

14.9

New Zealand

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14.9.1 Introduction

The New Zealand component of earlier versions of the GTAP data base have been derived from the 1986/87 input-output (I/O) table, thus predating most of the structural change which has occurred in the New Zealand economy since mid-1984.

As part of a Foundation for Research, Science, & Technology - (FORST) funded project using the GTAP model, NZIER has undertaken to provide updated input/output data, and we are fortunate that the 1992/93 input/output data has recently become available. Details regarding the structure and data collection processes involved in the NZ I/O table can be found in the Statistics NZ 1991 publication 'Inter-Industry Study of the New Zealand Economy 1986-87'. The present paper describes the methods used to adjust this data in order to make it compatible with the GTAP framework. In doing so, the direction of 'Contributing Input-Output Tables to the GTAP Data base' (Huff and McDougall, 1996) is followed. References herein to arrays are from their table 1. The helpful cooperation of Mark Jackson from Statistics NZ in undertaking this work is noted.

14.9.2 Sectoral Concordance

Table 14.9.1 shows the industry disaggregation required for version 4 of the GTAP data base, and the equivalent industries available in the NZ I/O table. The latter are referenced using the National Accounts index. The final column of the table describes the method used to map the National Accounts data to the GTAP classification. These are in some cases described in more detail below.

In addition to these industry categories, the I/O table also provides data on inputs of employee compensation, operating surplus, commodity indirect taxes, non-commodity indirect taxes, subsidies, consumption of fixed capital, purchase of second-hand assets, imports, import duty, GST (value-added tax) and stamp duty, and outputs to household final consumption, private non-profit organisation consumption, central government consumption, local government consumption, changes in stocks, gross fixed capital formation and exports. Most of these are equivalent to the required categories of GTAP. On the input side, operating surplus and consumption of fixed capital are both incorporated into 'Employment of capital', purchases of second hand assets (which are zero in net terms) are removed from the table, and GST and stamp duty are both treated as commodity taxes. On the output side, consumption by private non-profit organisations is included in household consumption, and central and local government are combined.

The following sections describe in more detail how industries are disaggregated, and how other adjustments to the table are made.

Table 14.9.1 Industrial classifications

GTAP no.	Commodity description	National Accounts no.	Mapping method
1	Paddy rice	part of 011E (0%)	Pro rata split
2	Wheat	part of 011E (60%)	Pro rata split
3	Cereal grains n.e.c.	part of 011E (30%)	Pro rata split
4	Vegetables, fruit, nuts	011C, part of 11D(11%)	Direct, pro rata
5	Oil seeds	part of 011E (5%)	Pro rata split
6	Sugar cane, sugar beet	part of 011E (0%)	Pro rata split
7	Plant-based fibers	part of 011E (4%)	Pro rata split
8	Crops n.e.c.	part of 011E (1%)	Pro rata split
9	Bovine cattle, sheep and	parts of 011A (70%), 11D (40%)	Pro rata splits
10	Animal products n.e.c.	part of 011A (1%)	Pro rata split
11	Raw milk	011B, part of 11D (38%)	Direct, pro rata
12	Wool, silk-worm cocoons	parts of 011A (29%), 11D (11%)	Pro rata splits
13	Forestry	012A	Direct
14	Fishing	011F,013A	Direct
15	Coal	0.375	Direct
16	Oil	part of 022A,B	Manual split
17	Gas	part of 022A,B	Manual split
18	Minerals n.e.c.	023A	Direct
19	Bovine cattle, sheep and	part of 031A (94%)	Pro rata split
20	Meat products n.e.c.	part of 031A (6%)	Pro rata split
21	Vegetable oils and fats	part of 031C (20%)	Pro rata split
22	Dairy products	031B	Direct
23	Processed rice	part of 031C (1%)	Pro rata split
24	Sugar	part of 031C (40%)	Pro rata split
25	Food products n.e.c.	part of 031C (39%)	Pro rata split
26	Beverages and tobacco	031D,E	Direct
27	Textiles	032A	Direct
28	Wearing apparel	part of 032B (90%)	Pro rata split
29	Leather products	part of 032B (10%)	Pro rata split
30	Wood products	033A	Direct
31	Paper products, publishing	034A,B,C	Direct
32	Petroleum, coal products	035D,E	Direct
33	Chemical, rubber, plastic	035A,B,C,F,G	Direct
34	Mineral products n.e.c.	036A	Direct
35	Ferrous metals	part of 037A (50%)	Pro rata split
36	Metals n.e.c.	part of 037A (50%)	Pro rata split
37	Metal products	038A	Direct
38	Motor vehicles and parts	part of 038D (48%)	Pro rata split
39	Transport equipment n.e.c.	part of 038D (52%)	Pro rata split
40, 41	Machinery and equipment	038B,C,E	Direct
42	Manufactures n.e.c.	039A	Direct
43	Electricity	041A	Direct
44	Gas manufacture,	041B	Direct
45	Water	042A	Direct
46	Construction	051A,B, 052A	Direct
47	Trade, transport	061A to 072B	Direct
48	Financial, business,	081A to 083B, 083D, 94A, 95A, 193I	Direct
49	Public administration and	092A to 195A (excl 094A,095A,193I)	Direct
50	Dwellings	083C	Direct

14.9.3 *Industry disaggregations*

Sheep, beef and mixed livestock (011A)

This industry is allocated *pro rata* across industries 9, 10, and 12 with proportions based on the 1992/93 Statistics NZ Economic Survey for Cropping, Mixed and Other Livestock.

Agricultural contracting (011D)

This industry is allocated *pro rata* across the five largest agricultural products (wool, sheepmeat, beef, dairy and fruit and nuts) according to the value of gross output of those commodities in 1993 (see NZIER *Quarterly Predictions*). Sheepmeat (16%) and beef (24%) are both allocated to GTAP commodity 9.

All other farming (011E)

This industry is allocated similarly to 011A, across commodities 1, 2, 3, 5, 6, 7, and 8, using the Statistics NZ Horticulture Survey for 1992/93. Proportions for Paddy Rice (01) and Sugar Cane and Beets (06) are zero, these being the only two industries of the 49 which are non-existent in New Zealand.

Oil and gas (022A and B)

Statistics NZ is unable to disaggregate these industries (both 022A and 022B contain both oil and gas operations) other than on a *pro rata* basis. As this treatment is inadequate in this case, the sectors are disaggregated ‘manually’. Intermediate output going to petroleum and coal products (32) and all exports are considered to come entirely from oil (16), while intermediate outputs going to chemicals (33), electricity (42), gas manufacturing (43) and trade and transport (46) are considered to come from gas (17). Of the combined sector’s total output, these flows make up 81%, and most of the remainder is intra-industry trade. Of these flows, those considered to come from oil make up 68%, while those considered to come from gas make up the remaining 32%. The non-allocated 19% of total output is allocated to the two sectors according to these proportions. All inputs are also allocated according to these proportions. It is considered there to be no inter-industry trade between

oil (16) and gas (17). Only the petroleum and coal products industry imports Oil and Gas, and this is treated as oil. Imports by the oil and gas industries are split using the same proportions as above.

Slaughtering and preserving of meat (031A), manufacture of other food (031C), clothing and footwear (032B), basic metal industries (037A) and transport equipment manufacture (038D)

These industries are split according to the number of full-time employees in each GTAP commodity, obtained from the Statistics NZ Annual Business Directory Update for 1992/93.

14.9.4 Other adjustments

Rows in the NZ I/O table are as follows, and in brackets are the GTAP arrays for each:

- Industries 1-49 (AI01,03,05,07,09,11);
- Wages and salaries (AI13);
- Operating surplus (AI14);
- Commodity indirect taxes (AI16,18,24,25);
- Non-commodity indirect taxes (AI12);
- Subsidies (AI12);
- Consumption of fixed capital (AI14);
- Second-hand assets (none);
- Imports (AI02,04,06,08,10);
- Import duty (AI27);
- GST (AI16,17,18,19,20,21,24);
- Stamp duty (AI20).

Columns are:

- Industries 1-49 (AI01,13,14,16,17,27);
- Household consumption (AI05,06,18,19);
- Private non-profit organisation sales to households (AI05,06,18,19);
- Central government consumption (AI07,08,22,23);
- Local government consumption (AI07,08,22,23);
- Changes in stocks (AI09,10,25,26);
- Gross fixed capital formation (AI03,04,20,21);
- Exports (AI11,24).

The following sections discuss how these are adapted to fit GTAP requirements.

Commodity indirect taxes

Commodity indirect taxes are incurred on intermediate inputs, household consumption, stocks change, and exports. These taxes include motor spirit levies, tobacco and alcohol excise duties, road user charges, and various minor levies such as lottery and racing duties. These taxes are not levied on imports. The commodities upon which taxes are levied are coal (15), oil (16), gas (17), beverages and tobacco (26), trade and transport (46), and financial services (47). To split out the industry totals by commodity, we use data on commodity indirect tax by commodity, which indicates the following proportions: coal (0.1%), oil (2.6%), gas (1.2%), beverages and tobacco (40.3%), trade and transport (41.9%), and financial services (13.9%). These proportions are applied to the total tax amount of each of the industry and consumption destinations, as input to arrays AI16, AI18, AI24 and AI25 (the effect of GST is also included in these arrays, except AI25). As can be seen from an examination of the ratios of commodity indirect tax paid to intermediate purchases at a commodity by industry level, this method is not perfect, as considerable variation (more than might be considered plausible) in effective rates of taxation arises.

Consumption of fixed capital

This row of the New Zealand I/O table is included in ‘Employment of Capital’, along with ‘operating surplus’.

Second-hand assets

The New Zealand I/O table incorporates the trade of second-hand assets. In net terms, households purchase \$137m worth of second-hand assets (making up 0.3% of total household consumption), while a negative flow of \$192m is recorded from investment (not disaggregated by industry). The balance (\$55m) is exported. These flows are removed from the table.

Imports

Import values are initially supplied by Statistics NZ by industry only, i.e. not separated by commodity. Statistics NZ subsequently constructed the required matrix. This is done by giving coefficients to the imports row of the Make matrix with respect to the column totals of that matrix. Columns of the Make matrix shows the sources of supply of each commodity (including various domestic industries, and imports). These coefficients therefore represent the proportion of each commodity which is imported. A matrix is then constructed with these coefficients along the leading

diagonal, and this matrix is multiplied by the Absorb matrix. Rows of the Absorb matrix show the disposition of each commodity according to usage. Thus, this procedure effectively assumes that the import penetration for a particular commodity is the same for each usage of that commodity. This is a similar procedure to that described by Huff and McDougall in the case where initial information is on industry imports only. In addition, a separate commodity ‘travel’ is defined, representing all purchases by New Zealand citizens while travelling overseas (the total of which is equal to the ‘travel’ debit in the current account). For both household final consumption and intermediate use, ‘travel’ expenditure is included in purchases from Trade and Transport (46), as it is judged that most ‘travel’ purchases fall into this category.

Import values are measured exclusive of import duty. In order to calculate duty-paid import values (as required by GTAP), an import duty matrix is generated in analogous fashion to the method used to generate the imports matrix. These two are then summed to obtain duty-paid import values. Import duty by commodity (array AI27) is calculated as the row totals of the import duty matrix.

Subsidies

Subsidies (negative flows) are added to non-commodity indirect taxes.

GST not refunded

The Goods and Services Tax is a value added tax with few exemptions and a single rate of 12.5%. In the New Zealand I/O table, GST is paid on household consumption and investment, and also by the financial services (47), public services (48) and dwellings (49) industries, and by Exports. The incidence on these three industries is due to the fact that certain outputs of these industries are ‘exempt supplies’, on which GST is not charged. This means that these industries do not collect GST for these products, but are nevertheless required to pay GST on the inputs used in their production. In determining the incidence of GST across commodities for these industries, we face the problem that not all of the outputs of these three industries are GST exempt, and so the effective rate of GST on those commodities will vary depending on the intra-commodity balance of consumption. In practice, the approach adopted is to spread the GST paid on intermediate inputs *pro rata* according to purchases from industries 47-48, both purchases of domestically-produced commodities and imports. Nil GST is assumed to be paid on purchases of other commodities.

Most exports are GST-exempt, and the GST collected on exports (\$236m) reflects that collected on sales of goods and services to overseas citizens travelling within New Zealand. This is treated as a commodity tax on exports of the Trade and Transport commodity. Commodity taxes on exports of other commodities are set to zero.

The New Zealand I/O table does not disaggregate GST on household consumption by commodity. Because of the fact that a single rate is levied across all commodities, it seems

acceptable to disaggregate the total according to the value of household consumption across commodities. The total GST levied on household consumption (including that on the three industries) is \$3,682m, which is 10.1% of total household consumption. This is somewhat less than the actual rate of 12.5% because GST is not levied on the value-added component of exempt goods and services. GST is calculated using the 12.5% figure for all industries except 47-49, and the remainder unallocated GST is split between those three industries according to their relative outputs. This results in an effective rate of GST for these three industries of 4.3%. The effective rate of GST on imports is much lower than that on domestically-produced commodities, so a similar approach seems impractical in this case. Instead, GST on imports is just split according to import values. In the case of investment, the overall amount paid is also significantly below the nominal rate of 12.5%, so the same approach is adopted as for household consumption of imports, for both investment purchases of domestic commodities and of imported commodities.

Stamp duty

Stamp duty is a transactions tax currently payable only on purchases of non-residential, non-rural land and buildings. Stamp duty on other transactions was abolished in 1988. The total amount shown in the I/O table is \$87m, and this is treated as a commodity tax on investment usage of domestic construction products (array AI20).

Private non-profit organisation sales to households

This column is added to household consumption.

Central and local government consumption

These two columns are added together to make up government consumption.

Zero values

In the NZ I/O table, central and local government do not pay any taxes, so arrays AI22 and AI23 contain zero values. No separate data exists for the employment of land category, and so zero values are supplied.

Negative operating surplus figures

In the inter-industry table, operating surplus is negative for three GTAP commodities: meat from cattle, sheep, etc (19), other meat products (20) and petroleum and coal products (32).

The meat processing industry in New Zealand is, in general, not very profitable due to an excess of capacity. The 1993 and 1994 years saw quite vigorous bidding wars for stock in various parts of the country, resulting in two major processors leaving the industry. The main cause of the reported negative operating surplus for the two meat processing industries, therefore, was the high prices which competing processors were forced to pay to get stock. In 1993, average domestic stock prices are estimated to have been 30% above their 'normal' or 'equilibrium' level relative to international meat prices. Accordingly, the value of sales from cattle, sheep, etc (9) to meat from cattle, sheep, etc (19) and to other meat products (20) are reduced by this percentage. Sales to other destinations are not reduced because it is not clear that all of the products of cattle, sheep, etc experienced similar price growth. The operating surplus figures for the three industries are adjusted to maintain overall balance. This has the effect of reversing the \$55m and \$4m operating deficits of the two meat industries, becoming operating surpluses of \$205m and \$13m respectively. The operating surplus of cattle, sheep, etc falls from \$526m to \$249m.

For petroleum and coal products, the most important company in this sector is the Marsden Point Petrol Refinery, which is jointly owned by each of the main petrol distribution companies operating in New Zealand. It seems likely that the reason for the losses reported by this industry is a shifting of profit to downstream sectors, particularly to the petrol wholesale operations in trade and transport (46). The method used to adjust the I/O table, therefore, is based on adjusting the output flows from this sector upwards so as to generate a more 'realistic' operating surplus.

The appropriate level of operating surplus is determined rather arbitrarily by calculating the unweighted mean of the ratio of operating surplus to depreciation (proxying the amount of capital used in each industry), and then halving this figure to reflect the fact that petrol refining is a relatively capital-intensive activity. This figure (being a ratio of 1.7) is then applied to the value of depreciation reported for Petroleum and Coal Products, to give a revised operating surplus of \$289m, in contrast to a reported operating deficit of \$52m. Adjustment is done by increasing the value of sales to all destinations sufficient to generate this revised operating surplus. The table is then balanced by reducing sales from trade and transport to all destinations by equal amounts, and reducing the operating surplus of that industry.

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Value units

Value flows in the GTAP model are expressed in 1995 US\$ millions. The NZ I/O table, as well as all the values mentioned in this paper, are expressed in March year 1992/93 NZ\$ thousands. No conversion is carried out in creating the HAR files supplied.