

BE.1 Abstract

This chapter documents the construction of an Input-Output Table (IOT) for Zimbabwe, 2017. The IOT is structured to be consistent with GTAP IOTs, so that it can be included in the GTAP database.

Although the aim is a GTAP-consistent IOT, we begin by constructing a Social Accounting Matrix (SAM) since the data sources are problematic, as discussed below. The greater consistency requirements of SAMs, particularly between incomes and expenditure, provides more internal validation of the data. We then derive the IOT from this SAM. The base year, 2017, was selected to be consistent with other data in GTAP.

BE.2 Introduction

There have been several Input Output Tables (IOT) and Social Accounting Matrices (SAM) constructed for Zimbabwe. The first were IOTs constructed for 1964 and 1965, published simultaneously in 1966 (CSO, 1966). In 1996, IFPRI published a SAM for 1991 (IFPRI 1996). This SAM was used as the basis for Zimbabwe's inclusion in GTAP. A SAM for 2013 was constructed by Davies, Kwaramba and van Seventer (Davies, et al., 2018). There are also references to a SAM for 2016 constructed by Lofgren and Cicowicz (Lofgren & Cicowicz, 2022).

The 2013 SAM was constructed without benefit of official Supply and Use Tables (S&UT). In addition, while both a Household and a Labour Force Survey (ZimStat, 2013; ZimStat, 2012) had been undertaken, only the published reports giving summary tables were available. The compilation was therefore based on very patchy data from a range of sources. Some of the information was drawn from the 1991 SAM, even though it was recognized that the severe disruption to the economy between 1997 and 2009 created a sharp discontinuity between the two periods. Not only had the economy declined, but its structure changed significantly as domestic production shrank and was replaced by imports. See Davies, Kwaramba and van Seventer (Davies, et al., 2018) for more discussion of data sources and methods used.

After the construction of the 2013 SAM, ZimStat published Supply and Use Tables for 2012 (ZimStat, 2018), and made the anonymized unit records for the Poverty, Income, Consumption and Expenditure Surveys for 2011 (ZimStat, 2013) and 2017 (ZimStat, 2018), and for the Labour Force Surveys for 2011 (ZimStat, 2012), 2014 (ZimStat, 2015) and 2019 (ZimStat, 2020) publicly available. These should provide more official data on which to base the construction of a SAM than has hitherto been available. However, as reported below, anomalies and inconsistencies in these data sources make them less useful than they might appear to be at first sight.

Zimbabwe's hyperinflation played havoc with its data. There are several years—primarily between 2005 and 2009—for which national accounts are either unavailable or are very unreliable.

The United States Dollar (USD) was adopted as the unit of account for most economic data after 2009. The Zimbabwe dollar was reintroduced officially in June 2019. The official exchange rate remained at 1:1 through February 2019, so data were presented in USD up to then. But the market rate had begun to diverge from the official rate for some entities as early as 2016, so the reliability of the data becomes questionable. We believe that this was not significant in 2017, the year for which the SAM is constructed. However, the disruption to the National Accounts and other data caused by the hyperinflation continued to influence the accounts long after the hyperinflationary period was over. In part this was because of the loss of reliable series of data which had been used as the basis for updating.

As we will see, however, the problems with official data do not arise solely from the inflation and divergence between the official and market exchange rate.

BE.3 Approach to constructing the GTAP Input Output Table

Basic method

In broad terms the sequence of steps followed was:

1. We split the agricultural sector in the SUT2012 into 25 sub-sectors, raising the number of sectors from 36 to 60, as explained in paragraph 1 below.
2. We converted S&UT2012 to 2017 using a multiplier model and additional 2017 data, as outlined in Appendix B.
3. We modified SUT2017, based on our perceptions of “errors” in S&UT2012. These changes are outlined in section 3 below.
4. We constructed a preliminary balanced SAM based on this prior SAM.
5. We then split the balanced SAM further, raising the number of activities to 120.
6. We derived a preliminary GTAP-consistent IOT from this disaggregated SAM.
7. We made further adjustments to the disaggregated SAM based on large divergences between the preliminary IOT and comparator IOTs.
8. We derived the final GTAP-consistent IOT from the adjusted SAM

In all these steps, we treated the published estimates of national accounts as controls and adjusted other data to match GDP and its components as closely as possible (see Section 3 below for discussion).

Primary Data Sources

The primary sources of data used are shown in Table 8.125:

Table 8.125: Primary Data Sources

Publisher	Year	Title
ZimStat	2018	Supply and Use Tables for Zimbabwe for the year 2012
ZimStat	2019	Gross Domestic Product 2009-2017 Base Year 2012
ZimStat	2018	Poverty, Income, Consumption and Expenditure 2017 Report
ZimStat	2019	Zimbabwe Poverty Report 2017
ZimStat	2020	2019 Labour Force and Child Labour Survey.
ZimStat	2020	Quarterly Digest of Statistics 2019 Q4
ZimStat	2021	Monthly Summary of External Trade Statistics November 2021
RBZ	2021	Balance of Payments 2020 Q4

We supplemented these official sources with a variety of other data drawn from annual reports of private companies and parastatals, employment councils and the like. These are primarily used to corroborate splits that we need to make to match the GTAP disaggregation.

BE.4 2012 Supply and Use Tables

The 2012 Supply and Use Tables (S&UT2012) (ZimStat, 2018) should provide a basis for construction of SAMs and IOTs. However, the tables contain anomalies, making us dubious about their validity. As an illustration, the Use Table (UT) shows that households are significant purchasers of mineral products such as copper, chrome, and nickel. It suggests more of these mining outputs are sold to households than are exported. That seems implausible and is not confirmed by household surveys. We discuss other anomalies in more detail below.

The S&UT2012 were not constructed as part of the process of estimating Zimbabwe's National Accounts, as recommended by SNA, but as a standalone exercise after the 2012 GDP estimates were published. The GDP and associated estimates for 2012 were not adjusted ex post in light of the S&UT2012. The tables also seem to have been compiled without regard to other data published by ZimStat. Published National Accounts data show GDP at Market Prices for 2012 show as (US)\$17.1bn (ZimStat, 2018) while the 2012 UT shows it as \$15.8bn. Compensation of Employees in the 2012 UT is as \$10.1bn, while a National Accounts publication which includes an Employment Survey, gives annual earnings for that year as \$6.4bn.

The S&UT2012 thus include both internal puzzles and inconsistencies with other ZimStat data. Although it is not clear which of the sources to treat as most accurate, aspects of the S&UT2012 persuade us that mistakes have been made in compiling them. We therefore have either adjusted them or not use them at all. The case for not using them is strong. If there are noticeable errors such as these, what similar but less obvious errors have been made? However, there are no other recent sources that purport to show interindustry flows of products. We therefore start

by adjusting the S&UT2012. To do this we draw on other sources, such as the Quarterly Digest of Statistics (QDS), (ZimStat, 2020).

In addition to the S&UT2012, ZimStat has made anonymized unit record data available for the both the household and the labour force surveys available.

Possible explanations of “errors”

Although this is not the place to review the S&UT2012 fully, we need some idea why the apparent errors arise if we are to adjust them. Appendix D provides an extract from the report on the S&UT2012 listing the sources used by ZimStat in constructing it. Clearly, they were able to draw on more disaggregated data than are published. One can only speculate as to the possible reasons for the errors – if such they be.

- * Parts of the UT seem to record supplies rather than uses. But this is not obviously the case for all parts.
- * Some diagonal entries in the UT suggest the data on off-diagonal inputs were insufficient to get gross output up to the required level of gross domestic supply and that the diagonal has been used as a balancing item.
 - The S&UT2012 contains abridged versions which (almost) reduce the number of commodities to match the number of sectors (34 products and 30 sectors). We estimated the share of each intermediate input in total intermediate inputs for each sector. The diagonal (or block diagonal) entries (i.e. inputs of sectors into themselves) are greater than 50% in all but two of the sectors. 19 of these 29 diagonal entries are greater than 80%. While we expect some sectors to be their own major suppliers (e.g., electricity which combines generation and distribution), we do not expect that to be dominant for all sectors.

National accounts as controls and the MacroSAM

We follow the standard procedure of using the NIPA to construct a MacroSAM which provides control totals at an aggregate level. As already noted, there are puzzles within the NIPA and inconsistencies between NIPA and other data provided by ZimStat.⁹⁴ These suggest the GDP data from NIPA may not be a reliable reflection of their true values in Zimbabwe. This opens the possibility of adjusting NIPA estimates before using them to anchor the micro SAM. However, we do not do this for two primary reasons.

⁹⁴These anomalies include Compensation of Employees derived from labour force surveys being considerably greater than value added for corresponding sectors in the NIPA; implausibly low figures for change in inventories; inconsistencies between wage rates derived from employment data and NIPA data. Such differences are not the normal inconsistencies between survey data and national accounts data we expect to find in all countries.

First, it is useful if the disaggregated numbers that go into the SAM are consistent in aggregate with the published NIPA. These are the numbers that, for better or worse, inform government policy.

Second, making an adjustment in one component of NIPA requires matching adjustments in others. Raising CoE raises GDP as measured by the income approach, requires an adjustment to sector outputs as measured by the output approach and to expenditure components as measured by the expenditure approach. While the CoE may seem self-evidentially wrong and we may have evidence from other sources of how much they might be adjusted by, we have no evidence about which of these other components should be adjusted.

We therefore, as far as is possible, ensure that the SAM we finally derived is consistent with the NIPA. The one respect in which this is not true is in the measure of intermediate goods and consequently the gross output of sectors. Although past published NIPA provided some data on Gross output, there have not been new estimates published for some time. The set of NIPA we use do not give any data on either gross outputs or intermediates. There are data for some sub sectors in mining, manufacturing, and utilities (ZimStat, 2020). As explained in Appendix B, we derive our initial estimates using these sources and past data. However, when we balance the SAM and make ad hoc adjustments to implausible initial coefficients, we allow both to change considerably from their prior estimates.

Splitting Sectors: General Method

There are 36 Sectors and 120 Products represented in the S&UT2012. See Tables 2.11 and 2.12. For some purposes it is useful to split the sectors further. For example, given the importance of agriculture in Zimbabwe, we would ideally have more than one agricultural sector. We discuss below some of the specific splits we make. In broad terms

1. We use the composition of products produced by the parent sector (as given in the ST) to make an initial split of gross output.
2. We use these shares to split the parent account in the UT. This maintains the consistency of the original account but results in all the sub-sectors having the same cost structure.
3. We then make ad hoc adjustments to these shares, based on information from other sources and some judgements. Thus, for example, we assume that tobacco farming delivers inputs only to the tobacco sub-sector of manufacturing and not to, say, rice processing.
4. These ad hoc adjustments result in the expanded UT being inconsistent with the original. The sums of the sub-sector rows match the original rows of the parent sector. However, the gross output of each sub-sector no longer matches the original supply of its product that was used to split the parent account cost in the first place.
 - (a) Note that we use the shares of sub-sector supplies to allocate inputs into the parent sub-sector. An alternative would have been to find other sources of information to allocate

the costs of each sub-sector. This would have resulted in the gross outputs of the sub-sector matching what is in the supply table. But the row sums of the sub-sectors would no longer match the row for the parent sector.

5. We then use a statistical balancing procedure (Cross Entropy) to ensure consistency.

In the initial table the number of sectors is less than the number of products. Sectors thus produce several outputs. That does not present a problem; it is this that allows us to make the initial split. Only three products in the initial table are produced by more than one sector: “P091 Construction Services”, “P094 Accommodation, Food and Beverage Services” and “P108 Imputed Rental of Owner Occupied” are all supplied by “I07 Electricity and Gas” in addition to their principal sectors. However, the shares of this secondary source in total supply are small: 3.4%, 0.3% and 0.4% respectively. We thus ignore them.

Table 8.126 shows the distribution of sectors according to the number of products they supply.⁹⁵

Table 8.126: Distribution of Sectors by number of products supplied

Number of products supplied	Number of sectors	Sectors
1	16	
2	5	
3	5	
4	4	
5	2	Other Mining, Quarrying & Support Services Real Estate, Renting & Business Services
6	1	Electricity & Gas
11	1	Manufacturing of Food, Beverages & Tobacco
12	1	Mining metal ores
26	1	Agriculture, Animal, Hunting & Related Services

Updating the 2012 Supply Use Table

Despite these problems, we began by combining the S&UT2012 into a single SUT. We then used final demands from 2017 in a multiplier model, to generate a 2017 SUT. The method is explained in Appendix B. We then followed an iterative process of adjusting the updated SUT. The following sections give details of the ad hoc adjustments made to the individual sectors.

The original S&UT classifies industries according to ISIC Rev 4 and products according to the CPC Rev2.

⁹⁵ A full description of the sectors and the products they supply is given in Table 8.129.

Individual Accounts

In this section we provide details of how we split the sectors in the S&UT2012 and detail what ad hoc changes we made to some of the recorded flows.

It should be borne in mind that when the share of an input into a sector is reduced explicitly, the shares of all other inputs are increased implicitly.

I01 Agriculture

Pre-splitting adjustments

The original UT shows use of livestock (P022-P025) by “I13 Manufacture of Chemical, Pharmaceutical & Chemical Products”. This seems consistent with our hypothesis that the compilers have confused supplies and uses – it is more likely that pharmaceuticals enter livestock production than vice versa. However, we rather assume that the destination of these was wrong and reassign them to “I09 Manufacture of Food, Beverages & Tobacco “, which implausibly shows no inputs of livestock in the original.

Splitting

In S&UT2012 agriculture is represented as a single activity, producing 25 commodities (see Appendix A). This single activity was disaggregated into the same number of sub-sectors as commodities, using the shares of sub-sector output values in the total value of output of the parent sector. Inputs into the parent sector are allocated to sub-sectors in the same proportions, save that inputs of the 25 commodities into the parent sector are assumed to flow only to the sub-sector producing them. This results in slight variations of the coefficients of inputs into gross output across agricultural sub-sectors.

This disaggregation increases the number of sectors in the original SUT from 36 to 60.

- Raw milk is not listed as a separate agricultural product. It is presumably included in Cattle, as per ISICRev4. According to the QDS, in 2012 the value of milk intake by processors were 18% of the values of cattle slaughtering plus milk intake (ZimStat, 2020). These are shares in manufactured output, not of live animals and raw milk in agriculture. We use that proportion even though we know there is milk and cattle slaughtering that is not done through commercial processors.
- Livestock products are split into “P022 Cattle”, “P023 Goats and Sheep”, “P024 Chickens, live” and “P025 Other Live Animals”.
- ISICRev4 classifies eggs with “0146 Raising of Poultry”

I02 Forestry

No adjustments.

I03 Fishing

No adjustments.

I04 Mining Coal & Lignite

The original UT shows that coal is the biggest input into this sector. We examined company reports for Hwange Colliery, the biggest coal producer in Zimbabwe, and saw no sign of it using coal in its production. Some coal is used for coking, so there may be intra sector transactions (coking is classified within mining of coal). We therefore do not remove it entirely. We therefore halved the purchase of coal by this sector.

I05 Mining Metal Ores

Split into 12 sub-sectors:

- A030 Iron ore
- A031 Copper
- A032 Cobalt
- A033 Chrome
- A034 Iridium
- A035 Nickel
- A036 Platinum
- A037 Rhodium
- A038 Ruthenium
- A039 Precious metals
- A040 Gold
- A041 Palladium

Each is initially assumed to have the same input structure as the parent sector. However, see the discussion in the next sub-section on Other Mining & Quarrying

I06 Other Mining & Quarrying & Support Services

Split into 5 sub-sectors:

- A042 Asbestos
- A043 Graphite
- A044 Phosphate

- A045 Diamonds
- A046 Mining services & other mining

Each is initially assumed to have the same input structure as the parent sector. In aggregate, 41% of mineral products are shown as being used as intermediate inputs in the Mining Industry. 45% are exported and 6.5% is sold to households. Only 1.9% is supplied to Manufacturing.

This results in Mining itself accounting for 53% of total inputs into Mining as is shown below:

Input into Mining Activity	
Mining	53.4%
Manufacturing	4.1%
Electricity	1.1%
Other inputs	0.9%
CoE	31.6%
GOS	4.7%
Mixed	3.9%

These seem implausible. Refining of metals is generally classed as manufacturing (ISI-CRev4 Category 2420). If the refining takes place on the mine, the refined ore will be classified as an output of mining. However, the SUT records transactions, so to show up in the SUT, refining would have to be undertaken by a separate entity from the mine. It does seem that in reality most refining in Zimbabwe take place off the mines' sites.

We would therefore expect most mining output to be purchased by "I14 Manufacture of Base Metals". Although there are some flows, most seem to go into Chemicals. We therefore move the flows from Chemicals to basic metals and other non-metallic metal minerals as appropriate.

I07 Electricity & Gas

Production

Production takes place in I07 Electricity and Gas. According to coal miner Hwange's annual report, in 2015 sales of coal to the Hwange power station accounted for 42% of the revenue. If we apply that to the 2017 Revenue, its sales to that power station would be \$28m in 2015. The UT shows sales of \$24m to electricity in 2012.

Sales

The total value in basic prices of domestic supply of electricity in 2012 was \$2.472bn according to S&UT2012. This seems implausibly high. Imports are \$36.2m. Most electricity is generated by the Zimbabwe Power Corporation (ZPC) and distributed by Zimbabwe Electricity Transmission and Distribution Company (ZETDC). About 3% of electricity is supplied by independent power producers, using hydro and biofuels. ZPC's total revenue from sales of electricity in 2012 was \$408m. (ZPC Annual Reports)

I08 Water

See Section 5 below on adjustments to value added.

I09 Manufacture of Food, Beverages & Tobacco

The single sector “I09 Manufacturing of Food, Beverages and Tobacco” in the S&UT2012 is split into 11 sub-sectors. Inputs are distributed according to product shares, except:

1. Maize is assumed to be delivered to “Grain Mill Products, starches, sugar, other food” (86%) and “Animal Feeds” (14%)
2. “Other cereals” are delivered to the same two sectors in the proportions 99% and 1%.
3. All remaining cereals are assumed to be delivered only to “Grain Milling Products, starches, sugar, other food”.
4. Soya is assumed to be delivered to the same two sectors in the proportions 97% and 3%.
5. Cotton deliveries to “Oils and Fats” and “Animal Feeds” are both raised to 30% and deliveries to other Food sub sectors are reduced proportionately.
6. Sunflowers are assumed to be delivered as inputs into “oils and Fats” (70%) and “Grain Mill Products, starches, sugar and other food” (30%).
7. “Potatoes” and “Sweet Potatoes, Cassava and Yams” are delivered to “Vegetables, dried, chilled, etc” (50%) and “Grain Mill Products, starches, sugar and other food” (50%).
8. “Tea leaves (productive tea)” is delivered entirely to “Other Foods, nec”.
9. “Productive Sugar Cane” is delivered entirely to “Grain Mill Products, starches, sugar and other food”.
10. “Tobacco, Flue Cured, Burley and Oriental” is delivered entirely to “Tobacco Products”.
11. “Fruits, fresh and dried” is delivered to “Preserved or dried fruits and nuts” (80%) and “Beverages” (20%).
12. “Cattle” is delivered to “Meat” (80%) and “Dairy Products and egg products” (20%). This represents the delivery of milk.
13. “Goats & Sheep”, “Chickens, live” and “Other live animals” are all assumed to be delivered entirely to “Meat”.
14. “Fish and other fishing products” are delivered entirely to “Processing of Fish and Fish Products”.

There several minor changes made to items that did not constitute significant inputs into Food, Beverages and Tobacco in the original SUT. As with all other ad hoc changes, the final coefficients after adjusting were also influenced by the statistical balancing procedure.

110 Manufacture of Textiles, Wearing Apparel & Footwear & Leather

Split into 4 sub-sectors.

- A062 Yarn & thread; woven & tufted textile fabrics
- A063 Textile articles other than apparel
- A064 Knitted or crocheted fabrics; wearing apparel
- A065 Leather & leather products; footwear

Input coefficients are the same as the parent sector except as shown in the following table:

Table 8.127: Input Coefficients into Textiles and Clothing

	Yarn & thread; woven & tufted textile fabrics	Textile articles other than apparel	Knitted or crocheted fabrics; wearing apparel	Leather & leather products; footwear
Average Split	17%	29%	32%	22%
Adjusted:				
Cotton	33%	67%		
Knitted or crocheted fabrics; wearing apparel	-	-	67%	33%
Leather & leather products; footwear	-	-	20%	80%

111 Manufacture of Wood & Wood Products

No adjustments.

112 Manufacture of Paper & Paper Products & Printing

No adjustments.

113 Manufacture of Chemical, Pharmaceutical & Chemical Products

This sector produces 5 products:

	Share in product supplied by sector
P068 Coke Oven Products	8%
P069 Basic Chemicals	52%
P070 Other Chemical Products, Man made Fibres	32%
P079 Pharmaceutical Products	9%
P078 Petroleum oils, gases and Bitumen	-

Two adjustments were made:

1. The input of P069 into itself was raised (and into the other sub-sectors were reduced).
2. More significantly, we created an input of “Grain Mill Products, starches, sugar and other food” into “Petroleum Products”, although the original UT shows no such flow. This was to capture the blending of domestically produced ethanol with imported petroleum. The amount was estimated based on the legal requirement that blended fuel contains 15% ethanol, although this amount has varied over the years). This provides a link between sugar cane and petroleum via the refining industry.

I14 Manufacture of Basic Metals

The sector supplies four products:

	Share in product supplied by sector
P071 High Carbon Ferrochrome	18%
P072 Basic Metals	17%
P073 Non-ferrous metals	62%
P074 Other non-ferrous metals	3%

We assumed

1. Iron Ore is delivered to P071 (20%) and P072 (80%)
2. Chrome is delivered to P071 (80%) and P072 (20%)
3. All other metallic outputs of mining are supplied to P073 (90%) and P074 (10%).

I15 Manufacture of Rubber & Plastics Products

No adjustments.

I16 Manufacture of Other Non-Metallic Mineral Products

Split into 3 sub-sectors:

- A076 Glass & other non-metallic products
- A077 Plaster, lime, Cement, concrete, building stone
- A080 Other non-metallic minerals nec

All assumed to have the same input structure as the parent sector.

I17 Manufacture of Furniture & Related Products

No adjustments.

I18 Manufacture of Fabricated Metal Products

No split made but inputs into itself halved. This raised all other coefficients.

I19 Manufacture of Electrical Equipment, Machinery & Equipment

Split into 2 sub-sectors:

- A083 General-purpose machinery, engines & parts & Electrical
- A084 Special-purpose machinery agric or forestry machinery

Both assumed to have the same input structure as the parent sector.

I20 Manufacture of Office & Computing Machinery

No adjustments

I21 Manufacture of Motor Vehicles & Other Transport Equipment & Communication

The sector produces 2 products:

	Share in product supplied by sector
P086 Transport Equipment and Accessories	40%
P087 Radio, Television and Communication Equipment	60%

Inputs of these two products into their split sub-sector were assumed to be primarily into the production of themselves (90%), with only 10% going to the other sub-sector. All other inputs were assumed to be the same as the parent sector.

I22 Other Manufacturing, nec

Split into 2 sub-sectors:

- A088 Manufacturing services on physical inputs owned by others
- A089 Miscellaneous manufactured products

Both assumed to have the same input structure as the parent sector.

I23 Construction of Buildings & Civil Engineering Works The sector supplies 2 products

- A090 Construction
- A091 Construction services

We assumed that some of the inputs – mainly construction materials – into the initial sector are inputs into construction only and reallocated them accordingly:

I24 Wholesale & Repair of Motor Vehicles

Table 8.128: Inputs into Construction Sectors

	A090 Construction	A091 Construction services
Unadjusted Shares	80%	20%
Adjusted Shares:		
P027 Forestry & logging products	100%	
P066 Products of wood, cork, straw & plaiting materials	100%	
P070 Other chemical products; man-made fibres	100%	
P076 Glass & glass products & other non-metallic products nec	100%	
P077 Plaster, lime, Cement, concrete, building stone	100%	
P078 Petroleum oils, gases & bitumen	60%	40%
P082 Fabricated metal products	100%	

No adjustments.

I25 Retail Trade

No adjustments.

I26 Hotels & Restaurants

This sector supplies Accommodation, Food and Service Activities, and is renamed accordingly in the extended SAM. It is not split in the extended SAM. However, diagonal inputs account for 73% of total costs. We reduce them to 35%. This raises the shares of all other inputs proportionately.

I27 Transport Services & Storage

The S&UT2012 has “Transport Services and Storage” producing three products, “Passenger transport services” “Freight services” and “Supporting transport services”. (It is not clear where storage services are accounted for). In the disaggregated SAM, the sector is split into these three sub-sectors. Inputs are split proportionately, except that it is assumed that inputs of each of the two transport services into each other are small.

Table 8.129: Inputs into Transport Services

	A095 Passenger transport services	A096 Freight services	A097 Supporting transport services
Unadjusted Shares	65%	22%	13%
Adjusted shares:			
P095 Passenger transport services	90%	10%	-
P096 Freight transport services	10%	90%	-

I28 Information, Post & Telecommunications

— A098 Postal & courier services & Published materials

- A099 Telecommunications, broadcasting & information supply services
- A100 Support Services for Telecommunications & Information

All assumed to have the same input structure as the parent sector.

I29 Financial Intermediation Services

No adjustments.

I30 Insurance & Pension Services

Split into 4 sub-sectors:

- A103 Life Insurance Services
- A104 Non-Life Insurance Services
- A105 Other Insurance & Auxiliary Services
- A106 Pension Services

All assumed to have same structure as parent sector.

I31 Real Estate Renting & Business Services

Split into 5 sub-sectors:

- A107 Real estate services
- A108 Imputed rental of owner occupied
- A109 Legal & accounting services
- A110 Business Services, Professional, technical, research
- A111 Other professional, business & technical services

Inputs are assumed to be the same as the parent sector, except that A108 is assumed not to deliver any inputs to the other sectors.

I132 Public Administration and Government

In SAMs Government is typically treated as a productive activity (Public Administration) that supplies an output which is mostly bought by Government as an institution. It is useful for us to explain the adjustments we made to each of these jointly.

Public Administration (Government as a producer)

“I32 Public Administration” in S&UT2012 allocates 100% of value added to compensation of employees. Although CoE in government is high, typically in other countries there is some allocation to GOS. There must be some GOS, if only because it includes depreciation of Government assets. We therefore allocate 20% of COE to GOS. (see Section 5 below).

Final Consumption by Government (Government as an Institution)

Typically, Government as an institution purchases few products. It is Government as a producer (“Public Administration”) that makes the input purchases, including payment of wages, and Government as an institution that buys these services. The main other services Government might buy are education and health, depending on how matters are reported.

S&UT2012 shows Government as an institution purchasing 37 of the 120 products. In our view, most of these purchases should be shown as inputs into the production of Public Administration Services. We therefore reassigned them to that productive sector.

Since public education and health are important in Zimbabwe, we assume Government purchases these services. Education is typically around 20% of total budget allocation and Health around 7%. We therefore use these shares to allocate Government expenditure between the three items it purchases in the proportions Public Administration 73%, Education 20%, and Health 7%.

Interestingly, in the original Table which, as we have suggested, are incorrectly assigned intermediate purchases to Government Final Expenditure, only Tertiary Education was purchased by Government.

I133 Education

Pre-splitting

There are three education products – primary, secondary, and tertiary – and one education activity. The original table shows flows of each of the education products as the main intermediate inputs into the Education activity. Such flows may represent purchases of further education services. That is presumably what intermediate flows of education product into other activities represent. But one would not expect such services to represent over 30% of the inputs into education. Furthermore, such flows would presumably be flows of the tertiary education product, whereas the 2012UT records the main flows as primary education.

We therefore reduce this flow. If we simply reduce it without distributing it to other inputs (a process for which we have no guidance), it reduces the share of aggregate intermediates in Gross Output. However, the UT also shows that value added in the Education Activity are 60% of gross output (41% CoE and 19% GOS). This seems relatively low, particularly given the preponderance of public education.

We think it is reasonable to interpret the flows of education to education as properly representing value added.

Splitting

The three education products represent 57%, 28% and 15% of education. We split the single activity into three in these proportions. We split the inputs in the same proportions, but reduce the supplies of education services to 3%, 1% and 1% respectively to reduce the use of education along the lines suggested above. In effect this reduces the share of education service inputs into education from 38% of total costs to 2.9%. CoE are raised from 41% to 64% and GOS from 19% to 29%.

I134 Health & Social Care Services

No adjustments

I135 Other Services

Split into 3 sub-sectors:

- A117 Other Social Services
- A118 Recreational services
- A119 Other services nec

Each is assumed to have the same structure as the parent sector, except inputs of Other services into itself are reduced

I36 Domestic Services

No adjustments.

Gross Capital Formation

Gross Fixed Capital Formation

The UT shows a wide range of inputs into GFCF that seem implausible. Many intermediates, such as electricity, should probably be incorporated in the production of the capital goods that are purchased. We eliminate the implausible ones, which raises the shares of the remaining ones.

There is also the question of whether some items are omitted. Although we think of this as GFCF it should be gross capital formation excluding changes in inventories. Thus, it should include some intangibles. It should include some valuation of changes in the national herd. We have not made these adjustments.

Change in Inventories

Change in Inventories for 2012 in S&UT2012 are 10.6% of GDP at Market Prices. In the NIPA they are -2.3%. In the S&UT2012, there are changes in inventories for services, as shown in Table 8.130.

While service activities may carry inventories of inputs they use, it is difficult to explain inventories of services themselves (although this might reflect timing adjustments). This is unusual

Table 8.130: Change in Inventories of Services in the S&UT2012

Code	Description	Change in Inventories as percent of total use of product at purchaser prices
P092	Wholesale trade services & Repairs	-2.6%
P093	Retail trade services	-2.5%
P094	Accommodation, food & beverage services	2.1%
P096	Freight transport services	-0.1%
P101	Financial intermediation & related services	-0.1%
P107	Real estate services	-0.1%
P111	Other professional, business & technical services	-0.1%
P112	Public administration	-0.1%
P113	Education Services Primary Schools	-0.3%
P116	Human health & social care services	-0.5%
P118	Recreational, cultural, tourism & sporting services	0.0%
P110	Other services, nec	-0.1%

and suggests that change in inventories may have been used as a balancing item or that they have been confused with inventories of products held by sectors.

In the NIPA, change in inventories after 2012 fall by an order of magnitude as shown in Table 2 In 2012 they are shown as \$392m Thus in 2017, they fall to \$8m (0.04% of GDP). Since we use this as a control for distributing inventories across products, the anomalies do not have much influence. We have therefore not adjusted them.

Table 8.131: Changes in Inventories according to NIPA

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Changes in Stocks (\$m)	272	211	390	-392	5	6	8	11	8	10
As % of Domestic Expenditure	2.3%	1.4%	2.3%	-1.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Source: (ZimStat, 2020, p. 22)

(Note that since total change in inventories is an aggregate of changes in individual inventories that could be positive or negative, a low aggregate can be consistent with very large individual changes. To circumvent this in the balancing (discussed later), we use a technique that assumes changes in inventories move in the same direction across products.

If there is an overall increase in inventories, we assume that positive individual changes increase, and negative individual changes become less negative.)

BE.5 Gross Outputs of Sectors

Making ad hoc adjustments to the Use Table in the way we have described above changes the outputs of activities. If we were confident in the ST, we would use it to constrain the changes to the UT, essentially scaling the revised cost structures to match the given gross domestic supplies. However, as we have indicated, we are not confident about some of the numbers in the ST published in 2012S&UT. Furthermore, we have updated that table to 2017 using the process described in Appendix B. Although the resulting updated SAM is balanced, it is not clear whether we should

give priority to the updated supply or the updated output as control totals when we make ad hoc adjustments. We have therefore allowed the adjusted cost structures to differ from the given supply values in some instances. This results in an unbalanced SAM which we have permitted the cross entropy balancing algorithm to resolve, even though the disparities are in some cases higher than we would normally prefer.

BE.6 Distribution of value added

In the original UT, 5 sectors have Compensation of Employees (CoE) but no Gross Operating Surplus (GOS) or Mixed Income, (which might have signalled a misclassification).

- I08 Water Supply
- I32 Public Administration
- I33 Education
- I34 Health and Social Care Services
- I36 Domestic Services

This is appropriate for I36 Domestic Services but wrong for the other four, not least because GOS includes consumption of fixed capital. Since Education and Health services are provided by both the public and for-profit sectors, we would expect them to have some net operating services. We therefore adjusted these.

For I08 Water Supply we looked at the Zimbabwe National Water Authority’s Annual Report and assigned 30% of CoE to GOS (ZINWA, various). For the other three, we redistributed an arbitrarily chosen 20% of CoE to GOS.

The original data also distributes some of value added to “Mixed Incomes (Farm & Non-Farm Value Added)”. For many purposes it is better to allocate these to either CoE or GOS. We split it in proportion to the shares of CoE and GOS in (CoE + GOS) in each sector.

BE.7 Trade

Data for trade in goods came from the Monthly Summary of External Trade Statistics (ZimStat, 2021). Data for trade in services came from Balance of Payments statistics (RBZ, 2021).

BE.8 Indirect Taxes

The original UT shows “Taxes on Production” for each of its 36 sectors. We use these to allocate production taxes across sectors in the disaggregated SAM.

The original ST has a column vector showing “Taxes on Products less Subsidies” for each of the 120 products. These combine VAT, Customs Duties, Excise Duties and other minor indirect taxes. The UT shows these distributed across the 36 sectors, to move from sector GVA at basic prices to sector GDP at Market prices. This is done by aggregating the product taxes of the principal products of the sector, which is possible because the ST is diagonal. However, it shows total indirect tax revenue gathered on the products produced by the sector, not taxes paid on purchases by the sector. We are thus unable to infer taxes less refunds paid on intermediate inputs by the sector.

BE.9 Trade and Transport Margins

Although the original ST shows margins as “Trade and Transport Margins”, they are recycled only to “Wholesale trade services & repairs” and “Retail trade services”. We would expect some of the margins to relate to transport and possibly to insurance, as they do in many countries. However, we have not adjusted this.

BE.10 Savings

The latest NIPA do not publish savings data. For the SAM, government savings were estimated using Budget data, foreign Savings came from the Balance of Payments data, while Enterprise and Household savings were derived as residuals in the balance procedure.

BE.11 Constructing the prior SAM

The initial task building a SAM is to compile a MacroSAM drawing primarily on the NIPA. The disaggregated MicroSAM is constructed drawing on a wide range of data sources. The NIPA based MacroSAM provides control totals that constrain the disaggregation in the MicroSAM. Thus, for example, disaggregated household expenditures are drawn from household surveys, but in aggregate are constrained to match aggregate private consumption expenditure in the MacroSAM (and thus the NIPA). Because of this constraint, the resulting MicroSAM can be collapsed to a MacroSAM that matches the NIPA based one, and thus NIPA.

As indicated in the discussion throughout this Report, the Zimbabwean data and the ad hoc adjustments we have made have reduced the reliability of the constraints provided by the MacroSAM. While we constructed a preliminary MacroSAM as a starting point for our compilation, several aspects of it changed as we modified our preliminary MicroSAM.

Table 8.132 therefore shows the MacroSAM derived from the final MicroSAM, rather than the initial MacroSAM derived from the NIPA. Following Table 8.132 is an account of each cell in it with an indication of how it was disaggregated into its MicroSAM counterpart.

Table 8.132: Macro SAM for Zimbabwe, 2017, US\$ million

Activities	Acti- vities	Commo dities	Labour	Capital	Enter- prises	House- holds	Govern- ment	Net activ- ity taxes	Net prod- uct taxes	Import duties	Income taxes	Accu- mulation	Change in inven- tories	Rest of the world	Total
Activities		52651													52651
Commodities	32419	4354				17497	4912					2158	5	4340	65685
Labour	9031													3	9034
Capital	11007													1	11008
Enterprises				10630			139								10769
Households			9016		8 544		517							1709	19786
Government					13	249		194	1713	295	1 592				4055
Net activity taxes	194														194
Net product taxes		1713													1713
Import duties		295													295
Income taxes					688	904									1592
Accumulation					1509	1132	-1522						5	1045	2163
Changes in inventories															5
Rest of the world		6672	18	378	15	5	9								7098
Total	52651	65685	9034	11008	10769	19786	4055	194	1 713	295	1 592	2163	5	7098	

Source: Various sources and own calculations

<i>i</i>	(Commodities,Activities)... US\$32,419million
	Total intermediate consumption is the sum of activity level total intermediate consumption. The disaggregation into a Use matrix of 120 activities using 120 commodities (see Appendix A. for details) is achieved in two stages. The first stage disaggregates total intermediate inputs down to activity level as outlined in Appendix B. The second stage disaggregates total intermediate inputs for each activity in intermediate inputs for up to 120 commodities using the 2012 Use Matrix shares as a starting point.
<i>ii</i>	(Labour,Activities)... US\$9,031million
	Compensation of employees is available from NIPA (ZimStat, 2018a) and is disaggregated across 120 activities as outlined in Appendix B. However, see iv below.
<i>iii</i>	(Capital,Activities)... US\$11,007million
	Gross Operating Surplus is available from NIPA (ZimStat, 2018a) as an economy-wide total, and is disaggregated across activities as outlined in Appendix B. However, see iv below.
<i>iv</i>	(Mixed Income,Activities)... US\$2,928million
	Mixed Income is available from NIPA (ZimStat, 2018a) as an economy-wide total, and is disaggregated across activities as outlined in Appendix B. However, it is then distributed between Labour and Capital as described in the text and is therefore zero in the final balanced macro SAM.
<i>v</i>	(Activity Tax,Activities)... US\$,194million
	Net other taxes on production by all activities is available from NIPA (ZimStat, 2018a) as an economy-wide total. It is disaggregated across activities as outlined in Appendix B.
<i>vi</i>	(Activities,Commodities)... US\$52,651million
	Output of total domestic economy is at the economy-wide level the sum of cells i-v above in the macro SAM. Disaggregation into a Supply matrix of 120 activities making/supplying 120 commodities is initially based on supply shares from the 2012 SUT (ZimStat, 2018b).
<i>vii</i>	(Commodities,Commodities)... US\$4,354million
	Transactions Margins for each of the 120 commodities (where applicable) are derived using margins rates from the 2012 SUT and applied to 2017 estimates of marketed supply as outlined in Appendix B. The total margins collected are recycled as revenues to the wholesale and retail services accounts according to their 2012 SUT shares.
<i>viii</i>	(Sales Tax,Commodities)... US\$1,713million

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Net taxes on products less import duties as an economy-wide total are derived from total net taxes on product (including import duties) as reported in NIPA (2018a). Total import duties taken from the Consolidated Revenue Fund (Government of Zimbabwe 2018)- are then subtracted. Tax rates for each of the 120 commodities are derived from the 2012 SUT using the Leontief modelling approach (see Appendix B), after adjusting total tax collected on each commodity by the macro share of domestic sales tax in total product tax. The latter is available from NIPA (2018a).

<i>ix</i>	(Import Tax,Commodities)... US\$,295million	Total import duties at the economy-wide level is taken from the Consolidated Revenue Fund (Government of Zimbabwe 2018). Import duty (collection) rates for each of the 120 commodities are derived from the 2012 SUT using the Leontief modelling approach (see Appendix B), after adjusting total tax collected on each commodity by the macro share of import duties in total product tax. The latter is available from NIPA (ZimStat, 2018a).
<i>x</i>	(Rest of the World,Commodities)... US\$6,672million	Imports of goods are taken from the Monthly Statement of External Trade (ZimStat, 2021) and of services from the Balance of payments (RBZ, 2021). They are scaled across commodities to match the total for imports as reported in NIPA (ZimStat, 2018a).
<i>xi</i>	(Households,Labour)... US\$9,016million	Compensation of residents is derived as a residual from the compensation of employees (see ii above) after accounting for payments to (see next item) and from (see xxxix below) the rest of the world.
<i>xii</i>	(Rest of the World,Labour)... US\$,18million	Remittances abroad by non-Zimbabwe employees is taken from the Balance of Payment (RBZ, 2021).
<i>xiii</i>	(Enterprises,Capital)... US\$10,630million	Gross operating surplus of corporations is transferred from the activity account (see iii above) to the enterprise account after accounting for payments to the rest of the world (see next item) and receipts from the rest of the world (see xl below).
<i>xiv</i>	(Rest of the World,Capital)... US\$,378million	Transfers of capital income abroad are taken from the Balance of Payments (RBZ,2021).
<i>xv</i>	(Household,Mixed Income)... US\$2,928million	Mixed income of households is taken from NIPA (ZimStat, 2018a), see iv above and transferred to households. However, because it is then distributed to labour and capital, this item is zero in the final balanced macro SAM.
<i>xvi</i>	(Households,Enterprises)... US\$8,544million	

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Miscellaneous transfers from enterprises to households include dividend and interest payments. It is derived as a residual from enterprise income discussed in xiii above after accounting for enterprise property income transfers to the government (see xvii below), enterprise corporate taxes (see xviii below) enterprise savings (see xix below) and enterprise transfers to the rest of the world (see xx below).

<i>xvii</i>	(Government,Enterprises)... US\$,13million Property income received by government is derived from the Consolidated Revenue Fund (Government of Zimbabwe 2018).
<i>xviii</i>	(Direct Tax,Enterprises)... US\$,688million Current taxes on income and wealth paid by enterprises is taken from the Consolidated Revenue Fund (Government of Zimbabwe 2018)
<i>xix</i>	(Savings=Investment,Enterprises)... US\$1,509million Gross saving by enterprises is initially assumed to be 20% of enterprise income.
<i>xx</i>	(Rest of the World,Enterprises)... US\$,15million Current transfers by enterprises to the rest of the world is taken from the Balance of Payments (RBZ,2021).
<i>xxi</i>	(Commodities,Households)... US\$17,497million Final consumption expenditure by households is available from NIPA (ZimStat, 2018a) as an economy-wide total. Disaggregation across commodities is based on the shares from the 2017 household survey data, PICES, ZimStat, 2018c).
<i>xxii</i>	(Government,Households)... US\$,249million Transfers received by government from households is taken from the Consolidated Revenue Fund (Government of Zimbabwe 2018).
<i>xxiii</i>	(Direct Tax,Households)... US\$,904million Current taxes on income and wealth of households is taken from Consolidated Revenue Fund (Government of Zimbabwe 2018). Unallocable direct taxes have been assigned to households.
<i>xxiv</i>	(Savings=Investment,Households)... US\$1,132million Gross saving by households and NPISHs is derived as the residual of the savings – investment account.
<i>xxv</i>	(Rest of the World,Households)... US\$,5million Transfers by households to the rest of the world is taken from the Balance of Payments (RBZ,2021).
<i>xxvi</i>	(Commodities,Government)... US\$4,912million Final consumption expenditure by government is available from the NIPA (ZimStat, 2018a) and is further broken down into government expenditure on specific commodities based on shares from the 2012 SUT and adjusted as discussed in section 3.5.32.
<i>xxvii</i>	(Enterprises,Government)... US\$,139million

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Current payments by the government to enterprises comprises interest payments on government debt. Taken from Consolidated Revenue Fund (Government of Zimbabwe 2018).

<i>xxviii</i>	(Households,Government)... US\$,517million
	Transfers by government to households. Taken from Consolidated Revenue Fund (Government of Zimbabwe 2018).
<i>xxix</i>	(Savings=Investment,Government)... US\$-1,522million
	Gross saving by government is the sum of savings by central and local government. Derived from the Zimbabwe Government Finance Statistics by taking the difference between reported total revenues and current expenditures
<i>xxx</i>	(Rest of the World,Government)... US\$,9million
	Transfers by government to the rest of the world is taken from the Balance of Payment accounts (needs to be confirmed)
<i>xxxi</i>	(Government,Activity Tax)... US\$,194million
	Net other taxes on production in all activities is discussed in v above.
<i>xxxii</i>	(Government,Sales Tax)... US\$1,713million
	Net taxes on products less import duties is discussed in viii above.
<i>xxxiii</i>	(Government,Import Tax)... US\$,295million
	Import duties is discussed in ix above.
<i>xxxiv</i>	(Government,Direct Tax)... US\$1,592million
	Direct taxes paid by enterprises and households is discussed in xviii and xxiii above.
<i>xxxv</i>	(Commodities,Savings=Investment)... US\$2,158million
	Gross fixed capital formation is available from NIPA (ZimStat, 2018a). The breakdown into commodities is initially based on shares from the 2012 SUT.
<i>xxxvi</i>	(Change in Stocks,Savings=Investment)... US\$,5million
	Change in inventories: see xxxvii below.
<i>xxxvii</i>	(Commodities,Change in Stocks)... US\$,5million
	Change in inventories is available from NIPA (ZimStat, 2018a). The breakdown into commodities is initially based on shares from the 2012 SUT.
<i>xxxviii</i>	(Commodities,Rest of the World)... US\$4,340million
	Exports of goods are taken from Monthly Trade data (ZimStat, 2021). Exports of services are taken from the Balance of Payment (RBZ, 2021).They are mapped to the 120 commodities and are scaled to match the total for exports of goods and services as reported in NIPA (ZimStat, 2018a).
<i>xxxix</i>	(Labour,Rest of the World)... US\$,3million
	Compensation of Zimbabwe residents received from the rest of the world is taken from the Balance of Payment accounts (RBZ, 2021).
<i>xl</i>	(Capital,Rest of the World)... US\$,1million
	Property income paid by the RoW is taken from the Balance of Payment accounts (RBZ, 2021).
<i>xli</i>	(Households,Rest of the World)... US\$1,709million

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Transfers received by households from the rest of the world comprises other current transfers received from the rest of the world taken from the Balance of Payment accounts (RBZ, 2021).

xlii (Savings=Investment,Rest of the World)... US\$1,045million

Current account balance (foreign savings) is taken from the Balance of Payment accounts (RBZ, 2021)

BE.12 Balancing the SAM

Statistical balancing routines, such as entropy or RAS, should be employed only after all available information has been used to reduce the imbalances as much as possible. However, in the present case the manual adjustments and lack of constraints discussed in the foregoing sections meant that substantial imbalances remained in the preliminary SAM, even after the available information sources had been used. Rather than make further ad hoc adjustments to the accounts, achieving balance by essentially manual means, we used the cross entropy balancing routine. See (Robinson, et al., 2001; Davies & Thurlow, 2013) for descriptions of the method.

BE.13 Constructing the IOT

Since the balanced SAM has the same number of activities as commodities, its SUT component is square. Furthermore, the ST is diagonalized, so there are no off diagonal elements.

It was converted to a GTAP V.10/11 IOT, at basic prices according to the following steps:

1. The SAM was reconstructed to match the required GTAP accounts using the Mappings listed in Appendix D.
2. Since intermediate demand in the Use Matrix is still valued in market prices while supplies in the Supply Matrix are valued in basic prices, the Use Matrix is converted from market prices to basic prices by removing:
 - (a) Indirect taxes on products (domestic sales tax and import duties) according to the shares of intermediate and final demand for each product (excluding exports) and allocating them to a specific row for indirect taxes on products.
 - (b) Trade margins on products according to the shares of each row of the matrix created in the previous point and allocating them to the row of trade services.
3. Imports of products are removed from intermediate and final demand (excluding exports) according to the shares of each product's row and allocated to a specific row of intermediate imports. Instead of aggregating them up into a row, as is the case with product taxes, imports are left in matrix format to suit GTAP requirements.

4. The diagonalized Supply Matrix is removed so that there is no separation of products and industries.

The resulting IOT can now be assembled to achieve the format set out in GTAP Data Bases: GTAP Data Bases: GTAP I-O Table Format (<https://www.gtap.agecon.purdue.edu/databases/contribute/altviewformat.asp>).

References

CSO, 1966. National Accounts and Balance of Payments of Rhodesia 1965. Salisbury: Central Statistical Office.

Davies, R., Kwaramba, M. & van Seventer, D., 2018. A 2013 Social Accounting Matrix for Zimbabwe. Helsinki: UNU-WIDER Working Paper 2018/139.

Davies, R. & Thurlow, J., 2013. A 2009 Social Accounting Matrix (SAM) for South Africa, Washington DC: International Food Policy Research Institute.

Government of Zimbabwe, 2018. Consolidated Statement of Financial Performance of the Consolidated Revenue Fund for the period ended 31 December 2017, Harare: Ministry of Finance.

Lofgren, H. & Cicowiez, M., 2022. Taxation, infrastructure investment, growth, and poverty reduction: A case study of Zimbabwe. Buenos-Aires: Documentos de Trabajo del CEDLAS N° 295 , CEDLAS-Universidad Nacional de La Plata.

RBZ, 2021. Balance of Payments 2020 Q4, Harare: Reserve Bank of Zimbabwe.

Robinson, S., Cattaneo, A. & El-Said, M., 2001. Updating and Estimating a Social Accounting Matrix Using Cross Entropy Methods. Economic Systems Research, 13(1), pp. 47-64.

ZimStat, 2012. 2011 Labour Force Survey, Harare: Zimbabwe National Statistics Agency (ZIMSTAT).

ZimStat, 2013. Poverty Income Consumption and Expenditure Survey 2011/12 Report, Harare: Zimbabwe National Statistics Agency (ZIMSTAT).

ZimStat, 2014. Central Business Register Inquiry. s.l.:s.n.

ZimStat, 2015. 2014 Labour Force Survey, Harare: Zimbabwe National Statistics Agency (ZIMSTAT).

ZimStat, 2015. National Accounts 2009-2014 Report, Harare: Zimbabwe National Statistics Agency (ZIMSTAT).

ZimStat, 2015. National Income 2009-2014 Report, Harare: Zimbabwe National Statistics Agency (ZIMSTAT).

ZimStat, 2018. Gross Domestic Product Tables: Base Year 2012, 2009-2017, Harare: Zimbabwe

National Statistics Agency (ZIMSTAT).

ZimStat, 2018. Poverty, Income, Consumption and Expenditure 2017 Report, Harare: Zimbabwe National Statistics Agency (ZIMSTAT).

ZimStat, 2018. Supply and Use Tables for Zimbabwe for the year 2012. Harare: Zimbabwe National Statistical Agency.

ZimStat, 2020. 2019 Labour Force and Child Labour Survey, Harare: Zimbabwe National Statistics Agency (ZIMSTAT).

ZimStat, 2020. Quarterly Digest of Statistics 2019 Q4, Harare: Zimbabwe National Statistics Agency (ZIMSTAT).

ZimStat, 2021. Monthly Summary of External Trade Statistics November 2021, Harare: Zimbabwe National Statistics Agency (ZIMSTAT).

ZINWA, various. Annual Integrated Report. Harare: Zimbabwe National Water Authority.

Appendix

Activities and Commodities in a 2017 SAM for Zimbabwe

Table 8.134: Matching Sectors and Products in the 2012S&UT

Sector		Product	
I01	Agriculture, Animal, Hunting, & related Services	P001	Wheat
		P002	White maize
		P003	Rice
		P004	Sorghum
		P005	Millet (mhunga)
		P006	Rapoko
		P007	Other cereals
		P008	Vegetables beans etc
		P009	Nyimo (ndlubu)
		P010	Soya beans
		P011	Groundnuts (unshelled)
		P012	Cotton
		P013	Sunflowers
		P014	Potatoes
		P015	Sweet Potatoes, Cassava & Yams
		P016	Tea Leaves (productive tea)
		P017	Productive Sugar Cane
		P018	Tobacco, Flue Cured, Burley & Oriental
		P019	Fruits (fresh & dried)
		P020	Seeds for vegetables & oilseeds
		P021	Other Crops n.e.c.
		P022	Cattle
		P023	Goats & Sheep
		P024	Chickens live
		P025	Other Live animals
		P026	Agriculture Support Services
I02	Agriculture Forestry & Logging	P027	Forestry & logging products
I03	Agriculture, Fishing & Aquaculture	P028	Fish & other fishing products
I04	Mining Coal & Lignite	P029	Coal & Lignite (peat)
I05	Mining Metal Ores	P030	Iron ore
		P031	Copper
		P032	Cobalt
		P033	Chrome
		P034	Iridium

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Sector		Product
		P035 Nickel ores & concentrates
		P036 Platinum
		P037 Rhodium
		P038 Ruthenium
		P039 Precious metal ores & concentrates
		P040 Gold
		P041 Palladium
I06	Other Mining & Quarrying & Support Services	P042 Asbestos
		P043 Graphite
		P044 Phosphate
		P045 Diamonds
		P046 Mining services & other mining
I07	Electricity & Gas ⁹⁶	P047 Electricity & gas
		P048 Electricity, gas & (on own account)-sec products
		P050 Support Services Electricity, & gas
I08	Water Supply	P049 Purification & Distribution of water
I09	Manufacture of Food, Beverages & Tobacco	P051 Meat
		P052 Vegetables, dried, chilled etc
		P053 Processing of Fish & fish products
		P054 Preserved or dried Fruits & nuts
		P055 Oils & fats
		P056 Dairy products & egg products
		P057 Grain mill products, starches & starch products; sugar, other food products
		P058 Animal Feeds
		P059 Other Food n.e.c
		P060 Beverages
		P061 Tobacco products
I10	Manufacture of Textiles, Wearing Apparel & Footwear & leather	P062 Yarn & thread; woven & tufted textile fabrics
		P063 Textile articles other than apparel
		P064 Knitted or crocheted fabrics; wearing apparel
		P065 Leather & leather products; footwear
I11	Manufacture of Wood & Wood Products	P066 Products of wood, cork, straw & plaiting materials
I12	Manufacture of Paper & Paper Products & Printing	P067 Pulp, paper & paper products; printed matter

Continued ...

⁹⁶Sector I07 also supplies small amounts of P091, P094 and P106

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	Sector		Product
I13	Manufacture of Chemical, Pharmaceutical & Chemical Products	P068	Coke oven products
		P069	Basic chemicals
		P070	Other chemical products; man-made fibres
		P079	Pharmaceutical products
I14	Manufacture of Basic Metals	P071	High Carbon Ferrochrome
		P072	Basic metals (iron & steel & alloys)
		P073	Non-ferrous metals e.g. Copper, nickel, aluminium, lead, zinc & tin
		P074	Other non-ferrous metals & articles (metals with no iron)
I15	Manufacture of Rubber & Plastics Products	P075	Rubber & plastics products
I16	Manufacture of Other Non-Metallic Mineral Products	P076	Glass & glass products & other non-metallic products n.e.c
		P077	Plaster, lime, Cement, concrete, building stone
		P080	Other non-metallic minerals n.e.c
I17	Manufacture of Furniture & Related Products	P081	Furniture; other transportable goods n.e.c.
I18	Manufacture of Fabricated Metal Products	P082	Fabricated metal products
I19	Manufacture of Electrical Equipment, Machinery & Equipment	P083	General-purpose machinery, engines & parts & Electrical
		P084	Special-purpose machinery agricultural or forestry machinery
I20	Manufacture of Office & Computing Machinery	P085	Office, accounting & computing machinery
I21	Manufacture of Motor Vehicles & Other Transport Equipment & Communication	P086	Transport equipment & accessories
		P087	Radio, television & communication equipment
I22	Other Manufacturing n.c.e	P088	Manufacturing services on physical inputs owned by others
		P089	Miscellaneous manufactured products
I23	Construction of Buildings & Civil Engineering Works	P090	Construction
		P091	Construction services
I24	Wholesale & Repair of Motor Vehicles	P092	Wholesale trade services & repairs
I25	Retail Trade	P093	Retail trade services
I26	Hotels & Restaurants	P094	Accommodation, food & beverage services

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Sector		Product	
I27	Transport Services & Storage	P095	Passenger transport services
		P096	Freight transport services
		P097	Supporting transport services
I28	Information, Post & Telecommunications	P098	Postal & courier services & Published materials
		P099	Telecommunications, broadcasting & information supply services
		P100	Support Services for Telecommunications & Information
I29	Financial Intermediation Services	P101	Financial intermediation & related services
		P102	Other Financial & Auxiliary Services
I30	Insurance & Pension Services	P103	Life Insurance Services
		P104	Non-Life Insurance Services
		P105	Other Insurance & Auxiliary Services
		P106	Pension Services
I31	Real Estate Renting & Business Services	P107	Real Estate Services
		P108	Imputed rental of owner occupied
		P109	Legal & accounting services
		P110	Business Services, Professional, technical, research
		P111	Other professional, business & technical services
I32	Public Administration	P112	Public administration
I33	Education	P113	Education Services Primary Schools
		P114	Education Services Secondary Schools
		P115	Education Services Tertiary
I34	Health & Social Care Services	P116	Human health & social care services
		P117	Other Social Services
I35	Other Services	P118	Recreational, cultural, tourism & sporting services
		P119	Other services n.e.c.
I36	Domestic Services not supplied domestically	P120	Domestic services
-		P078	Petroleum oils, gases & bitumen

Source: Own Construction from (ZimStat, 2018)

Initial Estimates for Activity GDP and Other Variables

The 2017 NIPA provided data on GDP for highly aggregated industries, but not for intermediate inputs or gross value of production (GVP). Disaggregated data for selected sectors (mining, manufacturing, and utilities) are available from ZimStat (2020). We must estimate these for the other activities in the SAM. We could use the ratios of sectoral GDP to GVP in S&UT2012 to scale up to 2017. However, this considers only the direct relationships. We therefore use a SUT multiplier modelling approach to estimate GDP, intermediate inputs and GVP for those detailed activities for which we do not have direct information.

First, a final demand vector for commodities for the year 2017 is estimated by multiplying the 2012 SUT shares of each component of final demand (household and government expenditure, gross domestic investment, and exports) by the 2017 values of the matching aggregate GDP expenditure components. The results are summed to get a single final demand vector.

The Leontief inverse of the 2012 SUT which at this stage is expanded with detailed agriculture activities (see paragraph 3.5.1 above) is multiplied by this estimated 2017 final demand vector. This results in estimates of GVP for each of the 60 (36 original + detailed agriculture) sectors for 2017 which are multiplied by the 2012 shares in GVP of intermediate inputs, GDP, and its activity level components (compensation of employees, gross operating surplus and mixed income). This generates initial 2017 estimates for the prior 2017 SAM. The underlying assumption is that the 2012 SUT technical coefficients have not changed.⁹⁷

The GDP estimates for the 60 activities are benchmarked on the higher level GDP values published in the 2017 NIPA data, using their respective intra-activity shares. For example, the sum of GDP of the manufacturing sub-sectors is forced to equal the total GDP of manufacturing in the 2017 NIPA data. Initial activity level multiplier estimates for the income components of GDP (wage earnings, gross operating surplus and mixed income) are scaled in a biproportional way to the adjusted activity level GDP estimates and to 2017 NIPA values for the totals of the GDP income components.

For mining, manufacturing, and utilities, the detailed estimates of value added and total intermediate inputs are replaced by 2017 QDS data (ZimStat, 2019). 2017 estimates of total intermediate inputs for those 60 activities that are not available from the QDS, are enhanced by using older 1 digit activity level 2014 NIPA ratios of total intermediate inputs to GDP (ZimStat, 2015), multiplied with matching 2017 GDP NIPA data. These high level estimates are then combined with intra-activity 2012 SUT shares to arrive at detailed 2017 estimates. This approach was taken because there are no direct estimates of total intermediate inputs for those activities not covered in the QDS. This extra loop brings in 2014 data on total intermediate input to GDP ratios instead of using the 2012 SUT ratios. The working hypothesis is that newer data - for 2014 in this case - is better than 2012 data.

A similar SUT multiplier modelling approach is followed to create initial 2017 estimates for activity taxes as well as commodity level estimates of total marketed supply and distribution

⁹⁷However, these coefficients will change when the cross entropy method rebalances the prior 2017 SAM. There are subsequent ad hoc changes made to some of them, as explained in the text.

margins. In the case of the latter, margin rates from the 2012 SUT are used as a starting point and applied to the SUT multiplier model estimates for 2017 of marketed supply.

Sources used by ZimStat in compiling the S&UT2012

The following is an extract from the documentation for S&UT2012, illustrating what ZimStat reference in their data sources.

Figure 1: Data Sources used by ZimStat for compiling S&UT2012 Data Sources and Methods for Supply and Use Tables Compilation

- Central Business Register (CBR) 2013-14 Turnover Statistics and numbers employed
- Survey of Services (SS) 2014-15
- Business income and / or VAT records
- Insurance institutions regulatory reports from Insurance and Pension Fund Commission (IPEC)
- Financial Statements for Banks, Local Government, Public Corporations
- Government Finance Statistics from the Ministry of Finance and Economic Development
- Balance of Payments / Merchandise Trade from ZIMSTAT and the Reserve Bank of Zimbabwe
- Establishment Surveys / Census e.g. Census of Industrial Production (CIP), -Mining figures from the Chamber of Mines, Non Profit Institutions Serving Households Survey (NPISH) 2012.
- Household Based Surveys e.g. Poverty, Income, Consumption and Expenditure Survey (PICES) 2011/12, Labour Force Survey 2011 and 2014, Agriculture and Livestock Surveys (ALS) 2012.
- Zimbabwe Population Census 2012

Data Sources for the Income Approach

- Income statistics
- Employment statistics
- Government expenditure and revenues
- Tax statistics

Data for Expenditure Approach

- Household survey of consumer expenditure
- Investment survey
- Foreign trade statistics
- Balance of payments
- International Trade in Services surveys

Other data sources

- Consumer price statistics
- Producers' price statistics
- Import price statistics
- Export price statistics
- Company annual report and accounts
- Company financial web-sites
- Regulatory Accounts and Trade Associations

Source (ZimStat, 2018, pp. 18-19)

Mapping from SAM accounts to GTAP Accounts

Table 8.135: Map between SAM and GTAP Accounts

Code	Extended SAM description	Code	GTAP Description
A001	Wheat	a_wht	Wheat
A002	Maize	a_gro	Cereal grains nec
A003	Rice	a_pdr	Paddy rice
A004	Sorghum	a_gro	Cereal grains nec
A005	Millet	a_gro	Cereal grains nec
A006	Rapoko	a_gro	Cereal grains nec
A007	Other cereals	a_gro	Cereal grains nec
A008	Vegetables beans etc	a_v_f	Vegetables, fruits, nuts
A009	Nyimo (ndlubu)	a_v_f	Vegetables, fruits, nuts

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Code	Extended SAM description	Code	GTAP Description
A010	Soya beans	a_osa	Oilseeds
A011	Groundnuts (unshelled)	a_osa	Oilseeds
A012	Cotton	a_pfb	Plant-based fibers
A013	Sunflowers	a_osa	Oilseeds
A014	Potatoes	a_vf	Vegetables, fruits, nuts
A015	Sweet Potatoes	a_vf	Vegetables, fruits, nuts
A016	Productive Tea	a_ocr	Crops nec
A017	Productive Sugar Cane	a_cb	Sugar cane, sugar beet
A018	Tobacco	a_ocr	Crops nec
A019	Fruits	a_vf	Vegetables, fruits, nuts
A020	Seeds for vegetables & oilseeds	a_ocr	Crops nec
A021	Other Crops	a_ocr	Crops nec
A022	Cattle	a_ctl	Bovine cattle, sheep and goats, horses
A023	Goats & Sheep	a_ctl	Bovine cattle, sheep and goats, horses
A024	Chickens live	a_oap	Animal products nec
A025	Other Live animals	a_oap	Animal products nec
A026	Agriculture Support Services	a_obs	Business services nec
A027	Forestry	a_frs	Forestry
A028	Fishing	a_fsh	Fishing
A029	Coal	a_col	Coal
A030	Iron ore	a_ox	Other Extraction (formerly omn Minerals nec)
A031	Copper	a_ox	Other Extraction (formerly omn Minerals nec)
A032	Cobalt	a_ox	Other Extraction (formerly omn Minerals nec)
A033	Chrome	a_ox	Other Extraction (formerly omn Minerals nec)
A034	Iridium	a_ox	Other Extraction (formerly omn Minerals nec)
A035	Nickel	a_ox	Other Extraction (formerly omn Minerals nec)
A036	Platinum	a_ox	Other Extraction (formerly omn Minerals nec)
A037	Rhodium	a_ox	Other Extraction (formerly omn Minerals nec)
A038	Ruthenium	a_ox	Other Extraction (formerly omn Minerals nec)
A039	Precious metals	a_ox	Other Extraction (formerly omn Minerals nec)
A040	Gold	a_ox	Other Extraction (formerly omn Minerals nec)

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Code	Extended SAM description	Code	GTAP Description
A041	Palladium	a_oxt	Other Extraction (formerly omn Minerals nec)
A042	Asbestos	a_oxt	Other Extraction (formerly omn Minerals nec)
A043	Graphite	a_oxt	Other Extraction (formerly omn Minerals nec)
A044	Phosphate	a_oxt	Other Extraction (formerly omn Minerals nec)
A045	Diamonds	a_oxt	Other Extraction (formerly omn Minerals nec)
A046	Mining services & other mining	a_oxt	Other Extraction (formerly omn Minerals nec)
A047	Electricity & gas	a_ely	Electricity
A048	Electricity, gas & (on own account)-sec products	a_ely	Electricity
A049	Purification & Distribution of water	a_wtr	Water
A050	Support Services Electricity, & gas	a_ely	Electricity
A051	Meat	a_cmt	Bovine meat products
A052	Vegetables, dried, chilled etc	a_ofd	Food products nec
A053	Processing of Fish & fish products	a_ofd	Food products nec
A054	Preserved or dried Fruits & nuts	a_ofd	Food products nec
A055	Oils & fats	a_vol	Vegetable oils and fats
A056	Dairy products & egg products	a_mil	Dairy products
A057	Grain mill products, starches, sugar, other food	a_ofd	Food products nec
A058	Animal Feeds	a_ofd	Food products nec
A059	Other Food n.e.c	a_ofd	Food products nec
A060	Beverages	a_b_t	Beverages and tobacco products
A061	Tobacco products	a_b_t	Beverages and tobacco products
A062	Yarn & thread; woven & tufted textile fabrics	a_tex	Textiles
A063	Textile articles other than apparel	a_tex	Textiles
A064	Knitted or crocheted fabrics; wearing apparel	a_wap	Wearing apparel
A065	Leather & leather products; footwear	a_lea	Leather products
A066	Products of wood, cork, straw & plaiting materials	a_lum	Wood products
A067	Pulp, paper & paper products; printed matter	a_ppp	Paper products, publishing
A068	Coke oven products	a_p_c	Petroleum, coal products
A069	Basic chemicals	a_chm	Chemical products

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Code	Extended SAM description	Code	GTAP Description
A070	Other chemical products; man-made fibres	a_chm	Chemical products
A071	High Carbon Ferrochrome	a_i_s	Ferrous metals
A072	Basic metals	a_i_s	Ferrous metals
A073	Non-ferrous metals	a_nfm	Metals nec
A074	Other non-ferrous	a_nfm	Metals nec
A075	Rubber & plastics products	a_rpp	Rubber and plastic products
A076	Glass & other non-metallic products	a_nmm	Mineral products nec
A077	Plaster, lime, Cement, concrete, building stone	a_nmm	Mineral products nec
A078	Petroleum oils, gases & bitumen	a_p_c	Petroleum, coal products
A079	Pharmaceutical products	a_bph	Basic pharmaceutical products
A080	Other non-metallic minerals n.e.c	a_nmm	Mineral products nec
A081	Furniture; other transportable goods n.e.c.	a_omf	Manufactures nec
A082	Fabricated metal products	a_fmp	Metal products
A083	General-purpose machinery, engines & parts & Electrical	a_ome	Machinery and equipment nec
A084	Special-purpose machinery agric or forestry machinery	a_ome	Machinery and equipment nec
A085	Office, accounting & computing machinery	a_eeq	Electrical equipment
A086	Transport equipment & Accessories	a_otn	Transport equipment nec
A087	Radio, television & communication equipment	a_ele	Computer, electronic and optical products
A088	Manufacturing services on physical inputs owned by others	a_omf	Manufactures nec
A089	Miscellaneous manufactured products	a_omf	Manufactures nec
A090	Construction	a_cns	Construction
A091	Construction services	a_cns	Construction
A092	Wholesale trade services & Repairs	a_trd	Trade
A093	Retail trade services	a_trd	Trade
A094	Accommodation, food & beverage services	a_afs	Accommodation, Food and service activities
A095	Passenger transport services	a_otp	Transport nec
A096	Freight transport services	a_otp	Transport nec
A097	Supporting transport services	a_whs	Warehousing and support activities
A098	Postal & courier services & Published materials	a_cmn	Communication
A099	Telecommunications, broadcasting & information supply services	a_cmn	Communication

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Code	Extended SAM description	Code	GTAP Description
A100	Support Services for Telecommunications & Information	a_cmn	Communication
A101	Financial intermediation & related services	a_ofi	Financial services nec
A102	Other Financial & Auxiliary Services	a_ofi	Financial services nec
A103	Life Insurance Services	a_ins	Insurance (formerly isr)
A104	Non-Life Insurance Services	a_ins	Insurance (formerly isr)
A105	Other Insurance & Auxiliary Services	a_ins	Insurance (formerly isr)
A106	Pension Services	a_ins	Insurance (formerly isr)
A107	Real estate services	a_rsa	Real estate activities
A108	Imputed rental of owner occupied	a_dwe	Dwellings
A109	Legal & accounting services	a_obs	Business services nec
A110	Business Services, Professional, technical, research	a_obs	Business services nec
A111	Other professional, business & technical services	a_obs	Business services nec
A112	Public administration	a_osg	Public Administration and defense
A113	Education Services Primary Schools	a_edu	Education
A114	Education Services Secondary Schools	a_edu	Education
A115	Education Services Tertiary	a_edu	Education
A116	Human health & social care services	a_hht	Human health and social work activities
A117	Other Social Services	a_ros	Recreational and other services
A118	Recreational services	a_ros	Recreational and other services
A119	Other services n.e.c.	a_ros	Recreational and other services
A120	Domestic services	a_ros	Recreational and other services

Source: Own Construction