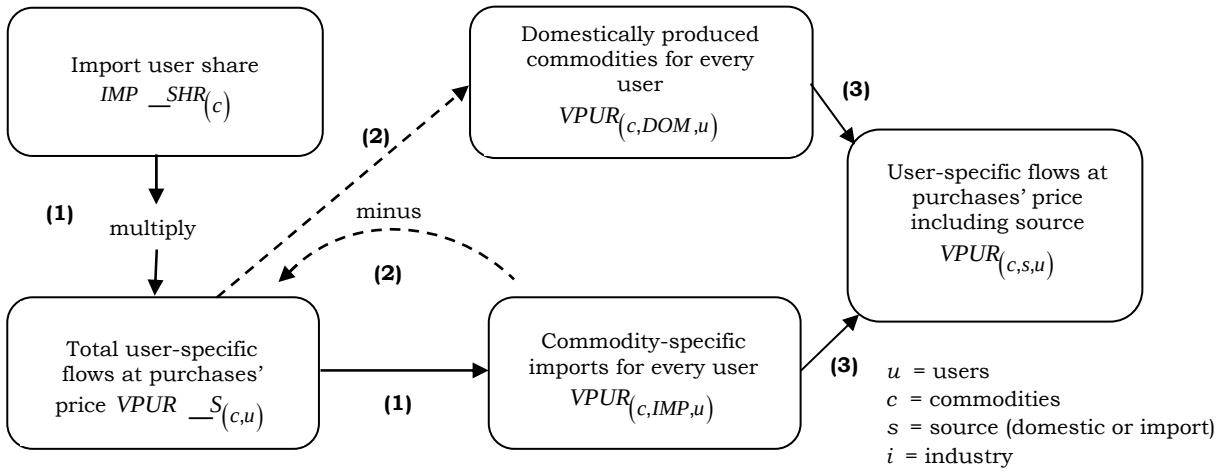
$$\mathrm{TAX}_{(c,t)} = \mathrm{TAX}_{(c)} * \mathrm{TAX\_SHR}_{(c,t)} \quad \text{for all } c \in COM,\ t \in Taxes \qquad \text{(E2)}$$

Once we have determined the commodity-specific taxes we can calculate the basic price of imported commodities, which in turn is used to calculate commodity-specific import shares.

The commodity-specific flows, as they appear in the Use table, are valued at purchasers' prices and include imports. Since there is no information available on user-specific imports, we calculate the commodity-specific import share.[11] We assumed that (1) no imported good is re-exported and (2) the commodity-specific import share is the same over all users. For example, if imported meat makes up 10 percent of total sales (use) of meat from both domestic and imported sources, then all users of meat will use 10 percent of imported meat in their meat purchases. To determine how much of each commodity is imported, this share is then multiplied by each users' total use of a commodity. This is illustrated by the first step in Figure 4.

The user-specific domestic flows are calculated by deducting the user-specific imported flow from the total use of that commodity. This is illustrated by step 2 in Figure 4. Step 3 in Figure 4 illustrates the user-specific matrices including the source dimension.

Figure 4. Creating a source dimensions: domestic and imports



Adapted from Roos, 2012:133

We adjust 2 commodities; *TransGoodRd* and *TransRail*. The ST suggests that the *TransGoodRd* commodity, which is a margin commodity, is domestically produced and a large share is imported. By calculating the import share described above, we see that the import share for *TransGoodRd* is 160%.

We adjust this commodity by reducing the imports of *TransGoodRd* and moving the residual to the domestic production of *TransGoodRd* by the *TransGoodRd* industry. We also add the residual to the operating surplus of the *TransGoodRd* industry.

[11] $IMP\_SHR_{(c)} = \frac{IMPORTS_{(c)} + Tariff_{(c)}}{\sum_{u \in USERS} VPUR_{(c,u)}}$ where u refers to the following users, (1) current production, (2) investors, (3) private consumption, (5) public consumption and (6) change in inventories. Because no imported good is re-exported, there is no import dimension for any of the flow associated with exports. Note that the basic price of imports is the values of imports plus tariffs.

Table 8. Summary of the supply entries for the *TransGoodRd* commodity

	MAKE_I	Imported	Domestic VAT	Margin	Total supply/demand at purchasers price	Import share (%)
TransGoodRd	76,277	340,016	285	-204,136	217,153	157

The second commodity that we adjust is the *TransRail* commodity. The Supply Table suggests that the *TransRail* commodity, which is a margin commodity, is domestically produced and approximately 84% is imported. The Use table shows that this commodity is only used to facilitate exports or directly exported.

Table 9. Summary of the supply entries for the *TransRail* commodity

	MAKE_I	Imported	Domestic VAT	Margin	Total supply/demand at purchasers price	Import share (%)
TransRail	60,201	46,877	-	-51,034	56,044	84

We adjust this commodity by setting the imports of *TransRail* to zero and move the value to the domestic production of *TransRail* by the *TransRail* industry. We also set the exports of *TransRail* to zero and add the value to the intermediate use of *TransRail* by the *TransRail* industry.

By adjusting *TransGoodRd* and *TransRail* via this procedure described above, we ensure that:

- the zero pure profits conditions holds, that is, the industry-specific input costs equal domestic production of these commodities by the industries; and
- commodity-specific aggregate demand equals commodity-specific aggregate supply.

However, we have altered the total import and export value. We correct this by scaling the commodity-specific import and export values to the aggregate values in the SUT.

4.6. Step 6: Creating margin matrices

The output of wholesalers and retailers is measured by the value of the trade margins realised on the goods they sell i.e. the difference between the sale value of products sold and the cost of purchasing these products. The reason for this is that the productive activity associated with distribution is understood to be the provision of

services of displaying the goods in an informative and attractive way (StatsSA, 2006c:14).

Trade and transport margins are the difference between the purchasers' price and the producers' price of a product. It is therefore possible that a product can be sold at different purchasers' prices due to differences in margins and net taxes (UN, 1999:56). A clear distinction should be made between transport services and -margins. Transport services move people, where transport margins move goods. Transport margins can be treated in two different ways. Firstly, when transport is arranged in such a way that the purchaser has to pay separately for the transport costs i.e. the transport costs are billed separately, it is identified as transport margins. The customer does not only buy the goods, but also the transport services from producers. Secondly, if transport services are not billed separately i.e. the producer transports the goods without extra cost to the purchaser, transportation

will appear as intermediate consumption to the producer and at the same time it will be included in the basic price (UN, 1999:133).

For all agricultural, mining and manufacturing commodities, margins are given as the sum of trade and transport margins. The following should be noted:

- there are no margins for services provided because services are delivered directly from producers to consumers, and hence do not require margins;
- there are no margins on inventories because they comprise of unfinished commodities and materials; and
- only domestically produced margins are used i.e. margins are not imported.

Included in the margin column are 3 negative values. Values are negative for Trade - and Transport services. The reason for this is that in the Use Table, the values for trade and transport services show only those that are consumed directly and does not include any margins. Instead, margins are included in the value of the goods at purchases' prices shown in the rest of the Use Table. Consequently, in the Supply Table, trade and transport margins should be deducted from the total supply of market services. This is done by entering trade and transport margins as a negative number in order to balance the supply and use of trade and transport services at purchasers' prices (UN, 1999:33).

The complexity of the purchasers' values in the Use Table is that we only have commodity-specific information on total margins and not user-specific and margins-

specific. We therefore construct the trade and transport margins based on the same principle as imports. The task at hand is two-fold, (1) determine user-and-commodity-specific margins i.e. V1MAR_M to V5MAR_M and (2) split the user-and-commodity-specific-margins between trade and transport margins commodities.

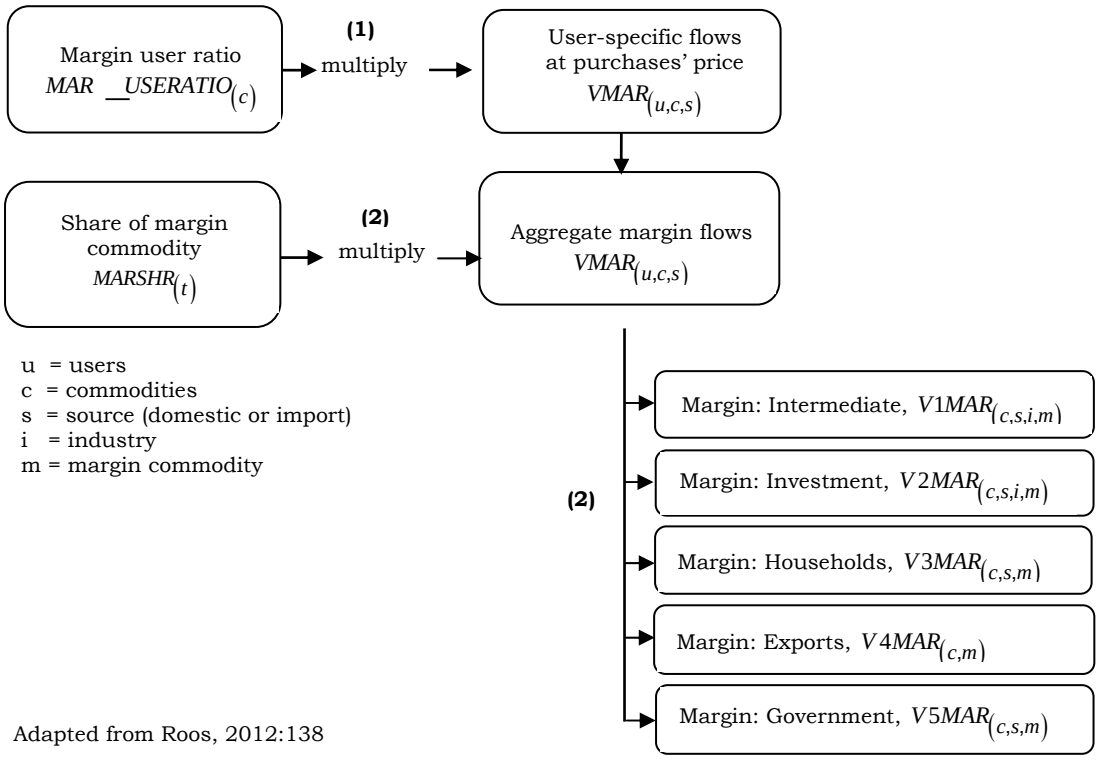
4.6.1. Constructing the margin matrices by user

We create the margin matrices, V1MAR to V5MAR, by calculating the margin-use-ratio for each commodity. To create these matrices we assume that:

- the margin-use-ratio is the same for all users, i.e., if the margin-use-ratio for commodity *c* is 8 per cent, it is 8 percent for all users of commodity *c*;

- the margin rate is the same for both domestic and imported commodities; and
- the share of the type of margin used is the same for all users.

Figure 5. Creating source dimensions for the margin matrices



Adapted from Roos, 2012:138

Since the flows in the Use Table are at purchases' prices, i.e., includes margin commodities, and given that the commodity specific margins are given in the Supply

Table, the margin-use-ratio is calculated.[12] The margin-use-ratio is then multiplied with the user specific flow valued at purchases' price to create the user specific aggregate margins. This is illustrated by (1) in Figure 5.

Our next task is to distribute the aggregate user-specific margin for each commodity, between transport and trade margins. Since the total value of trade and transport margins are known, the share of trade and transport in total margin are

calculated. [13] Again, it is assumed that all users use the same proportion of trade and transport margins. The margin commodity share is then multiplied with the aggregate user specific margin. This yields margin matrices by commodity, source and user for all margin commodities. This is illustrated by (2) in Figure 5.

4.7. Step 7: Creating indirect tax matrices for all users

Taxes on products are payable on goods and services when they are produced, delivered, sold, transferred or otherwise disposed of by their producers and is proportional to their production values (UN, 1999:26). There are two columns in the Supply table that reports commodity-specific taxes on products: VAT on imports and VAT on domestic goods. UgAGE requires the creation of user-specific tax matrices, V1TAX to V5TAX, which implies that the values in the tax columns have to be distributed over users.

Although commodity-specific taxes are known, user specific taxes are unknown i.e. no information is available on who pays these taxes. To determine user-specific taxes, commodity specific taxes are multiplied with a tax factor. This tax factor assigns a weight to each user, indicating who will pay most of the tax.

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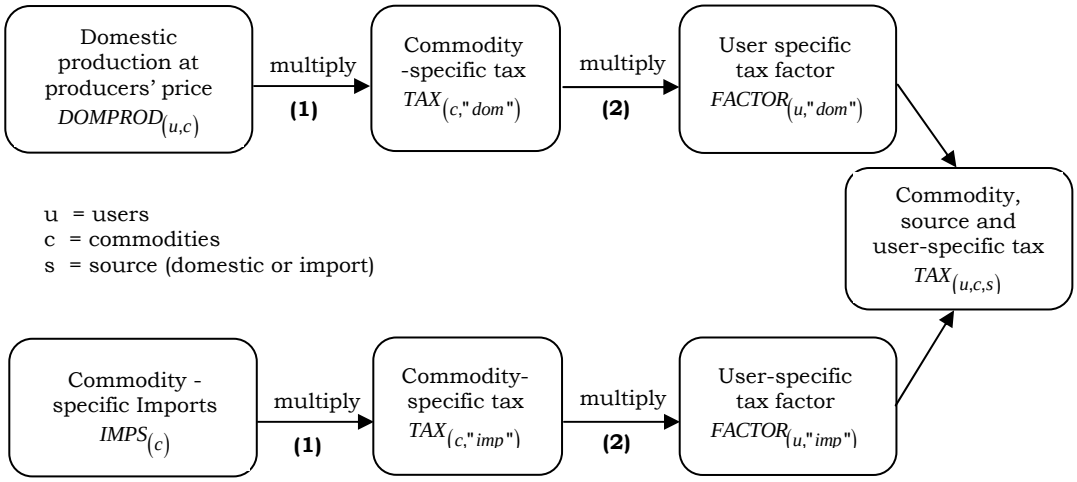
[12] $MAR\_USERATIO_{(c)} = \frac{MARGIN_{(c)}}{\sum_{u \in USER} \sum_{s \in SRC} VPUR_{(u,c,s)}}$ where u refers to the following users, (1) current production, (2) investors, (3) private consumption, (4) exporters and (5) public consumption. Because inventories are unsold commodities, there is no margin matrix associated with inventories.

[13] $MARSHR_{(t)} = \frac{MARGIN_{(t)}}{\sum_{t=1}^{3} MARGINS_{(t)}}$ where t is the margin commodity, t = 1 (TransRail), t = 2 (TransGoodRd), t = 3 (Trade) and t = 4 (MotorSaleRep).

Figure 6. Creating indirect tax matrices for all users



Adapted from Roos, 2012:141

A tax factor of 1 is assigned for producers' and investment, and 3 to households.[14] The implication of the tax factor is that households carry most of the tax burden. Commodity-specific tariff revenues are not explicitly given in the SUT tables. As mentioned before they are included with VAT on imports. We created the tariff vector in Step 6 and the values are held in the satellite vector as illustrated in Figure 1.

4.8. Step 8: Creating matrices for the basic flows

The aim of this step is to create the domestic flow values of the BAS1 to BAS6 matrices. These flows are illustrated in the first row of Figure 1. As explained in Section 3, the flows at purchases price include domestic and imported flows at basic value plus margin costs plus taxes. The imported flows at basic prices are calculated in Step 6, margin flows in Step 7 and tax matrices in Step 8. Based on the outcomes of these steps, the domestic flows valued at basic prices are determined.

To calculate the domestic basic flows, we subtract the imports, margin and tax flows from the total purchases values summed over source:

$$BAS_{(u,c,dom)} = \sum_{s \in SRC} VPUR_{(u,c,s)} - BAS_{(u,c,imp)} - \sum_{s \in SRC} \sum_{m \in MAR} MAR_{(u,c,s,m)} - \sum_{s \in SRC} TAX_{(u,c,s)} \quad \text{(E3)}$$

At the end of this step the domestic flows of the V1BAS to V6BAS matrices is created.

[14] For the commodities *Petroleum*, *ElecEquip* and *OthManuf* we assign a tax factor of 1 for all users.

4.9. Step 9: Creating an industry dimension for the investments column

Currently, the matrices pertaining to investors (user 2) are vector matrices implying that there is only 1 representative investor. This is consistent with the investment data included in the SUT. However, we know that investors buy commodities to construct capital in each industry. Therefore, there is a need to split the investment column into an investment matrix with 82 industries.

To create the industry dimension for investments, we calculate the capital rental share of each industry:

$$IND\_SHR_{(i)} = \frac{V1CAP_{(i)}}{\sum_{i \in IND} V1CAP_{(i)}} \quad \text{(E4)}$$

This share is then multiplied with the appropriate commodity and source-specific investment:

$$INVEST_{(c,s,i)} = V2BAS_{(c,s)} * IND\_SHR_{(i)} \quad \text{(E5)}$$

4.10. Step 10: Final balancing of the UgAGE database

The database created using Step 1 – 10 creates distortions. For the UgAGE database to be balanced, two conditions have to be satisfied.

4.10.1. Condition 1: industry costs should equal industry output

The first condition states that the industry costs should equal the industry output. This means that when considering Figure 1, the column totals for each industry in the producer column, should be equal to the domestic output of each industry:

$$IND\_COSTS_{(i)} = IND\_OUTPUT_{(i)}$$

where

$$IND\_COSTS_{(i)} = \sum_{c \in COM} \sum_{s \in SRC} V1PUR_{(c,s,i)} + \sum_{c \in COM} \sum_{s \in SRC} \sum_{m \in MAR} V1MAR_{(c,s,i,m)}$$

$$+ \sum_{c \in COM} \sum_{s \in SRC} V1TAX_{(c,s,i)} + \sum_{o \in CLS} V1LAB_{(i,o)} \qquad \text{(E6)}$$

$$+ \; V1CAP_{(i)} \; + \; V1LND_{(i)} \; + \; V1PTX_{(i)}$$

and

$$IND\_OUTPUT_{(i)} = \sum_{c \in COM} MAKE_{(i,c)} \qquad \text{(E7)}$$

where

- $IND\_\_COST_{(i)}$ is total cost of each industry;
- $\sum_{c \in COM} \sum_{s \in SRC} V1PUR_{(c,s,i)}$ is the basic intermediate flows to all industries summed over all commodities and sources;
- $\sum_{c \in COM} \sum_{s \in SRC} \sum_{m \in MAR} V1MAR_{(c,s,i,m)}$ is the total margins used to facilitate flows to industries, summed over commodities, sources and types of margins;
- $\sum_{o \in CLS} V1LAB_{(i,o)}$ is the compensation of employees summed over all labour classes;
- $V1CAP_{(i)}$ is the industry specific gross operating surplus;
- $V1LND_{(i)}$ is the rental value of land for the agricultural, forestry and mining industries;
- $V1PTX_{(i)}$ is the industry-specific production taxes;
- $IND\_OUTPUT_{(i)}$ is the total industry output; and
- $\sum_{c \in COM} MAKE_{(i,c)}$ is the total industry output summed over commodities.

4.10.2. Condition 2: domestic commodity output equals domestic use

The second condition states that the domestic commodity output should equal the total domestic basic flows to all users:

$$COM\_OUTPUT_{(c)} \; = \; COM\_USE_{(c)} \qquad \text{(E8)}$$

where

$$COM\_OUTPUT_{(c)} = \sum_{i \in IND} MAKE_{(i,c)} \quad \text{(E9)}$$

and

$$\begin{aligned} COM\_USE_{(c)} = & \sum_{i \in IND} V1BAS_{(c,"dom",i)} + \sum_{i \in IND} V2BAS_{(c,"dom",i)} \\ & + V3BAS_{(c,"dom")} + V4BAS_{(c)} + V5BAS_{(c,"dom")} \\ & + V6BAS_{(c,"dom")} + \sum_{c \in COM} \sum_{u \in USER} \sum_{s \in SRC} \sum_{i \in IND} VMAR_{(u,c,s,i,m)} \end{aligned} \quad \text{(E10)}$$

where
- $COM\_OUTPUT_{(c)}$ is the commodity output summed over all industries;
- COM_USE_c is the total commodity use of each commodity summed over all users;
- $\sum_{i \in IND} MAKE_{(i,c)}$ total commodity output summed over all industries; and
- $\sum_{i \in IND} V1BAS_{(c,"dom",i)}$ to $V6BAS_{(c,"dom")}$ is the basic value of all domestically used commodities, used by all users; and
- $\sum_{c \in COM} \sum_{u \in USER} \sum_{s \in SRC} \sum_{i \in IND} VMAR_{(u,c,s,i,m)}$ is the value of all margin commodities.

After we completed all the data adjustments procedures explained in the previous steps, it is likely that the above conditions are not satisfied. The RAS procedure is used to balance the database given the SUT data.

Table 10 organises the targets set for all the variables in the UGAGE database. The expenditure and income components, as well as the production taxes, are set to values in the SUT. The targets for labour payments, capital and land were calculated in Step 2, and their aggregate value is equal to the total factor payments in the SUT. The tariff target was set in Step 6 and adding it to indirect taxes will set the target for taxes on commodities and imports, which is equal to SUT data. In the UgAGE TABLO code, the two conditions are check via the DIFFCOM and DIFFIND variables. The equations are:

$$DIFFIND_{(i)} = IND\_COSTS_{(i)} - IND\_OUTPUT_{(i)} \quad \text{(E11)}$$

and

$$DIFFCOM_{(c)} = COM\_OUTPUT_{(c)} - COM\_USE_{(c)} \quad \text{(E12)}$$

The values for $DIFFIND_{(i)}$ and $DIFFCOM_{(c)}$ should be zero.

Table 10. Targets set for variables in the UgAGE database

GDP expenditure side	*Value millions*	*Share (%)*
Consumption	9,018,227	76.4
Investment	2,085,681	17.7
Inventories	334,575	12.8
Government	1,808,819	15.3
Exports	1,514,286	12.8
Imports	2,950,101	-24.9
Total	11,811,538	100

GDP income side	*Value millions*	*Share (%)*
Labour	3,390,475	54.7
Land	686,297	2.7
Capital	6,506,474	37.7
Indirect taxes	742,114	6.7
Tariff revenue	133,538	1.2
Production taxes	352,640	3.1
Total	11,811,538	100

4.11 Tests for model validity

Since UgAGE consists of a large number of linearised equations which has been calibrated by a large database, it is possible that errors may occur. Errors may occur in the database, the equations in the model or in the specification of the model closure. Following Horridge, a number of tests are performed each time the model equations or data are changed (Horridge, 2005:71).

4.11.1. Test 1: Real and nominal homogeneity tests

After the database has been created it is useful to test the model theory with the data. One characteristic of UgAGE is that economic agents respond to changes in the relative prices and not the absolute price level. This implies that if all exogenous nominal variables, such as the consumer price $(p3tot)$, increase by 1 per cent, all endogenous nominal variables will increase by 1 per cent while real variables remain unchanged.

A second characteristic is that UgAGE displays constant returns to scale. This implies that if all exogenous real variables are shocked by 1 per cent, all endogenous real variables will increase by 1 per cent. All prices should remain unchanged.

The theory of the model is represented in a number of equations. Most of the equations are written in percentage change form. Percentage change equations make it easier to conduct the homogeneity tests because the exogenous percentage change variables can directly be shocked with 1 per cent. Other equations can be

written in ordinary change form or include ordinary change variables i.e. ∂Y. These variables are denoted by *del* or the letter $d\_$ followed by the variable name. The correct shock must now be calculated. For example, inventory changes are denoted by *d_x6cs*. The correct shock is 1 per cent of the basic value of inventories i.e. 0.01*BAS6.

4.11.2. Test 2: GDP from the income and expenditure side should be equal

This test checks that the percentage changes in GDP from the income side and expenditure side are the same. For this test, real household consumption is shocked with 10 per cent. Errors in the database or in the equations may cause GDP from income and expenditure side to be unequal. In addition to the solution file, the simulation generates an updated database. This updated database is used in test 3 as the initial solution to a simulation.

4.11.3. Test 3: Updated database should be balanced

In this test, this updated database, produced in Test 2, is used as the initial database. By using the updated database as the initial solution, Tests 1 and 2 are repeated. The results should be similar to those explained in Test 1 and 2. If not, there might be error with the Update statements.

4.11.4. Test 4: Repeat the above steps using a multistep solution method

Tests 1 - 3 can be repeated by breaking each simulation into a number of steps. By doing this, more subtle errors can be identified, such as a percentage change variable that is passing through zero or formulae are used to alter data after it has been read in.

4.11.5. Test 5: Explain the results

It is possible that even if the above tests were successfully performed, errors may still occur. For example, if the export demand elasticities in the database had the wrong sign the model would still pass the tests. These types of errors are only detected by careful inspection of the results.

5. UPDATING THE CGE DATABASE FROM 2002 to 2009

5.1. Introduction

The aim of this section is to explain the method by which we update an IO database from an historical year (2002) to a later year. In this case, the initial database is for 2002 and is described in Section 4. The prerequisite of the method described in this section is that the initial database must satisfy the balance conditions described in Section 4.11. Our initial database, after the adjustments noted above, satisfies all the necessary balancing conditions.

In updating the database to 2009 we incorporate data that allows us to scale the initial database to a desired year. Normally, we do not have a complete IO table for the most recent year. Instead, we often have recent macro data, such as the main GDP components, and some vector data, such as household consumption and exports by broad commodity classification.

The update relies on the ADJUSTER program created by Mark Horridge (2009) to update the database.[15] The equations used to update the database are captured in a TABLO program, ADJUST.TAB, which has been adapted to the UgAGE model. The next section draws on the text in Horridge's documentation.

5.2. The scaling approach

Each matrix in the original UgAGE database will be scaled to meet overall targets, such as the balancing conditions and desired totals. Equation (E15) is an example of how the household demand for commodity *c* from source *s* is scaled.[16] The scaling equations for the remaining user matrices are similar.

$$V3BAS_{(c,s)}^{2009} = V3BAS_{(c,s)}^{2002} * QCOM\_CS_{(3)} * QCOM\_SU_{(c)} * QCOM\_CU_{(s)} * QCOM\_U_{(c,s)} * QCOM\_C_{(s,3)} * ATOT \quad \text{(E13)}$$

where

- $V3BAS_{(c,s)}^{2002}$ is the basic flow of household demand by commodity *c* and source *s*. This matrix appears in the original balanced database.

[15] Modellers can download a file from the CoPS web site which contains all the ingredients to update a database ((http://www.monash.edu.au/policy/archivep.htm). The file contains (1) a word document describing the technical aspects of the ADJUSTER program, (2) the TABLO file (ADJSTER.TAB) which contains all relevant equations and (3) several command files (*.CMF). These command files illustrates a series of example computations.

[16] In the coding file, we use number to denote the different users of commodities. We use the number 3 to denote household demand. For a description of the users see Section 2.1.

$V3BAS^{2009}_{(c,s)}$ is the basic flow of household demand by commodity *c* and source *s*. This matrix appears in the updated database;

- $QCOM\_CS_{(3)}$ is the multiplier specific to household demand*;*
- $QCOM\_SU_{(c)}$ is the multiplier specific to commodity *c*;
- $QCOM\_CU_{(s)}$ is the multiplier specific to source *s;*
- $QCOM\_U_{(c,s)}$ is the multiplier specific to commodity *c* and source *s*;
- $QCOM\_C_{(s,3)}$ is the multiplier specific to source *s* and household demand*;* and
- $ATOT$ is the economy-wide multiplier.

The multipliers generally have fewer dimensions than the original data matrices and can be used to scale several matrices. For example, if $ATOT$ were to increase by 10% all flows would increase by 10%.

In the closure, all multipliers are exogenous.[17] Via swap statements, each multiplier may be used as an instrument to achieve a particular target. For example, we could endogenise $ATOT$ and $QCOM\_CS_{(3)}$, and in its place exogenise gross domestic product $(GDPEXP)$ and aggregate consumption expenditure $(V3TOT)$. We would then set a target value for $GDPEXP$ and $V3TOT$. GEMPACK calculates the changes to $ATOT$ and $QCOM\_CS_{(3)}$ which are required to hit their target values of $GDPEXP$ and $V3TOT$, while enforcing the balancing conditions. Horridge lists two advantages of the proportional scaling approach (Horridge, 2009:2):

- changes to flows are proportional to their original value and zero flows remains at zero. It is rare for flows to change sign; and
- costs and sales shares, which underlie CGE simulations results, are changed as little as possible.

5.3 Implementing complex scaling procedures using levels GEMPACK

In scaling the original database, we should:

- list the database matrices to be scaled;

[17] A closure defines the choice between endogenous and exogenous variables. Endogenous variables are determined by an equation in the model whereas exogenous variables are not determined in the model. Via swap statements, endogenous variables can be swapped with exogenous variables, thereby rendering them exogenous. Only exogenous variables are shocked in the command file.

- provide formulae showing how potential target values, such as aggregate consumption, are related to the matrices stored in the TABLO file.;
- define the balancing conditions that must be enforced;
- associate scale factors with each matrix which define the transformation to be applied. For each target scalar that we wish to hit and for each balancing condition that must be enforced, we need to define a corresponding scale factor of matching dimension.

GEMPACK allows us to express the above ideas concisely. All the matrices in the original database, the formulae, the balancing conditions and the scaling factors are specified in ADJUSTER.TAB. What remains for us is to specify the target values.

Based on the information provided to us, we update the intermediate use of commodities by all industries, as well as GDP and all the expenditure components, except inventories. This means that implicitly total inventories are specified as a residual. Table 11 lists the target values for selected aggregate variables. The target values refer to 2009 and drawn from the *Background to the Budget 2011/12 Fiscal Year* document (MOFPED).

Table 11. Gross domestic product at current prices – demand-side, Bill Shs

GDP expenditure side	***Value***	***%***
Aggregate consumption	25,637	76.4
Aggregate investment	7,306	21.8
Aggregate stocks*	92	0.3
Aggregate government expenditure	3,281	9.8
Aggregate exports	7,791	23.2
Aggregate imports	10,555	31.5
Gross domestic product	33,552	100

* Aggregate stocks is calculated as a residual
Source: MOFPED, 2011, Table 2b, p A4

As explained before, we exogenise the variables for which we set targets and endogenise the appropriate multiplier. For example, we exogenise *GDPEXP* and endogenise *ATOT* . In addition to setting the target values, we ensure that the

balancing conditions are enforced. Via the multipliers, GDP from the supply-side is adjusted. These values are summarised in Table 15. All other matrices, not listed in Table 11 and 12 are updated by a similar procedure described in this section.

GDP income side	***Value***	***%***
Compensation of employees	9,568	29.0
Capital rentals	18,493	55.1
Land rentals	2,000	5.9

Taxes on products	2,390	7.1
Production taxes	1,093	3.3
Gross domestic product	33,552	100

Table 12. Gross domestic product at current prices – supply-side, Bill Shs

Having created an updated database, our next task is to create two additional industries and commodities; an oil and refinery sector. The creation of these sectors is described in the next section.

6. CREATING OIL AND REFINERY INDUSTRIES AND COMMODITIES

There is no explicit recognition of an Oil sector in the database. In this section the creation of a *RawOil* sector, with an appropriate cost and sale structure, is explained. Our aim is to create:

- An additional industry (columns) in the database, namely *RawOil*. *RawOil* is originally included in the *Mining* sector and therefore we disaggregated this sector into a *Mining* sector, which mainly captures all mining activities other oil drilling, and an *RawOil* sector, which represents all oil drilling activities.
- An additional commodity (row) in the database. The new commodity is called *RawOil*.

There are three specific characteristics that distinguish the *RawOil* commodity commodity from other commodities. Firstly, we assume that this commodity is mainly produced domestically. Secondly we assume that this commodity is used only as an intermediate input into the *Petroleum* industry. Finally, this industry use

a combination of intermediate commodities, labour, capital and land as inputs in the production of the *RawOil* commodity.

It should be noted that in the absence of published data on these sectors, we impose hypothetical values to illustrate how this sector may be created. As with all the previous data manipulation procedures described above, the creation of this sector is automated. We can therefore easily accommodate any changes to the imposed values.

To disaggregate the *Mining* sector into a *RawOil* and other *Mining* sectors, the following information regarding the new sectors is required (1) the value of outputs, (2) input structure, and (3) sales structure.

6.1. Creating the oil sector

6.1.1. Value of output

Currently we do not have information regarding the total value of the *RawOil* sector. We assume, for illustrative purposes only, that the value of the *RawOil* industry is 10% of the mining industry, that is:

$$MAKE_{("\text{RawOil}","\text{RawOil}")} = MAKE^{unadjusted}_{("Mining","Mining")} * 0.1 \qquad \text{(E14)}$$

The value of the mining sector, after the oil sector is created, is:

$$MAKE_{("\text{Mining}","\text{Mining}")} = MAKE^{unadjusted}_{("\text{Mining}","\text{Mining}")} - MAKE_{("\text{RawOil}","\text{RawOil}")} \qquad \text{(E15)}$$

6.1.2. Sales structure

Recall from our discussion in Section 4.11.2, that commodity output is equal to the sum of the total domestic use valued at basic price. We therefore need to distribute the total output value $\left(MAKE_{("\text{oil}","\text{oil}")}\right)$ over the users of the commodity, *RawOil*. To create the sales structure of the *RawOil* commodity, we assume that 100% of the

total value of the *RawOil* commodity is used as an intermediate input in the *Petroleum* industry. That is:

$$V1BAS_{("\text{RawOil}","\text{dom}","\text{Petroleum}")} = MAKE_{("\text{RawOil}","\text{RawOil}")} \qquad \text{(E16)}$$

To accommodate the new commodity, we adjust the use structure of the commodity *Mining* by deducting the use structure of the commodity *RawOil* from the use structure of the *Mining* commodity, that is:

(E17)

$$COM\_USE^{(adjusted)}_{(u,"Mining","dom")} = VBAS_{(u,"Mining","dom")} - VBAS_{(u,"RawOil","dom")}$$

To adjust the use of margins to facilitate movement of *RawOil* to the *Petroleum* industry, we assume that the margin rate for the commodity *RawOil* is the same as for *Mining*. We then recalculate the margin matrices and scale them to the total margin value.

6.1.3. Cost structure

In this step we create the input (cost) structure of the industry *RawOil*. Recall from our discussion in Section 4.11.1 that industry cost should equal industry output. This proved to be difficult because of (1) the lack of information regarding industry specific input and cost structures and (2) the input structure of the industries may differ. Due to the lack of information, we assume that the cost structure for the *Oil* industry is similar to the *Mining* sector in the UgAGE database. Hence, we adopt (1) the source-specific intermediate input commodities and (2) the share in which each of these commodities are used from the *Mining* industry. Since we assumed that the value of the *RawOil* sector is 10% of the total *Mining* sector, we allocate 10% of all input costs from the *Mining* industry to the *RawOil* industry.

After we created the new *RawOil* sector the:

- elements in the sets increased from 82 commodities and industries to 83 commodities and industries ; and
- database is slightly unbalanced. The imbalances are corrected to ensure that the balancing conditions holds.

7. REPRESENTING THE UGAGE DATABASE IN A SOCIAL ACCOUNTING MATRIX (SAM) FORMAT

Table 14 presents the entire UgAGE database in the form of a Social Accounting Matrix (SAM). A SAM is an integrated framework that records all transactions in an economy in a given year. It provides information on the prevailing economic and social structure of an economy; illustrates the interaction of various agents; and captures economic flows at both micro and macro levels. Under a SAM framework, it is possible to track how income is generated and consequently distributed and transferred within the economy. Presented in the form of a square matrix, a SAM is composed of different accounts, with entries along the rows representing receipts while column entries track

expenditures. Further details can be found in Corong and Horridge (2011).[18] The SAM extends on an IO database in that it includes transfers between different agents such as households and enterprises. SAM's can also be useful for poverty and income distribution analysis where household income is classified by group, i.e. households per region and by income quartiles.

A SAM adheres to double entry accounting in which a flow is both recorded as a receipt and an expense, thereby resulting in the row sum for each account being equal to its corresponding column sum. The Ugandan SAM shown in Table 14 is square, that is the row labels are the same as the column labels. Most of the entries included in the Ugandan SAM are based on the data from the updated database created in Section 5.

Closer examination of Table 14 reveals that the first 8 rows of the SAM correspond to the IO table database shown in Figure 1. We can therefore match the matrices in the UgAGE database with the entries in the SAM. The entries found along the intersection of the government row and column accounts representing commodity tax, production tax and tariff are computed directly. Entries found along the intersection of the household and enterprise rows and columns represent aggregate labour income and capital rentals and are also computed directly. All SAM entries based on the UgAGE database are printed in black. The IO database does not include information on transfers between the different agents. We complete these entries by calculating the share of each transfer in GDP and then multiplying the share with the GDP computed for 2009. We then determine the income of each agent by entering these entries along the relevant row cells. To determine the

transfers in each column, we calculate the share of this transfer in total expenditure of each agent. We then multiply this share with the agents' income. Entries based on shares are printed in blue. Savings by the different agents are calculated as a residual, which is printed in red in Table 14.

Entries in the SAM are named after the matrices found in the UgAGE database. We now briefly explain the entries found in the SAM. Our first entry is the MAKE matrix. The MAKE represents the domestic production of commodities by industry valued at basic price. The commodity-specific totals for column 1 are equal to the commodity-specific totals of row 1. That is, the domestic output of commodity *c* valued at basic price is equal to the sum over users of the domestic use valued at basic price. The third column shows the value of industry-specific input costs. These costs include intermediate costs at purchasers' price (V1BAS + V1MAR + V1TAX), labour (V1LAB_O)

[18] Refer to Alarcon *et al.*, (2006) for a detailed description of the 2002 Uganda SAM. The description of the SAM structure was taken from Corong and Horridge (2011).

and capital (V1CAP) costs as well as production taxes (V1PTX). The sum over costs is equal to industry-specific output, that is, the totals in column 3 are equal to the totals in row 3. Note the following: (1) that the capital rentals are inclusive of land rentals, and (2) in the database capital rentals are inclusive of mixed income (see Section 3.4.3). The reader will notice that the above discussion on rows and columns 1 and 3 are consistent with the balancing conditions described in Section 4.11.

Column 2 includes the data entries for industry-specific imports valued at basic price. Recall from our discussion in Section 4.6, that the basic value of imports is the c.i.f value of imports (V0CIF) plus commodity-specific tariffs (V0TAR). The supply of imported commodities (totals of column 2) is equal to the demand of imported commodities by users, i.e. totals of row 2. Note that the total value of tariffs (V0TAR_C) appears in row 11 as it is part of government receipts.

The value of labour payments to the representative household (V1LAB_I) in column 4 refers to wage income inclusive of mixed income and corresponds to the labour costs to industry in row 4.[19] Note that the household in Table 14 refers to 1 representative household. We do not classify households by region and income quartiles as in the 2002 SAM. The reason for this is that the UgAGE model includes only 1 representative household and when we constructed the UgAGE database, we aggregated the households as they appear in the 2002 SAM. The value of capital rentals to enterprises (V1CAP_I) in column 6 refers to capital income and

corresponds to the capital costs to industry in row 6.[20] Row 5 shows the value of mixed income by industry. In the UgAGE database capital rentals is inclusive of mixed income. We explicitly include mixed income in Row 5 in Table 14 so that we can calculate the transfers between entities (the sub-matrix of rows 10-15 and Colum 10-15).

The total value of production tax in column 7 is the sum of all industry-specific production taxes which is found along the intersection of row 7 and column 3. Row 8 refers to commodity tax which is inclusive of all indirect taxes. There are non-zero entries for commodity taxes which are paid by industries (V1TAX), households (V3TAX), and investors (V2TAX). We assume that there are no tax entries for government (V5TAX) and exports (V4TAX).[21] The sum of these taxes is equal to the government receipts of commodity taxes (VTAX_CSI) found in the intersection of row 12, column 8.

[19] OCC is a set including 16 labour classes. The classification is based on the level of education reflecting skills and by gender and region (Alarcon *et al.*, 2006:14).
[20] The 2002 SAM does not include land rentals. However, for the UgAGE database we create land rentals for all agriculture, forestry and mining industries. A description of the land rentals is presented in Section 4.2.4.
[21] See Section 4.8 for a description of the creation of the tax matrices included in UgAGE.

Row 12 shows government income from different sources. These sources include all user-specific indirect tax (VTAX_CSI), production tax (V1PTX_I) and tariffs (V0TAR_C). Notice that the row and column totals of the government account is equal.
The sum total of row 13 refers to the value of the savings by households, enterprises, government and foreigners. Total saving is equal to the total of column 13, which refers to total investment.

Column and row 15 refers to foreign receipts and payments. The sum total of row 15 refers to the value of the foreign exchange receipts. Total foreign receipts are equal to the total of column 15, which refers to foreign payments.

As an example of the procedure followed to determine transfers between agents, we explain the process by which we determine the transfers and savings for enterprises. Table 18 represents a sub-section of the larger SAM and only shows the transfers between agents. Consider the Enterprise row. The row total represents enterprise income whereas the column total represents enterprise expenditure. Our first aim is

to complete the entries along the enterprise row.[22] These entries are; VENTHOU displays the value of transfers received by enterprises from households; VENTENT

displays the value of transfers received by enterprises from enterprises, VENTGOV displays the value of transfers received by enterprises from government and VENTROW displays the value of transfers received by enterprises from the ROW. To determine the value of the transfers along the row, we assume that the share of each transfer to GDP is the same between 2002 and 2009. For example, to determine the value of VENTHOU in 2009, we determine the share of VENTHOU to GDP in 2002 and then multiply this share with the GDP in 2009, that is;

$$\text{VENTHOU}^{2009} = \frac{\text{VENTHOU}^{2002}}{\text{GDP}^{2002}} * \text{GDP}^{2009} \qquad \text{(E18)}$$

$$\text{VENTHOU}^{2009} = \frac{14{,}030}{11{,}811{,}520} * 33{,}545{,}400 = 39{,}846 \qquad \text{(E19)}$$

All other transfer entries along the row are calculated in a similar way. Table 16 su summarises the transfers between agents. We now turn our attention to the transfer entries in the enterprise column. These values represent transfers from enterprises to various agents. These entries are VHOUENT, VENTENT, VGOVENT and VROWENT. To

[22] We assume that the same transfers occurred in 2009 as displayed in the 2002 SAM. Hence, if the 2002 SAM displays a transfer between agents, we display this transfer in the 2009 SAM.

determine these values we calculate, from the 2002 SAM, the share of the transfer in total enterprise expenditure and multiply the share with the enterprise income.

$$\text{VHOUENT}^{2009} = \frac{\text{VHOUENT}^{2002}}{\text{EXPENT}^{2002}} * \text{INCOME\_ENT}^{2009} \quad \text{(E20)}$$

$$\text{VHOUENT}^{2009} = \frac{1,667,507}{2,572,813} * 8,802,635 = 5,705,216 \quad \text{(E21)}$$

We follow the same procedure to complete the remaining column transfers from enterprises. Savings by enterprises (VSAVENT) is then calculated as the difference between enterprise income and expenditure. We apply the same reasoning in

deriving all other transfers. Cautions however should be taken when interpreting the transfers between agents as they are based on 2002 shares

Table 13. Example of transfers to and from enterprises

Agents / Agents	Household	**Enterprise**	Government	Capital Account	ROW	Total
Household		**VHOUENT** (5,705,216)				
Enterprise	**VENTHOU** (39,846)	**VENTENT** (542,030)	**VENTGOV** (280,388)		**VENTROW** (357,630)	**Enterprise income*** (8,802,635)
Government		**VGOVENT** (447,933)				
Capital Account		**VSAVENT** (1,421,311)				
ROW		**VROWENT** (686,146)				
Total		**Enterprise expenditure** (8,802,635)				

*Not shown in this table is the row value of 7,582,741 which represent the gross operating surplus exclusive of mixed income. This value is represents the earnings to enterprises from capital.

Table 14. UgAGE Aggregate Social Accounting Matrix (SAM) Database (2009)

			1 Domestic Commodities	2 Imported commodities	3 Industries	4 Labour	5 Mixed income	6 Capital	7 Production Tax	8 Commodity Tax	9 Tariff	10 Households	11 Enterprises	12 Government	13 Private Investment	14 Stocks	15 Rest of the World	16 Total
			← C →	← C →	← I →	← O →		← I →	← I →	← I →	← I →	← I →	← I →	← I →	← I →	← I →	← I →	← I →
	1 Domestic Commodities	↑ C ↓			V1BAS("dom") + V1MAR("dom") (9,638,406)							V3BAS("dom") + V3MAR("dom") (19,843,844)		V5BAS("dom") + V5MAR("dom") (3,232,144)	V2BAS("dom") + V2MAR("dom") (5,162,868)	V6BAS("dom") (81,433)	V4BAS("dom") + V4MAR("dom") (7,787,247)	Demand for Domestic Commodities
	2 Imported commodities	↑ C ↓			V1BAS("imp") + V1MAR("imp") (4,624,291)							V3BAS("imp") + V3MAR("imp") (4,341,350)		V5BAS("imp") + V5MAR("imp") (48,665)	V2BAS("imp") + V2MAR("imp") (2,013,275)	V6BAS("imp") (10,565)		Demand for Imported Commodities
	3 Industries	↑ I ↓	MAKE (45,745,940)															Sales
	4 Labour	↑ O ↓			V1LAB_O (9,568,384)													Wage Income
	5 Mixed income				(12,911,153)													Mixed Income
	6 Capital	↑ 1 ↓			V1CAP + V1LND (7,582,741)													Capital Income
	7 Production Tax	↑ I ↓			V1PTX (1,092,847)													Production Tax
	8 Commodity Tax	↑ 1 ↓			V1TAX_CSI (328,119)							V3TAX_CS (1,448,090)		V5TAX_CS (0)	V2TAX_CS (133,010)		V4TAX_C (0)	Commodity Tax
	9 Tariff	↑ C ↓		V0TAR (481,043)														Tariff
	10 Households	↑ 1 ↓				V1LAB_I (9,568,384)	(12,911,153)					VHOUHOU (3,463,979)	VHOUENT (5,705,217)	VHOUGOV (199,839)			VHOUROW (1,899,867)	Household Income
	11 Enterprises	↑ 1 ↓						V1CAP_I (7,582,741)				VENTHOU (39,846)	VENTENT (542,030)	VENTGOV (280,388)			VENTROW (357,630)	Enterprises' Income
	12 Government	↑ 1 ↓							V1PTX_I (1,092,847)	VTAX_CSI (1,909,219)	V0TAR_C (481,043)	VGOVHOU (465,939)	VGOVENT (447,933)				VGOWROW (3,067,995)	Government Income
	13 Private Investment	↑ 1 ↓										VSAVHOU (2,441,650)	VSAVENT (1,421,311)	VSAVGOV (3,543,538)			VSAVROW (-5,347)	Savings
	14 Stocks	↑ i ↓													VSTKINV_CS			Stocks
	15 Rest of the World	↑ C ↓		V0CIF (10,557,101)								VROWHOU (1,703,742)	VROWENT (686,146)	VROWGOV (160,403)				Foreign Exchange Receipts
	16 Total	↑ 1 ↓	Supply of domestic Commodities	Supply of Imported Commodities	Output (Costs)	Wage Costs	Mixed i Costs	Cost of Capital	Production Tax	Commodity Tax	Tariff	Household Expenditures	Enterprises' Expenditure	Government Expenditure	Private Investment	Stocks	Foreign Exchange Payments	

Legend: I – 83 Industries; C – 83 Commodities; O – 16 Labour Class Types;

Note: Blue cells represent data based on 2002 shares (i.e., not found in Figure 1).
Red cells are calculated as residuals

8. SUMMARY OF SELECTED RESULTS

Some of the salient features of the new 2009 dataset and SAM are described in this section. For reporting purposes, we aggregate the 83 industries to 10 broad industries and the 83 commodities to 10 broad commodities. The following sectors are listed in both Figures 15 and 16; Agriculture, Mining, Raw Oil, Manufacturing, Petroleum, Utilities, Construction, Trade, Transport and Services. We include Raw Oil and Petroleum separately because they are related to the Raw Oil either as a commodity or industry (see Section 6).

Table 15 shows the sales of commodities by broad group to different users. Each entry is valued at purchasers' price. Here, sales include sales of domestically produced products plus sales of corresponding imported products. We include rows 3 and 4 because these commodities were either created (*RawOil*) or part of a sector that was created (*Petroleum*) (see Section 6). As shown in Table 16, the commodity *RawOil* is only used as an input in the production process, that is, the commodity *RawOil* is used as an intermediate input in the *Petroleum* industry. The *Petroleum* industry produces a commodity called *Petroleum* which is mainly used as an intermediate input and by households.

Agricultural products are sold primarily to households (53.8 per cent), with the next largest customer being other industries; primarily food processing industries in the broad manufacturing group. Relative to demand for agricultural products, demand for mining (excluding oil) is small and is spread fairly evenly across intermediate, household and foreign buyers.

Total sales of manufacturing products (excluding petroleum) is twice that of agricultural products. The major source of demand for manufacturing is the household sector (48.6) per cent). The next largest source of demand is industries for production. Other forms of final demand – investment and export – contribute the remaining demand.

Demand for utilities is concentrated in the household sector (65.2 per cent), while demand for construction is heavily oriented towards investment (88.6 per cent). Demand for trade services is also heavily concentrated in one area, with industry demand comprising 84.2 per cent of total sales.

The services sector sells widely throughout the economy, other than to investors. Government is an important source of services demand, with 20.8 per cent of services products going to the public sector.

Overall, as shown in row 11, households are the largest user (43.7%) of all commodities followed by intermediate use (24.8). Exports comprise 13.3 per cent of total sales, while investment demand contributes 12.5 per cent and government demand 5.6 per cent.

Table 15. Sales structure by broad commodity, purchasers' price

		Users						
	Commodity	**Intermediate**	**Investors**	**Household**	**Export**	**Government**	**Stocks**	**Total**
1	Agriculture	2,850,724	63	5,647,603	1,976,159	0	19,678	**10,494,226**
	%	(27.2)	(-)	(53.8)	(18.8)		(0.2)	**(100)**
2	Mining	104,768	0	93,046	83,481	0	85	**281,379**
	%	(37.2)		(33.1)	(29.7)		(-)	**(100)**
3	Raw Oil	15,794	0	0	0	0	0	**15,794**
	%	(100)						**(100)**
4	Manufacturing	5,513,825	2,398,133	10,452,970	3,055,577	0	84,516	**21,505,021**
	%	(25.6)	(11.2)	(48.6)	(14.2)		(0.4)	**(100)**
5	Petroleum	636,406	38	759,774	14,337	0	-12,282	**1,398,274**
	%	(45.5)	(-)	(54.3)	(1.0)		(-0.9)	**(100)**
6	Utilities	235,030	0	878,927	234,633	0	0	**1,348,589**
	%	(17.4)		(65.2)	(17.4)			**(100)**
7	Construction	278,063	4,910,919	352,724	0	0	0	**5,541,706**
	%	(5.0)	(88.6)	(6.4)				**(100)**
8	Trade	508,503	0	95,158	0	0	0	**603,662**
	%	(84.2)		(15.8)				**(100)**
9	Transport	788,645	0	752,868	218,088	3,658	0	**1,763,260**
	%	(44.7)		(42.7)	(12.4)	(0.2)		**(100)**
10	Service	3,659,058	0	6,600,213	2,204,973	3,277,150	0	**15,741,395**
	%	(23.2)		(41.9)	(14)	(20.8)		**(100)**
11	**Total**	**14,590,774**	**7,309,152**	**25,636,575**	**7,791,916**	**3,281,090**	**91,998**	**58,693,305**
	%	**(24.9)**	**(12.5)**	**(43.7)**	**(13.3)**	**(5.6)**	**(0.2)**	**(100)**

Table 16 shows the cost structure of broad industries. Note that the input share for the *RawOil* industry is similar to that of the *Mining* industry by assumption. A key feature of these numbers is the capital/labour ratios of each industry. For example, in agriculture the cost of capital is more than the cost of capital. If the cost of land is included with the cost of capital, then the capital cost is more than twice that the cost of labour. The mining (excluding oil) and oil sectors are much more capital and land intensive, though both use more labour per unit of capital and land than do mining sectors in developed mining-oriented economies such as Australia and Canada. Note that in this table, and in the primary database, we recognise only agricultural land and land which incorporates a natural resource. Thus, for the manufacturing and services industries land is not a cost (see Section 4.2.4).

The manufacturing industries in total are capital intensive, but not nearly as much as the

Utilities sector which has a capital to labour ratio of nearly five. The largest capital to labour ratio belongs to the transport sector, with a ratio of seven.

All other sectors are mildly labour intensive. Overall, for the economy as a whole, the capital to labour ratio is approximately two. The cost of labour comprises 20.9 per cent of total costs, while the cost of capital is 40.4 per cent and the cost of land is 4.4 per cent.

In terms of total cost of production, the largest industry aggregate is Services, followed by agriculture and manufacturing. At present mining (including oil) comprises only a small share of the Ugandan economy.

Table 16. Cost structure by broad industry

	Industry	Intermediate (domestic)	Intermediate (import)	Margin	Commodity tax	Labour	Capital	Land	Production tax	Total
1	Agricul-ture %	818,622 (11.2)	311,0099 (2.5)	105,173 (1.1)	21,945 (0.2)	2,044,795 (56.3)	3,585,933 (16.4)	1,989,109 (8.8)	11,792 (3.4)	**8,888,467** **(100)**
2	Mining %	10,170 (6.7)	10,125 (6.6)	1,147 (0.8)	503 (0.3)	17,009 (31.3)	52,928 (30.2)	10,245 (20)	19,179 (3.9)	**121,305** **(100**
3	RawOil %	1,106 (6.7)	1,101 (6.6)	33 (0.2)	55 (0.3)	1,850 (31.3)	5,758 (30.2)	1,115 (20)	2086 (3.9)	**13,104** **(100)**
4	Manufac-turing %	3,440,055 (37.4)	1,787,815 (22.1)	456,071 (5.6)	80,751 (1.2)	714,567 (10.3)	1,628,960 (18.1)	0 (-)	779,172 (5.4)	**8,887,391** **(100)**
6	Petro-leum %	13,618 (80.8)	720 (1.9)	2874 (14.7)	34 (0.07)	20 (0.5)	16 (1.5)	0 (-)	0 (-)	**17,283** **(100)**
7	Utilities %	42,069 (3.3)	62,795 (4.3)	5,484 (0.4)	4,465 (0.3)	216,563 (16.1)	953,289 (75.5)	0 (-)	0 (-)	**1,284,666** **(100)**
8	Construc-tion %	812,263 (13)	816,165 (16.4)	100,925 (1.9)	34,422 (0.7)	524,955 (35)	3,024,198 (28.8)	0 (-)	76,194 (4.1)	**5,389,121** **(100)**
9	Trade %	855,314 (18.5)	322,817 (7.4)	25,482 (0.6)	39,579 (0.8)	819,349 (48.2)	2,462,775 (24)	0 (-)	198,352 (-0	**4,723,669** **(100)**
10	Transport %	202,391 (9.4)	196,748 (9.5)	13,044 (0.7)	43,571 (2.4)	172,805 (8.7)	1,340,411 (69.4)	0 (-)	0 (-)	**1,968,971** **(100)**
11	Services %	2,610,064 (19.3)	1,114,906 (7.8)	122,502 (0.8)	102,793 (0.8)	5,056,470 (40.2)	5,439,158 (30.5)	0 (-)	6,072 (0.5)	**14,451,964** **(100)**
12	**Total %**	**8,805,672 (19.2)**	**4,624,291 (10.1)**	**832,734 (1.8)**	**328,119 (0.7)**	**9,568,384 (20.9)**	**18,493,426 (40.4)**	**2,000,468 (4.4)**	**1,092,847 (2.4)**	**45,745,941 (100)**

We turn our focus to the entries in the SAM that are not derived or computed from the 2009 CGE database. In Table 14, these entries are captured in rows 10 to 15, excluding row 13 and 14 and columns 10 to 15, excluding column 13 and 14. More specifically, we refer to the blue

and red entries in Table 14. Rows and columns 13 and 14 represent investment and stocks which are derived from the CGE database. For each agent we first review the row entries which refer to income receipts. Thereafter we review column entries. Column entries refer to expenditures by the agents. Savings by the various agents is calculated as a residual.

Row 10 in Table 14 shows all income generated by households. The largest part of household income is from mixed income (38.3%) followed by income from labour (28.4%) and intra-household transfers (10.3%). Labour income is exclusive of mixed income. Row 11 in Table 14 shows all income receipts by enterprises. The largest part

of income generated by enterprises is from capital rentals (86.1%) followed by transfers from other enterprises (6.2%). Capital rentals are exclusive of mixed income.

We turn our focus to the expenditure by households and enterprises. Column 10 shows that 71.2% of household expenditure is on commodities and services followed by transfers between households at 10.3%. Transfers from household to the government and ROW are lower at 1.4 and 7.2% respectively. Our SAM suggests household savings of 1.6%. Column 11 shows that enterprise expenditure is the highest for transfers to households (64.8%) followed by transfers to the ROW and the government at 7.8% and 5.1% respectively. The 2009 SAM suggests enterprise savings at 16.1%.

Row 12 in Table 14 shows the income receipts of the government. Government receipts include income from taxes (commodity and production taxes), transfers from households, enterprises and the rest of the world. The largest source of government income is from taxes (46.6%) followed by overseas transfers (41.1%). The 2009 SAM suggests that 44% of government spending is on commodities and services followed by transfers to enterprises and households. Government savings is 47.5%. A possible reason for the high savings rate is the transfers from the ROW to the government. Recall from our discussion in Section 7 that for each agent we first complete the row entries, that is, we determine all the income receipts. These entries are determined based on the share of each transfer to the GDP in the 2002 SAM. This share is then multiplied with the 2009 GDP. This is the procedure followed to determine transfers from the ROW to the government (39.3%). Summing over row entries yields government receipts, which is equal to government expenditure. Given that we have values for government spending on commodities and services, transfers

from the government to various economic agents, savings is calculated as the residual.

Row 15 shows the income for the ROW. The largest share of income is from imports at 80.5% followed by household transfers to the ROW at 13%. Column 15 shows that 59.4% of transfers from the ROW are for Ugandan exports of commodities and services followed by transfers to the government (23.4%).

9. CONCLUDING REMARKS

This paper represents the guidance manual on the construction of the CGE database for 2002, the updating of this database to 2009 as well as the development of a 2009 SAM. The paper firstly presents a detailed description on the structure of the CGE

database and the data provided to us. Our primary source of data is the 2002 SUT and SAM. We proceed to identify the gap between the required database and the SUT data. Several data manipulation steps are taken to transform the SUT data into the CGE database. We described each data step. After the construction of a 2002 database, we create 2 additional sectors, *Oil* and *Petrol Refinery* sectors. For the creation of these sectors we required information on the value, cost and sales structure of each of these sectors. Our final task is to create a 2009 SAM which is based on the 2009 CGE database. The entries of the first 8 rows in the SAM are taken from the CGE database. The entries for the transfers between economic agents are derived and based on the share of these entries in the 2002 SAM. Finally it should be noted that the deliverables described in this paper/manual are used only in the interim. Currently, a new SAM based on 2009/10 data is being constructed. As soon as this SAM is finalised, a new CGE database will be constructed, which will replace the database described in this paper.

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Appendix A. List of sets and elements in UgAGE

	IND = COM		IND = COM	MAR	OCC	SRC
1	Maize	54	FabMetalProd	MotorSaleRep	URM	Dom
2	Rice	55	MachEquip	Trade	URF	Imp
3	Wheat	56	ElecEquip	TransRail	UUM	
4	Cassava	57	OthManuf	TransGoodRd	UUF	
5	Potato	58	Electricity		SSRM	
6	Cotton	59	Water		SSRF	
7	TobaccoFarm	60	Building		SSUM	
8	Simsim	61	CivilEng		SSUF	
9	Sunflower	62	MotorSaleRep		SRM	
10	Groundnuts	63	Trade		SRF	
11	Millet	64	RepairOthSer		SUM	
12	Sorghum	65	HotelRest		SUF	
13	SugarCereal	66	TransRail		HSRM	
14	Beans	67	TransPasRd		HSRF	
15	FlowerSeed	68	TransGoodRd		HSUM	
16	CoffeeFarm	69	TransAir		HSUF	
17	TeaFarm	70	OthTransAct			
18	Cocoa	71	PostService			
19	Vanilla	72	TeleCom			
20	Matoke	73	FinServices			
21	OthFruitVeg	74	RealEstDwl			
22	DairyFarm	75	OthCompAct			
23	AnimalFarm	76	BusService			
24	Forestry	77	Government			
25	Fishing	78	Education			
26	Mining	79	Health			
27	FishProd	80	ComSocWork			
28	OilsFats	81	Recreational			
29	DairyProd	82	OthActivity			
30	GrainProd	83	RawOil			
31	BakeryProd					
32	Sugar					
33	CoffeeProc					
34	TeaProc					
35	Alcohol					
36	Softdrink					
37	Tobacco					
38	MeatProcess					
39	StarchProd					
40	Textiles					
41	LeatherFoot					
42	WoodProducts					
43	PulpPapPrint					
44	Petroleum					
45	Paints					
46	PharmaMeds					
47	Soap					
48	BasicChem					
49	RubPlastic					
50	MetalProduct					
51	Ceramic					
52	CementLime					
53	BasIrnStl					

Appendix A (continue). List of sets and elements in UgAGE

Labour class	Short name
Unskilled rural male	URM
Unskilled rural female	URF
Unskilled urban male	UUM
Unskilled urban female	UUF
Semi-skilled rural male	SSRM
Semi-skilled rural female	SSRF
Semi-skilled urban male	SSUM
Semi-skilled urban female	SSUF
Skilled rural male	SRM
Skilled rural female	SRF
Skilled urban male	SUM
Skilled urban female	SUF
Highly skilled rural male	HSRM
Highly skilled rural female	HSRF
Highly skilled urban male	HSUM
Highly skilled urban female	HSUF

Source	Short name
Domestic	Dom
Imported	Imp

Appendix B. Mapping of 241 SUT industries to 82 industries

SUT original number	Industry description	UgAGE numbers	UgAGE short name
1	Maize Growing - Local Varieties	1	Maize
2	Maize Growing - Improved Varieties - Low Input	1	Maize
3	Maize Growing - Improved Varieties - High Input	1	Maize
4	Rice, Upland Growing - Present Practice	2	Rice
5	Rice, Upland Growing - Recommended Practice	2	Rice
6	Wheat Growing - Subsistence	3	Wheat
7	Wheat Growing - Recommended Practice	3	Wheat
8	Cassava Growing - Subsistence	4	Cassava
9	Cassava Growing - Recommended Practice	4	Cassava
10	Irish Potatoes Growing - Subsistence	5	Potato
11	Irish Potatoes Growing - Recommended Practice	5	Potato
12	Sweet Potatoes Growing - Subsistence	5	Potato
13	Sweet Potatoes Growing - Recommended Practice	5	Potato
14	Cotton Growing - Traditional	6	Cotton
15	Cotton Growing - Improved	6	Cotton
16	Tobacco Growing - Flue-Cured	7	TobaccoFarm
17	Tobacco Growing - Fire-Cured	7	TobaccoFarm
18	Tobacco Growing - Air-Cured	7	TobaccoFarm
19	Simsim Growing - Subsistence	8	Simsim
20	Simsim Growing - Recommended Practice	8	Simsim
21	Sunflower Growing - Subsistence	9	Sunflower
22	Sunflower Growing - Recommended Practice	9	Sunflower
23	Groundnuts Growing - Subsistence	10	Groundnuts
24	Groundnuts Growing - Recommended Practice	10	Groundnuts
25	Millet Growing	11	Millet
26	Sorghum Growing	12	Sorghum
27	Sugar Growing	13	SugarCereal
28	Growing Of Other Cereal Crops, Etc.	13	SugarCereal
29	Beans Growing - Subsistence	14	Beans
30	Beans Growing - Recommended Practice	14	Beans
31	Growing Flowers For Export	15	FlowerSeed
32	Growing Of Other Horticultural Crops, Etc.	15	FlowerSeed
33	Coffee (Arabica) Growing Traditional Method	16	CoffeeFarm
34	Coffee (Arabica) Growing - Improved Method	16	CoffeeFarm
35	Coffee (Robusta) Growing Traditional Method	16	CoffeeFarm
36	Coffee (Robusta) Growing - Clonal	16	CoffeeFarm
37	Tea Growing Out-Grower	17	TeaFarm
38	Tea Growing - Estate	17	TeaFarm
39	Cocoa Growing - Traditional	18	Cocoa
40	Cocoa Growing - Improved	18	Cocoa
41	Vanilla Growing - Current Practice	19	Vanilla
42	Vanilla Growing - Recommended Practice	19	Vanilla
43	Matoke Growing - Subsistence	20	Matoke
44	Matoke Growing - Recommended Practice	20	Matoke
45	Passion Fruit Growing - Present Practice	21	OthFruitVeg
46	Passion Fruit Growing - Recommended Practice	21	OthFruitVeg
47	Growing Of Other Tree Crops, Etc.	21	OthFruitVeg

Appendix B (continue). Mapping of 241 SUT industries to 82 industries

SUT original number	Industry description	UgAGE numbers	UgAGE short name
48	Farming Of Cattle; Dairy Farming	22	DairyFarm
49	Farming Of Goats And Sheep	23	AnimalFarm
50	Other Livestock Farming	24	DairyFarm
51	Poultry Farming	23	AnimalFarm
52	Farming Of Pigs	23	AnimalFarm
53	Bee Keeping	23	AnimalFarm
54	Other Small Animal Farming; Production Of Animal Products	23	AnimalFarm
55	Unspecified Other Animal Farming; Production Of Animal Produ	23	AnimalFarm
56	Growing Of Crops Combined With Farming Of Animals	23	AnimalFarm
57	Forestry, Logging And Related Service Activities	24	Forestry
58	Fishing, Operation Of Fish Hatcheries And Fish Farms	25	Fishing
59	Mining Of Non-Ferrous Metal Ores, Except Uranium And Thorium	26	Mining
60	Quarrying Of Stone, Sand And Clay	26	Mining
61	Extraction Of Salt	26	Mining
62	Other Mining And Quarrying N.E.C	26	Mining
63	Processing And Preserving Of Of Fish And Fish Products	27	FishProd
64	Manufacture Of Vegetable And Animal Oils And Fats	28	OilsFats
65	Manufacture Of Dairy Products	29	DairyProd
66	Manufacture Of Grain Mill Products	30	GrainProd
67	Manufacture Of Prepared Animal Feeds	30	GrainProd
68	Manufacture Of Bakery Products	31	BakeryProd
69	Manufacture Of Sugar	32	Sugar
70	Coffee Processing	33	CoffeeProc
71	Tea Processing	34	TeaProc
72	Distilling, Rectifying And Blending Of Spirits, Ehtyl Alcoho	35	Alcohol
73	Manufacture Of Malt Liquors And Malt	35	Alcohol
74	Manufacture Of Soft Drinks; Production Of Mineral Waters	36	Softdrink
75	Manufacture Of Tobacco Products	37	Tobacco
76	Production, Processing, And Preserving Of Meat Products	38	MeatProcess
77	Manufacture Of Starches And Starch Products	39	StarchProd
78	Manufacture Of Jaggery	32	Sugar
79	Manufacture Of Other Food Products N.E.C	39	StarchProd
80	Cotton Ginning	40	Textiles
81	Preparation And Spinning Of Textile Fibres; Weaving	40	Textiles
82	Finishing Of Textiles	40	Textiles
83	Manufacture Of Made-Up Textile Articles; Except Apparel	40	Textiles
84	Manufacture Of Carpets And Rugs	40	Textiles
85	Manufacture Of Cordage, Rope, Twine And Netting	40	Textiles
86	Manufacture Of Knitted And Crocheted Fabrics And Articles	40	Textiles
87	Manufacture Of Wearing Apparel, Except Fur Apparel	40	Textiles
88	Tanning And Dressing Of Leather	41	LeatherFoot
89	Manufacture Of Footwear	41	LeatherFoot
90	Sawmilling & Planning Of Wood	42	WoodProducts
91	Manufacture Of Veneer Sheets; Manufacture Of Plywood, Laminb	42	WoodProducts

Appendix B (continue). Mapping of 241 SUT industries to 82 industries

SUT original number	Industry description	UgAGE numbers	UgAGE short name
92	Manufacture Of Builders' Carpentry And Joinery	42	WoodProducts
93	Manufacture Of Other Products Of Wood; Manufacture Of Articl	42	WoodProducts
94	Manufacture Of Pulp, Paper And Paperboard And Of Containers	43	PulpPapPrint
95	Manufacture Of Corrugated Paper, Paper Board And Containers	43	PulpPapPrint
96	M,Anufacture Of Other Articles Of Paper And Paperboard	43	PulpPapPrint
97	Publishing Of Books, Brochures, Musical Books And Other Publ	43	PulpPapPrint
98	Publishing Of Newspapers, Journals And Periodicals	43	PulpPapPrint
99	Printing	43	PulpPapPrint
100	Manufacture Of Refined Petroleum Products	44	Petroleum
101	Manufacture Of Paint, Vanishes And Similar Coatings, Printin	45	Paints
102	Manufacture Of Pharma-ceuticals, Medicinal Chemicals And Bota	46	PharmaMeds
103	Manufacture Of Soap And Detergents, Leaning And Polishing Pr	47	Soap
104	Manufacture Of Basic Chemicals, Except Fertilizers And Nitro	48	BasicChem
105	Manufacture Of Pesti-cides And Other Agro-Chemical Products	48	BasicChem
106	Manufacture Of Other Chemical Products Ne.C.	48	BasicChem
107	Manufacture Of Rubber Tyre And Tubes, Retreading Annd Rebuil	49	RubPlastic
108	Manufacture Of Plastic Products	49	RubPlastic
109	Manufacture Of Structural Metal Products	50	MetalProduct
110	Manufacture Of Non-Structural Ceramic Ware	51	Ceramic
111	Manufacture Of Refractory Ceramic Products	51	Ceramic
112	Manufactur Of Structural Nion-Refractory Clay And Ceramic Pr	51	Ceramic
113	Manufacture Of Cement, Lime And Plaster	52	CementLime
114	Manufacture Of Articles Of Concrete, Cement And Plaster	52	CementLime
115	Manufacture Of Basic Iron & Steel	53	BasIrnStl
116	Forging,Pressing	54	FabMetalProd
117	Treatment And Coating Of Metals; General Mechanical Engineering	54	FabMetalProd
118	Manufacture Of Cutlery, Hand Tools And General Hardware	54	FabMetalProd
119	Manufacture Of Other Fabricated Metal Products N. E. C.	54	FabMetalProd
120	Manufacture Of Machinery For Food ,Beverage And Tobacco	55	MachEquip
121	Manufacture Of Insulated Wire And Cable	56	ElecEquip
122	Manufacture Of Television And Radio Receivers,Sound Or Video	57	OthManuf
123	Manufacture Of Parts And Accesories For Motor Vehicles	57	OthManuf
124	Manufacture Of Bicycles And Invalid Carriages	57	OthManuf
125	Unspecified Manufacture Of Furniture	58	WoodProducts
126	Other Manufacturing N..E.C.	57	OthManuf
127	Production, Collection And Distribution Of Electricity	59	Electricity
128	Collection, Purification And Distribution Of Water	60	Water
129	Building Construction - Except Traditional Rural Houses	61	Building
130	Civil Engineering	62	CivilEng

Appendix B (continue). Mapping of 241 SUT industries to 82 industries

SUT original number	Industry description	UgAGE numbers	UgAGE short name
131	Building Of Traditional Rural Houses	61	Building
132	Building Installation	61	Building
133	Building Completion59	61	Building
134	Sale Of Motor Vehicles	62	MotorSaleRep
135	Maintenance And Repair Of Motor Vehicles	62	MotorSaleRep
136	Sale Of Motor Vehicles Parts And Accesories	62	MotorSaleRep
137	Sale, Repair, Maintenance Of Motorcycles And Related Parts	62	MotorSaleRep
138	Retail Sale Of Automotive Fuel	63	Trade
139	Wholesale Of Agricul-tural Raw Materials And Live Animals	63	Trade
140	Wholesale Of Food, Beverages And Tobacco	63	Trade
141	Wholesale Of Textiles,Clothing And Footwear	63	Trade
142	Wholesale Of Other Household Goods	63	Trade
143	Wholesale Of Sold, Liquid And Gaseous Fuels And Related Prod	63	Trade
144	Wholesale Of Construction Materials	63	Trade
145	Wholesale Of Other Intermediate Products, Waste And Scrap	63	Trade
146	Wholesale Of Machinery, Equipment And Supplies	63	Trade
147	Other Wholesale	63	Trade
148	Retail Sale In Non-Specialized Stores With Food, Beverages	63	Trade
149	Other Retail Sale In Non-Specialized Stores	63	Trade
150	Retail Sale Of Food, Beverages And Tobacco In Specia-lized Stores	63	Trade
151	Retail Sale Of Pharma-ceutical And Medical Goods, Cosmetics	63	Trade
152	Retail Sale Of Textiles, Clothing, Footwear And Leather Good	63	Trade
153	Retail Sale Of Household Appliances,Articles And Equipment	63	Trade
154	Retail Sale Of Hardware,Paints And Glass	63	Trade
155	Other Retail Sale In Specialized Stores	63	Trade
156	Retail Sale Of Second Hand Goods In Stores	63	Trade
157	Retail Sale Via Stalls And Markets	63	Trade
158	Other Non-Store Retail Sale	63	Trade
159	Repair Of Personal And Household Goods	64	RepairOthSer
160	Hotels, Camping Sites And Other Provisions Of Short-Stay Acc	65	HotelRest
161	Restaurants, Bars And Canteens	65	HotelRest
162	Railway Transport	66	TransRail
163	Other Scheduled Passenger Land Transport	67	TransPasRd
164	Other Non-Scheduled Passenger Land Transport	67	TransPasRd
165	Freight Transport By Road	68	TransGoodRd
166	Inland Water Transport	67	TransPasRd
167	Scheduled Air Transport	69	TransAir
168	Non-Scheduled Air Transport	69	TransAir
169	Cargo Handling	70	OthTransAct
170	Storage And Warehousing	70	OthTransAct
171	Other Supporting Transport Activities	70	OthTransAct
172	Activities Of Travel Agencies And Tour Operators,Tourist Ass	64	RepairOthSer
173	Activities Of Other Transport Agencies	64	RepairOthSer

Appendix B (continue). Mapping of 241 SUT industries to 82 industries

SUT original number	Industry description	UgAGE numbers	UgAGE short name
174	National Post Activities	71	PostService
175	Courier Activities Other Than National Post Activities	71	PostService
176	Telecommunications	72	TeleCom
177	Central Banking	73	FinServices
178	Commercial Banks, Other Monetary Intermediaries	73	FinServices
179	Financial Leasing	73	FinServices
180	Other Credit Granting, Micro Credit Institutions	73	FinServices
181	Nominal Banking Sector	73	FinServices
182	Activities Auxiliary To Financial Intermediation N.E.C, Fore	73	FinServices
183	Security Dealing Activities	73	FinServices
184	Activities Auxiliary To Insurance And Pension Funding	73	FinServices
185	Life Insurance	73	FinServices
186	Non-Life Insurance	73	FinServices
187	Real Estate Activities With Own Or Leased Property	74	RealEstDwl
188	Real Estate Activities On A Fee Or Contract Basis	74	RealEstDwl
189	Renting Of Agricultural Machinery And Equipment	64	RepairOthSer
190	Renting Of Personal And Household Goods N.E.C	64	RepairOthSer
191	Software Consultancy And Supply	64	RepairOthSer
192	Maintenance And Repair Of Office, Accounting And Computing Machinery	64	RepairOthSer
193	Other Computer Related Activities	75	OthCompAct
194	Research And Experimental Development On Natural Sciences An	76	BusService
195	Research And Experimental Development On Social Sciences And	76	BusService
196	Legal Activities	76	BusService
197	Accounting, Book-Keeping And Auditing Activities; Tax Consul	76	BusService
198	Business And Management Consultancy Activities	76	BusService
199	Architectural And Engineering Activities And Related Technic	76	BusService
200	Technical Testing And Analysis	76	BusService
201	Investigation And Security Activities	76	BusService
202	Photographic Activities	76	BusService
203	Imputed Rent Of Owner-Occupied Dwellings	76	RealEstDwl
204	Market Research	76	BusService
205	Advertising	76	BusService
206	Building-Cleaning Activities	76	BusService
207	Other Business Activities N.Ec..	76	BusService
208	General (Overall) Public Service Activities	77	Government
209	Regulation Of The Activities Of Agencies That Provide Health	77	Government
210	Regulation Of And Contribution To More Efficient Operation O	77	Government
211	Ancillary Service Activities For The Government As A Whole	77	Government
212	Defence Activities	77	Government
213	Public Order And Safety Activities	77	Government
214	Unspecified Compulsory Social Security Activities	77	Government
215	Primary Education	78	Education
216	General Secondary Education	78	Education
217	Technical And Vocational Seconday Education	78	Education

Appendix B (continue). Mapping of 241 SUT industries to 82 industries

SUT original number	Industry description	UgAGE numbers	UgAGE short name
218	Higher Eduication	78	Education
219	Adult And Other Education	78	Education
220	Hospital Activities	79	Health
221	Medical And Detal Practice Activities	79	Health
222	Other Human Health Activities	79	Health
223	Veterinary Activities	79	Health
224	Social Work With Accomodation	80	ComSocWork
225	Social Work Without Accomodation	80	ComSocWork
226	Activities Of Business And Employers' Organizations	80	ComSocWork
227	Activities Of Trade Unions	80	ComSocWork
228	Activities Of Religious Organizations	80	ComSocWork
229	Activities Of Other Membership Organizations N.E.C	80	ComSocWork
230	Motion Picture Projection	81	Recreational
231	Radio And Television Activities	81	Recreational
232	Dramatic Arts, Music And Other Arts Activities	81	Recreational
233	Other Entertainment Activities N.E.C	81	Recreational
234	Botanical, Zoological Gardens And Nature Reserves Activities	81	Recreational
235	Other Recreational Activities	81	Recreational
236	Washing And (Dry-) Cleaning Of Textile And Fur Proucts	82	OthActivity
237	Hair Dressing And Other Beauty Treatment	82	OthActivity
238	Sewage And Refuse Disposal, Sanitation And Similar Activities	82	OthActivity
239	Sporting Activities	82	OthActivity
240	Private Households With Employed Persons	82	OthActivity
241	Extra-Territorial Organizations And Bodies	64	RepairOthSer

Appendix C. Mapping of 142 SUT commodities to 82 industries

SUT original number	Commodity description	UgAGE numbers	UgAGE short name
1	Maize	1	Maize
2	Rice, Upland	2	Rice
3	Wheat	3	Wheat
4	Cassava	4	Cassava
5	Irish Potato	5	Potato
6	Sweet Potato	5	Potato
7	Cotton	6	Cotton
8	Tobacco	7	TobaccoFarm
9	Simsim	8	Simsim
10	Sunflower	9	Sunflower
11	Groundnuts	10	Groundnuts
12	Beans	11	Beans
13	Millet	12	Millet
14	Sorghum	13	Sorghum
15	Growing Of Other Cereal Crops, Etc.	14	SugarCereal
16	Growing Of Other Horticultural Crops, Etc.	11	Beans
17	Flowers For Export	15	FlowerSeed
18	Flower Seeds And Fruit Seeds	15	FlowerSeed
19	Coffee (Arabica)	16	CoffeeFarm
20	Coffee (Robusta)	16	CoffeeFarm
21	Tea	17	TeaFarm
22	Cocoa	18	Cocoa
23	Vanilla	19	Vanilla
24	Matoke	20	Matoke
25	Passion Fruit	21	OthFruitVeg
26	Growing Of Other Tree Crops, Etc.	21	OthFruitVeg
27	Farming Of Cattle; Dairy Farming	22	DairyFarm
28	Farming Of Sheep And Goats	23	AnimalFarm
29	Farming Of Horses, Asses, Mules And Hinnies, Etc	23	AnimalFarm
30	Poultry Farming	23	AnimalFarm
31	Pig Farming	23	AnimalFarm
32	Bee Keeping, Natural Honey	23	AnimalFarm
33	Other Animal Farming; Production Of Animal Products N.E.C	23	AnimalFarm
34	Agriculture And Animal Husbandry Service Activities, Except	23	AnimalFarm
35	Forestry, Logging And Related Service Activities	24	Forestry
36	Fishing, operation of fish hatcheries and fish farms	25	Fishing
37	MINING AND QUARRYING	26	Mining
38	Processing And Preserving Of Meat And Meat Products	27	MeatProcess
39	Processing And Preserving Of Fish And Fish Products	28	FishProd
40	Manufacture Of Vegetable And Animal Oils And Fats	29	OilsFats
41	Manufacture Of Dairy Products	30	DairyProd
42	Manufacture Of Grain Mill Products	31	GrainProd
43	Manufacture Of Prepared Animal Feeds	31	GrainProd
44	Manufacture Of Bakery Products	32	BakeryProd

Appendix C (continue). Mapping of 142 SUT commodities to 82 industries

SUT original number	Commodity description	UgAGE numbers	UgAGE short name
45	Manufacture Of Sugar	33	Sugar
46	Coffee Processing	34	CoffeeProc
47	Tea Processing	35	TeaProc
48	Distilling, Rectifying And Blending Of Spirits, Ehtyl Alcohol	36	Alcohol
49	Manufacture Of Wines	36	Alcohol
50	Manufacture Of Malt Liquors And Malt	36	Alcohol
51	Manufacture Of Soft Drinks; Production Of Mineral Waters	37	Softdrink
52	Manufacture Of Other Food Products	38	StarchProd
53	Manufacture Of Tobacco Products	39	Tobacco
54	Spinning, Weaving And Finishing Of Textiles	40	Textiles
55	Manufacture Of Textile Articles	40	Textiles
56	Manufacture Of Wearing Apparel	40	Textiles
57	Manufacture Of Leather, Products And Footwear	41	LeatherFoot
58	Sawmilling And Manufacture Of Wood Products	42	WoodProducts
59	Manufacture Of Pulp, Paper And Paperboard And Its Products	43	PulpPapPrint
60	Publishing	43	PulpPapPrint
61	Printing And Service Activities Related To Printing	43	PulpPapPrint
62	Reproduction Of Recorded Media	43	PulpPapPrint
63	Petroleum Refining, Manufacture Of Products Of Coal	44	Petroleum
64	Manufacture Of Paint, Vanishes And Similar Coatings, Printing	45	Paints
65	Manufacture Of Pharmaceuticals, Medicinal Chemicals And	46	PharmaMeds
66	Manufacture Of Soap And Detergents, Cleaning & Polishing	47	Soap
67	Manufacture Of Basic Chemicals, Fertilisers, Pesticides And	48	BasicChem
68	Manufacture Of Tyres, Tubes And Other Rubber Products	49	RubPlastic
69	Manufacture Of Plastic Products	49	RubPlastic
70	Manufacture Of Refractory Ceramic Products	50	Ceramic
71	Manufacture Of Structural Non-Refractory Clay And Ceramic Products	50	Ceramic
72	Manufacture Of Cement, Lime And Plaster	51	CementLime
73	Manufacture Of Articles Of Concrete, Cement And Plaster	51	CementLime
74	Manufacture Of Glass And Other Non-Metalic Mineral Products	52	Ceramic
75	Manufacture Of Basic Metal Products	53	MetalProduct
76	Manufacture Of Structural Metal Products	53	MetalProduct
77	Manufacture Of Fabricated Metal Products	54	FabMetalProd
78	Manufacture Of Machinery And Equipment	55	MachEquip
79	Manufacture Of Electrical Equipment, Apparatus And Supplies	56	ElecEquip
80	Manufacture Of Television, Radio And Apparatus For Telephony	56	ElecEquip
81	Manufacture Of Instruments, Watches And Clocks	56	ElecEquip
82	Manufacture Of Motor Vehicles, Bodies And Parts	57	OthManuf
83	Manufacture Of Ships And Boats	57	OthManuf
84	Manufacture Of Furniture	42	WoodProducts
85	Other Manufacturing N..E.C.	57	OthManuf
86	Electricity Supply	58	Electricity
87	Collection, Purification And Distribution Of Water	59	Water

Appendix C (continue). Mapping of 142 SUT commodities to 82 industries

SUT original number	Commodity description	UgAGE numbers	UgAGE short name
88	Construction Of Buildings	60	Building
89	Civil Engineering	61	CivilEng
90	Construction Of Rural Housing	60	Building
91	Building Installation	60	Building
92	Building Completion	60	Building
93	Sale Of Motor Vehicles	62	MotorSaleRep
94	Sale And Repair Of Motor Cycles And Sale Of Spare Parts	62	MotorSaleRep
95	Retail Sale Of Automotive Fuel	63	Trade
96	Wholesale Trade	63	Trade
97	Retail Trade	63	Trade
98	Repair Of Personal And Household Goods	64	RepairOthSer
99	Hotels, Camping Sites And Other Provisions Of Short-Stay	65	HotelRest
100	Restaurants, Bars And Canteens	65	HotelRest
101	Railway Transport	66	TransRail
102	Passenger Road Transport	67	TransPasRd
103	Goods Road Transport	68	TransGoodRd
104	Water Transport	67	TransPasRd
105	Air Transport	69	TransAir
106	Other Supporting Transport Activities	70	OthTransAct
107	Activities Of Travel Agencies And Tour Operators, Tourist	64	RepairOthSer
108	Activities Of Other Transport Agencies	64	RepairOthSer
109	Post Activities, Courier Services	71	PostService
110	Telecommunications	72	TeleCom
111	Central Banking	73	FinServices
112	Commercial Banks, Other Monetary Intermediaries	73	FinServices
113	Other Credit Granting, Micro Credit Institutions	73	FinServices
114	Insurance	73	FinServices
115	Activities Auxiliary To Financial Intermediation N.E.C, Fore	73	FinServices
116	Other Activities Auxiliary To Financial Intermediation, Insu	73	FinServices
117	Real Estate Activities	74	RealEstDwl
118	Imputed Rent Of Owner-Occupied Dwellings	74	RealEstDwl
119	Renting Of Transport Equipment	64	RepairOthSer
120	Renting Of Other Machinery And Equipment	64	RepairOthSer
121	Renting Of Personal And Household Goods N.E.C	64	RepairOthSer
122	Data Processing, Computer Consultancy And Related Activities	75	OthCompAct
123	Research And Experimental Development	76	BusService
124	Legal Activities	76	BusService
125	Accounting, Book-Keeping And Auditing Activities; Tax Consul	76	BusService
126	Business And Management Consultancy Activities	76	BusService
127	Architectural And Engineering Activities, Consultancies	76	BusService
128	Investigation And Security Activities	76	BusService
129	Photographic Activities	82	OthActivity
130	Other Business Services	76	BusService
131	Public Administration And Defence	77	Government
132	Education	78	Education

Appendix C (continue). Mapping of 142 SUT commodities to 82 industries

SUT original number	Commodity description	UgAGE numbers	UgAGE short name
133	Medical Services and Social Work	79	Health
134	Community, Cultural And Personal Services	80	ComSocWork
135	Activities Of Membership Organizations	80	ComSocWork
136	Entertainment Activities	81	Recreational
137	Botanical And Zoological Gardens And Nature Reserves Activities	81	Recreational
138	Other Recreational Activities	81	Recreational
139	Washing And (Dry-) Cleaning Of Textile And Fur Proucts	82	OthActivity
140	Hair Dressing And Other Beauty Treatment	82	OthActivity
141	Other Community, Cultural And Personal Services	80	ComSocWork
142	Private households with employed persons	82	OthActivity

Appendix D. Summary of all factor payment in the UgAGE database (2002)

	Industry	Labour	GOS	Land rentals	Production tax	Total
1	Maize	55,263	53,812	35,875	128	145,078
2	Rice	12,953	15,452	10,301	2	38,708
3	Wheat	2,271	649	649	0	3,569
4	Cassava	79,967	101,990	76,741	0	258,698
5	Potato	90,696	88,288	66,432	5	245,421
6	Cotton	6,741	4,340	3,100	99	14,280
7	TobaccoFarm	27,125	23,083	16,488	356	67,052
8	Simsim	5,988	5,532	4,163	0	15,683
9	Sunflower	1,716	1,639	1,233	0	4,588
10	Groundnuts	23,879	17,583	13,230	20	54,712
11	Millet	47,951	10,644	8,009	0	66,604
12	Sorghum	15,804	3,508	2,640	667	22,619
13	SugarCereal	20,098	19,069	14,301	158	53,626
14	Beans	92,212	112,743	84,833	17	289,805
15	FlowerSeed	5,795	6,220	4,443	0	16,458
16	CoffeeFarm	35,888	38,369	28,870	10	103,137
17	TeaFarm	18,369	1,775	1,336	15	21,495
18	Cocoa	693	1,409	1,060	0	3,162
19	Vanilla	4,352	4,075	3,066	0	11,493
20	Matoke	93,939	118,959	89,510	0	302,408
21	OthFruitVeg	9,896	6,785	5,105	667	22,453
22	DairyFarm	23,927	73,505	56,411	5	153,848
23	AnimalFarm	2,531	31,609	23,707	193	58,040
24	Forestry	1,702	316,966	51,962	59	370,689
25	Fishing	30,917	139,678	78,449	10	249,054
26	Mining	7,087	21,915	4,383	5,307	38,692
27	FishProd	5,459	6,446	0	0	11,905
28	OilsFats	975	856	0	2,166	3,997
29	DairyProd	2,432	7,341	0	2,477	12,250
30	GrainProd	10,335	69,762	0	17,926	98,023
31	BakeryProd	3,306	25,229	0	810	29,345
32	Sugar	16,871	22,256	0	9,769	48,896
33	CoffeeProc	6,349	7,597	0	341	14,287
34	TeaProc	31,730	24,654	0	10	56,394
35	Alcohol	16,283	64,652	0	3,625	84,560
36	Softdrink	22,447	52,957	0	417	75,821
37	Tobacco	13,532	5,662	0	1,178	20,372
38	MeatProcess	551	482	0	353	1,386
39	StarchProd	768	4,146	0	1,902	6,816
40	Textiles	15,749	22,480	0	25,992	64,221
41	LeatherFoot	1,270	6,359	0	15,037	22,666
42	WoodProducts	8,830	6,974	0	16,259	32,063
43	PulpPapPrint	8,610	8,054	0	14,516	31,180
44	Petroleum	6	5	0	0	11
45	Paints	506	444	0	2,302	3,252
46	PharmaMeds	511	1,655	0	0	2,166
47	Soap	7,566	33,049	0	16,516	57,131
48	BasicChem	2,205	11,133	0	2,986	16,324
49	RubPlastic	6,427	17,231	0	20,534	44,192
50	MetalProduct	14,788	13,976	0	8,483	37,247
51	Ceramic	8,264	54,837	0	12,523	75,624
52	CementLime	12,507	58,500	0	11,096	82,103
53	BasIrnStl	1,438	26,381	0	0	27,819
54	FabMetalProd	2,187	18,895	0	0	21,082
55	MachEquip	86	238	0	0	324

Appendix D (continue). Summary of all factor payment in the UgAGE database (2002)

	Industry	Labour	GOS	Land rentals	Production tax	Total
56	ElecEquip	142	495	0	32,716	33,353
57	OthManuf	370	691	0	24,221	25,282
58	Electricity	44,317	109,594	0	0	153,911
59	Water	27,209	231,430	0	0	258,639
60	Building	142,437	852,573	0	16,578	1,011,588
61	CivilEng	13,536	121,828	0	0	135,364
62	MotorSaleRep	10,903	74,987	0	82,418	168,308
63	Trade	212,047	948,355	0	0	1,160,402
64	RepairOthSer	96,353	84,944	0	0	181,297
65	HotelRest	76,666	405,561	0	0	482,227
66	TransRail	18,431	24,171	0	0	42,602
67	TransPasRd	19,364	193,052	0	0	212,416
68	TransGoodRd	7,161	33,543	0	0	40,704
69	TransAir	8,963	17,635	0	0	26,598
70	OthTransAct	7,547	8,740	0	0	16,287
71	PostService	10,720	6,007	0	0	16,727
72	TeleCom	50,595	112,570	0	0	163,165
73	FinServices	189,215	46,489	0	0	235,704
74	RealEstDwl	3,013	883,907	0	0	886,920
75	OthCompAct	5,636	4,697	0	0	10,333
76	BusService	87,658	82,075	0	1,556	171,289
77	Government	533,708	63,499	0	0	597,207
78	Education	737,419	140,518	0	0	877,937
79	Health	124,403	70,679	0	158	195,240
80	ComSocWork	54,562	54,233	0	0	108,795
81	Recreational	17,622	9,440	0	59	27,121
82	OthActivity	28,007	55,613	0	0	83,620
	Total	3,467,761	6,429,170	686,298	352,640	10,935,869