AN INPUT-OUTPUT MODEL
OF THE TASMANIAN ECONOMY

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The material generated by this research has not been accepted for the award of any other degree or diploma in any university. To the best of my knowledge and belief, the thesis contains no copy or paraphrase of material previously published or written by another person except where due reference is made in the text of the thesis.

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ABSTRACT

Input-output economics is an internationally accepted method of economic planning and decision making but the construction of input-output models within Australia has not been extensive even though a national transactions table was constructed early in the era of input-output. Over the last decade the situation has been changing with national tables, now constructed on a regular basis and regional studies proliferating. The major obstacle to the preparation of sub-national input-output tables is the paucity of commodity and trade data so that for most regional studies the emphasis has been on surveys. For two States, Western Australia and Tasmania, both commodity and trade data are tabulated by the Australian Bureau of Statistics thus providing the basis for the construction of input-output models principally from secondary data. An interindustry study for W.A. appeared in 1967. The aim of this study is to produce a Tasmanian transactions table together with the associated tables of coefficients and to quantify the structural economic inter-relationships by determining the output, income and employment multipliers of Tasmanian industries.

In Chapter 2 the input-output system and the assumptions are presented together with the mathematical relationships. The closed model and the dynamic input-output system incorporating capital coefficients, both extensions to the basic open static model, are also described. The forms of input-output analysis are outlined in Chapter 3 including structural and multiplier analysis and simulation.

Input-output analysis has assumed a dominant position in regional research and in Chapter 4 the development of regional models is outlined through a review of the pertinent sections of the literature. The Australian involvement is also traced. Regional studies are frequently motivated by regional problems and the need to provide planning techniques to lift regional prosperity. It is shown that the Tasmanian economy provides such an instance.

Chapter 5 is concerned with construction procedure and conceptual problems encountered in compilation. The sources of data are indicated and the selection of processing industries, final demand and processing sectors discussed. Producer prices are selected and competitive imports allocated directly.

The results are presented in Chapter 6. The main characteristics of the 45 industry transactions table, the table of input coefficients and the table of interdependence coefficients, are described. The components (direct, indirect and induced) of total income change per dollar change in final demand are generated together with type I and type II income multipliers. The problems encountered in closing the model are discussed and the range of results produced by different closure methods outlined. The direct, indirect and induced employment effects are presented along with type I and type II employment multipliers.

The final chapter sets the achieved objectives in perspective with other Australian studies. The deficiencies of the model are discussed along with suggestions for further research related to input-output compilation and analysis for the Tasmanian economy.

CHAPTER 1

INTRODUCTION

1.1 Objectives and Origins

The objectives of this study were:

(1) to construct an input-output transactions table for the State of Tasmania and determine the associated tables of coefficients

(2) to quantify the structural inter-relationships of the economy by determining the output, income and employment multipliers of Tasmanian industries.

The need for such a study was reported in 1970. Tasmania has long been faced with complex economic problems and the need for economic planning has been recognised both by Tasmanian business leaders and Government. In 1970, the Tasmanian Government together with the Federation of Tasmanian Chambers of Commerce commissioned the Hunter Valley Research Foundation to undertake a growth study of the State.

In one of its recommendations, the report [20 Sect. 17 p. 12 R29] proposed the construction of an input-output model for Tasmania. The report recognised that the techniques of input-output economics enable a wide variety of economic problems to be analysed along with the formulation of guidelines for various types of economic policies.

Since the pioneering work of Wassily Leontief in the 1930's, input-output analysis has grown into a widely accepted method of economic planning and decision making. Input-output tables have been constructed for many countries both developed and underdeveloped, market system and centrally planned. Over the last twenty years it has also become a widely used analytical technique for regional economic studies. An input-output table is a statistical description of the real flows of goods and services within an economy, and between that economy and the rest of the world in a given period. By recording intermediate as well as final flows of goods and services, it represents a more comprehensive system of social accounts than the usual national income-expenditure accounts. Input-output tables are not an alternative to econometric models but rather are complementary to this latter form of analysis. However, input-output analysis can be implemented emperically where no social accounting is performed and economic data is sparse, as is the case in most regional studies.

In the extension of input-output analysis from the national to the regional level the serious problems of demarcation are frequently encountered. This involves demarcation in both a geographical sense and from the point of view of disaggregating economic data. In this respect Tasmania is well suited for regional input-output research. Being an island there is no problem with geographical demarcation and trade beyond the boundaries of the region is readily discernable and tabulated. The economic entity of the study coincides both with a unit of political autonomy and with an administrative unit of the Australian Bureau of Statistics.

CHAPTER 2

INPUT-OUTPUT ECONOMICS

2.1 The Input-Output System

2.1.1 The Transactions Table

The basis of the input-output model is the transactions table. A transactions table can be expressed as a set of linear equations describing the in-flow and out-flow of goods and services among the various sectors of an economy during a given time period - usually a financial year. Each sector or industry has a total output, part of which is used as an input for production by other manufacturing sectors and part absorbed by sectors outside the productive system. These latter exogenous sectors are known as final demand sectors and for this study comprised personal consumption, public authority expenditure, stock changes, capital accumulation, exports to mainland States and overseas exports.

When output is recorded in money values, the transactions table becomes a double entry accounting identity. The total output, for any sector, is equated to the value of inputs from other sectors plus a payments sector for primary inputs - also termed the value added sector. Primary inputs consist of payments for labour, capital and management along with imports from outside the economy. For this model, the payments sector was divided between wages, gross operating surplus, indirect taxes, sales by final buyers and imports from interstate and overseas.

Figure 2-1 shows the normal layout of a transaction table. Each row in the manufacturing or processing sector shows the distribution of the output of that industry to other manufacturing industries and to final demand. Each column of the processing sector shows the industry's input purchases - intermediate goods from other manufacturing industries and primary inputs from outside the processing sector.

The table is subdivided into four quadrants. Quadrant I shows the value of goods and services which flow between industries during the year, reflecting the fact that the outputs of some industries become inputs for other industries. This quadrant is known as the processing sector.

Quadrant II shows the consumption of goods and services by final buyers, and the sectors from which these purchases are made. It is assumed that the purchases shown in quadrant II will not be used to produce further goods and services during the current time period. Capital goods, which form part of the current outputs of the sectors which produce them, will be used in the productive process in later periods. Thus it is important to note that in the transactions table, capital goods are recorded solely in relation to the sectors which produce them, not the sectors which purchase them.

Quadrant III shows payments made for the use of "primary" inputs used in each sector. The rows of this quadrant show how the bulk of the primary inputs used in the economy, have been divided among the various productive sectors. The columns show the value of each primary input used by each sector.

Figure 2-1 QUADRANTS OF THE TRANSACTIONS TABLE

		PROCESSING SECTOR						FINAL DEMAND						
	OUTPUT TO → INPUT FROM ↓	Industry 1	Industry 2		Industry i		Industry n	Consumption	Public Authority Expenditure	Domestic capital Formation	Gross Inventory Accumulation	Exports Interstate	Exports Overseas	TOTAL OUTPUT
PROCESSING SECTOR	Industry 1			Quadrant I					Quadrant II					X_1
	Industry 2													X_2
	Industry i													X_i
	Industry n													X_n
PAYMENTS SECTOR	Wages			Quadrant III					Quadrant IV					
	Gross Operating Surplus													
	Depreciation													
	Payments to Public Authorities													
	Imports Interstate													
	Imports Overseas													
	TOTAL PAYMENTS	X_1	X_2		X_j		X_n							

Quadrant IV shows the primary inputs which pass directly into final use, such as imports of consumer and capital goods, and direct employment of labour by households and non-trading government departments.

As has already been shown, corresponding rows and columns of industries within the processing sector must balance. There is, however, no necessary correspondence between the total of any row or column outside the processing sector. The row values of primary inputs and the column values of final demand are merely required to balance in total.

2.1.2 Mathematical Relationships

Let X_i be the total output of industry i where i=1, ..., n referring to the n endogenous sectors of the economy.

Let x_{ij} represent the amount of output industry i sold to industry j and which is used as an input in producing X_j.

Let D_i be the final demand for output of industry i, that is the sum of the output of industry i sold to the final demand sectors.

Let V_j be the value added for industry j, that is the sum of the payments sector for industries.

For a particular producing industry i, the total output, X_i, of that industry can be distributed among the various industries and final demand component as follows:-

$$X_i = x_{i1} + x_{i2} + \dots + x_{ij} + \dots + x_{in} + D_i.$$

Thus, distribution of output between intermediate and final demand can be expressed as

$$X_i = \sum_{j=1}^{n} x_{ij} + D_i \quad (i=1, \ldots, n) \qquad (2\text{-}1).$$

For a particular consuming industry j, the total output of that industry will be equal to the sum of total inputs (from other industries) plus payments made in the value added sector.

$$X_j = x_{1j} + x_{2j} + \ldots x_{1j} + x_{nj} + V_j$$

$$X_j = \sum_{i=1}^{n} x_{ij} + V_j \quad (j=1, \ldots, n)$$

The whole system can be represented in matrix form.

$$\begin{bmatrix} x_{11} & x_{12} \cdots & x_{1j} \cdots & x_{1n} \\ x_{21} & x_{22} \cdots & x_{2j} \cdots & x_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ x_{i1} & x_{i2} \cdots & x_{ij} \cdots & x_{in} \\ \vdots & \vdots & & \\ x_{n1} & x_{n2} \cdots & x_{nj} \cdots & x_{nn} \end{bmatrix} \quad \begin{bmatrix} D_1 \\ D_2 \\ \vdots \\ D_i \\ \vdots \\ D_n \end{bmatrix} \quad \begin{bmatrix} X_1 \\ X_2 \\ \vdots \\ X_i \\ \vdots \\ X_n \end{bmatrix}$$

$$\begin{bmatrix} V_1 & V_2 & \cdots V_j & \cdots V_n \end{bmatrix}$$

$$\begin{bmatrix} X_1 & X_2 & \cdots X_j & \cdots X_n \end{bmatrix}$$

2.1.3 The Table of Technical Coefficients

The technical coefficient of production may be defined as the amount of output from industry i required to produce a unit of output of industry j.

i.e. $$a_{ij} = \frac{x_{ij}}{X_j}$$

Thus each x_{ij} in the transactions table may be expressed as a product of the technical coefficient a_{ij} and the total output of sector j.

$$x_{ij} = a_{ij}X_j \qquad (2\text{-}2)$$

The technical coefficients may be written in matrix form as follows:-

$$A = \begin{bmatrix} a_{11} & a_{12} \cdots & a_{1j} \cdots & a_{1n} \\ a_{21} & a_{22} & a_{2j} & a_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ a_{i1} & a_{i2} \cdots & a_{ij} \cdots & a_{in} \\ \vdots & \vdots & \vdots & \vdots \\ a_{n1} & a_{n2} \cdots & a_{nj} \cdots & a_{nn} \end{bmatrix}$$

For an industry j, the technical coefficients show the amount of direct purchases required, from other industries, to increase the value of output of industry j by one dollar.

2.1.4 The Table of Interdependence Coefficients

The increase in direct purchases of inputs required to meet an additional dollar output of final demand does not represent the overall addition to total output. The increased purchase of inputs from other industries, requires these industries to purchase additional inputs to meet their increased output. A chain reaction of stimulated indirect production takes place throughout the processing sector.

The combined direct and indirect effects can be calculated by an iterative procedure but in practice this is not possible except for very small matrices. The alternative method is to use the general solution for an input-output model.

By substituting $a_{ij}X_j$ for x_{ij} in (2.1), the technical conditions of production can be written as:-

$$X_i = \sum_{j=1}^{n} a_{ij}X_j + D_i \quad \text{for } i=1, \ldots, n$$

or in matrix form

$$X = AX + D$$

$$X - AX = D \qquad (2\text{-}3)$$

From (2-3), the relationship between an exogenously determined level of final demand and the total production (including intermediate production) required to produce that final demand can be derived:-

$$X(I-A) = D \text{ where I is the } n \times n \text{ identity matrix}$$

$$X = (I-A)^{-1}D \text{ where } (I-A)^{-1} \text{ is the general solution}$$

$$= BD \qquad (2\text{-}4)$$

Each element, b_{ij}, of the matrix B represents the sum of the direct and indirect outputs of industry i required by the economic system in order to deliver a dollar of additional output of industry j to the final demand sector. The matrix B is known as the table of interdependence coefficients.

2.1.5 Stability Conditions

The stability conditions set out the mathematical requirements which must be met by any workable input-output system.

(a) Table of Technical Coefficients

- (i) at least one column in the table add up to less than unity
- (ii) no column in the table add to more than unity (which merely implies that no industry can pay more for its inputs than it receives from the sale of its output).

(b) Table of Interdependence Coefficients

(i) there can be no negative entries.[1]

A negative entry would mean that each time the industry with a negative entry expanded its sales to final demand, its direct and indirect input requirements would decline. That is, the more the industry expanded its output the less it would have to buy from other industries, clearly an economic contradiction. This condition is directly comparable to the linear programming requirements of non-negativity of activity levels.

These conditions are useful checks in the compilation of an input-output study. They are a means of detecting whether or not an error has been made in collecting or assembling data.

2.2 The Assumptions

The system described above is the open static model which is the basic (and still the most frequently used) form for input-output analysis. Before looking at extensions to and variations of this basic model, it is necessary to outline the assumptions of the basic model.

The essential assumptions of input-output theory are concerned with the nature of production. The unit of investigation is the industry which may consist of many individual firms.

It is assumed possible to group the productive sectors of an economy, such that, a single production function can be determined for each industry formed. Corollaries of this assumption are that a

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[1] Known as the "Hawkins-Simon Condition" The mathematical proof is developed in [17]

given product (which for empirical work may be a group of commodities) is only supplied by one industry and that there are no joint products.

Each industry is assumed to have a linear production function which is homogeneous of degree one. When the level of output is changed the amount of all inputs required is also changed in the same proportion i.e. constant returns to scale. The general form of the production function can be represented by

$$X_j = f(x_{1j}, x_{2j}, \ldots, x_{ij}, \ldots x_{nj})$$

Entries in the same column of the transaction table are the inputs of the same production function.

Input-output economics makes a further strong assumption about the nature of production - there is no substitution among input factors. Fixed coefficients of production are a characteristic of the fixed-proportion production function - a limiting case of the traditional homogeneous production function of degree one. A certain minimal input of each commodity (possibly zero) is required per unit of output of each commodity. This special production function is represented by

$$X_j = \min(\frac{x_{1j}}{a_{1j}} \frac{x_{2j}}{a_{2j}} \ldots \frac{x_{ij}}{a_{ij}} \ldots \frac{x_{nj}}{a_{nj}})$$

where the notation min (a, b, ..., z) means the smallest of the numbers a, b, ... z.

Since X_j equals the smallest of the input ratios

then $X_j \leq \frac{x_{ij}}{a_{ij}}$ j=1, ..., n; i=1, ..., n

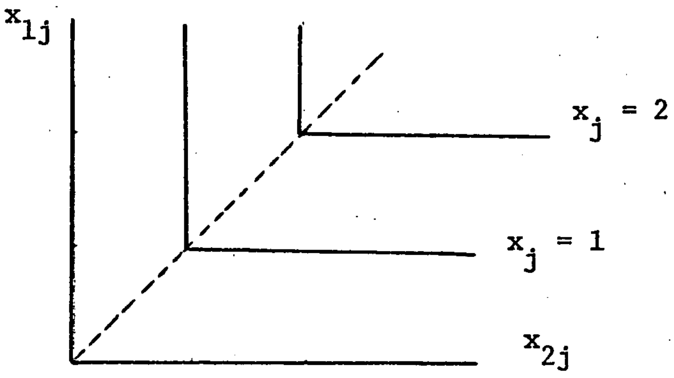
(Output is fixed by the smallest ratio first reached).

However, in drawing up the transaction table only scarce commodities are tabulated as inputs (i.e. free goods are not considered). As it is reasonable to assume no rational industry would use any input beyond the minimum requirement then output reduces to the equality of equation (2-2)

$$x_{ij} = a_{ij}X_j \quad j=1, \ldots, n; \quad i=1, \ldots, n.$$

Each input is required in fixed proportion to output.

With this type of production function there is only one efficient way to produce any given amount of output. The isoquant surfaces are thus nested right-angled corners.



This is a radical departure from conventional production theory where homogeneous production functions of degree one are assumed to have inputs which are continuously substitutable and the technical marginal rate of substitution between inputs diminishes. Ignoring such production possibilities would appear to be a serious limitation for input-output tables for the purposes of analysis and prediction. However, the assumption of discontinuous substitution can be defended in empirical work by the judgement given by Cameron [5 p235] that "the significant opportunity for choice in productive activity is characteristically not a choice between continuously substitutable factors (which can be solved by the equi-marginal productivity condition), but a choice between a finite number of methods of production with each of which is associated certain capital equipment and fairly closely specified rates of flows of inputs."

In practice constant returns to scale and diminishing returns to factor output may exist as depicted in the factor-factor diagram Fig. 2.2. Many different methods of production are open to the manufacturing industry. Each method uses some set of fixed proportions among inputs. One such production method is best at any given time. This is the method which firms in the industry use. An input-output table is a set of observations at a point in time, reflecting the best processes existing at that period of time (say for industry J, inputs 1 and 2 are used in the proportions shown at A)

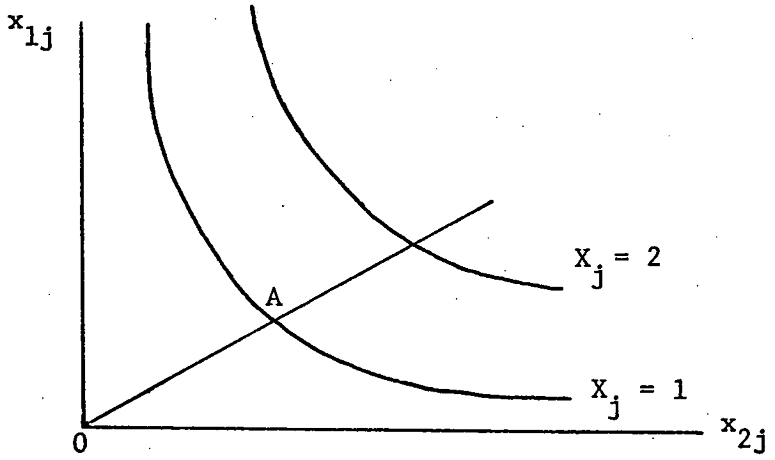


Fig. 2.2

Once a production method is adopted, it will be retained for a certain length of time and used to attain all possible output levels.

Output thus expands or contracts along the scale line OA. Cameron [4] in a time series analysis of selected input coefficients in 52 Australian industries, concluded that his results generally supported the assumption of fixed production coefficients in the short run.

However, eventually the production process changes and consequently technical coefficients change. Improved technology is recognised as the most important factor responsible for altering the technical coefficients (particularly so because technological change is also responsible for most of the changes in relative prices of inputs). Thus it is advisable, that complete or partial revisions of input-output tables be made at time periods of around five years.

A further assumption of the input-output model is that the total effect of carrying on several types of production is the sum of the separate effects. This is the additivity assumption (also an assumption of linear programming models) which rules out the possibility of external economies and diseconomies. This assumption is important in calculating projections. The total of any output needed to produce an assigned target of consumption goods can be built up by adding the separate outputs needed to produce each item of the target.

2.3 Variants to the Open Static Model

2.3.1 The Closed Input-Output System

The open system described earlier may be closed with respect to one or more of the sections in the final demand sector, by making that section of final demand part of the processing sector.

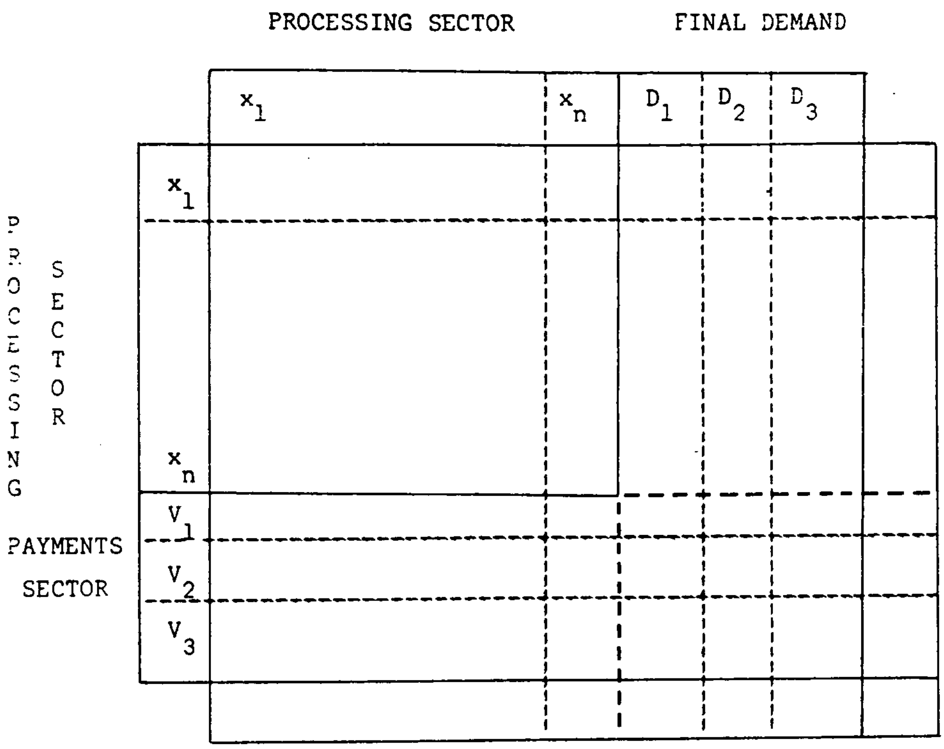
The most common form of closed system incorporates the personal consumption section of final demand as a productive sector. The consumption of goods and services becomes the industry "Households" the output of which is represented by payments to households, that is wage and salary payments (see Figure 2.3). Tables of technical coefficients and interdependence coefficients are formulated for this closed system in the same manner as for the open system.

This system has a close resemblance to the aggregate multiplier of the Keynesian income-consumption theory. Given a change in final demand, the open system is capable of evaluating only the direct and indirect effect on output requirement. However, changes in output levels lead to changes in income which in turn induces changes in consumption. Therefore, only part of the overall impact of a given change in final demand can be evaluated from an open system whereas, the closed system may be used to evaluate the direct and indirect effects of the open system plus the induced changes in income resulting from increased consumer spending.

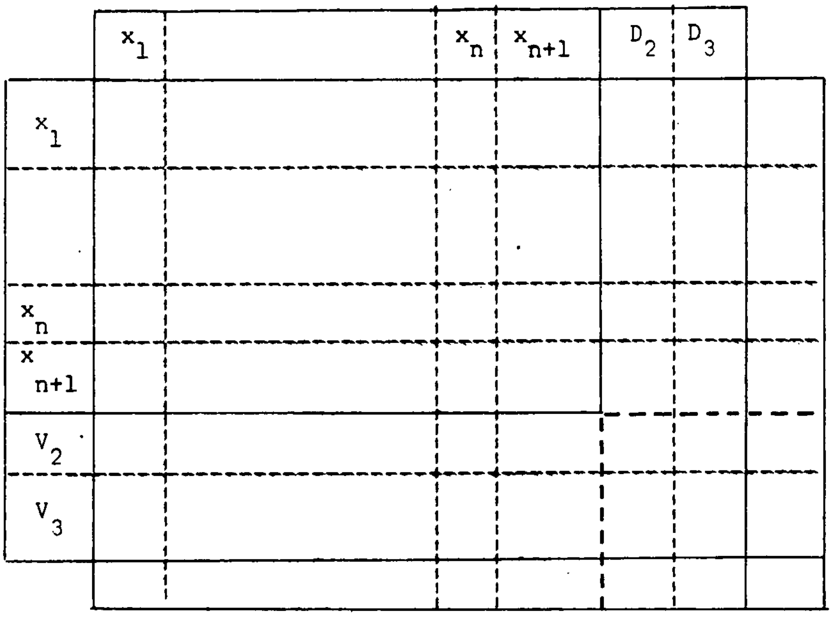
For some analytical work the system is closed with respect to exports and imports - in other cases both households and foreign trade are incorporated in the closed system.

It is also possible to shift an industry, normally included in the processing sector, to the autonomous final demand sector. This technique is used when an analysis is required of the inter-industry effects of changes in the level of activity of the particular industry. The extent to which an input-output system is open or closed is dependent upon the analytical use for which it is intended.

OPEN SYSTEM



PARTLY CLOSED SYSTEM



Section D_1 of the exogenous final demand sector has been made industry x_{n+1} of the endogenous processing sector.

Figure 2·3 Closing the Input-Output Model

The additional sectors made endogenous by closing a system, are also subject to the assumption of fixed coefficients of production. The coefficients associated with consumption, however, are behavioural rather than technical and, as a consequence, are not as stable as the true technical coefficients of a manufacturing industry. Therefore when using a closed system, the consumption coefficients must be revised more frequently than the technical coefficients of an open system.

2.3.2 The Dynamic Input-Output System

The static model is based upon current flows and current output and because of its fixed technical coefficients, it is limited to short run analysis. In recent years much of the research in the field of input-output economics has been directed towards the development of dynamic models aimed at long term analysis. The production of current inputs in one period is proportional to the output level of that period but, by contrast, the amount of capital goods produced is related to production in later time periods. The link between intertemporal models is achieved by using the acceleration principle which relates capital investment to changes in the level of output capacity.

In the static model, capital formation is recorded as a sector of final demand and recorded in the column Domestic Capital Formation. Capital is thus treated as a stock concept in contrast to the flow concept of goods and services within the processing sector. Where sufficient data are available in an economic system, it is possible to construct a capital transactions table. The layout of this table is similar to the transactions table of goods and services.

INTERINDUSTRY TRANSACTIONS TABLE

	x_1		x_j		x_n		S		
x_1	x_{11}				x_{1n}		S_1		X_1
x_i	x_{i1}		x_{ij}				S_i		X_1
x_n	x_{n1}		x_{nj}		x_{nn}		S_n		X_n
	X_1		X_j		X_n				

Sector S of Final Demand represents Domestic Capital Formation.

INTERINDUSTRY CAPITAL TRANSACTIONS TABLE

	x_1		x_j		x_n	
x_1	s_{11}					S_1
x_i	s_{i1}		s_{ij}			S_i
x_n	s_{n1}				s_{nn}	S_n
	S_1		S_j		S_n	

The element s_{ij} of the matrix S may be defined as the quantity of capital goods produced by industry i and sold to industry j.

Each row of the Capital Transactions Table shows the disposal pattern of capital goods produced by a particular industry. Each column shows the source of capital goods purchased by a particular industry.

Average and Incremental Capital Coefficients

The average capital coefficient, k_{ij}, may be defined as the amount of capital goods produced by industry i and required by industry j per unit of output of industry j

i.e. $$k_{ij} = \frac{s_{ij}}{X_j} .$$

The matrix K, of average capital coefficients, is used for structural analysis. The K_{ij}'s show the amount of capital required per unit of output of an industry.

For dynamic analysis, incremental capital coefficients Δk_{ij} are required. These coefficients show the amount of capital required per unit of increase in output capacity of an industry between two time periods.

$$\Delta k_{ij} = \frac{s_{ij}}{\Delta X_j} \quad \text{where } \Delta X_j = X_{j,t+1} - X_j,t$$

Intertemporal models are linked by means of the matrix of incremental capital coefficients, ΔK.

Requirements of the Dynamic Model

The data demands of the dynamic model are enormous and at the present time, theoretical development is well in advance of empirical application so that the dynamic input-output model lies at the frontier of current knowledge.

The construction of a general dynamic interindustry model requires a partly closed system incorporating income generation, a complete description of the capital structure of the economy to provide investment accelerators and some means of estimating alternative production techniques. This latter aspect may require linear or non-linear programming studies of firms within an industry.

A less rigorous, but intuitively appealing approach has been developed to incorporate technological change into dynamic models. New technical coefficients computed from a sample of "best practice" firms in each sector are substituted into the inter-temporal models. The underlying assumption is that at any given time, some firms in an industry are more advanced than others. The input patterns of these "best-practice" firms in an industry can be used to project what the average input patterns of that industry will be at some time in the future.

CHAPTER 3

ECONOMIC ANALYSIS WITH INPUT-OUTPUT MODELS

3.1 Input-Output and Economic Development

Input-output economics provides analytical methods which can be applied to any kind of economic system during any phase of its development. The form of economic analysis is positive rather than normative in that it deals with *what is or what will be* as opposed to *what ought to be*. That is input-output analysis is not an optimising technique.

All the various forms of analysis of input-output economics deal in terms of the final demand for goods and services and the inter-industry transactions required to satisfy that demand for an economy in equilibrium. Thus, the input-output method is a form of consistent equilibrium analysis.

The transactions table of an input-output model gives a detailed quantitative description of the industrial structure of an economy with respect to the year for which it is compiled. Although such a disaggregated presentation of national accounting could of itself be of some value in policy formulation, the real value of the input-output method lies in its capacity to analyse practical problems relating to industrial structure and to devise and test economic policy.

Economic development is brought about by the formation of a high level of interdependence within an economy. Higher real per capita income is achieved through industrialisation and a build up of the related tertiary activities. The shift in employment from primary to secondary and tertiary sectors means that the economy has to undergo a continuous phase of restructuring. Economic expansion can be aided by the use of analytical techniques to formulate economic policies which encourage strong structural interdependence within the economic entity. The input-output method is such a technique which is now widely used in the analysis of economic development, short-run forecasting, and simulation experiments on structural and policy changes for an economy.

The aim of this chapter is to outline some of the methods of economic analysis which may be applied to the transaction table compiled for this study. Some of the analytical techniques have been performed and are presented in Chapter 6, others may be performed in subsequent studies.

The methods fall into two broad categories, qualitative and quantitative analysis.

3.2 Qualitative Analysis

Structural Analysis

In a transactions table where the position of an industry in the table is arbitrarily assigned, hierarchial interindustry relationships may be obscured. Triangularisation is achieved by re-arranging the rows and columns so that, starting from the top of the transaction table, the rows are placed in descending order of the number of zero entries across a row. In a strictly triangular matrix, industries below any given row are that industries suppliers while the industries above that row purchase the given industry's output.

While symmetrical triangularisation is rare, re-arrangement from random ordering of industries towards triangularisation, simplifies the task of identifying interdependence within the economy. Industries near the bottom of a triangularised table have strong interdependence on the output side and are the basic industries of the economy.

Industries near the top of the table have strong interdependence on the input side and therefore have a high multiplier effect upon the rest of the economy when final demand for their product is increased. In planning future development these latter industries are the industries to be encouraged. The interindustry effects set off by their growth generate expansion in all sectors of the economy.

Triangularisation of successive tables is important for making intertemporal comparisons of the productive structure of an economy in order to examine the rate at which strong interdependence is being attained.

The Self-Sufficiency Chart

This form of analysis, explained and illustrated with empirical examples by Leontief [25] in his Scientific American article, makes use of three indicators of interindustry production levels to examine the external trade of an economic entity:-

(a) the amount of production that would be required from each industry to satisfy the direct and indirect demands of the domestic economy if it were to achieve self sufficiency

(b) the direct and indirect requirements of each exporting industry in order that its exports be produced entirely from domestic resources

(c) the amount of production, both direct and indirect required from particular sectors to producer goods that are currently imported.

While the development of strong industrial interdependence is important in the pursuit of economic development, the advantages of specialisation and exchange must be acknowledged together with the fact that economic self-sufficiency is not the ultimate goal.

However, increases in self-sufficiency usually are. The self-sufficiency chart form of analysis projects changes which will have to be brought about in groups of structurally related industries as the economic entity moves towards the degree of self-sufficiency where non-replaceable imports are covered by the exports needed to pay for them. That is, the projections indicate where policy guidance could help bring the economy towards the level of self-sufficiency where exports and imports balance on current account.

3.3 Quantitative Analysis

Multiplier Analysis

The macro economic and employment multipliers, developed from Keynesian theory, deal in the broad aggregates of the economy. The multipliers of input-output analysis deal with the impacts that individual industries exert throughout the economy and are thus supplementary to the aggregative multipliers. By dividing an economy into finer units, input-output analysis is capable of examining effects undetected in general macro analysis.

Industry multipliers were devised in a regional study by Moore and Petersen [31] and developed by Hirsch [18] in a later small area study. Multiplier analysis has become the most important technique used in regional economic impact analysis. Impact studies are concerned with changes in the parameters of an economy such as changes in final demand or a change in input structure of one of more industries. Multipliers relating to output, income and employment may be calculated from the input-output model together with the direct, indirect and induced components.

The output multiplier is the sum of the columns of the open Leontief inverse matrix (matrix B). The output multiplier for each industry J is $\sum_{i} b_{ij}$ and represents total requirements (direct and indirect) per dollar of final demand.

In order to calculate income multipliers the system is closed with respect to "Households". The Type 1 income multiplier is the ratio of the direct plus indirect income change to the direct income change resulting from a dollar increase in final demand for any given industry. The direct income change for a given industry is the entry in the Households row of the table of technical coefficients (let Matrix A including Households be A^*). The direct and indirect income change is calculated for each industry by the vector-matrix multiplication of the row vector for households in the A^* matrix and the column entries for each of the industries in the open Leontief inverse matrix.

$$\sum_{i=1}^{n} A^*_{Hj} \, b_{ij} \quad (j = 1, \ldots, n)$$

The calculation of Type II multipliers requires the generation of a Leontief inverse matrix for the system closed with respect to households (i.e. the B^* matrix). The households row of this matrix gives the direct, indirect and induced income changes per dollar change in final demand and is known as the regional income multiplier. The Type II multiplier is the ratio of the direct, indirect and induced income changes (regional income multipliers) to the direct income change.

Employment multipliers similar to the income multipliers may be calculated from the input-output model and are valuable to planners interested in the employment effects of changes in industrial output. The simplest forms are where employment is assumed to be directly proportional to output such as in the Central Queensland study by

Jensen [21]. The direct employment coefficient (e) for each industry J is calculated as the number of employees per $1,000 of output of industry J

$$e_j = \frac{X_j \text{ (in \$'000)}}{E_j}$$

where X_j is the value of industry output and E_j is the industry employment level in man years. The direct plus indirect employment change is calculated by multiplying the row vector of direct employment change coefficients (e_j) and the corresponding column entries of the open inverse matrix B and summing the resultant products, i.e.

$$\sum_{i=1}^{n} e_j \, b_{ij} \quad j = 1, \ldots, n$$

The calculation of the direct, indirect and induced employment change is similar but the closed inverse matrix B^* is used, i.e.

$$\sum_{i=1}^{n} e_j \, b^*_{ij} \; j = 1, \ldots, n$$

The Type I employment multiplier is the ratio of the direct plus indirect employment change to the direct employment change. The Type II employment multiplier is the ratio of the direct, indirect and induced employment change to the direct employment change.

The above employment multipliers assume a linear homogeneous employment-production function which is likely to be an over-estimation of the real values. More accurate employment multipliers can be produced when sufficient data exists to estimate curvilinear employment-production functions.

Projection and Simulation

Economic projection is one of the principal uses of input-output analysis. The objective is to measure the impact on the economy of autonomous changes in final demand. By decomposing an economy into finer units, input-output forecasting is capable of tracing out effects undetected in general macro-analysis.

For an economy operating under the market system, the final demand sectors are regarded as autonomous. The levels of final demand in a future time period can be estimated by econometric techniques. Input-output forecasting is aimed at determining the levels of activity which will have to be attained within the endogenous processing sector in order to sustain the estimated level of final demand. This is termed "consistent forecasting", as the output of each industry is consistent with the demands, both final and from other industries, for its products.

The projection method is based on the mathematical relationships established in Chapter 2. After estimating the projected level of final demand in appropriate industrial detail, the final demand sectors are aggregated to form a new final demand vector, say D'. Using the equation (2.4) $X = BD$ a new vector of total output, X', can be obtained:-

$$X' = BD'.$$

The levels of activity within the processing sector of a new transactions table can be established from the equation

$$(2.2) \qquad x_{ij} = a_{ij}X_j$$

so that

$$x'_{ij} = a_{ij}X'_j \quad i=1, \ldots, n; \quad j=1, \ldots, n.$$

The transactions table is completed by disaggregating the final demand vector and the payments sector.

Using computers and mathematical software packages the matrix multiplication involved in making projections can be calculated very simply and rapidly. The transactions table thus becomes a model of the flow of goods and services within an economy suitable for simulation studies and sensitivity analysis.

Structural simulation tests can be used to examine the effects of changes in exogenous variables (such as changes in the level of exports) and endogenous variables (such as adding new industries or removing existing industries). Policy simulation demonstrates the effects of government fiscal and monetary intervention in the economy, on such matters as increased government spending in particular sectors, changes in the level of consumer spending induced by changes in direct and indirect taxation and transfer payment. Simulation for policy determination can be performed more efficiently where price and income elasticities of demand have been determined.

Simulation experiments are of particular value to public policy makers when employment is linked to the monetary transactions. The simplifying assumption may be made that employment is directly proportional to the level of output in each industry. The direct employment coefficients described earlier may then be used to calculate the employment levels of new projected output totals for industries. If separate estimations of the exact relationship between levels of output and employment exist, then these equations can be used in lieu of the proportionality assumption. In either case estimations of employment levels on an industry basis, can be made for each new transactions table generated from simulation tests.

CHAPTER 4

REGIONAL INPUT-OUTPUT MODELS

4.1 The Development of Regional Models

The initial theoretical development and early empirical application of input-output economics dealt with a national economy. From the late 1940's there developed an accelerating upsurge in regional economic studies and input-output was quickly adapted to the regional level. Over the years, due to improved official statistics collection, the development of new compilation techniques and the proliferation of computer facilities and capacity, input-output analysis in some variation or form has assumed a dominant position in regional research.

The variety of regional models, which have been both formulated and applied, fall into the two broad classifications of inter-regional and single regional models. The former models take account of inter-dependence between regions as well as industries. As a consequence they are more complex than the latter models which closely resemble national models but refer to a smaller economic entity.

The inter-regional models have developed from two different concepts. The balanced regional model formulated by Leontief [26 Ch.9] used a national input-output table and disaggregates this into regional components. The two or more regions produce regional commodities consumed within their region of origin and national commodities which are traded between regions.

The pure inter-regional model proposed by Isard [22] developed a national table by aggregating a number of regional tables. The balanced regional model has had greater success in empirical application, though from the inception the two systems were not viewed as alternatives but complementary with the balanced regional model serving to determine regional implications of national projections and the pure inter-regional model estimating national implications of regional projections.

Generally, the empirical application of inter-regional models has been restricted by the lack of information on the flow of goods and services between regions. Inter-regional modelling was an ambitious concept to be attempted so early in the development of input-output economics but reflects the long felt desire of regional researchers to identify and quantify inter-regional transactions. Current inter-regional studies have a higher probability of accurately identifying these transactions flows due to the better data, methods and facilities mentioned earlier.

The early single region studies also suffered from a dearth of regional statistics. As an expedient, the compilers of both inter-regional and single region studies were forced to assume that coefficients from national input-output tables applied to the inter-industry flows within a region. Total gross output figures for each sector were assembled from published data and the national coefficients used to calculate the regional transaction table. That is, the a_{ij} elements from the national table of technical coefficients were multiplied by the regional industry output total, X^r_j to give the regional flow of goods from the i-th to the j-th industry, x^r_{ij},

$$x^r_{ij} = a_{ij}X^r_j \quad (i=1, \ldots, n; \; j=1, \ldots, n)$$

This assumption imposes a severe limitation on the use of such input-output tables for analytical purposes.

The single regional models may be broadly classed into those using surveys and those using non-survey techniques. Of the latter the simplest method involved representing the regional economy by essentially, unmodified national technical coefficients. In Australia Mules [31] used this procedure to construct an input-output matrix for South Australia.

The input-output study of Utah by Moore and Petersen [31] achieved a breakthrough from the practice of using unadjusted national coefficients in a regional model. A transaction table calculated by the above method was regarded as a first approximation. Then "the row and column distributions for each sector were modified in the light of differences in regional productive processes, marketing practices, or product-mix" [31 p371]. Statistics relating to exports and imports for the State of Utah were not available. The local inter-industry flows, for each industry, were identified by deducting from the estimates of gross output the estimated demand in Utah. A positive residual was treated as an export and a negative residual as an import. This procedure assumes that input requirements are used first from locally produced goods. This assumption is severely criticised by Tiebout [42 p145] because it "can lead to some ridiculous results in determining net exports and imports."

Since regional coefficients are known to vary considerably from national coefficients, the use of unadjusted national coefficients is undesirable. The largest source of variation between regional and national coefficients arises from the greater openness of regional economies. That is, the import component of any industry will normally be greater at the regional level than at the national level. A variety of adjustment techniques have been devised of which the R A S method is the most widely used.

The first survey-based regional table was produced by Hirsch [18] in a study of a small geographical region (the St. Louis Metropolitan area). Hirsch was able to identify more accurately exports and imports, as well as interindustry flows, by personal interviews and sample survey. Using these methods it was possible to identify the region's exports and imports beyond mere totals for each industry. In the final tabulation of the St. Louis study, the rows identified not only the regional distribution of interindustry sales but also the distribution of sales to specific industries outside the region (i.e. exports were disaggregated). Similarly, the columns identified the interindustry inputs from within the region together with inputs from specific industries outside the region(i.e. imports were disaggregated). The accuracy achieved by this type of study is obtained at very high cost and consequently the method is suitable only for small regional studies.

A hybrid approach, balancing the cheap but potentially unreliable non-survey approach with the cost-prohibitive survey method, is advocated by Richardson [41]. National coefficients are least appropriate to use for primary industries and industries in which the region specialises and surveys are required for accurate estimation.

Some geographically isolated regions record both production and trade data. Exports and imports of the region may be simply recorded as total trade or broken into foreign trade and trade with all other regions of the nation. For such regions, it is possible to construct input-output tables with little or no recourse to national coefficients and with accurate import-export sectors. Parker [34] was able to make such a study for Western Australia.

4.2 Australian Input-Output Studies

Although input-output tables have been compiled on a regular basis in a number of countries, Australian use of input-output analysis has not been extensive until recent years. Australian research began early in the era of input-output work with the construction of national tables by Cameron [6] for the year 1946-47. The production of national tables has since been taken up by the Commonwealth Bureau of Census and Statistics with the initial publication in 1964 of tables for 1958-59 [8]. This first table was regarded as experimental and made no attempt to gather data beyond that which was readily available. For the 1962-63 tables published in 1973 [9], more resources were used together with supplementary inquiries to augment the regular data collections. The 1968-69 tables published in 1976 [10] have a similar industry structure to the 1962-63 tables and for the purposes of analytical work are compatible. The Bureau now plans to produce national tables every five years.

The first State input-output study, that of Western Australia, was made by Parker [34]. The compilation of this table followed more closely that of a national table rather than regional in that commodity data of the factory censuses formed the basis of construction. Input-output tables for South Australia, based on adaption of the 1958-59 national coefficients, were tabulated by Mules [33] and used for the analysis of a particular industry sector.

The first small scale regional model was published in 1969 by McCalden [29] who used input-output analysis for a study of the economic structure of the town of Muswellbrook in New South Wales. Since that time there have been a number of town or city input-output studies compiled by survey work. These included Gatton (Qld) by Reynolds [40] and Tamworth (N.S.W.) by Percival [39] where the partial input-output method of intersectional flows was used. Harvey [16] produced an input-output model of the Darling Shire to examine the effects of the 1969-70 wool price slump on the economy of the township of Bourke. McGaurr [30] constructed input-output tables for Toowoomba with 9 of the 15 processing industries estimated from survey data with 2 industries estimated exclusively from secondary data.

Two sub-State, large regional studies have recently been completed by Jenson [23] with Central Queensland and Mandeville [28] with the Macquarie Region of New South Wales, both based on field work with questionnaires. The first inter-regional study in Australia is currently being prepared by a research team, led by members of the Department of Economics, University of Queensland [24]. Other input-output tables currently under construction include a model of South Australia by Butterfield, the Illawarra Region by Ali and the Townsville Region by Dickenson.

4.3 <u>The Need for a Tasmanian Regional Study</u>

In a report [35] presented to the Tasmanian Parliament on the occasion of the 1970-71 Budget, the Treasurer expressed concern that Tasmania's economic performance, in the pursuit of economic goals, compared unfavourably with that of mainland States and the overall Australian achievement. The objectives of economic policy in Australia have appeared from time to time in public documents and were consolidated by the Vernon Committee of Economic Enquiry [11] as:

A high rate of economic growth

A high rate of population growth

Full employment

Increasing productivity

Rising standards of living

External viability

Stability of costs and prices

Although, over the last decade, the level of achievement at a national level may have vacillated, at State levels there has been even greater variation, and in addition, widely differing rates of attainment of objectives between the component States have been observed. Indices which provide measures of regional prosperity currently suggest that Tasmania still does not measure up to the performance of other States. Table 4.1 shows that Tasmania has the lowest household income per capita and the lowest average weekly earnings per employed male unit of all Australian States.

Table 4.1 Average Income and Wages - Australia

$

	N.S.W.	Vic.	Qld.	S.A.	W.A.	Tas.	Aust.
Household Income per capita 1975/76	4499	4581	4124	4233	4291	3888	4404
Average Weekly earnings per employed male unit 1976/77	191	188	182	177	188	180	188

Source [33]

For many years, Tasmania has had an unemployment level higher than the Australian average, for 1976/77 5.24 per cent of the work force as against the Australian figure of 4.99 per cent.

Regional studies have indicated that a disparity in regional prosperity is prevented from growing to large proportions by the balancing mechanism of population drift, i.e. out-migration takes place from relatively depressed regions and is directed towards areas of better employment opportunities.

The net migration figures for Tasmania, indicate that the balancing mechanism operates. Despite a higher than average birth rate, Tasmania has a low rate of population growth by comparison with the rest of Australia. This can be attributed to the very low net migration figure for the State which in some years is actually negative. A significant feature of the population drift is that most out-migration appears to emanate from the 15-24 year age group, the new entrants to the work force.

The Draft Report of the State Strategy Plan [37 p10] has commented "..... the recorded unemployment in Tasmania at the end of June 1976, of about 9,000 persons, does not represent the true position. The migrants from Tasmania of working age should be considered as part of the unemployed of Tasmania. If they were to return immediately then there would not readily be employment for them. The true unemployment situation is closer to 11,200 unemployed, or nearly 6.2 per cent of the work force".

While the objective of a high rate of population growth has currently become controversial in some States it remains an important objective for Tasmania. The small Tasmanian population impedes economic development in that the domestic market is too small for many industries to achieve competitive economies of scale in production. High interstate freight rates accentuate the problem by making it difficult for

Tasmanian based industries to attain viable size by means of interstate marketing.

Apart from deterring the establishment of new industries, the interstate shipping rates have actually prompted a number of established firms to relocate on the mainland and others to undertake comparative cost studies to examine the feasibility of relocation.

The drift of potential work force participants has resulted in Tasmania being the State with the lowest proportions of population in the working age group 19 to 64 years. The Grants Commission [12 p8] has commented that this is one of the factors which may contribute to a State's comparatively low fiscal capacity.

The rural sector is also beset with serious problems. Along with the rural industries of all other States, the rural industries in Tasmania are being forced to restructure. By comparison with the more populous States, Tasmanian farm reconstruction may well have a greater impact on the economy of the State. Farm size is small, the proportion of the work force engaged in rural production, 9.0 per cent, is greater than the Australian average of 7.3 per cent (1971 Census figures) and most rural industries are more export oriented than the overall average for corresponding Australian industries. Two major rural industries, fruit growing and dairying are facing severe marketing problems for their products and industry contraction is taking place. Will the displaced farm operators and farm workers be provided with employment in the State, or will an accelerated drift towards interstate migration take place?

To what extent will changes in farm size and farm population affect interdependent industries?

In order to reverse what appears to be a trend towards economic stagnation, special policy measures are required to stimulate economic growth. These economic policies call for special economic analytical and planning procedures. An input-output study is a contribution towards this requirement. Despite the limitations imposed by the simplifying assumptions detailed in Chapter 2 and the problems of data deficiency outlined in this chapter input-output, with its rigid organisational framework and accounting consistency checks, has been shown to be an empirically workable model.

CHAPTER 5

PROCEDURE AND DATA SOURCES

5.1 The Integrated Censuses

The financial year 1968-69, the year of the first integrated census in Australia, was selected for this study. The integrated economic census has been the most important development affecting the quality of statistics compiled by the Australian Bureau of Statistics (ABS). The integration of censuses for manufacturing, mining, wholesale and retailing has meant that for the first time these censuses have been collected with a common framework of reporting units and data concepts and conform to an international standard industrial classification. The Australian Standard Industrial Classification (ASIC) [10] follows the principles used in the United Nations Industrial Standard Classification of objective coding of establishments to industry classes according to the nature of the detailed output of commodities and services reported by them.

The integrated censuses provided a far more comprehensive and consistent set of data for this study than had been available for earlier input-output studies in Australia. The integrated censuses were initiated by the demand for statistics suitable for economic studies, including input-output, the data needs of which were taken into account in the design of the censuses. The structure of the census analysis was directed towards the derivation of the more internationally accepted "value added" instead of the former concept of "value of production". The value of turnover was collected instead of the value of output at the factory and purchases and selected expenses in addition to the value of specified materials.

Large companies with a range of manufacturing activities were treated as being composed of several separate establishments. For instance, the mining operations of Electrolytic Zinc Company of Australasia Ltd. appeared as part of ASIC classification 11, ore processing in ASIC 29 and fertiliser manufacture in ASIC 271. The construction component of the transactions of the Hydro Electric Commission were incorporated in "Other Building" and not in "Electricity and Gas".

As well as new concepts of statistical structures and collection techniques, the integrated censuses for 1968-69 involved the development of major new computer programmes for storing, processing and tabulating data. All of these aspects of the new integrated censuses contributed to a considerable delay in publishing results. Preliminary information relating to highly aggregated structural data first appeared in 1971. Commodity data did not become available till late 1972.

5.2 The Selection of Industries

Input-output studies can be categorised into those that deal with national economies where data principally comes from official statistical sources, or regional studies where official statistics are inadequate so that surveys and other methods of estimating data have to be employed, most frequently by extrapolation from coefficients of national tables. Because of the wealth of official statistics recorded for Tasmania, this study has been directed at producing a table from published statistics with a minimum recourse instead of the value of output at the factory and purchases and selected expenses in addition to the value of specified materials.

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In order that the input-output table be of manageable size, manufacturing establishments had to be aggregated to form industries. Research into the aggregation problem by Fisher [14] and later Morimoto [32] suggested that an ideal aggregation would bring together establishments with a similar input pattern and producing the same products. In practice this requirement is very difficult to achieve and in this study (along with most others) the industries defined have been determined by the data available. For the major part of the table, the industries were based on the classifications used in the published results of the integrated censuses. Outside the censuses, a number of cost surveys were available for the rural sector and these were used to determine agricultural industries. Very little published data existed for the commercial industries and this sector finished up an aggregated conglomerate of financial, business and service industries.

Although the industries for the study had to be drawn up right at the outset, they could only ever be regarded as tentative. During compilation, the classification had to be changed many times. The resultant forty-five processing industries were less than half the industry size of national tables but considerably larger than most regional tables. The only other State table produced by similar methods, that of Western Australia [34] was of comparable size with 54 processing industries. Table 5.1 shows the ASIC classification of the industries together with the number of establishments operating within each industry.

Table. 5·1

INDUSTRY CLASSIFICATION IN TERMS OF ASIC

		ASIC	No. of ESTABLISHMENTS
1	Sheep	0111	2650
2	Beef Cattle	0121	420
3	Dairying	0122 0123	2550
4	Poultry	013	160
5	Fruit and Intensive Farming	014 0174	1240
6	Forestry	030	
7	Fishing and Hunting	041 042	
8	Metallic Minerals	11	39
9	Non-Metallic Minerals	12 14 15	36
10	Meat Products	211	35
11	Milk Products	212	30
12	Fruit Products	2131	15
13	Vegetable Products	2132	5
14	Flourmill and Cereal Products	215	7
15	Bread, Cakes and Biscuits	216	84
16	Other Food Products	214 218	11
17	Beverages and Malt	219	15
18	Textiles Yarns and Woven Fabrics	23	17
19	Clothing and Footwear	24	13
20	Log Sawmilling	2511	196
21	Resawn and Dressed Timber	2512	34
22	Joinery and Fabricated Board	2513-4-5-6	113
23	Furniture and Mattresses	252	54
24	Pulp, Paper and Paper Board	2611	4
25	Paper Bags and Fibre Board Containers	2612-4-5	6
26	Publishing and Printing	262	42
27	Basic Chemicals	271	8
28	Other Chemicals	272-4	8
29	Clay Products	282	12
30	Cement and Cement Products	283	34
31	Other Non-Metallic Mineral Products	281 284	7
32	Basic Metal Products	29	14
33	Fabricated Metal Products	31	88
34	Motor and Rail Vehicles	321 3223-4-5	12
35	Ship and Boat Building	3221-2	15
36	Other Manufacturing	33 34	72
37	Electricity and Gas	361 362	5
38	Residential Building	411 (part) 42 (part)	
39	Other Building	411 (part) 412 42 (part)	
40	Wholesale Trade	46 47	920
41	Retail Trade	48	4007
42	Transport and Storage	51 52 53 54 55 56	
43	Ownership of Dwellings	632 (part) and imputed rent	
44	Commerce	61 62 631 632 (part) 633 91 92 93 94	
45	Government	37 71 72 81 82 83 84	

5.3 Construction Procedure for the Transactions Table

To ensure that the large volume of data used in the construction of the transactions table was handled in a systematic and consistent manner, rules of procedure were adopted from three sources. Evans and Hoffenberg [13] for an early empirical study, compiled a comprehensive description of the practical and conceptual problems encountered. This work remains the most widely used reference for input-output emperical procedures. Secondly Chapter 3 of Cameron's publication [7] gives an excellent description with a worked example of the procedure for constructing assignment and transactions tables. Finally the descriptive text accompanying the ABS 1962-63 tables [9] was particularly valuable source of reference during construction.

The construction procedure made use of the accounting relationship within a transactions table to provide both means of locating specific gaps in the statistical data and a means of checking inconsistencies between different sources. A flow diagram, linking the various tables of published structural data was constructed for each industry. Figure 5.1 is an example of an industry flow diagram. These diagrams provided industry totals which formed the perimeter of the transactions table and provided control figures for the entries to the inner cells of the matrix.

Beginning with the manufacturing sector, commodity data were assembled under two classifications, commodities and industries. For data collection purposes, the ABS assigned an establishment to an industry according to the principal product of the establishment. Many establishments, however, manufactured more than one commodity.

INDUSTRY NO................

DETAILS OF OPERATIONS

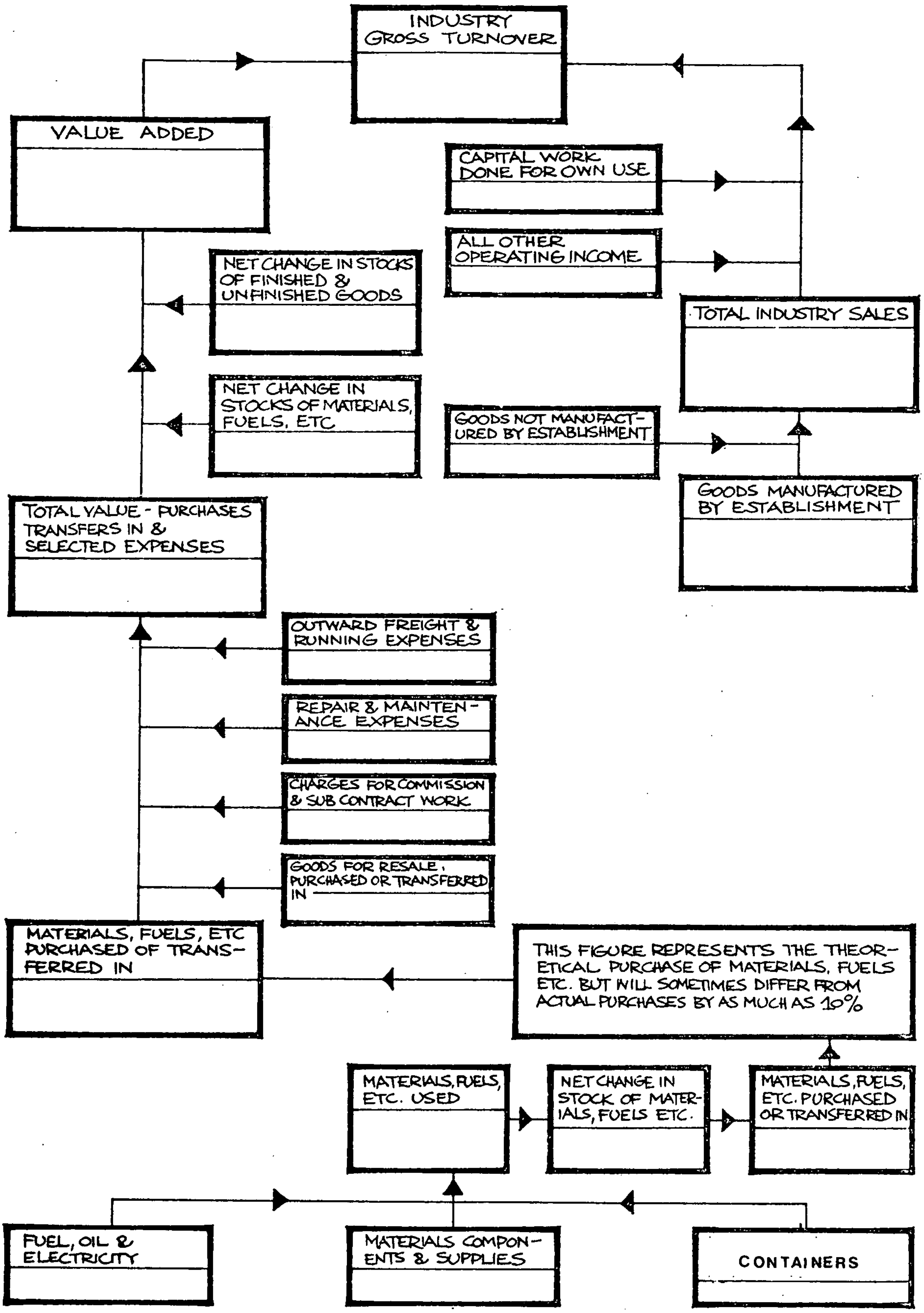


FIGURE 5-1

The commodity list, therefore, was much larger than the number of industries. Also a number of commodities in the list were produced by more than one industry. For this reason, an assignment table had to be compiled prior to the transactions table. The layout is depicted in Figure 5.2. This procedure enabled the total output of each commodity to be assigned to the several industries producing that commodity.

Two commodity checks were then provided:-

(1) for each industry whether the total costs were equal to the total value of commodities produced;

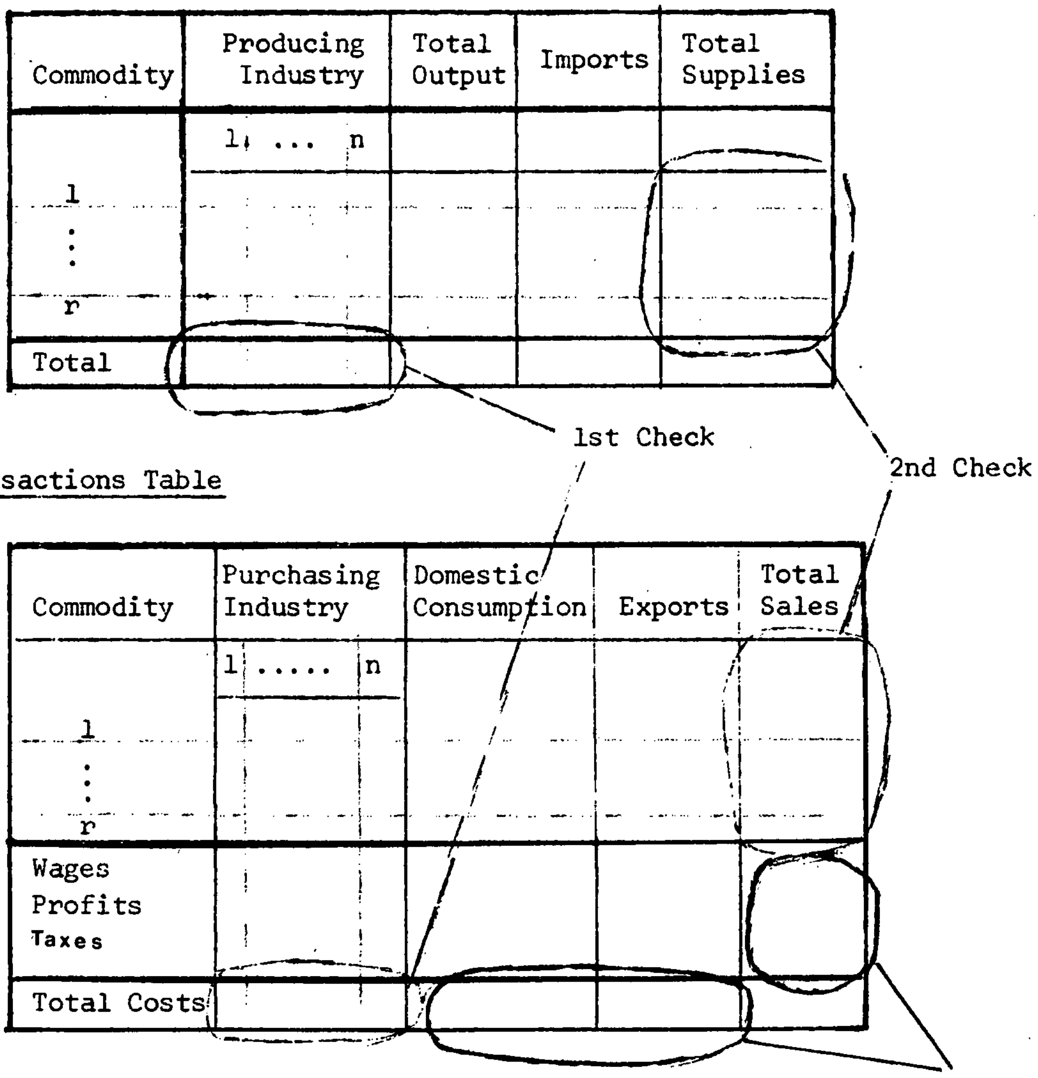
(2) for each commodity, whether total supplies were in equality with total sales.

The commodity groupings were aggregated and the matrix transposed to form a "make matrix". Off-diagonal elements in this matrix represented secondary production. The coverage ratios (production by the industry of commodities primary to it, expressed as a percentage of the total output of such commodities) and specialisation ratios (production by the industry of commodities primary to it, expressed as a percentage of the total output of that industry) were calculated for all industries. For industries or commodity groupings with poor ratios, further aggregations were made to arrive at the make-matrix presented on Table 5.2.

The usage of commodities by consuming industries was assigned from commodity worksheets and not from the make-matrix. Where possible, supplying industries were identified but in most cases the assignment was in accordance with the market share assumption - commodities are assumed to be purchased from producing industries in

Figure 5·2 COMPILATION ARRANGEMENT FOR TRANSACTIONS

A. Assignment Table



Commodity	Producing Industry	Total Output	Imports	Total Supplies
	1 ... n			
1				
⋮				
r				
Total				

B. Transactions Table

Commodity	Purchasing Industry	Domestic Consumption	Exports	Total Sales
	1 ..... n			
1				
⋮				
r				
Wages Profits Taxes				
Total Costs				

3rd Check Sum of primary input totals equals sum of final demand totals

Table 5-2 Tasmanian Input-Output Tables 1968-69 Make Matrix of the Manufacturing Sector

		COMMODITY GROUP PRODUCING INDUSTRY	1 211 MEAT PRODUCTS	2 212 MILK PRODUCTS	3 2131 FRUIT PRODUCTS	4 2132 VEGETABLE PRODUCTS	5 215 FLOURMILL & CEREAL PRDTS	6 216 BREAD CAKES AND BISCUITS	7 214218 OTHER FOOD PRODUCTS	8 219 BEVERAGES AND MALT	9 231232 TEXTILES YARNS WOVEN FAB	10 233 CARPETS FELT CANVASS	11 24 CLOTHING AND FOOTWEAR	12 2511 LOG SAWMILLING	13 2512 RESAWN & DRESSED TIMBER	14 2514 JOINERY WOODEN FITTINGS	15 2515 WOODEN CONTAINERS	16 25132516 PLYWOOD OTHER WOOD PRODT	17 252 FURNITURE AND MATTRESSES	18 2611 PULP PAPER & PAPERBOARD	19 26122614 PAPERBAGS FIBREBD CONTRS	20 2621 PUBLISHING	21 26222623 PRINTING AND STATIONERY	22 271 BASIC CHEMICALS	23 272274 OTHR CHEMS RELATED PRODS	24 282 CLAY PRODUCTS	25 283 CEMENT & CEMENT PRODUCTS	26 281284 OTHR NONMETAL MINERAL PD	27 29 BASIC METAL PRODUCTS	28 3111 FABRICATED STUCTRL STEEL	29 31123114 ARCHITURL PRCD PLATE STL	30 312 SHEET METAL PRODUCTS	31 313 OTHER FABRICTD METAL PDS	32 3213223 MOTOR AND RAIL VEHICLES	33 32213222 SHIP AND BOAT BUILDING	34 331 PHOTOGPHIC SCIENCE EQUIP	35 332 APPLIANCES ELECTL EQUIP	36 333 OTHER MACHINERY EQUIPMNT	37 34 MISCELLANEOUS MANUFACTRE	38 0 ADJUSTMENT	TOTAL PRODUCTION BY INDUSTRY CLASS	PRODUCTION CLASSED PRIMARY TO INDUSTRY CLASS	PRODUCTION CLASSED SECONDARY TO INDUSTRY CLASS	SPECIALIZATION RATIO
1	211	MEAT PRODUCTS	19713	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	N.P.	36	19749	19713	36	99,82
2	212	MILK PRODUCTS	..	30572	..	..	..	N.P.	N.P.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	215	..	..	442	31229	30572	657	97,90
3	2131	FRUIT PRODUCTS	..	..	4547	N.P.	..	..	N.P.	N.P.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	N.P.	..	..	..	..	..	..	..	332	4880	4547	332	93,19
4	2132	VEGETABLE PRODUCTS	..	..	..	13151	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	13151	13151	0	100,00
5	215	FLOURMILL & CEREAL PRDTS	..	..	..	51	3146	..	537	54	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3788	3146	642	83,05
6	216	BREAD CAKES AND BISCUITS	..	..	..	..	..	7353	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	7353	7353	0	100,00
7	214218	OTHER FOOD PRODUCTS	..	N.P.	..	..	407	..	22510	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	**	22917	22510	407	98,22
8	219	BEVERAGES AND MALT	..	..	N.P.	..	..	..	..	8592	..	..	..	..	..	..	..	..	..	..	..	..	..	N.P.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	237	8829	8592	237	97,32
9	231232	TEXTILES YARNS WOVEN FAB	..	..	..	..	..	..	..	..	32492	N.P.	N.P.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	N.P.	..	..	224	32716	32492	224	99,32
10	233	CARPETS FELT CANVASS	..	..	..	..	..	..	..	..	..	1735	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	N.P.	..	..	..	..	..	N.P.	52	1787	1735	52	97,09
11	24	CLOTHING AND FOOTWEAR	..	..	..	..	..	..	..	..	N.P.	..	1366	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	**	1366	1366	0	99,99
12	2511	LOG SAWMILLING	..	..	..	..	..	..	..	..	..	..	..	12546	825	..	19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	13391	12546	844	93,70
13	2512	RESAWN & DRESSED TIMBER	..	..	..	..	..	..	..	..	..	..	..	2317	13003	N.P.	27	..	N.P.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	115	15462	13003	2458	84,10
14	2514	JOINERY WOODEN FITTINGS	..	..	..	..	..	..	..	..	..	..	..	..	83	3513	N.P.	N.P.	24	..	..	..	..	..	..	..	..	..	..	..	..	..	N.P.	..	N.P.	..	..	..	..	18	3638	3513	125	96,56
15	2515	WOODEN CONTAINERS	..	..	..	..	..	..	..	..	..	..	..	N.P.	..	..	897	..	..	..	..	..	..	..	..	..	..	..	..	..	..	N.P.	..	..	..	..	..	..	..	22	919	897	22	97,60
16	25132516	PLYWOOD OTHER WOOD PRODT	..	..	..	..	..	..	..	..	..	..	..	N.P.	..	..	..	8409	N.P.	..	..	..	..	..	..	..	..	..	..	..	..	..	N.P.	..	..	..	..	..	N.P.	32	8441	8409	32	99,62
17	252	FURNITURE AND MATTRESSES	..	..	..	..	..	..	..	..	..	15	..	..	N.P.	153	..	18	5095	..	..	..	..	..	..	..	..	..	..	..	..	N.P.	55	N.P.	..	..	..	..	N.P.	33	5369	5095	273	94,91
18	2611	PULP PAPER & PAPERBOARD	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	61359	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	61359	61359	0	100,00
19	26122614	PAPERBAGS FIBREBD CONTRS	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5854	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5854	5854	0	100,00
20	2621	PUBLISHING	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1519	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1549	1519	30	98,05
21	26222623	PRINTING AND STATIONERY	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	95	24	5086	..	**	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5205	5086	120	97,70
22	271	BASIC CHEMICALS	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	23669	..	..	..	N.P.	N.P.	..	..	..	..	..	..	..	..	..	..	311	23980	23669	311	98,70
23	272274	OTHR CHEMS RELATED PRODS	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1003	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1003	1003	0	100,00
24	282	CLAY PRODUCTS	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2118	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2118	2118	0	100,00
25	283	CEMENT & CEMENT PRODUCTS	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	11682	N.P.	..	..	..	..	..	..	..	..	..	..	..	16	11697	11682	16	99,87
26	281284	OTHR NONMETAL MINERAL PD	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1190	..	..	..	..	..	..	..	..	..	..	..	..	1190	1190	0	100,00
27	29	BASIC METAL PRODUCTS	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	118623	N.P.	N.P.	..	N.P.	..	..	..	..	313	..	589	119526	118623	903	99,24
28	3111	FABRICATED STUCTRL STEEL	..	..	..	..	..	..	..	..	..	..	..	..	..	N.P.	..	..	..	..	..	..	..	..	..	..	..	..	202	3829	10	103	25	30	..	..	1	193	N.P.	1	4393	3829	564	97,16
29	31123114	ARCHITURL PROD PLATE STL	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	N.P.	1556	94	N.P.	N.P.	N.P.	..	..	N.P.	..	429	2079	1556	523	74,83
30	312	SHEET METAL PRODUCTS	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	130	..	..	..	..	..	..	..	..	..	N.P.	..	N.P.	3042	N.P.	N.P.	..	N.P.	132	N.P.	..	39	3342	3042	300	91,01
31	313	OTHER FABRICTD METAL PDS	..	..	..	..	..	..	..	..	N.P.	N.P.	..	..	..	..	..	..	N.P.	..	..	..	..	..	..	..	..	..	N.P.	N.P.	72	..	3554	..	..	..	..	..	N.P.	735	4360	3554	806	81,51
32	3213223	MOTOR AND RAIL VEHICLES	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	N.P.	..	..	..	..	..	..	..	..	..	..	N.P.	N.P.	..	382	5474	..	..	..	..	..	21	5877	5474	403	93,14
33	32213222	SHIP AND BOAT BUILDING	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	176	..	..	..	N.P.	**	176	176	0	99,97
34	331	PHOTOGPHIC SCIENCE EQUIP	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	N.P.	..	..	..	148	..	..	..	10	158	148	10	93,55
35	332	APPLIANCES ELECTL EQUIP	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	107	..	..	..	..	3409	N.P.	N.P.	7	3523	3409	114	96,76
36	333	OTHER MACHINERY EQUIPMNT	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	N.P.	..	..	..	..	..	..	..	..	..	N.P.	100	N.P.	..	N.P.	59	26	N.P.	171	1279	..	190	1825	1279	546	70,06
37	34	MISCELLANEOUS MANUFACTRE	..	..	..	..	..	..	..	..	..	N.P.	..	..	..	..	..	..	N.P.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	N.P.	..	676	50	726	676	50	93,12
38	0	ADJUSTMENT	..	**	192	93	..	219	232	129	45	125	58	18	27	20	9	**	140	..	..	..	..	44	..	..	..	17	811	846	22	128	272	50	25	7	186	168	56	..	3940	0	0	,00
		TOTAL PRODUCTION BY COMMODITY GROUP	19713	30572	4740	13295	3553	7572	23279	8776	32537	1875	1424	14881	13939	3686	952	8427	5390	61359	5949	1543	5116	23713	1004	2118	11682	1208	119635	4775	1660	3474	4287	5612	227	155	4114	1954	732	3941	458865			
		PRODUCTION CLASSED PRIMARY TO COMMODITY GROUP	19713	30572	4547	13151	3146	7353	22510	8592	32492	1735	1366	12546	13003	3513	897	8409	5095	61359	5854	1519	5086	23669	1003	2118	11682	1190	118623	3829	1556	3042	3554	5474	176	148	3409	1279	676	0		443885		
		PRODUCTION CLASSED SECONDARY TO COMMODITY GROUP	0	0	192	144	407	219	769	184	45	140	58	2335	935	173	55	18	294	0	95	24	30	44	0	0	0	17	1012	946	104	432	733	138	51	7	705	675	56	0			11039	
		COVERAGE RATIO	100,00	100,00	95,94	98,92	88,55	97,11	96,70	97,91	99,86	92,51	95,96	84,31	93,29	95,30	94,27	99,79	94,54	100,00	98,40	98,42	99,41	99,81	99,97	100,00	100,00	98,56	99,15	80,19	93,74	87,56	82,89	97,54	77,51	95,25	82,86	65,45	92,33	,00				

** VALUE LESS THAN $500

THE ELEMENTS OF THE ADJUSTMENT ROW AND COLUMN ARE THE AGGREGATED VALUES OF CONFIDENTIAL ENTRIES proportion to their levels of output. During the assignment task, where allocation according to the market share assumption became too subjective, further aggregations of industries were made so that, the final table finished up with 27 manufacturing industries.

A similar procedure of commodity assignment was adopted for the rural, fishing and mining industries. The third consistency check was to test that the sum of primary input totals equalled the sum of final demand totals.

In the construction of an input-output table, inter-industry flows can be traced by determining either the distribution of sales (i.e. filling out the rows) or the cost structures of industries (recording the column elements). For each industry the sources of information were always incomplete so that both methods had to be used concurrently as industry sales can substitute for inadequate data on another industry's costs and vice versa, an industry's purchases can provide information on another industry's output distribution. The output of the transport and teriary sectors was determined largely from usage data of other industries. Data on inputs for these industries were sparse and national coefficients were used to assist in the estimation of input columns.

The transaction values for the rural and fishing industries were determined on an industry basis using published industry surveys, farm financial recording data of the Department of Agriculture, the A.B.S. bulletins "Primary Industries and Meteorology" and "Trade and Shipping".

Although this meant allowing for secondary production, the industry basis was considered more accurate than the ABS method of defining industries on a commodity basis and adjusting the survey data. It was fortunate that for the accounting period chosen for this study a large number of economic surveys were made on Tasmanian primary industries. Information was extracted from the following sources:

The Australian Sheep Industry Survey 1967-68 to 1969-70, Bureau of Agricultural Economics 1972.

The Australian Dairy Industry, An Economic Survey 1968-69 to 1970-71, Bureau of Agricultural Economics 1973.

The Australian Apple and Pear Industry, An Economic Survey 1967-68 to 1969-70, Bureau of Agricultural Economics 1972.

The Australian Commercial Egg Producing Industry, An Economic Survey 1968-69 to 1970-71, Bureau of Agricultural Economics 1974.

The Tasmanian Beef Cattle Industry 1968-69 to 1970-71, Bureau of Agricultural Economics 1973.

Beef Cattle on Australian Sheep Properties, Occasional Paper No. 8, Bureau of Agricultural Economics 1972.

Pig Raising in Australia, An Economic Survey 1967-68 to 1969-70, Bureau of Agricultural Economics 1972.

Smith, J.T. and Fergusson, D.J. "The Tasmanian Crayfishery, An Economic Survey 1964-65", Supplement to: Tasmanian Fisheries Research Vol. 3 No. 2 Hobart 1969.

Price Structure of the Fresh Milk and Manufacturing Sectors of the Tasmanian Dairy Industry, Robin Gray and Associates, Launceston, 1970.

Australian Hop Industry Survey 1969-70, J.P. Makeham and Associates, Melbourne, 1970.

Estimates of Agricultural Expenditure 1968-69 to 1970-71, Australian Bureau of Statistics 1973.

The total value of output for agriculture and fishing was at "local value" as published by the ABS. Forestry included the value of forest products as published by the Bureau and Government current expenditure on management of forest resources from the annual report of the Forestry Commission.

For the industry "Electricity and Gas", in addition to census data, information was used from the annual report of the H.E.C. and The Electricity Supply Industry in Australia published by the Electricity Supply Association of Australia.

Output of the two building industries was defined on an activity basis with industry 38 representing the value of work done on new dwellings and industry 39 consisting of all construction other than dwellings and all repairs. The published building statistics had to be supplemented by recourse to the national tables for estimates of transaction values.

The industry "Government" included the three tiers, Federal, State and Local. It was an aggregate of a number of industries used in national tables and included Public Administration, Defence, Welfare Services and the government portion of Education, Health, Communication and Water, Sewerage and Drainage.

5.4 The Treatment of Conceptual Problems

5.4.1 Valuation of Production

In the compilation of an input-output table the value of output can either be expressed in producers' values which are the prices sellers receive for their goods, or in purchasers' values which are the prices buyers pay for their goods. The latter is larger than the former because it includes transportation costs, wholesale margins and retail margins. The trade and transport industries are treated as producing the value of their services as measured by their gross margins. The two pricing systems are alternative methods of distributing these services among the other industries in the table.

In a table using producers' prices, each industry is treated as paying the transportation costs and trade margins on all its input purchases. The value of these services is treated as purchases from the trade and transport industries. Thus both outputs and inputs are stated at f.o.b. prices. Each specific marketing cost is assigned as a direct cost to the industry that consumes the commodity. Output of the trade activities is defined as gross margins - operating costs plus net revenues, i.e. the value of goods handled by trade establishments is not counted.

In a purchasers' price system, each industry is treated as paying the transportation and trade costs of all its sales of output. The sales and purchases of commodities are stated at delivered prices. Each specific marketing cost is assigned as a direct cost to the industry that produces the commodity and is part of its input pattern. Marketing costs are actually counted twice; first as a purchase by the producing industry and second in the value of outputs from that industry.

Producers' prices have been used in this study because they avoid double counting and its consequent distortion of technical coefficients. The commodity flows have been valued at the price at which they leave the producer and exclude commodity taxes. These are shown as paid by the users of the commodities on which these taxes are levied. The transaction table thus conforms with the national tables which are described as being at "basic values". With respect to intra-industry flows, some studies show these values in the transactions table and others, such as 1962-63 Australian tables [9], net out such flows. With the integrated censuses, data transfers to other establishments within the same enterprise have been collected so that in this study it has been possible to estimate intra-industry flows with sufficient accuracy to compile the table in gross values.

5.4.2 Competitive and Non-Competitive Imports

Imports for final use have been charged directly to the various sectors of final demand. However, imports for intermediate use had to be divided into competitive imports, imported commodities which were also produced domestically, and non-competitive imports, imported commodities not produced domestically. This latter group was treated in the same manner as imports for final use, that is, entered directly as inputs of purchasing industries. The allocation of competitive imports was complicated by the methods of data collection. When an enterprise within an industry is recording its inputs for statistical purposes, the usual procedure is not to make the distinction as to whether the commodity used is imported or of local origin. Consequently usage data do not distinguish competitive imports.

As a matter of statistical expediency, many national inter-industry studies allocate competitive imports indirectly. The import is consumed by an industry, processed along with the domestic counterpart and then redistributed in that industry's output row. With this method there is a measure of double counting as the total of each row and column does not represent purely domestic production but rather the total output of the domestic industry plus competing imports.

In this study all imports have been allocated directly. The small size of the economic entity allowed most competitive commodities in the import data to be traced to an importing industry. The reamining commodities were allocated to using industries according to the market share assumption i.e. users draw on supplies from local and external sources in the proportions of total supply. This method was considered less of a distortion to the table than indirect allocation.

5.4.3 Final Demand

The broad aggregates of personal consumption were obtained from the National Accounts. The detail necessary for the transactions table was obtained from a number of sources including The Apparent Consumption of Foodstuffs, the residuals in the allocation of commodity output and the weighting used in the Consumer Price Index.

Public Authority expenditure was estimated from the A.B.S. bulletins Finance and Commonwealth Authorities and the Treasury bulletins Commonwealth Payments To or From the States and the Report of the Auditor-General.

Data on private capital expenditure was obtained from the bulletins of the integrated census and Building Industry. Estimates of capital expenditure in the primary sector were obtained from industry surveys.

The capital expenditure of public authorities was extracted from the finance bulletins mentioned above and departmental loan programmes.

Stock changes were obtained from the bulletins of the censuses with no adjustment for changes in the value of money.

Data on exports were at f.o.b. prices. An estimate was made for transport costs to the wharf together with charges of other distributive industries and deducted from the value of exports of the productive industries. These estimated charges have been shown as exports of the distributive industries. Re-exports are small and are shown as an output of imports to exports.

5.4.4 Primary Inputs

The integrated censuses provided a far better estimate of wages and salaries than the earlier factory census as the former include employees working at separately located administrative offices and ancillary units. Estimates of wages and salaries in the rural industries were based on surveys in these industries. For the Government sector, wages and salaries were estimated from public accounts.

The estimation of Gross Operating Surplus was principally as a residual subsequent to all other allocations. It includes profit, depreciation and rent.

Indirect taxes included payroll tax, land tax, local Government rates, excise, road taxes, gambling taxes and sales taxes. Estimation of customs duty was considered too approximate to warrant a separate row and has been aggregated with indirect taxes.

Subsidies have been treated as negative commodity taxes and the row entries are a net figure representing the difference between indirect taxes and subsidies. As the transactions table has been constructed in producers' values, subsidies have been shown as a deduction from commodity taxes paid by purchasers so that the dairy industry subsidy has been treated as an input (negative) of the Milk Products industry.

CHAPTER 6

RESULTS

6.1 The Transactions Table

The interindustry flows for 1968-69 have been presented in a 45 industry transaction table (Appendix 1) with seven final demand columns and six final payments rows. Intermediate usage by the processing sector comprised $1,375 million or 60 per cent of the gross output of $2,456 million for Tasmania. The total trade reflected the openness of a regional economy with exports of $372 million or 15.1 per cent of total output and imports of $278 million amounting to 11.3 per cent of total usage.

Figure 6.1 provides a visual comparison of the magnitudes in terms of output, of the 45 processing industries. As was to be expected, the conglomerate industries "Commerce" and "Government" formed large proportions of total industry output. The manufacturing sector was dominated by "Basic Metal Products" and its principal supplier, "Metallic Minerals", was prominent in the primary sector. "Sheep" and "Dairying" held the important positions among the rural industries.

Table 6.1 shows the diversity of output patterns of the Tasmanian processing industries. "Non-Metallic Minerals", "Paper Bags and Fibre Board Containers" sold nearly all their production to other Tasmanian industries. Twelve industries sold their output completely within Tasmania. Six industries exported a very high proportion of their production. These were:

RELATIVE SIZE OF INDUSTRIES: INPUT–OUTPUT TABLE TASMANIA 1968–69

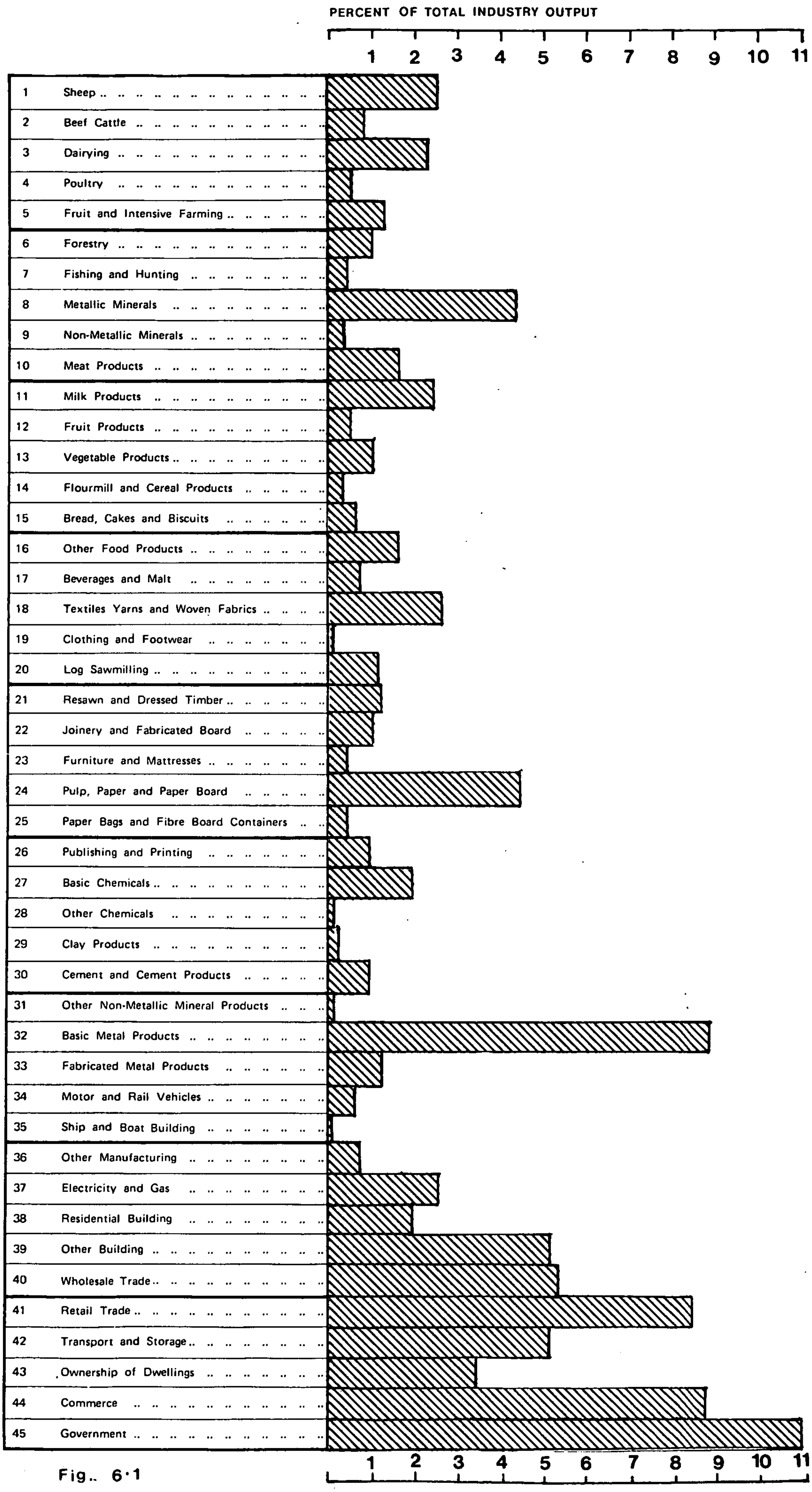


Fig.. 6·1

TABLE 6·1 DIRECTION OF INDUSTRY SALES

		Percent of Industry Output		
		Inter-mediate Usage	Total Tasmanian Usage*	Exports
1	Sheep	39	41	59
2	Beef Cattle	52	55	45
3	Dairying	90	94	6
4	Poultry	23	100	0
5	Fruit and Intensive Farming	21	31	69
6	Forestry	84	100	0
7	Fishing and Hunting	10	49	51
8	Metallic Minerals	64	70	30
9	Non-Metallic Minerals	96	100	0
10	Meat Products	5	71	29
11	Milk Products	17	60	40
12	Fruit Products	7	54	46
13	Vegetable Products	1	14	86
14	Flourmill and Ceral Products	74	98	2
15	Bread, Cakes and Biscuits	1	100	0
16	Other Food Products	11	26	74
17	Beverages and Malt	13	99	1
18	Textiles Yarns & Woven Frabrics	18	32	68
19	Clothing and Footwear	36	51	49
20	Log Sawmilling	62	64	36
21	Resawn and Dressed Timber	45	47	53
22	Joinery and Fabricated Board	48	62	38
23	Furniture and Mattresses	15	85	15
24	Pulp, Paper and Paper Board	15	19	81
25	Paper Bags & F'board Containers	97	100	0
26	Publishing and Printing	69	97	3
27	Basic Chemicals	41	48	52
28	Other Chemicals	79	90	10
29	Clay Products	97	100	0
30	Cement and Cement Products	65	69	31
31	Other Non-Met. Mineral Products	88	99	1
32	Basic Metal Products	4	12	88
33	Frabricated Metal Products	75	93	7
34	Motor and Rail Vehicles	37	55	45
35	Ship and Boat Building	30	57	43
36	Other Manufacturing	61	85	15
37	Electricity and Gas	72	100	0
38	Residential Building	0	100	0
39	Other Building	26	100	0
40	Wholesale Trade	40	78	22
41	Retail Trade	8	100	0
42	Transport and Storage	53	83	17
43	Ownership of Dwelling	0	100	0
44	Commerce	65	94	6
45	Government	1	100	0

* Intermediate plus local final demand

Basic Metal Products	88 per cent
Vegetable Products	86 per cent
Pulp Paper and Paper Board	81 per cent
* Other Food Products	74 per cent
Fruit and Intensive Farming	69 per cent
Textiles, Yarns and Woven Fabrics	68 per cent

(* This industry included the large confectionery manufacturer Cadbury Schweppes Pty Ltd)

For Figure 6.2, industries have been aggregated into industrial sectors and the proportions of total gross output formed by the sectors, calculated. These proportions have been compared to corresponding industrial sectors prepared from the 1968-69 Australian input-output tables of the A.B.S.

Primary Industries (rural, fishing and mining), appeared relatively larger within the State economy. Of greater significance was the importance to Tasmania of manufacturing based on forestry output (wood products, furniture and paper) and metallic mineral processing by "Basic Metal Products". This latter group in Tasmania contained the industrial giants of Comalco Aluminium (Bell Bay) Ltd., Electrolytic Zinc Company of Australasia Ltd., Tasmanian Electro Metallurgical Company Pty Ltd., and Savage River Mines.

On a proportional basis, imports were approximately three times more important for the State economy. The highly aggregated industry "Commerce" was considerably smaller in Tasmania, possibly due to larger national firms in this industry having their head offices in either Melbourne or Sydney and the Tasmanian establishments merely being branch offices.

COMPARATIVE SIZE : INDUSTRY SECTORS TASMANIA AND AUSTRALIA 1968-69

SECTOR SUPPLY AS A PERCENTAGE OF TOTAL SUPPLY

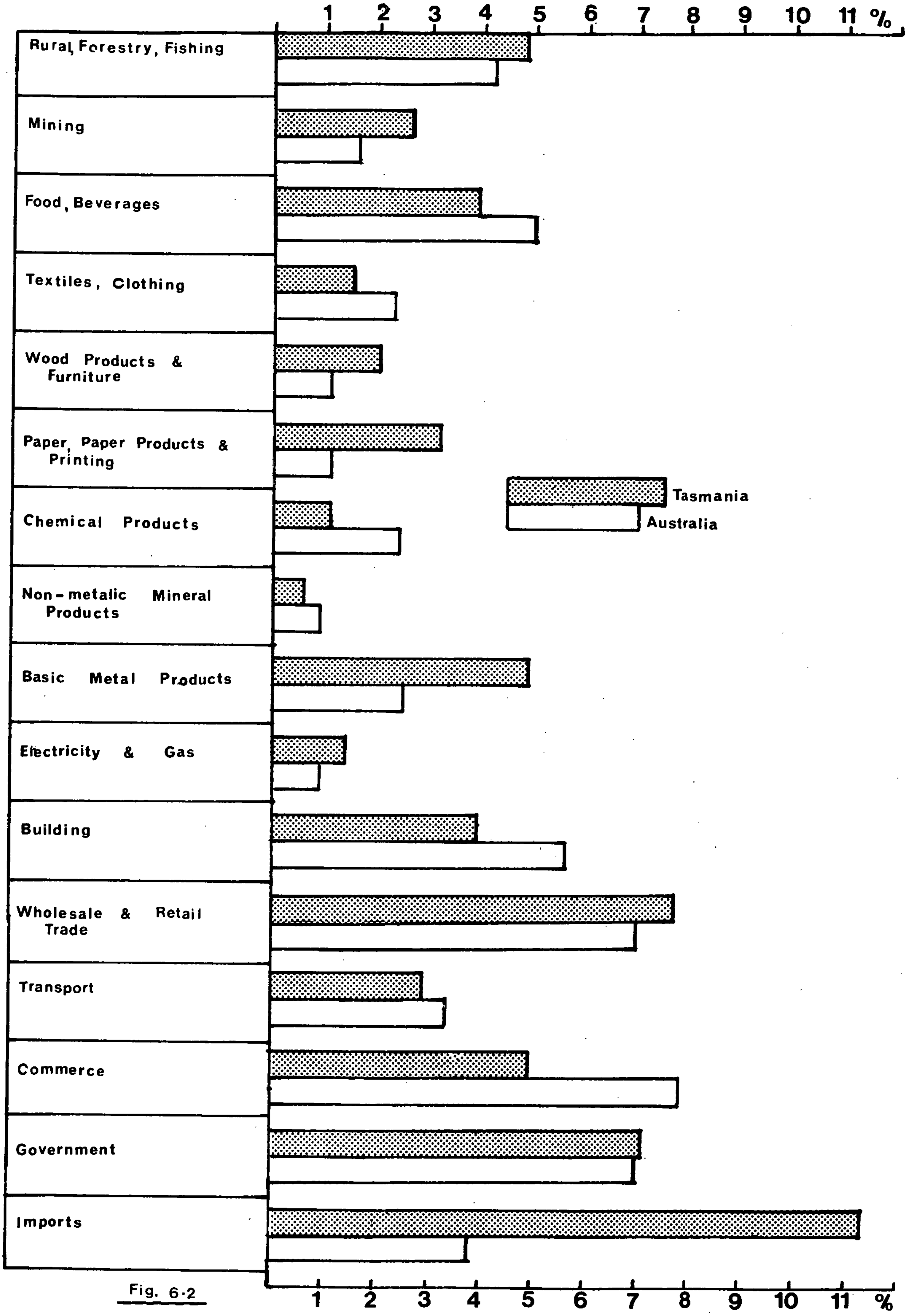


Fig. 6·2

Government was slightly larger in the Tasmanian economy which was consistent with the trend for smaller States to have larger proportions of their work force in State Government employment.

The biggest structural contrast between the two economies was in the manufacturing industries covered by ASIC classification 31 to 34, fabricated metal products, transport equipment, industrial machinery, household appliances and leather, rubber and plastic products. These industries (not represented in the graph) amounted to 9 per cent of Australian total gross output compared to 1.5 per cent for Tasmania. Products of these industries featured strongly in the Tasmanian import list.

6.2 National Accounting

The final demand and value added quadrants of the transactions table provided the necessary information for the calculation of the Gross Domestic Product for Tasmania in the conventional national accounting format. The tabulation included the total market value of goods and services produced in Tasmania after the deduction of the costs of intermediate goods and services used in the process of production, together with total factor earnings. In Table 6.2, the Tasmanian domestic accounts have been presented alongside Australian national account figures for 1968-69.

The Gross Domestic Product for Tasmania in 1968-69 was $802 million. In another study, G.D.P. for Tasmania was calculated by Hudson [19] for 1968-69 as $806 million. In view of the different methods of estimation employed, the two calculations proved remarkably close.

Wages, salaries and supplements were lower than might be expected on a basis of straight population proportion but this was

TABLE 6.2 TASMANIAN AND AUSTRALIAN PRODUCTION ACCOUNTS 1968-69

($ Million)

	Tasmania	Australia	Tas. as Proportion of Aust. %
Final consumption expenditure			
Private	449	16,507	2.7
Government	108	3,334	3.2
Gross fixed capital expenditure			
Private	81	4,731	1.7
Government	57	2,531	2.3
Increases in stocks	13	669	1.9
Gross domestic expenditure	708	27,437	2.6
Exports	372	3,913	9.5
Domestic turnover of goods and services	1,080	31,350	3.4
Less imports	278	4,276	6.5
Expenditure on gross domestic product	802	27,074	3.0
Wages, salaries and supplements	389	13,974	2.8
Gross operating surplus	375	10,364	3.6
Gross domestic product at factor cost	764	24,338	3.1
Indirect taxes less subsidies	38	2,736	1.4
Gross domestic product	802	27,074	3.0
Population at 30.6.69 (thousands)	389	12,106	3.2
GDP per capita ($)	2,062	2,236	92.2

consistent with the statistic that Tasmania has the lowest income per capita in the Commonwealth. Exports and imports again showed up as being very important within the State economy.

6.3 Technical Coefficients

The input coefficients have been presented in Appendix 2. These were calculated from the transactions table by dividing each column entry by the column total and thus show the value of inputs required from each industry to produce one dollar's worth of the output of the industry at the head of the column. To facilitate comparisons, selected inputs of the processing industries have been presented in percentage terms in Table 6.3. Eight industries purchased at least half of their inputs from other Tasmanian industries:

Milk Products	88 per cent
Meat Products	79 per cent
Vegetable Products	63 per cent
Resawn and Dressed Timber	54 per cent
Basic Metal Products	52 per cent
Bread, Cake and Biscuits	51 per cent
Poultry	50 per cent
Residential Building	50 per cent

Industries which relied heavily on imports for their inputs were:

Paper Bags and Fibre Board Containers	47 per cent
Fabricated Metal Products	40 per cent
Flour Mill and Cereal Products	38 per cent

High wage outlays were made by:

Government	56 per cent
Publishing and Printing	40 per cent

TABLE 6·3 SOURCE OF INDUSTRY INPUTS

		Percent of Total Industry Input		
		Tasmanian Industries	Imports	Wages
1	Sheep	24	3	19
2	Beef Cattle	36	3	29
3	Dairying	30	4	12
4	Poultry	50	20	10
5	Fruit and Intensive Farming	46	10	21
6	Forestry	23	8	40
7	Fishing and Hunting	16	6	28
8	Metallic Minerals	22	10	28
9	Non-Metallic Minerals	24	4	22
10	Meat Products	79	2	15
11	Milk Products	88	4	8
12	Fruit Products	47	17	23
13	Vegetable Products	63	4	18
14	Flourmill and Cereal Products	39	38	9
15	Bread, Cakes and Biscuits	51	8	25
16	Other Food Products	40	22	22
17	Beverages and Malt	43	11	18
18	Textiles Yarns and Woven Fabrics	29	23	26
19	Clothing and Footwear	29	16	43
20	Log Sawmilling	38	13	26
21	Resawn and Dressed Timber	54	5	21
22	Joinery and Febricated Board	44	11	22
23	Furniture and Mattresses	40	16	27
24	Pulp, Paper and Paper Board	33	19	23
25	Paper Bags and F'Board Containers	19	47	15
26	Publishing and Printing	28	6	40
27	Basic Chemicals	40	23	19
28	Other Chamicals	38	24	10
29	Clay Products	28	11	34
30	Cement and Cement Products	48	5	19
31	Other Non-Met. Mineral Products	29	20	39
32	Basic Metal Products	52	16	13
33	Fabricated Metal Products	23	40	23
34	Motor and Rail Vehicles	20	24	39
35	Ship and Boat Building	24	14	30
36	Other Manufacturing	19	31	31
37	Electricity and Gas	21	14	30
38	Residential Building	50	10	27
39	Other Building	40	14	35
40	Wholesale Trade	17	2	32
41	Retail Trade	14	4	36
42	Transport and Storage	13	14	38
43	Ownership of Dwellings	17	1	0
44	Commerce	35	4	28
45	Government	12	6	56

Forestry	40 per cent
Other Non-Met. Mineral Products	39 per cent
Motor and Rail Vehicles	39 per cent

6.4 Interdependence Coefficients and Output Multipliers

The direct and indirect coefficients presented in Appendix 3 were calculated by making the matrix inversion $(I-A)^{-1}$ using the computer programme SUPERPASSION[2]. This table shows the combined direct and indirect expansion in all industries consequent upon an increase of $1 of final demand for the products of a given industry. For each of the 45 processing industries in the table, the column entries have been summed to produce the output multipliers.

An output multiplier for a given industry measures the sum of direct and indirect requirements from all industries needed to deliver an additional dollar of output of the given industry to the final demand sector. An output multiplier indicates the degree of structural interdependence between any given industry and the rest of the State's economy. In Table 6.4, the output multipliers have been ranked in numerical order.

Output multipliers tend to be high for industries which use a large proportion of Tasmanian inputs and a small proportion of imports. Conversely, output multipliers are low for industries which use a high proportion of imported inputs. The industry "Milk Products" with a multiplier of 2.3362 obtained 88 per cent of its inputs from within the Tasmanian economy and only 4 per cent from imports. The industry "Paper Bags and Fibre Board Containers" used

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[2] An adaption from PASSION published by Benz [2]. This inversion was made with the assistance of officers of the I.A.C.

Table 6·4 Output Multipliers in Ranked Order

1	Milk Products	2.3362
2	Meat Products	2.1168
3	Vegetable Products	1.8924
4	Resawn And Dressed Timber	1.7955
5	Bread, Cake And Biscuits	1.7878
6	Residential Building	1.7425
7	Fruit Products	1.7249
8	Poultry	1.7184
9	Basic Metal Products	1.6868
10	Cement And Cement Products	1.6807
11	Other Food Products	1.6636
12	Fruit And Intensive Farming	1.6277
13	Joinery And Fabricated Board	1.6193
14	Beverages And Malt	1.6183
15	Furniture And Mattresses	1.5960
16	Other Building	1.5741
17	Basic Chemicals	1.5669
18	Other Chemicals	1.5585
19	Flourmill And Cereal Products	1.5285
20	Beef Cattle	1.5120
21	Commerce	1.5010
22	Log Sawmilling	1.4994
23	Pulp, Paper And Paperboard	1.4450
24	Dairying	1.4293
25	Publishing And Printing	1.4072
26	Textiles Yarns And Woven Fabrics	1.3952
27	Clothing And Footwear	1.3945
28	Other Non-Metal Mineral Products	1.3944
29	Clay Products	1.3805
30	Ship And Boat Building	1.3607
31	Engineering Products	1.3399
32	Sheep	1.3366
33	Non-Metallic Minerals	1.3352
34	Metallic Minerals	1.3088
35	Forestry	1.3040
36	Electricity And Gas	1.2998
37	Transport And Storage	1.2959
38	Motor And Rail Vehicles	1.2851
39	Paper Bags And Fibreboard Containers	1.2684
40	Other Manufacturing	1.2683
41	Ownership Of Dwelling	1.2602
42	Wholesale Trade	1.2497
43	Fishing And Hunting	1.2267
44	Retail Trade	1.2074
45	Government	1.1689

19 per cent of inputs from other Tasmanian industries and 47 per cent from outside the economy and consequently had a low output multiplier of 1.2684. The general trend was for an inverse relationship to exist between the output multiplier and the propensity to import.

6.5 Income Multipliers

For the purposes of regional planning, income effects are considered of greater importance than output effect. In this study both the Type I and Type II income multipliers have been calculated using the methods described in Chapter 3. The transactions table was closed with respect to Households, i.e. the Wages row and the Personal Consumption column were included as the 46th processing industry and a new inverse matrix (B*) was calculated. In Table 6.5, the tabulations used in the calculation of the income multipliers have been presented.

The Household row of the B* matrix (termed the Regional Income Multiplier) provided, for each industry, the total direct, indirect and induced income change consequent to an increase of $1 in output to the final demand sector of each industry. The results have been presented numerically in column 6 of Table 6.5 and graphically in Figure 6.3 ranked by total effect. The direct, indirect and induced components of total effect have been graphically differentiated.

The direct changes are the largest of the three components in 36 of the 45 industries and the indirect changes are the largest for the remaining nine sectors. This latter group contains the manufacturers of products from primary industries, namely:

Meat Products
Vegetable Products
Milk Products

TABLE 6·5 OUTPUT AND INCOME MULTIPLIERS : TASMANIA 1968-69

	INDUSTRY	1 OUTPUT MULTIPLIER (a)	2 DIRECT INCOME CHANGE (a)	3 DIRECT & INDIRECT INCOME CHANGE (a)	4 INDIRECT INCOME CHANGE (a)(b)	5 TYPE I INCOME MULTIPLIER (c (d)	6 DIRECT INDIRECT & INDUCED INCOME CHANGE (a) (e)	7 INDUCED INCOME CHANGE (a) (f)	8 INDIRECT & INDUCED INCOME CHANGE (a) (g)	9 TYPE II INCOME MULTIPLIER (c) (h)
1	Sheep	1.337	0.191	0.287	0.096	1.503	0.397	0.110	0.206	2.079
2	Beef Cattle	1.512	0.291	0.430	0.139	1.478	0.595	0.165	0.304	2.046
3	Dairying	1.429	0.123	0.236	0.113	1.919	0.327	0.091	0.204	2.659
4	Poultry	1.718	0.097	0.277	0.180	2.856	0.384	0.107	0.287	3.959
5	Fruit and Intensive Farming	1.628	0.208	0.375	0.167	1.803	0.519	0.144	0.311	2.495
6	Forestry	1.304	0.398	0.497	0.099	1.249	0.689	0.192	0.291	1.731
7	Fishing and Hunting	1.227	0.284	0.350	0.066	1.232	0.485	0.135	0.201	1.708
8	Metallic Minerals	1.309	0.277	0.373	0.096	1.347	0.516	0.143	0.239	1.863
9	Non-Metallic Minerals	1.335	0.224	0.321	0.097	1.433	0.445	0.124	0.221	1.987
10	Meat Products	2.117	0.152	0.403	0.251	2.651	0.558	0.155	0.406	3.671
11	Milk Products	2.336	0.077	0.328	0.251	4.260	0.455	0.127	0.378	5.909
12	Fruit Products	1.725	0.234	0.413	0.179	1.765	0.572	0.159	0.338	2.444
13	Vegetable Products	1.892	0.184	0.395	0.211	2.147	0.547	0.152	0.363	2.973
14	Flourmill and Cereal Products	1.529	0.088	0.233	0.145	2.648	0.323	0.090	0.235	3.670
15	Bread, Cakes and Biscuits	1.789	0.254	0.411	0.157	1.618	0.570	0.159	0.316	2.244
16	Other Food Products	1.664	0.222	0.372	0.150	1.676	0.515	0.143	0.293	2.320
17	Beverages and Malt	1.613	0.176	0.343	0.167	1.949	0.475	0.132	0.299	2.699
18	Textiles Yarns and Woven Fabrics	1.395	0.256	0.359	0.103	1.402	0.497	0.091	0.194	1.942
19	Clothing and Footwear	1.395	0.426	0.537	0.111	1.261	0.744	0.207	0.318	1.746
20	Log Sawmilling	1.499	0.258	0.437	0.179	1.694	0.606	0.169	0.348	2.349
21	Resawn and Dressed Timber	1.796	0.209	0.451	0.242	2.158	0.624	0.173	0.415	2.986
22	Joinery and Fabricated Board	1.619	0.219	0.419	0.200	1.913	0.580	0.161	0.361	2.648
23	Furniture and Mattresses	1.596	0.265	0.428	0.163	1.615	0.593	0.165	0.328	2.238
24	Pulp, Paper and Paper Board	1.445	0.232	0.375	0.143	1.616	0.519	0.144	0.287	2.237
25	Paper Bags and Fibre Board Containers	1.268	0.150	0.231	0.081	1.540	0.320	0.089	0.170	2.133
26	Publishing and Printing	1.407	0.398	0.508	0.110	1.276	0.704	0.196	0.306	1.769
27	Basic Chemicals	1.567	0.189	0.343	0.154	1.815	0.476	0.133	0.287	2.519
28	Other Chemicals	1.559	0.104	0.241	0.137	2.317	0.334	0.093	0.230	3.212
29	Clay Products	1.381	0.343	0.455	0.112	1.327	0.630	0.175	0.287	1.837
30	Cement and Cement Products	1.681	0.192	0.383	0.191	1.995	0.531	0.148	0.339	2.766
31	Other Non-Metallic Mineral Products	1.394	0.386	0.499	0.113	1.293	0.691	0.192	0.305	1.790
32	Basic Metal Products	1.687	0.131	0.336	0.205	2.565	0.465	0.129	0.334	3.550
33	Fabricated Metal Products	1.340	0.230	0.320	0.090	1.391	0.443	0.123	0.213	1.926
34	Motor and Rail Vehicles	1.285	0.390	0.470	0.080	1.205	0.650	0.180	0.260	1.667
35	Ship and Boat Building	1.361	0.305	0.395	0.090	1.295	0.547	0.152	0.242	1.793
36	Other Manufacturing	1.268	0.307	0.381	0.074	1.241	0.528	0.147	0.221	1.720
37	Electricity and Gas	1.300	0.303	0.396	0.093	1.307	0.549	0.153	0.246	1.812
38	Residential Building	1.743	0.273	0.484	0.211	1.773	0.670	0.186	0.397	2.454
39	Other Building	1.574	0.347	0.506	0.159	1.458	0.701	0.195	0.354	2.020
40	Wholesale Trade	1.250	0.324	0.398	0.074	1.228	0.551	0.153	0.227	1.701
41	Retail Trade	1.207	0.356	0.417	0.061	1.171	0.578	0.161	0.222	1.624
42	Transport and Storage	1.296	0.375	0.470	0.095	1.253	0.652	0.182	0.277	1.739
43	Ownership of Dwellings	1.260	0.000	0.082	0.082	-	0.114	0.032	0.114	-
44	Commerce	1.501	0.279	0.433	0.154	1.552	0.600	0.167	0.321	2.151
45	Government	1.169	0.564	0.616	0.052	1.092	0.853	0.237	0.289	1.512

(a) Per $ of supply to final demand

(b) Col 3 minus col 2

(c) Per $ of direct income change

(d) Col 3 divided by col 2

(e) Household row of matrix B^{*} = Regional Income Multiplier

(f) Col 6 minus col 3

(g) Col 4 plus col 7

(h) Col 6 divided by col 2

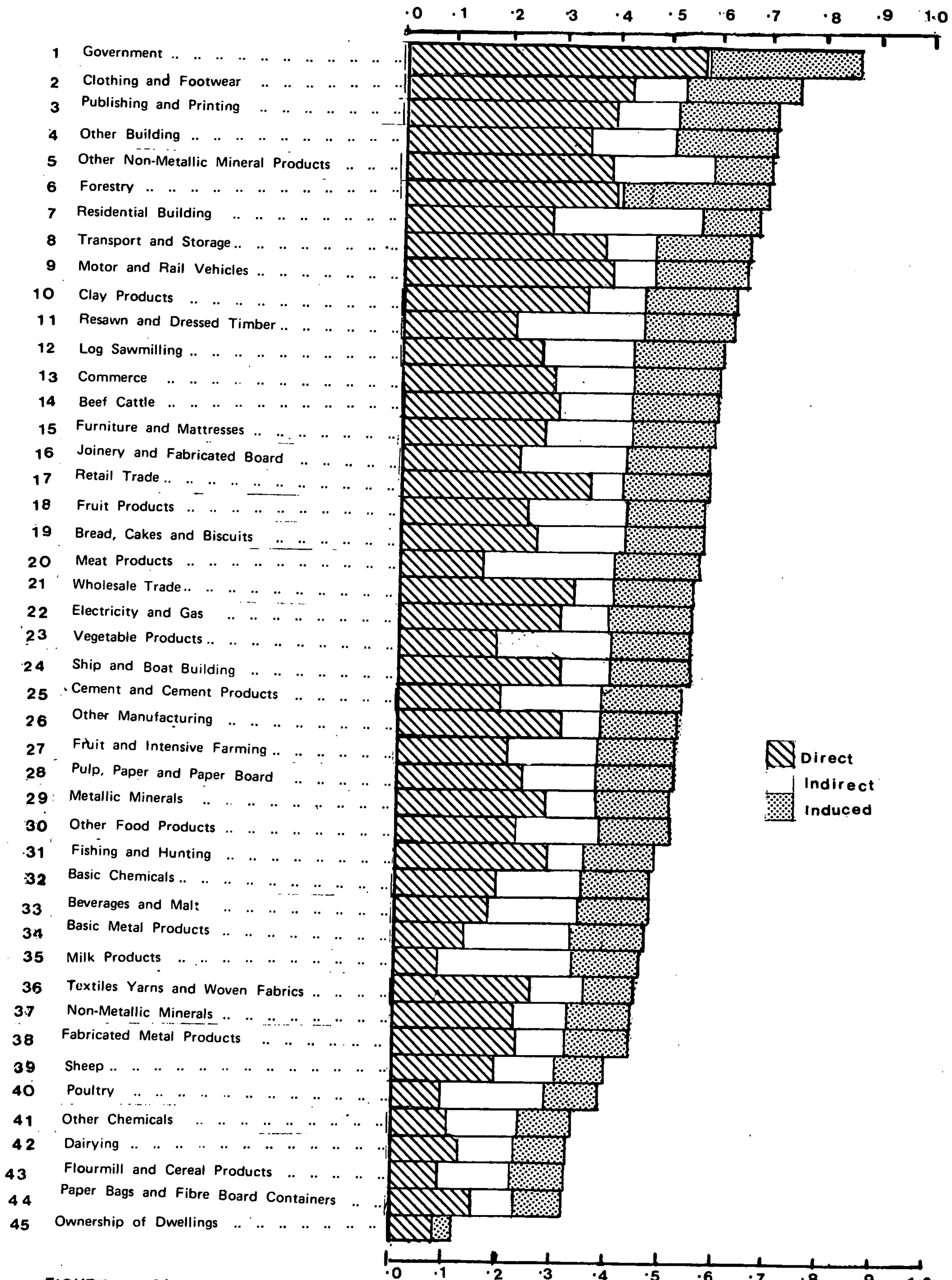

FIGURE 6.3 Direct, Indirect and Induced Income per Dollar of Sales to Final Demand: TASMANIA 1968-69

Resawn and Dressed Timber

Basic Metal Products

and reflects the relatively high usage of Tasmanian products by these industries.

The Type I and Type II multipliers measure income generated consequent upon a dollar change in household payments brought about by a change in final demands for the output of the given industry. The ratios are:

$$\text{Type I Multiplier} = \frac{\text{Direct and indirect income change}}{\text{Direct income change}}$$

$$\text{Type II Multiplier} = \frac{\text{Direct, indirect and induced income change}}{\text{Direct income change}}$$

The Type II multipliers thus take account of the induced effects of consumer spending in addition to the direct and indirect inter-industry effects.

The Type I multipliers have been presented in column 5 of Table 6.5 and Type II multipliers in column 9. The multipliers have been assembled in order of numerical rank in tables 6.6 and 6.7. The numerical rankings for both multipliers were very similar, the differences being due to rounding errors. When a linear homogeneous consumption function is assumed there will be a constant relationship between the two types of multipliers for a given input-output table. In this study, the ratio between the two sets of multipliers was approximately 1.386.

The manufacturing industries based on primary products tended to have high rankings and the service type industries low rankings. Conforming to the general pattern established by other studies, Tasmanian industries tended to exhibit an inverse relationship between the rankings of the regional multiplier and the rankings of the Type I and Type II income multipliers.

Table 6·6 Type I Income Multipliers
in Ranked Order

1	Milk Products	4.260
2	Poultry	2.856
3	Flourmill And Cereal Products	2.648
4	Meat Products	2.651
5	Basic Metal Products	2.565
6	Other Chemicals	2.317
7	Resawn And Dressed Timber	2.158
8	Vegetable Products	2.147
9	Cement And Cement Products	1.995
10	Beverages And Malt	1.949
11	Dairying	1.919
12	Joinery And Fabricated Board	1.913
13	Basic Chemicals	1.815
14	Fruit And Intensive Farming	1.803
15	Residential Building	1.773
16	Fruit Products	1.765
17	Log Sawmilling	1.694
18	Other Food Products	1.676
19	Bread, Cakes And Biscuits	1.618
20	Pulp, Paper And Paperboard	1.616
21	Furniture And Mattresses	1.615
22	Commerce	1.552
23	Paper Bags And Fibreboard Containers	1.540
24	Sheep	1.503
25	Beef Cattle	1.478
26	Other Building	1.458
27	Non-Metallic Minerals	1.433
28	Textiles Yarns And Woven Fabrics	1.402
29	Fabricated Metal Products	1.391
30	Metalic Minerals	1.347
31	Clay Products	1.327
32	Electricity And Gas	1.307
33	Ship And Boat Building	1.295
34	Other Non-Metalic Minerals Products	1.293
35	Publishing And Printing	1.276
36	Clothing And Footwear	1.261
37	Transport And Storage	1.253
38	Forestry	1.249
39	Other Manufacturing	1.241
40	Fishing And Hunting	1.232
41	Wholesale Trade	1.228
42	Motor And Rail Vehicles	1.205
43	Retail Trade	1.171
44	Government	1.092
45	Ownership Of Dwellings	-----

Table 6-7 Type II Income Multipliers in Ranked Order

1	Milk Products	5.909
2	Poultry	3.959
3	Meat Products	3.671
4	Flourmill and Cereal Products	3.670
5	Basic Metal Products	3.550
6	Other Chemicals	3.212
7	Resawn and Dressed Timber	2.986
8	Vegetable Products	2.973
9	Cement and Cement Products	2.766
10	Beverages and Malt	2.699
11	Dairying	2.659
12	Joinery and Fabricated Board	2.648
13	Basic Chemicals	2.519
14	Residential Building	2.454
15	Fruit and Intensive Farming	2.495
16	Fruit Products	2.444
17	Log Sawmilling	2.349
18	Other Food Products	2.320
19	Bread, Cakes and Biscuits	2.244
20	Furniture and Mattresses	2.238
21	Pulp, Paper and Paperboard	2.237
22	Commerce	2.151
23	Paper Bags and Fibreboard Containers	2.133
24	Sheep	2.079
25	Beef Cattle	2.046
26	Other Building	2.020
27	Non-Metallic Minerals	1.987
28	Textiles, Yarns and Woven Fabrics	1.943
29	Fabricated Metal Products	1.926
30	Metallic Minerals	1.863
31	Clay Products	1.837
32	Electricity and Gas	1.812
33	Ship And Boat Building	1.793
34	Other Non-Metallic Mineral Products	1.790
35	Publishing And Printing	1.769
36	Clothing And Footwear	1.746
37	Transport And Storage	1.739
38	Forestry	1.731
39	Other Manufacturing	1.720
40	Fishing and Hunting	1.708
41	Wholesale Trade	1.701
42	Motor and Rail Vehicles	1.667
43	Retail Trade	1.624
44	Government	1.512
45	Ownership of Dwellings	- - -

6.6 Model Closure

The closure of the model with respect to Households creates some difficult conceptual problems and many studies have not been explicit in their treatment of model closure. In order to close the model, it is necessary to define the output of the Households row, that is, what constitutes payments to Households. The row "Wages" (which includes the drawings of proprietors) is an obvious component but "Gross Operating Surplus" must also be considered. However, some proportion of Gross Operating Surplus will be repatriated outside the region. This proportion will vary widely from industry to industry, depending on the content of local ownership and source of company borrowings. Data to make such an estimate is rarely available. Further, not all Payments to Households will be spent on Personal Consumption as portions go to taxation and savings.

The declaration of the Personal Consumption column as the input column of Households and then placing it within the processing sector implies that the regional consumption function is linear and homogeneous. Inversion of the closed matrix is a surrogate for successive iterations of increased household income which is spent on household consumption. Cross section income studies indicate that this form of linear income-consumption function is an over-estimation. These considerations are further complicated by the necessity to balance the Household row and column once they are considered part of the processing sector.

Two recent studies that have been explicit on the method of closure have used rather different procedures. Jensen [23] in the Central Queensland Interindustry Study defined the Households column as "Personal Consumption" and the row as "Salaries and Wages". Additional primary inputs were not incorporated into the row because of the difficulty of accurate estimation. In order to balance the row and column, Jensen scaled the column values to balance with the row total. For a Toowoomba input-output model, McGaurr [30] defined the Households row as all three rows of primary inputs having a component of payment to Households, Salaries and Wages, Operating Surplus and Rent. As the Household row total then exceeded the Household column, a new row "Household Balance" was added. This row contained a single element, the balancing item, under the column Households.

It appeared possible that the first method would yield an under-estimation of multipliers and the second method an over-estimation. This study has followed a middle course. The wages row was defined as Households output and the Personal Consumption column as Households input. The balancing of the Households row and column was achieved by adding a new column "Household Balance" with a single element (the balancing item of $60.7M) in the Wages row so that both row and column summed to $449.4M. The income and employment multipliers presented in this study have been calculated with this method of model closure.

Two other methods of closure were also examined. In both methods the "Personal Consumption" column was declared the Households column and the Households row contained the row "Wages" and a proportion of the row "Gross Operating Surplus". In the first method G.O.S. was scaled so that the Households then balanced with the column. In the second, 50 per cent of the G.O.S. was added to Wages to form the Households row. Row and column were balanced by adding a new row "Household Balance" with a single element under the column Households.

The tabulation of the various types of income and employment multipliers calculated from different methods of closure has not been presented in full. To allow a comparison of the range of results obtained, some income and employment results for industry 18 "Textile Yarns and Woven Fabrics" have been presented in Table 6.8. The method of closure used by Jensen yielded the lowest estimates and the method used by McGaurr the highest estimates. Comparing the total income change (direct, indirected and induced) for all industries, Method 2 was consistently higher than Method 1 by around 5 per cent. The amount by which Methods 3, 4 and 5 exceeded Method 2 was dependent upon the ratio of Wages to Gross Operating Surplus in the various industries. Method 5 exceeded 2 by between 66 and 260 per cent. With respect to Type 11 income multipliers, the amount by which Methods 3, 4 and 5 exceeded 2 was considerably less as the former methods had much higher direct income coefficients.

The wide range of results obtained from the different methods of closure indicates the importance of obtaining accurate estimates of the proportion of primary inputs that are retained within the regional economy. Studies based on surveys may be able to obtain this information but it is impossible to obtain from secondary data as it is currently collected. However, the value of such information warrants an examination of the feasibility of collection by the ABS.

Sufficient data has been presented in this study for subsequent users to recalculate multipliers should their research demand a different method of model closure.

6.7 Employment Multipliers

Information from a wide variety of sources was used to estimate the work force number for each input-output industry. These included "Wage and Salary Earners in Civilian Employment" which is basically a pay roll tax series, "Labour Force Estimates" a population survey, economic, agricultural and population census data and the primary

TABLE 6.8 EFFECTS OF DIFFERENT MODEL CLOSURE METHODS

Input-Output Tables: Tasmania 1968-69

Industry 18 Textiles Yarns and Woven Fabrics ASIC 23

TYPE OF CLOSURE		INCOME AND EMPLOYMENT EFFECT			
		Direct Income Change (a)	Total Income Change (b)	Type II Income Multiplier	Type II Employment Multiplier
Method 1	(c)	0.256	0.472	1.846	1.949
Method 2	(d)	0.256	0.497	1.943	2.059
Method 3	(e)	0.290	0.619	2.132	2.210
Method 4	(f)	0.362	0.808	2.229	2.223
Method 5	(g)	0.469	1.088	2.320	2.236

(a) Households row of A* matrix

(b) Households row of B* matrix

(c) Households row defined as "Wages". Household column defined as "Personal Consumption" with the column scaled to equate row and column.

(d) Households row defined as "Wages". Households column defined as "Personal Consumption". Row and column equated by adding a new column "Household Balance" with a single element in the Wages row.

(e) Households column defined as "Personal Consumption". Households row defined as "Wages" plus a scaled proportion of "Gross Operating Surplus" so that Households row and column balanced.

(f) Households column defined as "Personal Consumption". Households row defined as "Wages" plus 50% of "Gross Operating Surplus". Row and column balanced by adding a new row "Households Balance" with a single element in the Households column.

(g) Households column defined as "Personal Consumption". Households row defined as "Wages" plus "Gross Operating Surplus". Row and column balanced similar to (f).

industry surveys detailed in Chapter 5. The ABS provided considerable assistance in obtaining the estimates which have been presented in column 1 of Table 6.9. The proportions of the work force in industry sectors have been represented graphically in Figure 6.4.

Employment-production functions for industries were not estimated. The direct employment change for each industry was calculated as the number of workers per $1,000 of output.. This method assumes a linear homogeneous employment function. The industries "Government" and "Clothing and Footwear" exhibited the highest direct employment effect while the food processing industries tended to have low figures, the Milk Products industry being particularly low.

The direct and indirect and then the direct, indirect and induced employment effects were calculated by the methods described in Chapter 3. Type I and Type II employment multipliers were calculated as:

$$\text{Type I multiplier} = \frac{\text{Direct and indirect employment change}}{\text{Direct employment change}}$$

$$\text{Type II multiplier} = \frac{\text{Direct, indirect and induced employment change}}{\text{Direct employment change}}$$

The employment multipliers have been presented in Table 6.10 ranked in numerical order of the Type II multipliers. "Milk Products" which had been shown to have large interindustry effects (see output multipliers) and a small direct employment effect, consequently, had very high employment multiplier values. "Meat Products" was high for the same reasons. In general, industries which processed primary products (i.e. products from rural forestry and mining) tended to have high employment multipliers. The order of ranking of the Type I multipliers approximated that of the Type II but the employment multipliers did not exhibit the direct relationship shown to exist

TABLE 6-9 EMPLOYMENT MULTIPLIERS : TASMANIA 1968-69

	INDUSTRY	WORKFORCE (a)		EMPLOYMENT CHANGE (b)			MULTIPLIERS	
		NUMBER (1)	PER CENT OF TOTAL (2)	DIRECT (3)	DIRECT & INDIRECT (4)	DIRECT INDIRECT & INDUCED (5)	TYPE I (6)	TYPE II (7)
1	Sheep	4790	3.1	0.138	0.177	0.229	1.288	1.664
2	Beef Cattle	1155	0.7	0.111	0.178	0.255	1.596	2.294
3	Dairying	4718	3.1	0.151	0.201	0.243	1.330	1.613
4	Poultry	267	0.2	0.043	0.117	0.167	2.719	3.882
5	Fruit and Intensive Farming	3870	2.5	0.220	0.288	0.356	1.306	1.613
6	Forestry	1226	0.8	0.091	0.134	0.224	1.473	2.461
7	Fishing and Hunting	708	0.5	0.135	0.165	0.228	1.218	1.684
8	Metallic Minerals	3648	2.4	0.062	0.102	0.169	1.645	2.731
9	Non-Metallic Minerals	292	0.2	0.070	0.114	0.171	1.628	2.459
10	Meat Products	1115	0.7	0.051	0.194	0.267	3.777	5.196
11	Milk Products	829	0.5	0.025	0.195	0.254	7.793	10.162
12	Fruit Products	943	0.6	0.141	0.249	0.324	1.775	2.305
13	Vegetable Products	798	0.5	0.059	0.173	0.245	2.923	4.124
14	Flourmill and Cereal Products	160	0.1	0.037	0.101	0.143	2.736	3.875
15	Bread, Cakes and Biscuits	925	0.6	0.120	0.191	0.265	1.592	2.211
16	Other Food Products	1673	1.1	0.075	0.145	0.212	1.920	2.810
17	Beverages and Malt	528	0.3	0.058	0.139	0.201	2.406	3.477
18	Textiles Yarns and Woven Fabrics	3700	2.4	0.105	0.152	0.217	1.443	2.059
19	Clothing and Footwear	360	0.2	0.228	0.274	0.371	1.199	1.623
20	Log Sawmilling	1698	1.1	0.113	0.171	0.250	1.511	2.209
21	Resawn and Dressed Timber	1201	0.8	0.074	0.164	0.246	2.215	3.312
22	Joinery and Fabricated Board	1177	0.8	0.089	0.158	0.233	1.781	2.632
23	Furniture and Mattresses	680	0.4	0.115	0.177	0.255	1.536	2.206
24	Pulp, Paper and Paper Board	3759	2.4	0.062	0.113	0.180	1.805	2.889
25	Paper Bags and Fibre Board Containers	354	0.2	0.059	0.089	0.130	1.502	2.210
26	Publishing and Printing	1527	1.0	0.125	0.164	0.256	1.315	2.048
27	Basic Chemicals	1359	0.9	0.052	0.103	0.165	1.985	3.175
28	Other Chemicals	46	0.0	0.037	0.090	0.133	2.439	3.627
29	Clay Products	246	0.2	0.110	0.150	0.232	1.357	2.101
30	Cement and Cement Products	735	0.5	0.057	0.124	0.193	2.160	3.364
31	Other Non-Metallic Mineral Products	175	0.1	0.129	0.169	0.260	1.312	2.010
32	Basic Metal Products	4157	2.7	0.034	0.100	0.161	2.922	4.693
33	Fabricated Metal Products	1589	1.0	0.093	0.127	0.185	1.368	1.989
34	Motor and Rail Vehicles	1149	0.7	0.136	0.168	0.253	1.232	1.854
35	Ship and Boat Building	120	0.1	0.134	0.167	0.238	1.247	1.779
36	Other Manufacturing	1066	0.7	0.108	0.137	0.206	1.266	1.903
37	Electricity and Gas	2644	1.7	0.076	0.115	0.187	1.520	2.463
38	Residential Building	4069	2.6	0.159	0.236	0.324	1.488	2.038
39	Other Building	12239	7.9	0.174	0.233	0.325	1.339	1.864
40	Wholesale Trade	8775	5.7	0.121	0.160	0.232	1.335	1.932
41	Retail Trade	20875	13.5	0.180	0.213	0.288	1.179	1.597
42	Transport and Storage	7647	4.9	0.107	0.150	0.236	1.407	2.200
43	Ownership of Dwellings	—	—	—	0.039	0.054	-	-
44	Commerce	21560	13.9	0.179	0.255	0.333	1.421	1.857
45	Government	34642	22.4	0.230	0.253	0.363	1.096	1.579

(a) Total Workforce 154,600 (b) per $1,000 of Sales to Final Demand

Col 3 Workers per $1,000 of Industry Output

Fig. 6·4 EMPLOYMENT BY INDUSTRY SECTORS - TASMANIA 1968-69

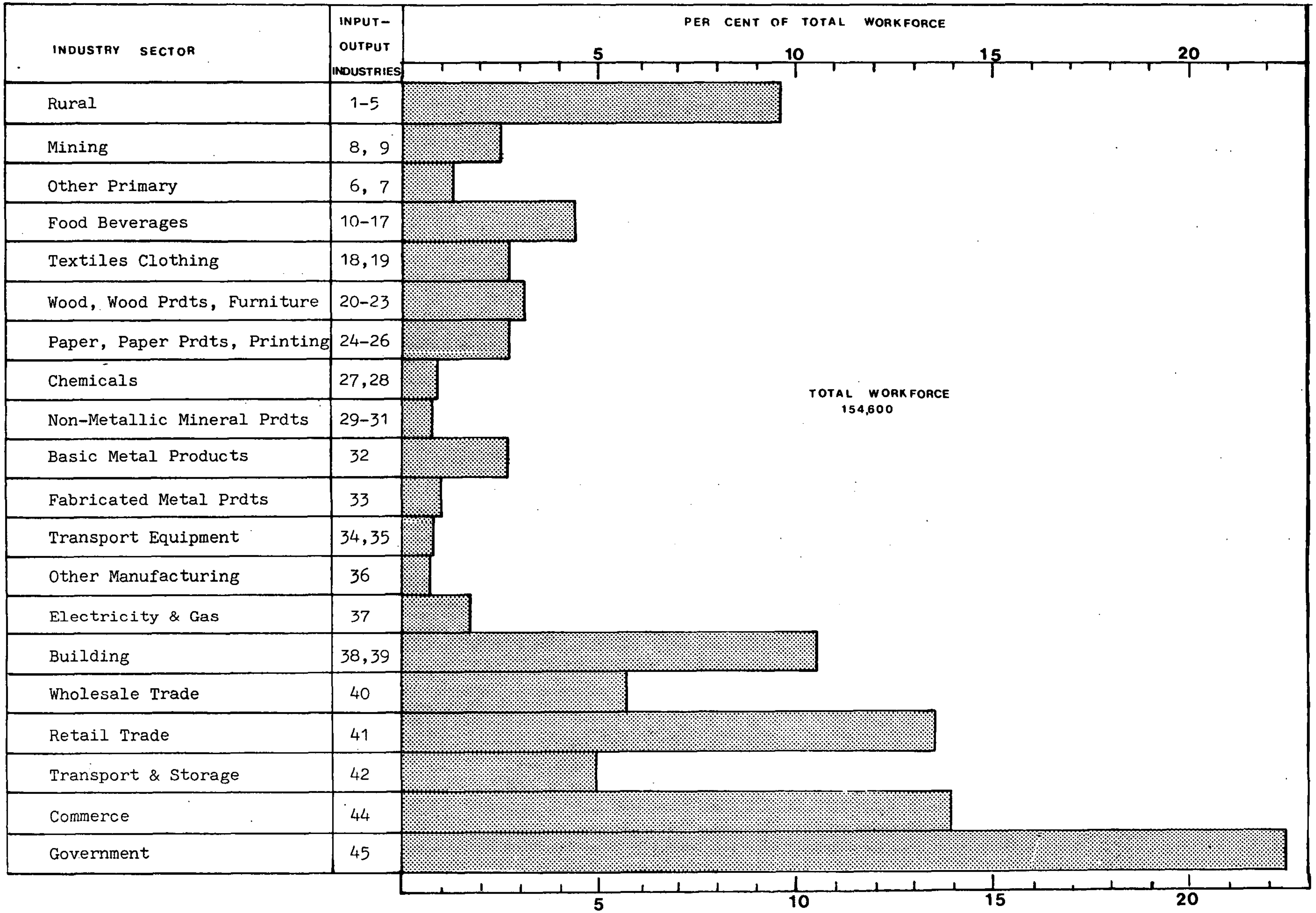

TABLE 6-10 EMPLOYMENT MULTIPLIERS

(IN RANKED ORDER OF TYPE II)

		Type I	Type II
1	Milk Products	7.793	10.162
2	Meat Products	3.777	5.196
3	Basic Metal Products	2.922	4.693
4	Vegetable Products	2.923	4.124
5	Poultry	2.719	3.882
6	Flourmill & Cereal Products	2.736	3.875
7	Other Chemicals	2.439	3.627
8	Beverages & Malt	2.406	3.477
9	Cement & Cement Products	2.160	3.364
10	Resawn & Dressed Timber	2.215	3.312
11	Basic Chemicals	1.985	3.175
12	Pulp, Paper & Paperboard	1.805	2.889
13	Other Food Products	1.920	2.810
14	Metallic Minerals	1.645	2.731
15	Joinery & Fabricated Board	1.781	2.632
16	Electricity & Gas	1.520	2.463
17	Forestry	1.473	2.461
18	Non-Metallic Minerals	1.628	2.459
19	Fruit Products	1.775	2.305
20	Beef Cattle	1.596	2.294
21	Bread, Cake & Biscuits	1.592	2.211
22	Paper bags & Fibrebd.Containers	1.502	2.210
23	Log Sawmilling	1.511	2.209
24	Furniture & Mattresses	1.536	2.206
25	Transport & Storage	1.407	2.200
26	Clay Products	1.357	2.101
27	Textiles Yarns and Woven Fabrics	1.443	2.059
28	Publishing & Printing	1.315	2.048
29	Residential Building	1.488	2.038
30	Other Non Metallic Mineral Prdts.	1.312	2.010
31	Fabricated Metal Products	1.368	1.989
32	Wholesale Trade	1.335	1.932
33	Other Manufacturing	1.266	1.903
34	Other Building	1.339	1.864
35	Commerce	1.421	1.857
36	Motor & Rail Vehicles	1.232	1.854
37	Ship & Boat Building	1.247	1.779
38	Fishing & Hunting	1.218	1.684
39	Sheep	1.288	1.664
40	Clothing & Footwear	1.199	1.623
41	Dairying	1.330	1.613
42	Fruit & Intensive Farming	1.306	1.613
43	Retail Trade	1.179	1.597
44	Government	1.096	1.579
45	Ownership of Dwellings	-	-

between the Type I and Type II income multipliers.

The three components of total employment change, direct, indirect and induced have been presented in Table 6.11 ranked according to total effect. The direct employment effect was the largest component for 31 of the 45 industries. Of the other 14 industries, the indirect effect was the largest component for 10, leaving 4 industries (Cement and Cement Products, Pulp, Paper and Paper Board, Metallic Minerals and Basic Chemicals) where the induced employment effect was dominant. For 11 industries both the indirect and induced employment effects were higher than the direct effect. These were the top ranking industries with respect to employment multipliers.

Table 6.12 provides an indication of the change in output required of an industry to bring about a change in employment of 100 workers. The output change has been tabulated both in absolute and proportional terms and for direct and total (direct, indirect and induced) employment effect. For the industry "Vegetable Products", an increase in direct employment of 100 workers would result from a lift in output of $1.685M or 12.53 per cent of the existing output level. When indirect and induced employment effects are also considered an increase in direct output of only $0.409M or 3.04 per cent of the existing output level is required to bring about the same employment change within Tasmania.

TABLE 6-II DIRECT, INDIRECT & INDUCED EMPLOYMENT

PER $1000 OF SALES TO FINAL DEMAND

INDUSTRY	DIRECT	IN-DIRECT	INDUCED	TOTAL
1 Clothing and footwear	0.228	0.045	0.097	0.371
2 Government	0.230	0.022	0.111	0.364
3 Fruit and Intensive Farming	0.221	0.068	0.068	0.356
4 Commerce	0.179	0.076	0.078	0.333
5 Other building	0.174	0.059	0.091	0.325
6 Residential building	0.159	0.078	0.087	0.324
7 Fruit products	0.140	0.109	0.075	0.324
8 Retail trade	0.180	0.032	0.075	0.288
9 Meat products	0.051	0.142	0.073	0.267
10 Bread, cakes & biscuits	0.120	0.071	0.074	0.265
11 Other non-met. Mineral Products	0.129	0.040	0.090	0.260
12 Publishing and Printing	0.125	0.039	0.092	0.256
13 Beef Cattle	0.111	0.066	0.077	0.255
14 Furniture & Mattresses	0.115	0.062	0.077	0.255
15 Milk products	0.025	0.170	0.059	0.254
16 Motor and Rail Vehicles	0.136	0.032	0.085	0.253
17 Log sawmilling	0.113	0.058	0.079	0.250
18 Resawn & dressed timber	0.074	0.090	0.081	0.246
19 Vegetable products	0.059	0.114	0.071	0.245
20 Dairying	0.151	0.050	0.043	0.243
21 Ship & Boat building	0.134	0.033	0.071	0.238
22 Transport and storage	0.170	0.044	0.083	0.236
23 Joinery & Fabricated Board	0.089	0.069	0.076	0.234
24 Wholesale trade	0.121	0.040	0.072	0.233
25 Clay products	0.110	0.039	0.082	0.232
26 Sheep	0.138	0.040	0.052	0.229
27 Fishing and hunting	0.135	0.029	0.063	0.228
28 Forestry	0.091	0.043	0.090	0.224
29 Textiles, Yarns and woven fabrics	0.105	0.047	0.065	0.217
30 Other food products	0.075	0.069	0.067	0.212
31 Other manufacturing	0.108	0.029	0.069	0.206
32 Beverages and malt	0.058	0.081	0.062	0.201
33 Cement and Cement Products	0.057	0.067	0.069	0.193
34 Electricity and Gas	0.076	0.039	0.072	0.187
35 Fabricated metal products	0.093	0.034	0.058	0.185
36 Pulp, paper and paperboard	0.062	0.050	0.068	0.180
37 Non-metallic minerals	0.070	0.044	0.058	0.172
38 Metallic minerals	0.062	0.040	0.067	0.169
39 Poultry	0.043	0.074	0.050	0.167
40 Basic chemicals	0.052	0.051	0.062	0.165
41 Basic metal products	0.034	0.066	0.061	0.161
42 Flour mill and cereal Products	0.037	0.064	0.042	0.143
43 Other chemicals	0.037	0.053	0.044	0.133
44 Paperbags & Fibrebd Containers	0.059	0.030	0.042	0.130
45 Ownership of Dwellings	0.000	0.039	0.015	0.054

TABLE 6-12 OUTPUT AND EMPLOYMENT EFFECT : TASMANIA 1968-69

	Industry	DIRECT CHANGE IN GROSS OUTPUT REQUIRED TO ACHIEVE A CHANGE IN EMPLOYMENT OF 100 WORKERS			
		DIRECT EMPLOYMENT (a)		TOTAL EMPLOYMENT (b)	
		OUTPUT CHANGE $'000	PER CENT	OUTPUT CHANGE $'000	PER CENT
1	Sheep	726	2.08	436	1.25
2	Beef Cattle	899	8.66	392	3.77
3	Dairying	633	2.12	411	1.31
4	Poultry	2321	37.45	598	9.65
5	Fruit and Intensive Farming	453	2.58	281	1.60
6	Forestry	1100	8.16	447	3.31
7	Fishing and Hunting	739	14.12	439	8.39
8	Metallic Minerals	1614	2.74	591	1.00
9	Non-Metallic Minerals	1433	34.25	583	13.90
10	Meat Products	1950	8.97	375	1.73
11	Milk Products	3997	12.06	393	1.19
12	Fruit Products	712	10.60	309	4.60
13	Vegetable Products	1685	12.53	409	3.04
14	Flourmill and Cereal Products	2708	62.50	699	16.10
15	Bread, Cakes and Biscuits	833	10.81	377	3.89
16	Other Food Products	1325	5.98	472	2.13
17	Beverages and Malt	1728	18.94	497	5.45
18	Textiles Yarns and Woven Fabrics	950	2.70	461	1.31
19	Clothing and Footwear	437	27.78	270	17.10
20	Log Sawmilling	885	5.89	401	2.67
21	Resawn and Dressed Timber	1347	8.33	407	2.51
22	Joinery and Fabricated Board	1125	8.50	427	3.23
23	Furniture and Mattresses	866	14.71	393	6.67
24	Pulp, Paper and Paper Board	1601	2.66	554	0.92
25	Paper Bags and Fibre Board Containers	1697	28.25	768	12.78
26	Publishing and Printing	800	6.54	390	3.20
27	Basic Chemicals	1920	7.36	605	2.32
28	Other Chemicals	2724	217.39	751	59.94
29	Clay Products	905	40.65	431	19.34
30	Cement and Cement Products	1741	13.61	517	4.04
31	Other Non-Metallic Mineral Products	774	57.14	385	28.43
32	Basic Metal Products	2921	2.41	622	0.51
33	Fabricated Metal Products	1076	6.29	541	3.16
34	Motor and Rail Vehicles	733	8.70	395	4.70
35	Ship and Boat Building	747	83.33	420	46.84
36	Other Manufacturing	925	9.38	486	4.93
37	Electricity and Gas	1318	3.78	535	1.54
38	Residential Building	629	2.46	309	1.21
39	Other Building	574	0.82	308	0.44
40	Wholesale Trade	830	1.14	430	0.59
41	Retail Trade	555	0.48	347	0.30
42	Transport and Storage	933	1.31	424	0.59
43	Ownership of Dwellings	-	-	1841	3.92
44	Commerce	557	0.46	300	0.25
45	Government	434	0.29	275	0.18

(a) 100 workers divided by the direct employment change

(b) 100 workers divided by the total employment change
(Direct, indirect and induced)

CHAPTER 7

CONCLUSIONS

7.1 The Results in Perspective

This study set out to construct a regional input-output model for 1968-69 and the transactions table produced presents, for the first time, an overall view of the type, size and interdependence of economic activity within the State of Tasmania. Comparison with tables of other States is difficult as the only other State table, that of Western Australia produced by Parker [32], related to a financial year one decade earlier. However the two studies indicated an interesting contrast in the degree of openness of the two State economies. Tasmania, with imports at 15 per cent of the total transactions output, had a far more open economy than W.A. where imports were 11 per cent of total transactions. The level of imports into Tasmania approached the level of imports reported in two sub-State large regional models, Macquarie 1968-69 [see 26] and Central Queensland 1965-66 [see 23] with 19.5 per cent and 16.1 per cent respectively.

These two regional studies also calculated multipliers. Income multipliers tend to be directly proportional to the size of population with national multipliers higher than State multipliers, State higher than regional, which in turn is higher than urban. This results from income leakages (principally by imports but also from Federal and State taxation) being highest at the small regional level. The Tasmanian Type II income multipliers ranged from 5.909 to 1.512, mean 2.370 and the Macquarie region 4.14 to 1.33, mean 1.82, which conforms to the expected pattern. The Central Queensland results, however, were slightly higher with Type II income multipliers ranging from 6.093 to 1.305, mean 2.434. This can be partly explained by the high proportion (7 per cent) of Tasmanian total output produced by the industry "Government" (an industry with a very low income multiplier) compared with the Central Queensland figure of 2 per cent. Also leakages by imports are rather similar for both regions. Type II employment multipliers for Tasmania ranged from 10.162 to 1.579, mean 2.677 and for Central Queensland 8.143 to 1.285, mean 2.434.

Although smaller in size, the Tasmanian input-output table has been constructed with similar industry classifications to the latest national tables and both relate to the same financial year. This should facilitate the work of researchers examining regional implications of national policies. The study has also provided an estimate of Tasmanian Gross Domestic Product which adds to the set of regional social accounts gradually being built up by Australian input-output studies.

7.2 The Need for Further Research

Although the table provides a framework which may be used for analytical work concerned with the Tasmanian economy, the model provided does have deficiencies of which potential users should take cognisance. In keeping with most other input-output studies, there has been a lengthy gap between the financial year under study and the publication of results. The time period in this instance was extended by the late publication of the results of the first integrated censuses and the fact that the table was constructed with minimal resources. Although any given table may be updated by a variety of techniques, its accuracy declines over time due to changes in industrial structure and technology. Now that an initial set of input-output tables has been produced for the State, the task of constructing subsequent tables has been simplified. It would appear a good follow-up investment to construct tables for later years, preferably for financial years coincidental with national tables.

The type of changes which has occurred in the Tasmanian economy since the construction of this table includes switches in demand from one sector to another (e.g. Associated Pulp and Paper Mills no longer imports kaolin clay but instead uses clay from its own newly developed Tasmanian mine); new industries have been established within ASIC classifications (e.g. several large woodchip establishments now constitute part of ASIC 2516 and North West Acid Pty. Ltd. included in ASIC 271); and technology has changed in some industries (e.g. the majority of dairy farms now send whole milk to factories, not cream as in 1968-69).

In Chapter 5 it was shown that data availability allowed a far greater reliance to be placed on the transactions determined for the primary and manufacturing sectors than transactions for the tertiary and services sectors. The procedures used for these latter sectors involved approximations which were unavoidable in the absence of more resources to obtain information direct from firms. The ABS has planned to eventually bring construction and transport within the integrated censuses. This will greatly improve the accuracy of estimation of transactions flows for industries within these sectors.

Subsequent studies should be planned with sufficient resources to conduct field surveys of business establishments within the commercial sector, not only to improve accuracy, but also to allow separation of the conglomerate industry "Commerce" into several industries. Similarly subsequent research should be directed at dividing the very large industry "Government" into at least four smaller industries, Federal Government, State Government, Local Government and Education.

The value of analytical work would be enhanced by the disaggregation of the huge manufacturing industry "Basic Metal Products". Although this industry has been shown to comprise 14 establishments, it is dominated by four large companies with widely differing input patterns. For instance, a sizeable proportion of the inputs of E.Z. Co. Ltd. comprise ores produced on the West Coast of Tasmania, whereas TEMCO purchases the bulk of its inputs from interstate, manganese ore from the Northern Territory, coke from Newcastle and limestone from South Australia. Because of diverse input purchases, the interindustry effects of component company activities could be expected to be dissimilar. However, due to confidentiality rules, the published secondary data had to be aggregated. Direct approach to the companies for primary data may well result in a subsequent table being able to form two industries within the ASIC classification 29.

7.3 Some Further Applications of the Model

Chapter 3 examined some of the analytical techniques which may be undertaken subsequent to the production of an input-output table. Some of the analytical work (the calculation of output income and employment multipliers) has been presented in Chapter 6.

The basis has now been laid for further analytical work by other researchers. In particular, this study was aimed at providing a tool for quantitative examination of the ramifications of industry problems and selecting appropriate industry assistance at all levels of Government but particularly at State level. Some immediately apparent uses are outlined.

Whilst policies of the Federal Government can be expected to have the greatest influence on the structure and level of economic activity, State and Local Governments undertake a wide range of measures aimed at exerting an influence in this field. These include differential assistance to firms such as subsidised power, credit, land and transport, subsidies on production, State taxation concessions and conditional operation such as the requirement for an extractive industry to undertake mineral processing within the State.

The type of assistance provided by the Tasmanian Government for the establishment of new or the expansion of existing industries has been described by Hanson [13 p 4]. Although Hanson was unable to find any firm statement of Government policy with respect to industrial development in Tasmania, he did conclude that the Government places most emphasis on attracting small to medium-size labour-intensive firms. This suggests a preference for income and employment generating industries. However, there was no evidence of quantitative studies by Government to measure benefits and costs in order to rank specific projects for the efficient allocation of assistance funds.

Without these studies the granting of assistance may not necessarily be in accord with the income-employment objective. For instance when indirect and induced effects are considered, a labour intensive industry which imports most of its materials may not exceed the employment and income generation effects offered by a capital intensive industry which purchases local inputs and produces, for the local market, goods which are import replacements. The input-output model has provided a basis for this type of appraisal and the selection of industries which will build up industrial infrastructure.

The results of this study can also assist in predicting the total effects on Tasmanian economic activity of changes in economic policy at the Federal level. The Callaghan Inquiry [3] used the Tasmanian input-output model to examine interindustry relationships in Tasmania and in addition, from the Tasmanian and national tables, examined the effects on economic activity and employment resulting from currency devaluation.

The Industries Assistance Commission has been one of the principal users of the Australian input-output tables for their investigations into structural change and interdependence of industries. The IMPACT medium term model of the Australian economy [see 21] has a sub model ORANI [see 38] which was constructed from national input-output tables. In the investigations into the effects of such variables as tariff changes, the regional implications have been estimated with such simplifying assumptions as the percentage change predicted at the national level also occurs in each region and immobility of resources does not constrain adjustment between the regions. The incorporation of State and other small area input-output tables into simultation work facilitates projections with greater accuracy at the regional level. Since the construction of the Tasmanian transactions table, the I.A.C. have been using it in their analysis of the effects of tariff changes.

The transactions table and associated coefficients and multipliers have been used by the State Government for an impact analysis related to the industries "Textiles Yarns and Woven Fabrics" and "Clothing and Footwear". This impact study examined the direct, indirect and induced income and employment effects on all Tasmanian industries brought about by closing down these two industries through a range of final demand contractions. An estimate was made of the consequent population outflow from the State and its community costs.

It seems apparent that as results of this study become more widely circulated, they will provide the basis for further economic research related to Tasmania. It is to be hoped that usage of the input-output model will bring forth firstly, an acknowledgement of the need for a new transactions table pertaining to a subsequent financial year and secondly, the necessary resources required to improve on this model in accordance with the recommendations reported in this chapter.

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