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Chapter 1

INTRODUCTION, PROBLEM STATEMENT AND METHODOLOGY

1.1.   Introduction

Poverty, inequality and unemployment are realities within the South African economy, and it is therefore no surprise that these are main focus areas in the government's current macroeconomic policy framework (GEAR). Achieving these aims, however, will require high government expenditure, which in turn, must be balanced with increased revenue from either borrowing or from increased taxes or from restructuring taxes. Prudent fiscal management requires staying within the fiscal budget deficit norm of about 2.5 percent of GDP. Borrowing to fund expenditure is not a clear option as government debt is already high, and financing the debt utilizes revenue sources that could have been applied to alleviate poverty.   Higher taxes to finance higher expenditure are the other option, but in South Africa the tax burden is already high. Increasing taxes further will only serve to hamper economic growth, which as it is, is not sufficient to generate revenue to pay for the required spending, or to create enough employment opportunities. On the other hand, lowering taxes may also achieve the objectives of GEAR. Another option is restructuring the tax structure, with the aim to broaden the tax base, to reduce the tax burden, to redistribute income and wealth, and to create economic growth. This possibility needs to be investigated. This study will focus on the Value Added Tax (VAT) and specifically the restructuring of VAT, and will aim to answer questions on (a) how the VAT structure could be changed, and (b) how any changes in the VAT structure would impact on the economy.

1.2.   Poverty, Inequality and Unemployment in South Africa

Poverty in South Africa is severe. In a report on poverty in South Africa, published by Statistics South Africa (2000), it is stated that the proportion of households spending less than R800 per month (the household poverty line) is 28.5 percent. This group of

households is considered very poor. 48.4 percent of South Africans spend less than R250 per month, a per capita poverty line. These statistics are according to the 1996 census. This group of households is classified as poor. Table 1.1 gives an indication of poverty in South Africa based on monthly expenditure:

Table 1.1: *The Percentage of South Africans Living in Poverty from the 1996 Census from (Stats SA,2000:2,60)*

Monthly expenditure (R)	Cumulative Percentage
R600 and below	16,5
R601 – R800	28,4
R801 – R1000	41,3
R1001 - R1800	64,60
R1801 - R3500	82,00
R3501 or more	100,00

As can be seen from table 1.1, 28,4 percent of households spent less than R800 per month, with R800 the household poverty line based on spending.

There is considerable variation between races and by provinces, indicating the degree of inequality that exists. According to the World Bank's Development Report based on 1998 figures, South Africa's level of inequality is among the worst in the world. Inequality is an economic problem - just as the twin evils inflation and unemployment. Inequality cannot be changed rapidly (Stats SA,2000:3). The level of inequality illustrates the accessibility of resources and employment opportunities across different income groups, gender groups, and land areas. In South Africa, the ownership of wealth is also highly inequal: in 1985 the top five percent of the population owned 27 percent of all wealth, while the bottom 65 percent owned only 10 percent (Van Heerden and Schoeman,2000:286). The World Bank reported that the richest 10 percent of South Africa's population contributed 47.3 percent of GDP, while the poorest 10 percent of the population only contributed 1.4 percent of GDP (World Bank: 1998/1999:327). Another indication of inequality is the number of households living with no salary or wage: According to the 1998 household survey 50 percent of Africans, 24 percent of Coloureds,

28 percent of Indians, and 36 percent of Whites live with no wage or salary income (Stats SA,2000:3). Table 1.2 also gives an indication of inequality in South Africa:

Table 1.2:   Monthly Household Expenditures by Population Group from (Stats SA,2000:64)

Population group	R0-R600	R601-R1000	R1001-R1800	R1801-R3500	R3501-Or more	Total
African	21,5%	32,4%	27,5%	14,2%	4,4%	100%
Coloured	7,8%	13,6%	25,8%	32,7%	20,2%	100%
Indian	0,8%	1,7%	9,3%	37,0%	51,1%	100%
White	1,4%	1,4%	5,8%	20,4%	71,1%	100%
Total	16,5%	24,9%	23,3%	17,4%	28,0%	100%

Inequality in South Africa may be characterized by a situation of dualism: a certain section of the population (mostly Whites) live in first world circumstances, while the majority of the population (mostly Blacks) live under third world conditions. Table 1.2 above shows that the majority of African households (53.9 percent) spend less than R1000 per month, compared to 2.8 percent White households. The majority of White households (71.1 percent), on the other hand, spend more than R3501 per month, compared to the African households where only 4.4 percent spend more than R3501 per month. Inequality, however, does not only exist between population groups, but also between gender groups and between rural and urban households.

A Gini Coefficient is usually used as a measure of inequality, the closer the Gini Coefficient to one the more inequal the distribution of income and wealth. South Africa's Gini Coefficient according to Statistics South Africa, based on the 1995 household survey, and taking income and expenditure into account, is equal to 0.59 percent (Stats SA,2000:83). Table 1.3 gives a summary of Gini Coefficients calculated by Statistics South Africa. The figures are based on income only:

The Gini Coefficient for the African population group is much higher than for the White group. There is, however, a general increase in inequality for all population groups from 1995 to 1998.

Table 1.3: *Gini Coefficients on Pay for African, Coloured and White People, 1995-1998 from (Stats SA,2000:88)*

Population group	1995	1996	1997	1998
African	0,70	0,78	0,77	0,81
Coloured	0,57	0,61	0,59	0,65
White	0,55	0,61	0,62	0,67

Unemployment in South Africa is also severe. In 1995, 28 percent of households in South Africa contained no earners, and 43 percent contained only one (Stats SA,1998:56). The official unemployment rate has risen from 16.9 percent in 1995 to 22.9 percent in 1997 (Stats SA,2000:3). The highest level of unemployment is for elementary occupations filled mostly by unskilled persons. Unemployment is also higher for the African population group, as well as for women in general. Employment in the formal sector also decreased from 1994 to 1997 - in 1994 5.3 million jobs existed in the formal sector compared to 5.1 million in 1997. Figure 1.1 illustrates the distribution of the employed in the different economic sectors in 1997:

Figure 1.1: *Distribution of the Employed in Economic Sectors in 2001 from (SA SAM 2003)*
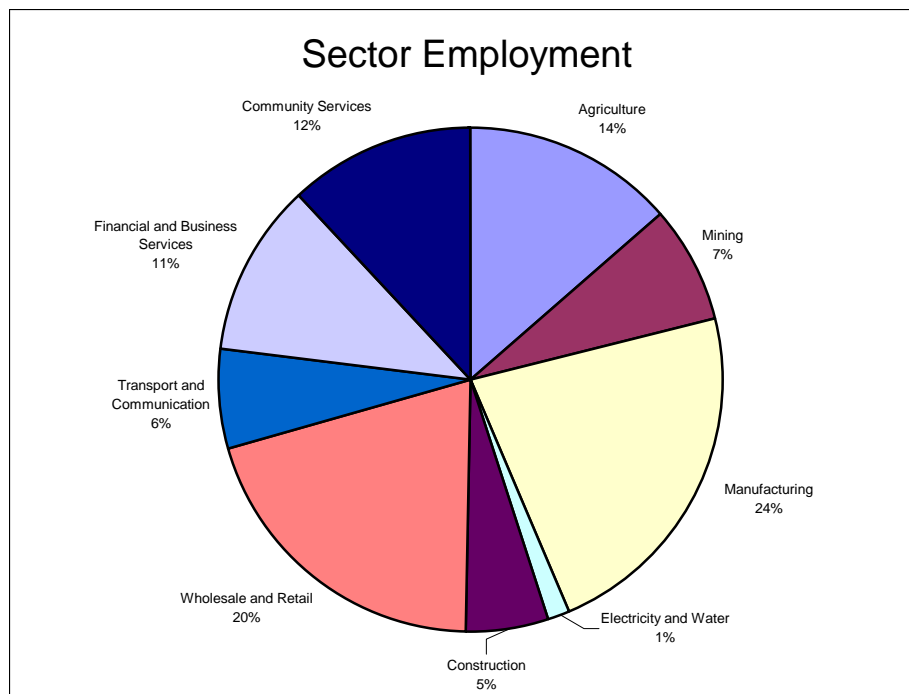
Manufacturing contributes the most to employment (24 percent) in value terms followed by wholesale and retail (20 percent). Community services contribute 12 percent; this illustrates the government's role as an employment provider.

Poverty, growing inequality, declining employment opportunities combined with the inaccessibility of jobs make policy towards alleviating poverty a real challenge.

1.3.   Government Policy

Since the Apartheid-era a number of government strategies have been developed to address inequality, employment, and poverty.   The Growth, Employment and Redistribution (GEAR) strategy, the Reconstruction and Development Program (RDP), Affirmative Action, and the Land Reform strategy are the most important.

GEAR

South Africa's current macro-economic policy strategy GEAR is a program aimed at generating economic growth, creating sufficient employment opportunities, delivering social services, redistributing income, and protecting its citizens (RSA, 1997:2). The Government introduced the GEAR strategy in 1996. The long-run vision of GEAR is to create a competitive fast-growing economy; sufficient jobs for all job seekers; to redistribute income; to provide health, education and other services, to all; to secure the home environment; and to create a productive place to work. The following, core elements of the strategy, are aimed specifically towards redistribution and alleviating poverty:

- Budget reform to increase redistributive expenditure;
- Stimulating investment to create more jobs;
- Expansionary infrastructure programs aimed at addressing service deficiencies;
- Training, funded through a levy system (the skills development levy).
  (RSA,1996:3)

South Africa's huge unemployment problem requires acceleration in economic growth. Economic growth and job creation need to take place simultaneously. Job creation needs to be sustainable. An increase in investment is needed to drive economic growth. GEAR also makes provision for various employment-intensive public expenditure programs such as land reform, low-cost housing, community water, and municipal infrastructure, which will be used to create jobs and will also work towards redistribution.

RDP

The Reconstruction and Development Program (RDP) focuses on the provision of safe water, sanitation systems, housing, and infrastructure.   The RDP program was constructed even before GEAR was introduced. The success of RDP is dependent on the country's ability to develop. Development in turn is a function of economic growth and redistribution. GEAR, therefore may be seen as a platform for RDP. The social policies in GEAR are in line with RDP objectives and work towards:

- Improvement in education - higher quality, better access, improved pass rates, more involvement from the private sector.
- Health and welfare services - free access, comprehensive primary care, improved health conditions, more rural clinics, redistribution of resources from expensive institutionally-based services to under-services areas, assistance of disabled and needy children.
- Housing, land reform and infrastructure - accelerated housing delivery, job-creation through different projects, improved water and sanitation in rural communities, land reform through asset redistribution, emerging farmer support through financing, marketing support, technological interventions and extension services.

(RSA,1996:15-16).

The strategies mentioned above, need expanded expenditure. This must be achieved without increasing the deficit, and thus debt.

The Budget

Redistribution was also addressed in past budgets. Government expenditure on social services, with specific focus on services for the poor, increased. These include housing schemes and subsidies, water, and sanitation. Education received more. Resources were reallocated to benefit the previously disadvantaged communities. Health services for the poor improved, with free primary health care. The tax structure was also improved to lower the burden on the lower and middle-income groups.   State assets will be restructured; some will be sold, as to pay back debt. This will reduce expenditure on interest, leaving more revenue for redistribution. Extensive measures were undertaken from 1997 to further the objectives of GEAR. A discussion of certain past budgets (from 1997 to 2003) follows below.

In the 1997 budget R300 million was set aside for poverty relief. Social security for the elderly was increased. More money was allocated to adult education. Expenditure on housing doubled. There was increased spending on land restitution, redistribution and tenure. Various RDP projects were undertaken; free health care, primary school nutrition programs, community water supply and sanitations, just to mention a few. The tax structure was reviewed to make it more equitable. (RSA,1997).

In the 1998 budget RDP expenditure increased again. Welfare and social grants, health services, education, housing programs, water schemes, land redistribution and reform, and poverty relief programs received more than in the previous budget. Again the tax structure was changed to improve equity. Bracket creep was reduced (bracket creep mainly affects the lower and middle-income groups, and by eliminating it more money is put back in the pockets of the poor). (RSA,1998).

The 1999 budget followed the same trend set by the previous two budgets. Poverty relief expenditure increased.   More money was allocated to spend directly to job creation. Education expenditure increased. Expenditure on health increased. Welfare services and grants also increased. RDP expenditure on housing projects and water schemes increased

by over 25 percent between 1995 and 1998, and will continue to grow. More was spent on policing and security. RDP projects, including the delivery of water, sanitation and jobs to previously disadvantaged, undertaken in previous years, were deemed successful. Under the land redistribution program 179 thousand hectares of land had been transferred to 33 thousand households. The tax structure was changed again to benefit lower income groups. (RSA,1999).

In the 2000 budget the Government announced the restructuring of state assets to repay debt, leaving more money to spend on development. It was estimated that 57 percent of spending now went to the poorest 40 percent of South Africans; and 9 percent of spending to the wealthiest 20 per cent. Redistribution had been achieved through increased spending on poverty relief, housing subsidies, child support, free primary health care, the redistribution of resources between provinces and/or, districts, schools, and hospitals within provinces. The Government proposed the imposing of capital gains tax. Capital gains tax aims to make the income tax more equitable. Various tax loopholes were closed - this would broaden the tax base. Non-profit organizations are exempted from tax. Now donations to non-profit organizations, pre-primary schools, and primary schools, children's homes, organizations caring for the aged, and those focused on HIV/AIDS, will be tax deductible. Tax relief was again extended to the lower income groups, even though, in this budget, the higher income groups also received some relief. The biggest beneficiaries however were the people in the lower and middle-income groups.   (RSA,2000).

The 2001 budget allocated more funds to provinces to strengthen their social service delivery. Expenditure on infrastructure, housing, water and sanitation, health, education, policing, and all other welfare and social areas increased.   The tax structure was improved again to make it even more equitable. Capital gains tax would be implemented on 1 October 2001. VAT rates on illuminating paraffin were zero-rated. This would definitely benefit the lower income groups, since paraffin is an important energy source for low-income households. (RSA,2001).

In the 2002 budget support for local governments increased, to strengthen their capacity towards the provision of basic municipal services to poor households. The criminal justice sector received more to strengthen the fight against crime. Spending on education increased, as did spending on social grants and old age pensions. More money was allocated towards HIV/Aids programs. More money was allocated to improve employment in the Health Sector. Spending on infrastructure increased: so that roads, rail services, the Post-Office, and other infrastructure could be expanded. RDP spending increased: the electrification of houses, access to water and sanitation were some of the issues that would be addressed. More money was set aside for sustainable land reform. Tax relief was extended to all income groups, with the lower income groups benefiting most. An accelerating depreciation allowance scheme was introduced to stimulate investment. Small businesses received tax relief with the aim to stimulate small business development. Proposals to simplify the VAT administration system were also announced. (RSA,2002a).

The 2003 budget focused on reducing poverty by increasing the child support grant and by increasing spending on the primary school nutrition program: the total increase in spending intending to meet the needs of children was R11,9 billion. Expenditure on social grants also increased. Other focus areas were HIV/Aids, basic services, land restitution, restructuring of universities and technikons, skills development and the fight against crime. In the 2003 budget generous tax relief was extended to low and middle income groups. Of the total tax relief 56 percent accrued to tax payers earning less than R150 000 per year, and 23 percent to those earning between R150 000 and R250 000 per year. (RSA,2003:4,11).

To summarize: from 1997 to 2003 significant budgetary measures were imposed towards the objectives of GEAR. There was increased government expenditure especially on social services, education, health, and poverty relief. Focus was placed on RDP projects combined with land reform. The tax structure was adjusted to make it more equitable, and also to promote small business and investment. The overall tax burden was reduced. The deficit was kept within the current deficit norm of 2.5 percent of GDP.

Government Expenditure, Tax Revenue and the Deficit

From 1997 to 2002 government expenditure, and more specifically spending towards social services, increased. However, the scope for increasing spending on social services is limited. Firstly, the aim of the government is to reduce the deficit, which in turn will require a cut in government spending, and therefore does not leave not enough scope for social spending.   Secondly the high population growth rate reduces the impact of increased spending on social services, making social spending ineffective.   Social spending should increase faster to keep track of population growth (RSA,1996:3-4).

Figure 1.2:   Government Expenditure from 1990 to 2002 from SARB Time Series Data
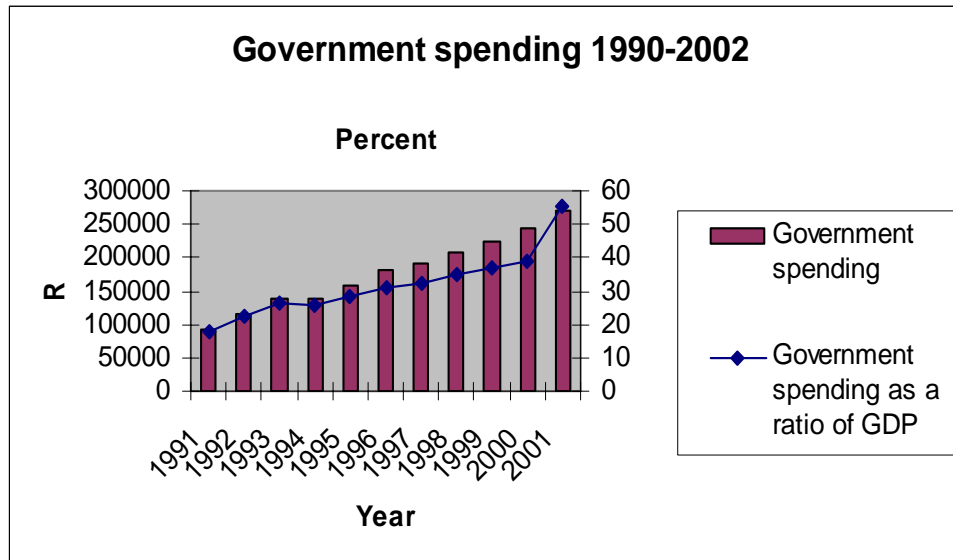
KBP4186 and KBP6006

The years 1999/2000, 2000/2001. 2001/2002 are estimates only - (RSA 2002b)

As may be seen from figure 1.2 above, government expenditure increased steadily from 1991 onwards. Government expenditure as a percentage of gross domestic production (GDP) also increased, showing a faster increase in 2002.

High government expenditure must be accompanied by increased revenue, as not to increase the deficit. The change in government revenue is shown in figure 1.3:

Figure 1.3:   Government Revenue from 1990 to 2002 from SARB Time Series Data
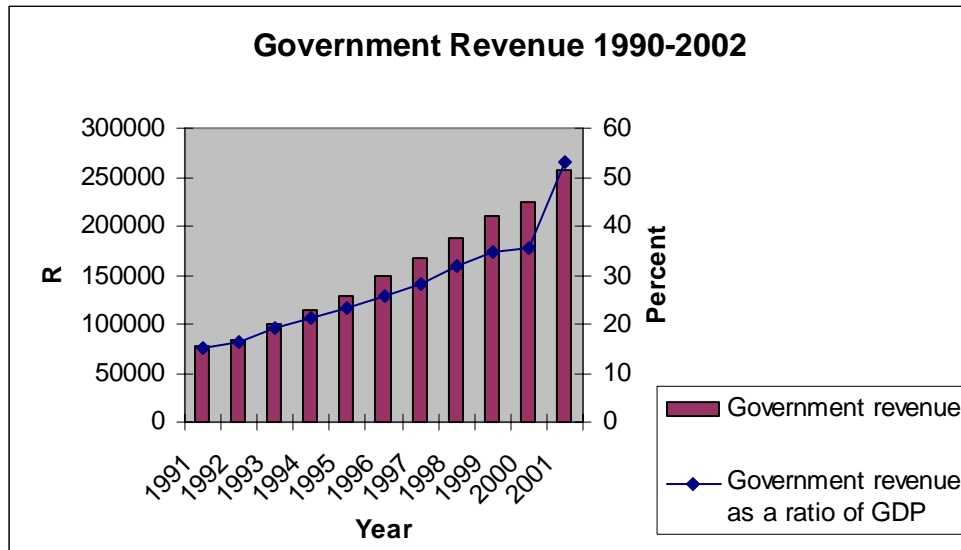
KBP4176 and KBP6006

The years 1999/2000, 2000/2001. 2001/2002 are estimates only - (RSA 2002b)

Revenue also increased from 1991 onwards. Revenue as a percentage of GDP also increased more during 2002. The main reason for this is the increase in tax collected during the budget year 2001/2002. The increase in revenue is attributed mainly to more efficient tax collection methods. Redistribution and poverty alleviation will also require that the tax system remains progressive, while the revenue base should be as broad as possible. Taxation on retirement funds, higher excise duties on tobacco, and improved tax collection will lead to an increase in revenue. However, the personal income tax structure will have to be adjusted to correct fiscal drag, and excessive tax rates will be reduced. This in turn will lower the revenue base. If the economic growth rate increases, it will mean an increase in tax revenue relative to GDP. (RSA,1996:10-11).

Figure 1.4 shows the budget deficit / surplus of government for the period 1990 to 2002.

The budget deficit was efficiently reduced from an average of seven percent in 1993 to about an average of 0.86 percent in 2002. This is mainly due to prudent fiscal management, more efficient tax collection, and the broadening of the tax base.

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*Figure 1.4:   The Budget Deficit / Surplus from 1990 to 2002 from Time Series
                Data*
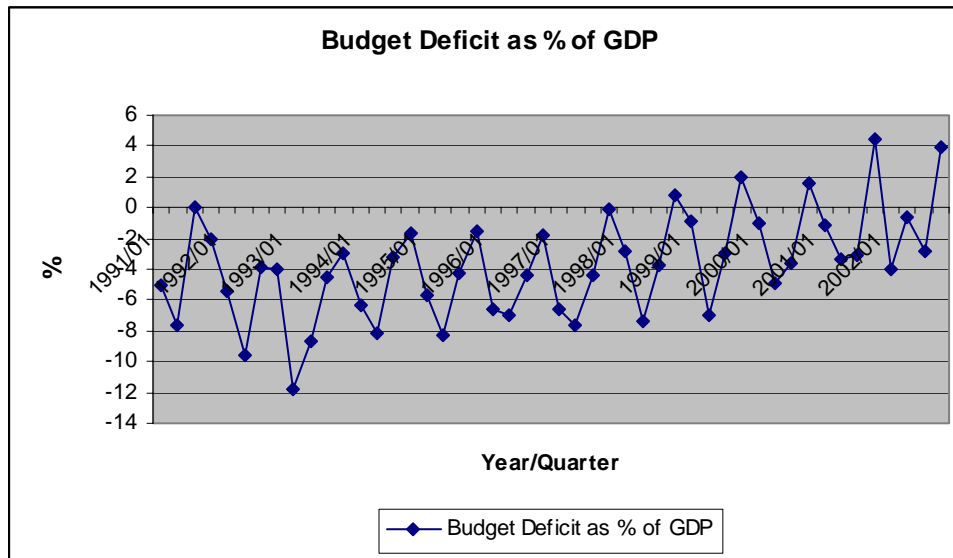
KBP4420

An increase in real GDP growth also facilitates higher revenue collection, and therefore higher government expenditure while maintaining the deficit norm; the deficit as a percentage of GDP remained the same. At the same time economic growth might also assist in job creation and thus poverty alleviation. Economic development is not possible without economic growth and a proper revenue base. Figure 1.5 shows the growth in real GDP from 1990 to 2001. For the past two years real growth did not exceed 1 percent in any quarter.

The revenue base is made up mostly of taxes. The most important taxes are income tax, company tax, value added tax, import taxes, and estate duties. During 2000 a new tax, namely capital gains tax was introduced. With this large demand on revenue, and debt getting more extensive, steps should be taken to broaden the revenue base. This study will mainly focus on VAT as revenue source of government, and will investigate how, and if, VAT may be restructured to increase revenue, to lower the tax burden and to redistribute income.

Figure 1.5:   Growth in Real GDP from 1990 to 2001 from Time Series DATA
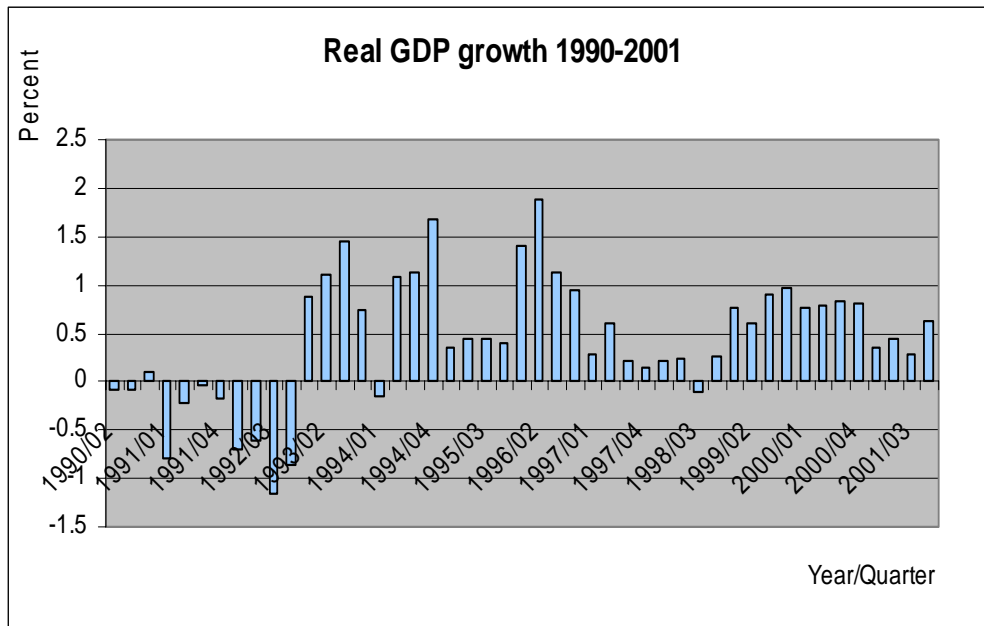
SARB Timeseries KBP6006

1.4.   Restructuring Value Added Tax

The plan to change from the then existing general sales tax (GST) to value added tax was announced in the early 90's. VAT was implemented on 30 September 1991 at a rate of 10 percent. The implementation process was experienced by most as painful. Questions were raised about the administrative burden VAT would impose, whether or not VAT would fully replace GST as a revenue source, and whether or not VAT would be inflationary: would VAT lead to a once-off increase in general prices or would it lead to inflationary expectations? Issues were also raised about the burden of VAT on poor households. VAT is in nature regressive, unless specific steps like zero-rating essential foodstuff, are taken. This is the reason why initially, when VAT was imposed, certain food items were zero-rated. Brown bread, maize meal, samp, mealie rice, dried mealies, dried beans, lentils, pilchards, milk powder, milk, rice, unprocessed vegetables and fruit, vegetable oil, and eggs are some of the food items exempted (SA Tax, 2001:Schedule 2 Part B).

In 1993 the statutory VAT rate increased to 14 percent. One of the latest changes in the VAT structure is the zero-rating of paraffin in 2001 (RSA,2001:16), to further assist poor households, and in 2002 Minister Trevor Manuel announced the attempts that are going to be made to improve the VAT administration system, to simplify tax compliance for small businesses, and to simplify the process of calculating VAT obligations (RSA,2002a:17). Since 1993 no changes were made to the statutory VAT rate.

The economic debate on VAT mainly focused on the redistributive nature of VAT. Fourie and Owen (1993) stressed that the regressiveness of VAT should be considered taking the complete tax structure into account; specifically against the progressive nature of income tax. Fourie and Owen (1993) came to the conclusion that VAT is mildly regressive, and that zero-rating, or even differential VAT rates for different goods would reduce some of the regressiveness. On the other hand, the advantages of such a tax system must not be eroded by administrative complications, or practical applicability that differential rates or zero-rating would impose. Zero-rating or differential rates might also create non-compliance and tax evasion. Lastly Fourie and Owen (1993), stressed that the social goals of zero-rating may be achieved by direct social transfers instead.   Other authors such as Sartorius von Bach and Van Zyl (1994) also indicated that higher equality may be achieved by zero rating foodstuffs. In South Africa certain necessities (as may be seen from the list above), consumed mostly by poor households, are already exempted from VAT.   In the 2001 budget, Minister Trevor Manuel also excluded paraffin, a commodity used as fuel and energy source by most poor households in South Africa. Minister Manuel, however, stated in an interview on 21 February 2002, that there is no real evidence that the advantages of zero-rating paraffin actually reach poor households as it is intended to. He also indicated that (at that moment) no other social grant scheme or direct transfers to poor households would take place, as he is not certain such an act would be financially sustainable (Finansies & Tegniek,2002).

Another factor that needs to be considered is the importance of VAT as a revenue source for government. Table 1.4 shows the importance of the different revenue sources for government:

Table 1.4:   *The Major Revenue Sources of National Government as a Percentage of Total Tax Receipts from (SARB,2001:S-54)*

Item	1996	1997	1998	1999	2000	2001
Taxes on income and profits	**55,96**	**58,13**	**59,38**	**60,46**	**60,14**	**59,30**
Income tax	54,28	54,94	56,09	56,12	55,35	54,43
Secondary company tax	1,03	0,94	0,90	1,08	1,36	2,16
Other	0,65	2,25	2,39	3,24	3,43	2,71
Payroll taxes (Skills development levy)	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,59**
Taxes on property	**1,81**	**1,65**	**1,64**	**1,58**	**1,97**	**1,87**
Domestic taxes on goods and services	**39,55**	**37,53**	**37,82**	**36,87**	**37,28**	**37,18**
VAT	26,62	25,18	25,06	24,37	24,95	25,67
Excise duties	12,51	11,99	12,56	12,39	12,27	11,22
Other	0,42	0,36	0,20	0,13	0,06	0,29
Taxes on international trade and transactions	**5,01**	**4,90**	**3,51**	**3,37**	**3,50**	**3,89**
Custom duties	4,33	4,56	3,77	3,34	3,36	3,69
Other	0,68	0,34	-0,26	0,03	0,13	0,20
Other taxes	**0,83**	**0,84**	**0,93**	**0,83**	**0,84**	**1,13**

The total percentages will not sum to 100 percent, because the tax refunds to SACU countries are yet to be subtracted.

As may be seen from Table 1.4, VAT is the second most significant revenue source for the Treasury next to direct income tax, and contributes around 25 percent to total tax revenue. If one compares VAT to personal tax or corporate tax separately the importance of VAT is even bigger. Also, the government sees VAT as a dependable and broad-base tax revenue source (RSA,2002a:17). The pressure on government income sources to finance high government expenditure towards GEAR necessitates one to look into the expansion of VAT as a revenue source. At the same time government has lowered the tax burden of low- and middle-income households in the past two budgets (2002 and 2003).   The question asked is whether or not lowering VAT is an option for redistribution. Changes in the VAT structure should be investigated especially the possibility of a lowering of the statutory VAT rate.

It is now almost a decade since the inception of VAT. At this time it might be valuable to investigate some of the issues around VAT. Some of the questions that need to be addressed are:

(a)   How regressive is VAT, taking current zero-ratings into consideration?

(b)   What are the implications of VAT on the standard of living of the different income groups (especially the lower income group)?

(c)   How may the importance of VAT as a revenue source for the government be improved?

(d)   How savings and future capital will be influenced by changes in the VAT structure?

(e)   How restrictive is VAT as a fiscal policy instrument: to what extent would an increase in VAT lower aggregate demand and therefore restrict growth?

(f)   How neutral is VAT? Can zero-rating labour-intensive industries, for example, contribute to lower unemployment?

1.5.   Using a Computable General Equilibrium Model to Simulate Changes in VAT

A computable general equilibrium (CGE) model a set of equations that indicate the relationship between the different variables.   CGE models work by simulating the interaction between various economic participants and markets, as specified in neo-classical general-equilibrium theory. Behaviour is based on the optimization principle as found in microeconomics. The model requires that all markets should be in equilibrium with full closure, demand must equal supply in all markets. When an economy is at general equilibrium it will mean market efficiency. Supply and demand interaction (the principle on which all market economies are based) gives an efficient allocation of prices and quantities at equilibrium level. In a general equilibrium framework it means all the markets in the economy function at optimal levels. (Starr, 1997:5).

CGE models link prices with taxes, making CGE models very useful for the purpose of evaluating changes in the tax structure. The disaggregation of households in CGE models allows for the evaluation of the impact of policy on distribution. South African statistics and specific features of the South African economy are added to the model, making it an applied CGE model. This model will be used to analyze the effect of changes in the VAT structure on the economy. CGE models are often used to evaluate trade policy, taxation, structural adjustment, economic development and welfare

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distribution. For this application a CGE model is used to measure the impact of changes in VAT on the economy, and specifically welfare.

General equilibrium modeling has its roots in general equilibrium theory. General equilibrium theory in turn, has its roots in Adam Smith's (1776) book "The Wealth of Nations". Cournot (1838) and Jenkins (1870) contributed literature to partial equilibrium analysis of a single market. Walras (1874), however, was the first economist to work on the principle of general equilibrium. Walras's model consisted of households and firms. Walras identified a vector of prices that cleared all the markets. He not only discussed the existence of equilibrium but also the stability thereof. He was the first to stipulate that an equal number of equations and variables is a necessary (but not sufficient) condition for general equilibrium. Walras, however, could not prove his theorem sufficiently, the proof only followed later. Edgeworth (1881) developed the notion of the contract curve where each point on the curve shows competitive equilibrium while satisfying a set of conditions, including optimal allocation. Pareto (1909) introduced competitive equilibrium and the optimal allocation of resources. Cassel (1918) simplified Walras's system of general equilibrium. Various authors contributed to the proof of existence of equilibrium started by Walras. They include Neisser (1932), Zeuthen (1932), Von Stackelberg (1933), and Wald (1936).   In 1937 Von Neumann published an application of general equilibrium theory and used the saddle-point theorem to prove the existence of general equilibrium. Hicks (1939) and Samuelson (1941-1942) specified the second-order conditions for profit maximization by producers, and utility maximization by consumers. At this time, game theory played an important role to prove and to specify conditions for the existence of equilibrium. The work done by Von Neumann and Morgernster (1944) used game theory to prove the existence of general equilibrium. In the early 1950's three economists, Kenneth Arrow, Gerard Debreu, and Lionel McKenzie entered the field of general equilibrium theory. In 1951 Arrow restated the ideas of welfare economics in the language of general equilibrium theory. In a paper presented by Debreu and McKenzie to the Econometric Society in 1952, they provided the proof that a fixed-point theorem would lead to proofs of existence of general equilibrium (As in Starr,1997:7). Arrow and Debreu (1954) argued the existence of equilibrium for a

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competitive economy. McKenzie (1954) summarized the existence theorems and conditions. Debreu (1959) gave a complete systematic account of the existence conditions - work mostly done by Arrow up to date, which includes various articles published by Arrow, and other authors. In 1962 Debreu published the most general version of the existence theorem. Debreu and Scarf contributed by elaborating on Edgeworth's bargaining model. Their findings were published in the 1963 publication called: "A limit theorem on the core of an economy". Arrow and Debreu received the Nobel Prize in economics for their work on general equilibrium theory in 1972 and 1983 respectively. (Starr,1997:7-9).

Empirical work on general equilibrium models was started by Johansen (1960) and Harberger (1962). Johansen's work focused on a multi-sector study of economic growth and Harberger studied the incidence of corporate income tax. Scarf in 1967 contributed a fixed-point algorithm to compute equilibrium, and provided the bridge between theory and empirical work. Shoven and Whalley (1972), Whalley (1973), Shoven (1976) and Whalley (1977) contributed a series of papers on the incidence of taxation. Adelman and Robinson (1978) developed a model to investigate income distribution policy in developing countries. Other important contributions followed and some include Lysy and Taylor (1980), a multi-sector model developed for Australia by Dixon, Parmenter, Sutton and Vincent (1982), Ginsburgh and Mercenier (1987), Adelman and Robinson (1988), Bourguignon, Branson and De Melo (1989), Dixon and Meagher (1990), Meagher (1990), Devarajan, Lewis and Robinson (1994), the 1-2-3 model developed by Devarajan, Go, Lewis, Robinson, and Sinko (1997), a simple dynamic model was developed by Devarajan and Go (1998), Löfgren, Harris and Robinson (2000), Devarajan and Go (2002), and Bourguignon, Pereira and Stern (2002) to mention a few. Institutions like the World Bank and the International Food Policy Research Institute (IFPRI) make extensively use of CGE modeling to aid policy analysis. CGE models specifically developed for South Africa include Van Heerden (1996), Gibson and Van Seventer (1997), Arndt and Lewis (2000), Devarajan and Van der Mensbrugge (2000), Lewis (2001), Van Seventer (2001) for TIPS, Thurlow and Van Seventer (2002), and Thurlow (2003). Van Heerden (1996) developed a dynamic overlapping- generations model to

test the welfare impact of redistribution as well as the incidence of various taxes on the young and the old. Gibson and Van Seventer (1997) applied their model to determine the impact of restructuring public expenditure by function in South Africa. The models developed by Arndt and Lewis (2000) and Lewis (2001) evaluated the impact of HIV/Aids on South Africa and the model of Devarajan and Mensbrugge model (2000) focused on trade reform in South Africa. Thurlow and Van Seventer (2002) also developed a standard general equilibrium model for South Africa. In 2003 Thurlow developed a dynamic general equilibrium model for South Africa.

For the purpose of this study, a standard CGE model developed by Löfgren et al (2001) at IFPRI is used to analyze the effect of changes in the VAT structure on the economy. Theoretical general equilibrium models are complex, with the existence of equilibrium one of the focal issues. Empirical models are simplified, but empirical models are sometimes more time consuming due to the large data requirements. The CGE model used in this study will require as data input a social accounting matrix (SAM) of South Africa, as well as certain elasticities of substitution estimated, using South African data. The CGE model is used to simulate changes in the VAT structure. Each simulation is analyzed to determine the effect on the economy. Factors of importance that will be observed are among others, standard of living, regressiveness of VAT, as well as changes in employment, income, and GDP. The different changes in VAT are compared and policy recommendations will be made.

This study will start by giving an overview of VAT: what design principles are incorporated within a VAT system. Chapter 2 also looks at the performance of VAT since its inception in 1991 to 2001. Chapter 3 will give a theoretical explanation of the CGE model used in the analysis of the effect of changes in the VAT structure as well as the adaptations made to the model. Thereafter the data requirements of a CGE model will be discussed, which includes a SAM and a set of substitution elasticities. The SAM and other data sources will be discussed in Chapter 4. The next chapter, Chapter 5, will discuss the changes in VAT and the impact of these changes on the economy, and lastly, Chapter 6 will contain some conclusions and policy recommendations.

1.6.   Summary

South Africa is faced with high levels of poverty, and unemployment, as well as a highly inequal distribution of income and wealth. The strategy GEAR is in place to set the direction for fiscal spending towards economic growth, employment creation, and redistribution. Fiscal spending, however, is constrained by insufficient revenue sources and trying to maintain a deficit of around 2.5 percent of GDP.   A balance should be struck between increasing revenue through higher taxes and maintaining incentives for growth. Another possibility is restructuring existing taxes to broaden the base, and to lower the burden, also to promote a more equitable distribution of income. This study will specifically investigate the possibility of restructuring VAT with the above-mentioned aims in mind. A CGE model will be used to analyze the effect of changes in VAT on the economy. The results will be used to draw conclusions and to make policy recommendations.

Chapter 2

INTRODUCING VALUE-ADDED TAX

2.1.   Introduction

VAT was introduced in South Africa in 1991 to replace GST. VAT is an indirect tax and is levied on the value added in production during the different stages (Metcalf in Baker and Elliott,1997:413). In South Africa VAT is levied on the supply and importation of goods and services, while exported goods and services are exempted. The South African Value-Added Tax Act No.89 of 1991 makes allowances for exemptions, exceptions, deductions and adjustments that effectively lower the VAT liability. VAT was imposed in 1991 at a statutory rate of 10 percent; the rate was increased to 14 percent in 1993. To reduce the regressiveness of VAT, various basic food items where exempted from VAT when introduced. Later, in 2001 paraffin, an energy source used by most poor households, was also exempted (RSA,2001:16). The latest changes in VAT aim at improving the administration of VAT with the objective to reduce the administrative burden especially for small businesses (RSA,2002a:17). When VAT was initially introduced there were some questions on whether or not VAT can replace GST as a revenue source for government, to what extent VAT would increase inflationary pressures, and how regressive VAT would be.

This chapter first gives a brief history of VAT; next it discusses issues within a VAT system with specific focus on South Africa. The last section analyzes VAT in South Africa since its inception in September 1991 till 2001, and addresses the questions: How important is VAT as a revenue source for government? How inflationary is VAT? What is the impact of VAT on the trade balance? How regressive is VAT taking current zero-ratings into consideration? What is the long- and short run variables that determine VAT collections?

Analyzing VAT from 1991 until 2001 will also provide clues in terms of issues to be considered for the future within the South African VAT system.

2.2.   VAT Overview

VAT is a tax instrument used by countries all over the world. Japan was the first country to introduce a VAT-like tax just after World War I. However, this tax was short-lived. Brazil, followed by Denmark, introduced VAT in 1967. Denmark was the first European Community (EC) (now the European Union (EU)) country to adopt VAT. Other countries in the EC like France, Germany, the Netherlands, Luxembourg, Belgium, Ireland, Italy, and the United Kingdom followed. The VAT structure differed from country to country and therefore VAT could not be imposed uniformly throughout the EC. In 1977 the sixth directive on VAT brought together the former directives of the EC, and established consistent rules for VAT in the European Community. Other countries in the EC like Greece, Portugal, and Spain also introduced VAT. (Metcalf in Baker and Elliott,1997:417-419).

VAT is also used by various developing countries. An example is Bolivia, who introduced VAT in 1986 as one of the country's centerpiece taxes. When introduced, the statutory VAT rate was 10 percent, but in 1992 it was raised to 13 percent. In 1993 VAT contributed about a third of the total tax revenue of the country. (McMahon and Schmidt-Hebbel in Fiscal Reform and Structural Change in Developing Countries. Vol. 2,2000:184). Another example is the Philippines, which introduced VAT in 1988 to replace all forms of sales taxes at that time. The statutory VAT rate at inception was 10 percent. VAT, in the Phillipines, is levied on final destination and exempts the primary sector, while exports are zero-rated. The tax credit method is used - credit for VAT paid on inputs are thus allowed. (Clarete and Diokno in Fiscal Reform and Structural Change in Developing Countries. Vol. 2,2000:102).

In 1989 Japan reintroduced a subtraction type VAT. Canada introduced VAT in 1991. VAT in Canada is levied on the purchaser, but vendors are responsible for collecting tax.

Other countries that also use a VAT system are New Zealand, Norway, Switzerland, and Turkey, (Metcalf in Baker and Elliott,1997:417-419) as well as Brazil, Colombia, India, South-Korea, and Taiwan.   The list is not inclusive, and in April 2001 about 123 countries had a VAT-like tax (Ebrill et al,2001:8).

VAT is generally experienced by most countries as an effective tax. Apart from Japan only five other countries ever removed a VAT, which are Vietnam, Grenada, Ghana, Malta and Belize. Three of these countries, Ghana, Malta and Vietnam, as well as Japan have since reintroduced the VAT (Ebrill et al,2001:14). Australia and the United States are the only OECD countries not ever to have introduced a VAT (OECD,1997:7), however, one state in the USA employs a VAT tax; the state of Michigan introduced VAT in1975 (World Bank Symposium,1990:4).

2.3.   Broad Issues Within a VAT System

There are eight broad issues within a VAT system. These issues are usually dealt with at the design stage of a VAT system. The choices when designing a VAT system are:

- The broad type; whether VAT should be based on consumption, income, or gross product.
- The regime for international trade: whether VAT should be levied at the place of origin or alternatively at the place of destination.
- The method that will be used to compute tax liability. The methods available are the subtraction, tax credit or invoice methods.
- The products, firms or sectors to be free of tax.
- Whether to apply exemptions or zero-rating to products, firms or sectors free of tax.
- The special rules or regimes that will apply to certain products, firms or sectors.
- Whether or not to use a single-rate or multiple rates within the VAT system.
- Whether or not to apply a tax-inclusive rate or alternatively a tax-exclusive rate. With the former tax is levied on the total amount of money transferred, including the tax itself. (World Bank Symposium,1990:5).

The rest of this section looks at some of the issues listed above by firstly discussing them in general, but then also discussing them specifically in the South African context. The issues of taxes on services, and tax evasion, are also discussed.

2.3.1   VAT: a Tax on Consumption

When introducing VAT, the most basic choice is to decide whether or not VAT would be imposed as a consumption, gross-product or income type tax. The following table illustrates the difference between the three types:

Table 2.1:   The Three Types of VAT from (Sicat,1988:70)

Deductible from Sales	Gross-Product	Income	Consumption
Purchases of materials and services	Yes	Yes	Yes
Depreciation of capital goods	No	Yes	Yes
Investment purchases	No	No	Yes
Base	GDP	NNI	Private Consumption

The three types of VAT differ in terms of the items deductible from the VAT base. With a gross-product type of tax only purchases of materials and services are deductible. The gross-product type of tax often leads to double taxation, as capital goods are taxed when first purchased, but may be taxed again when sold. The income type tax, on the other hand, also allows for the exclusion of depreciation on capital goods, however, the calculation of depreciation is a problematic issue. A consumption type tax allows for the deduction of purchases of materials and services as well as investment purchases. Most countries adopted a consumption-based tax, since VAT was in most cases intended to replace another consumption type tax, such as the sales tax. Consumption-based VAT also does not create a disincentive for investment like the other two types. (Sicat,1988:71-72).

South Africa's VAT is also a consumption type tax. Even though VAT is levied on production, VAT is generally seen as a consumption tax, as the consumer pays it at the final stage of production.

2.3.2   VAT and International Trade

VAT may be based on the location of production (also known as the origin principle) or on the location of final consumption (also known as the destination principle). A consumption tax is usually based on the destination principle. Under the destination principle exports are usually excluded from VAT, while imports are taxed. South Africa's VAT is also based on the destination principle, as exports are zero-rated. (Sicat,1988:73).

2.3.3   Methods Used for Computing VAT Liability

There are three methods that may be used to impose VAT, namely the subtraction, invoice (or also known as the credit method) and cash flow methods. The most common method used to impose VAT is the invoice (credit) method where VAT is calculated on total sales at each stage of the production process, and where a credit for any VAT paid on inputs in the production process is allowed. A firm is required to supply proof of the payment of input VAT before allowing the credit. With the subtraction method VAT is calculated by multiplying gross sales net of intermediate goods purchases at each stage of the production process with the statutory VAT rate. With the invoice method VAT is calculated by multiplying gross sales and allowing for credit on VAT payments by other firms at previous stages of the production process (Metcalf in Baker and Elliot, 1997:413-414). With the cash flow method VAT is calculated on the cash flow for a firm. The following cash flow equation may be used to denote the sources and uses of cash in a firm:

$$S + K^+ = L + M + K^-$$

where

S is the proceeds from the sales of goods or services

K^+ is the capital inflows, including both new equity and borrowing

L is payments for labour

M is intermediate goods

K^- is capital outflows, including dividend payments, interest payments, debt repayments and equity

VAT as calculated using the subtraction method is equal to $S - M$. Rearranging the terms give VAT as:

$$V = S - M = L + K^- - K^+$$

Therefore, VAT may also be calculated as payments to labor plus capital outflows less capital inflows. Old capital in the firm is taxed as it is repaid, or interest on it is paid, or servicing payments like dividends are made. (Metcalf in Baker and Elliott,1997:413).

Table 2.2:   The Difference Between the Subtraction and Credit Methods to Impose VAT

Transaction	Value	Subtraction method	Credit method
A farmer sells maize to mill	R200	R(200-0)x10%=R20	R200x10% = R20
The mill sells flour to baker	R300	R(300–200)x10%=R10	R300x10%=R30–R20=R10
Baker sell bread to consumer	R600	R(600-300)x10%=R30	R600x10%=R60-R30=R30
Total	**R1100**	**R60**	**R60**

*   Assume the farmer has no input costs and maize, flour and bread not exempt as usual.
*   VAT is levied at a rate of 10%.
Own Calculations

South Africa uses the invoice (credit) method to determine VAT liability. Under the invoice method each trader charges output tax on sales. In turn the trader is allowed a credit on his/her own purchases against the output tax. The trader will receive a refund if the credits exceed the output tax on sales. (Ebrill et al,2001:20). The trader must supply proof of the credits.

2.3.4   Items, Firms or Sectors to Exclude from VAT

Certain products, firms or sectors are often excluded from VAT. Economic, social and administrative reasons are often stated for their exclusion. Exclusions on economic and social reasons are mainly associated with welfare gains: Excluding certain commodities, for example food, may aid redistribution. Exclusions may also be on the ground of administrative impracticalities. Certain products, firms or sectors are difficult to tax, or too costly to tax. This usually applies to small firms. Retailing in most developing countries, as with South Africa, is characterized by a large number of small firms. Developing countries most often also have a large informal sector. Most agricultural activities are carried out by small-scale farmers. Usually operations are carried out as a household activity, the person often uneducated, with few or no records. This makes the collection and administration of VAT difficult and impractical. The cost of collecting taxes from small firms is very large in relation to the actual taxes collected, both in terms of compliance and administrative costs. There need to be some form of exemption of the small firm from the registration and returns requirement of VAT. (Due,1986:1-3).

To exclude small firms as a collection point a threshold is set. Small firms earning an annual turnover below the threshold are not required to register for VAT and are also not required to fill the VAT returns, or levy VAT on their products. Small firms, however, can then also not claim VAT credits. The main reason for the exclusion of small firms as a collection point, as stated above, is the fact that the compliance cost of small firms is proportionately larger than the compliance cost for larger firms.   (Agha and Haughton,1996:304). To reduce the compliance cost for small firms the threshold may be raised (Sanford and Godwin,1986:14). It is unlikely that the small firm will escape from paying VAT at all. Through the stages on intermediate inputs VAT will be paid, unless all trade (even in the intermediate stage) takes place between non-registered traders (Due,1986:4-5).

The threshold for small firms in South Africa is R300 000. Any person whose total value of taxable supplies exceeds the limit of R300 000 per year must register for VAT

(SARS,2003).   Small firms supplying less than R300 000 per year are therefore not required to register as a VAT payer. Figure 2.1 shows the ratio of small, medium and large firms in the Sectors of Production for South Africa. The data is obtained from the 1998 Supply and Use Tables as published by Statistics South Africa.

Figure 2.1:   The Ratio of Small, Medium, and Large Firms in the Sectors of Production in 1998 from (Conninghart,2001)
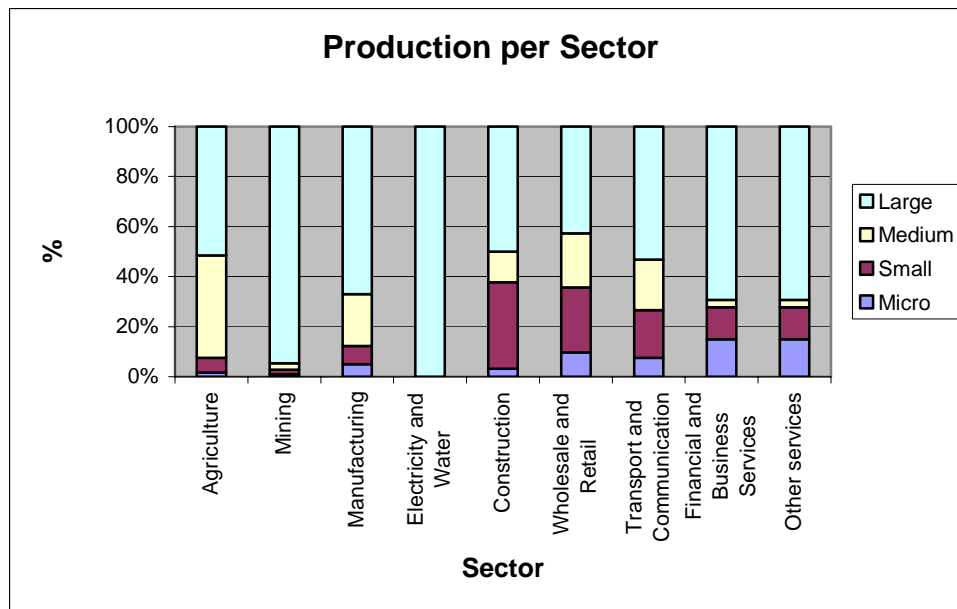
The micro, small and medium firms contribute between 40 and 55 percent of the producers in the agricultural, construction, wholesale and retail, as well as transport and communication sectors, respectively. Micro, small and medium firms contribute about 28 percent of the producers in the manufacturing sector.   In the services sectors the micro, small and medium firms contribute about 25 percent respectively.   In the mining sector less than 5 percent of the firms are micro, small and medium. Large firms do all the production in the electricity and water sector, mainly because large parastatals, government or local government municipalities supply these services.   The figure is based on relative production and not on the number of small firms. It might be expected that there are more than 50 percent SMME farmers in South Africa producing less than 50 percent of total production.

Sectors that are usually excluded as a collection point are the agricultural, education, health, and financial sectors. The reason for excluding the first three sectors is mainly for redistribution, while excluding the financial sector is usually due to administrative difficulties. Financial services are not easily taxed, and not necessarily all financial services are taxed. (Gillis,1986:1). It is difficult to determine the value of some services rendered by banks. In South Africa the financial sector is not fully exempt. There are a number of different types of transactions subjected to VAT. Some include the sale of cheque book covers, charges for the provision of information to third parties, installation and rental of electronic payment devices, brokerage fees on derivative trading, cash value of rental agreements and vehicle maintenance agreements, rental of safety deposit boxes, bureau fees on payroll services. (International VAT Monitor,1995:376). The list is not inclusive.

The IMF's Fiscal Affairs Department (FAD) recommends the zero-rating of agricultural production. In a study done on 30 countries, 25 countries exempt agricultural production. (Ebrill et al,2001:65). The agricultural sector, in South Africa, is not excluded, although certain products produced within this sector is excluded.

State output is sometimes excluded from VAT because the output is sold below the true market value.

Either zero-rating or exemption may achieve the exclusion of products, firms or sectors from VAT. The implication of zero-rating and exemption is discussed in the next section.

2.3.5   Zero-rating Versus Exemptions

Zero-rating is a situation where the rate of tax applied to sales is zero, though credit is still given for taxes paid on inputs. An example is exports: exports leave the country free of VAT, but the producers are allowed a refund on their inputs. (Ebrill et al,2001:3, Davis and Kay,1985 :5, and SARS,2003). The reasons for zero-rating exports are two-

fold. Firstly by zero-rating exports (while still allowing a refund for producers) create an incentive for producers to export rather than sell domestically, and secondly, to zero-rate exports are consistent with the destination principle. The destination principle is the international norm and requires that the country of final destination must determine the tax paid on the goods. Food, a necessity is often zero-rated from VAT to aid redistribution. Certain items may be zero-rated when it is considered as politically desirable to encourage consumption. Some items, firms or sectors pose administrative and practical problems. (Davis and Kay,1985:5). Other commodities, apart from exports, zero-rated in South Africa include the sale of a going concern to a registered vendor, certain inputs in farming, as well as fuel which is subject to the fuel levy (SARS,2003).

Exemption on the other hand means that again no tax is paid on outputs, but the tax paid on inputs may not be reclaimed (SARS,2003). Taxes paid on intermediate goods may not be reclaimed and will therefore affect the production decision (Ebrill et al,2001:3 and Davis and Kay,1985 :5). The reasons for exemptions are both economic and social reasons.   Items, firm or sector may be exempt due to redistribution goals or administrative impracticalities. Goods that are exempted in South Africa include certain financial services, donations, rental of accommodation, certain educational services, passenger transport by road or rail, as well as certain supplies by employee organizations (SARS,2003).

Consequences of Exemptions and Zero-Ratings

Zero-rating and exemptions have different impacts on government revenue. Also the stage at which exemption occurs may have alternative impacts. Exemption may occur at the final stage of sales, or during the intermediate stages of production. When exemption occurs at the intermediate stage of production the VAT chain is broken. If exemption occurs at the retail stage, only the value added at the final stage will not be subjected to VAT, while if exemption occurs at the intermediate stages of the production stages, sales of subsequent businesses acquiring the goods are overtaxed. Inputs prior to the exempt stage are not credible. The tax base is not reduced but augmented. (Jenkins and

Kuo,2000 :764). The following table illustrates the effect of zero-rating and exemption at different stages:

Table 2.3:   The Effect of Zero-Ratings and Exemptions on Government Revenue

Stage	Transaction Value	Without Zero-Rating or Exemptions	Zero-rating	Exemption	
			Zero rating occurs at final stage	At Retail Stage	At Intermediate Stage – Farmer
A farmer sells maize to mill	R220	R20-R0=R20	R220 : R20	R220 :R20	R200 :R0
The mill sells flour to baker	R330	R30-R20=R10	R330 :R10	R330 :R10	R330 :R30
Baker sell bread to consumer	R660	R60-R30=R30	R600 :R-10	R600 :R0	R660 :R30
Total Government Revenue	R60	R60	R20	R30	R60

*   The invoice method is used for calculating tax liability.
Own Calculations

Without any zero-ratings of exemptions the government collects an amount of R60. Suppose that bread is zero-rated. The zero-rating occurs at the final stage of production; the baker collects no VAT, and at the same time is allowed R10 credit on inputs. The total amount VAT collected through the production process is R20. Suppose now that bread is exempted; again the baker collects VAT and is also not allowed any credits on inputs. The total amount VAT collected is now R30. If, however, maize is exempted (not bread) it means that the farmer does not charge VAT on his maize, the miller is not allowed a credit, but in turn, collects VAT on flour sold to baker. The baker also collects VAT on his bread and is allowed a credit for VAT paid for flour. The total amount collected is R60.

Therefore, the stages where exemption may occur in the production process will have a different impact on government revenue. Revenue will fall if the exemption occurs at the stage of final sales. Revenue will increase when intermediate goods are exempt. When exemption occurs at the retail stage the VAT from the final stage is lost for government and the government only collects R30 VAT, instead of the possible R60 on value added. However, the VAT collected is more when the break occurs in the initial stage of production; the government receives R60.

The exemption of inputs will affect the production decision. The exemption of intermediate goods will create the incentive for producers to self-supply. For example: suppose security services are exempt. The purchaser of security services will not be allowed to claim a credit on security services. Therefore, instead of purchasing security services that are exempt, firms will rather supply security services themselves. This will generate a saving for the firm to the extent of the VAT paid on security services. As far as possible levying taxes on intermediate goods must be avoided. Levying taxes on inputs will distort the production decision and will lead to production inefficiency. (Davis and Kay,1985 :4).

Complications also arise when producers sell both exempt and taxable items. Producers will try to allocate the inputs to the exempt items, evading taxes thereby. Furthermore exemption creep may arise – exempting one commodity will increase the pressure for exemption of commodities used to produce the exempt commodity. Avoidance of tax payment may also occur when the taxpayer classifies goods as exempted goods to avoid tax payments. (Ebrill et al,2001:85-90). In South Africa vendors making only exempt supplies, may not be registered for VAT (SARS,2003).

A government should only apply zero-rating, exemption, or differential rates if there is a strong economic argument for the special treatment of a particular commodity group, because the tax structure will be under pressure of the different lobbying powers of various groups of producers and consumers. (Davis and Kay,1985:5).

It is important to note that exemptions and zero-rating may impose a revenue loss for government. (Sanford and Godwin,1986:6).

2.3.6   Single or Multiple Rates

When designing and applying a VAT system a country may either use a single VAT rate, meaning that all commodities and services are taxed at the same rate, or alternatively

employ multiple (or differential) rates. When employing differential rates, more than one rate is applied.

A single rate will ease compliance and is not likely to have a less distortionary impact on the production decision. (Sicat,1988:81). A single rate VAT system is the easiest to administer and is distributionally neutral (Alderman and Del Nino,1999:183). On the other hand, the argument for multiple rates is that it allows policy makers to discriminate between commodities, firms and sectors. A VAT system with multiple rates may be followed for economic and social reasons: A VAT is in nature regressive, and applying lower rates to certain commodities or sectors may reduce the regressiveness of the tax (Sicat,1988:81). Higher taxes, in turn, are often applied to goods with inelastic demand. VAT systems are often introduced with exemptions to reduce the impact on low-income households (Alderman and Del Nino,1999:183). Taxes on goods that individuals may consume regardless of price (such as tobacco) are often taxed at a higher rate. (Davis and Kay,1985 :3) Applying differential rates often reflects a government's distributional and fiscal objectives.

Table 2.4:   VAT Introduced with a Single Rate from (Ebrill et al,2001:69)

Date of Introduction	Number of Countries	Single Rate	Multiple Rates
Before 1990	48	12	36
1990-1994	46	31	15
1995-April 2001	31	25	5
TOTAL	**125**	**68**	**56**

Table 2.4 illustrate that there is a tendency among countries towards single rates. It is maybe proof that countries find single rates better.

When employing a single VAT rate, the IMF's Fiscal Advisory Department (FAD) recommends a rate between 11 and 19 percent (Ebrill et al,2001:65).

There are two basic reasons for rate differentiation. They are efficiency and equity. Efficiency may be promoted by levying lower rates on commodities for which the

demand is more elastic and higher rates on commodities for which demand is inelastic. This will minimize the impact of the tax on consumption patterns. An efficiency aspect that also needs to be considered is the ability of the tax to raise revenue. An efficient tax should also be levied according to the destination principle: the tax needs to be levied on the consumption of domestic residents. Equity objectives look at the distribution of income. Alternative commodity tax structures will alter the distribution of income. In terms of equity it will be more equitable to tax more heavily those goods that account for a greater share of the expenditure of the more wealthy. Having a progressive income tax structure is more likely to promote equity objectives than an indirect tax, but ultimately combining a progressive income tax structure with different VAT rates may improve equity. (Ebrill et al,2001:75).

Cost of Rate Differentiation

Applying differential VAT rates carries cost in terms of increased administration as well as compliance cost. It also makes politicians, or the government, vulnerable to lobbying and the political powers of producers and other interest groups. (Ebrill et al,2001:80)

The administration and compliance cost of VAT increases when applying differential rates because it complicates the taxpayers' books and invoices; it also complicates audits, creates scope for argument, and creates incentive for deliberate misclassification of items. With a multiple VAT rate system the compliance cost rises as the tax forms become more complex, and accounting records need to be more complete. (Agha and Haughton,1996 :304).

In terms of social reasons, another argument against applying differential rates is that other mechanisms like direct taxes, or social transfers may be used instead of differential VAT rate. These measures will not create distortion between supply and demand. (Sicat,1988:81). If commodities that consumers may readily substitute for each other are taxed at very different rates, then the tax system will artificially distort their choices between these commodities (Davis and Kay,1985 :3).

However, when applying differential rates, the invoice method is more suitable for dealing with differential rates (Ebrill et al,2001:21)

2.3.7   VAT on Services

Goods and services are often treated under a tax system as essentially the same. However, there are a number of differences between goods and services that should be taken into consideration under a VAT system. Firstly the income elasticity of demand for services is higher compared to that of commodities. Compared to commodities, services show a higher value added at the principle stage of production. Taxation on exports should also be treated differently for commodities and services. For services, taxation usually occurs at the place of production, except for consulting services delivered abroad, while with commodities the destination principle almost always applies. Also taxing services is more likely to lead to self-supply, which is not the case with commodities. (Kay and Davis,1986).

2.3.8   VAT Evasion

The VAT is harder to evade than its predecessor the sales tax, especially when the invoice method is used. The reasons for this are:
- Invoices provide a good audit trial.
- The tax is collected at all stages of production.
- Import taxes are collected at the point of entry.
- The onus of proof for tax credits is on the taxpayer.
- Regular crosschecking, even on a sample basis, helps income tax enforcement.
- Better record keeping is required.
- The VAT base may be widened over time by including more services, or by covering more items.
- The invoice method makes VAT self-enforcing, since the taxable buyer has an incentive to insist on an invoice. (Agha and Haughton,1996:303).

Some of the methods used, however, to evade VAT include:

- Understating sales.

- Inflating claims for VAT paid on inputs.

- Claiming credit for tax paid on inputs used in producing goods exempt from VAT. This usually happens when a producer sells both exempt and non-exempt items.

- A firm collects VAT, but it does not pay it to the receiver of revenue.

- Claiming VAT credit on purchases that are non-creditable. For example a car used for non-business purposes.

- Non-registration for VAT.

- Diversion of zero-rated exports to the domestic market.

- Claiming the transaction is not a taxable event, that it is a gift rather than a sale.

(Agha and Haughton,1996:304).

Agha and Haughton (1996) found that VAT compliance increases with lower VAT rates, fewer rates, a smaller population, more learning time and with greater spending on tax administration. The reasons for most of this is quite straightforward:

- The higher the VAT rate, the higher the incentive for the taxpayer to evade taxes and therefore the lower the compliance.

- The greater the number of VAT rates, the more opportunity for evasions, the harder to supervise and therefore the lower the compliance.

- The higher the expenditure on tax administration the more effective the system will be, and compliance will increase.

- The longer the experience with administering VAT the more effective the system will be, and compliance will increase.

- The smaller the population, the smaller number of VAT transactions to be observed, and compliance will increase.

(Agha and Haughton,1996:305).

2.4.   Analyzing VAT in South Africa from 1991 to 2001

The next section analyses the performance of VAT in its first decade of existence. The section first looks at the importance of VAT as a revenue source to government: How VAT compares to general sales tax (GST), how VAT compares to other tax revenue sources, and how each sector of the economy contributes to VAT revenue. The section also looks at the performance of VAT as a percentage of gross value added (GVA) and GDP respectively. Then this chapter focuses on the efficiency and C-efficiency ratios of VAT over the stated period. The efficiency and C-efficiency ratios are used to determine the broadness of the VAT base. Then the inflationary pressures of VAT in South Africa are investigated.   A section dealing with the influence of VAT on the Balance of Payments follows next. The section also looks at the regressiveness of VAT on its own compared to the progressiveness of the complete tax system.   Lastly, this section investigates the variables that determine VAT collections in the long- and short run.

2.4.1   VAT as a Revenue Source for Government

One of the initial questions when VAT was introduced was whether or not a 10 percent VAT can replace a 12 percent GST as a revenue source for government. Figure 2.2 compares GST with VAT over the period 1981 to 2001 as a percentage of total tax receipts.

Figure 2.2 below shows that VAT contributed slightly less than GST when the statutory rate was 10 percent – the GST rate at that time was 13 percent. Therefore the 10 percent VAT could not replace a 13 percent GST.   A reason for this might be transitional problems experienced when moving from a GST to a VAT. After 1993, when the rate increased to 14 percent, VAT contributed to revenue to the same extent as GST for the first four years, and thereafter slightly less. At this stage however it is still not possible to deduce what the difference is in terms of the economic impact of VAT as apposed to GST.

Figure 2.2:   VAT compared to GST from SARB Time Series Data
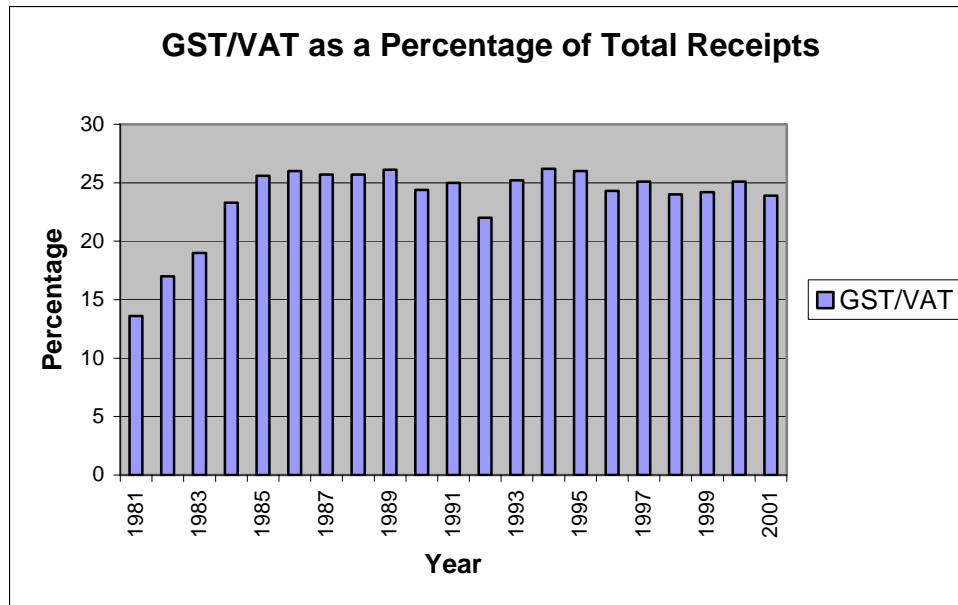
KBP4578M and KBP4595M

Another interesting observation is that GST increased from 1981 until it reached a plateau in 1986, whereas with VAT a plateau was reached almost immediately. One possible explanation is that VAT was implemented by using experience gained from implementing VAT.

It is also important to compare VAT with GST as a percentage of GDP. This is shown in Figure 2.3.

VAT as a percentage of GDP has steadily increased from 1993 onwards. At the end of 2001 VAT as a percentage of GDP was in the region of 10 percent.

The main reasons for the increase in VAT as a percentage of GDP can possibly be attributed to an increase in consumption, an increase in imports, rising inflation and a decline in investment. As VAT is a consumption tax, an increase in consumption will lead to an increase in VAT revenue, while inflation, in turn, increases the base on which VAT is levied. VAT payments on investment goods are excluded from VAT, and therefore a reduction in investment means less credits, and VAT receipts increase.

Figure 2.3:   *VAT as a Percentage of GDP for 1991 to 2001 from SARB Time Series*

                 Data
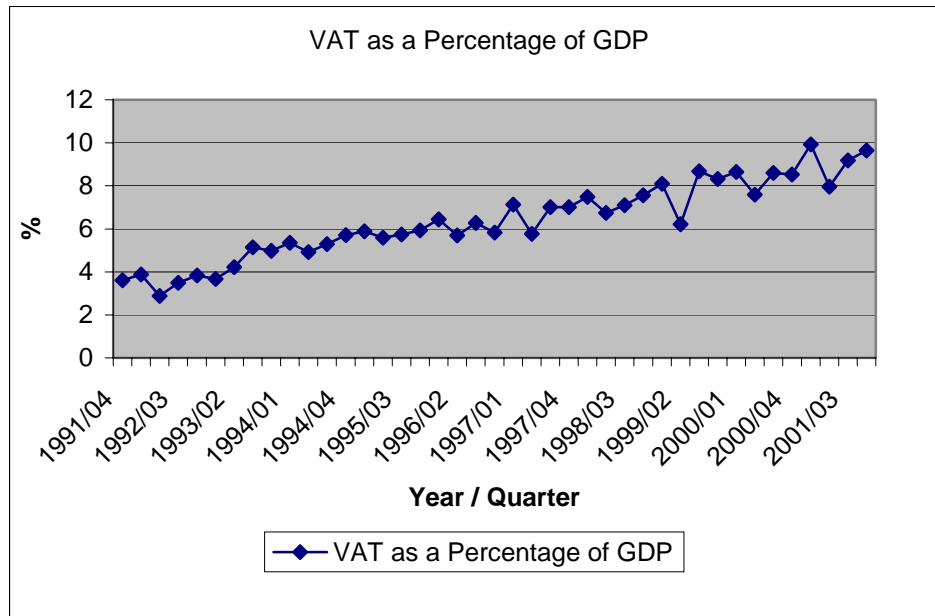
KBP6006C, KBP4578M and KBP4595M

The correlation tables in table 2.5 show VAT as a percentage of GDP compared to the variables listed above:

Table 2.5:   *The Correlation Between VAT as a Percentage of GDP and Chosen*

                 Explanatory Variables

Consumption				Imports		
	C	VAT			M	VAT
C	1			M	1	
VAT	-0.04422	1		VAT	0.420953	1

Investment				Inflation		
	GFI	VAT			CPI	VAT
GFI	1			CPI	1	
VAT	0.117209	1		VAT	0.381838	1

KBP6006K, KBP6007K, KBP6009K, KBP6014K, KBP6050K, and KBP7032Q

From the tables in Table 2.5 it seems that the increase in VAT as a percentage of GDP can be explained by rising imports and an increase in inflation, more than any of the other identified variables. A depreciation of the rand fueled the increase in imports, especially

over the last two years. It seems further that consumption as a percentage of GDP is declining, and therefore does not explain the increase in VAT as a percentage in GDP. However, there is not a strong correlation between any of the variables identified above and VAT as a percentage of GDP. The last section of this chapter further investigates the variables that determine VAT collections in the long- and short run.

The increase in VAT as a percentage of GDP can also be attributed to an increase in the efficiency of the administration of VAT collections. The VAT proposals to simplify VAT administration may also broaden the VAT collection base, this change, however, was only imposed in 2002, and can therefore not be the only reason for the increase in VAT as a percentage of GDP from its inception. The other VAT proposals, like the elimination of VAT on paraffin, would in contrast serve to contract the VAT base.

Figure 2.4, in turn, compares VAT to other taxes over the period 1990 to 2001:

Figure 2.4:   VAT Compared to Other Taxes from 1991 to 2001 SARB Time Series Data
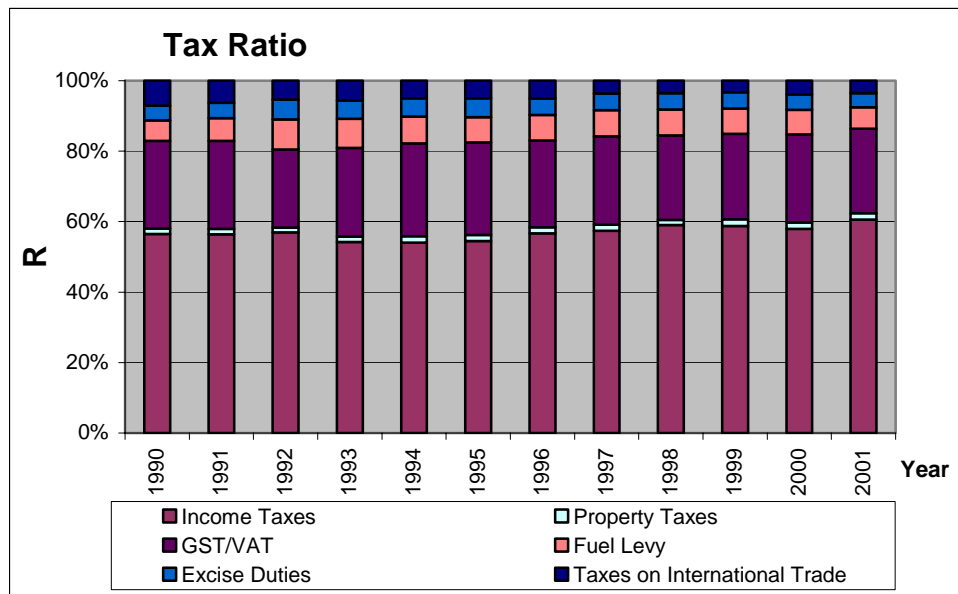
KBP4570M, KBP4577M, 4578M, 4579M, 4580M, and 4592M

If one compares VAT to all the major taxes levied in South Africa, one may see that VAT is the second most important revenue source for government after income taxes. VAT's

importance also remained relatively constant over the years. In 2002 VAT contributed 25 percent to total tax revenue (SARB,2002:S-54 and S-55).

It is also necessary to look at the contribution of each sector in the economy to VAT. This is shown in Figure 2.5:

Figure 2.5:   VAT per Sector in 2001 from (SA SAM,2003)
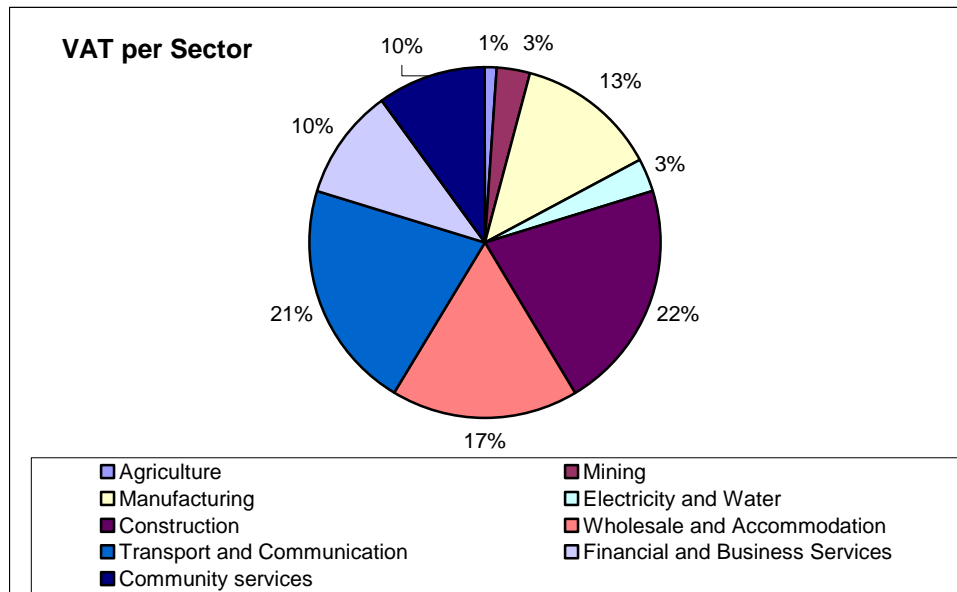
Figure 2.5 shows that the construction industry contributes 22 percent to total VAT receipts. The transport and communication sector contributes 21 percent to total VAT revenue. Wholesale, trade, accommodation and catering each contribute 17 percent followed by manufacturing with 13 percent. Both financial and community services contribute 10 percent each. Mining and electricity and water contribute three percent each, with agriculture only one percent.

Another way to look at the contribution of each sector in the economy to VAT, is by looking at the contribution to VAT by sector as a percentage of Gross Value Added in the same sector. Figure 2.6 shows the VAT contribution of the economic sectors as a percentage of Gross Value Added.

Figure 2.6:   VAT as a Percentage of Gross Value Added in 2001 from (SA SAM,2003)

VAT as a Percentage of GVA per Sector
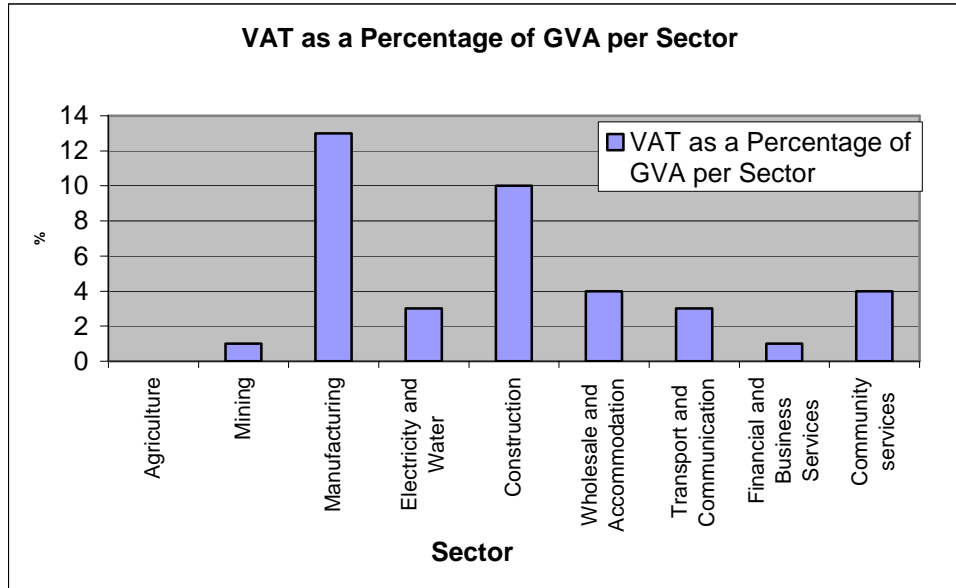
As shown in figure 2.6 the VAT collected in the agricultural sector is almost zero percent of gross value added in the same sector. This is mainly due to the large number of exemptions in that sector. Most basic food items are exempted from VAT.   The VAT collected in the mining sector is about one percent of gross value added in the same sector. The same applies for financial and business services. The reason for this is that the mining industry is a major exporter and exports are zero-rated, while most financial services are exempted.   Other sectors like electricity and water, wholesale and accommodation, transport and communication and community services only earn around three to four percent to gross value added of the respective sector. A possible reason for the low collection rate in water and electricity is the fact that a large portion of water and electricity production is used as an intermediate good (37,45 percent) meaning that firms can receive a credit for the use of water and electricity (SA SAM,2003). Construction pays 10 percent of gross value added. The VAT collected in the manufacturing sector is more than 13 percent of gross value added in the same sector and may be explained by the fact that exclusions in the manufacturing sector are limited.   Leakage may be contributed more to non-compliance and poor administration.

Total VAT as a percentage of total gross value added, equals six percent (SARB,2002:S-106 and S-54). Even though gross value added is not the exact VAT base, it indicates that there are some leakages from the system. Leakages may be due to exemptions, zero-rating, non-compliance and insufficient administration.

The efficiency ratio is widely used as a summary indicator of the performance of VAT. The efficiency ratio is an indicator of the extent to which the VAT bears uniformly upon a broad base. A higher ratio indicates a broader base. The efficiency ratio is the ratio of VAT revenues to GDP divided by the standard rate (expressed as a percentage). A more applicable measure (where differential rates or zero-rating applies) is the C-efficiency ratio. The C-efficiency ratio is the ratio of VAT revenues to consumption divided by the standard rate. The normalized C-efficiency ratio is 100 percent. A higher or lower C-efficiency rate will indicate the use of differential rates. Zero-rating will result in a C-efficiency rate of less than 100, while increasing the base will result in a C-efficiency ratio above 100. (Ebrill et al,2001:40-42). Both ratios were calculated for the period 1991 to 2001 and are shown in figure 2.7:

Figure 2.7:   Efficiency and C-efficiency Ratio of VAT from 1991 to 2001
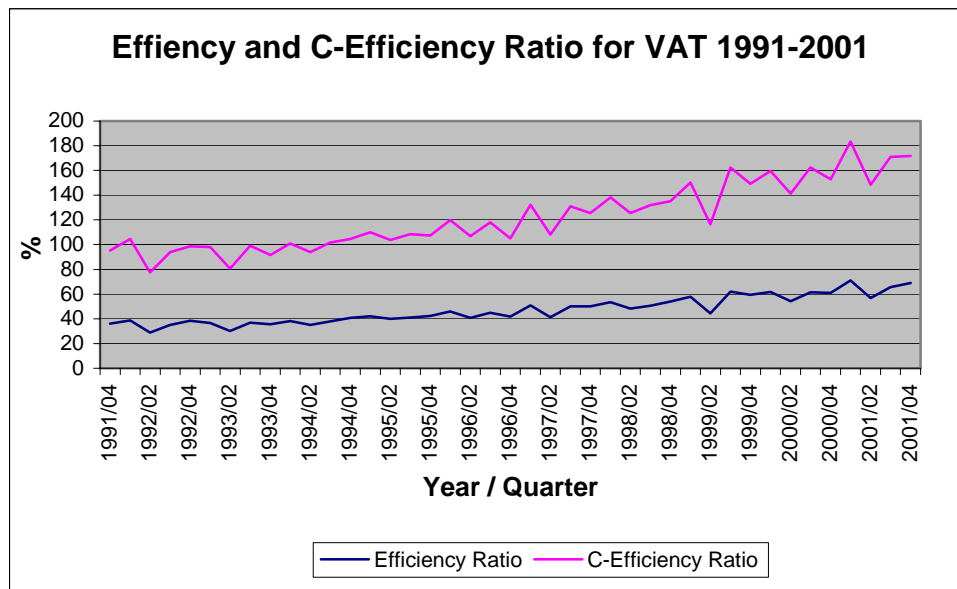
KBP6006C, KBP4578M, KBP6007C

*   Household consumption expenditure only is used for C-efficiency ratio.

Both the efficiency and C-efficiency ratios for VAT increased steadily from 1991 to 2001. Both the efficiency and C-efficiency ratio show the same trend. The C-efficiency ratio above 100 percent shows that the VAT base is relatively broad, and is steadily increasing. The increase in the base might be more attributable to more efficient collection techniques, since little was done since the inception of VAT to legally expand the base. Products and sectors, which were excluded since inception, are in most cases still excluded. On the other hand the government introduced more exclusions, for example paraffin.

2.4.2   VAT and Inflation

When VAT was initially proposed, the greatest controversy surrounding it was its effect on retail prices. If VAT increased, prices would increase. The whole of the VAT increase would not be reflected in prices. The extent to which prices will increase, due to an increase in VAT, depends on the ability of producers to shift the tax burden on to the consumer. The ability of producers to shift the tax burden on to the consumer, in turn, depends on the demand and supply elasticities.

The effect of changes in prices due to an increase in VAT may be classified as either a shift or an acceleration effect. A shift occurs when VAT leads to a higher CPI. The increase in VAT is a once-and-for all increase. The CPI will continue at a higher level. The intercept of the CPI changes but not the slope. The acceleration effect is associated with a change to the rate of the CPI. The acceleration effect *per se,* is not due to an increase in VAT, because VAT cannot be inflationary in itself. Rather changes in the tax burden, uncertainty and inflationary expectations may introduce acceleration in the rate of change of the CPI. (World Bank Symposium,1990:17-19).

To reduce the shift effect of VAT, the increase in prices (via an increase in VAT) may be accompanied by an increase in the money supply. This will finance trade at higher prices. The CPI will shift, but the rate of change in the CPI will not be affected. (World Bank Symposium,1990:19)

2.4.3   VAT and the Balance of Payments

Changes in VAT, and therefore relative prices, will have an effect on exports, imports, domestic production, and domestic consumption. The magnitude of the change in the foreign trade balance will depend on:

1)   The response of producers to the shift in the ratio export prices to domestic prices,

2)   The response of consumers to the price change, and

3)   The response of domestic consumers to the shift in the ratio of domestic prices to import prices. (World Bank Symposium,1990:29)

The CGE model used for the analysis of changes in the VAT structure will reflect the effect on exports, imports, domestic supply and domestic consumption via the CES type demand and CET type supply functions. Not only will one be able to observe the aggregate effect of changes in VAT on domestic supply, domestic consumption, exports and imports, one would also be able to observe the distribution effect between the large number of commodities included in the model.

2.4.4   The Regressiveness of VAT

A tax is regressive when lower income groups spend a larger proportion of their income on the tax, than higher income groups. Indirect taxes, including VAT are generally seen as regressive: a single positive rate of VAT applied to the broadest possible base is essentially a proportional tax on consumption and is therefore regressive in nature. (Ebrill et al,2001:106). Lower income groups spend the largest portion of their income on necessities like foodstuff in contrast to higher income groups, and for this reason lower income groups also spend a larger proportion of their income on indirect taxes. Excluding goods from VAT will improve the regressiveness of such a tax system. To reduce the regressiveness of VAT in South Africa, a large number of basic food items were exempted from VAT at inception and in 2001 paraffin was also exempted. Reducing the regressiveness of VAT would aid redistribution and improve equity.

Fourie and Owen (1993) evaluated the regressiveness of VAT in South Africa since the inception of VAT in 1991. They found that VAT is mildly regressive. They measured regressiveness as the ratio of total VAT payments by a household group to total the household group's respective income. This should be seen as an index of regressiveness. Davis and Kay (1985) also used this measurement to evaluate the regressiveness or progressiveness of UK VAT. The same measurement will also be used in the simulations to aid comparison. Figure 2.8 shows that VAT in 2001 was still regressive.

VAT in 2001 was mildly regressive[1]. The lower-income households spent a larger portion of their income (3.5 percent) on VAT than higher-income households (2.5 percent).

Figure 2.8:   The Regressiveness of VAT in 2001 from (SA SAM 2003)
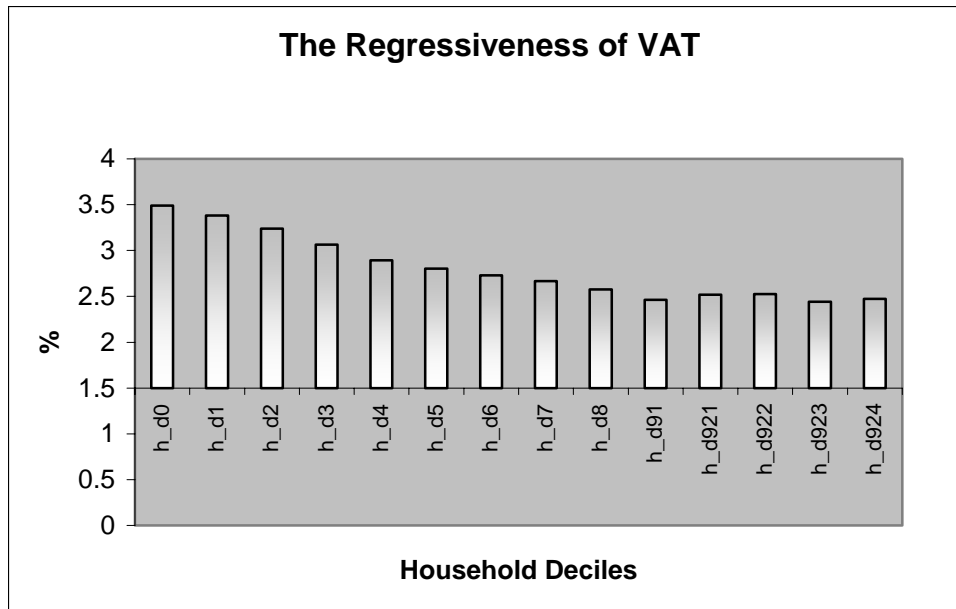
Davis and Kay (1985) as well as Fourie and Owen (1993), stressed that the progressiveness of the complete tax system should be taken into account and not only the regressiveness of VAT. The progressiveness of the taxes takes into consideration direct taxes paid by households as well as VAT. One should not focus on the distributional impact of VAT in isolation: what affects poverty and fairness is the impact of the tax

system as a whole. (Ebrill et al,2001:105). Figure 2.9 in turn shows the progressiveness of the complete tax system.

Figure 2.9:   The progressiveness of the complete tax system in 2001 from (SA
SAM 2003)
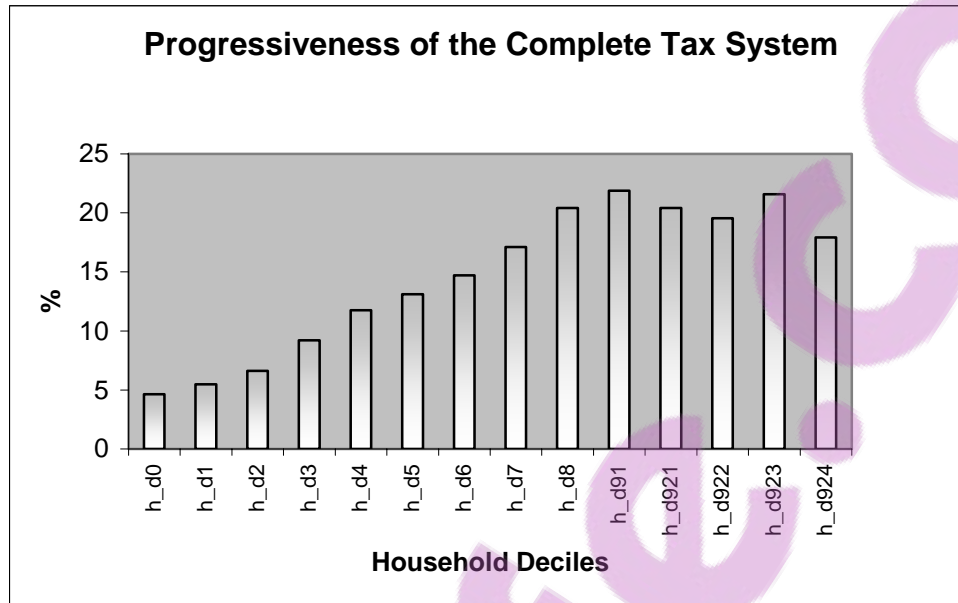
The tax system, overall is progressive when low-income households pay less than five percent of their income to taxes, compared to high-income households which pay about 20 percent.

It is generally accepted that income tax is more effective to achieve a progressive tax system than VAT. However, the higher the proportion of revenue raised through income tax compared to a consumption tax, the less progressive that income tax is likely to be. The last statement can be explained by (Davis and Kay,1985 :11). A combination of a broad-based sales tax with a progressive income tax is more likely to earn more revenue, while maintaining an overall progressive tax system.

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[1]   The formula for the calculation of the index of regressiveness is shown in Chapter 5.

2.4.5   Developing an Equation for VAT Collections for South Africa

As seen in section 2.4.1 VAT collections as a percentage of GDP increased over the last decade. The main reasons are an increase in imports as a percentage of GDP and improved collection methods. In this section the issue is further analyzed, by answering the question concerning those variables, which determine VAT collections in the long- and short run.

Using the definition of VAT to Estimate VAT Collections

Under section 1 of the Value Added Tax Act of 1991 VAT is levied on

a)   The supply by any vendor of goods and services in the course or furtherance of any enterprise carried on by him or her;

b)   The importation of any goods into South Africa; and

c)   The supply of any imported service by any person. (SA Tax, 2001)

Exports are usually exempt from VAT and to avoid escalation of VAT payments each trader is refunded for input taxes paid. The definition indicates the variables that will possibly explain the variance in VAT receipts, namely consumption expenditure by households (C), government consumption on goods and services (G), gross fixed capital formation (I), as well as imports (M). However, as imports (M) are already included in consumption expenditure (C) when consumption is determined, M will be excluded from the estimation.

Nominal quarterly data from the fourth quarter of 1993 is used. From the fourth quarter 1993 the VAT rate was 14 percent. Therefore for the purpose of this analysis a constant VAT rate is assumed. Consumption expenditure, gross fixed capital formation and government expenditure already include a VAT component. This is removed by dividing VAT collections by the VAT collection rate.

The following variables are used in the estimation process:

Table 2.6:   *Variables Used in the Estimation of a VAT Collection Equation from*

   SARB Time Series Data

Variable	Description
TIVAT	VAT collections
VATRR	VAT collection rate[2]
CONSE	Consumption expenditure
INVES	Investment
GCOTH	Government consumption expenditure (excl wages and salaries)

KBP4578, KBP6007, KBP6008, KBP6256, KBP6009

Table 2.7: Data Plots of Variables

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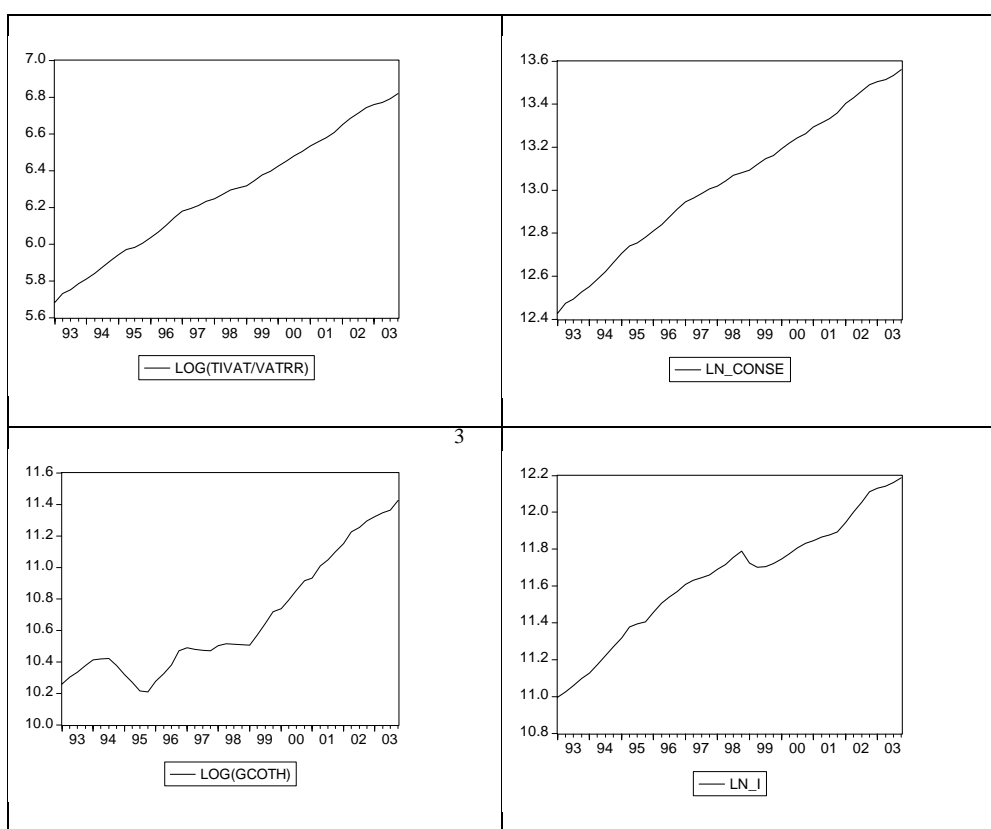
[2]   The VAT collection rate is based on actual VAT receipts as a percentage of the VAT revenue base.

[3]   The Chow Breakpoint test indicated a structural break in government consumption in 1994 quarter four. A dummy variable capturing the break in 1994 quarter four was incorporated in the error correction model, but proofed to be insignificant and is therefore omitted.

A series of unit root tests were performed to test for the presence of unit roots. Table 2.8, and 2.9 give the results of the Augmented Dickey-Fuller tests for non-stationarity for levels and first differences respectively.

Table 2.8: *Augmented Dickey-Fuller Tests for Non-stationarity, Levels 1991-2003*

Series	Model	Lags	$\delta_\delta, \delta_:, \delta$	McKinnon Critical Values 5%(1%)
$\ln\_CONSE$	Trend	1	-2.248[*]	-2.929(-3.585)
	Constant	1	-2.267	-3.514(-4.178)
	None	6	1.597	-1.948(-2.616)
$\ln\_INVES$	Trend	2	-2.106	-2.929(-3.585)
	Constant	2	-1.394	-3.514(-4.178)
	None	2	3.396	-1.948(-2.616)
$\ln\_GCOTH$	Trend	1	-1.388	-2.929(-3.585)
	Constant	1	0.570	-3.514(-4.178)
	None	2	2.100	-1.948(-2.616)
$\ln\_TIVAT/VATRR$	Trend	6	-14.601[**]	-2.929(-3.585)
	Constant	6	-4.069[*]	-3.514(-4.178)
	None	1	3.512	-1.948(-2.616)

[*]   Significant on a 5 percent level
[**]   Significant on a 1 percent level

From the tables 2.8 and 2.9 it follows that $\ln\_CONSE \sim$I(1), $\ln\_INVES \sim$I(1), and $\ln\_GCOTH \sim$I(1) on a five percent significance level.

Table 2.9: *Augmented Dickey-Fuller Tests for Non-stationarity, First Differences 1991-2003*

Series	Model	Lags	$\delta_\delta, \delta_:, \delta$	McKinnon Critical Values 5%(1%)
$\ln\_CONSE$	Trend	1	-4.709[**]	-3.514(-4.178)
	Constant	1	4.023[**]	-2.929(-3.585)
	None	4	-0.629	-1.948(-2.616)
$\ln\_INVES$	Trend	0	-4.202[**]	-3.514(-4.178)
	Constant	1	-4.103[**]	-2.929(-3.585)
	None	0	-2.187[*]	-1.948(-2.616)
$\ln\_GCOTH$	Trend	1	-3.269	-3.514(-4.178)
	Constant	1	-2.939[*]	-2.929(-3.585)
	None	1	-2.031[*]	-1.948(-2.616)
$\ln\_TIVAT/VATRR$	Trend	6	-4.718[**]	-3.514(-4.178)
	Constant	5	-4.166[**]	-2.929(-3.585)
	None	1	-2.960[**]	-1.948(-2.616)

[*]   Significant on a 5 percent level
[**]   Significant on a 1 percent level

Cointegration Equation

The following equation will be used as a priori.

$$\ln(TIVAT / vatrr) = f(\ln(CONSE), \ln(GCOTH), \ln(INVES))$$
$$\qquad\qquad + \qquad\qquad + \qquad -/+$$

It is expected that consumption expenditure (CONSE) will contribute positively to VAT collections, as an increase in consumption will increase VAT contributions and in turn VAT collections. Although the government is not a registered VAT vendor, the government is also a contributor to VAT as the government buys goods from VAT vendors. The government therefore is not excluded in total from the VAT base. It is therefore expected that an increase in government consumption will contribute positively to VAT collections via VAT vendors. Whether or not gross fixed capital formation INVES) will contribute positively or negatively to VAT collections is debatable. VAT payments on investment goods can be credited against VAT liability by registered VAT vendors. In this sense it is expected that an increase in gross fixed capital formation will lower VAT collections as a registered firm's VAT liability is reduced. However, it is also not clear how many investors are not registered as VAT vendors and will not be able to get a credit for VAT paid on gross fixed capital formation. These investors will increase the VAT base and contribute positively to VAT collection.

The long-run VAT collection equation:

$$\ln(TIVAT / vatrr) = c_1 \cdot \ln(CONSE) + c_2 \cdot \ln(GCOTH) + c_3 \cdot \ln(INVES) + c_4$$

The estimated equation exhibit cointegration at a 10 percent significance level under the constant, no trend, model (see table 2.11).

Table 2.10:   Estimation Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
(C_4)	-6.551442	0.004735	-1383.748	0.0000
LOG(CONSE) (C_1)	0.910711	0.002313	393.7641	0.0000
LOG(GCOTH) (C_2)	0.082639	0.000592	139.4927	0.0000
LOG(INVES) (C_3)	0.006292	0.001947	3.232041	0.0025
R-squared	0.999998	Durbin-Watson stat		0.512122
Adjusted R-squared	0.999998	F-statistic		5811371
S.E. of regression	0.000518	Prob(F-statistic)		0.000000

Table 2.11:   Augmented Dickey-Fuller Test Statistics on Testing for the Null

Hypothesis of No Cointegration

Model	Percent significance	McKinnon Critical Value (T=44)	ADF	Outcome
Constant No trend	1	-4.6355		No cointegration
	5	-3.9396	-3.661[4]	No cointegration
	10	-3.5951		Cointegration
Constant Plus trend	1	-5.1134		No cointegration
	5	-4.3994	-3.605	No cointegration
	10	-4.0457		No cointegration

Figure 2.10: Residual Plot

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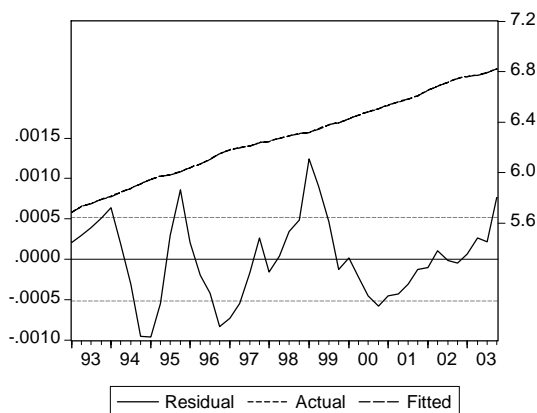
[4]   ADF-test statistics has to be less than the critical value in order for the null of no cointegration to be rejected in favor of stationary residuals and cointegration between the variables of the tested cointegration equation.

The Estimated Long-run Equation

$$\ln(TIVAT / vatrr) = 0.9107 \cdot \ln(CONSE) + 0.083 \cdot \ln(GCOTH) + 0.006 \cdot \ln(INVES) + c_4$$

In the long run, a one percent increase in consumption will lead to a 0.91 percent increase in VAT collections. The coefficient of ln(CONSE) is less than one as a one percent increase in consumption does not necessarily mean that VAT collections will increase to the same extend due to tax evasions and exclusions. A one percent increase in government consumption (GCOTH) will only increase VAT collections by 0.083 percent. The government is mostly excluded from VAT payments and it is therefore expected that government consumption is not a major contributor. Gross fixed capital formation (INVES) contributes positively to VAT receipts, as some firms might not be able to claim VAT inputs on investment due to non-registration. For example, firms earning below R300 000 per year are not allowed to register for VAT and therefore can also not claim VAT credits on inputs. A one percent increase in gross fixed capital formation only increase VAT collections by 0.006 percent.

The Error Correction Model

$$\Delta \ln(TIVAT / vatrr) = d_1 \cdot \Delta \ln(CE) + d_2 \cdot \Delta \ln(GCOTH) + d_3 resid(-1) + d_4$$

Therefore gross fixed capital formation (INVES) does not have a short-run impact on VAT tax collections. Short-run fluctuations in VAT collections depend on changes in consumption expenditure (CONSE) and government consumption (GCOTH). Consumption expenditure (CONSE) determines to a very large extent (both in the short- and long-run) how much VAT revenue is going to be collected. As imports are already included in consumption expenditure, it also plays a role.

Table: 2.12:   Estimation Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
d_4	0.000465	0.000149	3.128468	0.0033
RESVATI(-1) (d_3)	-0.003859	0.002123	-1.817661	0.0768
D_LN_CE (d_1)	0.904961	0.005155	175.5517	0.0000
D_LN_GCOTH (d_2)	0.078055	0.001260	61.95077	0.0000
R-squared	0.998916	Durbin-Watson stat		1.333906
Adjusted R-squared	0.998832	F-statistic		11975.92
S.E. of regression	0.000300	Probability (F-statistic)		0.000000
Breusch-Godfrey Serial Correlation LM Test[5]:				
F-statistic	1.853395	Probability		0.170960
Obs*R-squared	3.915611	Probability		0.141168

2.5.   Future Issues to Consider Within a VAT System

The government has used VAT as a revenue source now for more than 10 years. At this point in time it would also be valuable to look at issues arising within the VAT structure. Some of the issues that are investigated in the rest of this study are:

- The government lowered the direct tax rate for the last two budget years (2003 and 2002) as an expansionary measure. The alternative of lowering the statutory VAT rate needs to be investigated. The effect of a reduction in the VAT rate on welfare, and other economic variables need to be determined.

- VAT is mildly regressive, and zero-rating food may possibly reduce the regressiveness of VAT. The loss in revenue, due to the zero-rating of food, needs to be absorbed by alternative sources. The effect of zero-rating food and the use of alternative sources on welfare and tax efficiency, need to be investigated.

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[5]   The null hypothesis of no serial correlation up to order two cannot be rejected on a 10 percent level of significance.

- The possibility of applying zero-rating to labor-intensive industries with the aim to create jobs needs to be investigated as well. Again the loss in revenue needs to be absorbed by alternative sources. The effect of zero-rating labor-intensive industries and the use of alternative sources on employment, welfare and tax efficiency, needs to be investigated.

2.6.   Summary

VAT in South Africa is a consumption type tax as it is levied on final goods and services. Exports are zero-rated while imports are taxed. Various basic food items were exempt from VAT when VAT was initially introduced; the VAT system in South Africa also makes provision for the exemption of small firms: firms supplying goods below R300 000 per year are exempt from taxes. VAT is levied according to the invoice method whereby suppliers are allowed credit for VAT paid on inputs, if the suppliers can provide proof thereof.

VAT was introduced in South Africa in 1991 at a rate of 10 percent; in 1993 the statutory rate was increased to 14 percent. Since the inception of VAT various changes have been made to the VAT system. The changes aimed at reducing the regressiveness of VAT, as well as improving the tax administration system to ease the compliance burden of small firms.

VAT is an important revenue source for government. In 2001 VAT was the second largest revenue source for government after income tax, and it contributes 25 percent of total tax receipts. The government currently sees VAT as a dependable and broad-based revenue source.

Although the overall performance of VAT seems satisfactory, there are issues that need to be considered within the VAT system. These issues will be the focus of the rest of this study.

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McKinnon Critical Values for the ADF-statistic on testing for the null of no cointegration

N	Model	Percentage significance	θ_∞	θ_1	θ_2	Critical value T=44
1	Constant	1	-3.9001	-10.5340	-30.0300	-4.1550
	No trend	5	-3.3377	-5.9670	-8.9800	-3.4780
		10	-3.0462	-4.0690	-5.7300	-3.1416
1	Constant	1	-4.3266	-15.5310	-34.0300	-4.6972
	Plus trend	5	-3.7809	-9.4210	-15.0600	-4.0028
		10	-3.4959	-7.2030	-4.0100	-3.6617
2	Constant	1	-3.9001	-10.5340	-30.0300	-4.1550
	No trend	5	-3.3377	-5.9670	-8.9800	-3.4780
		10	-3.0462	-4.0690	-5.7300	-3.1416
2	Constant	1	-4.3266	-15.5310	-34.0300	-4.6972
	Plus trend	5	-3.7809	-9.4210	-15.0600	-4.0028
		10	-3.4959	-7.2030	-4.0100	-3.6617
3	Constant	1	-4.2981	-13.7900	-46.3700	-4.6355
	No trend	5	-3.7429	-8.3520	-13.4100	-3.9396
		10	-3.4518	-6.2410	-2.7900	-3.5951
3	Constant	1	-4.6676	-18.4920	-49.3500	-5.1134
	Plus trend	5	-4.1193	-12.0240	-13.1300	-4.3994
		10	-3.8344	-9.1880	-4.8500	-4.0457
4	Constant	1	-4.6493	-17.1880	-59.2000	-5.0705
	No trend	5	-4.1000	-10.7450	-21.5700	-4.3553
		10	-3.8110	-8.3170	-5.1900	-4.0027
4	Constant	1	-4.9695	-22.5040	-50.2200	-5.5069
	Plus trend	5	-4.4294	-14.5010	-19.5400	-4.7691
		10	-4.1474	-11.1650	-9.8800	-4.4063

Test Results for a Structural Break in GCOTH in 1994 Fourth Quarter

Chow Breakpoint Test: 1994:4			
F-statistic	67.02585	Probability	0.000000
Log likelihood ratio	64.70081	Probability	0.000000

The null hypothesis of no structural change can be rejected on a one percent significance level.

Chapter 3
THE MODEL

3.1.   Introduction

Löfgren et al (2001) developed a standard CGE model to be used for policy analysis by the International Food Policy Research Institute (IFPRI). IFPRI, the World Bank and other researchers extensively use this model to analyze a wide range of policy issues. The model follows the neoclassical-structuralist approach and specifically focuses on developing countries. The data requirement of this model is a disaggregated SAM, as well as a set of trade elasticities.   The model follows the SAM disaggregation of activities, commodities, factors, households and other institutions. The equations of the model simulate the actions of the institutions in this economy. The model is solved through a set of linear and non-linear equations using GAMS. Economical behavior is captured by parameters, some parameters are calibrated within the model, while the others are estimated using econometric techniques.   Production and consumption decisions are simulated through optimizing first-order conditions subject to a set of constraints. A set of equations, called the system constraints, balance the goods and factor markets as well as the macroeconomic aggregates savings-investment, the government and the current account from the rest of the world.

The discussion in this chapter is mainly from the paper published by Löfgren et al (2001) on the standardized model. The mathematical model is included in the appendix for readers interested in CGE modeling.

3.2.   Activities, Production and Factor Markets

Each producer, represented by an activity, assumes to maximize profits. Profits are defined as the difference between revenue, factor cost and intermediate inputs. The level

of activity, yields, and commodity prices at the producer level, in turn, defines revenue. Profits are maximized subject to a production function.

This model allows for a separation between production activities and commodities. The model permits any activity to produce multiple commodities and any commodity to be produced by multiple activities. Each activity produces one or more commodities (and any commodity may be produced by more than one activity) according to a fixed yield coefficient. A nested hierarchy is used to illustrate the production decisions. Figure 3.1 illustrates the different production decisions by the producer:

Figure 3.1:   Production Technology from (Löfgren et al, 2001)

```
                    ┌─────────────────────────┐
                    │    Commodity outputs     │
                    │  (fixed yield coefficient)│
                    └────────────┬────────────┘
                                 │
                    ┌────────────┴────────────┐
                    │     Activity level       │
                    │    (CES /Leontief)       │
                    │          (1)             │
                    └────────────┬────────────┘
              ┌──────────────────┴──────────────────┐
    ┌─────────────────┐                   ┌─────────────────┐
    │   Value added   │                   │   Intermediate  │
    │     (CES)       │                   │    (Leontief)   │
    │      (2)        │                   │       (3)       │
    └────────┬────────┘                   └────────┬────────┘
    ┌─────────────────┐                   ┌─────────────────┐
    │ Primary factors │                   │Composite commodities│
    │                 │                   │    Armington    │
    └─────────────────┘                   └────────┬────────┘
                                     ┌──────────────┴──────────────┐
                              ┌─────────────┐            ┌─────────────┐
                              │  Imported   │            │  Domestic   │
                              └─────────────┘            └─────────────┘
```
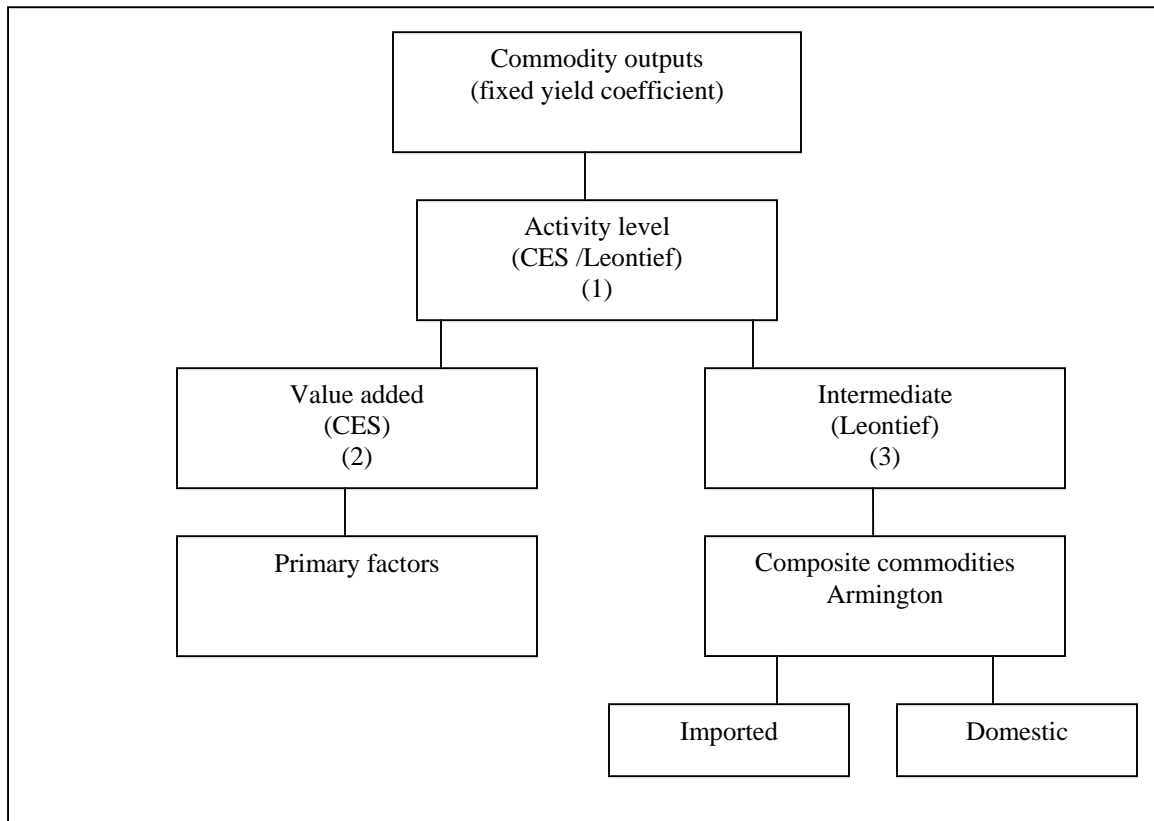
(1)   The producer must decide on the combination of intermediate inputs and factors to be used in the production process, according to their substitutability. This is known as the top-level activity function. Usually a Leontief function is applied to

this problem, but a CES function may also be used in identified sectors if there is sufficient evidence that suggests that the available techniques permit the aggregate mix between factors and intermediate inputs. For this application a Leontief function will be used for all the sectors. This is in line with a model constructed by Lewis (2001) for South Africa to look at the implications of HIV/Aids in South Africa.

(2)   The second decision involves the combination of factors to be used. Each activity uses a set of factors up to the point where the marginal revenue product of each factor is equal to its wage. Wages may differ across activities. The model also allows for wage distortions across activities due to exogenous causes, for example discrimination, status, and health.

(3)   The aggregate intermediate input decision is a Leontief function.

The modeler should choose appropriate factor market closures. The standard model provides three alternative factor market closures. The alternatives are discussed in the section on closures.

3.3.   Institutions

The institutions in this model include households, enterprises, the government, and the rest of the world. Households are disaggregated in terms of income, as it is important to be able to determine the welfare impact on the different income groups of a change in VAT. It is, however, questionable whether or not it is appropriate to disaggregate households on the basis of income when one is concerned with income distribution. This analysis wants to determine what the effect of a change in VAT on household income is, but by classifying households into income deciles defeats the purpose. Other possible classifications to consider are classification by gender, race, and location.

Households receive income from the factors of production as well as transfers from the other institutions. Transfers from the rest of the world are fixed in foreign currency. Households use their income to consume, save, pay direct taxes, and for transfers to other institutions. Enterprises' income is also generated from factors of production (mostly in the form of returns on capital) as well as transfers from other institutions. Enterprises pay direct taxes, save, and may also transfer income to other institutions. Enterprises transfer surpluses to households. Enterprises do not consume. The income of the government is mainly from taxes. Taxes are received from other institutions (direct tax) as well as from indirect taxes. The government uses its income for government consumption, subsidies (producers' and exports) and for transfers to other institutions. The government's expenditure exceeds its income resulting in a budget deficit (or negative savings). The foreign sector's transaction with this economy is in terms of imports and exports and transfers to and from the rest of the world. Foreign savings (or the current account deficit) is the difference between foreign currency spending and receipts.

A set of closures balances the government, savings and investment, and the rest of the world. Again the different alternatives will be discussed in the section on closures.

3.4. Commodity Markets

In this model all commodities enter the market. The producers' aim is to minimize the cost of supply subject to the substitutability between the different commodities. Figure 3.2 illustrates the decision of which commodities to produce:

(1)   The first decision is to decide on the commodity by choosing the relevant activity. A CES function is modeled as aggregation function. The demand for the output of each activity is modeled by minimizing the cost of supplying a given quantity of aggregate output subject to its CES function. Activity-specific commodity prices implicitly clear the market for each disaggregated commodity.

(2)   The second decision involves the allocation of domestic output between the domestic market and exports. Suppliers want to maximize sales revenue for any aggregated output level, subject to the imperfect transformability between exports and domestic sales. A CET function is modeled. The price received by domestic suppliers for exports is expressed in domestic currency and includes export taxes. The supply price for domestic sales is equal to the price paid by domestic demanders. Some commodities are not exported and total supply is passed to the domestic market. Domestic demand consists of household consumption, government consumption, investment, and intermediate inputs. Exports demands are infinitely elastic at given world prices.

Figure 3.2:   Commodity Flows from Adapted from (Löfgren et al, 2001)
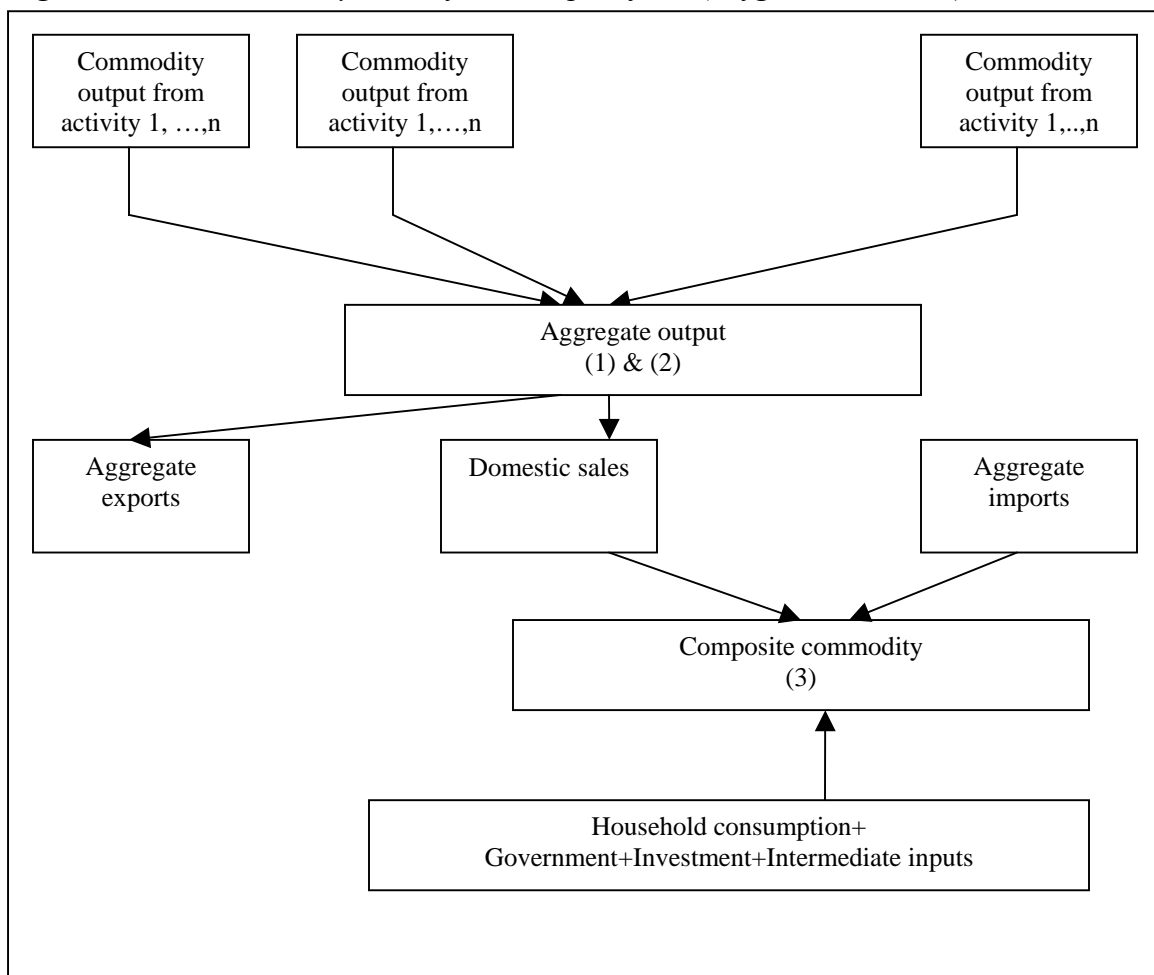
(3)   All demand is for a composite good made up from domestic supply and imports. This also is the third decision, whether to import, or consume domestic production. The assumption is that domestic demanders minimize cost subject to the imperfect substitutability between domestic supply and imports. This is known as the Armington (1969) function and is a CES type function. Where domestic supply is zero, total demand comes from imports and where imports are zero total demand is supplied by domestic production. International markets showing infinitely elastic supply at world prices demand imported commodities. The import prices paid includes import tariffs.

There is no assumption of perfect substitutability between exports and domestic supply or between imports and domestic supply in this model.   A set of elasticities of substitution specifies the substitutability of commodities.

3.5.   Closures

3.5.1   Factor Market

The standard CGE model provides different alternative closures for the factor market, savings-investment, the government and the rest of the world. The most applicable closure may then be used for this application.

Factor market closures used in this CGE model firstly assumes capital and high skilled labor are fully employed and activity specific. The model forces each activity to hire the base-year quantity of labor. In this case the quantity of factors demanded is fixed as well as the economy-wide wage. The activity-specific wage terms and the supply variable are flexible. This closure is preferred for short-run analysis, or/and when the quality of factors differs significantly over sectors. Therefore this closure assumes full employment and that the factors are activity-specific.

Secondly this CGE model assumes that semi-skilled and low-skilled labor is unemployed and mobile. This forces the model to take the quantity supplied of each factor as fixed. The economy-wide wage variable is then allowed to vary so that the quantity of factors demanded is equal to the quantity of factors supplied. Each activity pays an activity specific wage that is determined by the economy-wide wage and the (fixed) wage distortion variable. This closure therefore assumes unemployment with factor mobility.

The impact of these closures is that for capital and high-skilled labor total employment will not change. The only change here would be the activity specific rental price of capital and the wage of high skilled labor. Capital and high-skilled labor may therefore not move between activities. For semi- and unskilled labor, wages will remain constant as these factors experience high levels of unemployment. The only factor that would change for semi- and unskilled labor is employment. The wage rate of semi- and unskilled labor is fixed at real wage level. The real wage is included in the model as the initial wage level multiplied by the consumer price index relative to the initial CPI level.

3.5.2 Government

Different closures for the government are used for different simulations. The following closures are used:

(A)   The first closure assumes flexible government savings, with fixed direct tax rates. Government savings are treated as a residual. This closure is typically used when the government uses accommodating policy to finance, for example, zero-rating food.

(B)   The second closure assumes fixed government savings. Direct tax rates of domestic institutions are adjusted endogenously to generate a fixed level of government savings. The same number of percentage points adjusts the base-year tax rates of selected domestic non-government institutions endogenously. This closure is more progressive, as an increase of taxes with the same number of

percentage points will tax the already high taxpayers at a higher rate than low taxpayers.   This closure is typically used when government is using non-accommodating policy to finance, for example, zero-rating food. In this case an increase in direct taxes will be used to finance the cost of zero-rating food.

In all the closures government consumption is fixed either in real terms or as a share of nominal absorption.

An additional closure for the government balance was added. This closure allows the government deficit to remain fixed, while the statutory VAT rate change. The statutory VAT rate of either one commodity or all commodities can change, and this is the reason why the statutory VAT rate is defined over commodities.[1] This closure was used when food was zero-rated and the VAT on either business services or financial services was increased to eliminate the impact of the loss in VAT revenue. As the government closure used differs from simulation to simulation it will be discussed in more detail in Chapter 5, where the simulations are discussed.

3.5.3   Foreign Sector

The closure for the rest of the world assumes a flexible exchange rate with fixed foreign savings.   The adjustment rule follows from observations made by Davies and Van Seventer (2003) who noted that foreign savings as defined by the national accounts behaved relatively constant over the last 10 years.

3.5.4   Saving-Investment

The savings-driven investment closure is used for most of the simulations. All non-government savings are now fixed by fixing the marginal propensity to save for all non-government institutions. Capital formation (investment) is flexible. The quantity of each commodity in the investment bundle is multiplied by a flexible scalar. This will ensure

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[1]   This can be seen in Chapter 4.

that the investment cost is equal to the savings value. The level of savings determines investment. Nell, in a paper read by him (2002) found, in the long-run, exogeneity between saving and investment in South Africa; private savings were strongly exogenous to private investment in the period 1977 to 2001. This implies that the savings level will determine investment. (Nell,2002:26).

3.6.   Changes to the Standard IFPRI Model

The standardized model developed by Löfgren et al (2001) does not include more than one commodity tax, and for the purpose of this analysis it is necessary to do so as there are more than one category of commodity taxes in the South African tax system. The following commodity taxes are included:

Table 3.1:   Additional Commodity Taxes Included in the CGE Model

Commodity Tax Category	Description	Parameter in Model
VAT	Value Added Tax	$tvat(c)$
Fuel Levy	Government levy on fuel	$tfuel\ (c)$
Excise	Excise taxes on goods	$texcise(c)$
Net other commodity taxes	Other taxes on production, excluding subsidies	$tproducts(c)$

The standard CGE model also does not include a statutory VAT rate, but rather an actual (or effective) value-added tax rate. To do the simulation in this study it was necessary to include a statutory vat rate variable, as well as a suitable equation linking the statutory vat rate with the actual vat rate. The following equation was added to the model:

$$TVAT(C) = STATVAT(C) * leakage(c)$$

where

$TVAT(C)$ is the actual VAT rate

$STATVAT(C)$ is the statutory VAT rate

leakage(c)   is the ratio of the actual VAT rate to the statutory VAT rate

The VAT function in this model, however, does not model input and output taxes explicitly as it is not required for any of the simulations in this study. When the commodity is zero-rated the producers are still allowed to receive a credit for inputs, and VAT is still equivalent to a consumption tax (Gottfried and Wiegard,1990:2).

The complete model with all the adaptations for the South African specification is listed below in the Appendix.

3.7. Summary

The standard model developed by Löfgren et al (2001) will be used for the purpose of analyzing changes in the VAT structure on the South African economy. The standard model consists of a set of equations in the neoclassical-structuralist tradition. The activities, commodities, production factors, households and other institutions follow the SAM disaggregation. For this application the standard model is adapted to be representative of the South African economy. This is achieved by using a SAM as well as South African trade elasticities.

Appendix Chapter 3

APPENDIX CHAPTER 3

The Mathematical Model

Notational Principles

Endogenous variables	upper-case Latin letters without a bar
Exogenous variables	upper-case Latin letters with a bar
Parameters	lower-case Latin letters (with or without a bar) or
	lower-case Greek letters (with or without superscripts)
Set indices	lower-case Latin letters as subscripts to variables and
	parameters

Sets

A	Set of activities
ACES (contained in A)	Set of activities with a CES function at the top of the technology nest
C	Set of commodities
CD (contained in C)	Set of commodities with domestic sales of domestic output
CDN (contained in C)	Set of commodities without domestic market sales of domestic output (complement of CD)
CE (contained in C)	Set of exported commodities (with domestic production)
CEN (contained in C)	Set of non-exported commodities (complement of CE)
CM (contained in C)	Set of imported commodities
CMN (contained in C)	Set of non-imported commodities
CX (contained in C)	Set of commodities with domestic output
F	Set of factors
FLAB	Set of labor categories
H	Set of households
INS	Set of institutions (domestic and the rest of world)

INSD	Set of domestic institutions
INSDNG	Set of domestic non-government institutions

Parameters

α_a^a	efficiency parameter in the CES activity function
α_c^{ac}	shift parameter for domestic commodity aggregation function
α_c^q	CES function shift parameter
α_c^t	CET function shift parameter
α_a^{va}	efficiency parameter in the CES value-added function
β_{ch}^m	marginal share of consumption spending on marketed commodity c for household h
δ_a^a	CES activity function share parameter
δ_{ac}^{ac}	share parameter for domestic commodity aggregation function
δ_c^q	CES function share parameter
δ_c^t	CET function share parameter
δ_{fa}^{va}	CES value-added function share parameter for factor f in activity a
ρ_a^a	CES activity function exponent
ρ_c^{ac}	domestic commodity aggregation function exponent
ρ_c^q	CES function exponent
ρ_c^t	CET function exponent
ρ_a^{va}	CES value added function exponent
γ_{ch}^m	subsistence consumption of marketed commodity c for household h
γ_{ach}^h	subsistence consumption of home commodity c from activity a for household h
ϑ_{ac}	yield of output c per unit of activity a

$cwts_c$	weight of commodity c in the consumer price index
$dwts_c$	weight of commodity c in the producer price index
ica_{ca}	quantity of c per unit of aggregate intermediate input a
mps_i	base savings rate for domestic institutions i
$mps01_i$	0-1 parameter with 1 for institutions with potentially flexed direct tax rates
pwe_c	f.o.b export price in foreign currency units
pwm_c	c.i.f import price in foreign currency units
$qdst_c$	quantity of stock change
$\overline{qg_c}$	base-year quantity of government demand
$\overline{qinv_c}$	base-year quantity of fixed investment demand
$shif_{if}$	share for domestic institution i in income of factor f
$shii_{ii'}$	share of net income of i' to i ($i' \in INSDNG'$ and $i \in INSDNG$)
ta_a	tax rate for activity
te_c	export tax rate
tf_f	direct tax rate for factor f
$\overline{tins_i}$	exogenous direct tax rate for domestic institution I
$tins01_i$	0-1 parameter with 1 for institutions with potentially flexed direct tax rates
tm_c	import tariff rate
tq_c	rate of sales tax (as share of composite price inclusive of sales tax)
$trnsfr_{if}$	transfer from factor f to institution i
tva_a	rate of value-added tax for activity a

Variables

$DMPS$	change in domestic institution savings rates (=0 for base; exogenous variable)

DPI	producer price index for domestically marketed output
EG	government expenditures
EH_h	household consumption expenditure
EXR	exchange rate (local currency unit per foreign currency unit)
$GSAV$	government savings
$MPS_{i'}$	marginal propensity to save for domestic non-government institutions (exogenous variable)
PA_a	activity price (gross revenue per activity unit)
PDD_c	demand price for commodities produced and sold domestically
PDS_c	supply price for commodities produced and sold domestically
PE_c	export price in local currency units
$PINTA_a$	aggregate intermediate input price for activity a
PM_c	import price in local currency units
PQ_c	composite commodity price (market price)
PVA_a	price of (aggregate) value-added
PX_c	aggregate producer price for commodity
$PXAC_{ac}$	producer price of commodity c for activity a
QA_a	quantity (level) of activity
QD_c	quantity sold domestically of domestic output
QE_c	quantity of exports
QF_{fa}	quantity demanded of factor f for activity a
QG_c	government consumption demand for commodity c
QH_{ch}	quantity of consumption of marketed commodity c for household h
$QINT_{ca}$	quantity of commodity c as intermediate input to activity a
$QINTA_a$	quantity of aggregate intermediate input
$QINV_c$	quantity of fixed investment demand for commodity c
QM_c	quantity of imports of commodity
QQ_c	quantity of goods supplied to domestic market (composite supply)

QVA_a	quantity of (aggregate) value-added
QX_c	aggregate quantity of domestic output of commodity
$QXAC_{ac}$	marketed output quantity of commodity c from activity a
$TINS_i$	rate of direct tax on domestic institutions i
$TABS$	total nominal absorption
$TRII_{ii'}$	transfers from institution i' to i (both in the set $INSDNG$)
WF_f	average factor price
YG	government revenue
YI_i	income of institution i (in the set $INSDNG$)
YIF_{if}	income to domestic institution from factor f

Exogenous Variables

$\overline{CPI}$	consumer price index (exogenous variable)
$\overline{DTINS}$	change in domestic institution tax share (=0 for base; exogenous variable)
$\overline{FSAV}$	foreign savings in foreign currency unit (exogenous variable)
$\overline{GADJ}$	government consumption adjustment factor (exogenous variable)
$\overline{IADJ}$	investment adjustment factor (exogenous variable)
$\overline{MPSADJ}$	savings rate scaling factor (=0 for base)
$\overline{QFS_f}$	quantity supplied of factor f (exogenous variable)
$\overline{TINSADJ}$	direct tax scaling factor (=0 for base; exogenous variable)
$\overline{WFDIST_{fa}}$	wage distortion factor for factor f in activity a (exogenous variable)

The Model

The model specification is according to Löfgren et al (2001). The adjustments for South Africa incorporated into the Löfgren et al (2001) model is also shown. The model allows

for three types of commodities, namely domestic goods consumed domestically, imports and exports. Some prices are determined outside the model, the rest of the prices are determined within the model.

1. Price Block

Import Price

$$PM_c = pwm_c \cdot (1 + tm_c) \cdot EXR \qquad\qquad c \in CM \qquad\qquad\qquad \text{---}\textbf{1.1}$$

where

$c \in C$ set of commodities (also referred to as *c'* and *C'*)

$c \in CM(\subset C)$ set of imported commodities

$c \in CT(\subset C)$ set of domestic trade inputs (distribution commodities)

> The import price is the price paid by domestic users for imported commodities exclusive of sales tax. The import price is expressed in the local currency unit (rand). The import price equation states that import price is equal to the world price of imports converted to domestic currency by multiplying with the exchange rate inclusive of import tariffs.

Export Price

$$PE_c = pwe_c \cdot (1 - te_c) \cdot EXR \qquad\qquad\qquad c \in CE \qquad\qquad \text{---}\textbf{1.2}$$

where

$c \in CE(\subset C)$ set of exported commodities (with domestic production)

> The export price is the price received by domestic producers when they sell their output on world markets. The export price is also expressed in domestic currency (rand).

Export price is equal to the world export price converted to the domestic currency by multiplying with the exchange rate exclusive of export subsidies.

Demand Price of Domestic Non-Traded Goods

$$PDD_c = PDS_c \hspace{3cm} c \in CD \hspace{3cm} \textbf{---1.3}$$

where

$c \in CD(\subset C)$ set of commodities with domestic sales of domestic output

The price received by demanders and suppliers for domestic non-traded goods are equal. This is a deviation from the standard model. The standard model models transaction cost explicitly. In this application transaction costs are already included in the supply and use tables as intermediate inputs where required, and it is therefore not necessary to include transaction cost explicitly.

Absorption

$$PQ_c \cdot (1 - tq_c) \cdot QQ_c = PDD_c \cdot QD_c + PM_c \cdot QM_c \hspace{1cm} c \in (CD \bigcup CM) \hspace{1cm} \textbf{---1.4}$$

where

$$tq_c = leakage_c * STATVAT_c + tfeul_c + texcise_c + tproducts_c$$

Absorption (on the left-hand side) is the total domestic spending on a commodity at the domestic demander price, which in this model, will equal the domestic supplier prices, exclusive of sales tax. Absorption (on the right-hand side) is the sum of the value of domestic output and imports.

Marketed Output Value

$$PX_c \cdot QX_c = PDS_c \cdot QD_c + PE_c \cdot QE_c \qquad\qquad c \in CX \qquad\qquad \text{---}\textit{1.5}$$

where

$$c \in CX(\subset C) \qquad\qquad \text{set of commodities with domestic output}$$

The marketed output value is the sum of the value of domestic output sold domestically and the value of exports.

Activity Price

$$PA_c = \sum_{c \in C} PXAC_{ac} \cdot \vartheta_{ac} \qquad\qquad a \in A \qquad\qquad \text{---}\textit{1.6}$$

where

$$a \in A \qquad\qquad \text{set of activities}$$

The activity price is the revenue per activity unit and is the return from selling the output of the activity. The activity price is calculated by multiplying the yields per activity of output by the activity-specific commodity prices. This is then summed over all commodities because one activity might produce more than one commodity.

Aggregate Intermediate Input Price

$$PINTA_a = \sum_{c \in C} PQ_c \cdot ica_{ca} \qquad\qquad a \in A \qquad\qquad ---1.7$$

The aggregate intermediate input price is the cost of the disaggregated intermediate inputs per unit of aggregate intermediate input. The aggregate intermediate input price is activity-specific and is the sum of the value of the quantity of a commodity per unit of the aggregate intermediate input. The quantity of the commodity per unit of the aggregate intermediate input is known as the intermediate input coefficient.

Activity Revenue and Costs

$$PA_a \cdot (1 - ta_a) \cdot QA_a = PVA_a \cdot QVA_a + PINTA_a \cdot QINTA_a \qquad a \in A \qquad ---1.8$$

The value of activity revenue (net of activity taxes) is equal to the payments for value-added and intermediate inputs.

Consumer Price Index

$$\overline{CPI} = \sum_{c \in C} PQ_c \cdot cwts_c \qquad\qquad ---1.9$$

Consumer prices change. The DPI functions as the numéraire.

Producer Price Index for Non-Traded Market Output

$$DPI = \sum_{c \in C} PDS_c \cdot dwts_c \qquad\qquad ---1.10$$

The producer price index is fixed and functions as a numéraire in the model. This specification makes the model homogeneous to the degree zero. Price changes are then relative to the numéraire.

2. PRODUCTION AND TRADE BLOCK

CES technology: Activity Production Function

$$QA_a = \alpha_a^a \cdot (\delta_a^a \cdot QVA_a^{-\rho_a^a} + (1 - \delta_a^a) \cdot QINTA_a^{-\rho_a^a})^{-\frac{1}{\rho_a^a}} \qquad a \in ACES \qquad \text{---}\textit{2.1}$$

where

$a \in ACES(\subset A)$ set of activities with a CES function at the top of the technology nest

Production is carried out by activities that are assumed to maximize profits subject to the technology available. This equation states that the top level activity production function is a function of value-added and intermediate inputs. The function exponent, ρ , is a transformation of the elasticity of substitution between value-added and aggregate intermediate input.

CES technology: Value-Added Intermediate-Input Ratio

$$\frac{QVA_a}{QINTA_a} = (\frac{PINTA_a}{PVA_a} \cdot \frac{\delta_a^a}{1 - \delta_a^a})^{\frac{1}{1+\rho_a^a}} \qquad a \in ACES \qquad \text{---}\textit{2.2}$$

The optimal mix of intermediate inputs and value-added is a function of the relative prices of intermediate inputs and value-added.

Value-Added and Factor Demands

$$QVA_a = \alpha_a^{va} \cdot \left(\sum_{f \in F} \delta_{fa}^{va} \cdot QF_{fa}^{-\rho_a^{va}} \right)^{-\frac{1}{\rho_a^{va}}} \qquad\qquad a \in A$$

$$f \in F \qquad\qquad ---2.3$$

where

$f \in F$ set of factors (also referred to as *F'*)

> The quantity of value-added is a CES function of disaggregated factor quantities. The function ρ is a transformation of the elasticity of factor substitution.

Factor Demand

$$WF_f \cdot \overline{WFDIST_{fa}} = PVA_a \cdot (1 - tva_a) \cdot QVA_a \cdot \left(\sum_{f \in F'} \delta_{fa}^{va} \cdot QF_{fa}^{-\rho_a^{va}} \right)^{-1} \cdot \delta_{fa}^{va} \cdot QF_{fa}^{-\rho_a^{va}-1}$$

$$a \in A$$
$$f \in F \qquad\qquad ---2.4$$

> Activities demand factors at the point where the marginal cost of each factor is equal to the marginal revenue product of the factor. The marginal cost is defined on the left-hand side as the activity-specific factor price. The marginal revenue product is defined on the right-hand side net of intermediate input cost. The average factor price is an endogenous variable, while the wage-distortion variables are exogenous.

Disaggregated Intermediate Input Demand

$$QINT_{ca} = ica_{ca} \cdot QINTA_a \qquad\qquad a \in A$$

$$c \in C \qquad\qquad ---2.5$$

For each activity, the demand for disaggregated intermediate inputs is determined via a standard Leontief type function. The demand for disaggregated intermediate inputs is equal to the level of intermediate input use multiplied with a fixed intermediate input coefficient.

Commodity Production and Allocation

$$QXAC_{ac} = \vartheta_{ac} \cdot QA_a$$

$$a \in A$$
$$c \in CX$$
$$h \in H \qquad \qquad \textbf{---2.6}$$

where

$$h \in H \qquad \qquad \text{set of households}$$

On the right-hand side, production quantities are defined as yields multiplied by the activity levels. On the left-hand side, the quantities are allocated to market sales.

Output Aggregation Function

$$QX_c = \alpha_c^{ac} (\sum_{a \in A} \delta_{ac}^{ac} \cdot QXAC_{ac}^{-\rho_c^{ac}})^{-\frac{1}{\rho_c^{ac}-1}} \qquad \qquad c \in CX \qquad \qquad \textbf{---2.7}$$

Aggregated production of any commodity is defined as a CES aggregate of the different activities producing the commodity. The function exponent ρ specifies the degree of substitutability between different products. The values of ρ must be specified to ensure that the isoquant is convex to the origin, and therefore exhibits a diminishing technical rate of substitution.

First-Order Condition for Output Aggregation Function

$$PXAC_{ac} = PX_c \cdot QX_c (\sum_{a \in A'} \delta_{ac}^{ac} \cdot QXAC_{ac}^{-\rho_c^{ac}})^{-1} \cdot \delta_{ac}^{ac} \cdot QXAC_{ac}^{-\rho_c^{ac}-1}$$

$$a \in A$$
$$c \in CX \qquad \text{---}\textbf{2.8}$$

This equation is derived from maximizing aggregate output QX at the price PX, subject to the aggregation function and the disaggregated commodity prices PXAC. The optimal quantity of the commodity is inversely related to the activity-specific price: a decline in the price of PXAC of one activity relative to the others would shift demand in that direction. The output QX is sold at a price PX and is produced with inputs QXAC at prices PXAC.

Output Transformation (CET) Function

$$QX_c = \alpha_c^t \cdot (\delta_c^t \cdot QE_c^{\rho_c^t} + (1 - \delta_c^t) \cdot QD_c^{\rho_c^t})^{\frac{1}{\rho_c^t}} \qquad c \in (CE \cap CD) \qquad \text{---}\textbf{2.9}$$

Domestic production is allocated to two destinations, namely domestic sales and exports. The CET function is determined by both exports and domestic sales. The CET function is identical to a CES function except for negative elasticities of substitution. The exponent ρ is a transformation of the elasticity of substitution between exports and domestic sales. This reflects the assumption of imperfect substitution between the two destinations. The value of ρ is determined to specify an isoquant that is concave to the origin.

Export-Domestic Supply Ratio

$$\frac{QE_c}{QD_c} = \left(\frac{PE_c}{PDS_c} \cdot \frac{1 - \delta_c^t}{\delta_c^t} \right)^{\frac{1}{\rho_c^t - 1}} \qquad c \in (CE \cap CD) \qquad \text{---}\textbf{2.10}$$

This equation is determined by maximizing producer revenues subject to the CET function and a fixed quantity of output. This equation then defines the optimal mix of exports and domestic sales. The exports-domestic price ratio will determine the export-domestic demand ratio.

Output Transformation for Domestically Sold Outputs without Exports and for Exports without Domestic Sales

$$QX_c = QD_c + QE_c \qquad\qquad c \in (CD \cap CEN) \cup (CE \cap CDN) \qquad \text{---}2.11$$

where

$c \in CEN (\subset C)$ non-exported commodities

$c \in CDN (\subset C)$ commodities without domestic market sales of domestic output

This function replaces the CET function for produced commodities that are either sold domestically or exported, but not both. This function allocates the entire volume of output to either exports or domestic sales.

Composite Supply (Armington) Function

$$QQ_c = \alpha_c^q \cdot (\delta_c^q \cdot QM_c^{-\rho_c^q} + (1 - \delta_c^q) \cdot QD_c^{-\rho_c^q})^{-\frac{1}{\rho_c^q}} \qquad\qquad c \in (CE \cap CD) \qquad \text{---}2.12$$

This function is called the Armington function and is a CES function. This function specifies the composite supply as a function of imports and domestic supply. Imperfect substitutability between imports and domestic supply is assumed. The elasticity of substitution is specified by ρ .

Import-Domestic Demand Ratio

$$\frac{QM_c}{QD_c} = \left(\frac{PDD_c}{PM_c} \cdot \frac{\delta_c^q}{1 - \delta_c^q} \right)^{\frac{1}{1 + \rho_c^q}} \qquad\qquad c \in (CM \cap CD) \qquad ---\mathbf{2.13}$$

This equation is obtained by minimizing cost subject to the CES function and a fixed quantity of composite supply. This is the optimal mix between imports and domestic supply. The domestic-import price ratio determines the import-domestic demand ratio. The elasticity of substitution is specified by ρ .

Composite Supply for Non-Imported Outputs and Non-produced Imports

$$QQ_c = QD_c + QM_c \qquad\qquad c \in [(CD \cap CMN) \cup (CM \cap CDN)] \qquad ---\mathbf{2.14}$$

where

$c \in CMN (\subset C)$ set of non-imported commodities

This function replaces the Armington function for commodities that are either imported or produced domestically, but not both.

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3.   Institution Block

Factor Income

$$YF_f = \sum_{a \in A} WF_f \cdot \overline{WFDIST_{fa}} \cdot QF_{fa} \qquad\qquad f \in F \qquad ---\mathbf{3.1}$$

where

YF_f income of factor f

This equation defines the total income of each factor and is equal to the sum of activity payments. Activity payments, in turn, are equal to activity-specific wages multiplied with employment levels.

Institutional Factor Incomes

$$YIF_{if} = shif_{if} \cdot [(1 - tf_f) \cdot YF_f - trnsfr_{rowf} \cdot EXR] \qquad\qquad i \in INSD$$

$$f \in F \qquad\qquad \text{---}\textbf{\textit{3.2}}$$

where

$i \in INS$ set of institutions (domestic and rest of world)

$i \in INSD(\subset INS)$ set of domestic institutions

Total factor income is divided between domestic institutions in fixed shares after payment of direct factor taxes and transfers to the rest of the world. Transfers are converted to domestic currency by multiplying with the exchange rate.

Income of Domestic, Non-Government Institutions

$$YI_i = \sum_{f \in F} YIF_{if} + \sum_{i' \in INSDNG'} TRII_{ii'} + trnsfr_{igov} \cdot \overline{CPI} + trnsfr_{irow} \cdot EXR \qquad i \in INSDNG \quad \text{---}\textbf{\textit{3.3}}$$

where

$i \in INSDNG(\subset INSD)$ set of domestic non-government institutions (also *INSDNG'*)

The total income of domestic non-government institutions is equal to factor incomes, transfers from other institutions, which include other domestic non-government

institutions, the government and the rest of the world. Transfers from the rest of the world are converted to domestic currency by multiplying with the exchange rate.

Intra-Institutional Transfers

$$TRII_{ii'} = shii_{ii'} \cdot (1 - MPS_{i'}) \cdot (1 - TINS_{i'}) \cdot YI_{i'} \qquad i \in INSDNG$$

$$i' \in INSDNG' \qquad ---\mathbf{3.4}$$

Transfers between domestic non-government institutions are paid as fixed shares of the total institutional income net of direct taxes and savings.

Household Consumption Expenditures

$$EH_h = (1 - \sum_{i \in INSDNG} shii_{ih}) \cdot (1 - MPS_h) \cdot (1 - TINS_h) \cdot YI_h \qquad h \in H \qquad ---\mathbf{3.5}$$

where

$$h \in H(\subset INSDNG) \qquad \text{set of households}$$

The total value of consumption spending by households is equal to the income net of taxes, savings and transfers to other domestic non-government institutions. Households are the only institution among domestic non-government institutions that consumes commodities.

Household Consumption Spending on Marketed Commodities

$$PQ_c \cdot QH_{ch} = PQ_c \cdot \gamma_{ch}^m + \beta_{ch}^m \cdot \left(EH_h - \sum_{c' \in C} PQ_{c'} \cdot \gamma_{c'h}^m - \sum_{a \in A} \sum_{c' \in C} PXAC_{ac'} \cdot \gamma_{ac'h}^h \right)$$

$$c \in C$$

$$h \in H \qquad ---\mathbf{3.6}$$

This equation is determined by maximizing a utility function subject to a consumption expenditure constraint. This function is a LES function since spending on a commodity is a linear function of total consumption spending.

Investment Demand

$$QINV_c = \overline{IADJ} \cdot \overline{qinv_c} \qquad\qquad c \in C \qquad\qquad \text{---}\textbf{3.7}$$

Fixed-investment demand is defined as the base-year quantity multiplied by an adjustment factor. The adjustment factor is exogenous, and therefore also makes the investment quantity exogenous.

Government Consumption Demand

$$QG_c = \overline{GADJ} \cdot \overline{qg_c} \qquad\qquad c \in C \qquad\qquad \text{---}\textbf{3.8}$$

Government consumption demand is defined as the base-year quantity multiplied by an adjustment factor. This factor is also exogenous and therefore the quantity of government consumption is fixed.

Government Revenue

$$YG = \sum_{i \in INSDNG} TINS_i \cdot YI_i + \sum_{f \in F} tf_f \cdot YF_f + \sum_{a \in A} tva_a \cdot PVA_a \cdot QVA_a$$

$$+ \sum_{a \in A} PA_a \cdot QA_a + \sum_{c \in CM} tm_c \cdot pwm_c \cdot QM_c \cdot EXR + \sum_{c \in CE} te_c \cdot pwe_c \cdot QE_c \cdot EXR$$

$$+ \sum_{c \in C} tq_c \cdot PQ_c \cdot QQ_c + \sum_{f \in F} YF_{govf} + trnsfr_{govrow} \cdot EXR \qquad\qquad \text{---}\textbf{3.9}$$

where

$$tq_c = leakage_c * STATVAT_c + tfeul_c + texcise_c + tproducts_c$$

Total government revenue is the sum of revenues from taxes, factors and transfers from the rest of the world. Taxes include direct taxes from institutions, taxes on commodities, taxes on activities, import tariffs, but less exports subsidies. Taxes on commodities include VAT, fuel levies, excise duties and other taxes on products. Transfers are again converted to domestic currency by multiplying by the exchange rate.

Government Expenditures

$$EG = \sum_{c \in C} PQ_c \cdot QG_c + \sum_{i \in INSDNG} trnsfr_{igov} \cdot \overline{CPI} \qquad\qquad c \in C \qquad\qquad ---\mathbf{3.10}$$

Government spending is the sum of government spending on consumption goods and transfers.

4. SYSTEM CONSTRAINTS BLOCK

Factor Markets

$$\sum_{a \in A} QF_{fa} = \overline{QFS_f} \qquad\qquad\qquad f \in F \qquad\qquad ---\mathbf{4.1}$$

This equation equates the total factor quantity demanded and the total quantity supplied for each factor.

Composite Commodity Markets

$$QQ_c = \sum_{a \in A} QINT_{ca} + \sum_{h \in H} QH_{ch} + QG_c + QINV_c + qdst_c \qquad\qquad c \in C \qquad\qquad ---\mathbf{4.2}$$

This equation equates the quantity supplied and demanded of the composite commodity. The demand side includes demand for intermediate goods, household consumption demand, government consumption, investment, and stock changes. Government consumption, investment demand and stock changes are determined exogenously. Composite supply determines the demand for domestic sales and imports.

Current Account Balance for Rest of World (in Foreign Currency)

$$\sum_{c \in CM} pwm_c \cdot QM_c + \sum_{f \in F} trnsfr_{rowf} = \sum_{c \in CE} pwe_c \cdot QE_c + \sum_{i \in INSD} trnsfr_{irow} + \overline{FSAV} \qquad \text{---}\textbf{4.3}$$

The balance on the current account equates the spending and earning of foreign exchange. Two basic market-clearing closures may be used for the rest of the world. Foreign savings may be fixed, while the exchange rate equilibrates the current account. Alternatively, the exchange rate may be fixed while foreign savings fluctuate to determine equilibrium. This application will model a flexible exchange rate, with fixed foreign savings.

Government Balance

$$YG = EG + GSAV \qquad \text{---}\textbf{4.4}$$

The government sets current government revenue equal to the sum of current government expenditures and savings. Government investment is excluded from this balance.

Direct Institutional Tax Rates

$$TINS_i = \overline{tins_i} \cdot (1 + \overline{TINSADJ} \cdot tins01_i) + \overline{DTINS} \cdot tins01_i \qquad i \in INSDNG \qquad \text{---}\textbf{4.5}$$

This equation defines the direct tax rate of domestic non-government institutions. Three alternative closure rules may be modeled. The first closure models all variables on the

right-hand side as exogenous variables. Government savings is the endogenous variable that clears the government balance. The second closure fixes government savings. DTINS is now the flexible variable that clears the government balance by scaling the base-year tax rates of each tax-paying institution. Rates will change by a uniform number of percentage points for all tax-paying institutions. The third closure also fixes government savings. TINSADJ is now the flexible variable. Rates will now change by adding a uniform number of percentage points to the base-year tax rate for all taxpaying institutions. This will, however result in relatively large increases in the tax rate for relatively large base-year rates.

Institutional Savings Rates

$$MPS_i = \overline{mps_i} \cdot (1 + \overline{MPSADJ} \cdot mps01_i) + \overline{DMPS} \cdot mps01_i \qquad i \in INSDNG \qquad \text{---}4.6$$

The closure rule for the savings-investment balance will determine whether the right-hand side is considered fixed or whether either MPSAJD or DMPS are fixed. Fixing the right-hand side will in effect fix savings. Investment will adjust to equate the savings-investment balance.

Savings-Investment Balance

$$\sum_{i \in INSDNG} MPS_i \cdot (1 - TINS_i) \cdot YI_i + GSAV + EXR \cdot \overline{FSAV} = \sum_{c \in C} PQ_c \cdot QINV_c + \sum_{c \in C} PQ_c \cdot qdst_c$$

$$\text{---}4.7$$

This equation states that total savings and total investment have to be equal. Total savings consists of savings by domestic non-government institutions, government savings and foreign savings. Foreign savings is converted to domestic currency by multiplying with the exchange rate. Total investment is the sum of the value of investment demand and stock changes. Closures may be either investment-driven or savings-driven. A

variable called Walras is added to the savings-investment. The value of this variable should be equal to zero. If it is not equal to zero, one or more equations are not satisfied and a general equilibrium solution has not been found.

Total Absorption

$$TABS = \sum_{h \in H} \sum_{c \in C} PQ_c \cdot QH_{ch} + \sum_{a \in A} \sum_{c \in C} \sum_{h \in H} PXAC_{ac} \cdot QHA_{ach}$$

$$+ \sum_{c \in C} PQ_c \cdot QG_c + \sum_{c \in C} PQ_c \cdot QINV_c + \sum_{c \in C} PQ_c \cdot qdst_c \qquad\qquad ---\textbf{4.8}$$

Total absorption is the total value of domestic final demand. This will equal GDP at market prices plus imports minus exports.

Ratio of Investment to Absorption

$$INVSHR \cdot TABS = \sum_{c \in C} PQ_c \cdot QINV_c + \sum_{c \in C} PQ_c \cdot qdst_c \qquad\qquad ---\textbf{4.9}$$

The right-hand side is the total investment value. Total investment value is calculated as a share in nominal absorption multiplied with total absorption. Total investment, in turn, is equal to the value of investment demand and the value of changes in stock.

Ratio of Government Consumption to Absorption

$$GOVSHR \cdot TABS = \sum_{c \in C} PQ_c \cdot QG_c \qquad\qquad ---\textbf{4.10}$$

The right-hand side is the value of government consumption. The value of government consumption is calculated as a share in nominal absorption multiplied with total absorption.

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.

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4.2.   Definition

A SAM is another method of stating the circular flow in an economy. The circular flow results from commodities produced through activities[1] 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

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[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 tables[2] 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).

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[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								
		Activities	Commodities	Factors	Enterprises	Households	Government	Savings-Investment	Rest of World	TOTAL
R E C E I P T S	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 governmentFactor 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

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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 dissagregated 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

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[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:**
	media	29	Other transport equipment	44	Administration
14	Coke & refined petroleum	30	Furniture	45	Defense
	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
	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)
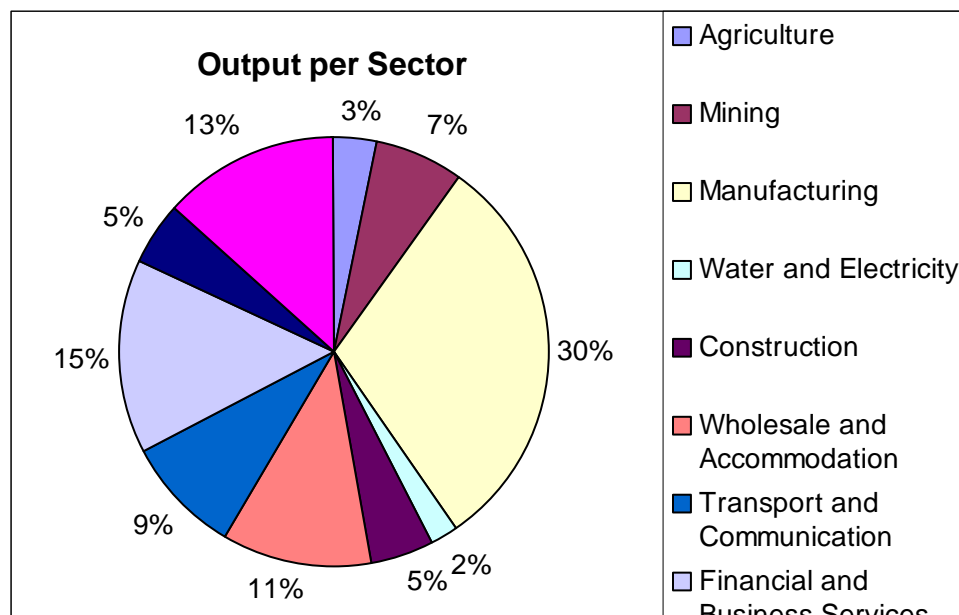
The manufacturing sector contributes 30 percent to total output, followed by the financial and business sector with 15 percent. The government is the third largest producer and contributes 13 percent. The wholesale and retail sector (including catering and accommodation) contributes 13 percent to total 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 – 1st decile
2	d1	10% of population – 2nd decile
3	d2	10% of population – 3rd decile
4	d3	10% of population – 4th decile
5	d4	10% of population – 5th decile
6	d5	10% of population – 6th decile
7	d6	10% of population – 7th decile
8	d7	10% of population – 8th decile
8	d8	10% of population – 9th decile
10	d91	5% of population – 10th decile
11	d921	1,25% of population – 10th decile
12	d922	1,25% of population – 10th decile
13	d923	1,25% of population – 10th decile
14	d924	1,25% of population – 10th decile

In South Africa the distribution of income is highly inequal. 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)
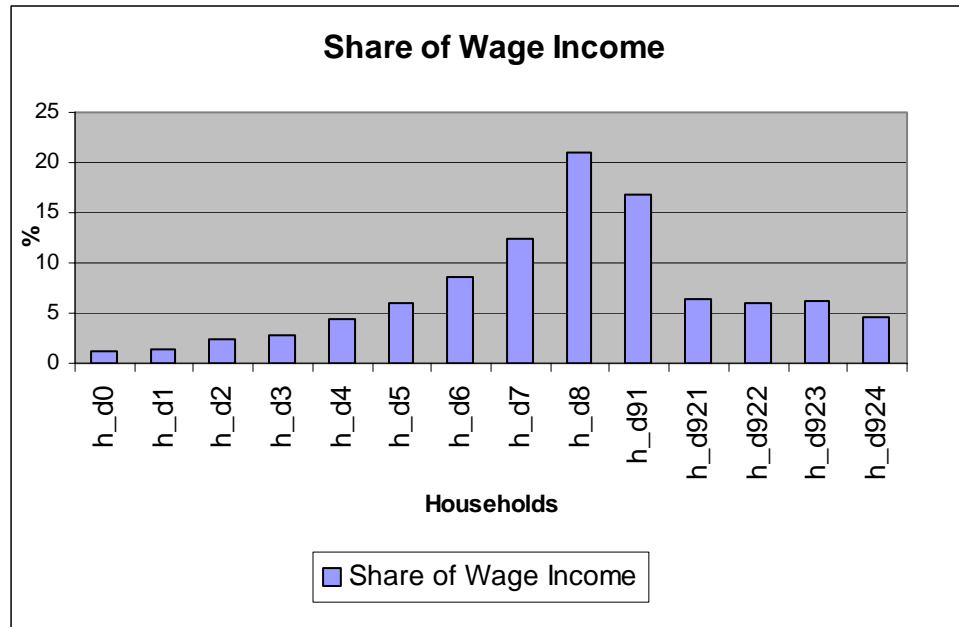
Enterprises

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)
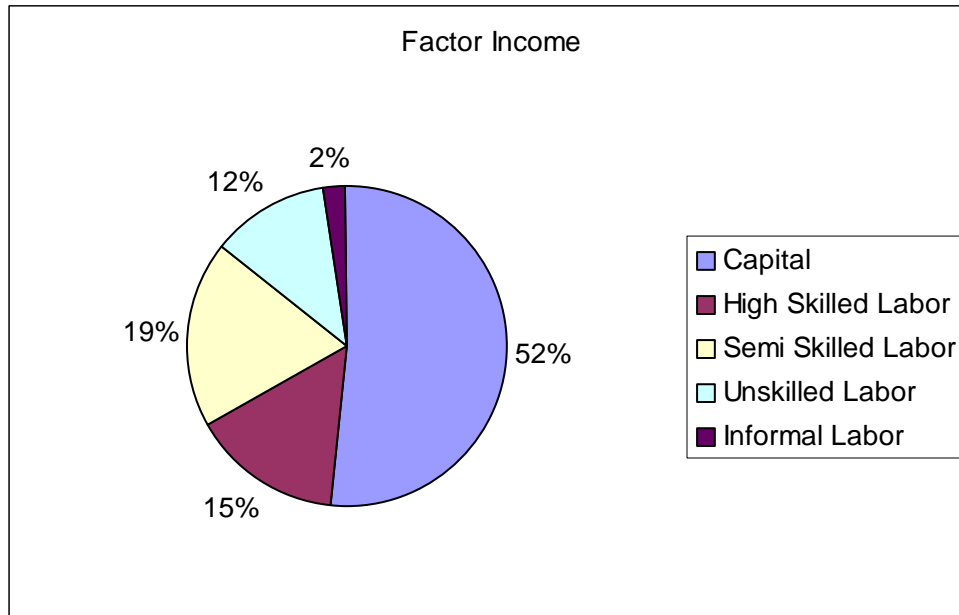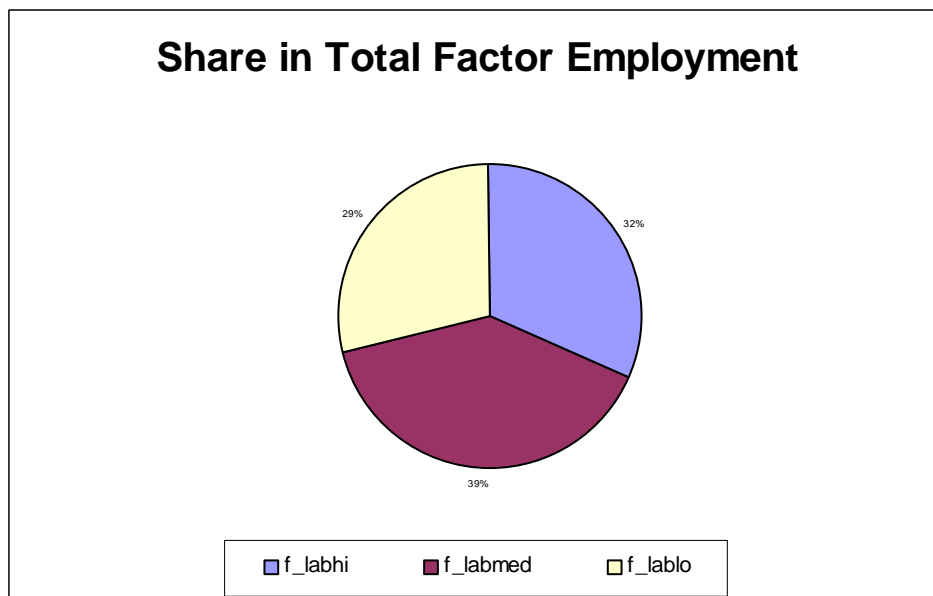

The total wage for labor is almost equally divided between high-, semi and unskilled labor. This should be considered against the number of people in each labor category. 3,754 million people were employed. From this total number 46 percent were semi skilled workers, 22 percent unskilled workers, 19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

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

Chapter 5

**RESTRUCTURING VALUE-ADDED TAX**

5.1. Introduction

There are various possible arguments for restructuring VAT. Firstly, the South African government's strategy GEAR, aims at creating growth, employment and redistribution. Lowering taxes may be used as a tool to achieve the set goals. For example, during the 2002 and 2003 budgets the government has lowered direct income taxes with the aim to generate growth, and also to redistribute. Redistribution was achieved by giving the largest portion of the tax relief to low- and middle-income groups. (RSA,2002a:16 and RSA,2003:16). Redistribution may also be achieved by restructuring VAT to lower the tax burden of the poor.

Secondly, in a report on poverty published by Statistics South Africa in 2000, it is stated that 48.8 percent of South Africans spend less than R250 per month - the per capita poverty line (Statistics South Africa,2000:2). Low-income households consume the largest portion of their income, food being the largest consumption expenditure item. As indicated by Figure 5.1 poor households spend approximately 20 percent of their income on food. As income increases the percentage spent on food decreases, with the highest income group only spending approximately three percent of their income on food.

Zero-rating food may possibly reduce poverty and also inequality in South Africa by reducing the regressiveness of Value Added Tax (VAT): because poor households spend a larger proportion of their income, they also spend a larger proportion of their income on VAT.

Figure 5.1:   The Portion of Income Spent on Food per Household Deciles 1998
from (SA SAM,2003)
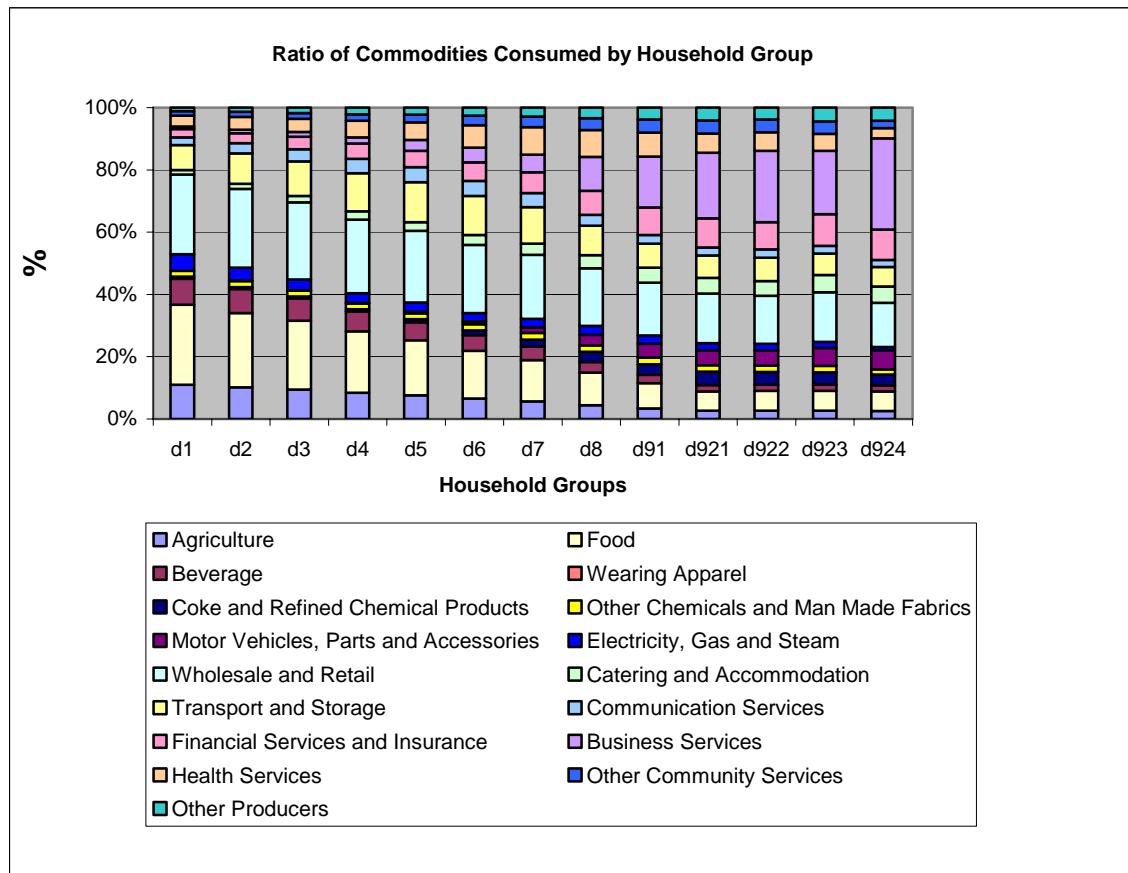
Thirdly, zero-rating food should also be considered against the high increase in food prices during 2002. An increase in food prices affects the poor especially, as they spend a larger portion of their income on food. It is therefore expected that low-income households would be more adversely affected by increases in food prices, as experienced during 2002, relative to high-income households. However, it is recognized that zero-rating food will only lead to a drop in prices and not necessarily to a change in the inflation rate. At the same time zero-rating food may provide immediate poverty relief.

Fourthly, the Commission of the European Communities is investigating the possibility of reducing the VAT rate of certain labour-intensive service industries with the objective to increase employment. Zero-rating labour-intensive industries in South-Africa are also a possibility necessary to be investigated as the official unemployment rate in South Africa in 1997 is 22.9 percent (Stats SA,2000:3).

This chapter aims to answer the question whether or not lowering VAT may achieve the set goals of GEAR, whether or not zero-rating food may reduce poverty and equality, whether zero-rating labor-intensive industries may create jobs and lastly whether or not it is the appropriate time to include the previously zero-rated food items in the VAT basket. VAT is also generally described as a "vanilla tax" meaning that the economic effect of such a tax is not significant (Metcalf as in Baker and Elliott,1997:420). The analysis that will follow will also serve to prove the extent to which the statement is true; how and to which extent changes in VAT would affect the economy.

The simulations conducted include decreasing the VAT rate, zero-rating food with alternative revenue replacement strategies, and zero-rating labor-intensive industries with alternative revenue replacement strategies. Each of these simulations will be done under alternative macroeconomic adjustment rules.

5.2.   The CGE Model

A CGE model is used to analyze the effect of changes in VAT on the economy. CGE models are highly suited to show the impact of VAT changes on distribution and welfare. CGE models incorporate consumer and producer behavior as well as the interaction between other economic agents, and therefore incorporate all effects on the distribution of income and economic welfare. The standardized CGE model discussed in chapter four is used to analyze the VAT issues discussed above.

The Data

The SA SAM commissioned by the World Bank in 2002/2003 is used as the main data source. The SA SAM is based on 2001 data and was compiled from a large number of data sources, as may be seen in chapter five. A combination of elasticities obtained from Gibson (2003), the IDC (1997), the South African CGE model of Lewis (2001), as well as the South African CGE model of Thurlow and Van Seventer (2002) is used in the CGE

model. The elasticities are discussed in chapter six. The other parameters will be calibrated within the CGE model to balance and configure the model.

5.3. Instruments

The impact of restructuring VAT on economic variables such as GDP, employment, consumption expenditure and investment is observed from the results obtained from the CGE model. The impact on industry and households is also observed. In fact, the CGE model includes a large number of economic variables that allow one to observe the effect of changes in VAT on the economy. Changes in these variables will be observed during each simulation. Apart from these variables other issues such as the regressiveness of VAT, the progressiveness of the complete tax system, changes in income distribution, and overall welfare changes would also be observed. The results of the simulations (experiments) are merely used to determine the value of the instruments below; the instruments do not form part of the model. The additional instruments specified are discussed below.

5.3.1 Regressiveness

Regressiveness is measured by taking the household's expenditure on VAT as a percentage of total income. The total expenditure on VAT for each household category is calculated within the CGE model as follows:

$$Regress(h) = \frac{\sum_c QH(c,h)*PQ(c)*statvat(c)*leakage(c)}{YI(h)}$$

where

$Regress(h)$	measures the regressiveness of VAT for each household
$QH(c,h)$	is the quantity of commodity c consumed by household h
$PQ(c)$	is the composite supply price of commodity c

statvat(*c*) * *leakage*(*c*)   is the actual VAT rate, paid on commodity *c*

YI(*h*)   is the total income of households.

Therefore the actual payment on VAT by a household category is calculated by taking the sum of the quantity consumed by that household of a specific commodity multiplying it with the composite supply price as well as the actual VAT rate on that commodity. The actual payment on VAT by a household category is then divided by the total income of that household to get the measure of regressiveness.

5.3.2 Progressiveness

The progressiveness of the complete tax system is measured by taking the total tax payment by each household as a percentage of total income.

Progress(h)

$$= \frac{(\sum_c QH(c,h) * PQ(c) * (statvat(c) * leakage(c) + tfuel(c) + texcise(c) + tproducts(c))) + tins(h) * YI(h)}{YI(h)}$$

where

Progress(h)   measures the progressiveness of VAT for each household

QH(*c,h*)   is the quantity of commodity *c* consumed by household *h*

PQ(*c*)   is the composite supply price of commodity *c*

statvat(*c*) * *leakage*(*c*)   is the actual VAT rate paid on commodity *c*

YI(*h*)   is the total income of households

tins (*h*)   is the marginal tax rate of households

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5.3.3 Distribution

A Gini Coefficient will be used to measure the impact of policy changes on distribution. The Gini Coefficient is then calculated using the following formula:

$$Gini_y = 1 + \frac{1}{N} - \frac{2}{N^2} \sum_{i=1}^{N} (N+1-i)(\frac{y_i}{\bar{y}})$$

where

N	is the number of observations
y	is the income arranged in ascending order
$\bar{y}$	is the arithmetic mean income (Creedy,2001:25)

The Gini coefficient lies between zero and one, where zero indicates perfect equality and one perfect inequality. (Shoven and Whalley,1992:130-131)

The ability of a tax structure to redistribute may be summarized using an L-measure. The L-measure is also called the Reynolds-Smolensky measure and is calculated as follows:

$$L = Gini_y - Gini_{yd}$$

where

$Gini_y$ is the pre-tax Gini Coefficient

$Gini_{yd}$ is the post-tax Gini Coefficient

The L-measure gives the extent of the change in inequality arising from the tax-system. (Creedy,2001:25-26).

5.3.4   Equivalent Variation

With CGE models an exact welfare comparison between two equilibrium situations may be achieved. The equivalent variation (EV) (as initially defined by Hicks (1939)) is often used to determine the welfare effect. The equivalent variation asks the question: "How much money is a particular change equivalent to?" The equivalent variation (as specified originally) measures the amount after the price change that the household would be prepared to pay to return to old prices (Creedy,1999:12). The South African CGE model includes an indirect compensation (IC) and EV measurement. The IC measures the income needed at initial prices to generate same welfare as before the simulation, the EV, in turn, measures the income change that, at initial prices, would be equivalent to the change simulated for the simulation (Löfgren *et al*,2001). The standard model also gives the EV value as a percentage of the initial consumption value (EVTAB). An increase in the EVTAB value would indicate an overall improvement in welfare. This measure will be used to evaluate the impact of the simulations of the welfare of the household deciles.

5.4.   The Simulations

5.4.1   Decreasing the Statutory VAT Rate from 14 Percent to 12.6 Percent

VAT was introduced in 1991 at a statutory rate of 10 percent. In 1993 the rate was increased to 14 percent. Since 1993 the statutory rate remained at 14 percent. At the same time the government decreased the tax rates on household income for the last two budget years (RSA,2002a:16 and RSA,2003:16). The question is whether a decrease in the statutory rate from 14 to 12.6 percent may be implemented as an alternative for a decrease in direct taxes.

The expected effect is that a decrease in VAT would serve to decrease prices and therefore increase real income. At the same time it would lead to a drop in government revenue and therefore a drop in government savings. This would in turn have an effect on GDP, trade, savings and investment. A reduction in VAT would have a welfare

implication.   The CGE model will aid to determine the size of the impact of decreasing VAT, and will indicate the effect on the different households in terms of welfare. The CGE model will also highlight effects not expected.

5.4.2   Zero-rating Food

When VAT was introduced in 1991 various basic food items were already exempted to improve the regressiveness of VAT. Food items like brown bread, maize meal, samp, mealie rice, dried mealies, dried beans, lentils, pilchards, milk powder, milk, rice, unprocessed vegetables and fruit, vegetable oil, and eggs are exempt (SA Tax,2001:Schedule 2 Part B). In 2001 paraffin a fuel used by most poor households was also exempt.

As may be seen from figure 5.1 poor households spend the largest proportion of their income on food. It seems as if zero-rating all food items may further contribute to improving the regressiveness of VAT, and simultaneously aid redistribution. However, the loss in revenue due to the zero-rating of food will have to be absorbed by other taxes. The loss in revenue may be replaced by either increasing direct taxes, or by allowing another commodity or service, more extensively used by high income groups, to absorb the loss by applying higher VAT rates to that commodity or service. This will also serve the purpose of redistribution. High-income groups, in turn, spend the largest proportion of their income on business services. Business services include bookkeeping, legal, accounting, programming and data processing, consultant engineers, architects, land surveyors, security, marketing, and other professional services. It seems that applying higher VAT rates to the business service industry will absorb the loss in revenue, but also simultaneously result in redistribution.

Zero-rating Food While Increasing Direct Taxes

Food will be zero-rated, while direct taxes will increase to absorb the loss in revenue. Direct taxes are increased with the same percentage point for all households, which is

more equitable: as lower income households' tax rates are already lower, the same percentage point average direct tax rate increase for all households will affect lower income households the least.

Zero-rating Food While Increasing VAT on Business Services

Food will be zero-rated, while VAT on business services will be increased to absorb the loss in revenue. Both direct taxes and government savings will be fixed.

5.4.3   Zero-rating Labor-intensive Industries

The Commission of the European Communities is investigating the possibilities of zero-rating labor-intensive service industries not exposed to trade. The objectives of this strategy are to increase employment and reduce the black economy. Employ will be increased via an indirect mechanism. Reducing the VAT rate would lead to a fall in consumer prices which in turn would generate increased demand. Increased demand would increase production activity and employment. The black economy referred to here is the formal economy which entails properly registered businesses, but which tend to under disclose VAT receipts. Lowering VAT rates will possibly increase compliance. The following requirements are set for the targeted services:

(1)   they must be labor-intensive;
(2)   they must, in the main, provide directly to final consumers;
(3)   they must be based locally, and not be exposed to international trade;
(4)   there must be a close link between lower prices resulting from the rate reductions and the foreseeable increase in demand and employment.

The industries targeted in the European Communities are small repair services, renovations of private dwellings, window cleaning, domestic care services, and hair dressing. (The Commission of the European Communities,2003:1-10).

The next step is to identify service industries in South Africa to meet the same requirements as above. Table 5.1 lists the service industries contained within the SA SAM (2003) and show how the industries are exposed to trade, what share they sell to households, and their use of semi- and unskilled labor as a percentage of total factor use:

Table 5.1:   Targeting Labor-Intensive Industries from (SA SAM,2003)

	Export Share (%)	Export – Output Ratio (%)	Import Share (%)	Import – Demand Ratio (%)	Household Sales Share (%)	Semi-skilled Labor Use Share (%)	Unskilled Labor Use Share (%)
C_HOTEL	2.3	41.7	1.8	34.3	0.73	13.3	4.5
C_TRANS	4.6	14.3	8.2	20.5	0.36	24.2	14.5
C_COMM	1.5	6.7	2.1	8.5	0.29	21	10.1
C_FINAN	2.6	6.2	1.6	3.5	0.33	22.3	3.3
C_BUS	1.1	2	1.6	2.8	0.33	15.1	6.9
C_MOTHS	0.3	2.1	0.3	2.1	0.65	19.9	3.3

For the purpose of this paper, financial service will be zero-rated. The change in employment of semi- and unskilled labor will be observed. Zero-rating financial services may possibly reduce the cost thereof and make it more accessible to poor households.

The fourth requirement (as stated by the Commission for the European Communities) specified above, requires that there should exist a close link between lower prices resulting from the rate reductions and the foreseeable increase in demand and employment. This criterion will be tested using a CGE model.

Zero-rating Financial Services

The financial service industry will be zero-rated. Changes in employment and other variables are observed.

Zero-rating Financial Services While Increasing Direct Taxes

Zero-rating the financial service industry will result in a loss in revenue for government. The revenue replacement strategy used here increases direct taxes with an equal percentage for all households.

5.5.   The Macroeconomic Adjustment Rules

Factor market closures assume capital and high skilled labor are fully employed and activity specific, while semi-skilled and low-skilled labor are unemployed and mobile. The impact of these closures is that for capital and high-skilled labor total employment will not change. The only change here would be the activity specific rental price of capital and the wage of high skilled labor. Capital and high-skilled labor may therefore not move between activities. For semi- and unskilled labor, wages will remain constant as these factors experience high levels of unemployment. The only factor that would change for semi- and unskilled labor is employment. The wage rate of semi- and unskilled labor is fixed at real wage level. The real wage is included in the model as the initial wage level multiplied by the consumer price index relative to the initial CPI level.

The closure for the rest of the world assumes a flexible exchange rate with fixed foreign savings. The adjustment rule follows from observations made by Davies and Van Seventer (2003) who noted that foreign savings as defined by the national accounts behaved relatively constant over the last 10 years.

The savings-driven investment closure is used for the simulations appended with SAV. The marginal propensity to save for all non-government institutions will be fixed, while capital formation is flexible. The level of savings determines investment. In a paper read by Nell (2002), he mentioned that, on the long-run, private savings were strongly exogenous to private investment in the period 1977 to 2001. This implies that the savings level will determine investment. (Nell,2002:26).

The numeraire in the model is the domestic price index.

5.6.   The Results

5.6.1   Decreasing the Statutory VAT Rate from 14 Percent to 12.6 Percent

It is not expected that lowering the statutory VAT rate to 12.6 percent would have any significant macro economic effects. Table 5.2 gives a summary of the GDP effects of lowering VAT from both the income and expenditure side:

Table 5.2:   Changes in Real GDP when Lowering the VAT Rate to 12.6 Percent

	BASE	SHARE in GDP	LOWERING VAT RATE	CONTRIBUTION IN CHANGE IN GDP
	R billion		Percentage change	Percentage
Consumption	608.633	59.15	0.54	0.32
Fixed Capital Formation	144.127	14.01	-1.39	-0.20
Change in Stock	7.436	0.72	Exogenous	
Government Consumption	231.34	22.48	Exogenous	
Exports	301.841	29.34	0.031	0.01
Imports	-264.464	-25.70	0.04	-0.01
GDP at Market Prices	**1028.914**	100	**0.12**	**0.12**
GDP at Factor Cost	916.45	89.07	0.12	0.103
VAT	58.613	5.69	-9.85	-0.561
Other Net Indirect Taxes	53.90	5.23	11.11	0.580

Source: BASE SA SAM 2003

CGE Simulations

The change in GDP at market prices is relatively small and is due to changes in the composition of aggregate demand. Lowering the statutory VAT rate results in an increase in GDP at market prices of 0.12 percent. Consumption expenditure increases with 0.54 percent as a result of the decline in prices. Investment declines with 1.39 percent, mainly as a result of the adjustment rules assumed. If VAT is lowered, the composite price of most commodities will decrease and consumption will therefore increase.   As government expenditure and the trade balance are assumed fixed, investment will decrease to counterbalance the increase in household consumption. The

mechanism behind this is: If the budget deficit goes up, government savings and therefore domestic savings decline. Given fixed foreign savings, and fixed private savings rates assumed, the only variable that is then allowed to adjust is investment. Hence investment will decline and counterbalance the increase in household consumption so that GDP increases to a lesser extent.

On the income side GDP at factor cost increases due to the expansion of domestic production activities. GDP at factor cost is derived from value-added, value-added in turn depends on changes in the employment of unskilled and semi-skilled labor. Employment of unskilled labor increased with 0.26 percent and semi-skilled labor with 0.4 percent. Changes in VAT and other net indirect taxes also contributed to the overall change in GDP at market prices. The initial decline in VAT contributed 0.56 percent of the overall decline in GDP. The other net indirect taxes increased to offset the initial reduction in VAT; this is mainly due to the expansion in the volume of production, as well as in imports.

Other macro economic results are summarized below in table 5.3.

Table 5.3:   Some Macro Economic Results when Lowering the VAT to 12.6 Percent

Item	BASE	LOWERING VAT RATE
	Percentage	Percentage Change
Consumer Price Index (CPI)	100	-0.4
Real Exchange Rate (REXR)	90.6	-0.1
Investment share in GDP	14	-0.3
Private savings share in GDP	14.7	0.1
Government savings share in GDP	-0.2	-0.4
Direct taxes share in GDP	15	0.1

Source: BASE SA SAM 2003

CGE Simulations

Lowering the statutory VAT rate with 10 percent from 14 to 12.6 percent will result in a decline in the CPI of 0.4 percent. This in turn will result in an increase in consumption of both imported goods and domestically produced goods. Given fixed foreign savings,

exports also have to increase - the increase in exports value relative to import value leads to an appreciation of the real exchange rate of 0.1 percent.

Lowering the statutory VAT rate is expected to lead to a loss in government revenue of 2.26 percent, however government revenue only declined with 2.18 percent. The smaller decline is due to the increase in revenue from import duties and activity taxes – even though the rates of these taxes remained the same the expansion in volume of imports and domestic activity resulted in the increase in income. The smaller decline in revenue is also associated with an increase in direct tax revenue – both personal tax revenue and corporate tax revenue increased due to an increase in factor income of capital and high-skilled labor (this may be seen in figure 5.3).

When lowering the VAT rate, investment as a share in GDP declined with 0.3 percent again due to the drop in government savings – government savings as a share in GDP declined with 0.4 percent in comparison to an increase in private savings to GDP of 0.1 percent. Private savings increased due to the income effect generated by lowering VAT.

Lowering the statutory VAT rate from 14 to 12.6 percent is expected to lower the composite price of all commodities. Lower prices will generate an income effect, real income increase and both domestic supply and imports, in most industries, will expand. The presence of a substitution effect depends on whether or not the decline in import prices (due to the appreciation of the exchange rate) is larger than the change in the domestic supply price. Figure 5.2 shows the expected change in the composite price of all commodities as well as the actual changes in price, indicating the factors that offset the expected change in commodity prices, and indicating the presence of a substitution effect.

Industries that produce commodities sold mostly to households will benefit from lowering the statutory VAT rate as consumption expenditure increases with 0.54 percent.

Figure 5.2:   The Expected and Actual Change in Commodity Prices When Lowering VAT to 12.6 Percent
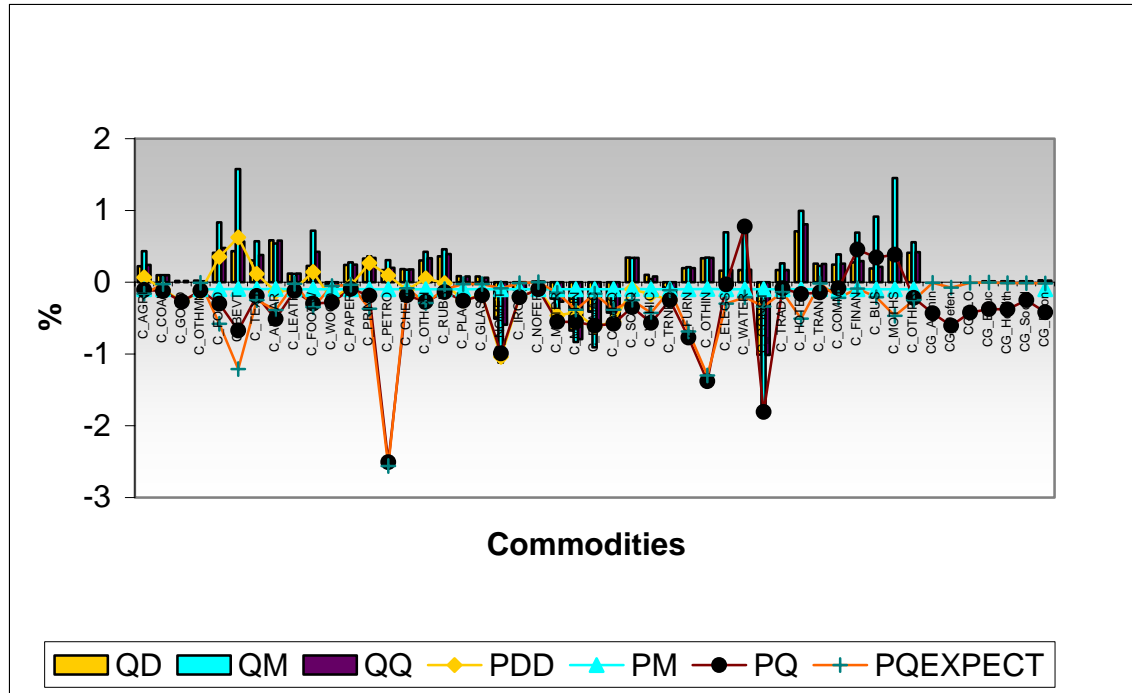
Source: CGE Simulations

Examples of industries that produce commodities sold mostly to households are food (94.8 percent), textiles (35.3 percent), beverages and tobacco (79.6 percent), apparel (32.8 percent), footwear (77.3 percent), hotel and accommodation (72.7 percent), transport (35.59 percent), and medical services (64.6 percent)[1]. Figure 5.2 shows that these industries benefit from lowering the statutory VAT rate and experience an increase in activity. The mechanism is as follows: lowering the statutory VAT rate will lead to an increase in domestic supply and imports – income effect. However, domestic supply is constrained with respect to capital and high-skilled labor. The activity-specific rental price of capital and the wage rate of high-skilled labor will increase. This will lead to an increase in the domestic supply price. There is also a change in the relative price of imports to domestic goods; import prices decline due to the appreciation of the exchange rate. In the industries selling mostly to households the domestic supply price increases. Due to this substitution effect imports increase with more. For commodities such as

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[1]   The number in the bracket indicates the percentage of total sales sold to households for each commodity.

agriculture, food, beverages, textiles, footwear, and petroleum, the relative large increase in imports results in a lower than expected decline in the composite price of these commodities. Thus, the net effect is still a reduction in the composite price of goods. For water, financial, business, and medical services, the increase in imports outweighs the initial decline in prices due to the lowering of the statutory VAT rate and the net effect is an increase in their respective composite prices.

Industries that do not benefit from lowering the statutory VAT rate are industries that produce commodities sold mostly to investment, as investment demand decreased with 1.4 percent. Examples of industries that produce commodities sold mostly to investment are machinery and equipment (51.5 percent), equipment and electronic machinery (23.3 percent), communication equipment (52.8 percent), and construction (58.41 percent)[2]. Construction experienced the largest decline in activity because construction sells exclusively to investment, and furthermore construction is also relatively capital intensive (41.5 percent), and experienced a decline in the activity-specific rental price of capital of 0.73 percent. Construction also does not import and therefore does not benefit from lower import prices.

To summarize: Industries that benefit from lowering the statutory VAT rate are industries that sell mostly to households, as private consumption expenditure increase. Industries that do not do well are industries that sell mostly to investment, or industries that are either capital or labor intensive as the rental price of capital as well as the wage rate of high-skilled labor increases.

The average level of domestic activities increased. This required the use of additional factors. The change in employment of semi- and unskilled labor will influence GDP at factor cost. Employment of high-skilled labor and the factor supply of capital will not change. This is a result of the macroeconomic adjustment rules assumed. The simulations assumed that the supply of high-skilled labor and capital is fixed – fully

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[2]   The number in the bracket indicates the percentage of total shares sold to investment for each commodity.

employed. Therefore for capital and high-skilled labor the adjusting factor is the activity-specific rental price of capital and wage rate of high-skilled labor. Figure 5.3 summarizes the impact of lowering VAT on factor income:

Figure 5.3:   The Percentage Change in Factor Income when Lowering the VAT rate to 12.6 Percent
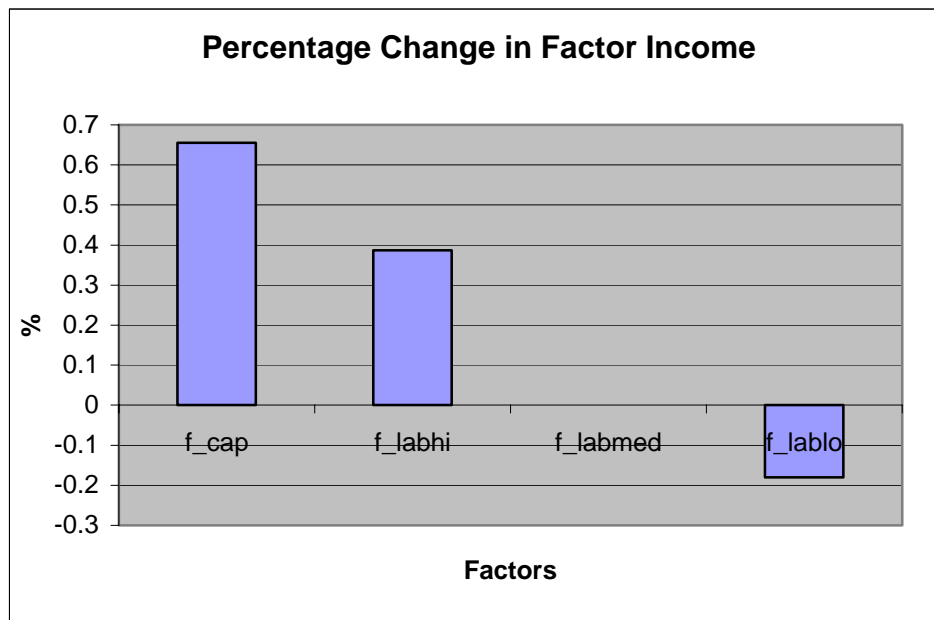
Source: CGE Simulations

As already seen above, the employment of unskilled labor increased with 0.26 percent and semi-skilled labor with 0.4 percent. However, the real wage of both semi-skilled labor and unskilled labor would decline as it is fixed at real wage levels - the reduction in the CPI of 0.4 percent resulted in an overall decline in wages. The average rental price of capital increased for most industries, except industries that show a decline in activity due to the decline in investment. The same applies to the wage of high-skilled labor. The changes in factor income will translate to changes in household income. Poor households are expected to do worse as factor income of unskilled labor declines. At the same time a lower VAT rate generates an increase in real income, which will increase consumption-expenditure. Both these effects are captured with an equivalent variation. Figure 5.4 shows the change in the EV value for all household deciles:

Figure 5.4:   *The Equivalent Variation when Lowering the VAT Rate to 12.6*
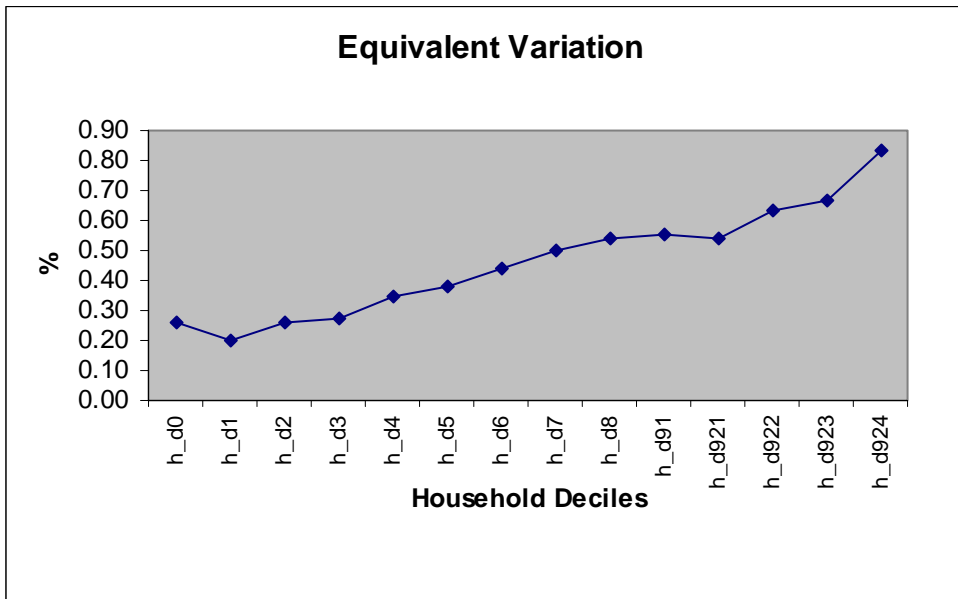
               Percent

Source: CGE Simulations

Reducing the VAT rate to 12.6 percent results in an overall improvement in welfare. High-income households benefit more due to the increase in their income from capital and high-skilled labor.   High-income households spend, in absolute terms, more on commodities than poor households and therefore also benefit to a greater extent from the reduction in VAT. Low-income households factor income from unskilled labor declines. This decline is still outweighed by the reduction in commodity prices, resulting in the overall increase in welfare.

The same simulation was performed, but now investment driven savings is assumed. The simulation showed that the marginal propensity to save, of firms and households, needs to increase with 1.8 percent to maintain the initial level of investment given the reduction in the VAT rate.

5.6.2 Zero-rating Food

Again it is not expected that zero-rating food would have any significant macroeconomic effect, as VAT on food is 0.6 percent of GDP. Table 5.4 summarizes the changes in GDP when food was zero-rated:

Table 5.4:   Changes in Real GDP when Zero-rating Food

	BASE	SHARE	ZERO RATE FOOD	CONTRIBUTION IN CHANGE IN GDP	ZERO RATE FOOD INCREASE DIRECT TAXES	CONTRIBUTION IN CHANGE IN GDP	ZERO RATE FOOD INCREASE VAT BUSINESS SERVICES	CONTRIBUTION IN CHANGE IN GDP
	R billion		% Change	%	% Change	%	% Change	%
Consumption	608.633	59.15	0.64	0.38	0.35	0.21	0.33	0.19
Fixed Capital Formation	144.127	14.01	-1.92	-0.27	-0.34	-0.05	-0.86	-0.12
Change in Stock	7.436	0.72	Exogenous		Exogenous		Exogenous	
Government Consumption	231.34	22.48	Exogenous		Exogenous		Exogenous	
Exports	301.841	29.34	-0.03	-0.01	0.14	0.04	0.02	0.01
Imports	-264.464	-25.70	-0.03	0.01	0.15	-0.04	0.02	-0.01
GDP at Market Prices	1028.914	100	0.11	0.11	0.16	0.16	0.07	0.07
GDP at Factor Cost	916.45	89.07	0.11	0.10	0.16	0.14	0.07	0.06
VAT	58.613	5.70	-9.32	-0.53	-9.23	-0.53	-2.23	-0.13
Net Indirect Taxes	53.90	5.23	10.04	0.55	10.40	0.55	2.61	0.14

Source: BASE SA SAM 2003

CGE Simulations

Again the change in GDP at market prices is relatively small and is due to changes in the composition of aggregate demand. Zero-rating food, without a revenue replacement strategy, results in an increase of GDP of 0.11 percent. The increase in GDP is due to a relatively large increase in consumption expenditure of 0.64 percent. The large increase in consumption expenditure is offset by a decrease in investment (1.92 percent), due to a reduction in government savings. These results follow directly from the adjustment rules assumed. If the composite price of food decreases (due to the zero-rating of food) consumption will increase. Investment will decrease to counter-balance the increase in household consumption. The reason for this is: If the budget deficit goes up, domestic savings decline. Given fixed foreign savings, and fixed private savings rates assumed, the only variable that is then allowed to adjust is investment. Hence investment will decline and counterbalance the increase in household consumption to such a degree that GDP as

a whole decreases. Under this simulation government revenue declined due to the zero-rating of food with 1.88 percent, the expected decline was 2.10 percent. The smaller decline in government revenue is associated with the increase in net other indirect taxes, combined with an increase in government revenue from income taxes. Although the direct tax rates are fixed, the increase in income will earn government higher revenue.

Zero-rating food with an increase in direct taxes to absorb the loss in revenue results in an increase in GDP of 0.16 percent. When zero-rating food while increasing direct taxes, the decrease in GDP may be attributed to the increase in direct taxes, which lowers the marginal propensity to save. In this simulation a balanced budget is assumed, with direct taxes being the adjusting variable. In other words, direct taxes increase to offset the decline in government revenue due to lower indirect taxes. Consequently, total household expenditure does not increase as much as in the previous simulation, and therefore private sector investment does not have to adjust downwards as much, since most of the adjustment is already achieved by household expenditure itself. Nevertheless, the net effect is not negative for GDP, in fact it is slightly positive. The tax rates of firms and households were proportionately increased with 2.09 percent to absorb the loss in revenue. This reduces the disposable income of households, which in turn lowers consumption expenditure.

Zero-rating food, while increasing VAT on business services, generates the lowest GDP growth. GDP grows with 0.07 percent due to an increase in consumption expenditure. Private consumption expenditure does not change significantly.   The reason is the same as in the second simulation. However, investment decreases more than in the previous simulation, presumably because investment demand is now also negatively impacted by the increase in VAT on business services. VAT on business services had to increase with 121.946 percent. This implies a statutory VAT rate on business services of 31.1 percent, which is unrealistically high.   Zero-rating food, while increasing VAT on business services, does not seem to be a realistic policy strategy to follow. However, for the purpose of this chapter the results of this simulation are discussed, as there are advantages to this policy strategy worth investigating.

On the income side, zero-rating food without a revenue replacement strategy will result in an increase in GDP at factor cost due to the increase in domestic activity. VAT declined with 9.32 percent, which contributed to an overall decline in GDP at market prices of 0.53 percent. Again other net indirect taxes increased to offset the initial decline in VAT. The increase in net indirect taxes is due to an increase in revenue from import tariffs and taxes on production. When zero-rating food while increasing direct taxes, GDP at factor cost increases and again the initial effect of VAT is offset by increases in other net indirect taxes. When food is zero-rated while VAT is increased GDP at factor cost now only increases with 0.07 percent. The net change in VAT is also much smaller when zero-rating food, while increasing the VAT rate on business services. Again the initial effect of VAT is offset by increases in other net indirect taxes.

Other macro economic results are highlighted in table 5.5:

Table 5.5:   Some Macroeconomic Results when Zero-rating Food

	BASE	ZERO RATE FOOD	ZERO RATE FOOD INCREASE DIRECT TAXES	ZERO RATE FOOD INCREASE VAT BUSINESS SERVICES
		Percentage Change	Percentage Change	Percentage Change
Consumer Price Index (CPI)	100	-0.7	-0.7	-0.5
Real Exchange Rate (REXR)	90.6	-0.1	0.1	0.1
Investment share in GDP	14	-0.3		-0.1
Private savings share in GDP	14.7	0.1	0.1	
Government savings share in GDP	-0.2	-0.3		
Direct taxes share in GDP	15	0.1	0.4	

SOURCE: BASE SA SAM 2003
          CGE Simulations

Zero-rating food results in a reduction in the CPI of 0.7 percent, when zero-rating food without a revenue replacement strategy, or when increasing direct taxes to absorb the loss in revenue. Zero-rating food,while increasing VAT on business services, only reduces the CPI with 0.5 percent.

Zero-rating food without a revenue replacement strategy results in an appreciation of the real exchange rate of 0.1 percent. Imports decline due to the higher import content of

investment demand, compared to household expenditure. Given fixed foreign savings, exports also have to decline, which presumably is achieved with an appreciation of the exchange rate. The real exchange rate appreciated with 0.1 percent, as total imports declined more than total exports.

Zero-rating food with a revenue replacement strategy (either increasing direct taxes or VAT on business services) results in a depreciation of the real exchange rate. Imports, and therefore also exports, go down for the same reason as before but not as much, and the exchange rate stays virtually constant. Zero-rating food while increasing direct taxes, results in a depreciation of the exchange rate of 0.1 percent. Zero-rated food, while increasing VAT on business services, results in a slightly higher depreciation of the exchange rate, as investment is more affected and therefore the impact on imports and exports is slightly higher than in the previous simulation.

Zero-rating food is expected to lower the composite price of commodities. The expected decline is equal to 5.535 percent. The actual change in the composite price of commodities is 4.13, 4.25 and 4.15 for zero-rating food without a revenue replacement strategy, or increasing direct taxes, or increasing VAT on business services, respectively. Figures 5.5, 5.6 and 5.7 show the factors that offset the larger decline in the composite commodity price when zero-rating food:

Food prices are expected to decrease with 5.5 percent due to the zero-rating of food. However, the price of food only decreased with 4.1 percent. The offsetting factor is the relatively large increase in the imports of food (3.2 percent). The relatively large increase in imports is due to both an income and substitution effect. The income effect, in turn, is due to lower import prices: import prices declined with 0.01 percent.   The substitution effect is due to a change in the relative price of imported foods to domestically produced foods – import prices decline with 0.01 percent compared to an increase in the price of domestic demand of 1.8 percent.

Figure 5.5:   The Expected and Actual Change in Commodity Prices When Zero-rating Food
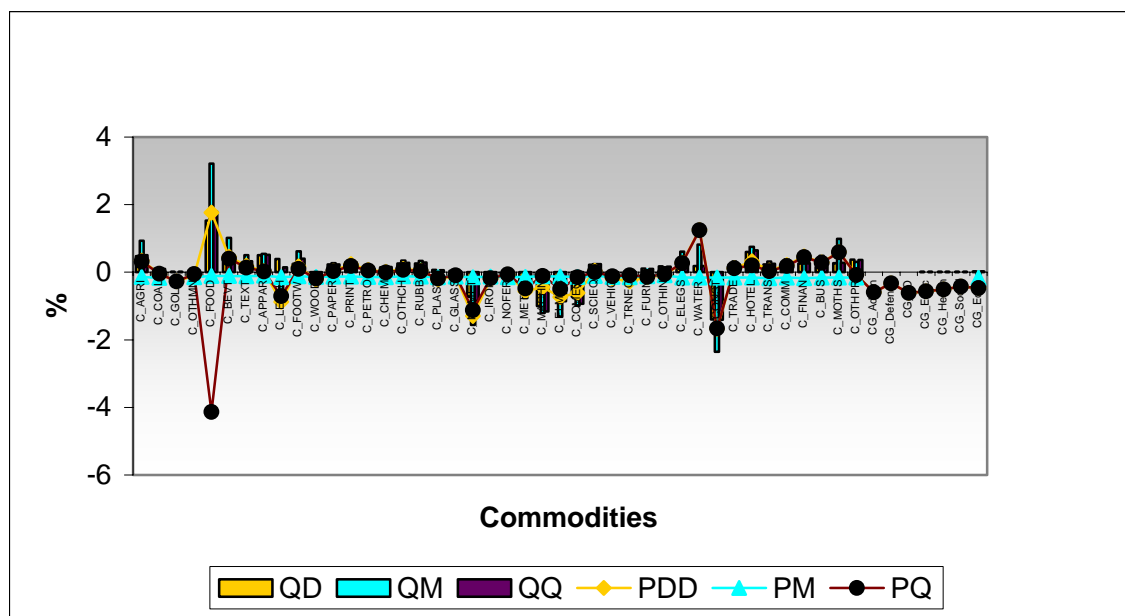
Source: CGE Simulations

The relatively larger than expected increase in imports resulted in a smaller than expected decrease in the composite price of food. The zero-rating of food and the resultant decline in the composite price of food will also generate an income effect that will cause both imports and domestic production to increase. Domestic production increased with 0.71 percent. There was a substitution away from exports as food exports declined with 3.36 percent. Food is also used intensively in the production of food itself, a factor that in turn will result in a larger decrease in the price of food. The net effect is a decline in food prices of 4.1 percent.

The agricultural industry benefits from zero-rating food, as agricultural products are used intensively in the production of food - agricultural products contribute 56.3 percent of total intermediate use in the food industry. The agricultural industry, in turn, also uses food as an intermediate good – 19.7 percent of total intermediate use. The resultant effect is a relatively large increase in activity in the agricultural industry.   Imports of agricultural goods increase with 0.94 percent due to lower import prices, and domestic sales increase with 0.47 percent. Other industries that also benefit (because they are using

food as an intermediate) are beverages and tobacco, hotel and accommodation, and the leather industry. The leather industry benefits to a very large extent as food (mainly meat) contributes to 65.6 percent of total intermediate use. Domestic sales of leather increase with 0.4 percent, while imports decline with 0.86 percent. Exports of leather increase with 2.14 percent. Most of the domestic sales of leather are for intermediate use by the footwear industry. This is then the reason why the footwear industry also benefits from zero-rating food. The service industries in general benefit from zero-rating food as most of the services use food as an intermediate. Service industries also benefit from lower import prices.

The water industry also experiences an increase in activity as the agricultural industry uses a large share of the total water use (2.9 percent). As domestic production of agricultural goods increase, water use will also increase. Furthermore, most services also use water to a large extent, and as the activities in services increase, the uses of water also increase.

Industries that do not benefit are the industries that sell mostly to investment. The construction industry is an example of an industry that performs very poorly. The construction industry sells 58.2 percent of total sales to investment. As investment demand decreases with 3.32 percent, demand for construction will also decrease. The domestic supply of construction decreases with 2.3 percent. The construction industry imports a very small share of total domestic demand (0.8 percent) and therefore does not benefit to a great extent from lower import prices.

The price effects when zero-rating food, while increasing direct taxes, are not significant. The food industry and industries producing commodities in the production of food benefit slightly from lower food prices. The price of leather again is reduced due to the lower price of food, a main intermediate in the production of leather. Most industries expanded slightly due to the increase in consumption expenditure. Again industries that sell mostly to investment experience a slight contraction of activities.

Figure 5.6:   *The Expected and Actual Change in Commodity Prices When Zero-rating Food While Increasing Direct Taxes*
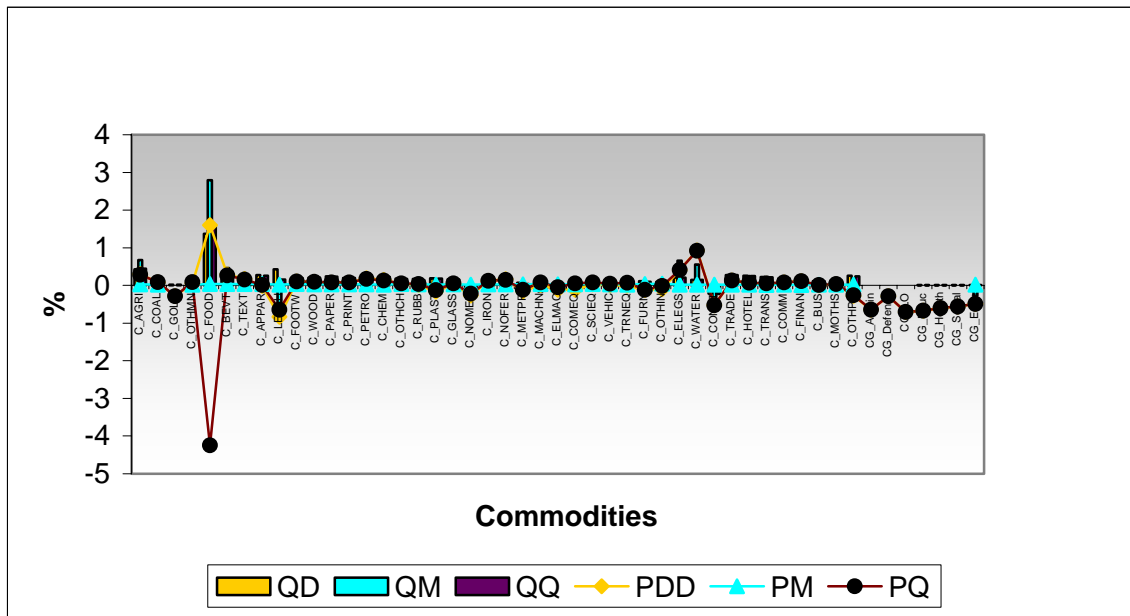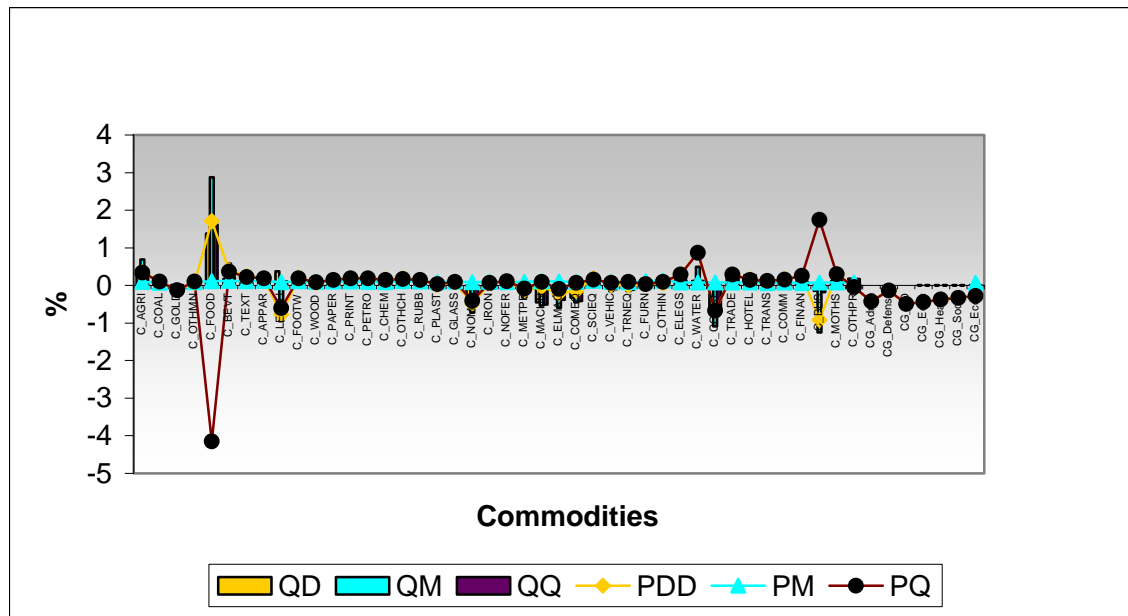

Source: CGE Simulations

The expected increase in the price of business services is 2.66 percent. The actual increase was lower at 1.75 percent. Domestic supply of business services decreased with 1.44 percent, while imports decreased with 1.25 percent. Composite supply declined with 0.18 percent, generating the largest offset to composite prices. Business services share of imports is relatively small (1.6 percent), and the share of imports to domestic supply is 2.8 percent. It is therefore not expected that the change in imports contribute to a large extent to the smaller increase in composite price. There is a substitution effect away from business services.

The rest of the industry results are similar when zero-rating food, while increasing VAT on business services.

The change in employment of semi- and unskilled labor will influence GDP at factor cost. Employment of high-skilled labor and the factor supply of capital will not change. This is a result of the macroeconomic adjustment rules assumed.

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Figure 5.7:   *The Expected and Actual Change in Commodity Prices When*
Zero-rating Food and Increasing VAT on Business Services
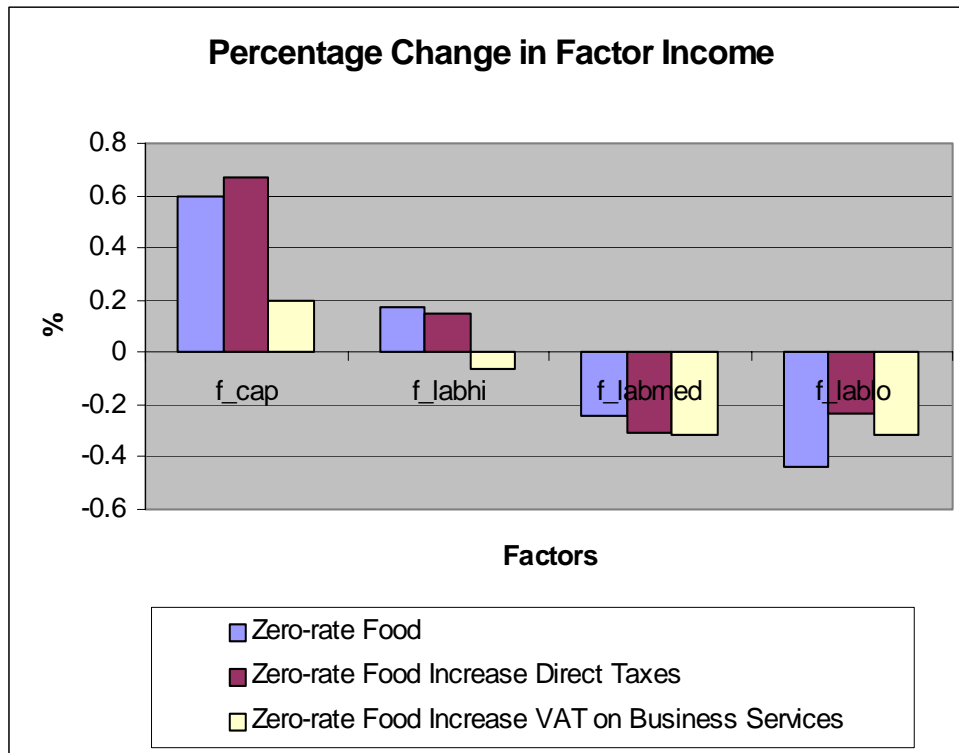

Source: CGE Simulations

The simulations assumed that the supply of high-skilled labor and capital is fixed – fully employed. Therefore for capital and high skilled labor the adjusting factor is the activity-specific rental price of capital and wage rate of high-skilled labor.

Changes in production activities will effect employment of unskilled and semi-skilled labor, as well as the return on capital and high-skilled labor. Figure 5.8 summarizes the impact of changes in employment and returns on factor income:

Zero-rating food without a revenue replacement strategy (FOODZEROSAV) will lead to a decline in the employment of semi- and unskilled labor, which in turn translates to a decline in factor income. Unskilled labor is more affected, as industries that experience a contraction in production, such as industries producing non-metal products, iron products, non-ferrous products, metal products, machinery, electronic machinery, equipment, and construction, use unskilled labor intensively.

Figure 5.8:   *The Percentage Change in Factor Income When Zero-rating Food*
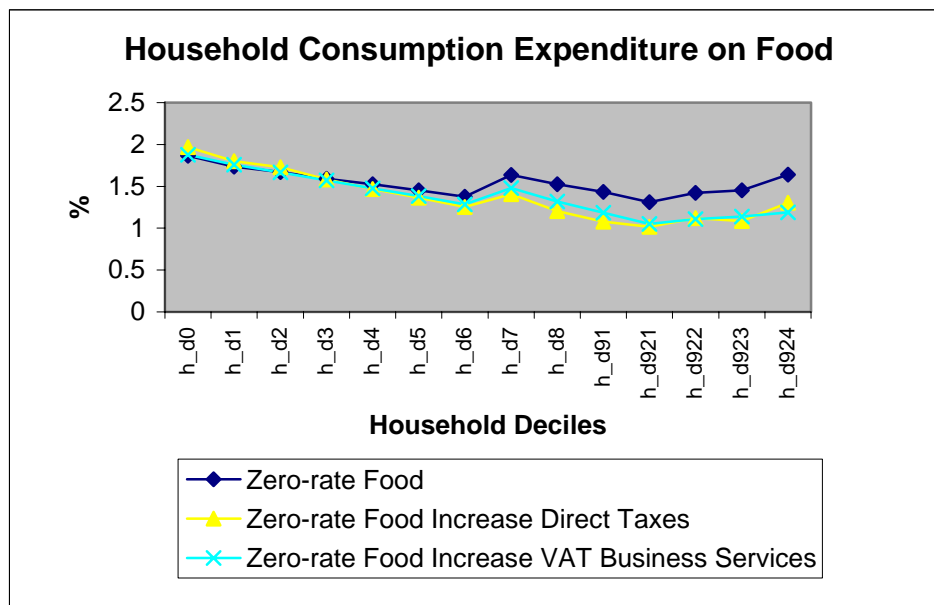

Source: CGE Simulations

Construction uses 41.1 percent unskilled labor of total factor use. Construction was an industry that experienced a particular large decline in activity. Factor income of capital and high-skilled labor increased. The increase in factor income is directly associated with an increase in the average rental price of capital and the average wage of high-skilled labor, as the quantity of both are assumed fixed. Return on capital increased with almost 0.6 percent as industries such as agriculture, food, leather, electricity, and water, are capital intensive. The capital share of total factor use is 69.4 percent in agriculture, 49.0 percent in food, 75.0 in leather, 63.7 in electricity and 77.9 percent in water production. The results when zero-rating food, while increasing direct taxes are similar. When zero-rating food, while increasing VAT on business services, high-skilled labor also experiences a decline in factor income. The construction industry showed a decline in the wage of high-skilled labor of -3.20 percent, business services showed a decline of -1.69 percent.   Other contributing industries are industries selling mostly investment goods as well as government.   The impact on factor income is more severe when

increasing VAT on business services. Changes in factor income in turn will impact on the income of households. This will in turn impact on consumption expenditure. The expenditure of households on food is an important issue, as one of the aims of restructuring VAT was poverty alleviation. A large number of South Africans suffer from malnutrition; increasing consumption expenditure of food by poor households may contribute to the alleviation of this problem. Figure 5.9 shows the changes in household consumption expenditure on food.

Figure 5.9:   *The Percentage Change in Household Consumption Expenditure   on Food When Zero-rating Food*


Household Consumption Expenditure on Food

Source: CGE Simulations

Zero-rating food under all simulations resulted in an increase in consumption of food by poor households. Zero-rating food without a revenue replacement strategy results in higher consumption expenditure for middle and high-income households, as their consumption expenditure is not constrained by higher taxes.

Consumption expenditure on business services increases for poor households under all simulations. This is due to the increase in real income experienced by poor households due to the zero-rating of food. The increase in consumption of business services is the largest for poor households when zero-rating food while increasing direct taxes, as the

decline in factor income is not as severe. High-income households will increase consumption of business services when food is zero-rated, also because their real income increases. As soon as zero-rating food is combined with a revenue replacement strategy, consumption of business services decline. This is especially the case when increasing VAT on business services. The higher price of business services leads to a decline in consumption of both middle- and high-income households.

Figure 5.10:   The Percentage Change in Household Consumption Expenditure   on Business Services When Zero-rating Food
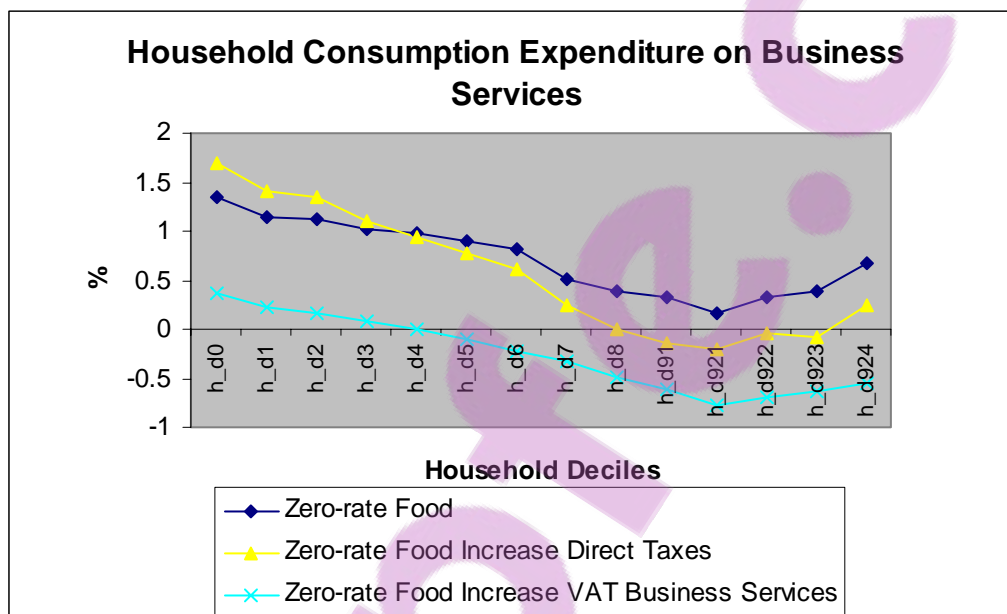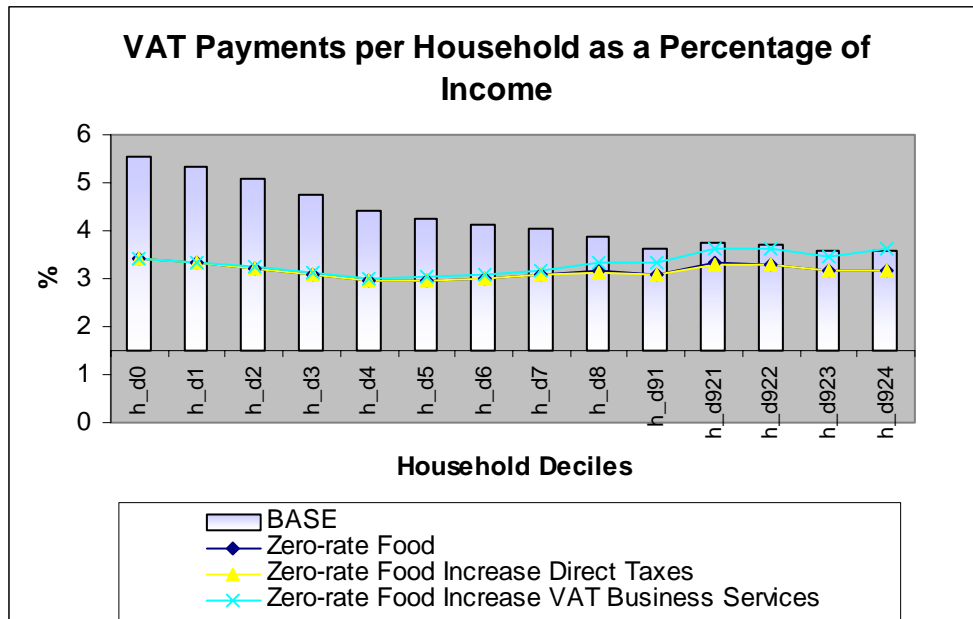

Source: CGE Simulations

The combined effect of changes in income and the price of consumption goods are captured with an equivalent variation measure. The equivalent variation gives an idea of the impact of zero-rating food with or without a revenue replacement strategy on welfare. The equivalent variation is discussed at the end of this section.

The regressiveness of VAT is measured by taking the actual VAT payments by households as a percentage of their income. The regressiveness of VAT is reduced if the VAT payment as a percentage of income decreases, and is increased if the opposite

applies.   Figure 5.11 illustrates the effect of each simulation on the regressiveness of VAT.

Figure 5.11:   Changes in the Regressiveness of VAT When Zero-rating Food
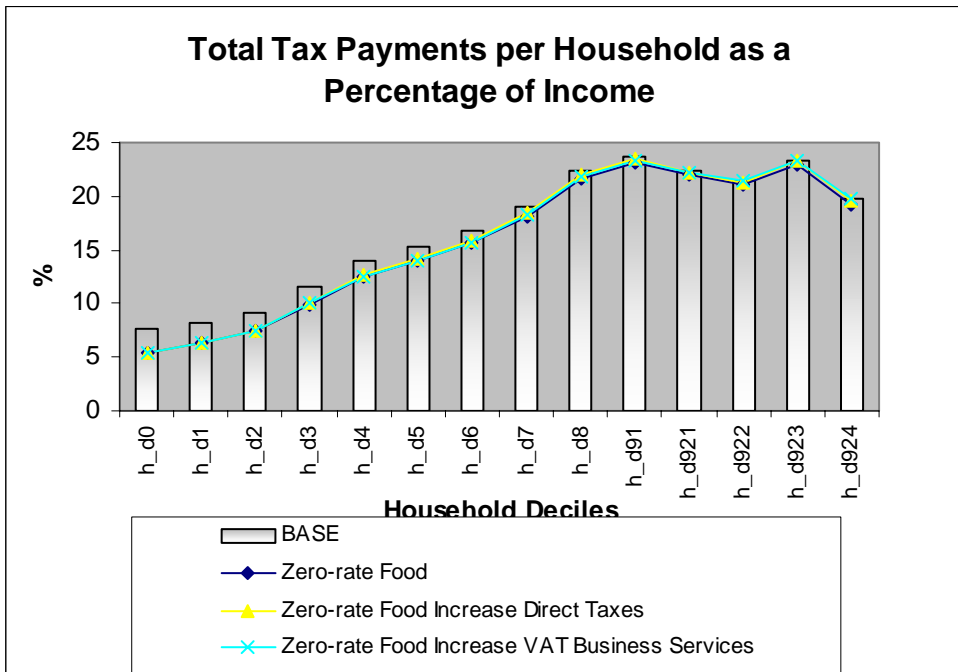

Source: BASE SA SAM 2003
           CGE Simulations

The base case indicates that VAT in 2001 was regressive, as lower income groups pay a larger percentage of their income to VAT than higher-income groups.   Lower-income households pay above five percent of their income on VAT compared to higher-income households paying less than four percent.   Zero-rating food, while increasing VAT on business services, is most effective in turning a regressive VAT into a progressive VAT. When zero-rating food without a revenue replacement strategy, or when increasing direct taxes, the impact on the regressiveness of VAT is similar.   Zero-rating food reduces the regressiveness of VAT.

It is also important to look at the progressiveness of the complete tax system. Progressiveness is measured by taking total tax payments by households as a percentage of income.

Figure 5.12:   Changes in the Progressiveness of the Overall Tax Structure When Zero-rating Food

Source: BASE SA SAM 2003
              CGE Simulations

Figure 5.12 shows that under all simulations the tax burden of lower-income groups is reduced, while the tax burden of higher-income groups is at least maintained. A question that arises at this point is whether the tax effect is generated by changes in income or changes in the tax rates. The Reynolds-Smolensky measure (also known as the L measure) is used to show the pre-tax and post-tax effect of income on distribution. The L measure consists of two Gini Coefficients that are calculated on pre-tax income and post-tax income respectively. Table 5.6 gives the L measure, as well as the two Gini Coefficients for the simulations.

The Gini Coefficient at base is comparable to Gini Coefficients calculated in other studies such as the World Bank (1998) and McDonald et al (2000) based on expenditure. The World Bank (1998) calculated the Gini Coefficient for 1993 at 0.58, and McDonald et al (2000) estimated the Gini Coefficient for all households by Province and Residential location in a range of 0.54 to 0.66.

*Table 5.6:   Gini Coefficients when Zero-rating Food*

Gini Coefficients		BASE	ZERO RATE FOOD	ZERO RATE FOOD INCREASE DIRECT TAXES	ZERO RATE FOOD INCREASE BUSINESS SERVICES
Pre-tax		0.57	0.57	0.57	0.57
	Percentage Change		0.12	0.10	0.06
Post-tax		0.54	0.54	0.54	0.54
	Percentage Change		0.14	0.01	0.07
L measure		0.02	0.02	0.02	0.02
	Percentage Change		-0.22	2.27	-0.11

SOURCE: Own Calculations

The Gini Coefficient in this study is calculated for the ten income deciles, and the data is therefore highly aggregated in terms of household information, and therefore does not say anything of the income distribution within each of the ten deciles. However, for the purpose of this study it is important to see how the Gini Coefficient changes from one simulation to the next.

Zero-rating food without a revenue replacement strategy results in an increase in pre-tax inequality that is aggravated for the post-tax case. The same applies when zero-rating food while increasing VAT on business services. Zero-rating food without a revenue replacement strategy, resulted in an increase in factor income favoring higher-income households, given that the average direct tax rate does not change, post-tax inequality will be higher. The same principle applies to the case where food is zero-rated and VAT on business services is increased. Zero-rating food while increasing direct taxes improves overall equity; direct taxes contribute 2.268 percent to the improvement in equity.

The equivalent variation (EV) is a measure of the monetary value of the price change. The higher the EV value, the higher the monetary value of the change, and the households are better off. Figure 5.13 gives an indication of the change in EV for each of the simulations from the base EV value.

Figure 5.13:   Equivalent Variation When Zero-rating Food
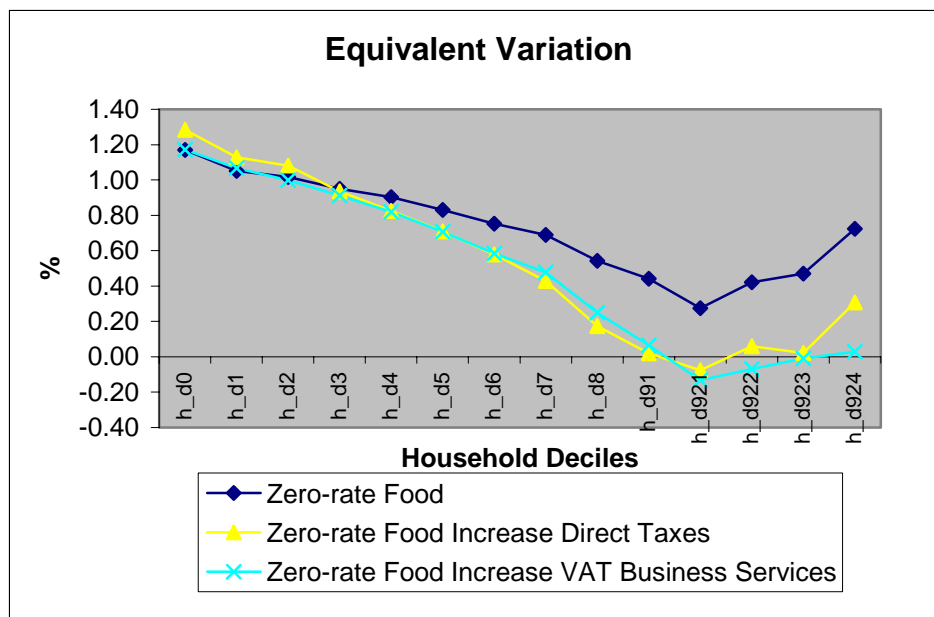
Source: CGE Simulations

Even though poor households experience a decline in income, overall welfare still shows an improvement.   The decline in food prices and the accompanying increase in consumption expenditure outweigh the decline in income. This is also explained by food being such an important expenditure item for poor households. High-income households did not experience the same levels of welfare improvement. High-income households' welfare improved when food was zero-rated without an increase in taxes, but when increasing either direct taxes or VAT on business services the welfare of high-income households showed a decline.

The three simulations were also performed assuming investment driven savings. This gives an indication of the required increase in the marginal propensity to save of firms and households to at least achieve the initial value of investment. When zero-rating food without a revenue replacement strategy, the marginal propensity of firms and households need to increase by 2.48 percent. When direct taxes were increased the required increase was 0.42, and when VAT on business services was increased the required rate was 1.09 percent.

5.6.3   Zero-rating Financial Services

The impact of zero-rating VAT on financial services on GDP is very small as VAT (as a percentage of GDP) is only 0.11 percent. Table 5.7 summarizes the impact of zero-rating financial services on GDP:

Table 5.7:   Changes in Real GDP when Zero-rating Financial Services

	BASE	SHARE	ZERO RATE FINANCIAL SERVICES	CONTRIBUTION IN CHANGE IN GDP	ZERO RATE FINANCIAL SERVICES INCREASE DIRECT TAXES	CONTRIBUTION IN CHANGE IN GDP
	R billion		% Change	%	% Change	%
Consumption	608.633	59.15	0.10	0.06	0.03	0.02
Fixed Capital Formation	144.127	14.01	-0.33	-0.05	0.07	0.01
Change in Stock	7.436	0.72	Exogenous		Exogenous	
Government Consumption	231.34	22.48	Exogenous		Exogenous	
Exports	301.841	29.34	-0.02	-0.01	0.02	0.01
Imports	-264.464	-25.70	-0.02	0.01	0.03	-0.01
GDP at Market Prices	1028.914	100	0.01	0.01	0.03	0.03
GDP at Factor Cost	916.45	89.07	0.01	0.01	0.03	0.02
VAT	58.613	5.70	-1.87	-0.11	-1.85	-0.11
Net Indirect Taxes	53.90	5.23		0		0

Source: BASE SA SAM 2003

CGE Simulations

Consumption will increase with 0.1 percent when zero-rating financial services without a revenue replacement strategy. Due to the assumptions that government consumption and the foreign balance do not change, the only adjusting variable is investment. Investment declines with 0.33 percent to counterbalance the increase in consumption. This results in an overall increase in GDP at market price of 0.01 percent. However, when direct taxes are increased to replace the revenue loss, consumption only increases with 0.03 percent. Now investment actually increases with 0.07 percent, generating an overall increase in GDP of 0.03 percent. The increase in investment is due to an increase in private savings. The increase in private savings is a result of an increase in income of all households and firms, given that the marginal propensity to save for all households and firms remain the same.

The government deficit due to zero-rating financial services savings increased from R1.750 billion to R2.632 billion. To maintain the deficit at the initial level of R1.750 billion direct taxes were increased proportionately with 0.005 percent.

Other macroeconomic variables of importance are listed in table 5.8:

Table 5.8:   Some Macro Economic Results when Zero-rating Financial Services

	BASE	ZERO RATE FINANCIAL SERVICES	ZERO RATE FINANCIAL SERVICES INCREASE DIRECT TAXES
		Percentage Change	Percentage Change
Consumer Price Index (CPI)	100		
Real Exchange Rate (REXR)	90.6		
Investment share in GDP	14	-0.1	
Private savings share in GDP	14.7		
Government savings share in GDP	-0.2	-0.1	
Direct taxes share in GDP	15		0.1

SOURCE: BASE SA SAM 2003
        CGE Simulations

Zero-rating financial services has no significant impact on the consumer price index, nor on the real exchange rate. When zero-rating financial services without a revenue replacement strategy, imports decline due to the higher import content of investment demand. The decline in imports will be accompanied by a decline in exports – the overall change in imports and exports are not significant. When zero-rating financial services, while increasing direct taxes, imports increase, due to the increase in both consumption expenditure and investment demand. The increase in imports is now accompanied by an increase in exports – again the change in imports and exports is not significant.

When zero-rating financial services without a revenue replacement strategy, government savings as a percentage of GDP will decline with 0.1 percent. This, in turn, results in a decline in investment to the same extent. When direct taxes are increased proportionately

to absorb the loss in revenue there is no change in government savings or in investment. Direct taxes as a percentage of GDP increase with 0.1 percent.

The most important aspect of interest is the impact of zero-rating financial services on employment. Table 5.8 above shows that GDP at factor cost increased with 0.01 percent when zero-rating financial services without a revenue replacement strategy, and 0.03 when increasing direct taxes to absorb the loss. The increase in GDP in factor cost, indicates an increase in employment of semi- and unskilled labor. Employment of high-skilled labor (and capital) will not change, as it is assumed fully employed. When zero-rating financial services without a revenue replacement strategy, employment of semi-skilled labor increased with 0.05 percent, while employment of unskilled labor declined with 0.02 percent. The decline in investment demand impacted heavily on unskilled labor as industries (such as the construction industry) use unskilled labor intensively. When zero-rating financial services, while increasing direct taxes proportionately, employment of semi-and unskilled labor increased with 0.06 percent respectively.   Since consumption and investment demand increased, employment of both semi- and unskilled labor has increased. It is important at this stage to look at the compositional changes in employment of semi- and unskilled labor.

The changes in employment of semi- and unskilled labor are associated with changes in the demand for semi- and unskilled labor in the industries. Figures 5.13 and 5.14 summarize the percentage change in the demand for semi- and unskilled labor under the two simulations.

The demand for semi- and unskilled labor increases with 0.5 percent when financial services are zero-rated without a revenue replacement strategy. Industries that benefit from zero-rating financial services are industries that sell mostly to households, as consumption increased. Other industries that benefit are industries, which produce commodities used as an intermediate in the delivery of financial services. Such industries are paper and print (25 percent of intermediate use), financial services itself (41 percent of intermediate use), and medical services (18.5 percent of intermediate use).

Figure 5.14:   Percentage Change in the Demand for Semi- and Unskilled Labor When Zero-rating Financial Services
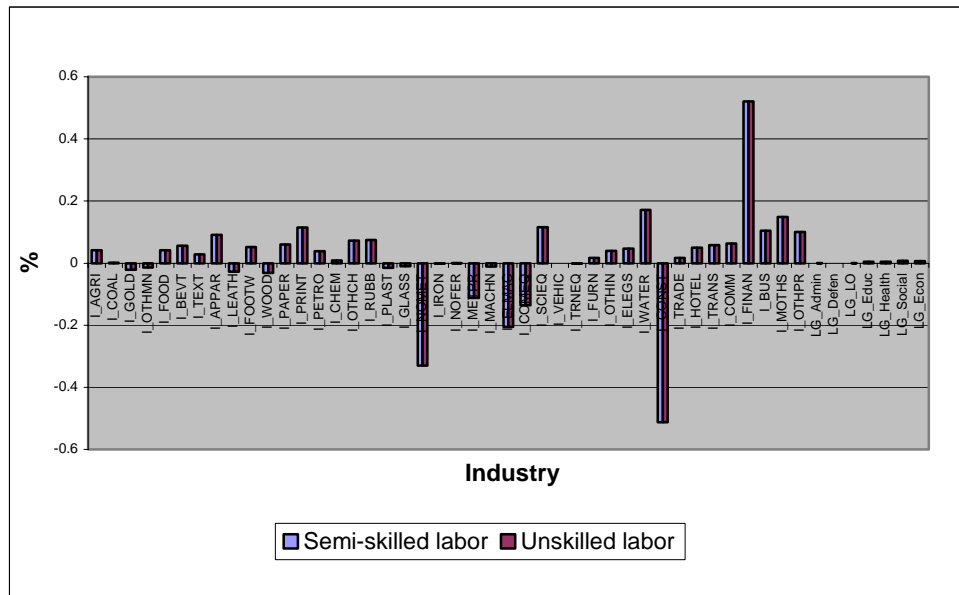
Source: CGE Simulations

Industries that use financial services intensively will also benefit from zero-rating financial services. Examples of such industries are the printing industry (21.5 percent of intermediate), the financial service industry itself (41 percent of intermediate use), the trade industry (13.27 of intermediate use), business services (10.63 percent of intermediate use), as well as other industries such as agriculture, food, petroleum, metal products, machinery, vehicles, electricity, construction, and transport.

The decline in the demand for semi- and unskilled labor is directly associated with industries that sell mostly to investment. The construction industry again experiences the largest decline in domestic activity, as it sells mostly (58.04 percent) to investment demand. The construction industry also employs unskilled labor intensively; 41.1 percent of total factor use is unskilled labor. Thus the decline in the employment of unskilled labor when zero-rating financial services, is due to the drop in investment demand that impact heavily on industries such as the construction industry, which in turn uses unskilled labor intensively.

Figure 5.15:   Percentage Change in the Demand for Semi- and Unskilled Labor When Zero-rating Financial Services While Increasing Direct Taxes

Source: CGE Simulations

When zero-rating financial services while increasing direct taxes to absorb the loss in revenue, all industries experience an expansion in domestic activity. However, the demand for semi- and unskilled labor in the financial service industry now only increased with 0.47 due to the lower increase in consumption. As there is no decline in investment demand, all industries benefit from zero-rating financial services.

The changes in the demand for semi- and unskilled labor, combined with the changes in the wage of high-skilled labor and the rental price of capital, result in changes in factor income. Table 5.9 shows the change in factor income under both simulations:

Table 5.9:   The Change in Factor Income when Zero-rating Financial Services

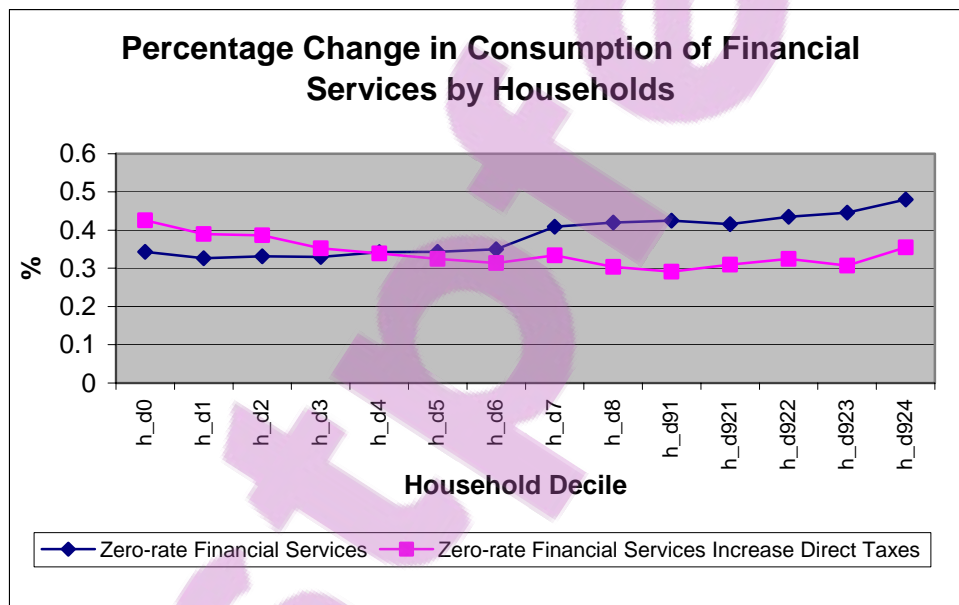|	BASE	ZERO RATE FINANCIAL SERVICES	ZERO RATE FINANCIAL SERVICES INCREASE DIRECT TAXES
Capital	458.493	0.13	0.15
High-skilled Labor	144.475	0.10	0.09
Semi-skilled Labor	179.576	0.05	0.03
Unskilled Labor	133.905	-0.04	0.02

Source: BASE SA SAM 2003

CGE Simulations

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When zero-rating financial services without a revenue replacement strategy factor income of capital will increase most, followed by high-skilled labor. Factor income of semi-skilled labor increases with 0.05 percent, while factor income of unskilled labor declines with 0.04 percent due to overall decline in the demand for unskilled labor. When zero-rating financial services while increasing direct taxes to absorb the loss in revenue, factor income of all factors increase. Again capital, followed by high-skilled labor, sees the largest increase in factor income. Factor income of semi- and unskilled labor increases with 0.03 and 0.02 percent respectively.

Zero-rating financial services may also possibly make it more accessible to poor households. Figure 5.16 shows the change in consumption of financial services by the household deciles:

Figure 5.16   Consumption of Financial Services When Zero-rating Financial Services
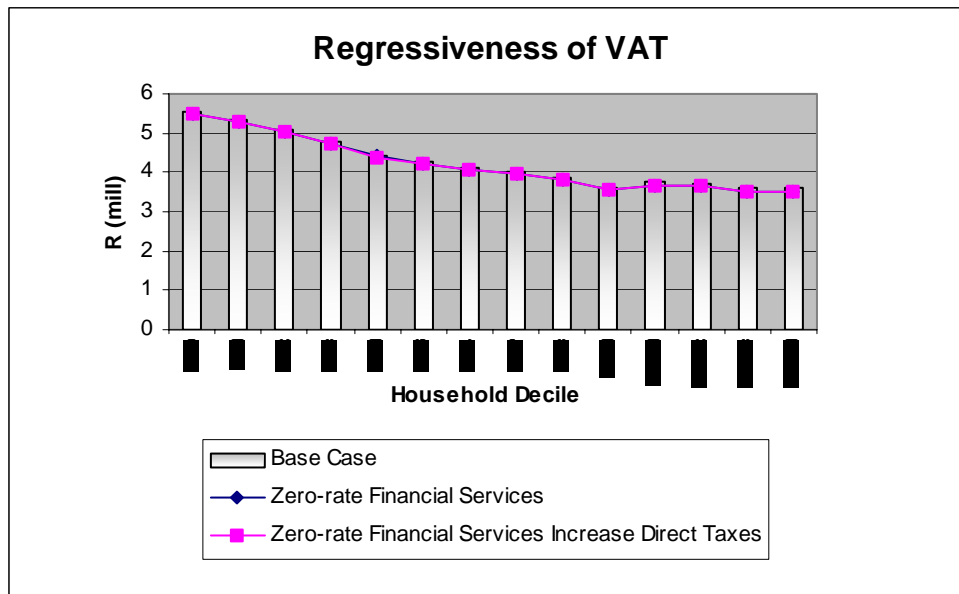

Source: CGE Simulations

Zero-rating financial services leads to an increase in the consumption thereof by all households. However, zero-rating financial services without a revenue replacement strategy benefits higher income groups more, as their consumption of financial services increases with more. When using direct taxes as a revenue replacement strategy the

consumption of financial services of poor households increases with relatively more. The consumption of financial services by high-income households is now constrained by the increase in direct taxes to replace the loss in revenue.

Zero-rating financial services is likely to increase the regressiveness of VAT, as high-income households spend a larger portion of their income (around six percent) on financial services, compared to poor households which only spend around two percent on financial services. As may be seen from figure 5.17, zero-rating financial services increases the regressiveness of VAT to a small degree. However, when zero-rating VAT, while increasing the direct tax rate, the overall progressiveness of the tax structure should be maintained. Figure 5.18 shows the progressiveness of the complete tax structure.

Figure 5.17:   Changes in the Regressiveness of VAT When Zero-rating Financial Services
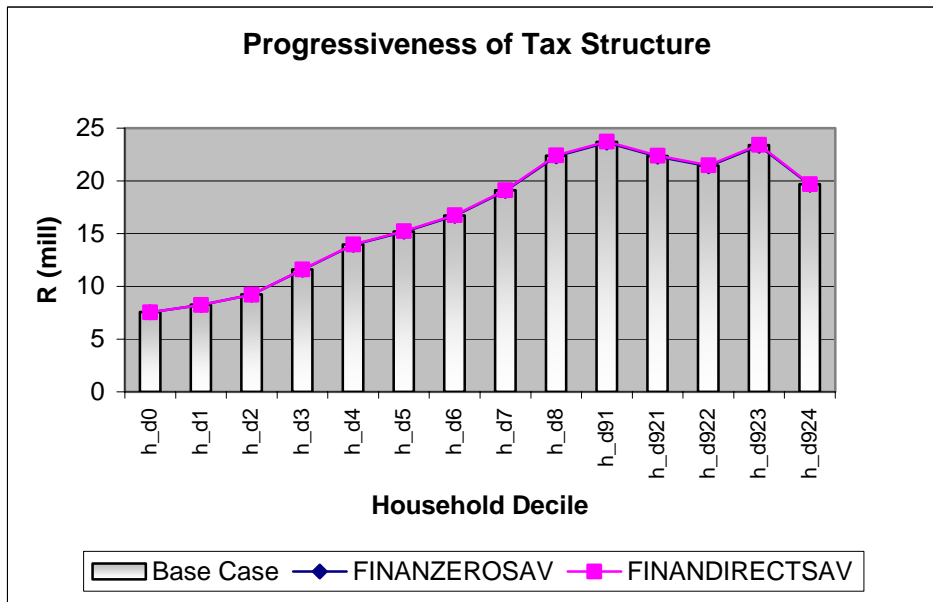

Source: BASE SA SAM 2003
            CGE Simulations

Zero-rating financial services, while increasing direct taxes, implies that one source of tax revenue is merely replaced with another and therefore the progressiveness of the complete tax structure is maintained.

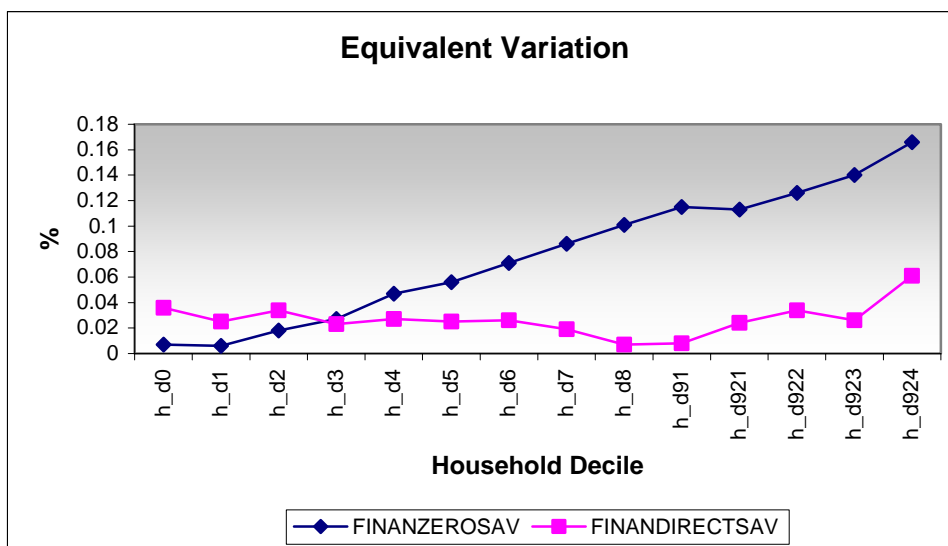*Figure 5.18:   Changes in the Progressiveness of the Tax Structure When Zero-rating Financial Services*

Source: BASE SA SAM 2003

CGE Simulations

Lastly figure 5.19 gives an indication of the overall welfare impact of zero-rating financial services.

Figure 5.19:   Equivalent Variation When Zero-rating Financial Services

Source: BASE SA SAM 2003

CGE Simulations

Zero-rating financial services leads to an overall welfare improvement of all households. High-income households benefit more: firstly high income households derive most of their income from high-skilled labor and capital which increased most when zero-rating financial services, and secondly high income households consume a larger share of financial services. Zero-rating financial services, while increasing direct taxes, results in a higher welfare improvement for low-income households, as they experience an increase in factor income. Middle- and high-income earners do not benefit to the same extent as before as they are constrained by the increase in taxes. However, all households still experience an improvement in welfare.

5.7.   What the Model Does Not Say

Zero-rating commodities, or increasing the VAT rate of selected commodities means differential VAT rates to certain commodities or industries. Applying differential VAT rates may contribute to the operational cost of VAT (as seen from chapter two). There are two types of operational costs associated to any type of tax, namely the administrative costs incurred by the tax authorities, and the compliance costs incurred by the taxpayers. (Ebrill et al,2001:53). Administrative cost is the cost associated with operating and enforcing such a tax system. (Cnossen,1994:1609). For instance, increasing VAT on the business services industry would mean that inputs in that industry (of other products) are credited at a different rate. This complicates the record keeping process. Administrative cost also increases, as the audit process gets more complicated. The model at this point in time does not capture the administrative and compliance cost associated with a certain tax scheme.   The model at this point, however, captures the results of applying differential rates on the economy.

5.8   Summary

This chapter investigated three possible ways in which the VAT structure of South Africa may be restructured, namely (a) the possibility of lowering the VAT rate from 14 to 12.6 percent to achieve the set targets of GEAR, (b) zero-rating food as a poverty reduction

strategy, and (c) zero-rating financial services (a service industry using semi-skilled labor intensively) to create employment. The standard CGE model developed by Löfgren et al (2001) was used, however the model was adapted to include more commodity taxes specific to the South African economy, and to include a statutory VAT rate. The data used for the model is the South African SAM, based on 2001 data. The SAM was commissioned by the World Bank and developed by Claude Van Der Merwe of Quantec. Gibson (2003) estimated the Armington trade elasticities for 43 industries within South Africa. These elasticities form the core of the elasticities used within the model. Other elasticities were obtained from the IDC (1997), the CGE model of Lewis (2001) and the CGE model of Thurlow and Van Seventer (2002). A number of instruments were included within the model to measure the impact of VAT on the welfare of households. The instruments included are the regressiveness of VAT, the progressiveness of the complete tax structure, the distribution of income through a set of Gini coefficients, and the overall impact of welfare, using an equivalent variation calculation. The model also captures the incidence of VAT, the price distortions imposed and the burden of the tax. The CGE model includes a large set of variables, which also show the effect of VAT.

Reducing the statutory VAT rate from 14 percent to 12.6 percent results in a decrease in GDP of 0.12 percent. The decline in GDP is associated with an increase in consumption of 0.5 percent due to lower prices. Investment however declines with 1.39 percent, mainly due to the assumptions of the model. Lowering VAT results in a decline in prices, which in turn will lead to an increase in imports. To maintain the fixed foreign trade balance assumed, exports increase accordingly; this is achieved by an appreciation of the real exchange rate of 0.1 percent. Industries which benefit from lowering VAT are industries selling mainly to households, for example agriculture, food, textiles, beverages and tobacco, apparel, footwear, and most service industries. Industries that do not benefit are industries that sell mostly to investment; the construction industry is most severely affected. Due to the changes in industry activity, employment of semi-and unskilled labor also changes – employment of unskilled and semi-skilled labor increases with 0.26 percent and 0.4 percent respectively. However, because the wages of unskilled and semi-skilled labor are fixed at real wage levels, factor income of semi-skilled labor is

unchanged while the factor income of unskilled labor shows a decline. The factor income of capital and high-skilled labor increases. The welfare effect of the lower prices still outweighs the income effect to generate an overall increase in welfare for all households, with high-income households experiencing the largest welfare gains. It seems that lowering the VAT rate may generate growth and employment, however the redistribution impact is under question as high-income households benefit to the largest extent from lowering the VAT rate.

Zero-rating food is not expected to have any significant effect on a macroeconomic level. Zero-rating food without a revenue replacement strategy resulted in an increase in GDP of 0.11 percent. This increase in GDP is due to a relatively large increase in consumption of 0.64 percent. Investment again decreases to counterbalance the increase in consumption (with 1.92 percent). Zero-rating food without a revenue replacement strategy results in a decline in imports, due to the larger import content of investment; this is followed by a decline in exports, which again is achieved by an appreciation of the exchange rate. Zero-rating food, while increasing direct taxes, resulted in a slightly larger increase in GDP of 0.16 percent. The change in GDP is associated with a relatively smaller increase in consumption combined with a relatively smaller decline in investment. Consumption is constrained due to the increase in direct taxes. Investment did not decline as much as the increase in direct taxes kept government savings unchanged. The impact on imports and exports when zero-rating food, while increasing direct taxes, are not significant. When zero-rating food while increasing VAT on business services GDP only increases with 0.07 percent. Consumption showed the smallest increase for this simulation, while investment declined to a larger extent than when direct taxes were increased. This is because investment demand is also negatively impacted by the increase in the price of business services. Again the effect on import and exports is not significant.

Zero-rating food without a revenue replacement strategy will lead to a decline in the composite price of food. The actual decline in food prices is smaller than expected. The following are possible reasons: lower food prices result in an increase in demand which

would drive prices upward, and lower food prices create a large increase in food imports (which is facilitated by the appreciation of the exchange rate). An offsetting factor is the fact that food is also used as an intermediate in the production of food itself; this would lead to a larger than expected decline in food prices. The net effect is a decline in the composite price of food of 4.13 percent. Other industries that benefit from lower food prices are industries that produce commodities used in the production of food, like the agricultural industries, or industries that use food as an intermediate in their production processes - the leather industry is an example. Industries that sell mostly to households also benefit, as well as industries that import. Industries that sell mostly to investment do not benefit from zero-rating food. When zero-rating food without a revenue replacement strategy, factor income of semi-skilled and unskilled labor, declines. There is still an overall welfare improvement for all households as the decline in the prices of food outweighs the employment effect; poor households experience the largest welfare improvement.   When zero-rating food while increasing direct taxes high income households experience a welfare decline. The welfare decline of high-income households is the largest when VAT on business services is increased. Zero-rating food may give immediate poverty relief, especially if combined with an increase in direct taxes. This will also effectively turn a regressive VAT into a progressive VAT, and at the same time improve the overall progressiveness of the tax structure.

The financial services industry use semi-skilled labor intensively (22.3 percent of total factor use). Zero-rating financial services may possibly generate employment of semi-skilled labor. The reasoning is as follows: lowering the VAT on financial services will result in a decline of the composite price thereof, which, in turn, will lead to an increase in the demand for financial services. Domestic supply of financial services will increase, increasing the need for semi-skilled labor. The results of the simulations performed showed that zero-rating financial services indeed resulted in an increase in employment – employment of semi-skilled labor increased with 0.05 percent. Factor income for all factors increased, except for the unskilled category. However, zero-rating financial services increased the regressiveness of VAT, as high-income groups use financial services more intensively. Zero-rating financial services without a revenue replacement

strategy, also generates the largest welfare gains for high-income households. When direct taxes are increased to absorb the loss in revenue due to the zero-rating of financial services, the welfare gains are equally spread among all households as one tax is replaced by another. Therefore zero-rating financial services may create employment for the labor category most intensively used (in this case semi-skilled labor). The negative impact on redistribution may be reduced by an increase in direct taxes. Zero-rating financial services also make them more accessible to poor households.

Chapter 6

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1.   Summary

Poverty, inequality and unemployment are realities within the South African economy, and policy intervention is called for. One policy intervention strategy is restructuring VAT. Lowering the statutory VAT rate may possibly give poverty relief as the VAT burden is reduced. Zero-rating food, a commodity used relatively more intensively by poor households, may also possibly alleviate poverty and at the same time improve the regressiveness of VAT. This will result in a more equitable tax structure, as the overall progressiveness of the tax structure is improved. Restructuring VAT by zero-rating labor-intensive service industries may possibly alleviate unemployment.   An attempt to answer the questions on how these changes in the VAT structure would impact on the economy is answered below.

VAT was introduced in South Africa in 1991 to replace GST. VAT is an indirect tax and is levied on the value added in production during the different stages of production. VAT in South Africa is a consumption-based tax, as the tax burden rests with the consumer. VAT in South Africa is levied at the place of destination. This means that exports are excluded from VAT, while imports are taxed.   In South Africa VAT liability is computed, using the invoice method. The invoice method charges VAT on outputs, while credits are given on inputs. The person or business liable for VAT must provide invoices as proof of inputs. Other methods available are the subtraction and cash flow methods. Furthermore, in South Africa various products and firms are excluded from VAT. Certain food items consumed mostly by poor households are excluded: maize, brown bread, samp, paraffin, etc. Small firms are also excluded from VAT; firms realizing a turnover of less than R300 000 per year are not required to register as a VAT payer. Certain services provided within the financial sector are also excluded, as it is difficult to determine a transaction value for these services. However, the financial

service sector is not excluded in full. South Africa uses a single-rate VAT system (14 percent from 1993) unless items are zero-rated or excluded.

Evaluating VAT over the period 1991 to 2001 showed that VAT is an important revenue source for government; it is the second largest revenue source next to income taxes and contributes up to 25 percent of total tax receipts. The government sees VAT as a broad-based revenue source, since 1994 the C-efficiency ratio was above 100 percent, showing that the VAT base is relatively broad, and is steadily increasing. However, VAT is still mildly regressive, even taking the initial zero-rating into account. Poor households spend up to 3.5 percent of their income on VAT, compared to high-income households who only spend 2.5 percent of their income on VAT.

Restructuring VAT may possibly achieve the strategies set by GEAR, namely growth employment, and redistribution. The issues to consider with their expected effect are listed below:

- The government lowered the direct tax rate for the last two budget years (2003 and 2002) as an expansionary measure. The alternative of lowering the statutory VAT rate needs to be investigated. The question whether or not a reduction in the VAT rate may achieve the strategies set by GEAR needs to be answered.
- Poor households face severe poverty. Zero-rating food, a commodity used most intensively by poor households, may possibly give immediate poverty relief. Furthermore VAT is still mildly regressive, and zero-rating food may possibly reduce the regressiveness of VAT. The loss in revenue, due to the zero-rating of food, needs to be absorbed by alternative sources. The effect of zero-rating food and the use of alternative sources on welfare and tax efficiency, need to be investigated.
- The possibility of applying zero-rating to labor-intensive industries with the aim to create jobs needs to be investigated as well. The financial service industry uses semi-skilled labor intensively, and zero-rating this industry may possibly generate employment. Again the loss in revenue needs to be absorbed by

alternative sources. The effect of zero-rating labor-intensive industries and the use of alternative sources on employment, welfare and tax efficiency, need to be investigated.

A CGE model is used to analyze the effect of changes in VAT on the economy. CGE models are highly suited to show the impact of VAT changes on distribution and welfare. CGE models incorporate consumer and producer behavior, as well as the interaction between other economic agents and therefore incorporate all effects on the distribution of income and economic welfare. The standardized CGE model discussed in chapter four is used to analyze the VAT issues discussed above. However, the standardized model developed by Löfgren et al (2001) does not include more than one commodity tax, and for the purpose of this analysis it is necessary to do so, as there are more than one category of commodity taxes in the South African tax system. The model was expanded to include VAT, fuel levies, excise duties, and other taxes on production.

The SA SAM commissioned by the World Bank in 2002/2003 is used as the main data source. The SA SAM is based on 2001 data and was compiled from a large number of data sources, as may be seen in chapter five. A combination of elasticities obtained from Gibson (2003), the IDC (1997), the South African CGE model of Lewis (2001), as well as the South African CGE model of Thurlow and Van Seventer (2002) are used in the CGE model. The elasticities are discussed in chapter six. The other parameters will be calibrated within the CGE model to balance and configure the model.

The following simulations were performed:

(1)   Lowering the VAT rate from 14 to 12.6 percent.
(2)   Zero-rating food. Food was first zero-rated without a revenue replacement strategy to see the impact on government savings and the rest of the economy. Secondly food was zero-rated while increasing direct taxes proportionately, and thirdly while increasing VAT on business services to absorb the loss in revenue. High-income households use business services most intensively.

(3)   Firstly, financial services were zero-rated without a revenue replacement strategy, and then secondly financial services were zero-rated while increasing direct taxes proportionately to absorb the loss in revenue.

6.2.   Conclusions and Recommendations

In conclusion:

- Lowering the statutory VAT rate may generate growth and employment. However, lowering the VAT rate would result in a more inequitable redistribution of income and wealth. Lowering the VAT should be considered in combination with a revenue replacement strategy, such as an increase in direct taxes, to maintain the progressiveness of the tax structure and therefore equality.

- Zero-rating food may give immediate poverty relief, as there is a positive welfare effect. Zero-rating food should be accompanied by an increase in direct taxes to prevent government revenue from falling. The employment effects (through a decline in investment) are less severe when government savings remain constant. Increasing direct taxes will also improve the progressiveness of the tax structure.

- Zero-rating financial services led to an increase in the employment of semi-skilled labor. When zero-rating financial services while increasing direct taxes, an increase in factor income was experienced by all factors. However, zero-rating financial services will increase the regressiveness of the VAT structure, as high-income households spend the largest portion of their income on financial services. At the same time, combining zero-rating financial services with an increase in direct taxes, may maintain the progressiveness of the complete tax structure. Zero-rating financial services may also make them more accessible to poor households.

Factors that were not considered in the model are the administrative and compliance cost aspects associated with restructuring VAT or applying differential VAT rates. These however would require comprehensive surveys of registered VAT payers. Future

research may seek to obtain data on collection and compliance cost to include these aspects in the model.

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