

**INDUSTRY
COMMISSION**

**Matching Input-output Data to
International Trade Data and Assembling a
Salter Database**

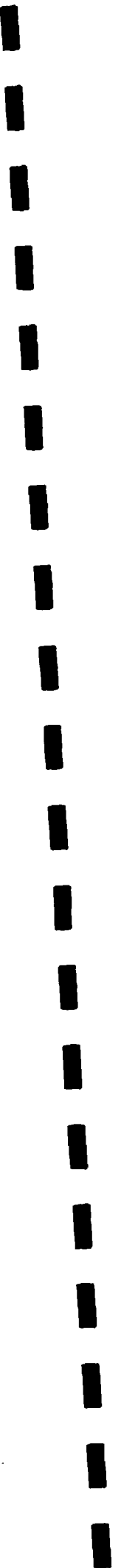
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1 INTRODUCTION

This paper traces the latter steps involved in constructing the 16 region, 37 sector multi-region Salter database. The regions are listed in Box 1 and the sectors in Box 2.

The initial equilibrium database for the Salter model is based on a set of single region input-output tables, international trade data, data on industry assistance and fiscal and macroeconomic data. The single region input-output tables are diverse in character. They originate from a variety of sources, base years and commodity classifications. The benchmark data set, however, must present a picture of a homogeneous system being modelled at a point in time. The reference time period chosen for the Salter model is 1988.

The starting point of this exercise is a set of individual region input-output tables which have generally been aggregated to the Salter 37 commodity classification (Hambley 1993). The object is to homogenise the format of the databases, update them to the reference year 1988, reconcile them with the international trade data and incorporate the assistance, fiscal and macroeconomic data. They are then collected, along with the trade data itself, into a multi-region database.

Box 1: Regions in the SALTER model

- | | | |
|----|----------------------------|---|
| 1 | Australia | |
| 2 | New Zealand | |
| 3 | Canada | |
| 4 | United States | |
| 5 | Japan | |
| 6 | Republic of Korea | |
| 7 | European Community | (United Kingdom, France, Federal Republic of Germany, Italy, Belgium, Netherlands, Luxembourg, Denmark, Ireland, Greece, Spain, Portugal) |
| 8 | Indonesia | |
| 9 | Malaysia | |
| 10 | Philippines | |
| 11 | Singapore | |
| 12 | Thailand | |
| 13 | People's Republic of China | |
| 14 | Hong Kong | |
| 15 | Taiwan | |
| 16 | Rest of the world | |

Box 2: Industries and commodities in the Salter model

Agriculture

- 1 Paddy Rice
- 2 Wheat
- 3 Other grains
- 4 Non-grain crops
- 5 Wool
- 6 Other livestock products

Resources

- 7 Forestry
- 8 Fishing
- 9 Coal
- 10 Oil
- 11 Gas
- 12 Other minerals

Food

- 13 Processed rice
- 14 Meat products
- 15 Milk products
- 16 Other food products

Non-food manufacturing

- 17 Beverages and tobacco
- 18 Textiles
- 19 Wearing apparel
- 20 Leather products
- 21 Lumber products
- 22 Pulp, paper and printing
- 23 Petroleum and coal products
- 24 Chemical, rubber and plastic products
- 25 Non-metallic minerals
- 26 Primary iron and steel
- 27 Non-ferrous metal products
- 28 Fabricated metal products
- 29 Transport equipment
- 30 Other machinery and equipment
- 31 Other manufacturing

Services

- 32 Electricity, gas and water
- 33 Construction
- 34 Trade and transport
- 35 Other services (private)
- 36 Other services (government)
- 37 Other services (ownership of dwellings)

The procedure consists of three major steps. The first step involves standardising each single region database as discussed in Chapter 2. This process requires each database to undergo a variety of specific and generic adjustments before updating and reconciliation. The second step is the updating and reconciliation procedure itself. Chapter 3 discusses how simulations conducted on the FIT model (James and McDougall 1993) are used to update the databases to the reference period and to reconcile them with the trade data and incorporate the assistance data. This chapter also describes how the fiscal and macroeconomic data collected is added to the updated databases. Finally, step three involves the construction of the multi-region equilibrium database. Chapter 4 discusses the collation of the updated databases, the inclusion of parameters and international trade structure and the derivation of the data to support the capital mobility extension of the model (McDougall 1993).

2 PREPARING HOMOGENEOUS SINGLE REGION INPUT-OUTPUT DATABASES

The single region databases that form the basis of the Salter multi-region database originate from a variety of sources. In the early phase of processing they undergo relatively mechanical procedures which bring them close to the commodity and industry aggregation required by Salter, while generally retaining the original table format (Hambley 1993). They must therefore undergo several additional adjustments before they are considered homogeneous and, therefore, ready to update. This chapter outlines the pre-update manipulation of the original single region input-output databases for all Salter regions except Hong Kong and the rest of the world. Preparation of synthetic input-output databases for these two regions is documented in Tormey (1993).

There are three types of adjustments made to a single region database before it is considered to be in Salter format; individual, commonplace and compulsory. Any given region's database requires specific adjustments unique to that particular region's input-output table to complete the conversion to Salter format. These specific adjustments are described, by region, in Appendix A. Also included in Appendix A is a list of any commonplace adjustments made to each region. A commonplace adjustment is one that is encountered frequently in the conversion of a database to Salter format. A discussion of these adjustments is presented in this chapter. Compulsory adjustments are those made to every database. These adjustments are also described in this chapter.

Individual Region Adjustments

Adjustments are made to each region's input-output tables to convert them to Salter format. The required format is summarised in Figure 1. Most countries do not present their tables exactly in this format. For example, the New Zealand input-output table reports government consumption in two components, Local and Central government consumption. These components need to be added together to produce a single government consumption vector consistent with the Salter format. Variations between the regional databases and Salter format are as wide and varied as the countries in the model.

Figure 1: The structure of a single region Salter database

	Intermediate usage	Investment	Consumption	Government	Stocks	Exports	Total sales
Demand for domestic commodities	AI01	AI 03	AI 05	AI 07	AI 09	AI 11	
Demand for imported commodities	AI02	AI 04	AI 06	AI 08	AI 10	Total imports	Duty AI 27
Taxes on domestic commodities	AI16	AI 20	AI 18	AI 22	AI 25	AI 24	
Taxes on imported commodities	AI17	AI 21	AI 19	AI 23	AI 26		
Labour	AI13						
Capital	AI14						
Land	AI15						
Industry taxes	AI12						
Total costs							

Commonplace Adjustments

Commonplace adjustments correct for differences between individual input-output tables and the Salter format that occur frequently. Table 1 summarises the commonplace adjustments made to the single region input-output tables.

Table 1: Summary of commonplace adjustments to input-output tables

<i>Region</i>	<i>Imports at basic values</i>	<i>Removing negatives</i>	<i>Deriving imports</i>	<i>Database balanced</i>	<i>Disaggregation performed</i>	<i>Reallocation performed</i>
Australia	O	O	O	O	X	X
New Zealand	X	O	O	O	X	X
Canada	O	X	O	X	X	X
United States	X	X	O	O	X	X
Japan	X	X	O	O	X	X
Korea	O	X	O	O	X	O
EC	X	X	O	O	X	O
Indonesia	O	O	O	O	X	O
Malaysia	O	O	X	X	X	O
Philippines	O	X	O	X	X	X
Singapore	X	O	X	X	X	O
Thailand	O	O	O	O	X	O
China	O	O	O	O	X	O
Taiwan	X	O	O	O	X	O

X indicates adjustment has been performed

O indicates adjustment not necessary

Imports at basic values

The basic values of imports in the Salter database are cif valuations inclusive of duty. The addition of freight and/or duty to give imports at basic values is a regular adjustment made to the single region databases. Often, the cost structure of an industry contains a single freight and/or duty vector as a component of value added. This needs to be distributed across individual imported commodity inputs. The method outlined, therefore, is one designed simply to reallocate costs. The freight and/or duty vector is pro-rated over imported intermediate usage by the share of imports of commodity *i* in total imported intermediate usage by industry *j*. This method assumes duty rates on each imported input are the same. For example, it assumes any particular industry pays the same duty rate on imports of coal as it does for motor vehicles. This undesirable property is rectified in the later stages of processing when target duty rates for each commodity are imposed on the database.

A similar method is used when there is a freight and/or duty figure reported as a component of final demand. The freight and/or duty vector is pro-rated over each end use using the share of imported commodity *i* by end use in total imports of commodity *i*.

Removing negatives from the database

Negative values for the basic values or purchasers' prices of domestic or imported commodities are not permitted in any end use category except that representing changes in stocks. Unwanted negatives can appear in the original input-output data when capital assets or used consumer goods are sold for scrap¹ to an industry as an input into production. By input-output convention, the sale of second-hand goods or scrap as raw materials into production is often recorded as a negative input and can cause negative entries in the intermediate transactions table.

For example, in a particular year, the car industry may buy \$1m worth of steel as an input into production. However, due to the demolition of certain capital assets, the car industry may sell \$2m worth of scrap metal back to the steel industry for recycling. In the input-output table this type of transaction may result in a negative \$1m entry in the intermediate usage of steel by the car industry. This is known as the 'negative input' treatment of scrap.

An alternative treatment is to create a separate category of primary factor payments to record sales by final buyers (ABS 1990a). This alternative treatment does not create negative values in the intermediate transactions matrix.

Where negative values occur for a particular Salter region, we convert from the 'negative input' to 'sales by final buyers' treatment by making the following adjustments:

- Intermediate usage: negatives appearing in intermediate usage are zeroed out.
- Primary factor payments: Zeroing out a negative in intermediate usage will cause an imbalance between total sales and total costs. Continuing the previous example, after zeroing out the negative \$1m of intermediate usage of steel by the car industry, the total costs of the car industry would have risen by \$1m yet the total sales of the car industry would not have changed. Conversely, total sales of steel would have increased by \$1m yet the total costs of the steel industry would not have changed. To offset these resulting imbalances, gross operating surplus (GOS) of the car industry is reduced by \$1m, and GOS of the steel industry is increased by \$1m.

1 'Scrap' can include the sale of second-hand motor vehicles as well as metal or paper for recycling.

The 'negative input' treatment can also lead to negative values recorded in the final demand transaction tables. To counter this, the negative value is zeroed out and total sales maintained by an offsetting increase in changes in stocks.

Deriving imports by commodity and end usage

The Salter database requires imports by both commodity and end usage (Figure 1). In some instances imports are presented as a row in the cost structure of industries. Imports are therefore provided by end use but not by commodity. To obtain import transaction tables in the correct format, imports by commodity are derived from independent international trade data. The process is described in Appendix C.

Where imports are presented by commodity but not by end usage, they are pro-rated across end usage categories (intermediate usage, investment, private and government consumption) using shares calculated from the end usage of domestically produced commodities. This assumes that if most of a domestically produced commodity is destined for private consumption, for example, then most imports will be too.

Balancing the database

Some of the databases are not balanced. This is because either the initial database was not balanced (as is the case of the Philippines and Canada) or because imports by commodity and end usage have been derived from international trade data (Malaysia and Singapore). A database is balanced using a two stage process. Firstly, the TABLO generated program EXTRACT extracts input-output coefficients from the original database. Secondly, the TABLO generated program PROJECT combines these coefficients with macroeconomic information calculated from the original database to produce a final, balanced database. Calder, McDougall and Strzelecki (1993) describe these programs in greater detail.

Overcoming concordance problems

Aligning the Salter commodity classification to those from a variety of sources invariably leads to aggregation problems. Aggregation problems occur when a Salter commodity is contained within a broader classification. For example, Other food products generally contains a host of components: Fruit, Vegetable, Flour mill and cereal products, Margarine, Confectionery and so on. Processed rice may be one component of Flour mill and cereal products. In this case, Processed rice must be disaggregated from the Other food products sector. The

disaggregation of a particular component from an aggregate sector is achieved using one of two methods; a 'naive split' or a RAS method. A brief outline of the 'naive split' process is presented later in the chapter and detailed descriptions of both methods are presented in Appendix D.

Often, the disaggregation has been partly performed. For example, Flour mill and cereal products were initially allocated in their entirety to the Processed rice sector in the Australian database. Ideally, data would be collected on the two components of interest in this category, processed rice and other flour mill and cereal products. However, and this is often the case, data is only available for the broad sectors Processed rice and Other food products. In this instance, flour mill and cereal products is added to other food products and the disaggregation performed using the available data. The aggregation procedure is also described in Appendix D.

Reallocating temporary commodities/industries

In an original input-output table there are cases where an aggregate service-based sector needs to be reallocated over a number of Salter industries. For example, the Australian database includes an industry called 'Services to agriculture'. This covers such activities as sheep shearing, crop dusting and spraying. In this case, costs and sales of Agricultural services are distributed across the entire agricultural sector. Assuming the Agricultural services industry is balanced (costs equals sales), the reallocation on a pro-rata basis will not unbalance any given industry in the agriculture sector after reallocation.

Compulsory Adjustments

The following section describes adjustments made to every single region database.

Intermediate usage adjustments

The most common method of disaggregation is the 'naive split' process detailed in Appendix D. This process involves the collection of external data (a complete list of the data collected is in Appendix E). The process uses external data on production shares, import shares and export shares to split imports, exports and total costs on a pro rata basis. The production and export shares together also provide a basis for splitting non-export sales on a pro rata basis.

In each region, Processed rice and Gas are extracted, via this 'naive split' method from Other food products and Oil and gas, respectively. Owing to the

simplicity of the pro-rata system, it has the potential to generate undesirable outcomes. For example, a country with relatively little Processed rice compared with Other food product production may find itself selling Paddy rice almost exclusively to the Other food products industry rather than to Processed rice. The possibility of generating poor results for a set of commodities over all countries has lead to the development of procedures that are designed to improve the input-output structure for these, and related, industries. These procedures are described below.

Processed rice adjustment

The Processed rice adjustment involves reallocating the intermediate usage² of Paddy rice from the Other food products to Processed rice industry. Intermediate usage of the remaining agricultural products (Wheat, Other grains, Non-grain crops, Wool and Other livestock) is reallocated from the Processed rice to Other food products industry. These changes are based on two assumptions. Firstly, the Processed rice industry uses only one agricultural input, namely, Paddy rice. Secondly, the Other food products industry uses no Paddy rice as an input into production.

This reallocation gives a new value of total costs for both the Processed rice and Other food products industries. The sales structure of these industries are adjusted to maintain balance. Exports of these commodities are held constant. Each component of domestic absorption³ for Processed rice and Other food products are added together and pro-rated by shares calculated from the new value of total costs less exports. This ensures total costs equals sales following the reallocation.

Oil and Gas adjustment

The Oil and Gas adjustment involves reallocating the intermediate usage of Gas by the Petroleum and coal products industry to usage of Oil. This assumes that the Petroleum and coal products industry processes no Gas, only crude oil. Intra-industry usage in the Oil and Gas industries is also adjusted. The assumption is made that the Oil industry uses only Gas as an input and similarly, that the Gas industry uses only Oil as an input.

2 'Intermediate usage' in this context means intermediate usage from both domestically produced and imported sources along with commodity taxes on each.

3 Domestic absorption is defined as sales for intermediate usage, investment, private and government consumption and changes in stocks. In this context the adjustment is made only to sales of the domestically produced product.

This reallocation gives a new value of total sales for both the Oil and Gas industries. The cost structures of these industries are adjusted to maintain balance. Each component of total costs (excluding intra-industry usage) for these industries are added together and pro-rated by shares derived from the new value of sales. This ensures total costs equals sales following the reallocation.

Splitting Gross Operating Surplus over capital and land

Gross operating surplus (GOS) is allocated between capital and land on a pro rata basis using shares of capital and land in GOS for each industry. Agriculture is the only sector that uses land in the model⁴. The problem is to determine the shares to facilitate the allocation.

The original European Community (EC) and Australian databases have capital and land allocated by industry. The GOS splits for these databases are presented in Table 2. It is obvious from this table that the GOS splits for the EC are assumed to be 70 to 30 per cent while the split for the Australian database hovers around the 40 to 60 per cent mark for capital and land respectively.

Table 2: GOS splits for EC and Australia by agricultural industry (per cent)

	<i>Paddy rice</i>	<i>Wheat</i>	<i>Other grains</i>	<i>Non-grain crops</i>	<i>Wool</i>	<i>Other livestock</i>
EC						
Capital	70.00	70.00	70.00	70.00	70.00	70.00
Land	30.00	30.00	30.00	30.00	30.00	30.00
Australia						
Capital	36.22	37.83	36.79	41.58	37.77	39.36
Land	63.78	62.17	63.21	58.42	62.23	60.64

Source: Ryan (1992) and Kenderes and Strzelecki (1991)

Another potential source of GOS splits is the database from the WALRAS model (Burniaux, Delorme, Lienert and Martin 1990). Designed by the Organisation of Economic Co-ordination and Development (OECD), the WALRAS model is a multi-sector, multi-country applied general equilibrium model designed to quantify the economy-wide effects of agricultural policies in OECD countries. The model contains two agricultural industries, Livestock and

4 This implies that shares of capital and land in GOS for non-agricultural industries are one and zero respectively.

Other agriculture. GOS splits for New Zealand, Canada, United States, Japan and the EC are presented in Table 3.

Table 3: GOS splits from the WALRAS model (per cent)

		<i>Livestock</i>	<i>Other agriculture</i>
New Zealand			
	Capital	50.00	50.00
	Land	50.00	50.00
Canada			
	Capital	55.48	57.59
	Land	44.52	42.41
United States			
	Capital	31.90	31.90
	Land	68.10	68.10
Japan			
	Capital	79.92	76.68
	Land	20.08	23.32
EC			
	Capital	77.25	74.53
	Land	22.75	25.47

Source: Burniaux *et al* (1990)

The data presented in Table 3 shows marked differences in GOS splits between countries, eg. the United States and Japan. The EC splits are roughly consistent with those assumed by Ryan (1992).

To allocate GOS by shares calculated from the WALRAS database poses problems. The WALRAS model does not include any non-OECD countries. This implies that the ASEAN countries, the three Chinas and Korea are not available (nine out of the sixteen Salter countries). Also, the WALRAS country coverage does not include an emerging industrialised nation that would be representative of these countries. Because the WALRAS model's GOS splits vary significantly between countries, deciding on a representative region on which to base GOS splits for non-OECD countries is a difficult decision.

For these reasons, and because of the need for a consistent allocation method across countries, every Salter database has GOS split equally over capital and land, ie. a 50 per cent share for both capital and land. The GOS splits for each Salter region are recommended as an area of further research.

Scaling databases to \$US 1988

The databases are now in Salter format. However, not all are valued in the same currency or for the same base year. To arrive at a set of homogeneous single region databases, each is scaled to a level of Gross Domestic Product (GDP) obtained for each region for the year 1988, denominated in \$US million. The GDP values are presented in the macroeconomic data summary in Appendix H.

Averaging databases

A final process for each database is the removal of potentially troublesome zeros from values targeted in the update procedure (described below). For example, a particular database may have zero exports reported for a particular commodity. Exports, however, may have a significant value reported in the international trade data. This could occur because of changes in a particular economy's structure (recall that the raw international trade data refers to 1988 while the raw input-output data refers to a variety of years), classification or recording errors or timing adjustments. A problem arises because the update procedure requires a percentage change shock to be calculated between these two values. A zero in the denominator makes the shock impossible to calculate and the target, therefore, cannot be achieved. To overcome this, an averaging procedure described in Calder, McDougall and Strzelecki (1993) ensures that each value targeted in the update procedure has at least a small base value to start with.

A set of homogeneous single region databases are now ready to update.

3 THE UPDATE PROCEDURE

The update procedure is designed to give the set of homogeneous single region databases an input-output and trade structure that resembles 1988. This is achieved by conducting simulations on FIT, a single country general equilibrium model, so that key values in the database are adjusted to be consistent with 1988 data collected from external sources.

The main aggregate components of GDP in each single region database are updated to be internally consistent with data collected from United Nations national accounts, summarised in Appendix H. Firstly, the individual components of Gross National Expenditure (GNE) are targeted. Secondly, the trade structure for 1988 compiled in Hambley (1993) and Hanslow (1993) is incorporated into each database. This is achieved by updating each database to be consistent with the international trade data. A variety of tax rates in the database are also updated to reflect assistance estimates for 1988 (Gotch 1993). The theoretical structure of the model does not explain changes in stocks. There is a facility in the FIT model to reduce stock changes in the databases to zero. Finally, to improve the quality of the update for the important Oil commodity, a Relative oil price index is also shocked to account for oil price changes which may have occurred between the original reference year for the input-output table and 1988. This chapter describes each aspect of the update procedure and the TABLO implementation of the calculation of the shocks fed into the FIT model.

Gross National Expenditure

To make the GNE for each region consistent with data collected from United Nations national accounts, the aggregate levels of investment (gross fixed capital formation), household and government consumption are targeted in the update procedure. Target values of each component are stored in header array format. The shocks to the FIT model are calculated as the percentage difference between the target and the actual database value⁵ of the expenditure aggregate.

5 As an example, aggregate household consumption from the database is calculated as the summation of consumption across commodities and sources at purchasers' prices.

Trade Structure

The international trade database is stored in header array format and contains four pieces of data from which export and import targets by commodity are derived:

- exports fob of non-margin commodity i from region s to region v ;
- supply of the freight margin from region s ;
- imports cif of commodity i by region v from region s ; and
- freight on the import of commodity i from region v to region s .

Under the current Salter classification, the freight margin is supplied only by the Trade and transport industry. The target level of exports for the Trade and transport sector in a particular region is calculated as the sum of non-margin exports of Trade and transport over v destinations plus the reported supply of the freight margin for that region. For the remaining sectors, the target value of exports is simply the sum of non-margin exports over v destinations.

A target value of imports by commodity for each region is calculated by summing imports cif over source countries for that region.

Percentage differences between these targets and the fob exports and cif imports reported in the single region databases are calculated and fed into the FIT model to update the trade structure.

The one exception to this method is where the international trade data shows that a region imports a zero amount of a commodity. In this case the shock to the cif value of imports is set equal to -99.9999 to avoid linearisation errors in the update procedure. A full explanation of why this is necessary and how it is carried out is given in Appendix L. A list of the regions and commodities for which this procedure is necessary is contained in Table L2.

Tax Rates

The model is chiefly designed to conduct trade liberalisation experiments. Therefore, extensive work has been carried out to gather estimates of tariff or tax equivalents of trade restrictions (Gotch 1993) to incorporate in the database. Five taxes are updated: import (tariffs), export, production, domestic and imported usage taxes. This chapter discusses the general methodology involved in updating these taxes as well as two exceptional taxes; export taxes used to model Voluntary Export Restraints (VERs) and source-specific import taxes.

General methodology

Where an estimate of a particular tax rate is gathered (even if the estimated rate is zero), the corresponding tax rate in the database is updated to that value. Extensive data has been collected on estimates of the tariff or tax equivalents of import duties and non-tariff barriers (NTBs) for the agricultural and food processing sectors and for coal in the EC and Japan. Also, tariff protection data on non-food manufacturing has been collected. Where no target data is collected, the tax rate that is available from the initial input-output database is generally assumed to be the best approximation.

Target domestic and imported usage taxes are applied to all domestic absorption categories; intermediate usage, investment, private and government consumption.

As data on tax and tariff equivalents of access or other restrictions on services is scant, export and import tax rates for these industries are targeted at a zero rate. Consumption and production taxes, however, are left at the same rate as in the initial input-output table.

Voluntary export restraints

One complication to the tax updates is the inclusion of VERs. Export tax equivalents of VERs are estimated on the export of Japanese Transport equipment (motor vehicles) to the United States, EC and Canada. Similar taxes are estimated on the export of Textiles and Wearing apparel to the same countries by exporters covered by the Multifibre Arrangement⁶. These VERs are modelled as destination-specific export taxes.

The FIT model used for updating the single region databases assumes that export taxes are non-discriminatory, that is, applied equally on exports irrespective of the destination. It is nevertheless possible to incorporate destination-specific export tax rates because of the fact that the databases are updated to a known trade structure.

This is area where further refinement of the procedure would yield a great simplification. The procedure both for calculating the shocks for the update and for subsequently reallocating the tax revenue (outlined in the next chapter) would be much simpler if destination specific export tax rate targets were available from an external source rather than being recalculated each time they are required.

6 Indonesia, Malaysia, Philippines, Singapore, Thailand, Korea, Taiwan and China.

The trade data contains the fob value of exports of each commodity by source and destination region. These values are inclusive of export taxes. The Salter database contains the basic value of exports, ie. the export tax free value of exports. Knowing the fob value of exports and the VER target tax rate by destination, we are able to calculate the shock to non-discriminatory export taxes that will give the correct level of total export tax revenue, which can subsequently be reassigned across specific destinations to yield the correct VER rates.

A further complication to updating the export tax rates is the assumption (Gotch 1993) of zero export taxes on intra-EC trade for the targeted commodities listed in Table 4. This is a second case in which destination specific export taxes are required. For this reason, the shocks to export taxes for the EC database are calculated differently from the method used for all other regions.

Table 4: Targeted commodities for EC trade

Salter commodity classification

Paddy rice
Wheat
Other grains
Non-grain crops
Wool
Other livestock products
Coal
Processed rice
Meat products
Milk products
Other food products
Electricity, gas and water
Construction
Trade and transport
Other services (private)
Other services (government)
Ownership of dwellings

Source: Gotch (1993)

The standard method for calculating the shock to export taxes for regions other than the EC is to first calculate the actual target value of fob exports minus the value of VER taxes:

$$\text{EXPmver}(i,s,v) = \text{EXPFOB}(i,s,v) / (1 + \text{VERTR}(i,s,v)) \quad (1)$$

where

$EXPmver(i,s,v)$ = the value of fob exports minus the value of VER taxes for commodity i from source s to destination v ;

$VERTR(i,s,v)$ = the target (VER) export tax rate on commodity i from source s to destination v ; and

$EXPFOB(i,s,v)$ = the target fob value of exports of commodity i from source s to destination v (obtained from the international trade data).

$EXPFOB(i,s,v)$ is available from the international trade database and $VERTR(i,s,v)$ from the external target data.

The actual \$US m value of VER export tax revenue is therefore:

$$TERver(i,s,v) = EXPFOB(i,s,v) - EXPmver(i,s,v) \quad (2)$$

where

$TERver(i,s,v)$ = the value of export tax revenue arising from VERs levied on commodity i from source s to destination v .

Since the single region databases do not contain destination specific exports or taxes, the export tax rate is updated to be consistent with the derived aggregate revenue:

$$VERnd(i,s) = \text{sum}(v, \text{sec}, (TERver(i,s,v))) / \text{sum}(v, \text{sec}, (EXPmver(i,s,v))) \quad (3)$$

where

$VERnd(i,s)$ = the target export tax rate arising from VERs on commodity i from source region s .

This target export tax rate will generate a level of export tax revenue that, when assigned to the correct destinations, will give the exact VER rate required. Reassigning the VER tax revenue is discussed in Chapter 4.

Commodities that are not subject to VERs (where equation (2) yields a zero) are updated to target non-destination specific export taxes, except in the EC. As explained above, the shock to export taxes for the EC single region database must take account of the assumption of zero export taxes on intra-EC trade for the targeted commodities listed in Table 4. For the non-targeted commodities in the EC the procedure is exactly the same as for all other regions. The procedure for updating the export taxes for the targeted commodities involves first calculating the target value of fob exports for non-intra EC trade:

$$EXPFOBnec(i,ec) = \text{sum}(v, \text{sec}, (EXPFOB(i,s,v))) - EXPFOB(i,ec,ec) \quad (4)$$

where

$EXPFOBnec(i,ec)$ = the value of fob exports of targeted commodity i from the EC to all regions other than the EC.

The export tax free target value of exports, that is exports at basic values, for non-intra EC trade is:

$$EXPBVnec(i,ec) = EXPFOBnec(i,ec) / XTPnd(i,ec) \quad (5)$$

where

$EXPBVnec(i,ec)$ = the basic value of exports of targeted commodity i from the EC to all regions other than the EC.

$XTPnd(i,ec)$ = the target power of the non-discriminatory export tax for exports of targeted commodity i from the EC to all regions other than the EC.

Since there are no export taxes on intra-EC trade for the targeted commodities, the total value of revenue from export taxes levied on EC exports is found by subtracting the basic value of non-intra-EC trade from the fob value of non-intra-EC trade:

$$T(i,ec) = EXPFOBnec(i,ec) - EXPBVnec(i,ec) \quad (6)$$

where

$T(i,ec)$ = the value of revenue from export taxes levied on exports of targeted commodity i from the EC to all regions.

The coverage-adjusted non-discriminatory tax rate that will generate the target level of export taxes when later assigned to the correct destination, can be calculated by dividing the target value of tax revenue from equation (6) by the basic value of total exports from the EC:

$$XTRca(i,ec) = T(i,ec) / (\text{sum}(v, \text{sec}, (EXPFOB(i,ec,v))) - T(i,ec)) \quad (7)$$

where

$XTRca(i,ec)$ = the target coverage-adjusted non-discriminatory export tax rate on exports of targeted commodity i from the EC to all regions.

Source specific import duties

Conglomerate regions such as the EC and Rest of the World have significant levels of intra-regional trade. The trade data also shows that Australia imports from and exports to itself. In the Australian case, this arises from the inclusion of re-exports in the original trade data.

Given intra-regional trade, what is the appropriate treatment of intra-regional duties? Bearing in mind that Australia charges no duty on re-export goods, it is

incorrect to apply a duty rate to these commodities. While this is not a crucial factor in the Australian database (owing to the small levels of trade involved), it is crucial in the EC. The EC maintains high levels of assistance, especially to its agriculture and food products sector. However, the import tax rates applied to intra-EC trade are not the same as those on imports from other sources. The import tax rates applied to intra-EC trade need to be set equal to zero for all commodities.

This source-specific import tax problem is handled in similar fashion to VERs. The international trade data provides figures on imports cif that will be included in the database by the update procedure. These are landed duty free values. Knowing this and the target import tax rates by source region, we are able to calculate the shock to the power of the non-discriminatory import tax that will generate the correct level of duty revenue, which can subsequently be reassigned across specific destinations to yield the correct duty rates. First, the target value of import tax revenue is calculated:

$$DR(i,v) = \text{sum}(s, \text{sec}, (IMPCIF(i,s,v) \times MTR(i,s,v))) \quad (8)$$

where

$DR(i,v)$ = the value of duty revenue from tariffs levied on commodity i in region v ;

$MTR(i,s,v)$ = the target import tax rate on commodity i from source s to destination v ; and

$IMPCIF(i,s,v)$ = the cif value of imports of commodity i from source s to destination v .

The target power of the non-discriminatory import tax is determined as such:

$$MTPnd(i,v) = 1 + (DR(i,v) / \text{sum}(s, \text{sec}, IMPCIF(i,v,s))) \quad (9)$$

where

$MTPnd(i,v)$ = the target power of the non-discriminatory import tax on commodity i in region v .

Changes in Stocks

Each individual region database contains changes in stocks (investment in inventory) of both domestically produced and imported commodities. The Salter model assumes these to represent a temporary disequilibrium in supply and demand so must be removed from the database (Jomini *et al.* 1991). Because changes in stocks can be positive or negative, in the equation system of the FIT model they are not defined in percentage change terms (James and McDougall

1993). Rather, domestic changes in stocks are defined as the absolute change in the ratio of stocks to total sales (multiplied by 100). Imported stocks are defined as the ratio of stocks to total imports (multiplied by 100). Putting a negative in front of these definitions, therefore, defines how the shocks are calculated to remove inventory investment from the databases.

Relative Oil Price Index

The FIT model contains a variable describing the price of imports of commodity *i* relative to the GDP price index (James and McDougall 1993). This is shocked for the Oil commodity to improve the quality of the update. The calculation of the shocks is presented in Appendix F.

Inclusion of the Fiscal Data

In addition to the data shown in Figure 1, a final single region database includes key fiscal aggregates used in the Salter model. These cover income tax, transfer payments and depreciation. These figures are either collected directly from United Nations national accounts sources or derived from related data. A summary of this procedure and the data collected are presented in Appendixes G and H respectively.

TABLO Implementation

Shocks to be fed into the FIT model are calculated using the TABLO generated program SHOCK. This program reads the homogeneous, single region databases derived in Chapter 2 and calculates the current values which are to be updated. The program also reads header array files containing the target trade, tax and macroeconomic data⁷. From these SHOCK calculates the target values for the update⁸. The shocks are then calculated as the percentage difference between the target and current values for each database item.

The shocks calculated are written to a header array file, one for each region. Running the FIT model requires the shocks to be read in text format. To achieve this, the program HATOXL is applied to each header array, the output of which

7 The header array files containing the tax and fiscal data are generated using the MODHAR program. The data is stored on an input file. Any change to the target tax rates, GNE components or relative oil import price indices can therefore be made using a text editor.

8 The exception to this is changes in stocks, the shocks for which are calculated from the input single region databases.

is run through an EXCEL macro that creates individual text files, one for each variable to be shocked, containing all the shocks for the update.

The FIT simulations are conducted using as inputs the homogeneous databases and shocks files. They are conducted using a three-stage extrapolation procedure (Pearson and Codsì 1991). The formatted solution file is checked to verify the solution is converging. Each database is also checked for unacceptable negatives and to ascertain whether the targets for the GNE, trade and tax components of the update are achieved. The checking uses two TABLO generated programs CHECKNEG and NEWUPDCHK. A guide to the computing procedures and a complete list of the files involved in the update procedure is presented in Appendix L.



4 CONSTRUCTING THE MULTI-REGION DATABASE

Constructing the multi-region database is done using the TABLO generated program PREMULTI. The program combines the updated single region databases, the synthetically produced Hong Kong and Rest of the World databases and the parameters. A summary of the data produced for the multi-region database is presented in Appendix I. The program also calculates the marginal budget shares for each region, splits export taxes and exports over destination and import taxes and imports over source countries (as discussed earlier). The final step is to derive the data for the capital mobility extension.

The Marginal Budget Share

Used in the calculation of the Frisch parameter, the marginal budget share is the average budget share times the elasticity of demand with respect to expenditure (Jomini *et al.* 1991, p.102-103).

Export Taxes and Exports by Destination and Margins

The inclusion of destination specific export taxes complicates the allocation of export taxes and exports over destinations. Export taxes now comprise two components, VERs and standard export taxes that in all regions except the EC are applied equally across all destinations. Allocating exports taxes, therefore, involves a two step procedure. Currently, VERs and non-discriminatory export taxes are stored in two separate header arrays (see Appendix L). A change in the system could easily be made to calculate both types of export taxes in the one step by reading in target export taxes from the one source, in the same way that import taxes are stored.

In a method similar to that used to calculate the export tax shocks, knowing the values of exports and VER tax rates is the key to the correct allocation of the updated value of export taxes over destinations. The export tax revenue from VERs, $TER_{ver}(i,s,v)$ is calculated using the procedure outlined in the section on voluntary export restraints in Chapter 3, and used to split the export tax revenue from the update over destinations. This procedure for calculating export tax revenue from VERs uses the identity that the value of tax revenue equals the tax paid value minus the tax free value (which is the tax paid value divided by the power of the VER tax):

$$TERver(i,s,v) = EXPFOB(i,s,v) - (EXPFOB(i,s,v) / (1+VERTR(i,s,v))) \quad (10)$$

where

$TERver(i,s,v)$ = the value of export tax revenue from VERs on commodity i from source s to destination v (as calculated from the international trade data);

$EXPFOB(i,s,v)$ = the target fob value of exports of commodity i from source s to destination v (obtained from the international trade data);

$VERTR(i,s,v)$ = the target (VER) export tax rate on commodity i from source s to destination v .

The next step is to allocate the export tax revenue from VERs from the single region databases, using $TERver(i,s,v)$ to derive the destination specific shares:

$$VERupd(i,s,v) = (TERver(i,s,v) / \sum(v, sec, TERver(i,s,v))) \times TERupd(i,s) \quad (11)$$

where

$VERupd(i,s,v)$ = the value of export tax revenue from VERs on commodity i from source s to destination v ;

$TERver(i,s,v)$ = the value of export tax revenue from VERs on commodity i from source s to destination v (as calculated from the international trade data); and

$TERupd(i,s)$ = the total (non-destination specific) value of export tax revenue from exports of commodity i from region s (from the updated single region databases).

The next step is to determine the revenue from export taxes not attributable to VERs. This is done by subtracting away the value of VER export tax revenue calculated in equation (11) from the updated level of export tax revenue:

$$TERstd(i,s) = TERupd(i,s) - \sum(v, sec, VERupd(i,s,v)) \quad (12)$$

where

$TERstd(i,s)$ = the value of revenue from export taxes not attributable to VERs on commodity i from region s .

If the standard export taxes are assumed to be non-discriminatory across destinations, then allocating this export tax revenue would involve pro-rating using the target value of exports from the trade data. However, because of the added complication that the EC has zero export taxes on intra-EC trade in the targeted commodities (see Table 4), the pro-rating of the non-VER export tax

revenue requires the following procedure. First the simple export shares are calculated from the international trade data:

$$I_EXPshare(i,s,v) = EXPFOB(i,s,v) / \text{sum}(v, \text{sec}, EXPFOB(i,s,v)) \quad (13)$$

where

$I_EXPshare(i,s,v)$ = the initial fob export shares (calculated from the international trade data).

Then the shares for exports from the EC to the EC (ie. $I_EXPshare(t,ec,ec)$ for the t targeted commodities) are set to zero.

$$I_EXPshare(t,ec,ec) = 0.0 \quad (14)$$

where

$I_EXPshare(t,ec,ec)$ = the initial fob export shares for exports for the targeted commodities t from source EC to destination EC.

This results in the export shares not summing to one. This is remedied by calculating new shares from the old shares:

$$F_EXPshare(i,s,v) = I_EXPshare(i,s,v) / \text{sum}(v, \text{sec}, I_EXPshare(i,s,v)) \quad (15)$$

where

$F_EXPshare(i,s,v)$ = the final fob export shares.

The total destination specific export tax revenue is calculated by splitting out over destinations the non-VER export tax revenue from the update using the final fob export shares and adding in the VER export tax revenue:

$$TER(i,s,v) = (TERstd(i,s) \times F_EXPshare(i,s,v)) + VERupd(i,s,v) \quad (16)$$

where

$TER(i,s,v)$ = the total value of export tax revenue on commodity i from region s to v .

The shares used to split the updated value of exports over destinations are based on basic values, which are calculated by subtracting the export taxes calculated in equation (16) from the fob value of exports from the international trade data:

$$EXPBVt(i,s,v) = EXPFOB(i,s,v) - TER(i,s,v) \quad (17)$$

where

$EXPBVt(i,s,v)$ = the target basic value of exports of commodity i from region s to region v .

The final step in the treatment of exports involves the freight margin. The multi-region Salter database contains separate headers for the non-margins and margins components of exports. The Trade and transport sector exports margins into a world-wide pool of freight. The multi-region database requires a vector of margins exports as a separate component of final demand. This is set equal to the margins exports in the trade data and assigned to the Trade and transport sector. Exports of margins are set equal to zero for the remaining 36 sectors in the database.

The basic value of exports in the updated single region databases is a combined total of both margins and non-margins exports. The procedure for allocating the updated basic value of exports over destinations thus involves first subtracting the value of margins, then using the target basic value of exports calculated in equation (17) to share out the remaining updated basic value of exports:

$$\text{EXPNM}(i,s,v) = (\text{EXPBVu}(i,s) - \text{EXPM}(i,s)) \times (\text{EXPBVt}(i,s,v) / \text{sum}(v,\text{sec},\text{EXPBVt}(i,s,v))) \quad (18)$$

where

$\text{EXPNM}(i,s,v)$ = the value of non-margin exports at basic values of commodity i from region s to destination v ;

$\text{EXPBVu}(i,s)$ = the updated level of exports at basic values of commodity i from region s .

Import Taxes and Imports by Source Region

Again, knowing the import values and target tax rates is the key to allocating the appropriate amount of duty to the source region. We proceed by calculating the target level of duty in the same way as in the section on source specific import duties in Chapter 3. Then the updated value of duties is allocated over source countries, using weights calculated from the target value of duty which is in turn calculated from the cif value of imports. Since the international trade data is internally consistent the cif value of imports is the fob value of exports plus the value of freight:

$$\text{IMPCIF}(i,v,s) = \text{EXPFOB}(i,s,v) + \text{FGHT}(i,s,v) \quad (19)$$

where

$\text{IMPCIF}(i,v,s)$ = the cif value of imports of commodity i into region v from region s ;

$FGHT(i,s,v)$ = the value of freight on commodity i from region s from region v .

The target value of duty is then the duty free value of imports multiplied by the target tax rate:

$$DUTYt(i,v,s) = IMPCIF(i,v,s) \times IMPTR(i,v,s) \quad (20)$$

where

$DUTYt(i,v,s)$ = the target value of duty levied on imports of commodity i into region v from region s ;

$IMPTR(i,v,s)$ = the target tax rate on imports of commodity i into region v from region s .

These target values of duty are then used as shares for splitting out the updated value of duties:

$$DR(i,v,s) = DRupd(i,v) \times DUTYt(i,v,s) / \text{sum}(s, \text{sec}, DUTYt(i,v,s)) \quad (21)$$

where

$DR(i,v,s)$ = the value of duty levied on commodity i into region v from region s ;

$DRupd(i,v)$ = the updated level of duty on commodity i into region s .

Imported intermediate usage, private and government consumption and investment are read off each individual updated single region database. These are in basic values, that is, cif imports plus duty. To allocate these over source regions, the cif imports from the trade data (equation (19)) are added to the target value of duty calculated in equation (20) to generate target basic values of imports to use as import shares:

$$IMPBV(i,v,s) = IMPCIF(i,v,s) + DUTYt(i,v,s) \quad (22)$$

where

$IMPBV(i,v,s)$ = the target basic value of imports of commodity i into region v from region s .

Each component of imports is split over source countries using shares calculated from the target basic values:

$$IMPshare(i,v,s) = IMPBV(i,v,s) / \text{sum}(s, \text{sec}, IMPBV(i,v,s)) \quad (23)$$

where

$IMPshare(i,v,s)$ = the share of imports at basic values of commodity i into region v from region s .

Data for the Capital Mobility Extension

An additional step in the construction of the multi-region database is the inclusion of data to support the capital mobility extension. Derivation of this data is presented in Appendix J and the data collected to facilitate the process in Appendix K.

TABLO Implementation

The PREMULTI program carries out the aforementioned procedures as well as combining the database with a set of parameters (stored in header array format). The final product is checked by another TABLO program called MRCHECK. This program examines the balance conditions that must hold in the multi-region database. For a particular region, these are that:

- total costs and sales for each industry are equal;
- NDP calculated from the expenditure and disposition sides are equal; and
- non-margin exports from region A to B plus freight equals what region B says it imports from A.

A computing guide and complete list of the files involved in the construction of the multi-region database is presented in Appendix L.

APPENDIX A: INDIVIDUAL AND COMMONPLACE ADJUSTMENTS MADE TO THE SINGLE REGION INPUT-OUTPUT TABLES

Introduction

This appendix lists the individual and commonplace adjustments by region that were discussed in Chapter 2. Hambley (1993) contains a description of how the single region input-output tables are aggregated to Salter classification.

Australia

The Australian database requires no individual adjustments, only the following commonplace adjustments:

- Brown coal, oil and gas, currently assigned to commodity 10 (Oil), to be pro-rated over commodities 9 (Coal), 10 (Oil) and 11 (Gas);
- Flour mill and cereal food products, currently assigned to commodity 13 (Processed rice), to be added to commodity 16 (Other food products) and pro-rated over 13 and 16; and
- the temporary commodity 38 (Agricultural services) to be reallocated over the agricultural industries (1-6) after their costs/sales structures are determined.

New Zealand

The single country database for the New Zealand requires the following individual adjustments:

- adding Household consumption CPI, Non-CPI and Private non-profit services provided to households to obtain private consumption usage;
- adding Local and Central government consumption to obtain government consumption usage;

-
- commodity tax paid by end usage¹ is calculated as the sum of Commodity indirect taxes nec., Sales tax and GST not claimed from IRD;
 - this commodity tax vector is split over commodities and sources for each usage to conform with Salter format (headers AI16-AI24 in Figure 1 of Chapter 2). This is done by pro-rating the vector using the shares of domestic and imported commodity *i* in total purchases² of all commodities by end usage;
 - payments to labour corresponds to 'Compensation of employees';
 - Gross Operating Surplus (GOS) is calculated as the sum of Consumption of fixed capital, Operating surplus and Second-hand assets³;
 - industry taxes are calculated as Non-commodity indirect taxes plus Non-commodity subsidies (subsidies are a negative tax in the input-output table); and
 - a negative GOS figure reported for the Iron and steel industry is replaced by a positive value. This is done by taking the GOS to total costs ratio for the Australian Iron and steel industry (which is 5 per cent) and applying this to the total costs of the New Zealand counterpart to obtain a new (positive) value for GOS. The difference between this new value and the old is subtracted from payments to labour to maintain costs and sales balance. A summary of the restructuring of the value added is presented in Table A1.

1 'End use' includes intermediate usage, private and government consumption, investment and exports.

2 Total purchases are calculated as the sum, over all *i* commodities, of domestic and imported commodity *i* by each usage. For example, from Figure 1, total usage for private consumption is the column sum of AI05 and AI06.

3 By definition (ABS 1990a) 'Second hand assets' are goods sold from households back to industry, eg. scrap metal sold for recycling, and can be considered as a part of GOS.

Table A1: Restructuring value added in the New Zealand iron and steel industry (\$NZ m)

<i>Component of value added</i>	<i>Old</i>	<i>Rescaled</i>
Labour	118	76
GOS	-11	31 ^a
Industry taxes	2	2
Total value added	109	109
Total costs	574	574

a This figure is 5 per cent of \$NZ574 m

Of the commonplace adjustments to be made, the New Zealand database requires:

- initial duty vector to be added to cif imports to yield basic values;
- a new duty vector is calculated by subtracting the initial value of total imports for each commodity from the new total imports for each commodity at basic values;
- GOS to be split over payments to capital and land;
- two sectors, Exploration and Extraction of crude petroleum and natural gas, currently assigned to commodities 10 (Oil) and 11 (Gas), respectively, to be added and pro-rated over 10 and 11; and
- Grain mill products, currently assigned to commodity 16 (Other food products), to be added to commodity 13 (Processed rice) and pro-rated over 13 and 16.

Canada

The single country database for the Canada requires the following individual adjustments:

- a temporary commodity 'Bauxite and alumina' is reported in the initial database⁴. This commodity records domestic and imported sales figures from the original Canadian database, but has not been assigned a costs structure. The assumption is made that Canada imports bauxite to manufacture alumina. On the imports side, Bauxite and alumina is added

4 The reason this sector is reported separately is that bauxite is the resource based commodity that forms part of Other minerals(commodity 12) and alumina is the manufactured product which comprises part of Non-ferrous metals(commodity 27).

to the imported sales of Other minerals. This assumes all imports of the composite commodity are bauxite. Domestically, sales are added to Non-ferrous metals. This assumes Canada manufactures only alumina;

- the vector containing commodity taxes on intermediate usage as a component of industry costs is pro-rated over commodities and sources using the share of domestic and imported intermediate usage of commodity i in total purchases of commodity i by industry j ;
- payments to labour is calculated as the sum of Wages and salaries, Supplementary labour income and Net income of unincorporated businesses⁵ for all industries except Ownership of dwelling. Net income of unincorporated business in the Ownership of dwellings industry is assigned to payments to capital;
- GOS corresponds to 'Other operating surplus'; and
- industry taxes are calculated as Other indirect taxes plus subsidies (subsidies are a negative tax in the input-output table).

Note that there is no duty for any imported end use nor commodity taxes on final demands in this database.

Of the commonplace adjustments to be made, the Canadian database requires:

- GOS to be split over payments to capital and land;
- negatives removed from both the domestic final demands and intermediate usage matrices;
- Barley, oats, rye, corn, grain nec, currently assigned to commodity 3 (Other grains), to be pro-rated over commodity 3 and 1 (Paddy rice);
- Grain polishing and flour making, currently assigned to commodity 13 (Processed rice), to be added to commodity 16 (Other food products) and pro-rated over 13 and 16;
- the temporary commodity 38 (Incidental services to agriculture) to be reallocated over the Agricultural and Forestry industries according to total sales shares determined from Hambley(1993) as follows. Paddy rice (0.00 per cent), Wheat (13.26 per cent), Other grains (7.89 per cent), Non-grain crops (19.51 per cent), Wool (0.00 per cent), Other livestock products (36.78 per cent), and Forestry (22.55 per cent);
- the temporary industry 38 (Other metal mines) to be aggregated with industry 12 (Other minerals).

5 These are described in Statistics Canada (1987) as payments made to owner-operators and are judged to be primarily payments to labour.

The United States

The single country database for the United States requires the following individual adjustments:

- the initial duty vector is calculated as the sum of duty on imports from Japan and the rest of the world;
- payments to labour corresponds to 'Wages';
- GOS corresponds to 'Property type income'; and
- industry taxes corresponds to 'Indirect taxes'.

Note that there are no commodity taxes in this database.

Of the commonplace adjustments to be made, the American database requires:

- initial duty and freight vectors to be added to imports to yield basic values;
- a new duty vector is calculated by subtracting the initial value of total imports for each commodity from the new total imports for each commodity at basic values;
- GOS to be split over payments to capital and land;
- negatives removed from both the domestic final demands and intermediate usage matrices;
- Cereals, currently assigned to commodity 3 (Other grains), to be added to commodity 1 (Paddy rice) and 2 (Wheat) then pro-rated over 1, 2 and 3;
- Other livestock products, currently assigned to commodity 5 (Wool), to be added to commodity 6 (Other livestock products) then pro-rated over 5 and 6;
- Crude petroleum and natural gas, currently assigned to commodity 10 (Oil), to be pro-rated over commodity 10 and 11 (Gas);
- Grain polishing and flour making, currently assigned to commodity 13 (Processed rice), to be added to commodity 16 (Other food products) and pro-rated over 13 and 16;
- Petroleum products, currently assigned to commodity 23 (Petroleum and coal products), to be added to commodity 24 (Chemical, rubber and plastic products) then pro-rated over 23 and 24; and
- the temporary commodity 38 (Agriculture, forestry and fishing services) to be reallocated over the Agricultural, Forestry and Fishing industries after their costs/sales structures are determined.

Japan

The single country database for Japan requires the following individual adjustments:

- the initial duty vector is calculated as the sum of duty on imports from the United States and the rest of the world;
- payments to labour corresponds to 'Compensation of employees';
- GOS corresponds to 'Property type income';
- industry taxes corresponds to 'Indirect taxes'; and
- negative GOS figure in industry 13 (Processed rice) in the initial database is considered a classification problem. A large subsidy is afforded this industry according to the value added structure derived from the International Trade and Industry Investigation Associations (ITIIA), Industry relations table (ITIIA 1985). It is apparent that this subsidy has been charged against GOS. The value added from the present database is rescaled to reflect that of the ITIIA as shown in Table A2.

Table A2: Restructuring value added in the Japanese processed rice industry

<i>Component of value added</i>	<i>Original</i>	<i>ITIIA</i>	<i>ITIIA shares</i>	<i>Rescaled Original</i>
Labour	4 131	48 314	- 0.17	1 036
GOS	-10 490	169 254	- 0.59	3 629
Industry taxes	245	-502 738	1.76	-10 779
Total value added	- 6 114	-285 170	1.00	- 6 114

Source: ITIIA (1985)

Note that there are no commodity taxes in this database.

Of the commonplace adjustments to be made, the Japanese database requires:

- initial duty and freight vectors to be added to imports to yield basic values;
- a new duty vector is calculated by subtracting the initial value of total imports for each commodity from the new total imports for each commodity at basic values;
- GOS to be split over payments to capital and land;
- negatives must be removed from both the domestic final demands and intermediate usage matrices;

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- Cereals, currently assigned to 1 (Paddy rice), to be added to commodity 2 (Wheat) and commodity 3 (Other grains) then pro-rated over 1, 2 and 3;
 - Other livestock products, currently assigned to commodity 5 (Wool), to be added to commodity 6 (Other livestock products) then pro-rated over 5 and 6;
 - Crude petroleum and natural gas, currently assigned to commodity 10 (Oil), to be pro-rated over commodity 10 and 11 (Gas);
 - Grain polishing and flour making, currently assigned to commodity 13 (Processed rice), to be added to commodity 16 (Other food products) and pro-rated over 13 and 16;
 - Petroleum products, currently assigned to commodity 23 (Petroleum and coal products), to be added to commodity 24 (Chemical, rubber and plastic products) then pro-rated over 23 and 24; and
 - the temporary commodity 38 (Agriculture, forestry and fishing services) to be reallocated over the Agricultural, Forestry and Fishing industries after their costs/sales structures are determined.

Korea

The single country database for Korea requires the following individual adjustments:

- Private and Government fixed capital formation are added to give investment;
- imports are valued at purchasers' prices. It is therefore necessary to subtract the commodity tax component of this reported figure to render imports at basic values. This is possible because a column vector of commodity taxes on imports by commodity is reported. These reported commodity taxes are pro-rated over each end use. This assumes that commodity tax rates are the same regardless of whether an import is sold for private or government consumption, investment or as an intermediate input. By calculating the share (at purchasers' prices⁶) of imported usage of commodity *i* in total imports of *i* and multiplying this by the reported commodity tax paid gives commodity taxes paid by commodity and usage. Subtracting this from the import figures reported at purchasers' prices gives the basic values required;
- payments to labour corresponds to 'Compensation of employees'; and

⁶ Assuming the commodity tax rate is ad valorem means the share can be calculated using basic values or purchasers' prices. This is discussed in greater detail later on.

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- industry taxes are calculated as Other indirect taxes plus subsidies (subsidies are a negative tax in the input-output table).

Note that there are no domestic commodity taxes in this database. They are included in industry taxes owing to the Value Added Tax (VAT) regime in Korea.

Of the commonplace adjustments to be made, the Korean database requires:

- GOS to be split over payments to capital and land;
- negatives to be removed from both the domestic final demands and intermediate usage; and
- Crude petroleum and natural gas, currently assigned to commodity 10 (Oil), to be pro-rated over commodities 10 and 11 (Gas).

For commodity 11 (Gas) the resulting value of imported changes in stocks is in absolute terms greater than the total value for all other final uses of imports of this commodity. Due to the value of imported changes in stocks for commodity 11 being negative (the value of imported stocks fell during the year), the total value of imports duty paid for commodity 11 is negative. Negative values for usage of a commodity are unacceptable since a cost minimisation strategy by firms would involve using infinite quantities of the commodity.

To correct for this situation the value of imported changes in stocks for commodity 11 is allocated to commodity 10 (Oil) with the commodity tax on imported changes in stocks for commodity 11 also allocated to commodity 10. This has the effect of preventing the total value of imports duty paid for commodity 11 being negative.

The European Community

The single country database for the EC taken from Ryan (1992) requires the following individual adjustments:

- the industries Other minerals, Transport equipment, and Other services private have a negative net operating surplus. To correct this, the value of returns to capital used in these industries is adjusted according to the following rule taken from Section 6 of Ryan (1992).

The adjusted value of returns to capital equals twice the value of capital depreciation.

To maintain a balanced database, the difference between the adjusted and unadjusted value of returns to capital is added to the change in domestic stocks vector.

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- the payments to land in the Forestry industry (not a land using industry in Salter) is allocated to returns to capital. Payments to land is interpreted as being what Appendix 1 of Ryan (1992) labels 'Employers social contributions'.
 - Section 6.13 of Ryan (1992) states that "No (returns to capital) data exists for Sector 34, Other Services: Ownership of Dwellings and while totals can be obtained for some countries, no input-output estimates are available." "...the figures for this sector should be regarded as unreliable and in need of further work." To address this situation the value of returns to capital in the Ownership of dwellings industry is adjusted according to the following rule.

The adjusted value of returns to capital equals the equivalent share of economy-wide capital as accounted for by the Ownership of dwellings industry in the Australian database. Note that the total is calculated before the adjustment is made, so that the Ownership of dwellings industry share in the post-adjustment EC database is not exactly the same as in the Australian database.

To maintain a balanced database, the difference between the adjusted and unadjusted value of capital is added to the household consumption vector.

- the final demand categories are modified to reflect the required Salter structure. Thus the F03 category (Collective consumption of private non-profit institutions) is included in the Salter input-output household consumption vector rather than the government consumption vector, in line with ABS (1990a) treatment.
- the value of imports is not at basic values. To correct this the row vectors for freight (Primary inputs: Freight) and duty (E690: Total taxes linked to imports of similar products) are pro-rated over import demand categories. Duty is pro-rated over both intermediate usage and final demand categories. However, freight is pro-rated over intermediate usage only. This is because it is assumed that the freight vector represents the total freight paid by each industry, whereas the duty vector represents the total duty paid on each commodity.

As a result of these different assumptions about freight and duty, they require different methods of pro-rating. The freight row vector (Primary inputs: Freight) is pro-rated using the method outlined in Chapter 2, and as such uses the assumption that freight rates are constant across all commodities for each industry. Thus freight is pro-rated over intermediate usage using the share of imports of commodity i in total imported intermediate usage of industry j .

The duty row vector (E690: Total taxes linked to imports of similar products) is pro-rated using the assumption that the duty rates are constant across all uses for each commodity. Thus duty is pro-rated over both intermediate usage and final demands using the share of imports of commodity *i* for each use in total sales of imported commodity *i*.

The assumption is that the row vector E690 is the total duty paid on each commodity. Thus the method of pro-rating is different from the method outlined in Chapter 2.

For the purpose of pro-rating duty, all negative values in the change in stocks vector are counted as zero in calculating total imports of each commodity.

- commodity taxes on domestic production are taken directly from Ryan (1992) except for commodity taxes on household consumption. For this category of final demand the domestic VAT row vector is added to the commodity tax on household consumption column vector.

Table A3: Salter-Ryan concordance for tax items

<i>Salter tax by final demand category</i>	<i>Ryan tax item</i>
Household consumption	Tax: F01 + Dom. Vat
Government consumption	Tax: F02
Investment	Tax: F19
Change in stocks	Tax: F29
Exports	Tax: F49

The commodity taxes on intermediate usage are adjusted to eliminate the occurrence of negative purchaser prices in the intermediate usage matrix. Where the purchasers' price is less than zero, the corresponding commodity tax is set to zero. This occurs only where the original Ryan database has taxes on zero flows.

- commodity taxes on imports are assumed to be zero for all demand categories except for household consumption. The commodity taxes on imports for household consumption are calculated using the assumption that the tax rate equals the VAT rate on household consumption of domestically produced commodities. The VAT rate on household consumption of domestically produced commodities is calculated using the domestic VAT vector and the vector of household consumption of domestically produced commodities.

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- three additional industries, Processed rice, Gas, and Fabricated metal products are added to the initial 34 industry and commodity classification, with all elements set equal to zero awaiting the disaggregation as detailed in Appendix D.

Of the commonplace adjustments to be made, the EC database required:

- Other food products (commodity 16) to be pro-rated over commodities 13 (Processed rice) and 16;
- Oil and gas assigned to commodity 10 (Oil) to be pro-rated over commodities 10 and 11 (Gas); and
- Other metals and products assigned to commodity 28 (Fabricated metal products) to be pro-rated over commodities 27 (Non-ferrous metals) and 28 (Fabricated metal products).

Indonesia

The single country database for Indonesia requires the following individual adjustments:

- exports are calculated as Exports of goods plus services;
- imports are valued at purchasers' prices. To obtain basic values, the same technique is employed as in the Korean database;
- payments to labour corresponds to 'Wages and salaries';
- GOS is calculated as Net operating surplus plus Depreciation; and
- industry taxes are calculated as Net indirect taxes plus Subsidies (subsidies are a negative tax in the input-output table).

Note that commodity taxes on domestically sourced components are included in the Net indirect tax figure owing to the VAT regime in Indonesia. We do not attempt to split this component out.

Of the commonplace adjustments to be made, the Indonesian database requires:

- GOS to be split over payments to capital and land;
- Coal and metal ores, currently assigned to commodity 9 (Coal), to be added to commodity 12 (Other minerals) then pro-rated over 9 and 12;
- Crude oil and natural gas, currently assigned to commodity 10 (Oil), to be pro-rated over commodities 10 and 11 (Gas);
- Food processing and preserving, currently assigned to commodity 15 (Milk products) and Cereal mill products, currently assigned to commodity

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- 13 (Processed rice), to be added to commodity 16 (Other food products) and pro-rated over 13, 15 and 16;
 - Textiles, leather and wearing apparel, currently assigned to commodity 20 (Leather products), to be added to commodities 18 (Textiles) and 19 (Wearing apparel) then split over 18, 19 and 20 using a RAS procedure (see Appendix D); and
 - Petroleum refinery products, currently assigned to commodity 23 (Petroleum and coal products), to be pro-rated over commodity 23 and 11 (Gas)⁷.

Malaysia

The single country database for Malaysia requires the following individual adjustments:

- The Malaysian database has 'Imputed bank service charges' as a component of final demand. In accordance with Australian Bureau of Statistics procedures (ABS 1990a), these are described as charges levied by the banking component of Private services on the various using industries. These charges are pro-rated over the intermediate usage of Private services by each industry by taking the share of domestic intermediate usage of industry *j* in the total intermediate usage of Other services (Private). The increase in costs, due to the reallocation of imputed bank service charges into intermediate usage, of each using industry is balanced by an offsetting reduction in value added (the Malaysian database requires value added to be split over labour, capital, land and industry taxes as discussed below);
- the database has a commodity tax vector by end use. It is split over commodities and sources for each end use to conform with Salter format using the same method as for the New Zealand database ie. by pro-rating the vector using the shares of domestic and imported commodity *i* in total purchases of all commodities by end usage;
- value added is reported as a single vector in the cost structure and needs to be split over labour, GOS and industry taxes. This process is presented in Appendix B.

Note that there is zero duty in this database.

⁷ Note: This is to separate the Liquefied petroleum gas component from the processing of Petroleum refinery products. LPG is added to the natural gas assigned from the Crude oil and natural gas split.

Of the commonplace adjustments to be made, the Malaysian database requires:

- imports by commodity, from the raw trade data reported in Hambley (1993), are split over usage to derive the import matrices using the shares of domestic commodity *i* by usage in total domestic sales of commodity *i*. The exception to this rule is the imports of wool which is pro-rated using import shares calculated from the Thailand database due to the absence of domestic wool production in Malaysia. Note that where commodity disaggregation is subsequently necessary (as shown in the following dot points) the raw trade data as reported in Hambley (1993) has been aggregated over the commodities requiring such disaggregation, prior to being pro-rated;
- the database to be balanced;
- Other agricultural products, currently assigned to commodity 1 (Paddy rice), to be added to commodities 2 (Wheat), 3 (Other grains) and 4 (Non-grain crops) then pro-rated over 1, 2, 3 and 4;
- Mining, currently assigned to commodity 12 (Other minerals), to be pro-rated over commodities 9 (Coal), 10 (Oil) and 11 (Gas);
- Dairy products, currently assigned to commodity 15 (Milk products), to be pro-rated over commodities 15 and 14 (Meat products);
- Grain mill products, currently assigned to commodity 13 (Processed rice), to be added to commodity 16 (Other food products) and pro-rated over 13 and 16;
- Wearing apparel, currently assigned to commodity 19 (Wearing apparel), to be split over commodities 19 and 20 (Leather and products) using a RAS procedure (see Appendix D);
- Petroleum refinery products, currently assigned to commodity 23 (Petroleum and coal products), to be pro-rated over commodity 23 and 11 (Gas)⁸;
- Basic metals, currently assigned to commodity 26 (Primary ferrous metals), to be split over commodities 26, 27 (Primary non-ferrous metals) and 28 (Fabricated metal products) using a RAS procedure (see Appendix D); and
- Other manufacturing goods, currently assigned to commodity 30 (Other machinery and equipment), to be added to commodity 31 (Other manufacturing) and pro-rated over 30 and 31.

8 This is the same type of split as carried out for Indonesia.

Philippines

The single country database for the Philippines requires the following individual adjustments:

- Re-exports are ignored. This does not effect the costs and sales balance of the database. The only effect is to lower the aggregate level of imports;
- In the costs structure of the database, an extra industry Agricultural services is present. The sales structure splits this industry into two ie. Agricultural and Crop farming services. These are added to yield the Agricultural services commodity to be reallocated across the agricultural industries as a commonplace adjustment;
- payments to labour corresponds to 'Wages'; and
- industry taxes correspond to Indirect taxes-subsidies.

Note that there is no duty in this database.

Of the commonplace adjustments to be made, the Philippines database requires:

- GOS to be split over payments to capital and land;
- negatives to be removed from domestic intermediate usage;
- the database to be balanced;
- Grain polishing and flour making, currently assigned to commodity 13 (Processed rice), to be added to commodity 16 (Other food products) and pro-rated over 13 and 16; and
- the temporary commodity 38 (Agriculture services) to be reallocated over the Agricultural industries after their costs/sales structures are determined.

Singapore

The single country database for Singapore requires the following individual adjustments:

- the database has a commodity tax vector by end use. It is split over commodities and sources for each end use to conform with Salter format using the same method as for the New Zealand database ie. by pro-rating the vector using the shares of domestic and imported commodity *i* in total purchases of all commodities by end usage;
- payments to labour corresponds to 'Compensation of employees'; and
- industry taxes correspond to 'Other indirect taxes'.

Note that there are no export taxes in this database.

Of the commonplace adjustments to be made, the Singapore database requires:

- GOS to be split over payments to capital and land;
- imports by commodity, from the raw trade data reported in Hambley (1993), are split over usage to derive the import matrices using the shares of domestic commodity i by usage in total domestic sales of commodity i . Note that where commodity disaggregation is subsequently necessary (as shown in the following dot points) the raw trade data as reported in Hambley (1993) has been aggregated over the commodities requiring such disaggregation, prior to being pro-rated. The exceptions to this share calculation method are for imports of commodities 1 (Paddy rice), 2 (Wheat), 3 (Other grains) and 7 (Forestry) which are pro-rated using shares calculated from the Korean database due to the absence of domestic production in Singapore. These commodity shares are calculated from the Korean database by adding domestic and imported usage by each industry or absorption category and then dividing this value by the total sales of the commodity. Prior to calculating these commodity shares, the Korean input-output table is adjusted so as to reflect the situation in Singapore where there is no domestic production of commodities 1,2,3,5 and 7. This adjustment involves entering zeroes for the intermediate usage of these five industries in the Korean template. Also, because industries 9,10,11 and 12 are aggregated into industry 12 in the Singapore database (as discussed below), these four industries are also aggregated in the Korean template used to calculate the shares;
- initial duty row vector to be added to imports to yield basic values by pro-rating over imported intermediate usage by the share of imports of commodity i in total imported intermediate usage by industry j . The duty vector is then calculated by subtracting the cif value of imports of each commodity from the basic value;
- the database to be balanced;
- Quarrying and mining, currently assigned to commodity 12 (Other minerals), to be pro-rated over commodities 9 (Coal), 10 (Oil), 11 (Gas) and 12; and
- Animal feed and other milled products, currently assigned to commodity 13 (Processed rice), to be added to commodity 16 (Other food products) and pro-rated over 13 and 16.

Thailand

The single country database for Thailand requires the following individual adjustments:

- Exports are equal to Exports plus 'Special exports' ;
- payments to labour corresponds to 'Wages and salaries';
- GOS is calculated as the addition of Operating surplus and Depreciation;
- industry taxes correspond to 'Indirect taxes less subsidies'.

Note that there are no commodity taxes or duty in this database.

Of the commonplace adjustments to be made, the Thai database requires:

- GOS to be split over payments to capital and land;
- Other cereals, currently assigned to commodity 2 (Wheat), to be added to commodity 3 (Other grains) and pro-rated over 2 and 3;
- Other livestock, currently assigned to commodity 5 (Wool), to be added to commodity 6 (Other livestock products) and pro-rated over 5 and 6; and
- Crude petroleum and natural gas, currently assigned to commodity 10 (Oil), to be pro-rated over commodities 10 and 11 (Gas); and
- the temporary commodity 38 (Agriculture services) to be reallocated over the Agricultural industries after their costs/sales structures are determined.

China

The Chinese database requires no individual adjustments, only the following commonplace adjustments:

- GOS to be split over payments to capital and land;
- Livestock production, currently assigned to commodity 6 (Other livestock products), to be added to commodity 5 (Wool) and pro-rated over 5 and 6; and
- Grain mill products and vegetables, currently assigned to commodity 16 (Other food products), to be added to commodity 13 (Processed rice) and pro-rated over 13 and 16.

Taiwan

The single country database for Taiwan requires the following individual adjustments:

- Exports are equal to Territorial and Non-territorial exports ;
- the database has a commodity tax vector by end use. It is split over commodities and sources for each end use to conform with Salter format using the same method as for the New Zealand database ie. by pro-rating the vector using the shares of domestic and imported commodity *i* in total purchases of all commodities by end usage;
- payments to labour corresponds to 'Compensation of employees';
- GOS is calculated as the addition of Operating surplus and Depreciation;
- industry taxes correspond to 'Other taxes'; and
- A negative GOS figure reported for the Coal industry is replaced by a positive value. This is done by taking the GOS to total costs ratio for the Korean Coal industry (which is 9.7 per cent) and applying this to the total costs of the Taiwanese counterpart to obtain a new (positive) value for GOS. The difference between this new value and the old is subtracted from payments to labour to maintain costs and sales balance. A summary of this procedure is presented in Table A4.

Table A4: Restructuring value added in the Taiwanese coal industry (NT m)

<i>Component of value added</i>	<i>Old</i>	<i>Rescaled</i>
Labour	3 256	2 800
GOS	-14	442 ^a
Industry taxes	26	26
Total value added	3 268	3 268
Total Sales	4 573	4 573

a Calculated as 9.7 per cent of 4 473

Of the commonplace adjustments to be made, the Taiwan database requires:

- the initial duty vector to be added to cif imports to yield basic values;
- a new duty vector is calculated by subtracting the initial value of total imports for each commodity from the new total imports for each commodity at basic values;
- GOS to be split over payments to capital and land;

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- Other common and special crops, currently assigned to commodities 2 (Wheat) and 3 (Other grains), to be added and pro-rated over 2, 3 and 4 (Non-grain crops);
 - Crude petroleum and natural gas, currently assigned to commodity 10 (Oil), to be pro-rated over commodities 10 and 11 (Gas); and
 - Agricultural services, currently assigned to commodity 5 (Wool), to be pro-rated over the agricultural industries once their costs/sales structure is determined.

APPENDIX B: CALCULATING VALUE ADDED FOR THE MALAYSIAN DATABASE

The Malaysian database reports value added as a single row in the cost structure of each industry. This appendix describes how this figure is split over payments to labour and Gross Operating Surplus (GOS).

The United Nations National Accounts Statistics (UN 1991b) contains information on the cost components of value added as presented in Table B1 for 1983, the reference year of the original input-output table.

Table B1: Cost components of value added, Malaysia 1983 (Millions Ringgits)

<i>Industry description</i>	<i>Labour</i>	<i>GOS</i>	<i>Value added</i>
Agriculture and hunting	1 896	6 259	8 155
Forestry and logging	568	2 703	3 271
Fishing	257	1 417	1 674
Mining and quarrying	742	9 014	9 756
Food, beverages and tobacco	535	2 151	2 686
Textile, wearing apparel and leather industries	341	279	620
Wood, wood products including furniture	522	557	1 079
Paper, paper products, publishing and printing	286	326	612
Chemicals, petroleum, coal, rubber & plastic products	555	2 512	3 067
Non-metallic mineral products	232	444	676
Basic metals	344	596	940
Fabricated metal products, machinery and equipment	1 062	2 634	3 696
Other manufacturing	1 062	2 634	3 696
Electricity, water and gas	241	783	1 024
Construction	2 544	302	3 846
Wholesale and retail trade, restaurants and hotels	2 606	5 478	8 084
Transport, storage and communication	1 446	2 210	3 171

Source: UN (1991b)

Table B2: Concordance between Salter and United Nations industry classifications

<i>Salter classification</i>	<i>United Nations classification</i>
Paddy rice	Agriculture and hunting
Wheat	Agriculture and hunting
Other grains	Agriculture and hunting
Non-grain crops	Agriculture and hunting
Wool	Agriculture and hunting
Other Livestock products	Agriculture and hunting
Forestry	Forestry and logging
Fishing	Fishing
Coal	Mining and quarrying
Oil	Mining and quarrying
Gas	Mining and quarrying
Other Minerals	Mining and quarrying
Processed Rice	Food, beverages and tobacco
Meat Products	Food, beverages and tobacco
Milk Products	Food, beverages and tobacco
Other Food Products	Food, beverages and tobacco
Beverages & Tobacco	Food, beverages and tobacco
Textiles	Textile, wearing apparel and leather industries
Wearing Apparel	Textile, wearing apparel and leather industries
Leather & Products	Textile, wearing apparel and leather industries
Lumber & Products	Wood, wood products including furniture
Pulp, Paper & Printing	Paper, paper products, publishing and printing
Petroleum & Coal Products	Chemicals, petroleum, coal, rubber and plastic products
Chemicals, Rubber & Plastic Prods products	Chemicals, petroleum, coal, rubber and plastic
Non-Metallic Mineral Products nec	Non-metallic mineral products
Primary Ferrous Metals	Basic metals
Primary Non-ferrous Metals	Basic metals
Fabricated Metal Products	Fabricated metal products, machinery & equipment
Transport Equipment	Fabricated metal products, machinery & equipment
Other Machinery and Equipment	Fabricated metal products, machinery & equipment
Other Manufacturing	Other manufacturing
Electricity, Gas and Water	Electricity, water and gas
Construction	Construction
Trade and Transport	Wholesale and retail trade, restaurants and hotels
	Transport, storage and communication
Other Services (Private)	Finance, insurance, real estate and business services
Other Services (Government)	Community, social and personal services
	Producers of government services
Ownership of dwellings	Finance, insurance, real estate and business services

Table B3: Allocating value added between labour and GOS, Malaysia 1983
('000 Ringgits)

<i>Salter commodity</i>	<i>Ratio to value added of</i>		<i>Malaysian value added</i>	<i>Payments to labour</i>	<i>GOS</i>
	<i>Labour</i>	<i>GOS</i>			
	(per cent)	(per cent)			
Paddy rice	23.25	76.75	2 263 196	526 183	1 737 014
Wheat	23.25	76.75	0	0	0
Other grains	23.25	76.75	0	0	0
Non-grain crops	23.25	76.75	4 948 737	1 150 559	3 798 179
Wool	23.25	76.75	0	0	0
Other Livestock products	23.25	76.75	700 086	162 767	537 319
Forestry	17.36	82.64	2 140 782	371 741	1 769 041
Fishing	15.35	84.65	1 674 143	257 022	1 417 121
Coal	7.61	92.39	0	0	0
Oil	7.61	92.39	0	0	0
Gas	7.61	92.39	0	0	0
Other Minerals	7.61	92.39	7 189 942	546 837	6 643 106
Processed Rice	19.92	80.08	133 087	26 508	106 579
Meat Products	19.92	80.08	0	0	0
Milk Products	19.92	80.08	169 623	33 786	135 838
Other Food Products	19.92	80.08	1 078 550	214 827	863 723
Beverages & Tobacco	19.92	80.08	556 071	110 759	445 312
Textiles	55.00	45.00	299 729	164 851	134 878
Wearing Apparel	55.00	45.00	236 927	130 310	106 617
Leather & Products	55.00	45.00	0	0	0
Lumber & Products	48.38	51.62	831 452	402 241	429 211
Pulp, Paper & Printing	46.73	53.27	564 753	263 921	300 833
Petroleum & Coal Products	18.10	81.90	243 069	43 985	199 084
Chemicals, Rubber & Plastic Prods	18.10	81.90	1 824 940	330 238	1 494 701
Non-Metallic Mineral Products nec	34.32	65.68	649 470	222 895	426 575
Primary Ferrous Metals	36.60	63.40	503 486	184 255	319 232
Primary Non-ferrous Metals	36.60	63.40	0	0	0
Fabricated Metal Products	28.73	71.27	300 607	86 376	214 232
Transport Equipment	28.73	71.27	882 334	253 528	628 806
Other Machinery and Equipment	28.73	71.27	1 714 864	492 745	1 222 119
Other Manufacturing	8.73	71.27	163 504	46 981	116 523
Electricity, Gas and Water	23.54	76.46	1 008 251	237 293	770 957
Construction	66.15	33.85	3 577 938	366 686	1 211 252
Trade and Transport ^a	34.51	65.49	11 153 275	849 495	7 303 780
Other Services (Private)	21.83	78.17	4 488 319	979 840	3 508 480
Other Services (Government) ^b	83.72	16.28	7 342 991	147 207	1 195 785
Ownership of dwellings	21.83	78.17	2 891 325	631 202	2 260 123

a Shares calculated by aggregating Wholesale and retail trade, restaurants and hotels with Transport, storage and communication.

b Shares calculated by aggregating Community, social and personal services with Producers of government services.

A concordance between the United Nations and Salter classifications is derived (Table B2) and the ratio of labour and GOS¹ to value added are multiplied by the value added figure reported in the Malaysian database. The result is shown in Table B3.

In Table B3 the shares for the industry (Trade and transport) are calculated by aggregating Wholesale and retail trade, restaurants and hotels with Transport, storage and communication. Also in Table B3 the shares for the industry Other services (government) are calculated by aggregating Community, social and personal services with Producers of government services.

The GOS figures derived in Table B3 represent payments to capital, land and industry taxes. Industry taxes are assumed to be zero. Agriculture is the only sector that uses land. As discussed in Chapter 2, GOS is divided equally between payments to capital and land.

1 'GOS' in this context includes payments to capital, land and industry taxes.

APPENDIX C: DERIVATION OF IMPORTS BY COMMODITY

This appendix describes how import figures from the pre-updated trade database (Hambley 1993) are converted to figures suitable to allocate across end uses in single region databases. As discussed in Chapter 2, the input-output tables for Malaysia and Singapore report imports as a row in the cost structure of each industry. Salter format requires imports by commodity and end use. Import figures derived from the trade data are allocated across end use to meet this requirement.

Imports cif, by commodity, taken from the trade data¹ are presented in the first column of Tables C1 and C3. These figures are in \$USm for the year 1988. The reference year for both the Malaysian and Singaporean input-output databases is 1983. These databases are denominated in Malaysian Ringgits and Singaporean dollars. Therefore, to obtain figures suitable to be allocated across end use, the 1988 trade data is converted to the home country's currency and deflated to 1983 levels.

Converting the trade figures to national currencies requires an exchange rate for 1988. These are obtained from UN (1991a) as 2.715 Ringgits/\$US and 1.946 \$ Singapore/\$US respectively. Multiplying these exchange rates by the figures from the trade data gives imports by commodity for 1988 valued in the home country's currency.

To deflate the figures to 1983, a value of imports index is obtained from UN (1988a) and UN (1983b) for the years 1988 and 1983. The index numbers imply a 29 percent reduction in the value of Malaysia's imports between 1988 and 1983, and a 38 percent reduction in the value of Singapore's imports over the same period. When applied to the 1988 figures, these percentage changes deflate the value of imports to 1983. The figures are ready to be allocated across usage as described in Chapter 2.

1 Using the cif value of imports from the trade data to obtain basic values implies zero duty is paid on each commodity.

Table C1: Derivation of cif imports, by commodity, for Malaysia

<i>Commodity</i>	<i>Imports 1988 \$US m</i>	<i>Imports 1988 m Ringgits</i>	<i>Imports 1983 m Ringgits</i>
Paddy Rice	0	0	0
Wheat	122	332	236
Other Grains	141	382	272
Non-grain crops	482	1 307	930
Wool	43	118	84
L'stock and non-wool l'stock prods.	29	78	56
Forestry	2	7	5
Fishing	83	226	161
Coal	32	88	63
Oil	156	424	301
Gas	32	87	62
Other Minerals	271	737	524
Processed Rice	81	220	156
Meat Products	75	204	145
Milk Products	170	463	329
Other Food Products	633	1 718	1 222
Beverages & Tobacco	58	157	111
Textiles	499	1 355	964
Wearing Apparel	21	57	41
Leather & Products	31	83	59
Lumber & Products	32	86	61
Pulp, Paper & Printing	468	1 270	904
Petroleum & Coal Products	664	1 802	1 282
Chemicals, Rubber & Plastic Prd	1 982	5 380	3 827
Non-Metallic Mineral Pro. nec	112	304	216
Primary Ferrous Metals	907	2 461	1 751
Primary Non-ferrous Metals	363	986	702
Fabricated Metal Products	664	1 802	1 282
Transport Equipment	839	2 277	1 620
Other Machinery & Equipment	7 106	19 292	13 723
Other Manufacturing	181	490	349
Electricity, Gas & Water	0	0	0
Construction	0	0	0
Trade & Transport	0	0	0
Other Services (Private)	23	63	45
Other Services (Government)	18	48	34
Ownership Of Dwellings	0	0	0

Source: See text.

Table C2: Derivation of cif imports, by commodity for Singapore

<i>Commodity</i>	<i>Imports 1988 \$US m</i>	<i>Imports 1988 \$Sm</i>	<i>Imports 1983 \$Sm</i>
Paddy Rice	0	1	0
Wheat	40	77	48
Other Grains	55	107	66
Non-grain crops	2 170	4 223	2 629
Wool	0	0	0
L'stock and non-wool l'stock prods	204	397	247
Forestry	21	42	26
Fishing	326	634	395
Coal	4	8	5
Oil	4 161	8 096	5 040
Gas	8	15	9
Other Minerals	203	395	246
Processed Rice	74	144	90
Meat Products	175	341	212
Milk Products	179	348	217
Other Food Products	1 135	2 208	1 375
Beverages & Tobacco	366	711	443
Textiles	1 601	3 115	1 939
Wearing Apparel	603	1 174	731
Leather & Products	342	666	415
Lumber & Products	660	1 284	799
Pulp, Paper & Printing	771	1 501	934
Petroleum & Coal Products	2 099	4 086	2 543
Chemicals, Rubber & Plastic Prd	3 456	6 726	4 187
Non-Metallic Mineral Pro. nec	564	1 098	683
Primary Ferrous Metals	1 359	2 644	1 646
Primary Non-ferrous Metals	1 387	2 699	1 680
Fabricated Metal Products	1 352	2 630	1 637
Transport Equipment	2 139	4 162	2 591
Other Machinery & Equipment	18 553	36 103	22 472
Other Manufacturing	994	1 934	1 204
Electricity, Gas & Water	0	0	0
Construction	0	0	0
Trade & Transport	0	0	0
Other Services (Private)	550	1 071	666
Other Services (Government)	27	52	32
Ownership Of Dwellings	0	0	0

Source: See text.

APPENDIX D: DISAGGREGATION: DESCRIPTIONS OF THE 'NAIVE SPLIT' AND RAS METHODS

For all the single region input-output databases except Hong Kong and Rest of the World, the input-output data available from Hambley (1993) is in an industry and commodity format that does not quite conform to the 37 industry and 37 commodity structure required for Salter. Overcoming these concordance problems often requires disaggregation of aggregated industry data. The list of the industry disaggregations required is noted in Appendix A of this paper.

This appendix outlines the methodology used for conducting the 'naive split' and RAS industry disaggregations on the single region databases. For a description of the data used to carry out both the 'naive split' and RAS industry disaggregations, refer to Appendix E.

'Naive Split' Procedure

This method of disaggregation is implemented using the TABLO program S3DBSW. This program is designed to pro-rate the cost and sales structure of the industry requiring disaggregation over two or more industries using shares calculated from production, import and export data.

When running S3DBSW the user is required to provide the name of the industry to be disaggregated, which is referred to as the source industry. The industries that the source industry is disaggregated over are referred to as the destination industries. Note that the number of industries that the source industry is disaggregated over is determined by the user and that the source industry is itself one of the destination industries. Thus the user is required to provide the names of the source and destination industries, in addition to specifying production and trade shares.

The S3DBSW program disaggregates one source industry at a time. Thus S3DBSW needs to be run once for each source industry requiring disaggregation, with each subsequent run using the input-output database created from the previous run as its starting point.

In the case where two industries require pro-rating over each other using the same shares, the process is simplified by first aggregating the industries together

before running the S3DBSW program. This process of aggregating industries prior to disaggregation is implemented using the TABLO program S3INDAGG.

The program S3INDAGG aggregates the cost and sales data of the relevant industries, and enters this in what will subsequently be the source industry in the execution of the S3DBSW program. It places zero entries in what will be the destination industry. As is the situation with the program S3DBSW, S3INDAGG must be implemented once for each new source industry.

S3DBSW program

The S3DBSW program requires two separate pieces of input, and has as its output a header array file which is the input-output database post-disaggregation. The two separate pieces of input are the initial single region input-output database, and a file containing five items of information that define the disaggregation to be performed. These five items are the source and destination industries and their respective production, import and export shares.

S3DBSW reads in the initial input-output database and calculates total sales for the source industry, which is multiplied by the production shares to determine the share of the source industry's total sales that will be allocated to each of the destination industries. This gives an initial production share weighted target value of total sales of the source industry for each of the destination industries.

As outlined in Chapter 2, exports are calculated separately and to maintain this target value for exports it is necessary to calculate a new total sales share excluding exports with which to pro-rate each of the components of sales except exports. The target value for exports is found by pro-rating the source industry's exports over the destination industries using the export shares. The target value of sales to the domestic market is calculated by taking the initial target value of total sales and subtracting the target value of exports.

The calculation of this target value of sales to the domestic market will require two separate methods, one for the source industry which is the first of the destination industries and a separate method for the remaining destination industries. The separate methods are required because the remaining destination industries may have a non-zero value of exports prior to the source industry being pro-rated across all destination industries, whereas the first of the destination industries has only the value resulting from the pro-rating.

For the first of the destination industries the target value of sales to the domestic market is calculated by subtracting this industry's share of the source industry export target from the initial production share weighted target value of total sales of the source industry. For the remaining destination industries the aim is

to find the proportion of total domestic sales of the source industry that will be attributed to these destination industries. This is calculated for each of the remaining destination industries by subtracting the destination industry's export target from that industry's share of the target value of total sales of the source industry. The difference between this method and the method used for the first destination industry is that the initial value of exports (value of exports prior to the source industry being pro-rated across all destination industries) for each the remaining destination industries is added to this total sales target.

The following example is given to clarify the method.

We have two industries Textiles and Clothing, where the data for the textiles industry is aggregated data that includes a component that should appear under the clothing classification. Thus the source industry is textiles and the destination industries are textiles and clothing. Suppose the target production and export shares for this example are as listed in Table D1 and the initial input-output data is given in Table D2.

Table D1: Production and export shares used for the naive split example

Industry	Production share	Export share
Textiles	0.8	0.6
Clothing	0.2	0.4

Table D2: Initial input-output database for the naive split example

Industry	Domestic sales	Exports	Total sales
Textiles	200	50	250
Clothing	100	20	120

- Step 1: Calculate the initial production share weighted value of total sales of the Textiles industry for each destination industry, as shown in Table D3.

Table D3: Total sales of textiles attributed to each destination industry for the naive split example

Destination Industry	Source industry total sales	Destination industry production share	Share weighted value of total sales
Textiles	250	0.8	$(0.8 * 250) = 200$
Clothing	250	0.2	$(0.2 * 250) = 50$

- Step 2: Calculate the target value of exports for each destination industry, as shown in Table D4.

Table D4: Target exports for the naive split example

Destination Industry	initial exports	Export share	Target exports after pro-rating
Textiles	50	0.6	$(50 * 0.6) = 30$
Clothing	20	0.4	$(50 * 0.4) + 20 = 40$

- Step 3: Calculate the target value of total domestic sales of the source industry to be attributed to each destination industry, as shown in Table D5.

Table D5: Total domestic sales of textiles attributed to each destination industry in the naive split example

Destination Industry	Initial exports	Target exports	Share weighted value of total sales	Total domestic sales target
Textiles	50	30	200	$(200 - 30) = 170$
Clothing	20	40	50	$(50 - 40) + 20 = 30$

Having calculated the total domestic sales targets of the source industry attributed to each destination industry it is necessary to convert these sales targets into shares. The share for each destination industry is calculated by dividing each domestic sales target by the sum of these targets across all destinations. Using these shares, the source industry's domestic sales are then pro-rated over the destination industries. Domestic sales cover intermediate, household consumption, investment and government usage as well as changes in stocks.

The source industry's sales of imported commodities are pro-rated over the destination industries using the import shares taken from the input file. This method is used for imported intermediate, household consumption, investment and government usage, changes in stocks, as well as the duty vector.

Continuing the previous two industry example, the following Tables D6 to D8 are provided to illustrate the pro-rating methodology.

- Step 4: Calculate the shares for pro-rating domestic sales of the source industry from total domestic sales targets, as shown in Table D6.

Table D6: Shares to pro-rate domestic sales for the naive split example

Destination Industry	Total domestic sales target	Shares used for pro-rating domestic sales
Textiles	170	$170 / (170 + 30) = 0.85$
Clothing	30	$30 / (170 + 30) = 0.15$

Table D7: Initial domestic sales structure for the naive split example

Domestic sales category	Textiles	Clothing
Intermediate usage	100	50
Household consumption	100	40
Investment usage	40	10
Government usage	40	30
Change in stocks	20	20
Total domestic sales	200	100

- Step 5: Calculate the final values of domestic sales for each destination industry by pro-rating domestic sales of the source industry, as shown in Table D8.

Table D8: Pro-rating domestic sales in the naive split example

Domestic sales category	Textiles	Clothing
Intermediate usage	$(100 * 0.85) = 85$	$50 + (100 * 0.15) = 65$
Household consumption	$(100 * 0.85) = 85$	$40 + (100 * 0.15) = 55$
Investment usage	$(40 * 0.85) = 34$	$10 + (40 * 0.15) = 16$
Government usage	$(40 * 0.85) = 34$	$30 + (40 * 0.15) = 36$
Change in stocks	$(20 * 0.85) = 17$	$20 + (20 * 0.15) = 23$
Total domestic sales	170	130

Having achieved the aim of disaggregating the sales structure of the source industry the two remaining tasks are to disaggregate the commodity tax vectors and disaggregate the cost structure of the source industry. To disaggregate the commodity tax vectors it is necessary to repeat the 5 steps outlined above, with the only difference being the target values to calculate the shares used for pro-rating the source industry's commodity taxes. The total commodity taxes on domestically produced commodities are used to calculate the shares in step 1. The total commodity taxes on sales to domestic users of domestically produced commodities is used to calculate the shares used in step 4. The import shares

taken from the input file are used to pro-rate the commodity taxes on sales of imported commodities.

The third and final task is to disaggregate the cost structure of the source industry so that the necessary condition that total sales equals total costs, remains true. The cost structure includes the intermediate usage matrices for both imported and domestic commodities and their respective commodity tax matrices. Also included are the three components of value added, that is returns to land, labour and capital, as well as government revenue from production taxes. The total sales shares (which are equal to the production shares) are used to pro-rate all the components of total costs.

S3INDAGG program

S3INDAGG is used in the case where two industries require pro-rating over each other using the same shares, and thus an industry aggregation is required prior to running the S3DBSW program. The program S3INDAGG aggregates the cost and sales data of the relevant industries, and adds this into what will subsequently be the source industry in the execution of the S3DBSW program. The relevant industries are what will subsequently be the destination industries in the execution of the S3DBSW program.

For the final demand components of total sales this involves summing across the source and destination industry rows, then entering this sum in the source industry row, and entering zeros for the destination industry rows. The same process applies for the commodity taxes levied on each of these components of total sales. For the value added components of total costs as well as production taxes, this process involves summing across the source and destination industry columns, and entering this sum in the source industry column, and entering zeros for the destination industry columns.

The example shown in Figures D1 to D3 is provided to illustrate the methodology for aggregating the cost and sales data of the relevant industries in the domestic and imported intermediate usage matrices. In this example a 4 industry 4 commodity input-output table is used with the source and destination industries as defined in the previous paragraph denoted by the letters S and D, respectively.

Figure D1: Initial intermediate usage matrix for S3INDAGG example

		Industry			
	Commodity	Source			Destination
		1	2	3	4
Source	1	X_{11}	X_{1S}	X_{13}	X_{1D}
	2	X_{S1}	X_{SS}	X_{S3}	X_{SD}
	3	X_{31}	X_{3S}	X_{33}	X_{3D}
Destination	4	X_{D1}	X_{DS}	X_{D3}	X_{DD}

Figure D2: Intermediate usage matrix after aggregation of total sales

		Source			Destination
		1	2	3	4
1		X_{11}	X_{1S}	X_{13}	X_{1D}
2		$X_{S1} + X_{D1}$	$X_{SS} + X_{DS}$	$X_{S3} + X_{D3}$	$X_{SD} + X_{DD}$
3		X_{31}	X_{3S}	X_{33}	X_{3D}
4		0	0	0	0

Figure D3: Final intermediate usage matrix after aggregation of total costs

		Source			Destination
		1	2	3	4
1		X_{11}	$X_{1S} + X_{1D}$	X_{13}	0
2		$X_{S1} + X_{D1}$	$X_{SS} + X_{DS} + X_{SD} + X_{DD}$	$X_{S3} + X_{D3}$	0
3		X_{31}	$X_{3S} + X_{3D}$	X_{33}	0
4		0	0	0	0

As can be seen in this example, S3INDAGG uses a 2 step procedure of first aggregating across rows then aggregating across columns for the intermediate usage matrix and the corresponding commodity tax matrix.

RAS Procedure

This section outlines the RAS procedures performed on the Indonesian and Malaysian input-output databases prior to them undergoing the single region database update procedure. The reason for using the RAS procedure is the same as for using the 'naive split' method, namely to perform disaggregations to overcome concordance problems.

The RAS split method is used only on three industry disaggregations, one in the Indonesian database and two in the Malaysian database. The Textiles, leather and wearing apparel industry in the Indonesian database is disaggregated into three industries, Textiles, Wearing apparel and the Leather products. For the Malaysian database, Wearing apparel is disaggregated into the Wearing apparel industry and the Leather products industry. The second disaggregation for the Malaysian database is Basic metals which is split into three industries, Primary ferrous metals, Primary non-ferrous metals and Fabricated metal products.

The reason for using a more sophisticated RAS procedure rather than the 'naive split' method for these three splits is based on expectations about the intermediate usage structure we require in the disaggregated industries. For example, we would expect the Indonesian textile industry to sell most of its output to the downstream processor, that is the Wearing apparel industry. We would expect the Wearing apparel industry to sell most of its output to various categories of final demand, particularly to households and for export. Similarly we would expect Fabricated metal products to have output from the Primary ferrous metals and Primary non-ferrous metals industries as a major input, but we would not expect the reverse to be true.

If the 'naive split' method were used for these three disaggregations it would impose the same intermediate usage structure on all the disaggregated industries. This would not conform to expectations about the vertically integrated structure of these industries.

Overview

The RAS disaggregation procedure is implemented using three sections of TABLO code, labelled ROWRAS1, ROWRAS4 and ROWRAS5. These programs are designed to achieve three aims. Note, however, that the first and second aims are actually implemented in reverse order.

The first aim is to pro-rate the cost and sales totals for the industry requiring disaggregation over their component industries using production and trade shares for the 'home' economy listed in Appendix E. The second aim is to make the cost and sales structure of the disaggregated industries similar to the cost

and sales structure of the same industries in another single region database. The single region database chosen to act as the template for the cost and sales structure of the disaggregated industries for both Malaysia and Indonesia was the Thailand database. The Thailand database was chosen because it was felt that the relevant industries in this region's database most closely resembled what we expect for the input-output structure of the disaggregated industries in Indonesia and Malaysia. Since imposing the cost and sales structure from a foreign database will unbalance the home country database, the third aim is to rebalance the home country database.

Taking the example of the Wearing apparel split in the Malaysian database, the ROWRAS1 process can be summarised as follows.

First the elements of costs and sales of Wearing apparel and Leather products in the Thailand database (the template database) are scaled so that the grand total of costs plus sales across both industries in the template equals the grand total of costs plus sales across both industries from the Malaysian database.

Next the ROWRAS1 process takes this scaled cost and sales structure for the Thailand Wearing apparel and Leather products industries and inserts it as the new cost and sales structure for the Malaysian Wearing apparel and Leather products industries.

Finally, the new cost and sales structures for the Malaysia Wearing apparel and Leather products industries are adjusted to accord with externally provided data on Malaysian production and trade shares.

The ROWRAS4 program then rebalances total costs and total sales using a RAS procedure. Finally, ROWRAS5 splits the final balanced database into the component header arrays and calculates the difference between total costs and total sales which can be used to check the convergence of the RAS procedure.

The entire RAS procedure disaggregates one industry at a time. Thus the RAS procedure needs to be run once for each source industry requiring disaggregation. The second industry disaggregation in the Malaysian database therefore uses the input-output database created from the first industry disaggregation as its starting point.

Methodology

In the first part of the process, ROWRAS1 assembles a RASTABLE for each country from their individual header arrays. A RASTABLE is like an input-output table, ie. one big array composed of individual header arrays in appropriate positions.

The country containing the industries to be disaggregated is referred to as the *destination* country, and the industries produced by disaggregation as the disaggregation industries. The country from which we take the disaggregation industry data used is referred to as the *source* country.

The matrices in the destination country are of the same dimensions as the source country. The data for the disaggregation industries in the destination country is present in one industry, called the aggregated industry and zero filled for the remaining industries. We refer to this zero filled data and the aggregated industry data as the data to be disaggregated. Ultimately, the aggregated industry values in the destination country are disaggregated by scaling the disaggregation industry values from the source country, according to aggregated industry totals from the destination country.

In some source countries, the data for commodity taxes were all zeros, while in the destination countries there were some non-zero data. For these special cases, the tax data for the disaggregation industries was made proportional to the intermediate usage of the disaggregation industries in the source country. The coefficient of proportionality was chosen to preserve the total commodity tax revenue from the disaggregation industries in the destination country.

Commodity taxes and changes in stocks can quite legitimately contain negative values. The existence of negatives in a table is known to lead to non-convergence of the RAS rebalancing procedure. To get around this problem, both ROWRAS1 and ROWRAS4 treat positive and negative values in the RASTABLEs separately.

At the end of ROWRAS1, the actual total costs of the constructed RASTABLE are no longer equal to its total sales. Thus we need to proceed to part two of the process.

In part two of the process, ROWRAS4 splits the RASTABLE into its positive and negative subparts and 'rasses' each part for twenty iterations. The 'RAS' process refers to scaling of a matrix 'A', ie. premultiplying it by 'R' factors and postmultiplying it by 'S' factors, where 'R' and 'S' have to be found such that the updated matrix 'A' ends up with the desired row and column totals. These desired row and column totals are computed in ROWRAS1 and do not change between iterations. It is only the RASTABLE (which is the matrix 'A' in the

'RAS' process) that is updated in each iteration until its computed row and column totals correspond to the desired totals.

In the third and last part of the process, ROWRAS5 splits the final updated version of the RASTABLE from ROWRAS4 into its component header arrays. Some check totals and differences are also computed in this part to indicate the extent of error.

ROWRAS1

In the TABLO code listed at the end of this appendix, the source country header arrays are assembled into a single `ras_table` array, while the destination country header arrays are assembled into a separate array: the `rastable` (without an underscore). Exports, Commodity taxes on Exports and Duty are excluded from both of the `ras` tables. There are three input header array files and one output header array file. There is also one output display file. The first two input files contain the input-output data for the source and destination countries. The input 'splits' file contains run time sets and split shares for total sales, for imports and for exports. It also contains an Identity matrix of size of disaggregation industries needed by the section called the 'Grubby code'.

As noted, the 'splits' file contains all the necessary 'run-time' sets. These sets define the industries and other elements of inputs (primary factors), and of usage (investment, household consumption, government consumption and stocks) and also subsets for disaggregation industries. They are called 'run-time' because they are defined at run-time, ie. they are read from an external data file during the running phase of the fortran program, where the fortran program is created by the TABLO code. This definition of the sets at run-time is what differentiates these sets from the sets defined explicitly inside the TABLO code.

The 'row_ras' file contains all the source country header arrays. The 'rowras' file contains all the destination country header arrays. The 'rastable' output file contains the `rastable` for the destination country as one header and separate headers for each of the desired positive and negative row and column totals. In addition it contains headers for Exports, Commodity taxes on Exports and for Duty.

The following code extract from ROWRAS1 illustrates the allocation of disaggregated values into the destination `rastable` and computation of 'scale'. A grand total is computed of all the disaggregation industries, both horizontally and vertically, across the `rastable`, minus the intersection section, (because it was computed twice), and a similar grand total across the source country `ras_table`. Then `scale` is computed by dividing the destination country grand total by the source country grand total. The disaggregation values for the

destination country are then taken from the source country and multiplied by 'scale'.

! Scale Source country (disag) data to be consistent with size of Destination country values!

coefficient scale;

```
formula scale=[sum(i,inputs,sum(u,dest,rastable(i,u)))
+sum(u,usage,sum(i,dest,rastable(i,u))
+sum(i,dest_imp,rastable(i,u))
+sum(i,tdest,rastable(i,u))
+sum(i,tdest_imp,rastable(i,u)))
-sum(u,dest,sum(i,dest,rastable(i,u))
+sum(i,dest_imp,rastable(i,u))
+sum(i,tdest,rastable(i,u))
+sum(i,tdest_imp,rastable(i,u)))
]/[sum(i,inputs,sum(u,dest,rastable(i,u)))
+sum(u,usage,sum(i,dest,rastable(i,u))
+sum(i,dest_imp,rastable(i,u))
+sum(i,tdest,rastable(i,u))
+sum(i,tdest_imp,rastable(i,u)))
-sum(u,dest,sum(i,dest,rastable(i,u))
+sum(i,dest_imp,rastable(i,u))
+sum(i,tdest,rastable(i,u))
+sum(i,tdest_imp,rastable(i,u)))];
!*****!
```

! Insert Source country data in io table for RAS !

formula

```
(all,i,dest)(all,u,usage)
rastable(i,u)=ras_table(i,u)*scale;

(all,i,dest_imp)(all,u,usage)
rastable(i,u)=ras_table(i,u)*scale;

(all,i,tdest)(all,u,usage)
rastable(i,u)=ras_table(i,u)*scale;

(all,i,tdest_imp)(all,u,usage)
rastable(i,u)=ras_table(i,u)*scale;

(all,i,inputs)(all,u,dest)
rastable(i,u)=ras_table(i,u)*scale;
```

The TABLO code extract from ROWRAS1 called the 'Grubby code', shown in the code listing at the end of this appendix, illustrates how the costs and sales structures are then adjusted to accord with externally provided production and trade shares.

The splits for total sales, exports and imports for the disaggregation industries are read in from the Splits file. For the disaggregation industries only, exports are added to positive row totals, `prowtot`, to get `dest_spx`, where 'spx' stands for 'sales plus exports' (recall that exports were omitted from the original rastable). The sales values for the disaggregation industries are then computed by splitting the sum of `dest_spx` and the negative row totals, `nrowtot`, according to `sale_split(s)` read in above. `Domdest` and `Impdest` are computed next, by summing the positive and negative row totals, `prowtot + nrowtot`, over the disaggregation industries, domestic and imported respectively. `Dutydest` is computed by summing duty over the disaggregation industries. This process is repeated for commodity taxes, both domestic and imported. The positive and negative row totals, `prowtot` and `nrowtot`, are recomputed for domestic and imported disaggregation industries.

In the part labelled 'specific code' which is in the middle of 'grubby code', the data for commodity taxes for the disaggregation industries is inserted from the intermediate usage for the source country. It is scaled by `domdest_t / destdom` for domestic, and `impdest_t / destimp` for imports. The positive and negative row totals, `prowtot` and `nrowtot`, are recomputed for the disaggregation tax industries, for both domestic and imported. The positive and negative column totals are also recomputed across the whole range. This constitutes the end of the 'specific code'.

At this point we had to allow for the possibility of there being different signs between source country and destination country totals. To overcome this for the columns in each disaggregation industry, we compute `cost_scale` which is positive totals, `pcoltot`, divided by the sum of positive plus negative totals. The positive column totals, `pcoltot`, for these relevant industries are made equal to `cost_scale * dest_sale`, where `dest_sale` was computed earlier. The calculation is repeated in a symmetrical manner for the negative column totals, `ncoltot`.

We now split exports into `dest_exp`. `Dest_smx` where 'smx' stands for 'sales minus exports' is computed by subtracting `dest_exp` from `dest_sale`. A `sale_scale` with a similar formula to `cost_scale` above, is computed for the disaggregation industries. The formula is positive row totals, `prowtot`, divided by the sum of positive and negative row totals ie. `(prowtot+nrowtot)`. To allow for the possibility that negative row totals can be greater in absolute value than positive row totals, a `sale_sign` is determined as a product of `dest_smx * sale_scale`. If `sale_sign` is negative, then `sale_scale` is made equal to zero. The

positive row totals, `prowtot`, are assigned the value of `dest_smx * the new sale_scale`. Symmetrically, the negative row totals, `nrowtot`, are assigned the value of `dest_smx * (1 - new sale_scale)`.

Exports are finalised for writing to an output file by being assigned the values in `dest_exp` for the disaggregation industries. Now we proceed to calculate imports and duty for the disaggregation industries. `Imp_scale` is computed according to the now familiar formula of positive row totals divided by the sum of positive plus negative row totals. Then the positive row totals, `prowtot`, are recomputed for imported disaggregation industries as `imp_split * impdest * imp_scale`. The negative row totals are symmetrically recomputed as `imp_split * impdest * (1 - imp_scale)`. Duty for these industries is computed as `imp_split * dutydest`. Similar code is then applied for commodity taxes for both the domestic and the imported disaggregation industries. This concludes the section of TABLO called the 'grubby code'.

It is now important to reconcile any opposing signs between the `rastable` and totals. Thus, check row and column totals for positive and negative elements separately are computed at this stage. Check totals for the sum of positive and negative elements are also computed. A `rowtot` and `coltot`, being the sum of positive and negative row and column totals, are also computed. The following tests are then performed over all the industries and other elements of usage and inputs sets as appropriate. If a positive check row total is zero then `prowtot` is made equal to zero, while `nrowtot` is made equal to `rowtot`. Symmetrical assignments are done for the negative check row totals. If the sum of positive and negative elements check row total is zero, then both `prowtot` and `nrowtot` are made equal to zero for that element. The code is similar for the column totals.

The grand totals for positive and negative row and column totals are then computed. The two positive grand totals (row vs column) have to match, and similarly the two negative grand totals. If the values are not equal the totals for the rows/columns with the grand total which is smaller in absolute value are partially scaled (not all elements - exclude domestic intermediate usage and domestic taxes), to correspond to the other value.

The process of reconciling any opposing signs between `rastable` and totals may give us the wrong signs in the corresponding desired totals. For example, negative elements might crop up in positive totals and vice versa. To overcome this problem we do one iteration of the 'RAS' process in `ROWRAS1` and repeat the code to reconcile any opposing signs between the `rastable` and totals. We also repeat the code to reconcile the grand totals.

Finally the newly computed rastable and its desired positive and negative row and column totals are written to the output file. The Exports, Taxes on Exports and Duty are also written out to the same output file as separate headers.

ROWRAS4

ROWRAS4 is a multi-step TABLO code program, where a process called 'RAS', explained earlier, is performed on the rastable. The code contains update (explicit) statements and a dummy equation, the latter ensuring that the database gets updated with each iterative pass through the code. We have used twenty iterations in our production runs to make the final version of the updated rastable add up as closely as possible to its desired row and column totals, passed to this program by ROWRAS1.

ROWRAS5

ROWRAS5 splits the final updated version of the rastable from ROWRAS4 into its component header arrays. It also computes check totals and check differences between the final and desired totals as well as between total sales and total costs. The header arrays containing these check values are output to a separate header array file, not the database output file. The user can then form a print image of this second output file, by using GEMPACK program SEEHAR, to inspect the differences, and to determine whether the level of accuracy achieved is acceptable.

ROWRAS1 tablo code

```
!*****!  
! ROWRAS1 - PART 1 IN SALTER DISAGG - !  
!   A PRELIMINARY DISAGGREGATION !  
!   OF THE DESTINATION COUNTRY, !  
!   DESTINATION INDUSTRIES !  
!   ACCORDING TO SOURCE COUNTRY. !  
!   A PRELIMINARY RASTABLE (INPUT-OUTPUT TABLE) !  
!   OF ALL THE HEADERS IS ASSEMBLED. !  
!   THE ABOVE RASTABLE IS 'RASSED' IN ROWRAS4 !  
!   (PART 2) STAGE. !  
!*****!
```

```
file splits # Split data #;  
file row_ras #Source country io data for disag#;
```

```
!*****!  
!               SETS !  
!*****!
```

```
SET  
  ind # sectors # MAXIMUM SIZE 40  
READ ELEMENTS FROM FILE SPLITS HEADER "SD01";
```

```
SET  
  ind2 # sectors # MAXIMUM SIZE 40  
READ ELEMENTS FROM FILE SPLITS HEADER "SI01";
```

```
SET  
  tind # sectors # MAXIMUM SIZE 40  
READ ELEMENTS FROM FILE SPLITS HEADER "STD1";
```

```
SET  
  tind2 # sectors # MAXIMUM SIZE 40  
READ ELEMENTS FROM FILE SPLITS HEADER "STI1";
```

```
SET  
  DEST # INDUSTRIES RECEIVING THE SPLIT # MAXIMUM SIZE 10  
  READ ELEMENTS FROM FILE SPLITS HEADER "SD03" ;  
SUBSET DEST IS SUBSET OF ind ;
```

SET

usage #columns of rastable# MAXIMUM SIZE 44

READ ELEMENTS FROM FILE SPLITS HEADER "SUS1" ;

SET

inputs #rows of rastable# MAXIMUM SIZE 164

READ ELEMENTS FROM FILE SPLITS HEADER "SIN1" ;

SET

DEST_IMP #INDUSTRIES RECEIVING THE SPLIT# MAXIMUM SIZE 10

READ ELEMENTS FROM FILE SPLITS HEADER "SI03" ;

SUBSET DEST_IMP IS SUBSET OF ind2 ;

SET

TDEST # INDUSTRIES RECEIVING THE SPLIT # MAXIMUM SIZE 10

READ ELEMENTS FROM FILE SPLITS HEADER "STD3" ;

SUBSET TDEST IS SUBSET OF tind ;

SET

TDEST_IMP #INDUSTRIES RECEIVING THE SPLIT# MAXIMUM SIZE 10

READ ELEMENTS FROM FILE SPLITS HEADER "STI3" ;

SUBSET TDEST_IMP IS SUBSET OF tind2 ;

SET

labour # labour # MAXIMUM SIZE 1

READ ELEMENTS FROM FILE SPLITS HEADER "SP01" ;

SUBSET labour IS SUBSET OF inputs ;

SET

capital # capital # MAXIMUM SIZE 1

READ ELEMENTS FROM FILE SPLITS HEADER "SP02" ;

SUBSET capital IS SUBSET OF inputs ;

SET

land # land # MAXIMUM SIZE 1

READ ELEMENTS FROM FILE SPLITS HEADER "SP03" ;

SUBSET land IS SUBSET OF inputs ;

SET

indtax # indtax # MAXIMUM SIZE 1

READ ELEMENTS FROM FILE SPLITS HEADER "SP04" ;

SUBSET indtax IS SUBSET OF inputs ;

SET

inv # inv # MAXIMUM SIZE 1

READ ELEMENTS FROM FILE SPLITS HEADER "SC01" ;

SUBSET inv IS SUBSET OF usage ;

SET

con # con # MAXIMUM SIZE 1

READ ELEMENTS FROM FILE SPLITS HEADER "SC02" ;

SUBSET con IS SUBSET OF usage ;

SET

gov # gov # MAXIMUM SIZE 1

READ ELEMENTS FROM FILE SPLITS HEADER "SC03" ;

SUBSET gov IS SUBSET OF usage ;

SET

stocks # stocks # MAXIMUM SIZE 1

READ ELEMENTS FROM FILE SPLITS HEADER "SC04" ;

SUBSET stocks IS SUBSET OF usage ;

SET

non_intu # non_intu # MAXIMUM SIZE 4

READ ELEMENTS FROM FILE SPLITS HEADER "SNU1" ;

SUBSET non_intu IS SUBSET OF usage ;

SET

inti # inti # MAXIMUM SIZE 121

READ ELEMENTS FROM FILE SPLITS HEADER "SIT1" ;

SUBSET inti IS SUBSET OF inputs ;

SET

non_inti # non_inti # MAXIMUM SIZE 124

READ ELEMENTS FROM FILE SPLITS HEADER "SNI1" ;

SUBSET non_inti IS SUBSET OF inputs ;

SET

non_intin # non_intin # MAXIMUM SIZE 123

READ ELEMENTS FROM FILE SPLITS HEADER "SNN1" ;

SUBSET non_intin IS SUBSET OF inputs ;

!

set primary (labour, capital, land, indtax);

set usage (ind, inv, con, gov, stocks);

set inputs (ind, ind2, tind, tind2, labour, capital, land, indtax);

!

subset ind is subset of usage;

subset ind is subset of inputs;

subset ind2 is subset of inputs;

subset tind is subset of inputs;

subset tind2 is subset of inputs;

!

subset primary is subset of inputs;

set non_intu (inv, con, gov, stocks);

subset non_intu is subset of usage;

set inti (ind, tind, indtax) ;

subset inti is subset of inputs;

set non_inti (ind2, tind2, labour, capital, land, indtax);

subset non_inti is subset of inputs;

set non_intin (ind2, tind2, labour, capital, land);

subset non_intin is subset of inputs;

!

coefficient

(all,u,usage)(all,i,inputs) ras_table(i,u);
(all,u,usage) pcol_tot(u);
(all,i,inputs) prow_tot(i);
(all,u,usage) ncol_tot(u);
(all,i,inputs) nrow_tot(i);

(all,j,ind) lab(j);
(all,j,ind) cap(j);
(all,j,ind) landc(j);
(all,j,ind) indirect(j);

(all,i,ind2)(all,j,ind) iint(i,j);
(all,i,ind)(all,j,ind) dint(i,j);

(all,i,ind2) iinv(i);
(all,i,ind) dinv(i);

(all,i,ind2) icon(i);
(all,i,ind) dcon(i);

(all,i,ind2) igov(i);
(all,i,ind) dgov(i);

(all,i,ind2) duty(i);

(all,i,ind2) istocks(i);
(all,i,ind) dstocks(i);

(all,i,tind2)(all,j,ind) iint_t(i,j);
(all,i,tind)(all,j,ind) dint_t(i,j);

(all,i,tind2) iinv_t(i);
(all,i,tind) dinv_t(i);

(all,i,tind2) icon_t(i);
(all,i,tind) dcon_t(i);

(all,i,tind2) igov_t(i);
(all,i,tind) dgov_t(i);

(all,i,ind) exports(i);
(all,i,tind) texports(i);

(all,i,tind2) tistocks(i);
(all,i,tind) tdstocks(i);

read lab from file row_ras header "AI13";
read cap from file row_ras header "AI14";
read landc from file row_ras header "AI15";
read indirect from file row_ras header "AI12";

read dint from file row_ras header "AI01";
read dinv from file row_ras header "AI03";
read dcon from file row_ras header "AI05";
read dgov from file row_ras header "AI07";
read dstocks from file row_ras header "AI09";

read iint from file row_ras header "AI02";
read iinv from file row_ras header "AI04";
read icon from file row_ras header "AI06";
read igov from file row_ras header "AI08";
read istocks from file row_ras header "AI10";

read dint_t from file row_ras header "AI16";
read dinv_t from file row_ras header "AI20";
read dcon_t from file row_ras header "AI18";
read dgov_t from file row_ras header "AI22";
read tdstocks from file row_ras header "AI25";

read iint_t from file row_ras header "AI17";
read iinv_t from file row_ras header "AI21";
read icon_t from file row_ras header "AI19";
read igov_t from file row_ras header "AI23";
read tistocks from file row_ras header "AI26";

read exports from file row_ras header "AI11";
read texports from file row_ras header "AI24";

read duty from file row_ras header "AI27";

formula

```
(all,u,usage)(all,i,inputs) ras_table(i,u)=0;

(all,i,ind)(all,u,ind) ras_table(i,u)=dint(i,u);
(all,i,ind)(all,u,inv) ras_table(i,u)=dinv(i);
(all,i,ind)(all,u,con) ras_table(i,u)=dcon(i);
(all,i,ind)(all,u,gov) ras_table(i,u)=dgov(i);
(all,i,ind)(all,u,stocks) ras_table(i,u)=dstocks(i);

(all,i,ind2)(all,u,ind) ras_table(i,u)=iint(i,u);
(all,i,ind2)(all,u,inv) ras_table(i,u)=iinv(i);
(all,i,ind2)(all,u,con) ras_table(i,u)=icon(i);
(all,i,ind2)(all,u,gov) ras_table(i,u)=igov(i);
(all,i,ind2)(all,u,stocks) ras_table(i,u)=istocks(i);

(all,i,labour)(all,u,ind) ras_table(i,u)=lab(u);
(all,i,capital)(all,u,ind) ras_table(i,u)=cap(u);
(all,i,land)(all,u,ind) ras_table(i,u)=landc(u);
(all,i,indtax)(all,u,ind) ras_table(i,u)=indirect(u);

(all,i,tind)(all,u,ind) ras_table(i,u)=dint_t(i,u);
(all,i,tind)(all,u,inv) ras_table(i,u)=dinv_t(i);
(all,i,tind)(all,u,con) ras_table(i,u)=dcon_t(i);
(all,i,tind)(all,u,gov) ras_table(i,u)=dgov_t(i);
(all,i,tind)(all,u,stocks) ras_table(i,u)=tdstocks(i);

(all,i,tind2)(all,u,ind) ras_table(i,u)=iint_t(i,u);
(all,i,tind2)(all,u,inv) ras_table(i,u)=iinv_t(i);
(all,i,tind2)(all,u,con) ras_table(i,u)=icon_t(i);
(all,i,tind2)(all,u,gov) ras_table(i,u)=igov_t(i);
(all,i,tind2)(all,u,stocks) ras_table(i,u)=tistocks(i);
```

! Calculate row & column totals !

formula

```
(all,u,usage) pcol_tot(u)=0;
(all,u,usage) ncol_tot(u)=0;
(all,i,inputs) prow_tot(i)=0;
(all,i,inputs) nrow_tot(i)=0;
```

```

(all,u,usage)
pcol_tot(u)=sum(i,inputs:ras_table(i,u)>0,ras_table(i,u));

(all,u,usage)
ncol_tot(u)=sum(i,inputs:ras_table(i,u)<0,ras_table(i,u));

(all,i,inputs)
prow_tot(i)=sum(u,usage:ras_table(i,u)>0,ras_table(i,u));

(all,i,inputs)
nrow_tot(i)=sum(u,usage:ras_table(i,u)<0,ras_table(i,u));

!*****!

```

```

file rowras #Destination country io data for RASing#;

```

```

coefficient

```

```

(all,u,usage)(all,i,inputs) rastable(i,u);
(all,u,usage) pcoltot(u);
(all,u,usage) ncoltot(u);
(all,i,inputs) prowtot(i);
(all,i,inputs) nrowtot(i);

```

```

(all,j,ind) lab_(j);
(all,j,ind) cap_(j);
(all,j,ind) landc_(j);
(all,j,ind) indirect_(j);

```

```

(all,i,ind2)(all,j,ind) iint_(i,j);
(all,i,ind)(all,j,ind) dint_(i,j);

```

```

(all,i,ind2) iinv_(i);
(all,i,ind) dinv_(i);

```

```

(all,i,ind2) icon_(i);
(all,i,ind) dcon_(i);

```

```

(all,i,ind2) igov_(i);
(all,i,ind) dgov_(i);

```

```

(all,i,ind2) duty_(i);

```

(all,i,ind2) istocks_(i);
(all,i,ind) dstocks_(i);

(all,i,tind2)(all,j,ind) iint__t(i,j);
(all,i,tind)(all,j,ind) dint__t(i,j);

(all,i,tind2) iinv__t(i);
(all,i,tind) dinv__t(i);

(all,i,tind2) icon__t(i);
(all,i,tind) dcon__t(i);

(all,i,tind2) igov__t(i);
(all,i,tind) dgov__t(i);

(all,i,ind) exports_(i);
(all,i,tind) texports_(i);

(all,i,tind2) tistocks_(i);
(all,i,tind) tdstocks_(i);

read lab_ from file rowras header "AI13";
read cap_ from file rowras header "AI14";
read landc_ from file rowras header "AI15";
read indirect_ from file rowras header "AI12";

read dint_ from file rowras header "AI01";
read dinv_ from file rowras header "AI03";
read dcon_ from file rowras header "AI05";
read dgov_ from file rowras header "AI07";
read dstocks_ from file rowras header "AI09";

read iint_ from file rowras header "AI02";
read iinv_ from file rowras header "AI04";
read icon_ from file rowras header "AI06";
read igov_ from file rowras header "AI08";
read istocks_ from file rowras header "AI10";

read dint__t from file rowras header "AI16";
read dinv__t from file rowras header "AI20";
read dcon__t from file rowras header "AI18";

read dgov__t from file rowras header "AI22";
read tdstocks_ from file rowras header "AI25";

read iint__t from file rowras header "AI17";
read iinv__t from file rowras header "AI21";
read icon__t from file rowras header "AI19";
read igov__t from file rowras header "AI23";
read tistocks_ from file rowras header "AI26";

read exports_ from file rowras header "AI11";
read texports_ from file rowras header "AI24";

read duty_ from file rowras header "AI27";

formula

(all,u,usage)(all,i,inputs) rastable(i,u)=0;

(all,i,ind)(all,u,ind) rastable(i,u)=dint_(i,u);
(all,i,ind)(all,u,inv) rastable(i,u)=dinv_(i);
(all,i,ind)(all,u,con) rastable(i,u)=dcon_(i);
(all,i,ind)(all,u,gov) rastable(i,u)=dgov_(i);
(all,i,ind)(all,u,stocks) rastable(i,u)=dstocks_(i);

(all,i,ind2)(all,u,ind) rastable(i,u)=iint_(i,u);
(all,i,ind2)(all,u,inv) rastable(i,u)=iinv_(i);
(all,i,ind2)(all,u,con) rastable(i,u)=icon_(i);
(all,i,ind2)(all,u,gov) rastable(i,u)=igov_(i);
(all,i,ind2)(all,u,stocks) rastable(i,u)=istocks_(i);

(all,i,labour)(all,u,ind) rastable(i,u)=lab_(u);
(all,i,capital)(all,u,ind) rastable(i,u)=cap_(u);
(all,i,land)(all,u,ind) rastable(i,u)=landc_(u);
(all,i,indtax)(all,u,ind) rastable(i,u)=indirect_(u);

(all,i,tind)(all,u,ind) rastable(i,u)=dint__t(i,u);
(all,i,tind)(all,u,inv) rastable(i,u)=dinv__t(i);
(all,i,tind)(all,u,con) rastable(i,u)=dcon__t(i);
(all,i,tind)(all,u,gov) rastable(i,u)=dgov__t(i);
(all,i,tind)(all,u,stocks) rastable(i,u)=tdstocks_(i);

```

(all,i,tind2)(all,u,ind) rastable(i,u)=iint__t(i,u);
(all,i,tind2)(all,u,inv) rastable(i,u)=iinv__t(i);
(all,i,tind2)(all,u,con) rastable(i,u)=icon__t(i);
(all,i,tind2)(all,u,gov) rastable(i,u)=igov__t(i);
(all,i,tind2)(all,u,stocks) rastable(i,u)=tistocks_(i);

```

! Calculate row & column totals !

formula

```

(all,u,usage) pcoltot(u)=0;
(all,u,usage) ncoltot(u)=0;
(all,i,inputs) prowtot(i)=0;
(all,i,inputs) nrowtot(i)=0;

```

```

(all,u,usage)
pcoltot(u)=sum(i,inputs:rastable(i,u)>0,rastable(i,u));

```

```

(all,u,usage)
ncoltot(u)=sum(i,inputs:rastable(i,u)<0,rastable(i,u));

```

```

(all,i,inputs)
prowtot(i)=sum(u,usage:rastable(i,u)>0,rastable(i,u));

```

```

(all,i,inputs)
nrowtot(i)=sum(u,usage:rastable(i,u)<0,rastable(i,u));

```

!*****!

! Scale Source country (disag) data to be consistent with size of Destination country values!

coefficient scale;

```

formula scale=[sum(i,inputs,sum(u,dest,rastable(i,u)))
+sum(u,usage,sum(i,dest,rastable(i,u))
+sum(i,dest_imp,rastable(i,u))
+sum(i,tdest,rastable(i,u))
+sum(i,tdest_imp,rastable(i,u)))
-sum(u,dest,sum(i,dest,rastable(i,u))

```

```

+sum(i,dest_imp,rastable(i,u))
+sum(i,tdest,rastable(i,u))
+sum(i,tdest_imp,rastable(i,u)))]
/[sum(i,inputs,sum(u,dest,ras_table(i,u)))
+sum(u,usage,sum(i,dest,ras_table(i,u))
+sum(i,dest_imp,ras_table(i,u))
+sum(i,tdest,ras_table(i,u))
+sum(i,tdest_imp,ras_table(i,u)))
-sum(u,dest,sum(i,dest,ras_table(i,u))
+sum(i,dest_imp,ras_table(i,u))
+sum(i,tdest,ras_table(i,u))
+sum(i,tdest_imp,ras_table(i,u)))]];

```

!*****!

! Insert Source country data in io table for RAS !

formula

```

(all,i,dest)(all,u,usage)
rastable(i,u)=ras_table(i,u)*scale;

```

```

(all,i,dest_imp)(all,u,usage)
rastable(i,u)=ras_table(i,u)*scale;

```

```

(all,i,tdest)(all,u,usage)
rastable(i,u)=ras_table(i,u)*scale;

```

```

(all,i,tdest_imp)(all,u,usage)
rastable(i,u)=ras_table(i,u)*scale;

```

```

(all,i,inputs)(all,u,dest)
rastable(i,u)=ras_table(i,u)*scale;

```

!*****!

! Grubby code for disaggregating cells according to external shares !

coefficient

```

(all,i,dest) sale_splits(i);
(all,i,dest) exp_splits(i);

```

```
(all,i,dest_imp) imp_splits(i);
(all,i,tdest) tsale_splits(i);
(all,i,tdest) texp_splits(i);
(all,i,tdest_imp) timp_splits(i);
(all,i,inputs) dest_sale(i);
(all,i,inputs) sale_split(i);
(all,i,inputs) dest_exp(i);
(all,i,inputs) exp_split(i);
(all,i,inputs) dest_smx(i);
(all,i,inputs) dest_spx(i);
```

```
impdest;
impdest_t;
destimp;
```

```
domdest;
domdest_t;
destdom;
```

```
dutydest;
```

```
(all,i,inputs) imp_split(i);
(all,u,dest) cost_scale(u);
(all,i,inputs) sale_scale(i);
(all,i,inputs) imp_scale(i);
(all,i,inputs) sale_sign(i);
```

```
(all,i,inputs) check_prow(i);
(all,i,inputs) check_nrow(i);
(all,i,inputs) check_row(i);
(all,i,inputs) rowtot(i);
```

```
(all,u,usage) check_pcol(u);
(all,u,usage) check_ncol(u);
(all,u,usage) check_col(u);
(all,u,usage) coltot(u);
```

```
prowcheck;
nrowcheck;
```

```
gprowtot;
gnrowtot;
```

```
gpcoltot;
gncoltot;
gpdiff;
gndiff;
gprnon_int;
gpcnon_int;
gnrnon_int;
gncnon_int;
gpr_ind;
gpc_ind;
gnr_ind;
gnc_ind;
```

```
(all,i,inputs) gprow_scale(i) ;
(all,i,inputs) gnrow_scale(i) ;
(all,u,usage) gpcol_scale(u) ;
(all,u,usage) gncol_scale(u) ;
```

```
read sale_splits from file splits header "S008";
read exp_splits from file splits header "S010";
read imp_splits from file splits header "S012";
```

```
read tsale_splits from file splits header "S008";
read texp_splits from file splits header "S010";
read timp_splits from file splits header "S012";
```

formula

```
(all,i,dest) sale_split(i) = sale_splits(i);
(all,i,tdest) sale_split(i) = tsale_splits(i);
```

```
(all,i,dest) exp_split(i) = exp_splits(i);
(all,i,tdest) exp_split(i) = texp_splits(i);
```

```
(all,i,dest_imp) imp_split(i) = imp_splits(i);
(all,i,tdest_imp) imp_split(i) = timp_splits(i);
```

formula

! Calculate total dest production and imports and their taxes
from destination country data !

```

(all,i,dest)
dest_spx(i)=prowtot(i)+exports_(i);

(all,i,dest)
dest_sale(i)=sale_split(i)*sum(j,dest,dest_spx(j)
+nrowtot(j));

domdest=sum(i,dest,prowtot(i)+nrowtot(i));
impdest=sum(i,dest_imp,prowtot(i)+nrowtot(i));
dutydest=sum(i,dest_imp,duty_(i));

(all,i,tdest)
dest_spx(i)=prowtot(i)+texports_(i);

(all,i,tdest)
dest_sale(i)=sale_split(i)*sum(j,tdest,dest_spx(j)
+nrowtot(j));

domdest_t=sum(i,tdest,prowtot(i)+nrowtot(i));

destdom=sum(i,dest,prow_tot(i)+nrow_tot(i));

impdest_t=sum(i,tdest_imp,prowtot(i)+nrowtot(i));

destimp=sum(i,dest_imp,prow_tot(i)+nrow_tot(i));

(all,i,dest)
prowtot(i)=sum(u,usage:rastable(i,u)>0,rastable(i,u));

(all,i,dest)
nrowtot(i)=sum(u,usage:rastable(i,u)<0,rastable(i,u));

(all,i,dest_imp)
prowtot(i)=sum(u,usage:rastable(i,u)>0,rastable(i,u));

(all,i,dest_imp)
nrowtot(i)=sum(u,usage:rastable(i,u)<0,rastable(i,u));

! ***** specific code !

coefficient

```

```
(all,i,tdest)(all,j,dest) map(i,j) ;  
(all,i,tdest_imp)(all,j,dest_imp) map2(i,j) ;
```

```
read map from file splits header "S013";  
read map2 from file splits header "S013";
```

```
formula
```

```
(all,u,usage)(all,i,tdest)  
rastable(i,u) = sum(j,dest:map(i,j)>0,ras_table(j,u))  
* domdest_t / destdom ;
```

```
(all,u,usage)(all,i,tdest_imp)  
rastable(i,u) = sum(j,dest_imp:map2(i,j)>0,ras_table(j,u))  
* impdest_t / destimp ;
```

```
! ***** End of specific code !
```

```
(all,i,tdest)  
prowtot(i)=sum(u,usage:rastable(i,u)>0,rastable(i,u));
```

```
(all,i,tdest)  
nrowtot(i)=sum(u,usage:rastable(i,u)<0,rastable(i,u));
```

```
(all,i,tdest_imp)  
prowtot(i)=sum(u,usage:rastable(i,u)>0,rastable(i,u));
```

```
(all,i,tdest_imp)  
nrowtot(i)=sum(u,usage:rastable(i,u)<0,rastable(i,u));
```

```
(all,u,dest)  
pcoltot(u)=sum(i,inputs:rastable(i,u)>0,rastable(i,u));
```

```
(all,u,dest)  
ncoltot(u)=sum(i,inputs:rastable(i,u)<0,rastable(i,u));
```

```
! For domestic production !
```

```
(all,u,dest)  
cost_scale(u)=pcoltot(u)/[pcoltot(u)+ncoltot(u)];
```

```

(all,u,dest)
pcoltot(u)=dest_sale(u)*cost_scale(u);

(all,u,dest)
cost_scale(u)=ncoltot(u)/[pcoltot(u)+ncoltot(u)];

(all,u,dest)
ncoltot(u)=dest_sale(u)*cost_scale(u);

(all,i,dest)
dest_exp(i)=exp_split(i)*sum(j,dest,exports_(j));

(all,i,dest)
dest_smx(i)=dest_sale(i)-dest_exp(i);

(all,i,dest)
sale_scale(i)=prowtot(i)/[prowtot(i)+nrowtot(i)];

(all,i,dest)
sale_sign(i)=dest_smx(i)*sale_scale(i);

(all,i,dest:sale_sign(i)<0)
sale_scale(i)=0.0;

(all,i,dest)
prowtot(i)=dest_smx(i)*sale_scale(i);

(all,i,dest)
nrowtot(i)=dest_smx(i)*(1-sale_scale(i));

! Split for exports !

(all,i,dest) exports_(i)=dest_exp(i);

! For imports !

(all,i,dest_imp)
imp_scale(i)=prowtot(i)/[prowtot(i)+nrowtot(i)];

(all,i,dest_imp)
prowtot(i)=imp_split(i)*imp_scale(i)*impdest;

```

```
(all,i,dest_imp)
nrowtot(i)=imp_split(i)*(1-imp_scale(i))*impdest;
```

```
(all,i,dest_imp)
duty_(i)=imp_split(i)*dutydest;
```

! For taxes on domestic production !

```
(all,i,tdest)
sale_scale(i)=prowtot(i)/[prowtot(i)+nrowtot(i)];
```

```
(all,i,tdest)
prowtot(i)=sale_split(i)*sale_scale(i)*domdest_t;
```

```
(all,i,tdest)
nrowtot(i)=sale_split(i)*(1-sale_scale(i))*domdest_t;
```

```
(all,i,tdest)
dest_exp(i)=exp_split(i)*sum(j,tdest,exports_(j));
```

```
(all,i,tdest)
dest_spx(i)=prowtot(i)+dest_exp(i);
```

```
(all,i,tdest)
dest_sale(i)=sale_split(i)*sum(j,tdest,dest_spx(j)
+nrowtot(j));
```

```
(all,i,tdest)
dest_smx(i)=dest_sale(i)-dest_exp(i);
```

```
(all,i,tdest)
sale_scale(i)=prowtot(i)/[prowtot(i)+nrowtot(i)];
```

```
(all,i,tdest)
sale_sign(i)=dest_smx(i)* sale_scale(i);
```

```
(all,i,tdest:sale_sign(i)<0)
sale_scale(i)=0.0;
```

```
(all,i,tdest)
prowtot(i)=dest_smx(i)*sale_scale(i);
```

```
(all,i,tdest)
nrowtot(i)=dest_smx(i)*(1-sale_scale(i));
```

! Split for taxes on exports !

```
(all,i,tdest) texports_(i)=dest_exp(i);
```

! For taxes on imports !

```
(all,i,tdest_imp)
imp_scale(i)=prowtot(i)/[prowtot(i)+nrowtot(i)];
```

```
(all,i,tdest_imp)
prowtot(i)=imp_split(i)*imp_scale(i)*impdest_t;
```

```
(all,i,tdest_imp)
nrowtot(i)=imp_split(i)*(1-imp_scale(i))*impdest_t;
```

```
display
prowtot;
nrowtot;
pcoltot;
ncoltot;
```

! End of grubby code for disaggregating cells according to external shares !

! Reconcile opposing signs between rastable and totals !

formula

```
(all,i,inputs)
check_prow(i) = sum(u,usage:rastable(i,u)>0,rastable(i,u));
```

```
(all,i,inputs)
check_nrow(i) = sum(u,usage:rastable(i,u)<0,rastable(i,u));
```

```
(all,u,usage)
check_pcol(u) = sum(i,inputs:rastable(i,u)>0,rastable(i,u));
```

```

(all,u,usage)
check_ncol(u) = sum(i,inputs:rastable(i,u)<0,rastable(i,u));

(all,i,inputs) check_row(i) = check_prow(i) + check_nrow(i);
(all,u,usage) check_col(u) = check_pcol(u) + check_ncol(u);

(all,i,inputs) rowtot(i) = prowtot(i) + nrowtot(i);
(all,i,inputs:check_prow(i)=0) prowtot(i) = 0.0;
(all,i,inputs:check_prow(i)=0) nrowtot(i) = rowtot(i);
(all,i,inputs:check_nrow(i)=0) nrowtot(i) = 0.0;
(all,i,inputs:check_nrow(i)=0) prowtot(i) = rowtot(i);
(all,i,inputs:check_row(i)=0) nrowtot(i) = 0.0;
(all,i,inputs:check_row(i)=0) prowtot(i) = 0.0;

(all,u,usage) coltot(u) = pcoltot(u) + ncoltot(u);
(all,u,usage:check_pcol(u)=0) pcoltot(u) = 0.0;
(all,u,usage:check_pcol(u)=0) ncoltot(u) = coltot(u);
(all,u,usage:check_ncol(u)=0) ncoltot(u) = 0.0;
(all,u,usage:check_ncol(u)=0) pcoltot(u) = coltot(u);
(all,u,usage:check_col(u)=0) ncoltot(u) = 0.0;
(all,u,usage:check_col(u)=0) pcoltot(u) = 0.0;

display
prowtot;
nrowtot;
pcoltot;
ncoltot;

```

! Scale row and column totals to add up !

formula

```

gprowtot = sum(i,inputs,prowtot(i));
gnrowtot = sum(i,inputs,nrowtot(i));
gpcoltot = sum(u,usage,pcoltot(u));
gncoltot = sum(u,usage,ncoltot(u));
gpdiff = gprowtot - gpcoltot;
gndiff = gnrowtot - gncoltot;

gprnon_int = sum(i,non_inti,prowtot(i));
gnrnon_int = sum(i,non_inti,nrowtot(i));
gpcnon_int = sum(u,non_intu,pcoltot(u));

```

$\text{gncnon_int} = \text{sum}(\text{u}, \text{non_intu}, \text{ncoltot}(\text{u}));$

$\text{gpr_ind} = \text{sum}(\text{i}, \text{inti}, \text{prowtot}(\text{i}));$

$\text{gnr_ind} = \text{sum}(\text{i}, \text{inti}, \text{nrowtot}(\text{i}));$

$\text{gpc_ind} = \text{sum}(\text{u}, \text{ind}, \text{pcoltot}(\text{u}));$

$\text{gnc_ind} = \text{sum}(\text{u}, \text{ind}, \text{ncoltot}(\text{u}));$

$\text{prowcheck} = \text{gprowtot} - \text{gpc_ind};$

$\text{nrowcheck} = \text{gnrowtot} - \text{gnc_ind};$

$(\text{all}, \text{i}, \text{non_inti})$

$\text{gprow_scale}(\text{i}) = \text{prowtot}(\text{i}) * (\text{gpcoltot} - \text{gpr_ind})$
 $\quad / \text{gprnon_int};$

$(\text{all}, \text{i}, \text{non_inti})$

$\text{gnrow_scale}(\text{i}) = \text{nrowtot}(\text{i}) * (\text{gncoltot} - \text{gnr_ind})$
 $\quad / \text{gnrnon_int};$

$(\text{all}, \text{u}, \text{non_intu})$

$\text{gpcol_scale}(\text{u}) = \text{pcoltot}(\text{u}) * (\text{gprowtot} - \text{gpc_ind})$
 $\quad / \text{gpcnon_int};$

$(\text{all}, \text{u}, \text{non_intu})$

$\text{gncol_scale}(\text{u}) = \text{ncoltot}(\text{u}) * (\text{gnrowtot} - \text{gnc_ind})$
 $\quad / \text{gncnon_int};$

$(\text{all}, \text{i}, \text{non_inti} : \text{prowcheck} < 0) \text{prowtot}(\text{i}) = \text{gprow_scale}(\text{i});$

$(\text{all}, \text{i}, \text{non_inti} : \text{nrowcheck} > 0) \text{nrowtot}(\text{i}) = \text{gnrow_scale}(\text{i});$

$(\text{all}, \text{u}, \text{non_intu} : \text{prowcheck} > 0) \text{pcoltot}(\text{u}) = \text{gpcol_scale}(\text{u});$

$(\text{all}, \text{u}, \text{non_intu} : \text{nrowcheck} < 0) \text{ncoltot}(\text{u}) = \text{gncol_scale}(\text{u});$

display

prowtot;

nrowtot;

pcoltot;

ncoltot;

gprowtot;

```

gpcoltot;
gnrowtot;
gncoltot;
gpdiff;
gndiff;
gpcnon_int;
gprnon_int;
gncnon_int;
gnrnon_int;
gpc_ind;
gpr_ind;
gnc_ind;
gnr_ind;
prowcheck;
nrowcheck;

```

! Perform 1 step of RAS and reallocate totals !

coefficient

```

(all,u,usage)(all,i,inputs) pr_rastable(i,u);
(all,u,usage)(all,i,inputs) nr_rastable(i,u);
(all,u,usage)(all,i,inputs) pc_rastable(i,u);
(all,u,usage)(all,i,inputs) nc_rastable(i,u);

```

```

(all,u,usage) pcol_sum(u);
(all,u,usage) ncol_sum(u);
(all,i,inputs) prow_sum(i);
(all,i,inputs) nrow_sum(i);

```

formula

```

(all,i,inputs) prow_sum(i)= sum(u,usage:rastable(i,u)>0,rastable(i,u));

```

```

(all,i,inputs)(all,u,usage: rastable(i,u) > 0 )
      pr_rastable(i,u)=rastable(i,u)*prowtot(i)
      /prow_sum(i);

```

```

(all,i,inputs)
nrow_sum(i)= sum(u,usage:rastable(i,u) le 0,rastable(i,u));

```

```

(all,i,inputs)(all,u,usage: rastable(i,u) le 0 )

```

```
nr_rastable(i,u)=rastable(i,u)*nrowtot(i)
/nrow_sum(i);
```

! Second step of RAS - scale to column totals !

```
(all,u,usage) pcol_sum(u)= sum(i,inputs:rastable(i,u)>0,pr_rastable(i,u));
```

```
(all,i,inputs)(all,u,usage: rastable(i,u) > 0 )
pc_rastable(i,u)=pr_rastable(i,u)*pcoltot(u)
/pcol_sum(u);
```

```
(all,u,usage)
ncol_sum(u)= sum(i,inputs:rastable(i,u) le 0,nr_rastable(i,u));
```

```
(all,i,inputs)(all,u,usage: rastable(i,u) le 0 )
nc_rastable(i,u)=nr_rastable(i,u)*ncoltot(u)
/ncol_sum(u);
```

! Update data as consequence of RAS !

```
(all,i,inputs)(all,u,usage)
rastable(i,u)=pc_rastable(i,u) + nc_rastable(i,u);
```

! Reallocate totals to have signs consistent with rastable !

formula

```
(all,i,inputs)
check_prow(i) = sum(u,usage:rastable(i,u)>0,rastable(i,u));
```

```
(all,i,inputs)
check_nrow(i) = sum(u,usage:rastable(i,u)<0,rastable(i,u));
```

```
(all,u,usage)
check_pcol(u) = sum(i,inputs:rastable(i,u)>0,rastable(i,u));
```

```
(all,u,usage)
check_ncol(u) = sum(i,inputs:rastable(i,u)<0,rastable(i,u));
```

```
(all,i,inputs) check_row(i) = check_prow(i) + check_nrow(i);
(all,u,usage) check_col(u) = check_pcol(u) + check_ncol(u);
```

```

(all,i,inputs) rowtot(i) = prowtot(i) + nrowtot(i);
(all,i,inputs:check_prow(i)=0) prowtot(i) = 0.0;
(all,i,inputs:check_prow(i)=0) nrowtot(i) = rowtot(i);
(all,i,inputs:check_nrow(i)=0) nrowtot(i) = 0.0;
(all,i,inputs:check_nrow(i)=0) prowtot(i) = rowtot(i);
(all,i,inputs:check_row(i)=0) nrowtot(i) = 0.0;
(all,i,inputs:check_row(i)=0) prowtot(i) = 0.0;

```

```

(all,u,usage) coltot(u) = pcoltot(u) + ncoltot(u);
(all,u,usage:check_pcol(u)=0) pcoltot(u) = 0.0;
(all,u,usage:check_pcol(u)=0) ncoltot(u) = coltot(u);
(all,u,usage:check_ncol(u)=0) ncoltot(u) = 0.0;
(all,u,usage:check_ncol(u)=0) pcoltot(u) = coltot(u);
(all,u,usage:check_col(u)=0) ncoltot(u) = 0.0;
(all,u,usage:check_col(u)=0) pcoltot(u) = 0.0;

```

```

display
prowtot;
nrowtot;
pcoltot;
ncoltot;

```

! Scale row and column totals to add up !

formula

```

gprowtot = sum(i,inputs,prowtot(i));
gnrowtot = sum(i,inputs,nrowtot(i));
gpcoltot = sum(u,usage,pcoltot(u));
gncoltot = sum(u,usage,ncoltot(u));
gpdiff = gprowtot - gpcoltot;
gndiff = gnrowtot - gncoltot;

```

```

gprnon_int = sum(i,non_inti,prowtot(i));
gnrnon_int = sum(i,non_inti,nrowtot(i));
gpcnon_int = sum(u,non_intu,pcoltot(u));
gncnon_int = sum(u,non_intu,ncoltot(u));

```

```

gpr_ind = sum(i,inti,prowtot(i));
gnr_ind = sum(i,inti,nrowtot(i));
gpc_ind = sum(u,ind,pcoltot(u));

```

```

gnc_ind = sum(u,ind,ncoltot(u));

prowcheck = gprowtot - gpc_ind;
nrowcheck = gnrowtot - gnc_ind;

(all,i,non_inti)
gprow_scale(i) = prowtot(i) * (gpcoltot - gpr_ind)
                / gprnon_int ;

(all,i,non_inti)
gnrow_scale(i) = nrowtot(i) * (gncoltot - gnr_ind)
                / gnrnon_int ;

(all,u,non_intu)
gpcol_scale(u) = pcoltot(u) * (gprowtot - gpc_ind)
                / gpcnon_int ;

(all,u,non_intu)
gncol_scale(u) = ncoltot(u) * (gnrowtot - gnc_ind)
                / gncnon_int ;

(all,i,non_inti:prowcheck<0) prowtot(i) = gprow_scale(i) ;

(all,i,non_inti:nrowcheck>0) nrowtot(i) = gnrow_scale(i) ;

(all,u,non_intu:prowcheck>0) pcoltot(u) = gpcol_scale(u) ;
(all,u,non_intu:nrowcheck<0) ncoltot(u) = gncol_scale(u) ;

display
prowtot;
nrowtot;
pcoltot;
ncoltot;
gprowtot;
gpcoltot;
gnrowtot;
gncoltot;
gpdiff;
gndiff;

```

```
gpcnon_int;  
gprnon_int;  
gncnon_int;  
gnrnon_int;  
gpc_ind;  
gpr_ind;  
gnc_ind;  
gnr_ind;  
prowcheck;  
nrowcheck;
```

```
!*****!
```

```
file (new) rasfile;
```

```
write rastable to file rasfile header "ras";  
write pcoltot to file rasfile header "pcto";  
write prowtot to file rasfile header "prto";  
write ncoltot to file rasfile header "ncto";  
write nrowtot to file rasfile header "nrto";  
write exports_ to file rasfile header "expt";  
write texports_ to file rasfile header "texp";  
write duty_ to file rasfile header "duty";
```

```
—
```

ROWRAS4 tablo code

```
!*****!  
! ROWRAS4 - PART 2 IN SALTER DISAGG -      !  
!     PERFORMS A RAS TO EQUATE             !  
!     TOTAL COSTS = TOTAL SALES            !  
!*****!
```

file splits;
file rasfile;

```
!*****!  
!           SETS                           !  
!*****!
```

SET

ind # sectors # MAXIMUM SIZE 40
READ ELEMENTS FROM FILE SPLITS HEADER "SD01";

SET

ind2 # sectors # MAXIMUM SIZE 40
READ ELEMENTS FROM FILE SPLITS HEADER "SI01";

SET

tind # sectors # MAXIMUM SIZE 40
READ ELEMENTS FROM FILE SPLITS HEADER "STD1";

SET

tind2 # sectors # MAXIMUM SIZE 40
READ ELEMENTS FROM FILE SPLITS HEADER "STI1";

!

SET

SOURCE # INDUSTRY TO SPLIT OUT # SIZE 1
READ ELEMENTS FROM FILE SPLITS HEADER "SD02" ;

SUBSET SOURCE IS SUBSET OF ind ;

SET

SOURCE_IMP # INDUSTRY TO SPLIT OUT # SIZE 1
READ ELEMENTS FROM FILE SPLITS HEADER "SI02" ;

SUBSET SOURCE_IMP IS SUBSET OF ind2 ;

SET

TSOURCE # INDUSTRY TO SPLIT OUT # SIZE 1

READ ELEMENTS FROM FILE SPLITS HEADER "STD2" ;

SUBSET TSOURCE IS SUBSET OF tind ;

SET

TSOURCE_IMP # INDUSTRY TO SPLIT OUT # SIZE 1

READ ELEMENTS FROM FILE SPLITS HEADER "STI2" ;

SUBSET TSOURCE_IMP IS SUBSET OF tind2 ;

!

SET

usage #columns of rastable# MAXIMUM SIZE 44

READ ELEMENTS FROM FILE SPLITS HEADER "SUS1" ;

SET

inputs #rows of rastable# MAXIMUM SIZE 164

READ ELEMENTS FROM FILE SPLITS HEADER "SIN1" ;

SET

labour # labour # MAXIMUM SIZE 1

READ ELEMENTS FROM FILE SPLITS HEADER "SP01" ;

SUBSET labour IS SUBSET OF inputs ;

SET

capital # capital # MAXIMUM SIZE 1

READ ELEMENTS FROM FILE SPLITS HEADER "SP02" ;

SUBSET capital IS SUBSET OF inputs ;

SET

land # land # MAXIMUM SIZE 1

READ ELEMENTS FROM FILE SPLITS HEADER "SP03" ;

SUBSET land IS SUBSET OF inputs ;

SET

indtax # indtax # MAXIMUM SIZE 1

READ ELEMENTS FROM FILE SPLITS HEADER "SP04" ;

SUBSET indtax IS SUBSET OF inputs ;

SET

inv # inv # MAXIMUM SIZE 1

READ ELEMENTS FROM FILE SPLITS HEADER "SC01" ;

SUBSET inv IS SUBSET OF usage ;

SET

con # con # MAXIMUM SIZE 1

READ ELEMENTS FROM FILE SPLITS HEADER "SC02" ;

SUBSET con IS SUBSET OF usage ;

SET

gov # gov # MAXIMUM SIZE 1

READ ELEMENTS FROM FILE SPLITS HEADER "SC03" ;

SUBSET gov IS SUBSET OF usage ;

SET

stocks # stocks # MAXIMUM SIZE 1

READ ELEMENTS FROM FILE SPLITS HEADER "SC04" ;

SUBSET stocks IS SUBSET OF usage ;

!

set primary (labour, capital, land, indtax);

set usage (ind, inv, con, gov, stocks);

set inputs (ind, ind2, tind, tind2, labour, capital, land, indtax);

!

subset ind is subset of usage;

subset ind is subset of inputs;

subset ind2 is subset of inputs;
subset tind is subset of inputs;
subset tind2 is subset of inputs;

!
subset primary is subset of inputs;
!

!
SUBSET SOURCE IS SUBSET OF usage ;
SUBSET SOURCE IS SUBSET OF inputs ;
SUBSET SOURCE_IMP IS SUBSET OF inputs ;
SUBSET TSOURCE IS SUBSET OF inputs ;
SUBSET TSOURCE_IMP IS SUBSET OF inputs ;
!

coefficient

(all,u,usage)(all,i,inputs) rastable(i,u);
(all,u,usage)(all,i,inputs) n_rastable(i,u);
(all,u,usage)(all,i,inputs) pr_rastable(i,u);
(all,u,usage)(all,i,inputs) nr_rastable(i,u);
(all,u,usage)(all,i,inputs) pc_rastable(i,u);
(all,u,usage)(all,i,inputs) nc_rastable(i,u);
(all,u,usage) pcoltot(u);
(all,u,usage) ncoltot(u);
(all,i,inputs) prowtot(i);
(all,i,inputs) nrowtot(i);

(all,i,ind2) duty_(i);

(all,i,ind) exports_(i);
(all,i,tind) texports_(i);

read rastable from file rasfile header "ras";
read pcoltot from file rasfile header "pcto";
read prowtot from file rasfile header "prto";
read ncoltot from file rasfile header "ncto";
read nrowtot from file rasfile header "nrto";
read exports_ from file rasfile header "expt";

```
read texports_ from file rasfile header "texp";
read duty_ from file rasfile header "duty";
```

! First step of RAS - scale to row totals !

coefficient

```
(all,u,usage) pcol_sum(u);
```

```
(all,u,usage) ncol_sum(u);
```

```
(all,i,inputs) prow_sum(i);
```

```
(all,i,inputs) nrow_sum(i);
```

formula

```
(all,i,inputs)
    prow_sum(i)=
    sum(u,usage: rastable(i,u) > 0,
        rastable(i,u));
```

```
(all,i,inputs)(all,u,usage: rastable(i,u) > 0 )
    pr_rastable(i,u)=rastable(i,u)*prowtot(i)
    /prow_sum(i);
```

```
(all,i,inputs)
    nrow_sum(i)=
    sum(u,usage: rastable(i,u) le 0,
        rastable(i,u));
```

```
(all,i,inputs)(all,u,usage: rastable(i,u) le 0 )
    nr_rastable(i,u)=rastable(i,u)*nrowtot(i)
    /nrow_sum(i);
```

! Second step of RAS - scale to column totals !

```
(all,u,usage)
    pcol_sum(u)=
    sum(i,inputs: rastable(i,u) > 0,
        pr_rastable(i,u));
```

```
(all,i,inputs)(all,u,usage: rastable(i,u) > 0 )
    pc_rastable(i,u)=pr_rastable(i,u)*pcoltot(u)
    /pcol_sum(u);
```

```
(all,u,usage)
    ncol_sum(u)=
    sum(i,inputs: rastable(i,u) le 0,
    nr_rastable(i,u));
```

```
(all,i,inputs)(all,u,usage: rastable(i,u) le 0 )
    nc_rastable(i,u)=nr_rastable(i,u)*ncoltot(u)
    /ncol_sum(u);
```

! Update data as consequence of RAS !

```
update (explicit) (all,i,inputs)
(all,u,usage:rastable(i,u)>0)
    rastable(i,u)=pc_rastable(i,u);
```

```
update (explicit) (all,i,inputs)
(all,u,usage:rastable(i,u) le 0)
    rastable(i,u)=nc_rastable(i,u);
```

variable y;x;

```
equation dummy y=min(1,sum(i,indtax,
    sum(u,stocks,rastable(i,u))),
    sum(i,ind,exports_(i)),
    sum(i,tind,texports_(i)),
    sum(i,ind2,duty_(i))
    )*x;
```

```
!*****!
```

—

ROWRAS5 tablo code

```
!*****!  
! ROWRAS5 - PART 3 (FINAL) IN SALTER DISAGG - !  
! EXTRACTS HEADER ARRAYS FROM RASTABLE FROM ROWRAS4 !  
! PERFORMS COMPARISON CALCULATIONS ON DATA !  
!*****!
```

file splits;
file rasfile;

```
!*****!  
! SETS !  
!*****!
```

SET
ind # sectors # MAXIMUM SIZE 40
READ ELEMENTS FROM FILE SPLITS HEADER "SD01";

SET
ind2 # sectors # MAXIMUM SIZE 40
READ ELEMENTS FROM FILE SPLITS HEADER "SI01";

SET
tind # sectors # MAXIMUM SIZE 40
READ ELEMENTS FROM FILE SPLITS HEADER "STD1";

SET
tind2 # sectors # MAXIMUM SIZE 40
READ ELEMENTS FROM FILE SPLITS HEADER "STI1";

SET
usage #columns of rastable# MAXIMUM SIZE 44
READ ELEMENTS FROM FILE SPLITS HEADER "SUS1" ;

SET
inputs #rows of rastable# MAXIMUM SIZE 164
READ ELEMENTS FROM FILE SPLITS HEADER "SIN1" ;

SET
labour # labour # MAXIMUM SIZE 1
READ ELEMENTS FROM FILE SPLITS HEADER "SP01" ;

SUBSET labour IS SUBSET OF inputs ;

SET
capital # capital # MAXIMUM SIZE 1
READ ELEMENTS FROM FILE SPLITS HEADER "SP02" ;

SUBSET capital IS SUBSET OF inputs ;

SET
land # land # MAXIMUM SIZE 1
READ ELEMENTS FROM FILE SPLITS HEADER "SP03" ;

SUBSET land IS SUBSET OF inputs ;

SET
indtax # indtax # MAXIMUM SIZE 1
READ ELEMENTS FROM FILE SPLITS HEADER "SP04" ;

SUBSET indtax IS SUBSET OF inputs ;

SET
inv # inv # MAXIMUM SIZE 1
READ ELEMENTS FROM FILE SPLITS HEADER "SC01" ;

SUBSET inv IS SUBSET OF usage ;

SET
con # con # MAXIMUM SIZE 1
READ ELEMENTS FROM FILE SPLITS HEADER "SC02" ;

SUBSET con IS SUBSET OF usage ;

SET
gov # gov # MAXIMUM SIZE 1
READ ELEMENTS FROM FILE SPLITS HEADER "SC03" ;

SUBSET gov IS SUBSET OF usage ;

SET

stocks # stocks # MAXIMUM SIZE 1

READ ELEMENTS FROM FILE SPLITS HEADER "SC04" ;

SUBSET stocks IS SUBSET OF usage ;

!

set primary (labour,capital,land,indtax);

set usage (ind,inv,con,gov,stocks);

set inputs (ind,ind2,tind,tind2,labour,capital,land,indtax);

!

subset ind is subset of usage;

subset ind is subset of inputs;

subset ind2 is subset of inputs;

subset tind is subset of inputs;

subset tind2 is subset of inputs;

!

subset primary is subset of inputs;

!

coefficient

(all,u,usage)(all,i,inputs) rastable(i,u);

(all,u,usage) pcoltot(u);

(all,u,usage) ncoltot(u);

(all,i,inputs) prowtot(i);

(all,i,inputs) nrowtot(i);

(all,u,usage) pcol_tot(u);

(all,u,usage) ncol_tot(u);

(all,i,inputs) prow_tot(i);

(all,i,inputs) nrow_tot(i);

```
(all,u,usage) pcol_dif(u);
(all,u,usage) ncol_dif(u);
(all,i,inputs) prow_dif(i);
(all,i,inputs) nrow_dif(i);
```

```
(all,i,ind) total_sales(i);
(all,u,ind) total_costs(u);
(all,i,ind) sales_costs(i);
```

coefficient

```
(all,j,ind) lab_(j);
(all,j,ind) cap_(j);
(all,j,ind) landc_(j);
(all,j,ind) indirect_(j);
```

```
(all,i,ind2)(all,j,ind) iint_(i,j);
(all,i,ind)(all,j,ind) dint_(i,j);
```

```
(all,i,ind2) iinv_(i);
(all,i,ind) dinv_(i);
```

```
(all,i,ind2) icon_(i);
(all,i,ind) dcon_(i);
```

```
(all,i,ind2) igov_(i);
(all,i,ind) dgov_(i);
```

```
(all,i,ind2) duty_(i);
```

```
(all,i,ind2) istocks_(i);
(all,i,ind) dstocks_(i);
```

```
(all,i,tind2)(all,j,ind) iint__t(i,j);
(all,i,tind)(all,j,ind) dint__t(i,j);
```

```
(all,i,tind2) iinv__t(i);
(all,i,tind) dinv__t(i);
```

```
(all,i,tind2) icon__t(i);
(all,i,tind) dcon__t(i);
```

```
(all,i,tind2) igov__t(i);
(all,i,tind) dgov__t(i);
```

```
(all,i,ind) exports_(i);
(all,i,tind) texports_(i);
```

```
(all,i,tind2) tistocks_(i);
(all,i,tind) tdstocks_(i);
```

```
read rastable from file rasfile header "ras";
read pcol_tot from file rasfile header "pcto";
read prow_tot from file rasfile header "prto";
read ncol_tot from file rasfile header "ncto";
read nrow_tot from file rasfile header "nrto";
read exports_ from file rasfile header "expt";
read texports_ from file rasfile header "texp";
read duty_ from file rasfile header "duty";
```

! Update data as consequence of RAS !

formula

```
(all,u,usage) pcoltot(u)=0;
(all,u,usage) ncoltot(u)=0;
(all,i,inputs) prowtot(i)=0;
(all,i,inputs) nrowtot(i)=0;
```

```
(all,u,usage)
pcoltot(u)=sum(i,inputs:rastable(i,u)>0,rastable(i,u));
```

```
(all,u,usage)
ncoltot(u)=sum(i,inputs:rastable(i,u) le 0,rastable(i,u));
```

```
(all,i,inputs)
prowtot(i)=sum(u,usage:rastable(i,u)>0,rastable(i,u));
```

```
(all,i,inputs)
nrowtot(i)=sum(u,usage:rastable(i,u) le 0,rastable(i,u));
```

```
(all,u,usage) pcol_dif(u) = pcol_tot(u) - pcoltot(u);
(all,u,usage) ncol_dif(u) = ncol_tot(u) - ncoltot(u);
(all,i,inputs) prow_dif(i) = prow_tot(i) - prowtot(i);
```

```
(all,i,inputs) nrow_dif(i) = nrow_tot(i) - nrowtot(i);
```

```
!*****!
```

```
(all,i,ind)(all,u,ind) dint_(i,u) = rastable(i,u);  
(all,i,ind) dinv_(i) = sum(u,inv,rastable(i,u));  
(all,i,ind) dcon_(i) = sum(u,con,rastable(i,u));  
(all,i,ind) dgov_(i) = sum(u,gov,rastable(i,u));  
(all,i,ind) dstocks_(i) = sum(u,stocks,rastable(i,u));
```

```
(all,i,ind2)(all,u,ind) iint_(i,u) = rastable(i,u);  
(all,i,ind2) iinv_(i) = sum(u,inv,rastable(i,u));  
(all,i,ind2) icon_(i) = sum(u,con,rastable(i,u));  
(all,i,ind2) igov_(i) = sum(u,gov,rastable(i,u));  
(all,i,ind2) istocks_(i) = sum(u,stocks,rastable(i,u));
```

```
(all,u,ind) lab_(u) = sum(i,labour,rastable(i,u));  
(all,u,ind) cap_(u) = sum(i,capital,rastable(i,u));  
(all,u,ind) landc_(u) = sum(i,land,rastable(i,u));  
(all,u,ind) indirect_(u) = sum(i,indtax,rastable(i,u));
```

```
(all,i,tind)(all,u,ind) dint__t(i,u)=rastable(i,u);  
(all,i,tind) dinv__t(i)=sum(u,inv,rastable(i,u));  
(all,i,tind) dcon__t(i)=sum(u,con,rastable(i,u));  
(all,i,tind) dgov__t(i)=sum(u,gov,rastable(i,u));  
(all,i,tind) tdstocks_(i) = sum(u,stocks,rastable(i,u));
```

```
(all,i,tind2)(all,u,ind) iint__t(i,u)=rastable(i,u);  
(all,i,tind2) iinv__t(i)=sum(u,inv,rastable(i,u));  
(all,i,tind2) icon__t(i)=sum(u,con,rastable(i,u));  
(all,i,tind2) igov__t(i)=sum(u,gov,rastable(i,u));  
(all,i,tind2) tistocks_(i) = sum(u,stocks,rastable(i,u));
```

```
(all,i,ind) total_sales(i) = prowtot(i) + nrowtot(i)  
                      + exports_(i);  
(all,u,ind) total_costs(u) = pcoltot(u) + ncoltot(u);  
(all,i,ind) sales_costs(i) = total_sales(i)  
                      - total_costs(i);
```

```
file (new) rowras;
```

```
write lab_ to file rowras header "AI13";
write cap_ to file rowras header "AI14";
write landc_ to file rowras header "AI15";
write indirect_ to file rowras header "AI12";
```

```
write dint_ to file rowras header "AI01";
write dinv_ to file rowras header "AI03";
write dcon_ to file rowras header "AI05";
write dgov_ to file rowras header "AI07";
write dstocks_ to file rowras header "AI09";
```

```
write iint_ to file rowras header "AI02";
write iinv_ to file rowras header "AI04";
write icon_ to file rowras header "AI06";
write igov_ to file rowras header "AI08";
write istocks_ to file rowras header "AI10";
```

```
write dint__t to file rowras header "AI16";
write dinv__t to file rowras header "AI20";
write dcon__t to file rowras header "AI18";
write dgov__t to file rowras header "AI22";
write tdstocks_ to file rowras header "AI25";
```

```
write iint__t to file rowras header "AI17";
write iinv__t to file rowras header "AI21";
write icon__t to file rowras header "AI19";
write igov__t to file rowras header "AI23";
write tistocks_ to file rowras header "AI26";
```

```
write exports_ to file rowras header "AI11";
write texports_ to file rowras header "AI24";
```

```
write duty_ to file rowras header "AI27";
```

```
!*****!
```

```
file (new) ras_file ;
```

```
write pcoltot to file ras_file header "pcto";
```

write prowtot to file ras_file header "prto";
write ncoltot to file ras_file header "ncto";
write nrowtot to file ras_file header "nrto";

write pcol_dif to file ras_file header "dipc";
write prow_dif to file ras_file header "dipr";
write ncol_dif to file ras_file header "dinc";
write nrow_dif to file ras_file header "dinr";

write total_sales to file ras_file header "tsal";
write total_costs to file ras_file header "tcos";
write sales_costs to file ras_file header "tdif";

—



APPENDIX E: DATA REQUIREMENTS FOR THE SINGLE REGION NAIVE SPLITS

As discussed in Appendix D, disaggregating the single region input-output databases requires external production and trade data. This appendix is a summary of this data and its sources, for both the naive splits and the RAS splits.

First the method of deriving the production share weights for each SALTER region is explained, followed by an outline of the method by which the trade share weights for each SALTER region are derived. Finally tables listing the data and shares used for both the production and trade splits are presented.

Calculating Production Share Weights

There are two major methods used in calculating the production shares used for the splits. The first main method is to use 1988 price and quantity data. The second is to subtract components from a single region database.

If production data in all industries for a particular split are unavailable, production shares from a representative region are used. The only occurrence of this is the Processed rice/Other food products split for the EC, which uses the shares obtained for Australia.

Method 1 for calculating production shares

For the first method, the production shares are calculated from the value of production in the relevant industries. The relevant industries are the SALTER classification industries that each aggregated single region input-output database industry requires disaggregating over. In several cases, such as the Non-food manufacturing data, the value of production could be obtained directly from the sources listed below. However, in most cases the value of production is calculated from separate price and quantity data obtained from these sources.

Method 2 for calculating production shares

The second method is used in the case where production data is available for all but one industry for a particular split. The value of production in the industry for which data is unavailable is calculated by subtracting the total production value for the remaining industries in the split from the value of production for the aggregated industry as shown in the single region database. A necessary requirement of this method is that production values for the remaining industries

in the split have to be calculated for the same year as the single region database. The cases where this occurs are all in agriculture and food products area, and are listed below.

- Wool data for USA is for 1985.
- Milk products and Processed rice data for Indonesia is for 1985.
- Paddy rice data for Malaysia is for 1983.
- Wool and Processed rice data for China is for 1987.
- Wheat data for Taiwan is for 1985.

Agriculture and Food Products Production Data

The agriculture and food products production data is mostly obtained from FAO (1986), FAO (1988) or FAO (1990) depending on the year for which data is required, generally 1988. The exceptions to the general requirement for 1988 data were listed above.

Additional sources for the agricultural production data are as follows:

- FAO (1991) is used to obtain the data necessary to calculate the import parity price for meat products for Canada, USA, Japan, Malaysia and the Philippines and import parity price for processed rice and fresh milk for the Philippines. The import parity price is the cif price of imports and its use in deriving domestic production shares assumes that the imported product is a perfect substitute for the domestic product. The import parity price is used as an estimate of the price of the domestically produced commodity where the price of the domestically produced commodity is unavailable.
- USDA (1991) is used to obtain data to calculate the import parity price for paddy rice for Canada, and to obtain data on the production price of paddy rice in the USA.
- UN (1989b) is used to obtain meat and dried milk and cream production quantity data for Canada, USA, Japan, Malaysia and the Philippines.
- ITILIA (1985) is used to obtain value of production data for paddy rice, wheat and other grains for Japan.
- UN (1989a) is used to obtain data on the value of total food products production for USA.
- FAO (1989) is used to obtain an import parity price for milk production for Indonesia, and to obtain data on the production price for wheat and other grains in USA.

-
- Council for Economic Planning and Development (1990) is used to obtain wheat production quantity data for Taiwan.

In most cases the quantity of production is obtained directly from the above sources. However, in the case of Processed rice, the quantity of production had to be calculated from data on a major input to production. The quantity of processed rice production is calculated by multiplying the data on the quantity of paddy rice available for processing by the 0.65 conversion factor, as outlined in FAO (1990).

The price data used to calculate the value of production is in most cases, obtained directly from the same sources as above. However, in several of the agricultural industries such as Processed rice, an import parity price is used.

Resources Production Data

The Oil, Coal and Gas production price data is obtained from IEA (1989) and the quantity data from UN (1988b), with the exceptions listed below.

- For Australia, the Oil, Coal and Gas data is obtained from ABS (1990b).
- For Malaysia, Other Minerals production value is from UN (1989a).
- For Taiwan, Oil and Gas quantity data is obtained from Council for Economic Planning and Development (1990).

Non-food Manufacturing Production Data

The manufacturing and industrial products production data is available in value terms directly, and is ISIC data from UN (1989b).

Trade Share Weights

The export and import shares are calculated from the value of exports and imports available in Hambley (1993), with the exceptions listed below.

- Oil/Coal/Gas trade splits for Australia are calculated from data obtained from ABS (1990b).
- Processed rice/Other food products trade splits for Australia are calculated from data obtained from IAC (1989).
- Primary non-ferrous metals/Fabricated metal products trade splits for EC are calculated from data obtained from UN (1988c).

-
- Agricultural services trade splits for Taiwan make use of the information contained in the single region database that shows there is no exports or imports of Agricultural services.

Initial Data and Calculated Share Weights

The raw data used to calculate the production and trade shares is given in Table E1. The production and trade shares used in the disaggregations are listed in Table E2.

Table E1: Production and trade data to support disaggregation

<i>Region</i>	<i>Industry</i>	<i>Production \$US m</i>	<i>Imports \$US m</i>	<i>Exports \$US m</i>
Australia	Coal	305.10	0.00	2.70
	Oil	2 396.90	749.20	757.50
	Gas	1 284.60	4.70	99.20
	Processed rice	125.00	1.00	79.00
	Other food products	6 948.00	518.00	1 377.00
New Zealand	Oil	165.00	292.35	37.31
	Gas	488.00	0.06	0.17
	Processed rice ^a	share = 0	5.99	0.00
	Other food products ^b	share = 1	263.10	285.44
Canada	Paddy Rice ^a	share = 0	13.18	2.04
	Other grains ^b	share = 1	76.43	354.86
	Processed rice	23.98	46.25	0.16
	Other food products	25 163.71	2 253.78	1 797.37
USA	Paddy Rice	1 092.31	7.75	73.61
	Wheat	6 742.50	63.97	4 884.48
	Other grains	13 863.45	153.98	6 085.23
	Wool	55.69	293.27	6.71
	Other livestock products	34 267.61	1 309.68	2 811.28
	Oil	44 667.00	25 844.06	77.20
	Gas	47 817.00	2 573.19	411.81
	Processed rice	1 463.45	50.35	728.19
	Other food products	188 449.10	6 569.49	7 388.13
	Petroleum & coal products	131 400.00	12 354.67	3 646.33
	Chemicals plastic rubber	96 500.00	27 725.59	36 082.73

a Assumes that none of the production should be attributed to this industry

b Assumes that all of the production should be attributed to this industry

Table E1: Production and trade data to support aggregation (contd)

<i>Region</i>	<i>Industry</i>	<i>Production \$US m</i>	<i>Imports \$US m</i>	<i>Exports \$US m</i>
Japan	Paddy Rice	16 782.00	0.00	0.02
	Wheat	710.00	1 033.67	0.00
	Other grains	383.00	2 809.84	0.01
	Wool ^a	share = 0	1 177.48	share = 0
	Other livestock products ^b	share = 1	1 909.09	96.61
	Oil	64.00	18 451.22	0.00
	Gas	239.00	7 128.01	1.48
	Processed rice	2 162.54	4.24	0.15
	Other food products	162 023.30	5 724.43	1 164.32
	Petroleum & coal products	51 696.00	7 850.21	419.14
	Chemicals plastic rubber	255 739.37	16 023.48	17 900.70
Korea	Oil	0.00	3 687.74	0.09
	Gas	0.00	500.64	0.24
EC	Processed rice ^c			
	Other food products ^c			
	Oil	14 603.00	41 450.23	7 652.63
	Gas	15 082.00	9 036.02	2 918.22
	Primary non-ferrous metals	10 605.40	27 713.76	20 662.92
	Fabricated metal products	44 328.10	34 785.33	33 738.53
Indonesia	Coal	5.66	49.83	41.60
	Oil	7 189.00	468.91	4 234.48
	Gas ^d	3 805.00	0.12	2 492.62
	Gas ^e	165.70	0.12	f
	Other minerals	341.90	162.81	670.72
	Processed rice	5 505.60	8.65	0.00
	Milk products	19.47	74.67	4.77
	Other food products	2 093.19	402.27	751.22
	Textiles	1 792.73	383.78	698.19
	Wearing apparel	255.68	3.32	787.52
	Leather & products	85.42	21.40	149.72
	Petroleum & coal products	7 325.30	440.08	f

a Assumes that none of the production should be attributed to this industry

b Assumes that all of the production should be attributed to this industry

c Australian shares are used for production and trade shares

d Gas used in the Oil/Gas split

e Gas used in the Petroleum & coal products/Gas split

f The production shares are also used as the export shares

Table E1: Production and trade data to support disaggregation (contd)

<i>Region</i>	<i>Industry</i>	<i>Production \$US m</i>	<i>Imports \$US m</i>	<i>Exports \$US m</i>
Malaysia				
	Paddy Rice	505.40	0.00	0.05
	Wheat ^a	share = 0	122.35	0.30
	Other grains	1.84	140.61	0.50
	Non-grain crops	672.69	481.55	2 465.33
	Coal	1.00	32.48	0.56
	Oil	2 740.00	156.02	2 342.38
	Gas ^g	1 499.00	32.04	730.28
	Gas ^e	63.72	32.04	f
	Other minerals	446.77	271.38	156.49
	Processed rice	315.09	81.00	0.77
	Meat products	664.99	75.06	9.46
	Milk products	355.93	170.44	21.81
	Other food products	4 517.06	632.85	2 610.32
	Wearing apparel	551.02	21.12	f
	Leather & products	19.47	30.54	f
	Petroleum & coal products	1 115.28	663.78	f
	Primary ferrous metals	873.30	906.54	f
	Primary non-ferrous metals	318.85	363.32	f
	Fab. metal products	718.27	663.76	f
	Other machinery	617.08	7 105.77	5 998.84
	Other manufacturing	144.34	180.66	215.26
Philippines				
	Oil	34.00	961.99	0.00
	Gas ^a	share = 0	28.12	21.55
	Other minerals	788.15	154.27	389.07
	Processed rice	275.47	47.59	0.00
	Other food products	2 043.65	334.13	837.10
Singapore				
	Coal ^a	share = 0	4.06	2.64
	Oil ^a	share = 0	4 160.52	183.62
	Gas ^a	share = 0	7.73	66.63
	Other minerals ^b	share = 1	202.99	119.02
	Processed rice ^a	share = 0	73.90	0.00
	Other food products ^b	share = 1	1 134.81	981.94

a Assumes that none of the production should be attributed to this industry

b Assumes that all of the production should be attributed to this industry

e Gas used in the Petroleum & coal products/Gas split

f The production shares are also used as the export shares

g Gas used in the Coal/Oil/Gas/Other minerals split

Table E1: Production and trade data to support disaggregation (contd)

<i>Region</i>	<i>Industry</i>	<i>Production</i> \$US m	<i>Imports</i> \$US m	<i>Exports</i> \$US m
Thailand				
	Wheat ^a	share = 0	39.74	0.03
	Other grains ^b	share = 1	3.34	156.85
	Wool ^a	share = 0	13.46	0.00
	Other livestock products ^b	share = 1	89.36	37.42
	Oil	119.00	852.17	0.00
	Gas	563.00	22.42	82.78
China				
	Wool	422.60	619.06	1.98
	Other livestock products	34 263.00	126.82	1 516.30
	Processed rice	11 222.66	0.32	37.26
	Other food products	16 004.60	477.79	1 774.33
Taiwan				
	Wheat	424.70	159.27	0.00
	Other grains ^a	share = 0	590.68	3.84
	Non-grain crops	2 057.36	1 402.73	430.12
	Oil	13.07	287.01	23.43
	Gas	144.03	21.06	5.62

a Assumes that none of the production should be attributed to this industry

b Assumes that all of the production should be attributed to this industry

Table E2: Production and trade shares to support disaggregation

<i>Region</i>	<i>Industry</i>	<i>Production</i>	<i>Imports</i>	<i>Exports</i>
Australia				
	Coal	0.0765	0.0000	0.0031
	Oil	0.6012	0.9938	0.8814
	Gas	0.3222	0.0062	0.1154
		1.0000	1.0000	1.0000
	Processed rice	0.0177	0.0019	0.0543
	Other food products	0.9823	0.9981	0.9457
		1.0000	1.0000	1.0000

Table E2: Production and trade shares to support disaggregation (contd)

<i>Region</i>	<i>Industry</i>	<i>Production</i>	<i>Imports</i>	<i>Exports</i>
New Zealand	Oil	0.2527	0.9998	0.9954
	Gas	0.7473	0.0002	0.0046
		1.0000	1.0000	1.0000
	Processed rice ^a	share = 0	0.0223	share = 0
	Other food products ^b	share = 1	0.9777	share = 1
		1.0000	1.0000	1.0000
Canada	Paddy Rice ^a	share = 0	0.1471	share = 0
	Other grains ^b	share = 1	0.8529	share = 1
		1.0000	1.0000	1.0000
	Processed rice	0.0010	0.0201	0.0001
	Other food products	0.9990	0.9799	0.9999
		1.0000	1.0000	1.0000
USA				
	Paddy Rice	0.0503	0.0343	0.0067
	Wheat	0.3107	0.2834	0.4423
	Other grains	0.6389	0.6822	0.5510
		1.0000	1.0000	1.0000
	Wool	0.0016	0.1830	0.0024
	Other livestock products	0.9984	0.8170	0.9976
		1.0000	1.0000	1.0000
	Oil	0.4830	0.9094	0.1579
	Gas	0.5170	0.0906	0.8421
		1.0000	1.0000	1.0000
	Processed rice	0.0077	0.0076	0.0897
	Other food products	0.9923	0.9924	0.9103
		1.0000	1.0000	1.0000
	Petroleum & coal products	0.5766	0.3082	0.0918
	Chemicals plastic rubber	0.4234	0.6918	0.9082
		1.0000	1.0000	1.0000

a Assumes that none of the production should be attributed to this industry

b Assumes that all of the production should be attributed to this industry

Table E2: Production and trade shares to support disaggregation (contd)

<i>Region</i>	<i>Industry</i>	<i>Production</i>	<i>Imports</i>	<i>Exports</i>
Japan	Paddy Rice	0.9400	0.0000	0.7917
	Wheat	0.0400	0.2689	0.0000
	Other grains	0.0200	0.7311	0.2083
		1.0000	1.0000	1.0000
	Wool ^a	share = 0	0.3815	share = 0
	Other livestock products ^b	share = 1	0.6185	share = 1
		1.0000	1.0000	1.0000
	Oil	0.2112	0.7213	0.0000
	Gas	0.7888	0.2787	1.0000
		1.0000	1.0000	1.0000
	Processed rice	0.0132	0.0007	0.0001
	Other food products	0.9868	0.9993	0.9999
		1.0000	1.0000	1.0000
	Petroleum & coal products	0.1682	0.3288	0.0229
	Chemicals plastic rubber	0.8318	0.6712	0.9771
		1.0000	1.0000	1.0000
Korea	Oil	no production	0.8805	0.2640
	Gas	no production	0.1195	0.7360
			1.0000	1.0000
EC	Processed rice ^c	0.0177	0.0019	0.0543
	Other food products ^c	0.9823	0.9981	0.9457
		1.0000	1.0000	1.0000
	Oil	0.4919	0.8210	0.7239
	Gas	0.5081	0.1790	0.2761
		1.0000	1.0000	1.0000
	Primary non-ferrous metals	0.1931	0.4434	0.3798
	Fabricated metal products	0.8069	0.5566	0.6202
		1.0000	1.0000	1.0000

a Assumes that none of the production should be attributed to this industry

b Assumes that all of the production should be attributed to this industry

c Australian shares are used for production and trade shares

Table E2: Production and trade shares to support disaggregation (contd)

<i>Region</i>	<i>Industry</i>	<i>Production</i>	<i>Imports</i>	<i>Exports</i>
Indonesia	Coal	0.0163	0.2343	0.0584
	Other minerals	0.9837	0.7657	0.9416
		1.0000	1.0000	1.0000
	Oil	0.6539	0.9997	0.6295
	Gas	0.3461	0.0003	0.3705
		1.0000	1.0000	1.0000
	Processed rice	0.7227	0.0178	0.0000
	Milk products	0.0026	0.1538	0.0063
	Other food products	0.2748	0.8284	0.9937
		1.0000	1.0000	1.0000
	Textiles	0.8401	0.9395	0.4269
	Wearing apparel	0.1198	0.0081	0.4815
	Leather & products	0.0400	0.0524	0.0915
		1.0000	1.0000	1.0000
	Petroleum & coal prod. ^f	0.9779	0.9997	sh. = 0.9779
	Gas ^f	0.0221	0.0003	sh. = 0.0221
		1.0000	1.0000	1.0000
Malaysia	Paddy Rice	0.4283	0.0000	0.0000
	Wheat ^a	share = 0	0.1643	share = 0
	Other grains	0.0016	0.1889	0.0002
	Non-grain crops	0.5701	0.6468	0.9998
		1.0000	1.0000	1.0000
	Coal	0.0002	0.0660	0.0002
	Oil	0.5846	0.3172	0.7253
	Gas	0.3198	0.0651	0.2261
	Other minerals	0.0953	0.5517	0.0485
		1.0000	1.0000	1.0000
	Meat products	0.6514	0.3057	0.3025
	Milk products	0.3486	0.6943	0.6975
		1.0000	1.0000	1.0000

^a Assumes that none of the production should be attributed to this industry

^b Assumes that all of the production should be attributed to this industry

^f The production shares are also used as the export shares

Table E2: Production and trade shares to support disaggregation (contd)

<i>Region</i>	<i>Industry</i>	<i>Production</i>	<i>Imports</i>	<i>Exports</i>
Malaysia (contd)				
	Processed rice	0.0652	0.1135	0.0003
	Other food products	0.9348	0.8865	0.9997
		1.0000	1.0000	1.0000
	Wearing apparel ^f	0.9659	0.4088	sh. = 0.9659
	Leather & products ^f	0.0341	0.5912	sh. = 0.0341
		1.0000	1.0000	1.0000
	Petroleum & coal prod. ^f	0.9460	0.9539	sh. = 0.9460
	Gas ^f	0.0540	0.0461	sh. = 0.0540
		1.0000	1.0000	1.0000
	Primary ferrous metals ^f	0.4571	0.4688	sh. = 0.4571
	Primary non-ferrous metals ^f	0.1669	0.1879	sh. = 0.1669
	Fab. metal products ^f	0.3760	0.3433	sh. = 0.3760
		1.0000	1.0000	1.0000
	Other machinery	0.8104	0.9752	0.9654
	Other manufacturing	0.1896	0.0248	0.0346
		1.0000	1.0000	1.0000
Philippines				
	Oil	0.0414	0.8406	0.0000
	Gas ^a	share = 0	0.0246	share = 0
	Other minerals	0.9586	0.1348	share = 1
		1.0000	1.0000	1.0000
	Processed rice	0.1188	0.1247	0.0000
	Other food products	0.8812	0.8753	1.0000
		1.0000	1.0000	1.0000
Singapore				
	Coal ^a	share = 0	0.0009	share = 0
	Oil ^a	share = 0	0.9509	share = 0
	Gas ^a	share = 0	0.0018	share = 0
	Other minerals ^b	share = 1	0.0464	share = 1
		1.0000	1.0000	1.0000
	Processed rice ^a	share = 0	0.0611	share = 0
	Other food products ^b	share = 1	0.9389	share = 1
		1.0000	1.0000	1.0000

^a Assumes that none of the production should be attributed to this industry

^b Assumes that all of the production should be attributed to this industry

^f The production shares are also used as the export shares

Table E2: Production and trade shares to support disaggregation (contd)

<i>Region</i>	<i>Industry</i>	<i>Production</i>	<i>Imports</i>	<i>Exports</i>
Thailand	Wheat ^a	share = 0	0.9226	share = 0
	Other grains ^b	share = 1	0.0774	share = 1
		1.0000	1.0000	1.0000
	Wool ^a	share = 0	0.1309	share = 0
	Other livestock products ^b	share = 1	0.8691	share = 1
		1.0000	1.0000	1.0000
	Oil	0.1745	0.9744	0.0000
	Gas	0.8255	0.0256	1.0000
		1.0000	1.0000	1.0000
China	Wool	0.0122	0.8300	0.0013
	Other livestock products	0.9878	0.1700	0.9987
		1.0000	1.0000	1.0000
	Processed rice	0.4122	0.0007	0.0206
	Other food products	0.5878	0.9993	0.9794
		1.0000	1.0000	1.0000
Taiwan	Wheat	0.1711	0.0740	0.0000
	Other grains ^a	share = 0	0.2744	share = 0
	Non-grain crops	0.8289	0.6516	share = 1
		1.0000	1.0000	1.0000
	Oil	0.0832	0.9317	0.8066
	Gas	0.9168	0.0683	0.1934
		1.0000	1.0000	1.0000

a Assumes that none of the production should be attributed to this industry

b Assumes that all of the production should be attributed to this industry

APPENDIX F : CALCULATING SHOCKS TO THE RELATIVE OIL IMPORT PRICE INDEX

This appendix outlines the methodology used for calculating the shocks to the relative oil import price index that are used in the FIT single region updating procedure. First we outline the general method by which the shocks to the 1988 Relative Price Index (RPI) for oil for each SALTER region are derived. Then we outline the problems encountered in calculating the RPI for oil, the methodology used for addressing these problems and the exceptions to this standard methodology.

The RPI shock is determined using the standard method for calculating shocks to percentage change variables. The shock equals the target value minus the current value, all of which is divided by the current value and then expressed as a percentage. The current value is the oil import price index for the base year (the reference year for the original input-output table) divided by the gross national product price deflator for that year. The target value is the oil import price index for the year 1988 divided by the gross national product price deflator for 1988.

Following algebraic manipulation this method can be simplified to:

$$\text{shock} = -100 \times (1 - M_{1988} \times P_{\text{base year}} / M_{\text{base yr}} \times P_{1988})$$

where

M_{1988} is the oil import price index for 1988

P_{1988} is the GNP price deflator for 1988

This method can be applied directly for some of the Salter regions using GNP deflator data from IMF (1991b) and oil import price index data from IEA (1991). The respective base years are detailed in Hambley (1993) and Ryan (1992). For Australia, the base year is 1986-87, for New Zealand 1986-87, for Canada 1986, for USA 1985, for Japan 1985, for Korea 1985, and for all European Community countries 1980. The calculation of an overall shock for the EC from the oil import weighted average of the RPIs for the individual EC countries is shown in Table F1. The oil import data is taken from UN (1984) and UN (1983a). The calculation of the shocks for other regions in this group is shown in Table F3.

Oil import price index data is unavailable from the above sources for Indonesia, Malaysia, Philippines, Singapore, Thailand, China and Taiwan. The Hong Kong database is a synthetic database constructed directly for 1988(see Tormey 1993)

and thus does not require an oil price index shock. The Oil import price index data can be calculated for Malaysia, Singapore and Taiwan from world oil price data obtained from ABARE (1991) using the following method.

Financial year nominal price data in US\$/barrel are averaged to obtain calendar year data for the base year and for the target year, which is 1988. This is shown in Table F2. The base year is set equal to 100 and a 1988 index value calculated as a percentage price change from the base year:

$$\text{Index value 1988} = \text{1988 calendar year price} \times 100 / \text{base calendar year price}$$

The RPI is the oil import price index deflated by a GNP price deflator. The US GNP price deflator for the base year and 1988 is used in the calculation of the RPI. For Malaysia the base year is 1983, for Singapore 1985 and for Taiwan 1986. The shock to the RPI is then calculated using the standard method outlined above, and is shown in Table F3.

In the absence of a better alternative, the RPI shocks for the remaining regions are taken to be the same as those for a 'representative' region for which data is available. Korea's RPI shock is taken to be the same as Japan's. The RPI shocks for Indonesia, Philippines, Thailand and China are taken to be the same as for Singapore.

Table F1: Calculation of the relative oil price index shock for the EC

<i>Country</i>	<i>Imports of oil (\$ US b)</i>	<i>Import price index base year 1988</i>		<i>GNP price deflator base year 1988</i>		<i>RPI shock</i>
UK	9.9655	62.38	38.97	71.7	116.1	- 61.42
Germany	24.2957	75.08	32.59	85.2	107.1	- 65.47
Italy	20.1719	52.16	37.06	51.3	121.9	- 70.10
Belgium	6.5973	53.61	33.45	75.0	108.0	- 56.67
Netherlands	4.7257	71.07	31.41	84.5	101.9	- 63.35
Denmark	1.3634	63.08	33.26	69.3	116.2	- 68.55
Ireland	0.4571	57.97	38.36	59.7	112.4	- 64.85
Greece	2.2965	35.10	53.30	39.6	154.7	- 61.13
Spain	11.2466	50.08	36.38	58.0	124.0	- 66.02
Portugal	1.9270	35.83	45.38	37.2 ^a	119.8	- 60.67
Import share weighted total						- 65.18

a GNP price deflator for Portugal is for 1986

Source: See text

Table F2: Oil price index calculations for Asian regions

	<i>Region</i> <i>MALAYSIA</i> <i>(base year 1983)</i>	<i>SINGAPORE</i> <i>(base year 1985)</i>	<i>TAIWAN</i> <i>(base year 1986)</i>	<i>All regions</i> <i>1988</i> <i>calender year</i>
Financial years	1982-83 1983-84	1984-85 1985-86	1985-86 1986-87	1987-88 1988-89
US\$/barrel (nominal)	31.87 28.65	28.23 22.27	22.27 15.07	16.29 14.47
Average US\$/barrel for calender year	30.26	25.25	18.67	15.38

Source: See text

Table F3: Relative oil price index shock by SALTER region

<i>Region</i>	<i>Import price index</i> <i>base year 1988</i>		<i>GNP price deflator</i> <i>base year 1988</i>		<i>RPI.</i> <i>shock</i>
Australia	60.54	50.56	111.00	126.00	- 26.43
New Zealand	56.10	41.58	123.95	142.80	- 35.67
Canada	58.41	50.11	102.40	112.50	- 21.91
USA	100.00	53.51	100.00	109.40	- 51.09
Japan	100.00	29.74	100.00	102.10	- 70.87
Korea					- 70.87
EC					- 65.18
Indonesia					- 49.89
Malaysia	100.00	50.83	100.00	143.31	- 64.53
Philippines					- 49.89
Singapore	100.00	60.91	100.00	121.56	- 49.89
Thailand					- 49.89
China					-49.89
Hong Kong					0.00
Taiwan	100.00	82.38	100.00	115.15	- 28.46
ROW					0.00

Source: See text

APPENDIX G: OUTLINING THE PROCEDURE USED TO INCLUDE THE FISCAL DATA

This appendix outlines the methodology used for supplementing the fiscal data in the single region updated databases once they have been updated. The fiscal data referred to in this appendix is required in its own right in the final multi-country database, and is distinct from the macroeconomic data required to support the updating procedure itself. Nevertheless, sources for both sets of data are given in Appendix H.

Three items of fiscal data are entered to supplement the fiscal information in the single region databases once they have been updated.

- Income tax to gross domestic product ratio
- Capital depreciation
- Consolidated general government surplus

The TABLO program S3FISCAL uses these three items of fiscal data to calculate the level of income tax, transfer payments and household savings for incorporation in the single region updated databases. A complete description of the entire computing process to form the Salter database, and an explanation of how this section fits into that process, can be found in Appendix L.

More explicitly, S3FISCAL reads the single region updated databases and separate header array files for each region that contain three headers covering the three items of data listed above. S3FISCAL then creates new single region databases that contain the pre-existing headers as well as the fiscal information, ready for compilation into the multi-region Salter database. The end result of S3FISCAL is that five new headers are included in the single region databases. These five headers are:

- the value of income tax revenue
- the value of transfer payments from government to households
- consolidated general government surplus
- the value of capital depreciation
- the value of saving by households

S3FISCAL calculates the value of income tax using the income tax to gross domestic product ratio, and calculates the value of transfer payments and savings as residuals.

Gross domestic product (GDP) is calculated from the input-output table, using an expenditures approach. Thus GDP is the sum of all final demand categories for domestic production, (household consumption, investment, government spending and exports) all at purchaser prices, minus imported intermediates at basic values, plus total import duty revenue. The program calculates income tax revenue by multiplying the income tax to GDP ratio by this value of GDP.

The consolidated general government surplus data is used to calculate the value of transfer payments from government to households. The value of transfer payments from government to households is the residual that balances total government outlays and total government spending. Total government spending is calculated from the input-output table as the sum of government spending on imported and domestically produced commodities, all at purchasers' prices. Total government outlays is calculated as total government revenue minus the consolidated general government surplus. Total government revenue is the sum of income tax and government revenue from commodity taxes. Government revenue from commodity taxes is calculated from the input-output table as the sum of government revenue from export taxes, import duties, commodity taxes on all final demand categories and intermediate usage, from both imported and domestic commodities, as well as revenue from production taxes.

The depreciation data is used to calculate net domestic product NDP, which is GDP minus capital depreciation. Household savings is then the residual that balances net investment and net exports. Thus household savings is calculated as NDP minus total household consumption, minus total government revenue, plus government transfer payments to households. Total household consumption is household final demand for commodities from both imported and domestic sources, valued at purchasers' prices. Note that due to the method of calculating transfer payments, total government revenue minus government transfer payments to households, equates to the value of total government spending plus the consolidated general government surplus.

APPENDIX H: FISCAL AND MICROECONOMIC DATA COLLECTED

Several items of macroeconomic data are necessary as control targets for the single region database updating process. For an explanation of the single region database updating process, refer to James and McDougall (1993) and Calder, McDougall and Strzelecki (1993). In addition to these control targets, three items of fiscal data are necessary to carry out the procedure for supplementing the fiscal information in the single region databases once they have been updated. This procedure was outlined in Appendix G. The purpose of this appendix is to summarise this data and its sources.

Macroeconomic control target data for the single region update procedure

Five items of data are necessary as inputs to the final stage processing procedure, which occurs prior to updating the single region databases. A complete description of the entire computing process to form the Salter database, and an explanation of where that stage fits into the process, can be found in Appendix L.

For each region, the macro control target data comprises:

- a GDP target
- an aggregate consumption target
- an aggregate government target
- an aggregate investment target
- a shock to the relative oil price index.

The GDP target data for 1988 is used as input into the SCALE program (Calder *et al* 1993) and the remaining macro data for 1988 are used as input into the FIT program (James and McDougall 1993). The GDP data is from UN (1991b) or World Bank (1990), except for Taiwan's which is from Council for Economic Planning and Development (1990). Where necessary the data has been converted from local currency to \$US million using 1988 exchange rates from IMF (1990, r.f. series).

The aggregate consumption target is consumption by households, and thus does not include consumption by government. The aggregate investment data is gross fixed capital formation by households and government. The private

consumption, government consumption and investment data are from UN (1990b), except for Taiwan, which is from Europa Publications Limited (1991). Again the data have been converted to \$US million using 1988 exchange rates from IMF (1990, r.f. series).

Both sets of data are listed in Table H1. Note that because the GDP data and the aggregate expenditure data may be from different sources they are not necessarily mutually consistent. The data for the shock to the relative oil price index was listed in Appendix F.

Table H1: Macroeconomic control target data for the single region update procedure, 1988 US\$ million

<i>Region</i>	<i>GDP</i>	<i>Aggregate consumption</i>	<i>Aggregate government</i>	<i>Aggregate investment</i>
Australia	263 871.52	150 655	44 335	68 123
New Zealand	41 855.43	26 056	7 143	7 264
Canada	484 618.51	280 715	91 115	106 755
USA	4 817 770.00	3 201 960	883 699	823 189
Japan	2 848 895.83	1 633 773	267 522	869 302
Korea	171 311.61	88 996	17 449	49 335
EC	4 753 825.29	2 840 728	874 277	950 033
Indonesia	82 726.52	48 049	7 567	20 114
Malaysia	34 674.66	17 107	4 963	8 371
Philippines	39 142.31	28 598	3 464	5 993
Singapore	23 874.88	11 499	2 652	8 556
Thailand	57 947.97	35 533	6 263	14 936
China	375 863.09	186 937	27 216	90 325
Hong Kong	55 594.39	32 754	3 843	14 351
Taiwan	116 661.44	58 586	17 664	24 172

Source: See text

Fiscal data for completing the single region updated databases

Three items of fiscal data need to be incorporated into each single region database once it is updated:

- income tax to GDP ratio
- capital depreciation
- consolidated general government surplus.

Table H2 provides total income tax as a percentage of GDP. Total income tax covers labour and non-labour sources, and includes capital gains tax and social security contributions. Total income tax data are adapted from IMF (1991a) and

converted to \$US million using 1988 exchange rates from IMF (1990, r.f. series). The GDP figures used for the denominator of the ratio are from Table H1.

Table H2 also provides 1988 depreciation data sourced from UN (1991b) and converted to \$US million using 1988 exchange rates from IMF (1990, r.f. series), except as follows. The 1988 depreciation data for Portugal used in calculating the EC total, and the depreciation data for Malaysia are estimates. These estimates assume that the ratio of depreciation to GDP is equal to the average ratio of depreciation to GDP in the remaining countries in the ASEAN or EC region, as appropriate. Indonesian depreciation data for 1988 is calculated by maintaining the same proportion to GDP as occurs in the 1987 Indonesian data.

ASEAN and EC depreciation data are calculated as the sum of depreciation data for each country in the relevant region. For Hong Kong, depreciation is calculated from a GDP weighted average of the depreciation to GDP ratios for China and Taiwan. Depreciation data for Taiwan is from Europa Publications Limited (1991).

Table H2: Fiscal data for completing the single region updated databases

<i>Region</i>	<i>Income tax to GDP ratio</i>	<i>Capital depreciation 1988 US\$ m</i>	<i>Consolidated general government surplus 1988 US\$ m</i>
Australia	0.2899	39 859	7 610
New Zealand	0.3814	3 355	- 882
Canada	0.3531	55 572	- 9 720
USA	0.2740	589 432	17 650
Japan	0.2136	406 555	- 11 323
Korea	0.1593	17 210	6 449
EC	0.2467	559 533	26 609
Indonesia	0.1574	3 776	1 655
Malaysia	0.1751	3 255	752
Philippines	0.1138	3 720	- 296
Singapore	0.1523	3 691	3 538
Thailand	0.1603	4 649	2 275
China	0.1526	35 921	14 905
Hong Kong	0.1109	5 168	3 922
Taiwan	0.1562	10 539	7 956

Source: See text

Finally, Table H2 provides 1988 consolidated general government surplus (CGGS) data generally sourced from the IMF (1991a) and converted to \$US million using 1988 exchange rates from IMF (1990, r.f. series).

Consolidated general government includes all levels of government, with the surplus being net of capital expenditure. This is because all government expenditure in the database is recurrent expenditure, not capital expenditure. A negative figure can be seen as a consolidated general government deficit.

The CGGS net of capital expenditure is derived for each SALTER region, using the following method. Consolidated general government income is taken as total revenue plus grants. Consolidated general government outlays is taken as total recurrent expenditure plus lending, minus repayments.

CGGS =

[total revenue + grants] - [total recurrent expenditure + lending - repayments]

IMF (1991a) does not provide 1988 values for CGGS for five countries, Denmark, Ireland, Greece, Spain and New Zealand. To combat this the following update procedure is used. The ratio of gross CGGS to GDP, and the ratio of capital expenditure to GDP, are assumed to be constant between the base year and 1988. Using this assumption, 1988 values are determined by multiplying the CGGS data for the base year by the ratio of GDP in 1988 to GDP in the base year.

$CGGS_{1988} = CGGS_{base\ year} * (GDP_{1988} / GDP_{base\ year})$

This method was used to update the Danish data from 1984, the Irish data from 1987, the Greek data from 1982, the Spanish data from 1987 and the New Zealand data from 1981.

IMF (1991a) provides only Central and Other government data for four countries, rather than consolidated general government data. The four countries are Germany, Italy, Singapore and the Philippines. For these countries, central government data on (Total expenditure plus lending minus repayments) is subtracted from (Total revenue plus grants) to obtain a central government surplus figure. This is added to the data for Other government surplus to estimate a gross CGGS figure. Similarly, capital expenditure data for central government and for Other government are added to obtain the capital expenditure data necessary to determine CGGS net of capital expenditure.

The consolidated general government capital expenditure data for Taiwan needed to be estimated using the average capital expenditure to GDP ratio for the Salter regions Indonesia, Malaysia, Philippines, Singapore and Thailand. Consolidated general government surplus data for Hong Kong were obtained in their entirety from Roberts (1991). Consolidated general government surplus data for China were obtained from State Statistical Bureau of the Peoples' Republic of China (1990). All the necessary fiscal data for the Rest of the World is documented in Tormey (1993).

APPENDIX I: DATA REQUIRED FOR THE MULTI-REGION SALTER DATABASE

Tables I1 and I2 summarise the header arrays containing the data and parameters in the multi-region Salter database.

Table I1: Data for the Salter Multi-Region Database

<i>Header</i>	<i>Dimension</i>	<i>Description</i>
DI01	i j s	Domestic intermediate usage
DI02	i j v s	Imported intermediate usage
DI03	i s	Domestic investment usage
DI04	i v s	Imported investment usage
DI05	i s	Domestic private consumption usage
DI06	i v s	Imported private consumption usage
DI07	i s	Domestic government consumption usage
DI08	i v s	Imported government consumption usage
DI10	i s	Exports of margins
DI11	i s v	Exports of non-margins
DI12	i s	Non-commodity indirect taxes net of subsidies
DI13	j s	Payments to labour
DI14	j s	Payments to capital
DI15	j s	Payments to land
DI16	i j s	Commodity taxes on domestic intermediate usage
DI17	i j s	Commodity taxes on imported intermediate usage
DI18	i s	Commodity taxes on domestic private consumption usage
DI19	i s	Commodity taxes on imported private consumption usage
DI20	i s	Commodity taxes on domestic investment usage
DI21	i s	Commodity taxes on imported investment usage
DI22	i s	Commodity taxes on domestic government consumption usage
DI23	i s	Commodity taxes on imported government consumption usage
DI24	i s	Commodity taxes on exports
DI27	i v s	Duty on imports
DI28	s	Income tax
DI29	s	Transfer payments
DI31	i v s	Freight
DP07	s	Depreciation
MK01	j s	Abnormal capital earnings
MK02	s	Net interest income of households
MK03	s	Net interest receipts of governments
MK04	s	Tax on labour income
MK05	s	Tax on property income

i is the number of industries

j is the number of industries ($i = j$)

s is the number of source regions

v is the number of destination regions ($s = v$)

Table I2: Parameters for the Salter Multi-Region Database

<i>Header</i>	<i>Dimension</i>	<i>Description</i>
DP01	i s	Elasticity of substitution between domestic and imported intermediates
DP02	i s	Elasticity of substitution between domestic and imported investment
DP03	i s	Elasticity of substitution between domestic and imported government
DP04	i s	Elasticity of substitution between labour, capital and land
DP05	i s	Marginal budget share
DP06	i s	Elasticity of substitution between domestic and imported consumption
RP01	i s	Elasticity of substitution between imported consumption
RP02	i s	Elasticity of substitution between imported investment
RP03	i s	Elasticity of substitution between imported government
RP04	i s	Elasticity of substitution between imported intermediates
DP13	s	Elasticity of labour supply to post-tax nominal wages
DP14	s	Parameter for indexing wages to the CPI
DP15	s	Frisch parameter
DP16	i s	Elasticity of demand with respect to expenditure
DP17	1	Elasticity of substitution between freight sources
MK06	1	World real bond rate
MK07	s	Real rate of return on equity
MK08	s	Exchange rate
MK09	s	Rate of growth in real household income
MK10	1	Length of simulation period
MK11	s	Rate of growth in real government receipts
MK12	s	Coefficient of adjustment in returns to capital
MK13	s	Elasticity of expected rate of return with respect on capital to capital stock
MK14	s	Steady state rate of growth in real capital stock

1 indicates a scalar

i is the number of industries

s is the number of source regions

APPENDIX J: DERIVATION OF DATA FOR THE CAPITAL MOBILITY EXTENSION

The data required as input to support the capital mobility extension of the Salter database are presented in Table J1. The extension is fully documented in McDougall (1993). The data required comprises both parameters that are estimated and figures derived from national accounts. This appendix describes each header array that is necessary for the capital mobility extension for the model. The procedure summarised in this appendix is carried out using the TABLO generated program PREMULTI. A complete description of the entire computing process to form the Salter database, and an explanation of where PREMULTI fits into the process, is given in Appendix L.

Table J1: Database Arrays for the Capital Mobility Extension

<i>Header</i>	<i>Dimension</i>	<i>Description</i>	<i>Data</i>
MK01	j s	Abnormal capital returns	1988 US\$ million
MK02	s	Household net interest income	1988 US\$ million
MK03	s	Government net interest receipts	1988 US\$ million
MK04	s	Tax on labour income	1988 US\$ million
MK05	s	Tax on non-labour income	1988 US\$ million
MK06	1	World real bond rate	per year
MK07	s	Real rate of return on equity	per year
MK08	s	Exchange rate	multiple of the base-case exchange rate
MK09	s	Rate of growth in real household consumption	per year
MK10	s	Length of simulation period	years
MK11	s	Rate of growth in real government receipts	per year
MK12	s	Rate of return adjustment coefficient	per year
MK13	s	Elasticity of expected gross rate of return	(none)
MK14	s	Steady state capital stock rate	per year

j is the number of industries

s is the number of regions

Data obtained from national accounts sources is used to derive some of the requirements for the capital mobility extension. The national accounts data is given in Appendix K and includes:

NFIGDPR(S) = ratio of net factor income from abroad to GDP for region s;

NLINFIR(S) = ratio of non-labour income from abroad to net factor income from abroad for region s;

TPDGDPR(S) = ratio of government net interest receipts to GDP for region s;

Note that Appendix K gives the derivation of the ratio of government net interest payments to GDP. The ratio of net interest receipts to GDP is the payments ratio multiplied by negative one.

TYTGDPR(S) = ratio of total income tax to GDP for region s;

TLTYTR(S) = ratio of labour to total income tax for region s; and

TNLTYTR(S) = ratio of non-labour to total income tax for region s.

The following is a description of how each header presented in Table J1 is derived:

MK01 Abnormal capital returns

This J by S array is set equal to zero to reflect initial long-run equilibrium.

MK02 Household net interest income

This is calculated using the following identity:

Household net interest income = Net property income from abroad -
Government net interest receipts

Net factor income from abroad is calculated by taking the GDP from each single-country database and multiplying it by NFIGDPR(S). Multiplying this figure by NLINFIR(S) gives a value for Non-labour or Net property income from abroad. When added across all regions, by definition, Net property income from abroad sums to zero. To ensure this property holds, the figure for the 'Rest of the world' is calculated as a residual. Taking the TPDGDPR(S) and multiplying it by the GDP from each single-country database gives the Government net interest receipts figure. From these, Household net interest income for each region are derived.

MK03 Government interest receipts

This is calculated in the derivation of the MK02 matrix.

MK04 Tax on labour income

Total income taxes, derived in a post-update procedure by multiplying TYTGDP(S) by the GDP for each region (refer Appendix H), are multiplied by TLTYTR(S) to give Tax on labour income.

MK05 Tax on non-labour income

Total income taxes used in the derivation of the MK04 matrix are multiplied by TNLTYTR(S) to give Tax on non-labour income.

MK06 Real world bond rate

Is a single parameter set at 0.035.

MK07 Real rate of return on equity

Is a parameter for each region set at 0.035.

MK08 Exchange rate

Is a parameter for each region set at 1.0.

MK09 Rate of growth in real household income

Is a parameter for each region set equal to the average annual growth of real GDP for the period 1978-88, expressed as a fraction rather than a percentage. The data for this parameter is presented in Appendix K.

MK10 Length of stimulation period

Is a single parameter set at 10.

MK11 Rate of growth in real government receipts

Is a parameter for each region set equal to the average annual growth of GDP for the period 1978-88, expressed as a fraction rather than a percentage.

MK12 Rate of adjustment coefficient

Is a single parameter set at 0.2.

MK13 Elasticity of expected gross rate of return

Is a parameter for each region to be calculated via a simulation shocking the equity premium shift variable. In the initial database, however, these are set to zero.

MK14 Steady state capital stock growth rate

Is calculated by summing the normal capital earnings, calculated as payments to capital less abnormal capital earnings from MK01, across industries. This is translated to a capital stock figure for each region by subtracting away the depreciation and dividing by the rate of return on equity parameter from header

MK07. The steady state capital stock growth rate is derived by subtracting depreciation from the ratio of investment to capital stock.

APPENDIX K: DATA REQUIREMENTS FOR THE CAPITAL MOBILITY EXTENSION

The following is a summary of data and sources for the capital mobility extension of the Salter database. Where possible the data has been collected for 1988. The data is stored in header array format and used as an input file to the PREMULTI program. A complete description of the entire computing process to form the Salter database, and an explanation of where PREMULTI fits into this process, is given in Appendix L.

Taxes on labour and non-labour income

Table K1 provides labour and non-labour income taxes (including social security contributions) as a percentage of total income tax revenues. For completeness, it also reproduces the data on the ratio of total income tax to GDP that was presented in Appendix H. The share of tax by type in total tax income and the ratio of total income tax to GDP allow us to scale the labour and non-labour income taxes to the GDP of each SALTER region.

Net interest payments by governments

Table K2 provides net interest payments on public sector borrowing as a proportion of GDP. It also gives an estimated breakdown of payments into those on domestic and foreign borrowing, although this breakdown is not required for the capital mobility extension.

Net interest payments should be calculated as gross interest payments minus gross interest receipts. IMF (1991a) gives gross interest payments by consolidated central government, but not gross interest receipts. We assume that all lending, whether domestically or abroad, is made by the private sector. The gross interest payments by central government are therefore used to represent net interest payments by general government. The split between domestic and foreign interest payments is based on the shares of foreign and domestic debt stocks, also from IMF (1991a).

No data for public debt interest payments is available for Hong Kong and Taiwan; the interest payment structure of Singapore is used to represent these two economies.

Note that the SALTER model equations require the ratio of net interest receipts to GDP, not the ratio of net interest payments to GDP. The ratio of net interest receipts to GDP is calculated by multiplying the ratio of net interest payments to GDP by negative one.

Net real property income from abroad

Table K3 shows net factor income from abroad in levels and as a percentage of GDP, and net non-labour (property) income from abroad as a percentage of net factor income for each SALTER region. Net factor income is calculated from the cited sources as factor income receipts from the rest of the world minus factor income payments to the rest of the world. Similarly, net non-labour income from abroad is calculated as capital income received minus capital income paid.

No data for net factor income is available for Indonesia, Malaysia or Hong Kong. It has been assumed that net factor income for Indonesia and Malaysia is the same percentage of GDP as in Thailand. Hong Kong is assumed to have the same percentage as Singapore.

Data for non-labour income is not available for China, Malaysia, Indonesia, Hong Kong, Taiwan and Singapore. It is assumed that non-labour income as a percentage of net factor income in Hong Kong, Taiwan and Singapore is the same as in Korea. China, Malaysia and Indonesia use the data for Thailand to obtain non-labour income as a percentage of net factor income.

World real interest rate

The nominal interest rate shown is that on holdings of the IMF's instrument, the Special Drawing Right (SDR). The interest rate on SDRs is based on the 'market rates' on short term money market instruments quoted in the five countries whose currencies are used to define the SDR. The component rates are the US three month treasury bill rate, the German three month interbank deposit rate, the French three month interbank money rate against private paper, the Japanese discount rate on two month private bills and the UK market yield for three month treasury bills. The SDR interest rate for 1988 obtained from IMF (1989) was 6.25 per cent.

A real rate of interest is obtained by subtracting the rate of inflation. The 1988 change in the CPI was 4.4 per cent in the United States, 1.2 per cent in Germany, 2.7 per cent in France, 0.7 per cent in Japan and 4.9 per cent in the

United Kingdom (IMF 1989). The simple average is 2.8 per cent. The real interest rate used in SALTER is therefore 3.5 per cent.

Average annual growth rate

Table K4 shows the average annual rate of growth of real GDP for each Salter region for the period 1978 to 1988.

Table K1: Taxes on labour and non-labour income by Salter region (per cent)

	<i>Total income tax as a % of GDP</i>	<i>Labour tax as a % of income tax</i>	<i>Non-labour tax as a % of income tax</i>
Australia	28.99	81.55	18.45
New Zealand	38.14	85.37	14.63
Canada	35.31	84.77	15.23
United States	27.40	87.48	12.52
Japan	21.36	50.19	49.81
Korea	15.93	58.96	41.04
EC.	24.67	86.08	13.92
Indonesia	15.74	8.63	91.37
Malaysia	17.51	26.66	73.34
Philippines	11.38	29.96	70.04
Singapore	15.23	58.96	41.04
Thailand	16.03	46.94	53.06
China	15.26	58.96	41.04
Hong Kong	11.09	58.96	41.04
Taiwan	15.62	58.96	41.04
ROW	15.03 ^a	78.79	21.21

a Calculated from Table H1 and H2 as a GDP weighted average of the ratios of total tax to GDP for Indonesia, Malaysia, Philippines, Singapore, Thailand, China, Hong Kong and Taiwan. This group of countries was chosen because it is felt that of the SALTER regions these countries most closely resembled the countries of the rest of the world.

Sources: Adapted from IMF (1991a)

Table K2: Net public sector interest payments on domestic and foreign debt as a proportion of GDP by Salter region (per cent)

	<i>Public debt interest as a % of GDP</i>	<i>Domestic public debt interest as a % of GDP</i>	<i>Foreign public debt interest as a % of GDP</i>
Australia	2.27	1.770	0.505
New Zealand	7.03	4.086	2.947
Canada	4.17	3.441	0.732
United States	3.49	2.876	0.614
Japan	3.26	3.239	0.018
Korea	0.92	0.516	0.408
EC	3.70	3.237	0.465
Indonesia	3.28	0.136	3.139
Malaysia	2.95	2.940	0.010
Philippines	5.56	3.399	2.161
Singapore	6.97	4.920	2.050
Thailand	2.74	2.025	0.715
China	0.42	0.000 ^b	0.420
Hong Kong	na	na	na
Taiwan	na	na	na
ROW	6.27	4.320 ^a	1.950 ^a

a Calculated as a GDP weighted average using interest payments as a percentage of GDP for Indonesia, Malaysia, Philippines, Singapore, Thailand, China, Hong Kong and Taiwan, and GDP data from Table H1.

b By assumption

Sources: Collated from IMF (1991a), converted to \$US million using 1988 exchange rates from IMF (1990), and expressed as a percentage using GDP data from Table H1.

Table K3: Net Factor income from abroad as a percentage of GDP and net non-labour factor income as a percentage of net factor income (NFI) by SALTER region

<i>Country</i>	<i>Currency and denomination</i>	<i>GDP</i>	<i>Net factor income</i>	<i>Net factor income as a % of GDP</i>	<i>Non-labour income as a % of NFI</i>
Australia	Aust. \$ m	336 485	- 12 771	- 3.795	99.773
New Zealand	N.Z. \$ m	63 806	- 3 483	- 5.46	100.000
Canada	Can. \$ m	596 420	- 18 882	- 3.166	100.000
US	US \$ m	4 817 780	10 324	0.214	99.874
Japan	Yen b	365 086	2 302	0.631	96.525
Korea	Won b	125 309	-1 733	- 1.383	120.892
EC.	US\$ m	3 555 263	-10 248	- 0.288	124.438
Indonesia ^a	Rupiahs b	82 695	na	na	na
Malaysia	Ringgit m	69 941	na	na	na
Philippines	Pesos m	825 852	- 2 982	- 0.361	1 019.182
Singapore	Sing \$ m	48 046	1 819	3.786	na
Thailand	Baht m	1 465 736	- 24 770	- 1.690	105.296
China	Yuan m	1 399 000	- 500	- 0.036	na
Hong Kong	HK \$ m	434 081	na	na	na
Taiwan	NT \$ m	3 496 951	- 34 796	- 0.995	na

^a The data for Indonesia is for 1987

Sources: UN (1991b). Data for Malaysia, Philippines, Singapore, Thailand and Hong Kong are from UN (1990a). Data for Taiwan are from Council for Economic Planning and Development (1990).

Table K4: Average annual growth of real GDP, 1978-1988, by Salter region (per cent)

Australia	3.3
New Zealand	2.2
Canada	3.3
United States	3.3
Japan	3.9
Korea	9.9
EC.	2.1
Indonesia	5.1
Malaysia	4.6
Philippines	0.1
Singapore	5.7
Thailand	6.0
China	10.3
Hong Kong	7.3
Taiwan	7.7
ROW	3.1 ^a

Source: World Bank (1990). Data for EC from OECD (1990). Data for Taiwan from Council for Economic Planning and Development (1990).

a Calculated as the growth rate of GDP for the world.

APPENDIX L: A COMPUTING GUIDE TO UPDATING SINGLE REGION DATABASES AND CONSTRUCTION OF THE MULTI-REGION DATABASE

Introduction

This appendix presents a computing guide to the files and procedures used to update the single region input-output databases (a process which includes adding the macroeconomic and assistance data), to add the fiscal data and to construct the SALTER multi-region equilibrium database. It presents lists and detailed descriptions of the files used at different stages of the process; update, adding fiscal data and construction.

Overview

The computer process for taking the initial single region input-output databases and forming the SALTER multi-region database is a six stage process.

- Stage 1: Early stage processing of single region input-output databases
- Stage 2: Later stage processing of single region input-output databases
- Stage 3: Final stage processing of single region input-output databases
- Stage 4: FIT updating procedure of single region input-output databases
- Stage 5: Compilation into multi-region database
- Stage 6: Calibration of the multi-region database

Stage 1: Early stage processing

This section outlines the computing procedures performed to implement the naive splits and RAS splits on the single region input-output databases prior to the later stage processing.

At the Industry Commission, the creation of the multi-region database is carried out in the C:\W\SALTER3 directory on COMPAQ #1. However, the Early stage processing is carried out in the directory C:\SINGLE. For a complete listing of

the directory structure for carrying out the construction of the multi-region database, refer to Figure L5.

The initial single region input-output databases requiring splits and commonplace adjustments are as follows:

AUS.DAT	Australia
NZ.DAT	New Zealand
CAN.DAT	Canada
USA.DAT	United States of America
JAP.DAT	Japan
KOR.DAT	Korea
EC.DAT	European Economic Community
IND.DAT	Indonesia
MAL.DAT	Malaysia
PHI.DAT	Philippines
SIN.DAT	Singapore
THA.DAT	Thailand
CHI.DAT	China
TAI.DAT	Taiwan

Each of these data files is located in the respective single country sub-directories, all of which branch off from the directory C:\SINGLE. Each single country directory can be found by using the 2 or 3 letter file names listed above for the data files, which are AUS, NZ, CAN, USA, JAP, KOR, EC, IND, MAL, PHI, SIN, THA, CHI AND TAI. The Hong Kong input-output database is constructed using a different process as discussed in Tormey (1993), and in the Early stage processing only undergoes the GOS split as discussed in Chapter 2. The initial input-output database is named HKFORM.dat and is located in HK subdirectory off C:\SINGLE.

To carry out and check the aggregation and disaggregation procedures which are detailed in Appendix A, a number of TABLO generated programs are used:

EXTRACT	Determines input-output coefficients
PROJECT	Takes input-output coefficients and input database, and generates a perfectly balanced database
BALANCE	Checks input-output database to determine if total sales equals total costs
CHECKNEG	Checks input-output database for unacceptable negatives

S3INDAGG	Aggregates industries that need to be reallocated
S3DBSW	Reallocates data for one industry over several industries
RICEADJ	Reallocates intermediate usage of Paddy rice in other industries
OILADJ	Reallocates intermediate usage of Oil in other industries
OILADJ2	Same as for OILADJ, but is used only on the KOR and EC databases
REALL	For input-output database having 38 industries, this program reallocates the 38th industry into the standard 37 industry format
NEWINDRY	Creates new industries with zero entries, for the EC database which has less than the full 37 industries.
GOS	Performs the 50/50 split of gross operating surplus between capital and land for industries 1 to 6.

Each of these GEMPACK programs is located in the TABLO sub-directory, which branches off from the directory C:\SINGLE.

There are also a number of files used as/or to create input into the reallocation process and are all stored in the respective single country sub-directories. These files include a number of MODHAR stinp decks that generate header array files. These include:

GEN.STI	Contains data on the number of industries in the initial input-output table
GEN2.STI	Contains data on the number of industries remaining, after running the REALL program
EXTRACT.STI	Contains the input data for running EXTRACT
PROJECT.STI	Contains the input data for running PROJECT
S?BAL.STI	Contains the input data for running BALANCE, where ? is the number denoting which stage of the process that balance is being checked.
S?NEG.STI	Contains the input data for running CHECKNEG, where ? is the number denoting which stage of the process that negatives are being checked.
INDAGG?.STI	Contains the input data for running MODHAR to create the aggregated industry data to be used in running S3INDAGG, where ? is the number denoting which aggregation is being performed.
???AGG?.STI	Contains the input data for running S3INDAGG, where (???) is the 2 or 3 letter country designation

S3DBSW?.STI	Contains the input data for running MODHAR to create the share weights to be used in running S3DBSW, where ? is the number denoting which disaggregation is being performed.
???SPLT?.STI	Contains the input data for running S3DBSW, where (???) is the 2 or 3 letter country designation
RICESETS.STI	Contains the input data for running MODHAR to create the share weights to be used in running RICEADJ
???RICE.STI	Contains the input data for running RICEADJ, where (???) is the 2 or 3 letter country designation
OILSETS.STI	Contains the input data for running MODHAR to create the share weights to be used in running OILADJ
???OIL.STI	Contains the input data for running OILADJ, where (???) is the 2 or 3 letter country designation
REALL.STI	Contains the input data for running MODHAR to create the share weights to be used in running REALL
GOS.STI	Contains the input data for running GOS

For each country, different industries required reallocation, yet the pattern of industry aggregation and reallocation is similar between countries, so batch files for each country have been written to carry out the whole procedure. These batch files are located in the C : \ SINGLE \ TABLO directory on the machine. The batch filenames utilise the 2 or 3 letter file names, as listed above for the data files, but have a (.BAT) extension, instead of (.DAT), eg. the batch file for Australia is (AUS.BAT).

The final output from the Early stage processing will be the single region input-output databases labelled as:

???RUPD.HAR where (???) is the 2 or 3 letter country designation

Stage 2: Later stage processing

Figure L1 gives a flow chart of the Later stage processing, which uses the following programs discussed in Calder, McDougall and Strzelecki (1993).

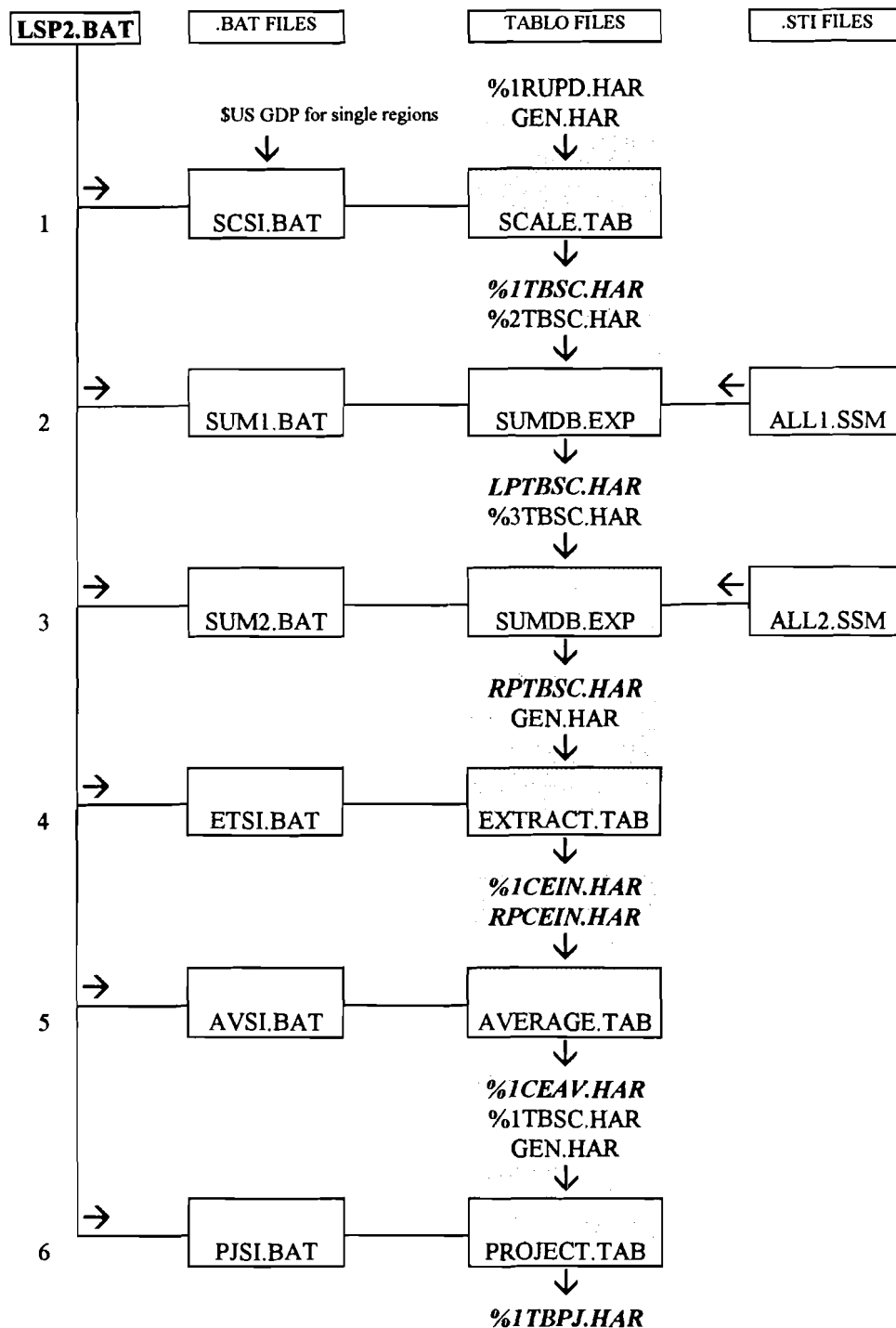
- SCALE.TAB
- SUMDB.EXP
- EXTRACT.TAB
- AVERAGE.TAB
- PROJECT.TAB

The Later stage processing is totally automated and is conducted using the two batch files LSP.BAT and LSP2.BAT. The input files for the Later stage processing are the ???RUPD.HAR files from the Early stage processing and the output single region input-output database files are listed below:

ASTBPJ.HAR	Australia
NZTBPJ.HAR	New Zealand
CNTBPJ.HAR	Canada
USTBPJ.HAR	United States of America
JPTBPJ.HAR	Japan
KRTBPJ.HAR	Korea
ECTBPJ.HAR	European Communities
INTBPJ.HAR	Indonesia
MSTBPJ.HAR	Malaysia
PHTBPJ.HAR	Philippines
SNTBPJ.HAR	Singapore
THTBPJ.HAR	Thailand
CHTBPJ.HAR	China
HKTBPJ.HAR	Hong Kong
TWTBPJ.HAR	Taiwan

These output single region input-output database files are referred to in the text as the TBPJ.HAR files. The LSP.BAT file works with 14 regions, which is the preceding list minus Hong Kong. The output single region input-output database file for Singapore (ie. SNTBPJ.HAR) is then used to create the Hong Kong single region input-output database as described in (Tormey 1993). All 15 regions are then run through LSP2.BAT to create the final TBPJ.HAR files.

Figure L1: The flow of files in later stage processing



Output files appear in bold italics.

%1 = AS,CN,NZ,US,JP,KR,EC,
IN,MS,PH,SN,TH,CH,TW

%2 = AS,CN,NZ,
US,JP,KR,EC,IN

%3 = MS,PH,SN,
TH,CH,TW

Stage 3: Final stage processing

Figure L2 gives a flow chart of the Final stage processing, which calculates the shocks required for macroeconomic, trade and tax target values to be achieved in the FIT process. The macro and fiscal targets are discussed in Appendix F, G and H of this paper. The trade targets are discussed in Hanslow (1993) and the tax targets are discussed in Gotch (1993).

The Final stage processing is carried out using the batch file FSP.BAT and requires the following input files and TABLO programs:

FISCAL.STI	this MODHAR input file contains the macro targets
TAXINPUT.STI	this MODHAR input file contains the tax targets
NEWTRADE.DAT	this data file contains the trade targets
??TBPJ.HAR	the input-output data files from Later stage processing
SHOCK.TAB	this TABLO program calculates the shocks to be fed into the update process
NEWSHOCK.TAB	same as for SHOCK but calculates the shocks for the EC database only
TAXINPUT.STI	creates six header arrays when run through the GEMPACK program MODHAR

Table L1: Header arrays contained in Taxinput.sti

<i>Header</i>	<i>Description</i>
IMPT	Import duty rate by importing country v on commodity i from source country s.
EXPT	Power of the export tax in country s on commodity i.
INDT	Power of the production tax in country s on industry j.
DCON	Power of the domestic usage tax in country s on commodity i.
ICON	Power of the imported usage tax in country s on commodity i.
VERS	Ver export tax rate equivalent in country s on commodity i to destination v.

There are three topics to discuss concerning the tax targets in TAXINPUT.STI:

- target power of the tax rates
- source specific import taxes
- VERs

As discussed in Chapter 3, tax rates are not collected on all commodities. When confronted with this situation there are two choices:

-
- 1) Assume the target tax rate is zero; or
 - 2) Assume the tax rate in the initial database is the best approximation.

As outlined in Gotch (1993), we generally take the second choice. However, zero target tax rates are assumed for import and export taxes on service based commodities. The SHOCK program (through the use of conditional statements) has the facility to invoke either assumption. When reading in the target power of the tax rates from TAXINPUT.STI, if the SHOCK program reads a zero then a zero shock is applied. This invokes assumption 2. If a non-zero is read in the power of the tax rate is updated to the value read in. If a zero tax rate is desired, a target power of the tax equal to one is placed in TAXINPUT.STI.

Targets for the source specific import duties are in TAXINPUT.STI, header IMPT. The shocks to import tax rates are calculated by the procedure outlined in Chapter 3. Target duty rates combine with NEWTRADE.DAT to calculate a target level of duty revenue. This level of revenue is converted to a import tax rate. A zero target duty rate in TAXINPUT.STI will not add to the target level of duty revenue calculated.

In a similar method to import specific duty rates, target VER rates combine with NEWTRADE.DAT to calculate a target level of export tax revenue attributable to VERs. This is used to calculate a target VER export tax rate which is added to the target power of the export tax rates contained in the header EXPT. Again, a zero VER target rate contributes nothing to the target level of export tax revenue.

In calculating the shocks for the update process, the FSP batch file calls on the batch files SHOCK.BAT and NEWSHOCK.BAT to execute the SHOCK and NEWSHOCK programs. These programs reads in each TBPJ.DAT file (which are hardwired into the TABLO code), TAXINPUT.DAT (generated by MODHAR using TAXINPUT.STI), FISCAL.DAT (generated by MODHAR using FISCAL.STI) and the updated trade data contained in header array format in the file NEWTRADE.DAT. The output is a group of header array files containing the shocks for the update process.

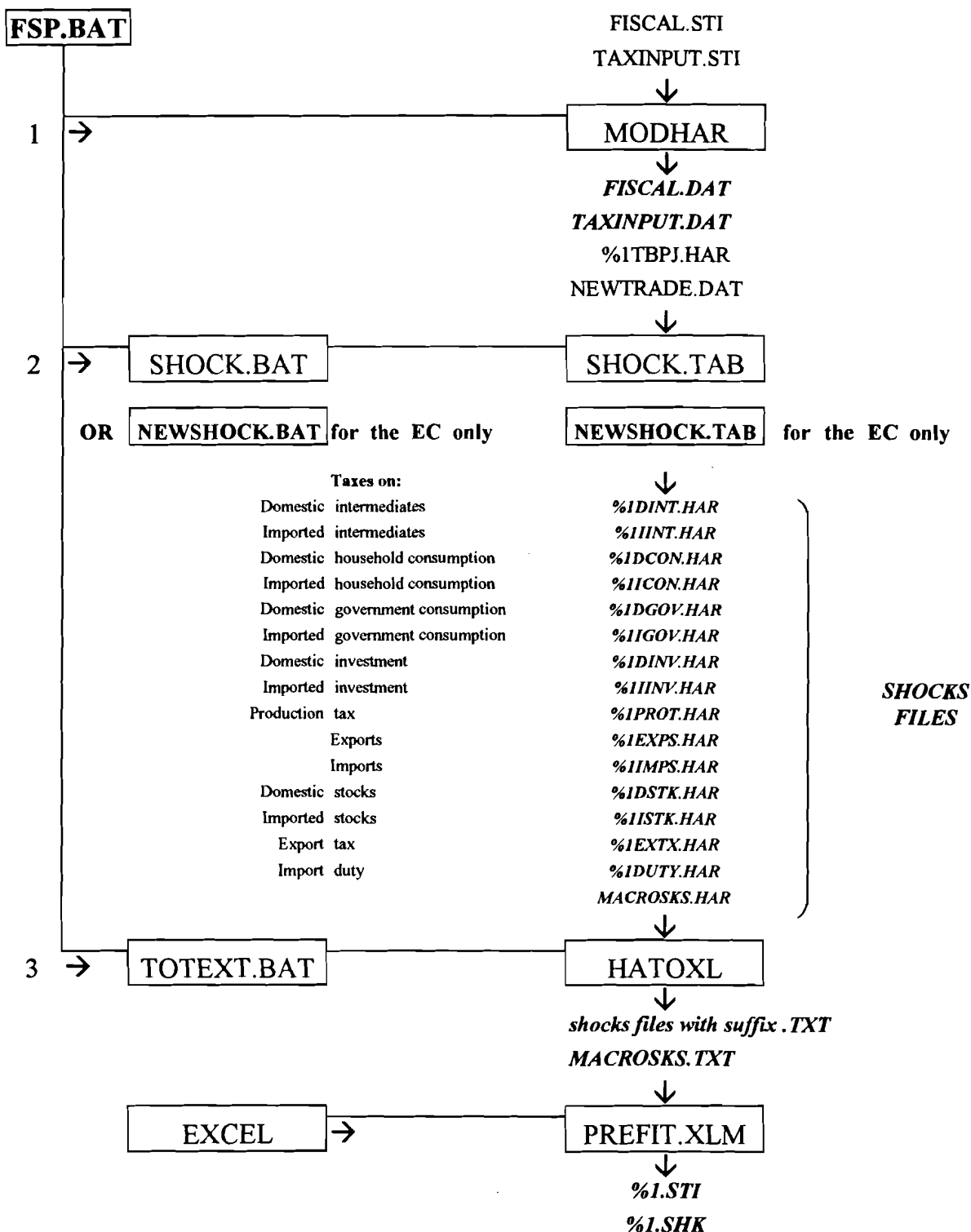
The FSP batch file also calls on the batch file TOTEXT.BAT which converts the output header array files from the SHOCK programs to text using the GEMPACK program HATOXL.

After the FSP batch file is finished, using the Excel macro PREFIT.XLM the shocks to each individual component for the update are saved as text files and the fiscal macro targets are added to stinp files that will be the inputs to the update process. These stinp files will be saved as ??STI where ?? is the two letter single region designation. These stinp files will call upon the text files

containing the shocks to each individual component for the update which are saved with the SHK file extension.

??DINT.SHK	shocks to domestic intermediates
??IINT.SHK	shocks to imported intermediates
??DCON.SHK	shocks to domestic consumption
??ICON.SHK	shocks to imported consumption
??DGOV.SHK	shocks to domestic government
??IGOV.SHK	shocks to imported government
??DINV.SHK	shocks to domestic investment
??IINV.SHK	shocks to imported investment
??PROT.SHK	shocks to production tax
??EXPS.SHK	shocks to exports
??IMPS.SHK	shocks to imports
??DSTK.SHK	shocks to domestic stocks
??ISTK.SHK	shocks to imported stocks
??EXTX.SHK	shocks to export tax
??DUTY.SHK	shocks to import duty

Figure L2: The flow of files in final stage processing



%I = AS, NZ, CN, US, JP, KR, EC, IN, MS, PH, SN, TH, CH, HK, TW

Output files appear in bold italics

Stage 4: FIT updating procedure

At the Industry Commission, the update is conducted on the DEC Unix machine. The TBPJ.HAR and text files containing the shocks are transferred to this machine and used as input into the update. The update is conducted using the FIT model which is detailed in James and McDougall (1993) and the files involved are:

FIT.TAB	a TABLO deck containing the FIT model structure;
FITCONDS	a TABLO input deck that conducts the condensation of the model;
FIT.STI	a SAGEM input deck that generates an environment file.

To generate the executable FIT file, TABLO is run in batch mode using FITCONDS as an input file. This reads FIT.TAB and produces a condensed FORTRAN code which is compiled as linked on the DEC using the command 'TABLOPAC FIT'. The executable FIT file is run (using any input single-country database) to generate an equations file FIT.EQ4. Running SAGEM in batch mode with FIT.STI as an input file generates the environment file containing the closure of the model. The environment file is called STANDARD.EN4. Simulations are now ready to be conducted on the FIT model. The input decks used to conduct the updates are the stinp files created during the Final stage processing, which are as follows:

AS.STI	The STINP deck used to conduct the Australian update;
NZ.STI	The STINP deck used to conduct the New Zealand update;
CN.STI	The STINP deck used to conduct the Canadian update;
US.STI	The STINP deck used to conduct the USA update;
JP.STI	The STINP deck used to conduct the Japanese update;
KR.STI	The STINP deck used to conduct the Korean update;
EC.STI	The STINP deck used to conduct the EC update;
IN.STI	The STINP deck used to conduct the Indonesian update;
MS.STI	The STINP deck used to conduct the Malaysian update;
PH.STI	The STINP deck used to conduct the Philippines update;
SN.STI	The STINP deck used to conduct the Singaporean update;
TH.STI	The STINP deck used to conduct the Thai update;
CH.STI	The STINP deck used to conduct the Chinese update;
HK.STI	The STINP deck used to conduct the Hong Kong update;
TW.STI	The STINP deck used to conduct the Taiwanese update.

These Stinp decks call upon the shocks text files and also contain the macroeconomic control targets as detailed in Appendix F and Appendix H. Four items of data appear at the end of each Stinp deck in the following order:

- Oil price shock
- Aggregate investment target shock
- Aggregate consumption target shock
- Aggregate government target shock

The output from the FIT updating procedure is an updated single region database, ??UPD and a formatted solution file ??FIT.SLX, where ?? is the two letter designation for each Salter region. Once updated, the databases are transferred back to COMPAQ #1 and checked before they can be collated into the multi-country database. The following is a list of the executable files used in checking the update procedure:

CHECKNEG	A TABLO generated file that checks input-output tables for unacceptable negatives.
EECUPDCK	A TABLO generated file that checks the actual updated values for the EC database
NEWUPDCK	A TABLO generated file that checks the actual updated values for all single region databases other than EC
CHKV4	An EXCEL macro that checks the convergence of the formatted solution file after update.

The steps for checking the database are as follows:

1. Each single region database is checked using the TABLO generated program CHECKNEG which checks for negative purchaser prices
2. Each single region formatted solution file from the update simulation is checked by loading the ??FIT.SLX file into EXCEL and executing the macro CHKV4.XLM
3. Each single-country database is checked using the TABLO generated program NEWUPDCK which allows you to manually check, using the EXCEL spreadsheet MRUPDCK.XLS, the updated values of:
 - aggregate private consumption;
 - aggregate investment;
 - aggregate government consumption;
 - exports by commodity;
 - imports by commodity;
 - commodity taxes;

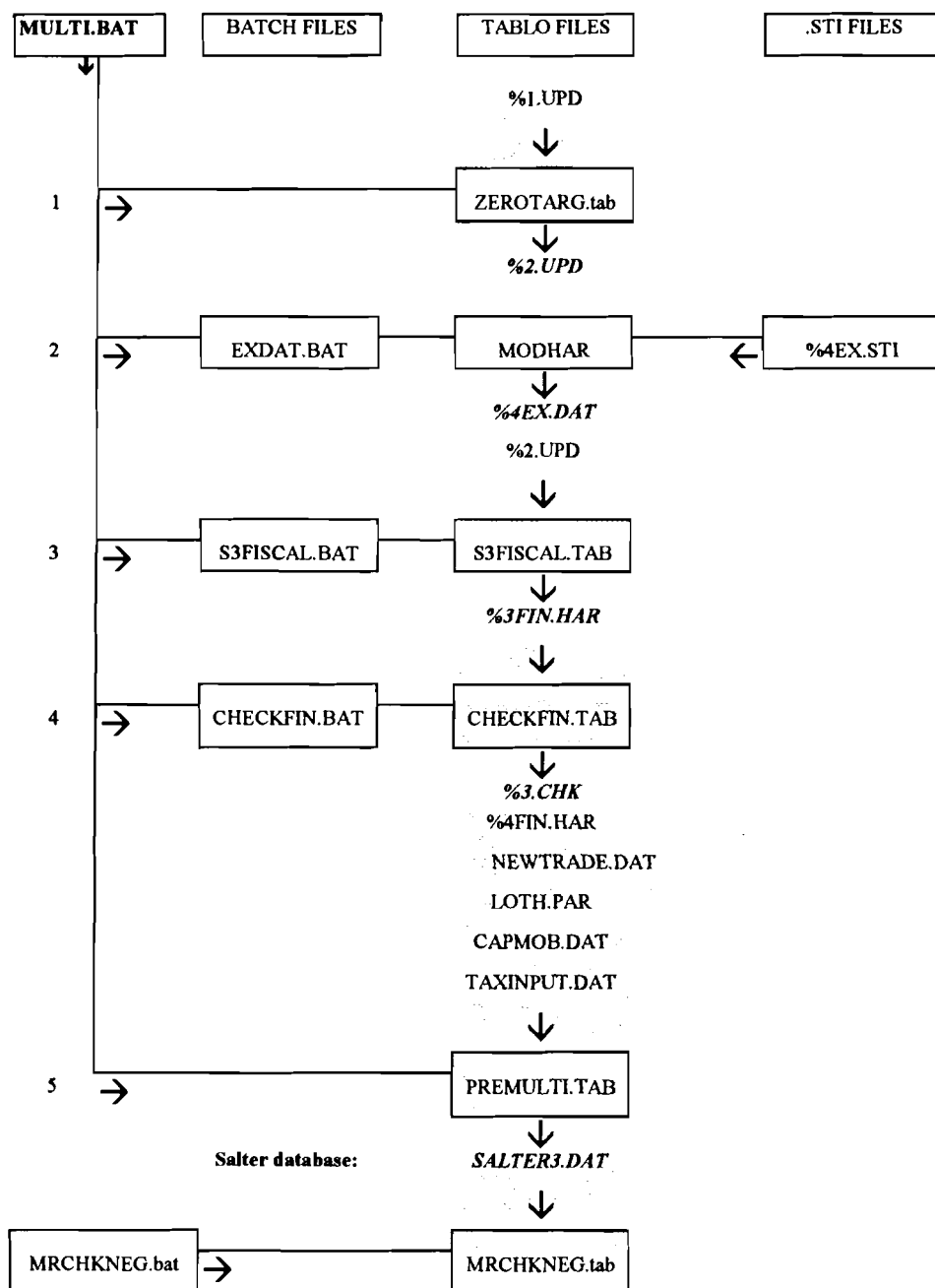
-
- export taxes;
 - voluntary export restraints;
 - import taxes; and
 - industry taxes.

The program also prints out domestic and imported changes in stocks to see how close to zero they have become. It also checks that total costs equal total sales for each industry. This program is run using the batch file NEWUPDCK.BAT. This batch file runs the TABLO program NEWUPDCK on each updated single region database, then converts the results to an EXCEL readable file using the GEMPACK program HATOXL. The EXCEL readable files are saved with the XLT extension using the naming convention, ??UPDTAB.XLT where ?? is the two letter designation for each Salter region. The results can be checked by opening the EXCEL spreadsheet MRUPDCK.XLS which is linked to each of the ??UPDTAB.XLT files.

Stage 5: Compilation into multi-region database

Figure L3 gives a flow chart of the construction of the multi-region database which is carried out using the batch file MULTI.BAT, and the checking process carried out using the batch file MRCHKNEG.BAT.

Figure L3: Flow chart of multi-region database construction and checking



%1 = NZ, CN, US, JP, KR, EC, CH, TW.

%2 = AS2, NZ2, CN2, US2, JP2, KR2, EC2, IN2, MS2, PH2, SN2, TH2, CH2, HK2, TW2.

%3 = AS, CN, NZ, US, JP, KR, EC, IN, MS, PH, SN, TH, CH, HK, TW.

%4 = AS, CN, NZ, US, JP, KR, EC, IN, MS, PH, SN, TH, CH, HK, TW, RW.

Output files appear in bold italics.

The first stage of the multi-region database construction using the MULTI batch file is to run the TABLO program ZEROTARG which corrects a particular error in the single region databases created during the FIT updating procedure. This error occurs when the FIT program attempts to achieve a target trade flow of zero, when the initial trade flow is non-zero. In the FIT updating procedure a multi-step solution procedure is used to avoid linearisation errors. However, in the case where the target value is zero for a non-zero number, the multi-step solution procedure will attempt to find a solution in one step. The following example is given to illustrate this result. However for a complete discussion of this result, refer to Pearson and Codsì (1991).

If XO is the initial value of a variable, and XT is the target value of the variable, with 'n' being the number of steps undertaken in the solution procedure, then the change in the variable can be found from the formula:

change in X (let this be denoted by the letter 'p') = $[XT - XO] / XO$

The shock applied to the variable at each step can be found from the formula:

shock = $100 * [n\text{-th root of } (1 + p) - 1]$

In the single case where XT equals zero, p will equal minus one, and thus the shock will be equal to minus one hundred, independent of the number of steps.

This result means that in all instances where the target value is zero for a non-zero number, the multi-step solution procedure will give linearisation errors. Although the resultant errors are small, less than 0.001 percent, the flow-on effects on the calculation of trade shares in the TABLO program PREMULTI created a need for the TABLO program ZEROTARG. This program is not a flexible method of solving this problem. It is set up to correct only the following occurrences of imports and/or exports to/from the relevant region for the particular commodity. Table L2 lists the relevant commodities for each region, and whether both imports and exports or just one of these needs to be zeroed.

Table L2: Target regions and relevant commodities for ZEROTARG

<i>Region</i>	<i>Commodity</i>	<i>Exports</i>	<i>Imports</i>
Australia	Ownership of dwellings	yes	yes
New Zealand	Paddy Rice	yes	no
	Processed Rice	yes	no
	Ownership of dwellings	yes	yes
Canada	Ownership of dwellings	yes	yes
USA	Ownership of dwellings	yes	yes
Japan	Ownership of dwellings	yes	yes
Korea	Ownership of dwellings	yes	yes
EC	Ownership of dwellings	yes	yes
Indonesia	Wheat	yes	no
	Ownership of dwellings	yes	yes
Malaysia	Ownership of dwellings	yes	yes
Philippines	Wool	yes	no
	Coal	yes	no
	Oil	yes	no
	Ownership of dwellings	yes	yes
Singapore	Wool	yes	no
	Ownership of dwellings	yes	yes
Thailand	Ownership of dwellings	yes	yes
China	Paddy rice	no	yes
	Ownership of dwellings	yes	yes
Hong Kong	Oil	yes	no
	Ownership of dwellings	yes	yes
Taiwan	Electricity, Water and Gas	yes	yes
	Ownership of dwellings	yes	yes

The program ZEROTARG reads in the single region databases for these 15 regions, sets equal to zero the imports/exports, commodity taxes and duties/export taxes thereon for the relevant commodity as specified in Table L2, then outputs the modified single region databases.

Following this correction procedure the MULTI batch file supplements the single region databases with the fiscal data, explained in Appendix H, using the TABLO programs:

S3FISCAL Adds extra fiscal data into the databases.

CHECKFIN Conducts a balance check on the databases.

The fiscal data is stored on files generated by the following MODHAR stinp decks (these are referred to in the text as EX.STI files):

ASEX.STI The input deck containing fiscal data for Australia

NZEX.STI The input deck containing fiscal data for New Zealand

CNEX.STI The input deck containing fiscal data for Canada

USEX.STI The input deck containing fiscal data for United States

JPEX.STI The input deck containing fiscal data for Japan

KREX.STI The input deck containing fiscal data for Korea

ECEX.STI The input deck containing fiscal data for the EC

INEX.STI The input deck containing fiscal data for Indonesia

MSEX.STI The input deck containing fiscal data for Malaysia

PHEX.STI The input deck containing fiscal data for Philippines

SNEX.STI The input deck containing fiscal data for Singapore

THEX.STI The input deck containing fiscal data for Thailand

CHEX.STI The input deck containing fiscal data for China

HKEX.STI The input deck containing fiscal data for Hong Kong

TWEX.STI The input deck containing fiscal data for Taiwan

The fiscal data is then added to each single-country database using the TABLO generated program S3FISCAL. This requires the added input EX.DAT files (obtained by running MODHAR with the EX.STI files as input). The single-region databases, complete with fiscal data, are then ready to be collated into the multi-region database. These files are referred to in the text as FIN.HAR files:

ASFIN.HAR The final updated database for Australia

NZFIN.HAR The final updated database for New Zealand.

CNFIN.HAR The final updated database for Canada.

USFIN.HAR The final updated database for the USA.

JPFIN.HAR The final updated database for Japan.

KRFIN.HAR The final updated database for Korea.

ECFIN.HAR	The final updated database for the EC.
INFIN.HAR	The final updated database for Indonesia.
MSFIN.HAR	The final updated database for Malaysia.
PHFIN.HAR	The final updated database for Philippines.
SNFIN.HAR	The final updated database for Singapore.
THFIN.HAR	The final updated database for Thailand.
CHFIN.HAR	The final updated database for China.
HKFIN.HAR	The final updated database for Hong Kong.
TWFIN.HAR	The final updated database for Taiwan
RWFIN.HAR	The database for the Rest of the World.

The TABLO program CHECKFIN checks these final updated single region databases for the percentage difference between total sales and total costs of each industry in each region, as well as the total difference between total sales and total costs for each region.

The multi-country database is then constructed using the following TABLO programs:

PREMULTI	Constructs the multi-region database.
CHECK3	Checks several balances in the multi-country database.
MRCHKNEG	Checks the multi-region database for unacceptable negatives

There are also a number of files used as/or to create input into the construction process, these include a number of header array files and MODHAR stinp decks:

LOTH.STI	A MODHAR stinp deck generating a header array file containing the medium-run parameters for the database
CAPMOB.STI	A MODHAR stinp deck generating a header array file containing data for the capital mobility extension.
TAXINPUT.DAT	A header array file containing the target power of the taxes.
NEWTRADE.DAT	A header array file containing the updated trade data.

The TABLO generated program PREMULTI takes the *FIN.HAR files, LOTH.PAR (the header array file generated by MODHAR using LOTH.STI), CAPMOB.DAT (the header array file generated by MODHAR using CAPMOB.STI), TAXINPUT.DAT (mentioned above) and the trade data (NEWTRADE.DAT) and creates a multi-region database SALTER3.DAT.

The single region databases are combined and an extra dimension added to each vector - source country. Where a header array reports flows between countries,

eg. imports and exports, these are allocated over source and destination countries. The TABLO generated program CHECK3 checks the multi-country database for:

- NDP balance between the expenditure and income approaches;
- the sum of margins exports reported by all regions equals the total of the freight matrix;
- the sum of all exports reported by all regions equals the total of the imports reported by all regions (ie. global trade sums to zero);
- costs and sales are equal for each industry in each country; and
- fob exports plus freight reported from country A to B are equal to cif imports reported by B from A .

Stage 6: Calibration of the multi-region database

At the Industry Commission, the calibration of the multi-region database is conducted on the DEC Unix machine. The multi-region database SALTER3.DAT is transferred to this machine and used as input into the calibration. The calibration is conducted using the batch files S3DBIN.BAT and S3ITERATE which calculate and then add to the multi-region database the header MK13. The header MK13 contains data on the elasticity of expected gross rate of return for each Salter region. For an explanation of how the elasticity of expected gross rate of return is calculated refer to McDougall (1993). Figure L4 is a flow chart of the multi-region database calibration procedure.

The batch file S3DBIN.BAT has as an input a text file MK13.TXT which contains initial estimates for the values in header MK13. The batch file calculates the actual values using these estimates as a starting point. The output of the batch file S3DBIN.BAT is a text file MK13.SEE which compares the initial estimates for the values in header MK13 and the calculated values. The aim of the calibration is to have the difference between these two at less than 0.00001 for each region.

The batch file S3ITERATE allows this aim to be realised by taking as the starting point estimates for the values in header MK13, the actual values calculated by the S3DBIN.BAT batch file. The output of the batch file S3ITERATE is a new multi-region database S3NEW.DAT and a text file MK13.SEE which again compares the starting point estimates for the values in header MK13 and the calculated values. The batch file S3ITERATE is repeatedly run until the difference between the starting point estimates for the

values in header MK13 and the calculated values is less than 0.00001 for each region.

Figure L4: Flow chart of calibration of multi-region database

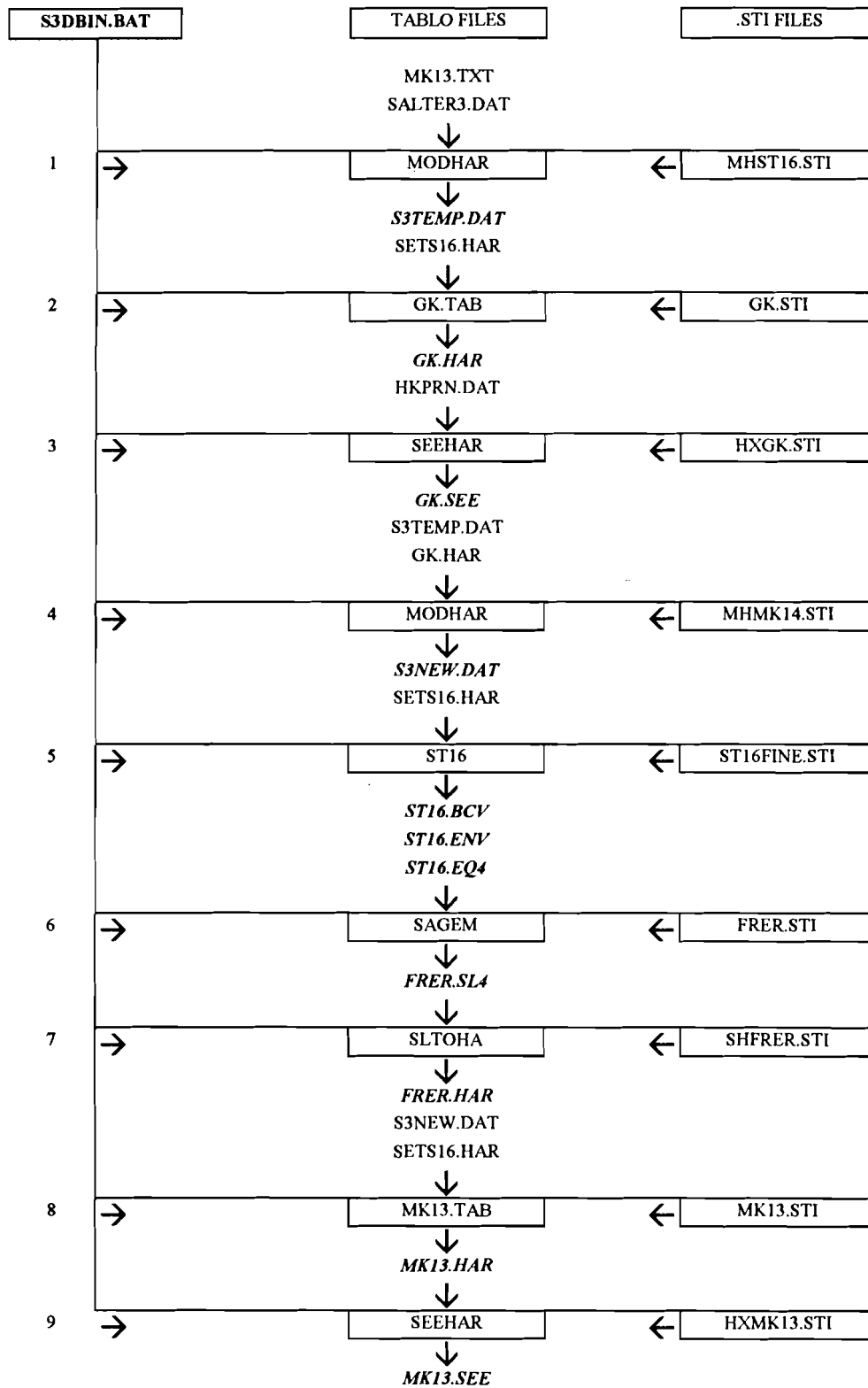
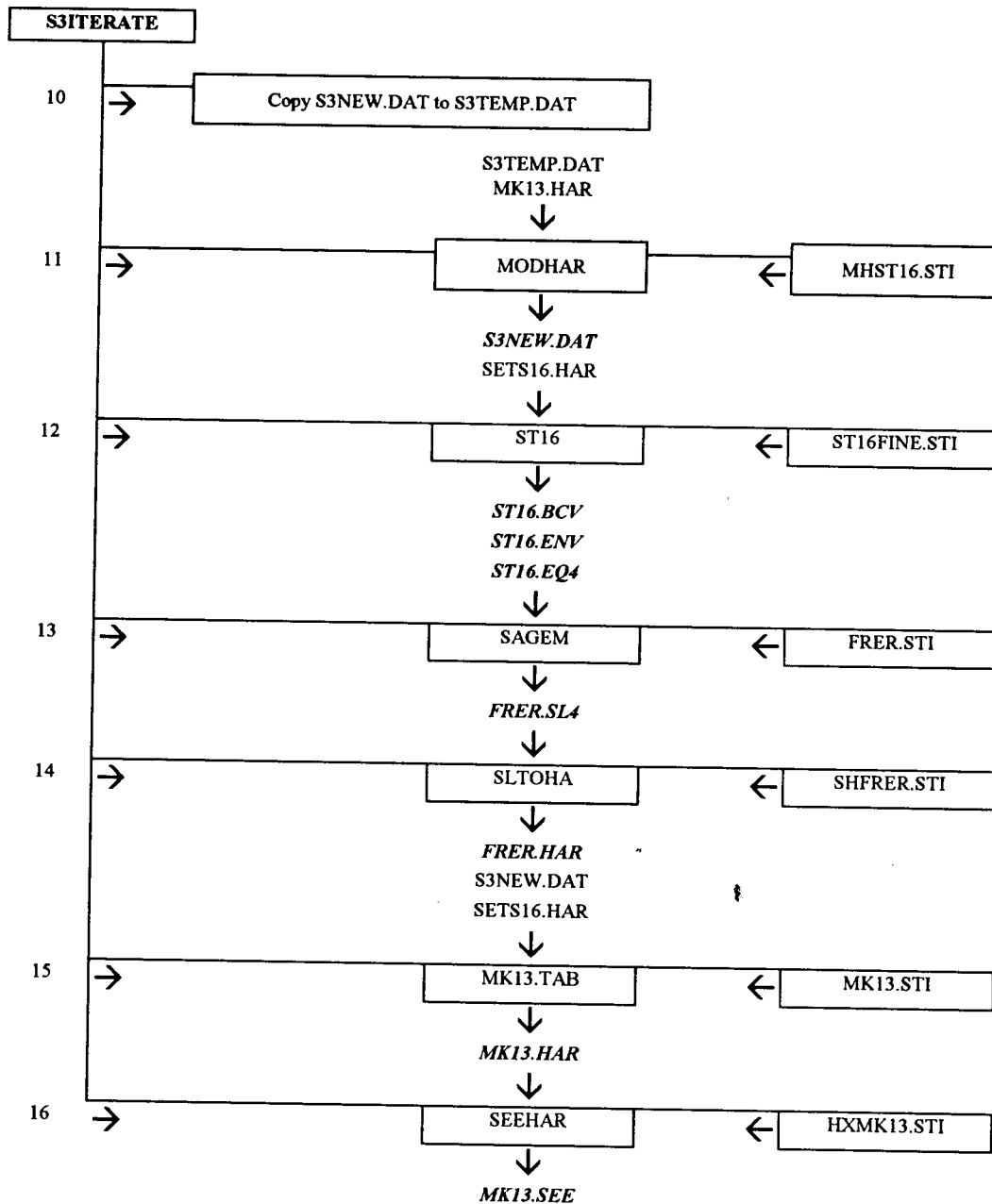
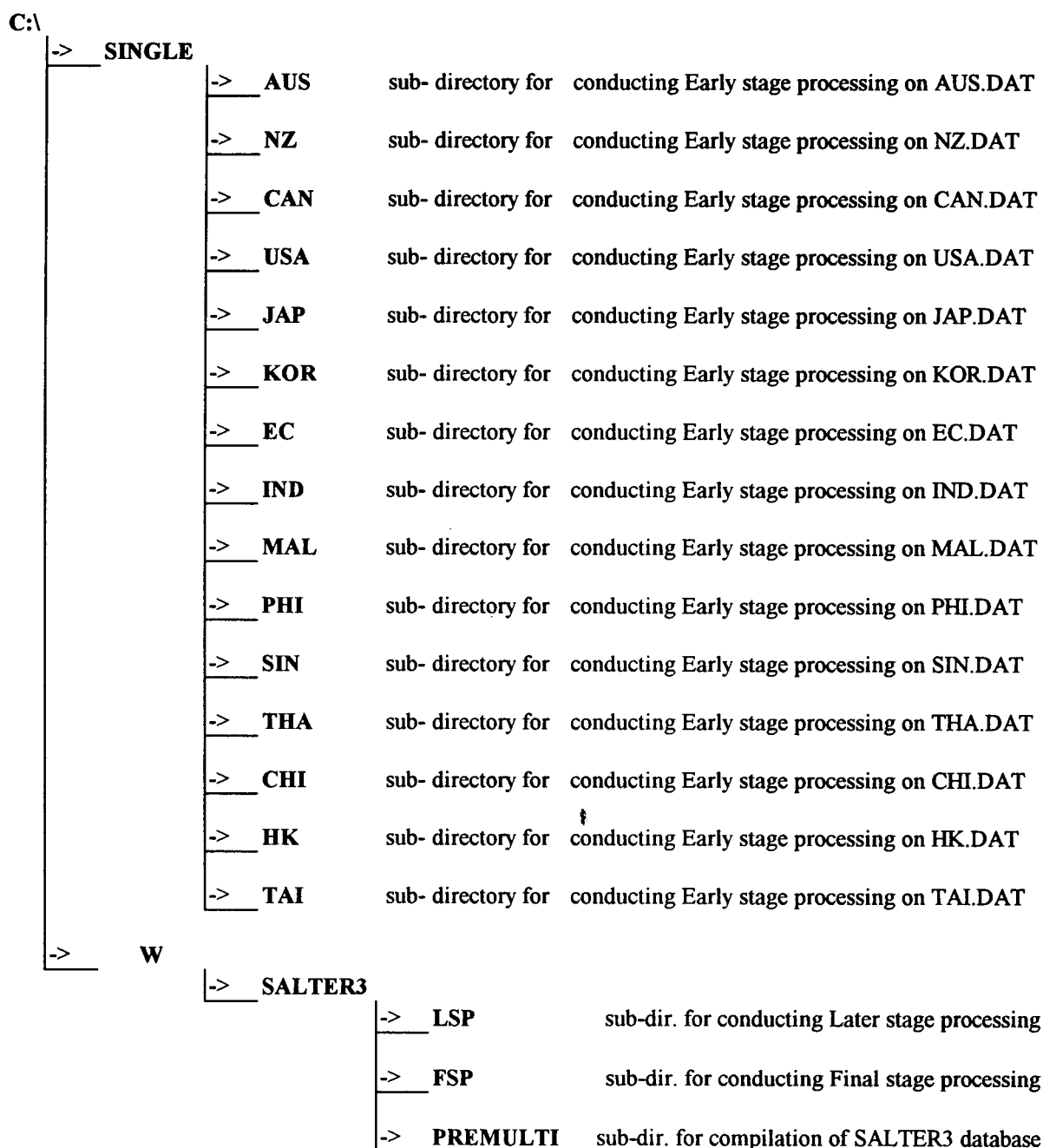


Figure L4: Flow chart of calibration of multi-region database (continued)



- S3ITERATE is repeated until numbers in MK13 converge
- steps 12 to 16 are steps 5 to 9 repeated

Figure L5: Directory structure for construction of **SALTER3** database



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