

11.P

Southern Africa

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11.P.1 Introduction

The GTAP project attaches high priority to improving its coverage of Africa. Contributing to this goal, the Version 5 data base has an improved treatment of southern Africa.

GTAP 4 (1995) distinguished 2 southern Africa regions:

- SAB (South African Customs Union) comprising: Botswana, Lesotho, Namibia, South Africa, Swaziland.
- RSA (Rest of Southern Africa) comprising: Angola, Malawi, Mauritius, Mozambique, Tanzania, Zambia, Zimbabwe.

GTAP 5 (1997) distinguishes 8 southern Africa regions:

- BWA Botswana
- XSC (Rest of South African Customs Union) comprising: Lesotho, Namibia, South Africa, Swaziland
- MWI Malawi
- MOZ Mozambique
- TZA Tanzania
- ZMB Zambia
- ZWE Zimbabwe
- XSF (Other Southern Africa) comprising: Angola, Mauritius

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Although we have sought the best available data, not much of the raw data that has been used is of high quality. Nevertheless, it constitutes a substantial improvement on previous versions of the GTAP data base, not least because of the additional regional detail.

GTAP users with a special interest in Southern Africa will want to work at a level of aggregation which is more or less supported by the level of commodity detail in the original source data (see Tables 11.P.A1 to 11.P.A7). For example, even though version 5 of the GTAP data base distinguishes between *Insurance* (*isr*) and *Other Financial Services* (*ofi*), these 2 sectors are combined in all the raw data sources for Southern Africa. For GTAP, they have been split using default shares. It would be a mistake, therefore, to treat the GTAP database proportions of these 2 commodities as authoritative for Southern Africa. A suggested commodity aggregation for Southern Africa GTAP use is provided in table 11.P.A8.

11.P.2 Data Sources

The original sources of country data are summarized in table 11.P.1. Details of particular sources follow.

Table 11.P.1 Overview of Data Sources

Code	Description	Source	Year	Currency Unit	No of sectors
BWA	Botswana	McDonald	1993/4	Pula million (2.7P/\$)	54
MWI	Malawi	MERRISA/Wobst	1994	million Kwacha (8.74=1\$US)	43
MOZ	Mozambique	MERRISA/Arndt et al	1995	Metical (Mt) (1994 Mt/\$ = 5918 [Arndt] or 9024 [CIA])	41
SAB	South Africa, Lesotho, Swaziland.	IDC	1995	million rand (3.63=1\$US)	99
TZA	Tanzania	MERRISA/Wobst	1992	(with Tanzanian Shilling (510 76 I-O) TShs = 1 US\$, 1994)	56
ZMB	Zambia	MERRISA/Hausner	1995	Million Zambian Kwacha (857 ZK=1\$ 1995)	27
ZWE	Zimbabwe	MERRISA/Thomas, Bautista	1991	million Zimbabwean \$ (8.15Z\$=1US\$, 1994)	27
XSF	Angola, Mauritius, Namibia	no data: residual category			
	Supplementary Southern Africa Trade Data	David Evans			38 (no services)

MERRISA

Data bases for Mozambique, Tanzania, Zambia, Zimbabwe and Malawi have been created as part of the work of the Macroeconomic Reforms and Regional Integration in Southern Africa (MERRISA) project, organized through the Trade and Macroeconomics Division of IFPRI. The MERRISA project, led by Sherman Robinson, brought together collaborators from several institutions, and was funded by DANIDA (Denmark) and GTZ (Germany). We are grateful to IFPRI for allowing us to draw on their data. More details of the MERRISA project may be found at:

<http://www.ifpri.cgiar.org/themes/mp12/merrisa.htm>

The MERRISA contributors were not able to draw upon recent, comprehensive input-output tables: none are available. They were forced to draw together data from a variety of sources. Their large input of judgment and local knowledge at once underlies both the unique value of their data -- and its weaknesses.

The MERRISA tables have several distinctive features:

- Peasant agricultural production for own use appears both as a labor input and as a sale to household consumption. We retained this feature (which has the effect of increasing GDP in a largely subsistence economy).
- For each good, trade and transport margins on imports, exports and locally-used domestic goods are distinguished. Since GTAP does not support domestic margins, we treated these margins as direct sales, except for export margins, which were treated as an input to the industry producing the good concerned.
- For each good, data on imports is aggregated over all users. So user-specific import/domestic shares cannot be deduced.

In the SAM tradition, there are multiple households and occupations, and full tracking of domestic income transfers. Not much of these survives the translation to the GTAP data format -- except for the skilled/unskilled labor ratios.

Tables 11.P.A1 to 11.P.A7 in the Appendix show the commodities originally distinguished in the MERRISA SAMs. They all have a fairly detailed breakdown of agriculture; some have fair detail within manufacturing; all have a coarse aggregation of the service industries.

Botswana

A SAM for Botswana was prepared by Scott McDonald of the University of Sheffield. It is similar in structure and spirit to the MERRISA SAMs.

South Africa

For South Africa, we made use of the data base prepared by the IDC for their IDCGEM general equilibrium model of South Africa. This is a large and sophisticated model; its raw database is 10 times as large as the largest MERRISA table (Tanzania). There is a fully disaggregated (by user) treatment of import usage, commodity taxes, and trade and transport margins. The IDC data is however less detailed than the MERRISA data in two respects:

- Peasant agricultural production for own use is ignored (probably not such a big problem in South Africa, where proletarianization is far advanced).
- There is but one agricultural commodity. We had to use supplementary data to split this single sector into the GTAP agricultural sectors.

11.P.3 Single Country Data Processing

A series of GEMPACK programs was used to convert original data for each country to the required GTAP format. Each dataset was first processed by a program specific to that country. This imposed a common format on all datasets. Subsequent programs were the same for all countries. The table below shows the roles of the programs, using file names for the case of Tanzania.

Table 11.P.2 Stages in Processing Single-country Data

Stage	Program	Input	Output	Tasks
1	tza1.tab	tzaraw.har	tza1.har	converts flows to 6 matrices: USEDOM, USEIMP: flows at basic values, by good and user TAXDOM, TAXIMP: commodity tax on above OTHCOST: production tax and factor payments TARIFF: tariff revenue
2	common1.tab	tza1.har	tza2.har	converts country units to US dollars * scales all flows in accordance with GDP growth rate * removes inappropriate tiny negative flows * makes small adjustments to factor payments
3	common2.tab	tza2.har	tza3.har	use mapping matrices MAPDOM, MAPIMP, AND MAPEXP to convert to GTAP sectoral classification
4	common3.tab	tza3.har	tza4.har	convert to GTAP format and write diagnostic and summary data

Stage 1 was mainly concerned with converting the diverse original formats to a common form. Several of the MERISSA tables allowed for a single commodity to be produced by two industries (for example, large and small-scale agriculture). We consolidated activities and commodities so that there was a one-to-one correspondence between the two. Except for the South African table, commodity

taxes and imports were originally specified as vectors. We used simple pro-rating assumptions to differentiate these by user.

Stage 2 used exchange rate and GDP data from IMF International Financial Statistics to (a) convert each table to US dollars, and (b) uniformly inflate all flows according the growth in GDP (as estimated by IMF) between the data collection year and the target year (1997). Some figures from this calculation are shown in columns 1 to 6 of the table 11.P.3. Column 3 shows GDP according to the original data. Column 7 shows how well this accorded with the IMF estimate for the same year. Column 2 shows what share of GDP was imputed from the consumption of family-produced food. Column 5 shows the IMF year-average exchange rate for the data year. Column 6 is ratio of [1997 US\$ GDP]/[Data Year US\$ GDP] drawn from the IMF data, or imposed if the IMF figures seemed implausible (Malawi, Mozambique, Tanzania). Columns 5, 6 and 3 are used to derive column 4, the estimate of 1997 US\$ GDP.

Table 11.P.3 GDP Comparisons

Code	Description	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Data Year	Share of Own Consumption in GDP	GDP Orig Local Currency	GDP New 1997 \$US	Exchange Rate	US\$ GDP MERRISA/ Growth	GDP Ratio IMF
BWA	Botswana	1993/4	0.00	11308	5021	2.680	1.19	1.017409
MWI	Malawi	1994	0.06	10216	1519	8.740	1.30	0.989562
MO	Mozambique	1995	0.19	172	2098	0.090	1.10	1.272169
Z								
SAB	South Africa etc	1995	0.00	503491	135543	3.630	0.98	0.918612
TZA	Tanzania	1992	0.17	1575	7802	0.298	1.50	1.131496
ZMB	Zambia	1995	0.15	2998322	3922	864.000	1.13	1.000107
ZWE	Zimbabwe	1991	0.02	29623	8370	3.450	0.97	1.000001

In Stage 3, data was mapped from the original number of commodities (27 for Zambia) to the 57-commodity GTAP classification. For each country, a matrix size 27 x 57 (for Zambia) was constructed showing, for domestically produced and domestically consumed goods, what share of the original good fell into each GTAP category. The nonzero elements of such a matrix are shown, for Zambia, in the final column of the table 11.P.A1 in the Appendix. For example, we allocated 100% of the original commodity CMAI (maize) to the GTAP commodity gro (cereal grains), 66% of the original CLIV (livestock) industry to the GTAP ctl (cattle) sector. Every GTAP sector was mapped to by at least one original sector.

Similar or identical matrices were also constructed for export and import usage. The domestic and export mappings were then used to calculate corresponding production mapping matrices used to split I-O table columns (industry costs). The production mappings for each region are shown in tables 11.P.A1 to 11.P.A7. There are two sources for the numerical values of these mappings. The first was used in the important case of South African agriculture. Ezra Steenkamp of the National

Department of Agriculture kindly supplied figures for South Africa production, imports and exports of each GTAP agricultural commodity. These were used to derive weights for the mapping matrices for South African agriculture.

The other source was a table of Mozambique imports, exports and production for 183 sectors (part of the inputs to the MERRISA Mozambique SAM). This was supplied by Channing Arndt, who helpfully translated the Portuguese labels. The table was mapped to 57 GTAP sectors and then used to derive weights for the mapping matrices for all commodities which needed splitting in all non-South African regions, and for South African non-agriculture.

The above sources were sufficient to, for example, break out cattle/sheep (ctl) and pigs/poultry (oap) from the South African agriculture industry, but not sufficient to recognize that cattle/sheep are used disproportionately by the beef/mutton industry (cmt) and pigs/poultry by the other meat (omt) industry. To capture this sort of technological detail, we constructed a one-region whole-world input-output data base using the GTAP 4 data base (expanded to 57 sectors). For South Africa, we scaled this I-O table so that it matched our South African control totals for the imports, exports and production of each of the 57 GTAP sectors. The resulting table also entered into our splitting procedure, as follows:

$$U_{iu} = \sum_{cv} [M_{ci} N_{vu} W_{iu} / Q_{cv}] B_{cv}$$

Here, U_{iu} is the domestic use matrix which we seek to make; B_{cv} is the original use matrix. Index i runs over the 57 GTAP commodities, while u runs over the 57 industries plus final demand categories. Indices c and v represent the goods and users of the original table B . M and N are mapping matrices of the type shown in table 11.P.A1: M maps old to new use of domestic commodities; N maps old to new production sectors. W_{iu} is the corresponding cell in the world I-O table. The denominator Q serves to ensure that cells in the new table U 'add up' to their counterparts in B . It is given by:

$$Q_{cv} = \sum_{iu} [M_{ci} N_{vu} W_{iu}]$$

After converting the original I-O tables to GTAP dimensions in this manner, it was found that small discrepancies between costs and sales of some commodities had been introduced. These were removed by repeatedly scaling industry costs until they added up to sales of the corresponding commodity.

It should be stressed that the rather elaborate procedure just described affects only those sectors of the original SAMs that mapped to more than one GTAP commodity. Furthermore, the majority of cells so generated contain only tiny values -- since they often refer to GTAP sectors which were tiny in these regions and so were not individually distinguished in the original SAMs.

The most important sectors in each regional SAM tend to map completely or overwhelmingly to just one GTAP sector. Thus, sales patterns and input technology for these sectors in the GTAP-dimensional data for that region bear a very close relation to the original SAM.

11.P.4 Trade Flows

The regional I-O tables underlying the GTAP database are contributed by a variety of institutions and individuals. In contrast, the trade flows data (showing sources of imports and destinations of exports) are drawn from a single source: the import and export statistics submitted by most countries to the UN (COMTRADE). Three problems arise:

- The trade data shows each flow twice - both an import and as an export. In practice these will differ, so GTAP must use complicated procedures to reconcile the two.
- Some countries do not report their trade - including, for 1997, Malawi, Mozambique, and Zambia. However, because of the data duplication mentioned in (a), this is only a problem with respect to trade flows between two non-reporting countries. For example, Zambian exports to the USA will likely appear in the COMTRADE records of USA imports.
- Countries joined in a custom union report their trade jointly. For example, our regions Botswana and South Africa are parts of South African Customs Union (*SACU*).

We did not think that the second problem was very serious. As a stylized fact, the southern African regions do not trade much with each other - except that they all trade with South Africa. This might be somewhat less true if we accounted for smuggling and other informal trade, however, we lack the data to do this. Hence we hope that trade data reported by SACU and by the rest of the world would record the great bulk of the trade of all our Southern African regions.

To solve the third problem, we had to split each flow of the COMTRADE data that referred to SACU either as a source or as a destination into 3 parts: showing flows to and from Namibia, Botswana, and South Africa (including Lesotho and Swaziland). And we had to estimate within-SACU trade for each GTAP commodity and similarly split that up into a 3 x 3 matrix.

We performed these splits using shares drawn from a within-SACU trade matrix relating to 1993 which was prepared by David Evans. The Evans matrix distinguishes Namibia, Botswana, and South Africa individually. Although it does not use the GTAP sectoral classification, the fit is good for the main traded commodities. Countries outside southern Africa are represented by a single "ROW" region.

A consequence of our procedure is that source and destination shares for a given commodity that relate to non-SACU sources and destinations will bear a common ratio for both Botswana and South Africa. For example, if for South African minerals, exports to Europe were twice as large as those to China, the same ratio would hold for minerals exported by Botswana.

11.P.5 The Southern Africa Residual Region

We had no I-O data for Angola or Mauritius. These two nations form the residual region within Southern Africa.

War has destroyed most of Angola's economy. The chief tradeable product is oil, which accounts for half of GDP. Much of the once important diamond trade now uses illegal channels.

The island of Mauritius is one the richer countries in the region: with an economy comparable to that of Malaysia or Thailand. Agriculture accounts for 9% of GDP and sugar, tea, flowers and fruit are exported. Export-oriented light industry is the most important sector. Tourism and financial services also provide foreign exchange.

The residual region, comprising these two is represented by a hybrid I-O table, constructed from the I-O tables of other regions with some of the above characteristics. The procedure, performed at the GTAP Center is described in the chapter on construction of composite regions (see chapter 14).

Appendix A

Table 11.P.A1 Commodities of the Original Zambia SAM

No	Code	Description	Mapped to GTAP
1	CMAI	Maize	gro:1.00
2	CSTA	Drought-tolerant staples	ocr:0.61 gro:0.39
3	CGNT	Groundnuts	osd:1.00
4	CSUG	Sugar	c_b:1.00
5	CCOT	Cotton	pfb:1.00
6	CTOB	Tobacco	ocr:1.00
7	CCOF	Coffee	ocr:1.00
8	CWHE	Wheat	wht:1.00
9	CHCR	Horticulture crops	ocr:0.66 v_f:0.34
10	COCR	Other crops	ocr:0.97 pdr:0.03
11	CLIV	Livestock products	wol:0.51 oap:0.39 ctl:0.10 rmk:0.00
12	CFIS	Fisheries	fsh:1.00
13	CFOY	Forestry	for:1.00
14	CMIN	Metal mining	omn:1.00 col:0.00 oil:0.00 gas:0.00
15	CFBT	Food, beverages, and tobacco	ofd:0.53 b_t:0.20 omt:0.10 vol:0.09 cmt:0.03 pcr:0.02 sgr:0.02 mil:0.00
16	CTAG	Textiles and garments	tex:0.52 wap:0.42 lea:0.05
17	CWAF	Wood, furniture, and paper	lum:0.61 ppp:0.39
18	CFER	Fertilizer, pesticides, and basic chemicals	crp:1.00
19	COMA	Other manufactures	nmm:0.52 fmp:0.19 omf:0.16 i_s:0.08 p_c:0.04 nfm:0.02
20	CEAW	Energy	ely:0.67 wtr:0.25 gdt:0.09
21	CCAG	Capital goods	ome:0.41 otn:0.34 ele:0.18 mvh:0.07
22	CCON	Construction	cns:1.00
23	CTSV	Trade and transportation services	trd:0.61 otp:0.25 cmn:0.09 atp:0.04 wtp:0.01
24	CTOU	Tourism	trd:1.00
25	CSER	Other market services	ros:1.00
26	CFIN	Finance	ofi:0.47 obs:0.38 dwe:0.09 isr:0.06
27	CPUB	Public non-market services	osg:1.00

Table 11.P.A2 Commodities of the Original Tanzania SAM

No	Code	Description	Mapped to GTAP
1	CCOTT	Cotton	pfb:1.00
2	CSISA	Sisal	pfb:1.00
3	CTEA	Tea	ocr:1.00
4	CCOFF	Coffee	ocr:1.00
5	CTOBA	Tobacco	ocr:1.00
6	CCASH	Cashew Nuts	v_f:1.00
7	CMAIZ	Maize	gro:1.00
8	CWHEA	Wheat	wht:1.00
9	CPADD	Paddy	pdr:1.00
10	CSORG	Sorghum	gro:1.00
11	COCER	Other Cereals	gro:1.00
12	CBEAN	Beans	v_f:1.00
13	CCASS	Cassava	ocr:1.00
14	CROOT	Other Roots & Tubers	v_f:1.00
15	COILS	Oil Seeds	osd:1.00
16	CSUGA	Sugar	c_b:1.00
17	COHOR	Other Horticulture	ocr:1.00
18	COCRO	Other Crops	ocr:1.00
19	CLIVE	Livestock	oap:0.78 ctl:0.21 rmk:0.01 wol:0.00
20	CFISH	Fishery	fsh:1.00
21	CFOHU	Forestry & Hunting	for:1.00
22	CMINE	Mining	omn:1.00 oil:0.00 gas:0.00 col:0.00
23	CMEAT	Meat & Dairy Prod.	omt:0.75 cmt:0.25
24	CFOOD	Processed Food	ofd:0.83 vol:0.14 sgr:0.02 mil:0.01
25	CGRAI	Grain Mill Products	ofd:0.95 pcr:0.05
26	CBEVT	Beverages	b_t:1.00
27	CTEXT	Textiles nes.	tex:1.00
28	CWEAR	Wearing Apparel	wap:1.00
29	CLEAT	Leather Products	lea:1.00
30	CWOOD	Wood & Wood Prod.	lum:1.00
31	CPAPE	Paper & Printing	ppp:1.00
32	CCHEM	Other Chemicals nes	crp:1.00
33	CFERT	Fertilizer & Pesticides	crp:1.00
34	CFUEL	Petroleum Refineries	p_c:1.00
35	CRUBB	Rubber Products	crp:1.00
36	CPLAS	Plastic Products	crp:1.00
37	CGLAS	Glass Products	nmm:1.00
38	CCEME	Cement, Clay, etc.	nmm:1.00
39	CIRON	Iron & Steel	i_s:0.88 nfm:0.12
40	CFMPR	Manu. of Metal prod.	fmp:1.00
41	CMAEQ	Machinery Equipment	ome:1.00

contd

Table 11.P.A2 Commodities of the Original Tanzania SAM (continued)

No	Code	Description	Mapped to GTAP
42	CELEQ	Electrical Equipment	ome:0.81 ele:0.19
43	CTREQ	Transport Equipment	otn:0.84 mvh:0.16
44	COMAN	Other Manufactures	omf:1.00
45	CELEC	Electricity	ely:1.00 gdt:0.00
46	CWATE	Water	wtr:1.00
47	CCNST	Construction	cns:1.00
48	CTRAD	Wholesale & Retail	trd:1.00
49	CTOUR	Tourism	trd:1.00
50	CHORE	Hotels & Restaurants	trd:1.00
51	CTR_C	Transport & Comm.	otp:0.63 cmn:0.21 atp:0.12 wtp:0.04
52	CFI_I	Financial Institutions	ofi:0.89 isr:0.11
53	CREAL	Real Estate	dwe:1.00
54	CBUSI	Business Services	obs:1.00
55	CPUBA	Public Administration	osg:1.00
56	COSER	Other Services	obs:0.97 ros:0.03

Table 11.P.A3 Commodities of the Original Mozambique SAM

No	Code	Description	Mapped to GTAP
1	CMAIZ	Maize	gro:1.00
2	CRICE	Rice	pdr:1.00
3	CWHEA	Wheat	wht:1.00
4	COGRA	Other grains (sorghum)	gro:1.00
5	CCASS	Cassava	ocr:1.00
6	CBEAN	Beans	ocr:1.00
7	COBFC	Fruit and Veg	v_f:1.00
8	CRCAS	Cashew	v_f:1.00
9	CRCOT	Cotton	pfb:1.00
10	COEXC	Citrus55 Copra32 SugarCane13	v_f:0.67 osd:0.32 c_b:0.02
11	COCRO	Other Crops	ocr:1.00
12	CLIVE	Livestock	oap:0.78 ctl:0.21 rmk:0.01 wol:0.00
13	CFORE	Forestry	for:1.00
14	CFISH	Fishing	fsh:1.00
15	CMINE	Mining (metal clay salt)	omn:1.00 oil:0.00 gas:0.00 col:0.00
16	CGMIL	Cereal Milling Maize45 Rice33 Wheat10	ofd:0.95 pcr:0.05
17	COFPR	Other food Sugar26 bread12 Oils9	ofd:0.70 omt:0.11 vol:0.10 sgr:0.05 cmt:0.04 mil:0.01
18	CBEVT	DrinkSmoke	b_t:1.00
19	CTEXT	Textiles50 Clothing50	tex:0.71 wap:0.29
20	CLEAT	Shoes Leather	lea:1.00
21	CWOOD	Wood products	lum:1.00
22	CPACK	PaperPrint	ppp:1.00
23	CFERT	Fertilizer	crp:1.00
24	CFUEL	Diesel gasoline	p_c:1.00
25	COCHE	Drugs soap tyres	crp:1.00
26	CINXM	Cement glass tiles	nmm:1.00
27	CMETI	Iron and steel prods	i_s:0.84 nfm:0.16
28	CTMEQ	Vehicles36 machines10 radio 8	omf:0.63 otn:0.16 ome:0.14 ele:0.04 mvh:0.03
29	COMAN	Other manuf	fmp:0.66 omf:0.34
30	CELWA	Elec89 and water11	ely:0.79 wtr:0.21 gdt:0.00
31	CCNST	Construction	cns:1.00
32	CRE_H	Rest/hotel	trd:1.00
33	CTR_C	Road39 air21 comms18	otp:0.55 wtp:0.18 cmn:0.16 atp:0.11
34	CFL_I	Banking88 insurance12	ofi:0.89 isr:0.11
35	CDWEL	Dwellings	dwe:1.00
36	CPA_D	Public admin and defence	osg:1.00
37	CEduc	Education	osg:1.00
38	CHEAL	Health	osg:1.00
39	COSER	Other services	obs:0.96 ros:0.04
40	CSPEC	Special programs	osg:1.00
41	CTRAD	Trade	trd:1.00

Table 11.P.A4 Commodities of the Original Zimbabwe SAM

No	Code	Description	Mapped to GTAP
1	CMZ	Maize	gro:1.00
2	CWT	Wheat	wht:1.00
3	COGRN	OtherGrain	gro:0.96 pdr:0.04
4	CHORT	Horticulture	v_f:1.00
5	CCOF	Coffee	ocr:1.00
6	CTEA	Tea	ocr:1.00
7	CGRNT	Groundnuts	osd:1.00
8	CCOT	Cotton	pfb:1.00
9	CSUG	Sugar	c_b:1.00
10	CTOB	Tobacco	ocr:1.00
11	COCRP	OtherCrops	ocr:1.00
12	CCAT	Cattle	ctl:0.97 rnk:0.03
13	COLVK	OtherLivestock	wol:0.50 oap:0.40 ctl:0.10
14	CFISH	Fishery	fsh:1.00
15	CFOR	Forestry	for:1.00
16	CMIN	Mining	omn:1.00 col:0.00 oil:0.00 gas:0.00
17	CGRM	GrainMilling	ofd:1.00
18	COFDP	OtherFoodProcessing	ofd:0.54 b_t:0.20 omt:0.10 vol:0.09 cmt:0.03 pcr:0.02 sgr:0.02 mil:0.00
19	CTEXT	Textiles	tex:1.00
20	COLGT	OtherLightManufacturing	b_t:0.69 lum:0.13 ppp:0.09 wap:0.08 lea:0.01
21	CFERT	FertilizerAgrichem	crp:0.99 p_c:0.01
22	COMAN	OtherMmanufacturing	nmm:0.47 fmp:0.17 omf:0.15 otn:0.09 i_s:0.06 ome:0.02 mvh:0.02 nfm:0.02 ele:0.01
23	CELWA	Elecwater	ely:0.79 wtr:0.21 gdt:0.00
24	CCONS	Construction	cns:1.00
25	CTDTP	TradeTransport	trd:0.61 otp:0.25 cmn:0.09 atp:0.04 wtp:0.01
26	CPUB	PublicServices	osg:0.51 ofi:0.23 obs:0.17 dwe:0.04 isr:0.03 ros:0.02
27	CPRIV	PrivateServices	osg:0.39 obs:0.36 ofi:0.19 dwe:0.03 isr:0.02 ros:0.01

Table 11.P.A5 Commodities of the Original Botswana SAM

No	Code	Description	Mapped to GTAP
1	Cattle	Cattle	ctl:0.97 rmk:0.03
2	OthLivestk	Other Livestock	oap:1.00 wol:0.00
3	FruitVegNuts	Fruit, veg & Nuts	v_f:1.00
4	Cereals	Cereals	gro:0.96 pdr:0.04 wht:0.00
5	OtherAgric	Other Agricultural Produce	ocr:0.61 for:0.22 osd:0.10 fsh:0.04 pfb:0.02 c_b:0.01
6	Diamonds	Diamond Mining	omn:1.00
7	CopperNickel	Copper/Nickel Mining	omn:1.00
8	Coal	Coal Mining	oil:0.33 gas:0.33 col:0.33
9	SandGravel	Sand & Gravel	omn:1.00
10	Cement	Cement	nmm:1.00
11	MeatandProds	Meat & Products	omt:0.83 cmt:0.17
12	DairyProds	Dairy Products	mil:1.00
13	OilsFats	Oils & fats	vol:1.00
14	Flours	Flours	ofd:1.00
15	PrprdFood	Prepared food	ofd:0.79 sgr:0.20 prc:0.00
16	BeerSftDrink	Beer & Soft Drinks	b_t:1.00
17	OtherBev	Other Beverages	b_t:1.00
18	Tobacco	Tobacco	b_t:1.00
19	Textiles	Textiles	tex:1.00
20	ClothesShoes	Clothing & Footwear	wap:0.95 lea:0.05
21	HidesSkins	Hides & Skins	lea:1.00
22	Petroleum	Petroleum	p_c:1.00
23	Chemicals	Chemicals	crp:1.00
24	Plastics	Plastics	crp:1.00
25	WoodandProd	Wood & Products	lum:1.00
26	PaperProd	Paper & Products	ppp:1.00
27	BrickGlass	Bricks, Glass & ceramics	nmm:1.00
28	Metals	Metals	i_s:0.89 nfm:0.11
29	MetalGoods	Metal Goods	fmp:1.00
30	MechEngin	Mechanical Engineering	ome:1.00
31	ElecEngin	Electrical Engineering	ome:0.70 ele:0.30
32	Vehicles	Vehicles	otn:0.84 mvh:0.16
33	OtherManuf	Other manufacturing	omf:1.00
34	Water	Water	wtr:1.00
35	Electricity	Electricity	ely:1.00 gdt:0.00
36	Construction	Construction	cns:1.00
37	TradeMarg	Wholesale & Retail Margins	trd:1.00
38	HotelsRest	Hotels & Restaurants	trd:1.00

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Table 11.P.A5 Commodities of the Original Botswana SAM (continued)

No	Code	Description	Mapped to GTAP
39	RailTrans	Rail Transport	otp:0.90 wtp:0.10
40	RoadTrans	Road Transport	otp:1.00
41	AirTrans	Air Transport	atp:1.00
42	Communicate	Communications	cmn:1.00 42
43	FinceInsure	Finance & Insurance	ofi:0.90 isr:0.10
44	BusServ	Business Services	obs:1.00
45	Rent	Rent	obs:1.00
46	OwnDwell	Ownership of Dwellings	dwe:1.00
47	CentralGov	Central Government	osg:1.00
48	LocalGov	Local Government	osg:1.00
49	Education	Education	osg:1.00
50	HealthPriv	Private Health	osg:1.00
51	HealthSubs	Subsidised Health	osg:1.00
52	DomServ	Domestic Services	ros:1.00
53	PersServ	Personal Services	ros:1.00
54	SodaAsh	Soda Ash	nmm:1.00

Table 11.P.A6 Commodities of the Original South African SAM

No	Code	Description	Mapped to GTAP
1	Agriculture	Agriculture	ctl:0.22 oap:0.15 v_f:0.12 for:0.12 gro:0.09 fsh:0.09 ocr:0.08 rmk:0.05 wht:0.03 c_b:0.03 osd:0.01 wol:0.01 pfb:0.00 pdr:0.00
2	Coal_mining	Coal mining	col:0.98 oil:0.01 gas:0.01
3	Gold_mining	Gold mining	omn:1.00
4	Diamonds	Other mining	omn:1.00
5	Meat_prcs	Meat Processing	cmt:0.80 omt:0.20
6	Dairy_prods	Dairy Products	mil:1.00
7	Veg_canning	Fruit & Vegetable Products	ofd:1.00
8	Fish_prcs	Fish Products	ofd:1.00
9	Oils_fats	Oils & Fats	vol:1.00
10	Grain_millng	Grain Mill Products	ofd:0.95 pcr:0.05
11	Bakery_prods	Bakery Products	ofd:1.00
12	Sugar_refng	Sugar Mills	sgr:1.00
13	Confectionry	Confectionery Products	ofd:1.00
14	Oth_food_prd	Other Food Products	ofd:1.00
15	Animal_feed	Animal Feeds	ofd:1.00
16	Wine_spirits	Distilleries & Wineries	b_t:1.00
17	Malt_liquors	Malt Beverages	b_t:1.00
18	Soft_drinks	Soft Drinks	b_t:1.00
19	Tobacco_prds	Tobacco Products	b_t:1.00
20	Spin_weave	Spinning & Weaving	tex:1.00
21	Textiles_nw	Made-up Textiles	tex:1.00
22	Garment_knit	Garment Knitting Mills	wap:1.00
23	Oth_knitting	Other Knitting Mills	tex:1.00
24	Carpets_rugs	Carpets & Rugs	tex:1.00
25	Cord_rop	Cordage & Rope	tex:1.00
26	Textiles_nec	Other Textiles	tex:1.00
27	Clothing	Clothing	tex:1.00
28	Leather_tan	Tanneries & Leather	lea:1.00
29	Leather_prd	Leather Products	lea:1.00
30	Footwear	Footwear	lea:1.00
31	Wood_prods	Wood & Wood Products	lum:1.00
32	Furniture	Furniture	lum:1.00
33	Pulp_paper	Pulp & Paper	ppp:1.00
34	Paper_cntnrs	Containers	ppp:1.00
35	Oth_paper_pr	Other Paper Products	ppp:1.00
36	Print_pub	Printing & Publishing	ppp:1.00
37	Basic_chem	Basic Chemicals	crp:1.00
38	Fertilizers	Fertilisers	crp:1.00
39	Resins_plast	Resins & Plastics	crp:1.00

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Table 11.P.A6 Commodities of the Original South African SAM (continued)

No	Code	Description	Mapped to GTAP
40	Paints_etc	Paints & Varnishes	crp:1.00
41	Drugs_medicn	Pharmaceutical Products	crp:1.00
42	Soap_cosmetc	Soap & Cosmetics	crp:1.00
43	Oth_chem_prd	Other Chemical Products	crp:1.00
44	Refineries	Petroleum Products	p_c:1.00
45	Tyres_etc	Tyres & Tubes	crp:1.00
46	Oth_rubber	Other Rubber Products	crp:1.00
47	Oth_plastics	Plastic Products	crp:1.00
48	Pottery_etc	Pottery	nmm:1.00
49	Glass_etc	Glass	nmm:1.00
50	Bricks_tiles	Clay Products	nmm:1.00
51	Cement	Cement	nmm:1.00
52	Nnmtl_min_pr	Other Non-Metallic Minerals	nmm:1.00
53	Basic_iron	Iron & Steel	i_s:1.00
54	Nonferr_metl	Non-Ferrous Metals	nfm:1.00
55	Cutlry_hrdwr	Cutlery & Hardware	fmp:1.00
56	Furn_fixturs	Furniture & Fixtures	fmp:1.00
57	Struct_metal	Structural Metal Products	fmp:1.00
58	Oth_metal_pr	Other Metal Products	fmp:1.00
59	Engines_etc	Engines & Turbines	ome:1.00
60	Agriclt_mchn	Agricultural Machinery	ome:1.00
61	Mtlwood_mchn	Woodworking Machinery	ome:1.00
62	Special_mchn	Special Machinery	ome:1.00
63	Office_mchn	Office Machinery	ele:1.00
64	Oth_mchn	Other Machinery	ome:1.00
65	Electrc_mchn	Elec. Industrial Machinery	ome:1.00
66	Radio_tv_equ	Radio, TV & Comm.	ele:1.00
67	Elec_applncs	Electrical Appliances	ome:1.00
68	Oth_elec_eq	Other Electrical Apparatus	ome:1.00
69	Motor_vehicl	Motor Vehicles	mvh:1.00
70	Mot_veh_part	Motor Vehicle Parts	mvh:1.00
71	Railway equip	Railroad Equipment	otn:1.00
72	Oth_trans_eq	Transport Equipment	otn:1.00
73	Jewellery	Jewellery	omf:1.00
74	Oth_manufac	Other Manufacturing	omf:1.00
75	Elec_gas_stm	Electricity	ely:0.95 gdt:0.05
76	Water_supply	Water	wtr:1.00
77	Buildng_cnst	Building Construction	cns:1.00
78	Oth_constrct	Civil Engineering	cns:1.00
79	Trade	Trade	trd:1.00

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Table 11.P.A6 Commodities of the Original South African SAM (continued)

No	Code	Description	Mapped to GTAP
80	Caterng	Catering & Accommodation	trd:1.00
81	Trans	Transport & Storage	otp:0.85 atp:0.10 wtp:0.05
82	Communicaton	Communication	cmn:1.00
83	Fin_insurnce	Finance & Insurance	ofi:0.78 isr:0.22
84	Real_estate	Real Estate	dwe:1.00
85	Businss_srvc	Business Services	obs:1.00
86	Mchn_rent	Equipment Renting	obs:1.00
87	Medical_etc	Health Services	osg:1.00
88	Srvc_prft	Other Profit Services	obs:1.00
89	Srvc_nonprft	Other Non-Profit Services	osg:1.00
90	Goods_nec	Other Goods & Services	obs:1.00
91	Domestic_srv	Domestic Servants	ros:1.00
92	Gov_admin	Gov: General Administration	osg:1.00
93	Gov_defence	Gov: Defence	osg:1.00
94	Gov_police	Gov: Police	osg:1.00
95	Gov_educatn	Gov: Education	osg:1.00
96	Gov_health	Gov: Health	osg:1.00
97	Gov_housing	Gov: Housing	osg:1.00
98	Gov_social	Gov: Social	osg:1.00
99	Gov_other	Gov: Other Services	osg:1.00

Table 11.P.A7 Commodities of the Original Malawi SAM

No	Code	Description	Mapped to GTAP
1	CMAIZE	Maize	gro:1.00
2	CTEA	Tea and Coffee	ocr:1.00
3	CSUGA	Sugar Growing	c_b:1.00
4	CTOBA	Tobacco growing	ocr:1.00
5	CFISH	Fisheries	fsh:1.00
6	CLIVE	Livestock and Poultry	oap:0.78 ctl:0.21 rmk:0.01 wol:0.00
7	CFORE	Forestry	for:1.00
8	COTHA	Other Agriculture	ocr:0.56 v_f:0.30 osd:0.11 pfb:0.02 pdr:0.02 wht:0.00
9	CMINE	Mining	omn:1.00 oil:0.00 gas:0.00 col:0.00
10	CMEAT	Meat products	omt:0.75 cmt:0.25
11	CDAIR	Dairy products	mil:1.00
12	CGRAI	Grain milling	ofd:0.82 vol:0.14 pcr:0.04
13	CBAKE	bakeries	ofd:1.00
14	CSUGP	Sugar production	sgr:1.00
15	CCONF	Confectioneries	ofd:1.00
16	CBEVE	Beverages	b_t:1.00
17	CCIGA	Cigarette manufacturing	b_t:1.00
18	CTEXT	Textiles and wearing apparel	tex:0.66 wap:0.31 lea:0.03
19	CWOOD	Wood products	lum:1.00
20	CFURN	Furniture and fittings	lum:0.57 omf:0.43 22
21	CPAPE	Paper and printing	ppp:1.00
22	CCHEM	Chemicals including fertiliser	crp:0.99 p_c:0.01
23	CSOAP	Soap	crp:1.00
24	CRUBB	Rubber products	crp:1.00
25	CCEME	Non-metallic mineral products	nmn:1.00
26	CMETA	Fabricated metal products	fmp:0.48 omf:0.45 i_s:0.06 nfm:0.01
27	CMACH	Plant and machinery	otn:0.44 ome:0.37 ele:0.10 mvh:0.09
28	CELEC	Electricity and water	ely:0.79 wtr:0.21 gdt:0.00
29	CCNST	Construction	cns:1.00
30	CTRAD	Distribution	trd:1.00
31	CBARS	Bars and restaurants	trd:1.00
32	CHOTE	Hotels and rooming houses	trd:1.00
33	CTELE	Posts and telecommunications	cmn:1.00
34	CPAST	Passenger transport	otp:0.94 wtp:0.06
35	CGOOT	Goods transport	otp:0.94 wtp:0.06
36	CAIRT	Air transport	atp:1.00
37	CCLEA	Clearing and forwarding	otp:1.00
38	CBANK	Banking and insurance	ofi:0.89 isr:0.11
39	CBUSI	Business services	obs:1.00
40	CPUBS	Public services	osg:1.00
41	CGARA	Garages	ros:1.00
42	CDWELL	Ownership of dwellings	dwe:1.00
43	CPERS	Personal and community services	ros:1.00

Appendix B

Suggested Aggregation

Table 11.P.A8 shows some suggested groupings of the GTAP sectors which could be made without losing very much of the information contained in the original data sources for Southern Africa. For example, we suggest that cereals are grouped together because few of the Southern African I-O tables supported GTAP's rice/wheat/other distinction. Again, only some of the original sources distinguished between different types of livestock. Some of the GTAP sectors are absent or tiny in Southern Africa (wol, oil, gas, mil, pcr, gdt) and scarcely deserve separate representation.

The actual choice of which sectors to group will depend very much on the application and on which countries are the focus of attention. Tables 11.P.A1 through 11.P.A7 would provide further guidance.

Table 11.P.A8 Suggested Sectoral Aggregation for Southern African Region

No	Code	Description	Group	No	Code	Description	Group
1	pdr	Paddy rice	cereals	30	lum	Wood products	
2	wht	Wheat	cereals	31	ppp	Paper products, publishing	
3	gro	Cereal grains nec	cereals	32	p_c	Petroleum, coal products	
4	v_f	Vegetables, fruit, nuts		33	crp	Chemical, rubber, plastic products	
5	osd	Oil seeds		34	nmm	Mineral products nec	
6	c_b	Sugar cane, sugar beet		35	i_s	Ferrous metals	
7	pfb	Plant-based fibers		36	nfm	Metals nec	
8	ocr	Crops nec		37	fmp	Metal products	
9	ctl	cattle, sheep and goats, horses	animals	38	mvh	Motor vehicles and parts	TransEquip
10	oap	Animal products nec	animals	39	otn	Transport equipment nec	TransEquip
11	mk	Raw milk	animals	40	ele	Electronic equipment	
12	wol	Wool, silk-worm cocoons	animals	41	ome	Machinery and equipment nec	
13	for	Forestry		42	omf	Manufactures nec	
14	fsh	Fishing		43	ely	Electricity	Utilities
15	col	Coal	fuel mining	44	gdt	Gas manufacture, distribution	Utilities
16	oil	Oil	fuel mining	45	wtr	Water	Utilities
17	gas	Gas	fuel mining	46	cns	Construction	
18	omn	Minerals nec		47	trd	Trade	
19	cmt	beef mutton etc	meat/milk	48	otp	Transport nec	Trans
20	omt	Meat products nec	meat/milk	49	wtp	Water transport	Trans

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Table 11.P.A8 Suggested Sectoral Aggregation for Southern African Region (continued)

No	Code	Description	Group	No	Code	Description	Group
21	vol	Vegetable oils and fats		50	atp	Air transport	Trans
22	mil	Dairy products	meat/milk	51	cmn	Communication	(perhaps joined into Trans)
23	pcr	Processed rice		52	ofi	Financial services nec	Finance
24	sgr	Sugar		53	isr	Insurance	Finance
25	ofd	Food products nec		54	obs	Business services nec	Other Service
26	b_t	Beverages and tobacco products		55	ros	Recreational and other services	Other Service
27	tex	Textiles	TCF	56	osg	Pub admin,defence, education, health	
28	wap	Wearing apparel	TCF	57	dwe	Dwellings	
29	lea	Leather products	TCF				