

Chapter 4

THE SOCIAL ACCOUNTING MATRIX AND OTHER DATA SOURCES

4.1. Introduction

In order to transform a general equilibrium model into a CGE model one needs to incorporate country specific data. Most of the data required by a CGE model is captured within a Social Accounting Matrix (SAM). The United Nations' (1993) System of National Accounts (SNA) defines a SAM as a presentation of SNA accounts in a matrix that elaborates the linkages between a supply and use table and institutional sector accounts. A SAM therefore contains data on production activities, intermediate inputs, primary factors, commodities, households and other institutions like enterprises, the government and the rest of the world. The SAM represents the flow of transactions in the economy. The data within a SAM is based mainly on national accounts data, but also includes data from household surveys as well as from other sources. The data in the SAM is more disaggregated to incorporate structural and behavioral aspects of an economy. Various SAMs have been drawn up representing the South African economy. Recently, Conninghart (2001), Statistics South Africa (2002) and Van Der Merwe (SA SAM, 2003) compiled SAMs for the South African economy. The World Bank, for specific use towards CGE modeling, commissioned the SAM compiled by Van Der Merwe in 2003. This SAM is used as data input for this CGE model. The applied CGE model will follow the South African SAM disaggregation of activities, commodities, factors, households and other institutions. The applied CGE model will then be used to analyze the effect of changes in VAT on the South African economy.

This chapter first defines a SAM, then gives a brief description of the uses of a SAM, and explains the use of a SAM within CGE modeling. The chapter then looks at the standard SAM and specifically the South African SAM compiled by Van der Merwe (SA SAM 2003) that is used as main data source within the CGE model. Lastly, other data sources used in the CGE model is listed.

4.2. Definition

A SAM is another method of stating the circular flow in an economy. The circular flow results from commodities produced through activities¹ with the available production factors. A SAM portrays the system of inter-industry linkages in an economy. For example intermediate inputs purchased by one industry at the same time represents sales of another industry. (Devarajan et al,1994:3-2). The United Nation's (1993) System of National Accounts (SNA), as already stated in section 5.1, defines a SAM as a presentation of SNA accounts in a matrix, which elaborates the linkages between a supply and use table and institutional sector accounts. The data contained within a SAM shows that the distribution of employment, living standards, the distribution of resources and the structure of production are interlinked (Pyatt and Round,1985:2). A SAM also shows government involvement and the role of the foreign sector (Devarajan et al,1994:3-2).

Technically, a SAM is a square matrix within which each account is represented by a row and a column (Löfgren et al,2001:3). The columns represent expenditures, and the rows incomes. The double-accounting principle ensures that the totals in the rows will equal the totals in the columns, that is the income from each activity or institution must equal expenditure (Pyatt and Round,1985:17). A SAM usually focuses on the real side of the economy. A SAM is static and therefore gives an account of a country's economic structure at one point in time.

4.3. The Objectives or Uses of a SAM

A SAM has two objectives or uses. The first use is for the organization of information on the socio-economic status of a region or a country, and the second to provide the statistical basis for the creation of plausible models (Pyatt and Round,1985:17). The United Nation's (1993) SNA's classification of the uses of a SAM is similar to the

¹ Each producer is represented by an activity (Löfgren et al,2001:9).

classifications above and divides the uses of a SAM into monitoring uses and uses towards analysis.

Organization of Information

The organization of information is the most obvious use of a SAM. A SAM consists of data on activities, products, intermediate inputs, factors, households and other institutions - making a SAM a comprehensive data source. The SNA has set down guidelines for deriving national income statistics as part of a more comprehensive social accounting matrix approach. Some data elements contained within a SAM are supply and use tables, flow-of-funds tables (only when flow of funds is incorporated), national accounts data, and household survey results. The SAM also provides the first step in upgrading statistical information. Since a SAM contains data from national accounts data and household surveys, a SAM forces attention to discrepancies between national accounts data and the results of household surveys (Pyatt and Round,1985:48). The reconciliation of data from various sources and varying qualities are therefore unavoidable (Pyatt and Round,1985:61).

A SAM is an extension of supply and use tables and shows the entire circular flow of income. Five types of accounts are distinguished within a SAM, namely the supply and use of goods and services, production, the distribution of income, the use of income, and capital transactions. Four types of units are included, namely products, establishments, primary input units, and institutional units. Goods and services are classified according to the Central Product Classification, while establishments are classified according to the categories of the International Standard Industrial Classification. (United Nations,1993).

Modeling Uses

Because a SAM provides a comprehensive set of data on almost all economic participants, a SAM is easily applied to policy analysis. It links policy, data and models (Pyatt and Round,1985:53). A SAM may be used by economic planners or by

development economists towards policy analysis, to test behavioral assumptions of a model, or to test a model's validity. SAM's have been applied to analysis of interrelationships between structural features of an economy and the distribution of income and expenditure among household groups (United Nations,1993).

A SAM is well equipped to deal with inequality studies focusing on the distribution of income that requires a household disaggregated by income, race, or geographical location. SAMs are applied to analysis of poverty, the satisfying of basic needs, and how different activities affect different socio-economic groups in society (Pyatt and Round,1985:17) and (United Nations,1993).

The economic agents within the SAM may be linked with a set of equations explaining their behavior. A complete model may be specified based on the SAM accounts. This will, however require the specification of (a) market behavior (supply, demand and market clearing conditions), (b) households with budget constraints, (c) a government account which also contains a budget constraint, (d) savings equaling investment, and (e) also specifying the external balance (Devarajan et al,1994:3-5). Because all the economic participants are linked a change in one sector of the linked SAM model will result in a change elsewhere. The use of equations within a SAM is closely related to the use of multiplier analysis. A SAM is based on Supply and Use tables² and these tables have fixed coefficients. The SAM presents the data in the supply and use tables in an inverse form. The inverse form is known as multipliers and gives a better analysis of the effect of exogenous changes on other economic variables. (United Nations,1993). A multiplier matrix consists of three separate multiplier matrices namely, one that captures the effects of transfers within the economy, a second that captures the effects of an injection in one section of the economy on the other sections, and a third that shows the full circular flow of an injection and back to its origin in a series of weakening cycles. These multipliers are analogous to fixed-price multipliers, but also incorporate income elasticities as represented in the SAM. The multipliers capture the link between

production and income (Pyatt and Round,1985:187). Under the assumption that prices remain fixed after income changes, fixed-price multipliers may be used to measure the effect of changes in injections into the economy on the levels of endogenous income (Pyatt and Round,1985:197). Multiplier analysis takes into account all the interaction within each step of the process of linkages among incomes, expenditures, and production. There is not a single multiplier, but a matrix of multipliers, which show the potential effect of expanding one cell of the original SAM on the rest of the cells. The SAM relationships may trace the complex interactions inherent in the circular process. (Pyatt and Round,1985:48). In analysis over the short term the fixed-coefficient in the matrix is sufficient to give a structural representation of the economy (United Nations,1993).

Another application of SAMs is their use in applied general equilibrium models. These models simulate the effects on various economic variables including growth and income distribution of various policies. Trade liberalization, tax rate changes and structural adjustment packages are some of the issues investigated. The data requirement for these models is a base-year SAM disaggregated into different products, establishments, labor groups and institutions, as well as data on population. Additional data is needed to estimate the relevant elasticities (United Nations,1993).

Using a SAM within a CGE Model

“A SAM provides a framework and consistent (base-year) data for economy-wide models with detailed classification of actors, employed persons and institutional sub-sectors, including various socio-economic household groups.” (United Nations,1993)

Social accounting matrices are often used to calibrate and balance CGE models. CGE models also include data from a balanced SAM. (Löfgren et al,2001:2).

² . Supply and use tables are in the form of matrices, which show how the supplies of goods and services from domestic suppliers and imports are allocated between intermediate and final uses, excluding exports (OECD,2003).

The whole SAM may be used or only certain parts of a SAM. A question that often arises is to what extent a SAM should be disaggregated. Disaggregation may vary in degree. Usually in a disaggregated SAM allowances are made for a number of factors and household accounts, different activities and for different commodities. A highly disaggregated SAM specifies industry activities, while a less disaggregated SAM may specify sectoral activities. Disaggregation, however, requires more data and effort. Disaggregation requires inter account flows, expenditure patterns by different households, income distribution patterns, different factor incomes from different activities, and more. There are limitations to the size of a SAM, which include the availability of data, the motivation for constructing it and the effort of constructing larger SAMs (Pyatt and Round,1985:17). An aggregate matrix, on the other hand, shows the main transaction categories as well as the domestic and national balancing items, contains national accounts figures, and gives a picture of the economy as a whole (United Nations,1993). A detailed matrix, on the other hand, shows interrelated transactions by paying and receiving units, that is, the interrelationships among economic flows. A detailed matrix may be used for analytical applications. Additional data, not included in the SAM, that is useful to include for modeling purposes are labor force participation rates and population size (United Nations,1993). However, a SAM needs to be disaggregated to the extent required by the model that uses the SAM. In addition, a SAM needs to be disaggregated according to the policy issue analyzed.

The benefit of using a SAM is its ability to capture the structural features of an economy. However, data constraints impose a threat on the ability of the SAM to contain structural features. First, the data should be as current as possible to incorporate structural changes. In some cases the data used within a SAM is outdated. (Van der Merwe,2002).

A criticism against the use of a SAM to calibrate a model is that it is statistically incorrect. The data contained within the SAM is based on a single observation and not on a series of observations as would be statistically more significant. It will be more realistic to use time series data instead of one single set of data. However, it is not easy to obtain SAMs over a range of periods as the scope of the data contained within a SAM

makes it difficult to obtain this data for a range of periods. To improve the realism of the model relevant elasticities may be estimated using time series data, while the rest is calibrated using the data of the SAM (United Nations,1993). This will make the model more realistic, but will also balance and configure the model.

4.4. Standard CGE Model - The SAM as Data Requirement

The standard CGE model developed by Löfgren et al (2001) from IFPRI uses a specific SAM structure to standardize inputs. Within the standardized SAM, activities, commodities, factors, enterprises, households, governments, savings and investments, as well as the rest of the world, may be specified according to the requirements of the issue being analyzed.

4.4.1 Explaining the Contents of the Standard SAM

The content of the social accounting matrix may be explained as follows:

Commodities

Commodities can be either produced domestically and/or imported. Commodities are valued at market prices, meaning import tariffs are added and export subsidies excluded. Final consumption expenditure consists of household consumption, government consumption, investment demand and the demand for intermediate inputs. For each traded commodity, the SAM accounts for costs associated with domestic, import and export marketing and transportation. This represents the cost of moving the commodity from the domestic producer to the demander and the other way around.

Table 4.1: Basic SAM Structure Used in the CGE Model from (Löfgren et al,2001:4)

		EXPENDITURES								
R E C E I P T S		Activities	Commodities	Factors	Enterprises	Households	Government	Savings- Investment	Rest of World	TOTAL
	Activities		Marketed outputs							Gross output
	Commodities	Intermediate inputs				Consumption expenditure	Government consumption	Investment	Exports	Demand
	Factors	Value added							Factor income from RoW	Factor income
	Enterprises			Factor income to enterprises			Transfers to enterprises		Transfers to enterprises from RoW	Enterprise income
	Households			Factor income to HH's	Surplus to HH's	Inter HH transfers	Transfers to HH's		Transfers to HH's from RoW	HH income
	Government	Producer taxes, Value-added taxes	Sales taxes, tariffs, exports taxes	Factor income to governmentFac tor taxes	Transfers to government Direct enterprise taxes	Transfers to government Direct HH taxes			Transfers to government from RoW	Government income
	Savings- Investment				Enterprise savings	HH savings	Government savings		Foreign savings	Savings
	Rest of World		Imports	Factor income to RoW	Surplus to RoW		Government transfers to RoW			Foreign exchange outflow
	TOTAL	Activity expenditures	Supply	Factor expenditures	Enterprise expenditure	Household expenditure	Government expenditure	Investment	Foreign exchange inflow	

Activities

The activities are responsible for the production of goods and services. Activities combine intermediate inputs and production factors, adding value, and produce goods and services that are either consumed domestically or exported to the rest of the world. The receipts are valued at producers' prices in the activity accounts, therefore VAT is levied on the production activity, while producers' subsidies reduce the expenses of activities. VAT is calculated on the value added by producers, and is equal to the amount of VAT paid by consumers minus the VAT paid by producers on intermediate inputs. Activities are permitted to produce multiple commodities, and any commodity may be produced by multiple activities. The activity block in the SAM closely resembles the supply and use tables (or in some cases the input-output tables). The inputs bought by activities are shown in rows, while the outputs sold by activities are shown in columns.

Factors

Value added by the activities includes compensation of employees, as well as gross operating surplus. Gross operating surplus in turn includes net operating surplus, as well as consumption of fixed capital. This is also equal to gross domestic production at factor cost. By adding other production taxes and excluding production subsidies one may derive gross domestic product at basic prices. By including indirect taxes, but excluding consumption subsidies, one finally derives gross domestic production at market prices. (Van der Merwe,2002). Therefore, the factors included are capital and labor. Labor, in turn may be disaggregated by skill or geographical area depending on the availability of data and the issue under consideration.

Apart from value-added factor income, income may also flow from the rest of the world. Factor payments are made to households, enterprises, the government and the rest of the world.

Households

Households may be classified by size of income, by demographic composition, by age or occupation of the head, by regions and so on. Distribution by these criteria serves different purposes. However, it is debatable whether disaggregating households into different income

categories is appropriate when the intention is to study the impact of policy of income distribution. The reason is that by disaggregating households into income categories one actually specifies income exogenously, while income is an endogenous variable in a CGE model. There is also no way of saying how households move between income categories if their income changes. The total income of households is equal to factor income from the sales of production factors via the allocation matrix, plus all transfers from government, enterprises, the rest of the world, and other households. The factor incomes are income from capital and labor. Transfers take the form of social welfare spending from government. Household expenditure includes the consumption of commodities, the payment of income tax, transfers paid, and private savings. A balanced accounting matrix requires household income to be equal to household expenditure.

Enterprises

Enterprises receive their income from the factor capital. The income of enterprises from factors is equal to gross operating surplus, which incorporates consumption of fixed capital. Enterprises may also receive income from transfers from other domestic institutions and from the rest of the world. The expenditure of firms consists of transfers paid to households, the rest of the world and the government, the payment of company tax and savings. Company tax is levied on the profit of firms. Enterprises are also included in SAM and shown separately.

Government

Government revenue consists of all the different taxes, namely, income tax, company tax, import tariffs, and VAT. The government also receives factor income in the form of property rental. Expenditure includes government expenditure on commodities, factor payments to households and the rest of the world, transfers to households and enterprises, producers' and export-subsidies, and government savings.

The Rest of the World

The foreign sector's receipts will be in the form of payment received for imports, transfers to the rest of the world, and factor payments, while their expenditure will be in the form of payment for exports, transfers, factor payments, as well as foreign savings.

Savings and Investment

Lastly, the model requires investment to equal total savings. Total savings consists of savings by households, enterprises, government, the foreign sector and consumption of fixed capital. Investment consists of investment by government and by non-government.

4.5. SAM Development in South Africa

The Central Economic Advisory Service compiled the first SAM for SA for the year 1978. Van Seventer et al (1992) (As in Van Der Merwe and Van Seventer,1995) updated the contents of this SAM to undertake intertemporal analysis of aspects of income distribution in SA. The Central Statistical Services published a SAM for 1992. The format is the same as the 1978 SAM. (As in Van Der Merwe and Van Seventer:1995:1-2). From 1992 onwards a number of isolated SAMs were developed for South Africa.

More recently Coninghart (2001) compiled a disaggregated SAM for South Africa, commissioned by the Department of Trade and Industry. The SAM is based on the most recent 2000 data available from the Reserve Bank of South Africa, as well as 1998 Supply and Use Tables as published by Statistics South Africa. 1996 household data from the 1996 Population Census was used to derive household income and expenditure. The SAM allowed for 6 household income categories, and 4 population groups. The SAM was aggregated to allow for three income groups; low-, middle, and high income. The SAM makes use of a residual to balance the SAM.

Statistics South Africa released a SAM for South Africa based on 1998 data. The SAM is constructed on the specifications set by the SNA of 1993. The main focus of this SAM is on households. Households are divided into four population groups and twelve expenditure groups. The four population groups are Africans, Coloureds, Indians and Whites. The twelve expenditure groups are divided according to percentiles. The lowest and highest deciles are divided into two groups respectively to make up the twelve expenditure groups. The high disaggregation of households makes this SAM very suitable towards poverty and distribution analysis. Data contained within this SAM is the 1998 Supply and Use Tables, National

Accounts data, Integrated Economic Accounts, the 1996 Population Census for South Africa, 1995 Household and Expenditure survey, as well as published and unpublished data from the South African Reserve Bank. The SAM also makes use of a residual to balance the SAM. (Statistics South Africa, 2000).

4.6. World Bank Commissioned SAM

The World Bank commissioned a SAM based on 2001 data according to the layout specified by the standardized CGE model. This SAM will be used as data input for this CGE and is discussed extensively below.³

4.6.1 The Process of Constructing the South African SAM

Firstly an aggregate SAM was constructed consisting of control totals. The control totals were obtained from South African national accounts data, as published by the South African Reserve Bank. The construction of the SAM was according to the Standard Industrial Classification (SIC) and the System of National Accounts (SNA) 1993. More disaggregated data was collected from different sources. Although various sources of data were included missing data still occurred. The missing data was then determined by using different estimation techniques. The SAM was then balanced. Income must equal expenditure. The initial SAM did not balance, since different sources of data were used, and due to missing data. The SAM was balanced using best estimates. Techniques that were employed were Bi-partial (RAS) scaling and log-linear optimization. (Van der Merwe,2002). To obtain an even higher level of accuracy, cross-entropy was used to refine the SAM.

4.6.2 Data Sources Used Within the South African SAM

Claude van der Merwe from Quantec, using the following main data sources, constructed the South African SAM:

- Statistics South Africa Input-Output Tables for 1971-1993
- Statistics South Africa Supply and Use Tables 1993-1998

³ The SA SAM commissioned by the World Bank, and adapted for the purpose of this study will be included in the CD-ROM in Excel format.

- SAM 1998
- SARB published and unpublished data for 1970-2001
- Statistics South Africa industry censuses and surveys
- 1970-1996 population census
- October Household Survey for 1994-1999
- Labour Force Survey for 2000-2002
- Household Income and Expenditure Survey for 2000
- ASSA 2000 Demographic model
- RSA Standardized Industry Database developed by Quantec (Van der Merwe,2002)

4.6.3. The Content of the South African SAM

Commodities and Services

There are 49 commodities and services in the South African SAM. The government produces five of the 49 commodities and services. Table 4.2 gives a list of the commodities.

The 49 commodities within the South African SAM may be aggregated to the SIC1 level, including agriculture, mining, manufacturing, electricity, construction, transport and communication, trade and accommodation, financial and business services, and community services.

Activities

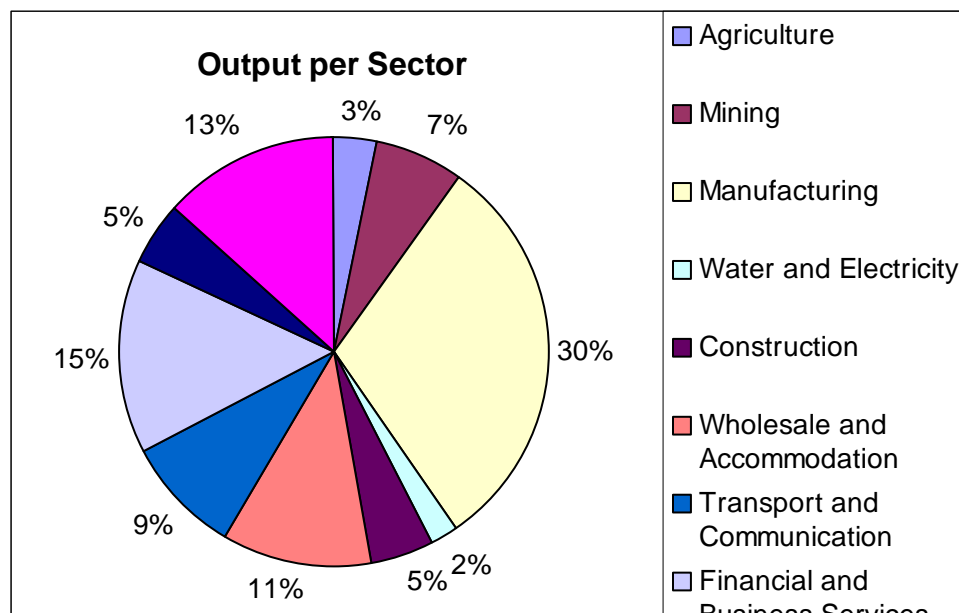
The South African SAM used for data input allows for 49 production activities. The 49 activities are classified exactly according to the classification of the commodities. The activities or industries are a group of homogeneous establishments defined in terms of inputs, production processes and outputs. These activities may also be aggregated to the nine activities according to the SIC1 level classification, namely agriculture, mining, manufacturing, electricity and water, construction, transport and communication, trade and accommodation, financial and business services, and community services. (Van der Merwe,2002)

Table 4.2: Commodities and Activities Included in the SA SAM from (SA SAM 2003)

1	Agriculture, forestry & fishing	20	Non-metallic minerals	36	Wholesale & retail trade
2	Coal mining	21	Basic iron & steel	37	Catering &
3	Gold & uranium ore mining	22	Basic non-ferrous metals		accommodation services
4	Other mining	23	Metal products excluding	38	Transport & storage
5	Food		machinery	39	Communication
6	Beverages and Tobacco	24	Machinery & equipment	40	Finance & insurance
7	Textiles	25	Electrical machinery	41	Business services
8	Wearing apparel	26	Television, radio &	42	Medical, dental & other
9	Leather & leather products		communication equipm		health & vet serv & Other
10	Footwear	27	Professional & scientific		community, social &
11	Wood & wood products		equipment		personal serv
12	Paper & paper products	28	Motor vehicles, parts &	43	Other producers
13	Printing, publishing & recorded		accessories		Government:
14	media	29	Other transport equipment	44	Administration
14	Coke & refined petroleum	30	Furniture	45	Defense
15	products	31	Other industries	46	Law and Order
15	Basic chemicals	32	Electricity, gas & steam	47	Education
16	Other chemicals & man-made	33	Water supply	48	Health
16	fibers	34	Building construction	49	Social services
17	Rubber products	35	Civil engineering & other		Economic services
18	Plastic products		construction		
19	Glass & glass products				

The contribution of each of the sectors to total output is as follows:

Figure 4.1: Contribution per Activity from SA SAM from (SA SAM 2003)



The manufacturing sector contributes 30 percent to total output, followed by the financial and business sector with 15 percent. The government is the third largest producer and contributes 13 percent. The wholesale and retail sector (including catering and accommodation) contributes 13 percent to total output, while the transport and communication sector contributes nine percent to total output. The mining sector contributes nine percent, while the construction and community service sectors contribute five percent respectively. Agriculture and electricity and water contribute three and two percent to output each.

Households

In the South African SAM the households are divided into ten income categories. However, the upper decile is divided further to incorporate more detail as well as structural aspects.

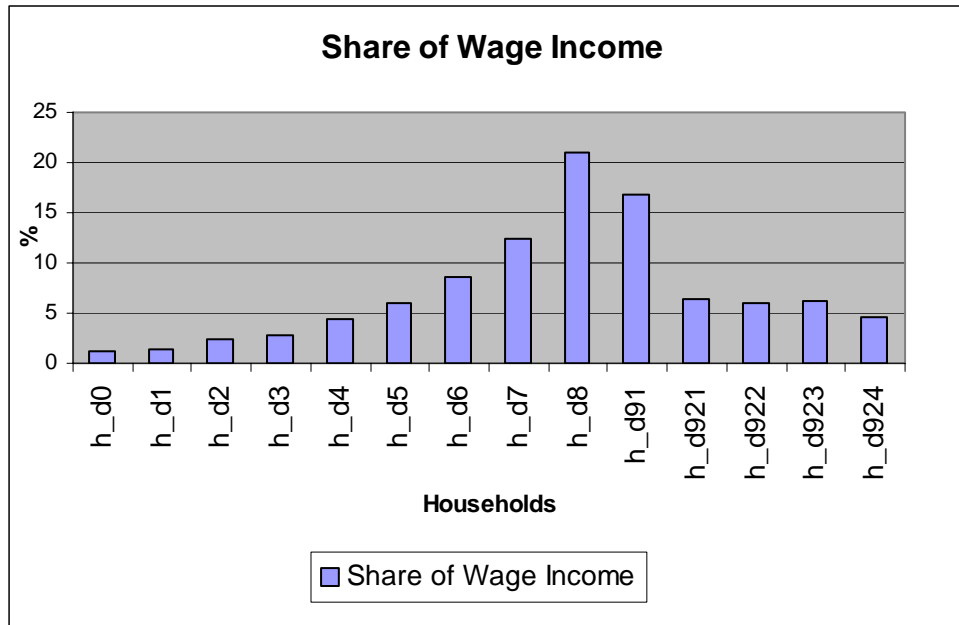
Table 4.3: Household Categories in SA SAM from (SA SAM 2003)

	Category	Income Range
1	d0	10% of population – 1 st decile
2	d1	10% of population – 2 nd decile
3	d2	10% of population – 3 rd decile
4	d3	10% of population – 4 th decile
5	d4	10% of population – 5 th decile
6	d5	10% of population – 6 th decile
7	d6	10% of population – 7 th decile
8	d7	10% of population – 8 th decile
8	d8	10% of population – 9 th decile
10	d91	5% of population – 10 th decile
11	d921	1,25% of population – 10 th decile
12	d922	1,25% of population – 10 th decile
13	d923	1,25% of population – 10 th decile
14	d924	1,25% of population – 10 th decile

In South Africa the distribution of income is highly unequal. The following figure indicates the wage income received by household category.

The first five household categories (d0 to d4) receive 10 percent of the total wage income. The next four household categories (d5 to d8) earn 50 percent of the total wage income. The last five household categories (d91 to d925) earn 40 percent of the total wage income. Taking into account that the last five household categories are the top 10 percent of the population it shows how unequal distribution of income in South Africa is. The upper five percent contributes 10 percent, a very large share of the total income generated. (Van der Merwe,2002).

Figure 4.2: Wage Income per Household Category from (SA SAM 2003)



Enterprises

The South African SAM makes provision for the inclusion of enterprises separately from other institutions (Van der Merwe,2002).

The Government

The government is disaggregated into a core government account and a different tax account. Different incomes for the government, included in the South African SAM are property income, transfers from the rest of the world, direct taxes, indirect taxes, and subsidies. The different tax incomes are listed below:

Table 4.4: Tax Revenue Sources Included in the SA SAM from (SA SAM 2003)

Corporate tax
Personal tax
Customs & excise
VAT/GST Producer
Other indirect taxes on products
Other indirect taxes on production

Government savings balances government income and expenditure. In South Africa's case government savings will be negative, since South Africa had a budget deficit of around R10 billion during the 2000 financial year (SA SAM,2003).

VAT appears in the row for VAT and in the commodity column. VAT is a consumption tax, as the burden rests on the consumer. By including it in the commodity column, VAT is automatically levied on consumption and imports, but not on exports. Another alternative would be to include VAT in the activity column as (as its name shows) a value-added tax. This will however complicate the modeling exercise as VAT is now levied on all domestic production (including exports), but not on imports. This is against the destination principle. The VAT shown in the table is the effective VAT collections.

All the taxes included in the SAM are valued in terms of the effective tax collections.

The Rest of the World

The South African SAM divides the rest of the world into twelve different trade regions (Van der Merwe,2002). For the purposes of this study the twelve trade regions will be re-aggregated as it is not necessary to disaggregate trade by region for evaluating changes in VAT.

Foreign savings balances the account of the rest of the world. In the base year, 2000, there was a deficit on the current account of R1,687 billion (SA SAM, 2003).

Factors

Factors are divided into labor and capital. Labor in turn is divided into unskilled, semi-skilled, and skilled labor, as well as informal labor. (Van der Merwe,2002)

Figure 4.3 shows that capital earns approximately 52 percent of total factor income. Semi-skilled labor is the second biggest earner and earns approximately 19 percent of total factor income. High-skilled labor earns 15 percent, followed by unskilled labor earning 12 percent, and informal labor earning two percent of total factor income.

Figure 4.3: Value Added by Factor Category from (SA SAM 2003)

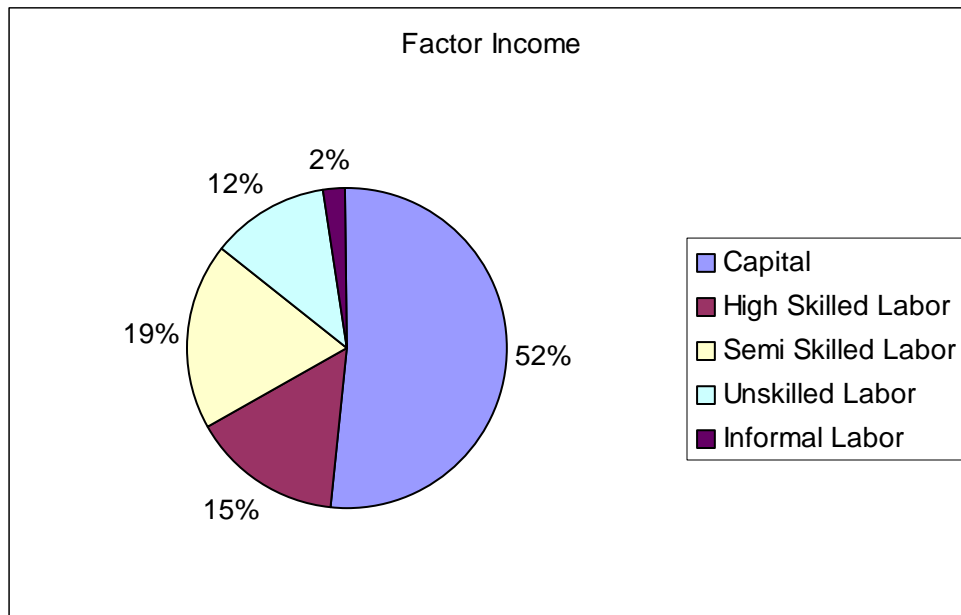
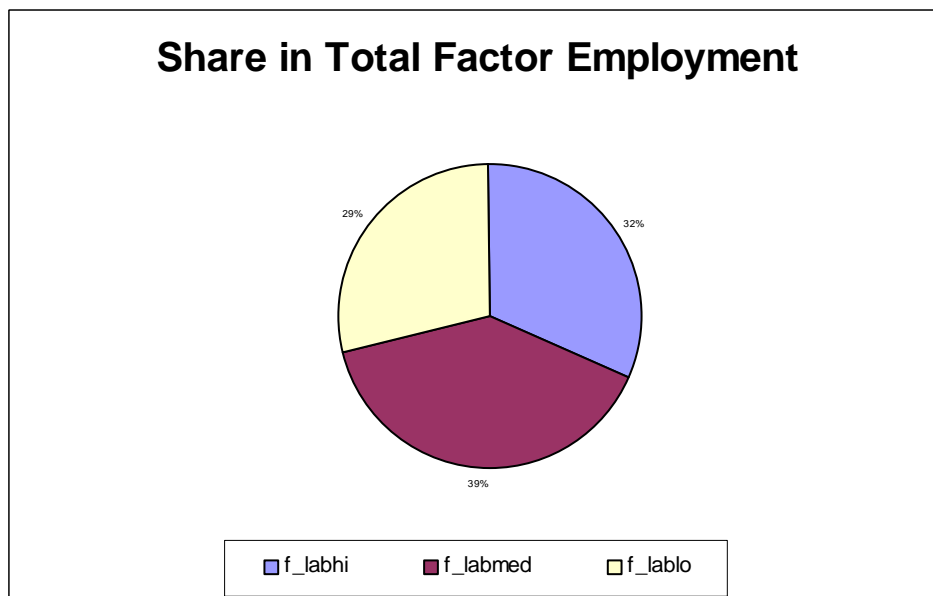


Figure 4.4: Employment by Labor Category from (SA SAM 2003)



The total wage for labor is almost equally divided between high-, semi and unskilled labor. This should be considered against the number of people in each labor category. 3,754 million people were employed. From this total number 46 percent were semi skilled workers, 22 percent unskilled workers, 19 percent informal labor and 13 percent highly skilled labor.

4.6.4 Valuation of Transactions

The transactions in the SAM may be valued according to output at basic prices that exclude taxes on products (like VAT), but include subsidies. Transactions may also be valued at producer prices. Producer prices may be derived from basic prices by including taxes on products, but excluding subsidies. Lastly, transactions may also be valued at purchaser prices. Purchaser prices, in turn, may be derived from producer prices by including trade margins, transport margins, and non-deductible VAT. (Van der Merwe,2003). For the purpose of analyzing VAT it is important that this amount is included when valuing transactions, therefore transactions will be valued at either producer prices or purchaser prices. In both cases VAT is included in transaction values.

4.7. Other Data Sources

The standardized CGE model requires (apart from a country-wide SAM) a set of trade elasticities as data input. The purpose of including trade elasticities is twofold. Firstly the model assumes imperfect substitution of commodities in trade and secondly, the model will be more realistic.

In the absence of elasticity coefficients the CGE model assumes perfect substitution between commodities. Assuming perfect substitution implies that the elasticity of substitution between two commodities is infinite, and that the corresponding price ratios are constant. In order to do away with the assumption of perfect substitution, and rather assuming imperfect substitution, which is more realistic, trade elasticities need to be estimated using trade data, and then be included in the CGE model. Combining the estimated trade elasticities with other elasticities calibrated within the SAM, will also balance and configure the base CGE model.

Various authors have estimated trade elasticities for South Africa. The International Development Corporation (1997) estimated trade elasticities for 25 manufacturing sectors for a sample period from 1973 to 1993. In another study Le Roux Burrows (1999) estimated Armington elasticities for 11 manufacturing and mining sectors. In 2003 Gibson estimated Armington elasticities for South Africa at industry level for the short and long run. The estimation was done for 42 industry categories for the period 1970 to 2001. (As in Gibson,2003:8-10)

The estimations done by Gibson (2003) will form the core of the elasticities used in this CGE model. Other elasticities will be obtained from other sources including the IDC(1997), the CGE model of Lewis (2001) as well as from the CGE model of Thurlow and Van Seventer (2002).⁴

4.8. Summary

The standard CGE model requires a SAM as part of the data input. The South African SAM, commissioned by the World Bank, will be used as data input into the CGE model. The SAM is based on 2000 data. The South African SAM disaggregates activities into 49 separate activities. Factors are divided into capital and labor. Labor in turn is divided into high-, semi-, and unskilled labor, as well as informal labor. Commodities are disaggregated into 49 different commodities exactly according to the classification of activities. Households are divided according to the 10 deciles, but the upper 10 percent are further divided into 4 groups. This gives a total of 14 households. Other institutions included are enterprises, the government and the rest of the world. Taxes are disaggregated to include the major sources of tax revenue for government. Taxes included are corporate taxes, personal taxes, VAT, fuel levy, customs and excise, other indirect taxes on products, and other indirect taxes on production.

The CGE model will follow the SA SAM's disaggregation of activities, factors, commodities, and institutions. The South African SAM contains comprehensive data on the South African economy, specifying the structure and behavioral aspects of the economy. Using this SAM in the CGE model will transfer these structural and behavioral aspects to the CGE model, making it an applied CGE model. However, to make the model more realistic certain trade elasticities estimated by various authors, using time series data, are included. The other elasticities are calibrated within the CGE model using data from the SAM. This will also serve to balance the model. The balanced CGE model may then be shocked with a change in the VAT structure. The effect of the change in VAT on the South African economy may then be observed and analyzed.

⁴ The elasticities used in the CGE model are included in Excel format in the CD-ROM within this book.