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The Impact of Major Development Projects on the Gladstone/Calliope, Fitzroy, Queensland, and Australian Economies: An Application of Input-output Analysis

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THE IMPACT OF MAJOR DEVELOPMENT PROJECTS ON THE GLADSTONE/CALLIOPE, FITZROY, QUEENSLAND, AND AUSTRALIAN ECONOMIES: AN APPLICATION OF INPUT-OUTPUT ANALYSIS

REPORT TO THE DEPARTMENT OF COMMERCIAL AND INDUSTRIAL DEVELOPMENT

AND

COMALCO LIMITED

BY

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PREFACE

In January 1978, the Department of Commercial and Industrial Development, and Comalco Limited commissioned the authors to apply the input-output technique for the analysis of the economic impact of major industrial developments at Gladstone. This document reports on that research.

This report has two objectives. Firstly, it presents a methodological framework for the analysis of economic impacts with input-output models. This approach, based on the Generation of Regional Input-Output Tables (GRIT) system developed previously by the authors, allows the analyst to measure the effects of both the construction and operating phases of new industries, plus the spatial incidence of impacts as they effect the local, regional, state and national economies.

Secondly, this report presents the results of the empirical application of the above system to the analysis of the economic impact of an aluminium smelter, cement clinker plant, and thermal power station. Quantitative results in terms of projected industry output, household income and employment effects are presented along with qualitative assessments designed to aid user interpretation of the results.

This report in conjunction with GRIT will facilitate an increasing economic content in the urban and regional planning process.

T.D. Mandeville
R.C. Jensen

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This project was co-ordinated by a Steering Committee with the following members:

Mr. G. Baker	Department of Commercial and Industrial Development
Mrs. D. Thomas	Department of Commercial and Industrial Development
Mr. G.E. Littlewood	Comalco Limited
Mr. R.R. Burke	Comalco Limited
Mr. P. Crooke	Comalco Limited
Mr. K. Willett	Co-ordinator General's Department
Mr. I. Johnson	Co-ordinator General's Department
Mr. L.J. Madden	Australian Bureau of Statistics
Mr. J. Dickinson	Department of Primary Industries
Mr. W.J. Higham	Department of Health.

The Steering Committee provided considerable input to this study. Particular thanks are due to Mr. G. Baker and Mr. G.E. Littlewood for their organisational assistance, encouragement and comments on the final draft of this report; to Mr. R.R. Burke in connection with the provision of necessary industry data; and to Mr. I. Johnson and Mr. K. Willett for their expert advice.

In connection with the study team's visit to Gladstone, particular thanks are extended to Mr. J. Gray of Comalco Limited's Gladstone Office for his organisational assistance; to Mr. K. Horsley who assisted with the interviews; and to the business people, local government and public authority people interviewed.

The computer programme was written, and the computing task capably undertaken by Mr. A. Broughton.

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T.D. Mandeville

R.C. Jensen

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PROLOGUE

"As artists began a century ago to construct their works backward, starting with the effect, so now with industry and planning. In general, electric speed-up requires complete knowledge of ultimate effects."

Marshall McLuhan, Understanding Media,
Abacus, 1964, p. 378.

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND AND OBJECTIVE OF THE STUDY

The 1970's have witnessed an increasing desire on the part of government and industry to assess the impact of new developments on host regions. Most new projects now require an Environmental Impact Assessment and recently governments have shown more interest in possessing information on the potential economic effects of new developments. Ideally this information would present a blueprint of the expected structure of the regional economy following the establishment of a new industry. This information is important for planning and decision making at all levels, enabling business and government to perceive the magnitude of eventual effects, and likely gaps in industry requirements and the provision of associated services.

At the local and regional level information relating to the impact of major projects has generally not been available and this has made it difficult to develop a consistent approach to regional economic planning. In Australia, regional economic impact studies have tended to be somewhat haphazard, employing a variety of approaches. One approach has been to 'assume' multipliers to be of a certain magnitude, or within a given range of magnitudes. The assumed multipliers are normally gained from informed opinion and represent 'best-guesstimates' in the absence of data from comparable regions, or resources to complete an empirical study in detail. Another approach has been to 'borrow' multipliers from a previously completed study from a region of similar industrial structure. A third approach has been the 'estimation' of multipliers by a variety of questionable techniques, often from sparse and unsuitable regional data. These multipliers derived must inevitably be of dubious value, but are often accepted as 'reasonable estimates' and assume an aura of authenticity which is not warranted.

In some circumstances the 'borrowing' or the 'best-guessing' of multipliers might be appropriate, for example in tentative or preliminary studies, or studies of relatively insignificant events which do not warrant a professional level of attention. Where the size or the importance of the impacting agent warrants serious attention, regional Keynesian multipliers, economic base multipliers or input-output multipliers can be developed. Of these three models, input-output is by far the most powerful technique (see Chapter 4). Input-output economics involves dividing the economy of an area into industrial groupings (sectors) and tracing out the transactions flows in dollars between the sectors for a given year. Once the flows or transactions table has been compiled, simple mathematical transformations can be made to derive output, income and employment multipliers for each sector in the economy. The multipliers allow the analyst to determine the economic impact (in terms of industry output, income to households, and employment) resulting from a given economic stimulus in a particular year. The model can also be adapted to examine the impact of a new firm or industry on an area. Further details on the input-output model appear in Appendix I and Chapter 4.

Input-output analysis is potentially a useful descriptive device and a powerful analytical technique. In practice, the time and expense required to construct survey-based tables has restricted the application of the technique to 'research' rather than operational applications. Certainly input-output techniques appear to have played a relatively insignificant part in most regional planning decisions made by government, due largely to the inability of analysts to produce input-output tables in the time span within which most decisions must be made. Recent work at the University of Queensland has altered this situation, thereby laying the groundwork for this study.

This study was commissioned by the Department of Commercial and Industrial Development, and Comalco Limited, both of which were concerned to provide information on the local, regional and economy wide effects of further major developments at Gladstone. Prior to the commencement of this study, the authors had developed a methodology termed the Generation of Regional Input-Output Tables (GRIT) system designed for general use in the production of regional input-output tables from both national input-output tables and other data sources. This methodology was applied to generate consistent input-output tables for the ten statistical divisions and the State of Queensland. GRIT is fully documented in Jensen, Mandeville and Karunaratne (1977), outlined in Appendix II of this report, and briefly discussed here. GRIT is a variable-interference non-survey based system producing hybrid (i.e. a combination survey and non-survey) input-output tables. GRIT is a logical extension of recent trends in the input-output literature towards the production of less costly input-output tables and thus is an attempt to elevate regional input-output analysis from the status of a 'research' technique to that of an operational planning technique. It provides the facility for users to develop holistically accurate regional input-output tables at relatively low cost.

Comalco Limited expressed a desire for an economic study of the Gladstone area to estimate the impact the construction and operation of its proposed aluminium smelter will have on the Gladstone/Calliope region. The Department of Commercial and Industrial Development has well-established interests in this and a number of other industrial developments in the area. These two organisations agreed to a joint commission to the authors to prepare an input-output table and multipliers for the area comprising Gladstone City and Calliope Shire and to analyse the impact of specific industries on the Gladstone City/Calliope Shire area, the Fitzroy Region, the State of Queensland, and Australia. The GRIT tables and methodology provided the ideal analytical framework for such a study.

The project terms of reference can be summarised as follows:

(a) to use the GRIT methodology to produce a 19-sector input-output table, and associated sector output, income and employment multipliers for the sub-region comprising Gladstone City and Calliope Shire for the year 1974-75;

(b) to develop a brief comparison of the economic structure of the Gladstone/Calliope, Fitzroy, Queensland and Australian economies;

(c) to derive a methodology based on GRIT for the analysis of the economic impact of new industries;

(d) to use the methodology derived in (c) to determine empirically and analyse the impact on the economies of Gladstone/Calliope, the Fitzroy region, the State of Queensland, and Australia of the following new industries:

  (i) Comalco Limited's proposed aluminium smelter;
  (ii) The Queensland Cement and Lime Company Limited's planned cement clinker plant;
  (iii) The Gladstone Power Station.

Other developments that are occurring or may occur in the Gladstone area such as the Rundle Shale Oil Project or a possible further expansion of the alumina refinery are not considered in this report.

1.2 OUTLINE OF THE REPORT

Chapter 2 provides a brief examination of the Gladstone/Calliope sub-region - its economic history and development and the nature of the sub-regional economy in 1974-75. In Chapter 3 the economic structures of Gladstone/Calliope, Fitzroy, Queensland and Australia are compared in terms of the relative importance of industries, imports and exports, and economic linkages. A survey of the literature on regional economic impact analysis is provided in Chapter 4 along with some discussion which provides a perspective on this study. Chapter 5 outlines the impact analysis methodology developed for this project and its application to this study, while Chapter 6 is concerned with an empirical examination of the impact of the three new developments on the four economies under examination. Finally Chapter 7 provides a summary of the conclusions arising out of the study. Extensive use of appendix tables has been made in the interests of the readability of this report. Readers desiring background details on the input-output technique and GRIT in particular are referred to Appendices I and II respectively.

CHAPTER 2

THE GLADSTONE AREA

2.1 LOCATION, DESCRIPTION AND GEOGRAPHY

The Gladstone area is defined for this study as the City of Gladstone plus the surrounding Shire of Calliope. Two of the industries whose impact will be examined in this report, the aluminium smelter and the cement clinker plant will be located in Calliope Shire, while the third industry, the Gladstone Power Station, is located within the boundaries of Gladstone. Thus the sub-region comprising Gladstone/Calliope is considered to encompass the bulk of local impacts. Population in the sub-region in 1976 was 24 003 persons, 5 055 of which resided in Calliope Shire, and 18 948 persons resided in Gladstone City.

Gladstone has an area of 440 sq. kilometres, and the total area of Calliope Shire is 5 875 sq. kilometres.

> "Gladstone is located on the coast at the mouth of a narrow stretch of water separating Curtis Island from the mainland. The indentured shoreline of Gladstone, between the points of discharge of the Calliope and Boyne Rivers, is protected from the prevailing south-east trade winds and consequently from substantial siltation from the longshore drift. It is these factors plus the depth of water resulting from the geological history that combine to make Gladstone an ideal harbour. The inland topography is quite rugged past an immediate area of coastal flats where progressive reclamation is underway."
>
> (Sinclair et al. 1976, p. 11.1)

Gladstone is 82 air kilometres south-east of Rockhampton and 376 air kilometres north-west of Brisbane.

> "Calliope Shire contains much rugged land and is bordered by the coastal Ulam and Calliope Ranges on the west, the Dawes and Many Peaks Ranges to the south and an offshoot of the Dee Range to the north. The Shire drains to the ocean with the Calliope and Boyne Rivers being the major catchments with Raglan Creek a major catchment to the north."
>
> (Sinclair et al. 1976, p. 10.1)

The Gladstone/Fitzroy/Bowen Basin/Central Queensland area has been the subject of many studies. Readers desiring further, or more comprehensive, background information on the area are referred to Catto (1966), Commonwealth Department of National Development and Queensland Department of Industrial Development (1969), Department of Economics, University of Queensland (1969), Harris and Eckermann (1972), Jensen (1976), Jensen, Mandeville and Karunaratne (1977), Jones, Flint and Pike (1975), Kaiser Engineers (1975), Nabalco Engineering (1974), Schubert et al. (1970), Sinclair, Knight and Partners and Bergsteiner, McInnes and Rigby (1976), and UPDA Planners (1974).

2.2 THE ECONOMIC DEVELOPMENT OF GLADSTONE CITY 1954-76

During the period 1933 to 1954 the economy of Gladstone evolved with the agricultural development of the hinterland. The area acted as a centre for agricultural processing (meat and butter, rural supplies and harbour activity). Exports from Gladstone were mainly meat and butter. Population rose from just over 3 000 to nearly 7 000 in this 21 year period; this represented a growth rate of 4 percent per annum, more than twice the rate for the State as a whole.

The main industry in Gladstone during the 1950's was the Swifts meatworks which, at peak times, employed over one-third of the workforce of the town. Activities at the meatworks declined in the late fifties leading to a closure of the plant in 1963. Reflecting this, the population increase in Gladstone declined to 0.5 percent per year over the period 1954 to 1961, less than half the number for any year in the 1950's. With the decline of the town's largest employer the general economic outlook of the area was pessimistic in 1961.

However, there were two, now well-documented, developments in the period 1954-66 which would significantly affect the economy of Gladstone. These were the development of the coal deposits in Central Queensland and the bauxite deposits at Weipa in the Cape York Peninsula. Beginning with the opening of Thiess Peabody Mitsui's coal mine at Moura in 1961 and later the Queensland Government's decision in 1964 to construct a railway line from Moura to Gladstone, Gladstone's future as the major coal export port for the region was assured. In 1962, work began on Stage 1 of the Calcap power station at Callide. Thus ...

> "By 1966 the foundations for the development of the Central Queensland coal deposits had been laid, first with the establishment of the Australian/Japanese company, then with the passing of appropriate State and Commonwealth legislation, the construction of the rail line from Moura to Gladstone, the commissioning of the first stage of the Calcap power station, and the initial improvements to Gladstone's port facilities... The significant point that must be stressed is that these arrangements had a major impact on the future of Gladstone, first because of its selection as the region's coal export port and second because the existence of the Calcap power station was related to the decision to locate the alumina refinery at Gladstone."
>
> (Harris and Eckermann, 1972)

In 1963, the decision was made to locate Queensland Alumina Limited's (QAL) refinery at Gladstone to treat the Weipa bauxite deposits.[1] Construction of the alumina refinery began in 1964, and this plus rail line construction and the upsurge in private and commercial building resulted in Building and Construction becoming Gladstone's main industry in the mid 1960's. Table 2.1 indicates the labour force (over 50 percent of the total workforce at Gladstone) employed in the Building and Construction industry in 1966. The upsurge in economic activity is reflected in the population increase during the 1961-66 period. Gladstone's population in 1961 was 7 181 and in 1966 reached 12 426 representing an increase of 11.6 percent per annum over the period.

With the beginning of the operational phase of the alumina refinery in 1967, the period 1966-71 saw an increase in the relative importance of Manufacturing as one of the major employment sources in the sub-region. However, in 1971 Building and Construction remained the largest single industry in terms of employment due mainly to expansions of the QAL alumina refinery and the commencement of the construction of the Gladstone Power Station in 1970. Population grew from 12 426 in 1966 to 15 166 in 1971 representing a growth of 4.1 percent per annum, substantially less than the years during the 1961-66 period, but still more than double the State average for that period. This period also saw a substantial increase in the exploitation of the Central Queensland coal deposits. The completion of the Moura rail link to Gladstone in 1966 produced a significant rise in coal production for export. The Utah Development Company's fields at Blackwater were also developed, the coal being transported by rail to Gladstone via Rockhampton. The rail line from Gladstone to Rockhampton was upgraded and port facilities at Gladstone were expanded and improved.

1. For background on the selection of Gladstone in preference to alternative sites see (Catto, 1966, pp. 12-18) and (Harris and Eckermann, 1972, p. 6).

TABLE 2.1

Workforce by Industry and Population, Gladstone City, 1954-76
(persons)

Industry	1954	1961	1966	1971	1976
1. Animal industries					
2. Other primary industries	83	95	84	98	80
3. Mining					
4. Manufacturing	1 101	835	649	1 259	1 715
5. Electricity, gas and water	13	18	69	37	308
6. Building and construction	273	214	2 911	1 523	1 383
7. Trade	389	601	637	998	1 201
8. Transport and communication	483	460	620	634	845
9. Finance					
10. Public administration and defence	423	473	843	1 146	1 680
11. Community services and entertainment, recreation					
Total	2 765	2 696	5 813	5 695	7 212
Population	6 944	7 181	12 426	15 166	18 948

Source: Australian Bureau of Statistics, Population Census. (Note that the 1976 figures refer to the new slightly larger, boundary of Gladstone City).

Coal exports increased from 1.6 million tonnes in 1965-66 to 7.2 million tonnes by 1970-71.

The Port of Gladstone has now become one of Australia's major ports and in terms of quantity of material handled it ranks first in the State. In recent years the Gladstone Harbour Board has been involved, not only in development of port facilities, but also in considerable land reclamation both on its own account and also in conjunction with the Queensland Department of Commercial and Industrial Development. This land is being made available for industry use. The following table indicates the growth of the port for the period 1960-61 to 1974-75.

TABLE 2.2

Cargo Handled at the Port of Gladstone

Year	Cargo Handled ('000 tonnes)			No. of Ships
	Imports	Exports	Total	
1960-61	95	77	172	71
1961-62	94	357	451	97
1962-63	88	364	452	108
1963-64	78	926	1 004	130
1964-65	111	1 223	1 334	131
1965-66	134	1 784	1 918	153
1966-67	730	1 855	2 585	173
1967-68	1 889	3 044	4 933	319
1968-69	2 638	4 271	6 909	344
1969-70	3 264	7 032	10 296	407
1970-71	3 317	8 402	11 719	415
1971-72	4 253	8 303	12 555	380
1972-73	4 651	9 319	13 970	384
1973-74	5 545	9 729	15 274	415
1974-75	6 634	9 098	15 731	430

Source: Gladstone Harbour Board, Annual Report, various issues.

Since the opening of the QAL plant in 1968, the main imports have been bauxite, petroleum products and caustic soda, with the main exports as coal, alumina and grains.

2.3 THE GLADSTONE/CALLIOPE ECONOMY IN 1974-75

This section will consider aspects of the Gladstone/Calliope sub-regional economy in detail, while Chapter 3 will compare and contrast the aggregate structure of Gladstone/Calliope with Fitzroy, Queensland and Australia. Discussion here of the Gladstone/Calliope economy is based on the 19-sector Gladstone/Calliope input-output table constructed for this project which appears in Appendix VI as Table VI-I. Technical details associated with the table construction are outlined in Appendix IV.

The Gladstone/Calliope input-output table summarizes the inter-industry flows in dollar terms in the sub-region for 1974-75. The first nineteen entries in the first row of the table indicate the sales of the Animal Industries sector to other sectors in the sub-region. For example, $922,000 worth of Animal Industry products were sold to the Food Manufacturing sector (column 4A). After the first nineteen, the next three entries in the first row indicate sales by Animal Industries to the three final demand categories of Households, Other Final Demand, (which includes investment, government expenditure and stock changes) and Exports from the sub-region. The final entry in the first row denotes the total output of the Animal Industries sector in 1974-75 of $2,322,000.

A more detailed study of the rows of Table VI-I draws attention to some important characteristics of the Gladstone/Calliope economy. First, some sectors, particularly service type sectors, export only a very small proportion of total output. Sectors such as Public Administration, Community Services, Finance, Trade and Building and Construction are established in the region at the level sufficient to provide the amounts of services required locally. Second the heavy reliance on the Metals and Metal Products sector (alumina refinery) for regional exports is demonstrated in the table.

The entries in the first column of Table VI-I indicate purchases by the Animal Industries sector from the other intermediate sectors of materials and services needed to produce its output. The last four entries in the first column show the purchases of labour in the Households row, the components of Other Value Added (depreciation, indirect taxes, interest and profits), the Imports of that sector, and finally, the total outlay of the Animal Industries sector which, by definition, must equal total output.

The column structure of the transactions table is important. In general terms, the columns indicate the relative propensities of industries to obtain their inputs from other sectors in the sub-region. Also since the columns show the pattern of purchases of each sector, they are the basis for the calculation of tables of co-efficients for the analytical application of input-output. An examination of the columns of the transactions tables is an important prerequisite to the analytical stage, and highlights some important points with respect to the Gladstone/Calliope economy.

First, the column shows, within the Household row, the sources by sector of the wages, salaries and supplements paid within the region, and indirectly the importance of each sector as a source of employment in the sub-region. Thus the most important employers in Gladstone/Calliope are the Metals and Metal Products, and the Building and Construction industries. Second, the columns show the imports by sector into the sub-region. The Metals and Metal Products sector stands out as the sub-region's largest importer, importing bauxite, petroleum products and other inputs into the alumina manufacturing process.

Table 2.3 is a further descriptive table prepared from the Gladstone/Calliope transactions table, indicating the relative importance of the various industries in the sub-regional economy. The total turnover in the sub-region, that is the sum of the outputs of the nineteen sectors was $246 million in 1974-75. The two sectors making by far the largest contribution to sub-regional turnover were the Metals and Metal Products sector which includes the alumina refinery and engineering/metal fabricating firms, and the Building and Construction sector. The major construction project in the sub-region in 1974-75 was the Gladstone Power Station, which employed circa 900 men on the site. The Transport and Communication sector is the sub-region's fourth largest industry, reflecting Gladstone's importance as the primary port for the Fitzroy region. No electricity was generated in the area in 1974-75; all electricity was imported from the Capricornia Regional Electricity Board (CREB) which operates coal-fired thermal power stations at Callide (120 MW) and at Rockhampton (22.5 MW). However a nominal electricity output was attributed to the area based on the number of CREB employees located at Gladstone in 1974-75. The Coal and Crude petroleum and Other Manufacturing sectors were non-existent in the area, but are included in the tables (zeroised) to maintain consistency with the overall GRIT sector classification system.

The Gross Regional Product (GRP) of Gladstone/Calliope may be calculated from the input-output table. This corresponds to the GNP concept for the Australian economy.

By definition,

GRP = Total output-intermediate purchases - imports

or

GRP = Wages and salaries + other value added

GRP = $123 million in Gladstone/Calliope.

While the Gladstone/Calliope input-output table describes the economy and yields interesting bits of information for 1974-75, in itself, it has no analytic content, that is, it does not answer questions concerning the reaction of the sub-regional economy to change. Let the input-output table represent the Gladstone/Calliope economy in equilibrium and subject it to a shock such as the location of a further major industry in the sub-region. When the repercussions of the shock have moved through the economy, what will be its new equilibrium position in terms of industry output, household income and employment? Such analysis is the focus of this report.

TABLE 2.3

Relative Size of Industries in the Gladstone/ Calliope Sub-Region 1974-75

Relative Size	Sector	Output ($'000)	Percent of Total Output in the Sub-Region
1	Metals, metal products	129,586	52.69
2	Building, construction	47,629	19.36
3	Trade	16,099	6.55
4	Transport and communication	14,791	6.01
5	Finance	9,459	3.85
6	Entertainment, recreation	4,122	1.68
7	Public administration and defence	4,108	1.67
8	Community services	3,684	1.50
9	Food manufacturing	3,519	1.43
10	Electricity, gas, water	2,906	1.18
11	Animal industries	2,323	0.94
12	Wood and paper manufacturing	2,060	0.84
13	Other mining	1,704	0.69
14	Non-metallic mineral products	1,332	0.54
15	Other agriculture	1,078	0.44
16	Machinery, appliances, equipment	967	0.39
17	Forestry, fishing	595	0.24
18	Coal and crude petroleum	0	0
19	Other manufacturing	0	0
	Total Turnover in the Sub-Region	245,962	100

Source: Gross output row of Table VI-I

CHAPTER 3

GLADSTONE/CALLIOPE, FITZROY, QUEENSLAND,

AUSTRALIA - A STRUCTURAL ANALYSIS

This chapter will focus on the structure of the economy in the four areas under consideration: Gladstone/Calliope, Fitzroy, Queensland, Australia. A comparison of these areas in terms of their relative industrial composition, patterns of imports and exports, and linkages between sectors will be undertaken using the 11 - sector input-output tables and associated multipliers for each area. Comment based on the 11 - sector tables in this chapter is relevant also to the 19 and 36 sector tables presented in the appendices. These should be considered simply as providing more detail relating to those sectors which are shown in more disaggregated form.

In the 11, 19 and 36 - sector input-output tables, sectors are represented by numbers in the interests of space. These numbers represent sectors as defined in Appendix III. It will be noted that the same sector number designator is retained throughout the various tables; the numbering is modified to denote finer detail in the 19 and 36 - sector tables. For example, Sector 4 in the 11 - sector tables refers to the Manufacturing sector; in the 19 - sector tables Sector 4 is disaggregated to Sectors 4A-4F. In the 36 - sector tables, these may be further disaggregated as 4A1-4A5, and so on.

For convenience in the reading of this chapter the sector titles for the 11 - sector tables are provided below:

Sector No.	
1	Animal industries
2	Other primary industries
3	Mining
4	Manufacturing
5	Electricity, gas and water
6	Building and construction
7	Trade
8	Transport and communication
9	Finance
10	Public administration and defence
11	Community services and entertainment, recreation.

3.1 INDUSTRIAL COMPOSITION AND IMPORT/EXPORT PATTERNS

Each cell entry in the transactions tables represents the sum of the transactions between two sectors for a given year.[1] Consequently each cell entry is important, it indicates whether the economic linkages between the sectors concerned are strong or weak, i.e. whether or not a change in the level of output of one sector is likely to affect the other. While it is important to identify weaker linkages, it is the stronger intersectoral linkages which are more critical in identifying those characteristics of an economy which determine its response to changing economic circumstances. The relative size of each cell entry, the distribution of these relative sizes over the table, and the tendency for larger entries to appear in particular sectors are therefore important in understanding the nature of each of the four economies being considered and the variation between them.

The tables for the four economies present some predictable contrasts in this respect. The Gladstone/Calliope region shows a table (Table 3.1) of relatively small transactions, with many zero entries in the endogenous matrix. Expanding the boundaries of Gladstone/Calliope to encompass the Fitzroy region (Table 3.2), the importance of the pastoral and coal mining industries become apparent.

The tables for Queensland and Australia (Tables 3.3, 3.4) indicate a sharp contrast to the tables for the region and sub-region. A much higher proportion of the cell entries are relatively large in magnitude, reflecting the more numerous intersectoral linkages which are characteristic of more diversified economies, which are less dominated by particular sectors and display numerous linkages which could be described as significant. These tables are typical of input-output tables describing advanced economies.

Further tables derived from the transactions tables highlight other features of these four economies. Table 3.5 indicates the relative importance of industries in the four areas. The Gladstone/Calliope economy

1. It should be kept in mind that the table for Gladstone/Calliope refers to 1974-75, those for Fitzroy and Queensland refer to 1973-74, and the Australian table refers to the 1968-69 year. Thus the transactions are not precisely comparable but enable general comparisons to be drawn.

Table 3.1 Gladstone/Calliope Sub-Region, 1974-75 ($'000) Transactions Table

	1	2	3	4	5	6	7	8	9	10	11	Households	Other final demand	Exports	Total
1	0	0	0	923	0	0	0	0	0	0	0	20	0	1379	2,322
2	85	45	1	170	2	2	0	83	0	0	2	462	0	820	1,674
3	0	1	3	765	0	552	1	3	0	0	1	0	0	378	1,704
4	26	18	40	2495	8	5011	54	62	1	66	54	1864	247	127520	137,466
5	5	3	5	2350	9	40	25	26	71	13	75	284	0	0	2,907
6	35	18	24	226	111	0	191	1681	432	479	181	0	44251	0	47,629
7	93	96	150	1065	29	2214	1012	476	405	24	200	9678	0	659	16,101
8	41	41	63	1150	118	1339	327	135	70	14	42	7018	1107	3325	14,790
9	1	1	86	578	9	81	1173	231	316	58	195	4140	1683	905	9,457
10	0	0	0	91	0	0	0	0	0	0	0	161	3856	0	4,108
11	2	0	1	86	1	4	33	2	5	18	9	3661	3248	736	7,806
Households	122	250	227	20724	738	14584	6250	5799	3431	2642	3898	0	0	0	58,665
Other value added	1402	799	348	41856	1547	5941	4815	3055	3716	67	1739	0	0	0	65,285
Imports	510	402	756	64987	335	17861	2220	3237	1010	727	1410	30773	0	0	124,158
Total	2322	1674	1704	137466	2907	47629	16101	14790	9457	4108	7806	58061	54392	135722	

Table 3.2 Fitzroy Region, 1973-74 ($'000) Transactions Table

	1	2	3	4	5	6	7	8	9	10	11	Households	Other final demand	Exports	Total
1	0	0	0	24254	0	0	0	0	0	0	0	451	0	31097	55,802
2	4436	3006	1673	3516	3	1	0	25	0	0	8	9252	4	10271	32,195
3	0	6	1524	6167	2000	1143	93	100	1	2	65	0	0	174319	185,417
4	2069	723	6214	9517	121	11413	563	1878	21	345	784	36767	20143	134853	225,411
5	460	303	5739	3440	192	309	370	137	659	152	1230	2940	4900	1200	22,031
6	852	412	3548	1216	732	0	793	2625	881	1483	1109	1526	81638	0	96,820
7	2834	1697	9396	6920	288	6998	4312	972	1309	107	1421	23618	1611	0	61,483
8	814	700	5008	5273	771	2363	1350	211	197	97	202	3235	511	1534	22,244
9	15	20	1237	1151	43	153	4073	108	1199	290	337	11189	4546	2447	26,808
10	0	0	6	274	1	0	0	0	0	0	0	574	12235	0	13,090
11	134	1	133	257	10	10	148	24	36	164	43	12331	24005	2028	39,324
Households	3094	3307	21273	45595	5571	29436	23674	8637	10315	8243	21783	0	0	0	180,928
Other value added	33546	17295	82668	41216	11036	12072	18915	4572	10231	201	7436	0	0	0	239,188
Imports	7546	4725	46998	76615	1263	32922	7192	2955	1959	2023	4906	116117	0	0	305,223
Total	55802	32195	185417	225411	22031	96820	61483	22244	26808	13090	39324	218000	149593	357749	

Table 3.3 State of Queensland, 1973-74 ($'000) Transactions Table

	1	2	3	4	5	6	7	8	9	10	11	Households	Other final demand	Exports	Total
1	0	0	0	312095	0	3	0	1	0	0	0	10111	0	183319	505,529
2	41501	61382	11322	309949	120	23	1	1588	0	9	174	140639	0	90808	657,516
3	1	111	14804	91743	13766	11884	1645	2196	21	61	1063	0	0	519578	656,873
4	60788	72829	84626	394773	9235	328661	37125	75579	3130	42829	28116	849620	90194	890524	2,968,029
5	6151	9741	25764	48451	6411	4793	9633	5793	32798	6236	30219	87448	23477	0	296,915
6	7461	8102	7540	23534	13642	0	15024	46367	28008	44375	15683	24136	857951	0	1,091,823
7	21512	29699	47977	132443	4674	99505	41522	34593	43209	3606	28104	629571	0	0	1,116,415
8	10485	20670	29268	128732	13708	40517	38181	14232	9542	5725	5041	180514	174628	50814	722,057
9	221	660	19923	32626	829	2750	105563	5745	59842	11708	9295	324634	0	280505	854,301
10	0	0	11	846	9	0	2	14	0	0	1	8381	409781	0	419,045
11	1446	29	476	2264	124	103	2360	1514	1261	4404	853	290400	270362	39316	614,912
Households	28669	77514	85392	605399	75983	325614	427912	256711	323647	249265	326882	0	0	0	2,782,988
Other value added	303288	345281	205746	459826	154542	136021	348767	193972	324300	5371	124989	0	0	0	2,602,103
Imports	24006	31498	124024	425348	3872	141949	88680	83752	28543	45456	44492	908881	0	0	1,950,501
Total	505529	657516	656873	2968029	296915	1091823	1116415	722057	854301	419045	614912	3454335	1826393	2054864	

Table 3.4 Australia, 1968-69 ($'000) Transactions Table

	1	2	3	4	5	6	7	8	9	10	11	Households	Other final demand	Exports	Total
1	0	1	0	1185931	0	14	1	3	0	0	0	43769	21993	622232	1,873,946
2	193476	92851	15440	577161	586	157	4	7895	1	28	4322	335529	333264	301135	1,861,849
3	2	394	18363	470209	52491	55570	7349	10643	147	339	7079	8143	48560	321334	1,000,621
4	208348	280538	121035	3549079	40106	1859872	441971	495529	29321	266528	927093	4854669	1896200	1555446	16,525,741
5	17852	23941	32862	242704	23588	22081	25185	21627	190829	25479	135228	366797	28788	287	1,157,247
6	23436	19887	9186	101038	39909	0	29546	125571	278303	172445	48591	0	3997780	1	4,845,692
7	100211	110921	45321	562172	13261	385348	191044	162183	48228	24171	179243	3533705	503924	196996	6,056,729
8	30146	39539	24881	554837	29414	148826	89373	48102	9487	38352	593420	828171	333464	616985	3,384,996
9	922	951	9227	157417	2444	12269	239213	27113	97148	45648	1601416	2524648	232167	40109	4,990,694
10	0	0	9	28	19	1	3	70	0	0	22930	37414	1945000	44736	2,050,210
11	30533	32832	28047	778958	70239	120418	769738	176634	525958	44054	589784	2113582	1329627	450	6,610,854
Households	161033	241950	319800	4023299	301100	1462987	2279173	1163141	1041000	1099426	1936590	0	0	0	14,029,499
Other Value Added	1082885	994926	357249	2492823	573097	582075	1885387	911837	2755381	16363	255597	1065440	-62004	22182	12,933,238
Imports	25101	23117	19202	1830083	10994	196074	98741	234649	14891	317378	309562	1828735	756707	195786	5,861,020
	1873946	1861849	1000621	16525741	1157247	4845692	6056729	3384996	4990694	2050210	6610854	17540602	11316898	3917679	

is dominated by the Manufacturing and Building and Construction sectors, which respectively account for 56 and 19 percent of the region's total industry output. In the Fitzroy region, the major sector is still Manufacturing which accounts for 29 percent of the region's total industry output. The bulk of this is, of course, alumina production from the refinery at Gladstone. Mining is the second-ranked, accounting for 24 percent of the region's output, most of this being coal production. The next most significant industries in Fitzroy are Agriculture and Building and Construction, each of which account for about 12 percent of the region's output.

In terms of aggregate structure, the Queensland economy exhibits many similarities to that of Fitzroy particularly with regard to the Agricultural, Manufacturing, Electricty and Building sectors. The main differences between the two areas are with regard to Mining and tertiary sectors. In the Fitzroy region, Mining and tertiary respectively account for 24 and 36 percent of the area's output. In contrast, for Queensland, Mining and tertiary account for 7 and 51 percent respectively. The Queensland and Australian tables exhibit the features of modern economies with emphasis on the secondary and tertiary sectors, while Fitzroy and Gladstone/Calliope are economies emphasising the primary and secondary sectors.

Table 3.6 allows a comparison of the relative importance of imports and exports in the four areas. Imports and exports being defined as goods and services flowing in and out of the area being considered. Generally as the size of the area-economy decreases, the relative importance of imports and exports increases. This situation is observed when the four economies are examined. Trade is relatively more important in the Gladstone/Calliope economy and least important in the Australian economy. Although the Queensland and Australian economies are similar in terms of the relative importance of industry sectors, there is a significant structural difference between the two in terms of Queensland's higher intensity of export orientation.

Appendix I outlines the procedures adopted in this study for the calculation of input-output multipliers, and briefly discusses the interpretation of these multipliers. Output, income and employment multipliers were calculated; these appear respectively in Tables 3.7, 3.8 and 3.9. The tables of direct coefficients, and the inverses of both open and closed versions of the 11 - sector tables are presented in

Table 3.5 Relative Importance of Industries in Gladstone/Calliope, Fitzroy, Queensland, Australia.

Sector	No.	Gladstone/ Calliope		Fitzroy		Queensland		Australia	
		Output ($'000)	Per cent	Output ($'000)	Per cent	Output ($'000)	Per cent	Output ($'000)	Per cent
Animal industries	1	2,322	1	55,802	7	505,529	5	1,873,944	4
Other primary industries	2	1,674	1	32,195	4	657,516	7	1,861,849	4
Mining	3	1,704	1	185,417	24	656,873	7	1,000,623	2
Manufacturing	4	137,466	56	225,411	29	2,968,029	30	16,525,735	33
Electricity, gas and water	5	2,907	1	22,031	3	296,915	3	1,157,248	2
Building and construction	6	47,629	19	96,820	12	1,091,823	11	4,845,693	10
Trade	7	16,101	6	61,483	8	1,116,415	11	6,056,728	12
Transport and communication	8	14,790	6	22,244	3	722,057	7	3,384,997	7
Finance	9	9,457	4	26,808	3	854,301	9	4,990,692	10
Public administration and defence	10	4,108	2	13,090	2	419,045	4	2,050,210	4
Community services and entertainment recreation	11	7,806	3	39,324	5	614,912	6	6,610,854	13
Total		245,964	100	780,625	100	9,903,415	100	50,358,573	100

Source: Tables 3.1, 3.2, 3.3, 3.4

Table 3.6 Relative Importance of Imports and Exports in Gladstone/Calliope, Fitzroy, Queensland, Australia.

	Gladstone/ Calliope	Fitzroy	Queensland	Australia
Imports ($'000)	124,158	305,223	1,950,501	5,861,020
Imports as percent of turnover	50	39	20	12
Exports ($'000)	135,722	357,749	2,054,864	3,917,679
Exports as percent of turnover	55	46	21	8

Source: Tables 3.1, 3.2, 3.3, 3.4.

Appendices VIII, X and XI respectively.

The tables of multipliers provide a large volume of information with respect to the structural output, income and employment characteristics of the four economies. Multipliers not only enable the measurement of impacts, but are in themselves a measure of the degree of inter industry interdependence existing between sectors in an economy. This section provides a brief discussion and comparison of the multipliers for Gladstone/Calliope, Fitzroy, Queensland and Australia, and is similar in structure to the discussion in Chapter 7 of Jensen, Mandeville and Karunaratne (1977).

3.2 OUTPUT MULTIPLIERS

Two types of output multipliers were calculated, namely the simple output multiplier as a summation of the columns of the inverse of the closed model, and the total output multiplier as the summation of the non-household rows of the inverse of the closed model. The simple output multiplier for sector j indicates the direct and indirect industrial support requirements from all sectors required for each increase of one dollar[1] in sales of the output of sector j to final demand. For example, each increase in the sale of the output of the Animal Industries sector to final demand in the Gladstone/Calliope area requires a total increase of $1.147 from all sectors in the region. The additional $0.147 required is in the form of industrial support from other local sectors; the disaggregation of these requirements by sector can be gained from the inverse of the open model, in this case the first column of Appendix Table X-I.

The total output multiplier for sector j measures direct, indirect and induced requirements from all sectors for each dollar increase in sales of sector j to final demand. In addition to the components of the simple output multiplier, it therefore includes the induced effect, or that increase in output from the local sector occasioned by increased household income as a result of the increase

1. Or decrease in industrial support requirements for a <u>decrease</u> in sales to final demand.

Table 3.7 Output Multipliers[1]: Gladstone/Calliope, Fitzroy, Queensland, Australia.

Sector	No.	Gladstone/Calliope		Fitzroy		Queensland		Australia	
		Direct & Indirect	Total	Direct & Indirect	Total	Direct & Indirect	Total	Direct & Indirect	Total
Animal industries	1	1.147	1.214	1.267	1.354	1.465	1.724	1.546	1.889
Other primary industries	2	1.159	1.298	1.273	1.395	1.480	1.843	1.558	1.983
Mining	3	1.260	1.416	1.239	1.372	1.559	2.001	1.519	2.230
Manufacturing	4	1.090	1.212	1.352	1.548	1.762	2.336	1.854	2.553
Electricity, gas & water	5	1.120	1.326	1.241	1.466	1.326	1.871	1.414	1.997
Building and construction	6	1.223	1.477	1.303	1.582	1.730	2.488	1.960	2.818
Trade	7	1.208	1.533	1.237	1.578	1.318	2.095	1.538	2.346
Transport and communication	8	1.221	1.544	1.357	1.710	1.418	2.164	1.575	2.347
Finance	9	1.165	1.459	1.200	1.528	1.289	2.046	1.433	1.941
Public administration and defence	10	1.196	1.688	1.257	1.771	1.464	2.613	1.547	2.601
Community services and entertainment, recreation	11	1.115	1.492	1.168	1.606	1.286	2.266	2.022	2.888

1. Total effects of a $1 change in the sales of the sector named at the left.

in sales to final demand. For example, each increase in the sale of the output of the Animal Industries sector in Gladstone/Calliope produces a total increase in output of 1.214. The induced effect of the increased sales will therefore be .067.

An examination of Table 3.7 provides some important information with respect to the expected output response of each sector in the four economies. This may be summarised as follows. First, we would expect that the four economies, ranked in size from Australia through to Gladstone/Calliope would display an overall pattern in the size of output multipliers which reflects this ranking. The larger economies would be expected to be more diversified and therefore to contain stronger linkages which would contribute to higher output multipliers. In actuality the output multipliers show the expected rankings with Australia showing the highest sector multipliers and Gladstone/Calliope showing the lowest.

Secondly, some similarities occur in the rankings of multipliers across the four areas. For instance, when the induced effect is included, the total output multiplier of the Public Administration and Defence sector is amongst the largest in all four economies. This draws attention to the importance of this sector as a leading component of all economies. The smallest total output multiplier amongst all the areas is that for the Animal Industries sector.

3.3 INCOME MULTIPLIERS

Table 3.8 provides income multipliers for the four economies. These are provided in three forms namely; (i) the direct income multiplier or household coefficient, indicating the first round effect on household income of an increase in output of each sector. For instance an increase of one dollar in output of the Animal Industries sector in Gladstone/Calliope would increase household income in that sector within the region by $0.053; (ii) the direct and indirect income multiplier, including the income increase occasioned in all sectors in the region by an increase in sales of one dollar to final demand by each sector. For instance the direct and indirect income effect of the Animal Industries sector in Gladstone/Calliope would be $0.095 as a result of industrial support requirements. Finally (iii) the direct, indirect and induced

Table 3.8 Income Multipliers: Gladstone/Calliope, Fitzroy, Queensland, Australia

Sector	Gladstone/Calliope			Fitzroy			Queensland			Australia		
	Direct	Direct & Indirect	Total	Direct	Direct & Indirect	Total	Direct	Direct & Indirect	Total	Direct	Direct & Indirect	Total
1. Animal industries	.053	.095	.120	.055	.120	.146	.057	.162	.238	.086	.220	0.312
2. Other primary	.150	.199	.252	.103	.168	.204	.118	.227	.333	.130	.274	0.390
3. Mining	.133	.223	.282	.115	.184	.224	.130	.276	.406	.320	.459	0.652
4. Manufacturing	.151	.175	.221	.202	.271	.329	.204	.358	.526	.224	.452	0.641
5. Electricity, gas and water	.254	.294	.371	.253	.311	.378	.256	.340	.499	.260	.377	0.535
6. Building and construction	.306	.363	.458	.304	.386	.469	.298	.473	.695	.302	.554	0.787
7. Trade	.388	.464	.585	.385	.470	.571	.383	.485	.713	.376	.522	0.741
8. Transport and communication	.392	.462	.582	.388	.488	.593	.356	.465	.683	.344	.499	0.708
9. Finance	.363	.419	.529	.385	.453	.551	.379	.472	.695	.209	.328	0.466
10. Public administration and defence	.643	.702	.885	.630	.709	.861	.595	.717	1.054	.536	.681	0.967
11. Community services and entertainment, recreation	.499	.537	.678	.554	.604	.735	.532	.611	.899	.293	.559	0.794

effect is listed, including the increase in income due to increased consumer expenditure in the region; this figure is $0.120 for the example quoted. The indirect effect may be calculated in this case as $0.095-$0.053 = $0.042 and the induced effect as $0.120-$0.095 = $0.025 per dollar of increased sales of the Animal Industries sector to the final demand of Gladstone/Calliope.

The direct income multipliers suggest, in effect, the labour intensity of each sector in each economy. These show, as expected, a high degree of similarity between the areas with slight variations reflecting the efficiency of labour use in particular sectors. There is, however, within each economy a wide disparity in these coefficient between sectors, reflecting the differences in labour intensity. This ranges for example, from $0.053 to $0.643 per dollar of output in the Animal Industries and Public Administration and Defence sectors in Gladstone/Calliope. These differences have an important effect on the calculation of both direct and indirect, and total income multipliers.

The total (i.e. direct, indirect and induced) income multipliers show a consistency between the four economies in the upper and lower rankings. Those sectors with the highest direct coefficients, namely the Public Administration and Defence and Community Services sectors show variable but consistently the highest total income multipliers over all the areas. This is further evidence of the contribution made by these sectors to the personal income of Australians. Each increase of one dollar in the value of output of the Public Administration sector destined for final demand in Gladstone/Calliope adds an additional $0.885 to regional household income; the same dollar increases in the same sector in Queensland would increase this income by $1.054. On the other hand, the rural sectors show the smallest total income multipliers.

3.4 EMPLOYMENT MULTIPLIERS

Table 3.9 presents employment multipliers for the four economies. These are provided in three forms, parallel to those described above for income multipliers. In general terms, if the wage rate between sectors is constant, employment multipliers would be expected to reflect income multipliers in terms of ranking between sectors and between regions.

Table 3.9 Employment Multipliers[1]: Gladstone/Calliope, Fitzroy, Queensland, Australia.

Sector	Gladstone/Calliope			Fitzroy			Queensland			Australia		
	Direct	Direct & Indirect	Total	Direct	Direct & Indirect	Total	Direct	Direct & Indirect	Total	Direct	Direct & Indirect	Total
1. Animal industries	.146	.161	.166	.051	.076	.083	.054	.085	.104	.041	.102	0.137
2. Other primary	.200	.215	.225	.107	.134	.144	.080	.112	.140	.166	.224	0.267
3. Mining	.045	.062	.073	.015	.035	.046	.020	.055	.089	.076	.127	0.199
4. Manufacturing	.014	.019	.028	.026	.051	.067	.040	.087	.131	.073	.152	0.223
5. Electricity, gas and water	.042	.023	.038	.042	.058	.076	.033	.051	.093	.079	.119	0.178
6. Building and construction	.052	.062	.080	.058	.080	.103	.061	.105	.163	.085	.174	0.261
7. Trade	.104	.117	.140	.121	.144	.171	.126	.147	.206	.163	.217	0.300
8. Transport and communication	.051	.065	.088	.180	.204	.232	.074	.101	.157	.111	.166	0.245
9. Finance	.035	.045	.066	.066	.082	.109	.050	.069	.127	.073	.116	0.167
10. Public admin. and defence	.059	.069	.104	.134	.152	.193	.112	.140	.227	.115	.204	0.311
11. Community services and entertainment recreation	.097	.104	.131	.152	.164	.200	.175	.193	.268	.125	.220	0.308

1. Employees per $1000 of output

The extent to which the income multipliers and employment multipliers vary in ranking highlights difference in personal income levels between sectors. For example, while the Animal Industries sector consistently showed in Table 3.8, the lowest requirements for the direct income component, its direct requirement in terms of employment (Table 3.9) is relatively high. On the other hand the Mining sector shows low labour usage in terms of employment, but higher contributions to household income, reflecting higher levels of wages and salaries in this sector.

The column of direct employment requirements shows variations both between economies for the same sector and between sectors in the same economy. The former is an indication of the diffences in technology which exist between the areas in the same sector. For example, the Mining sector has a much lower labour usage in Queensland and its regions than in Australia as a whole. This reflects reliance on capital intensive open cut coal mining technology in Queensland, while Australian coal production includes a substantial proportion of labour intensive underground mining.

Comparisons of sector multipliers between economies provide measures of the response which can be expected in each area to the establishment of a new industry or the expansion of any sector. We have seen that as the economy considered increases in area, the multiplier effects also increase, reflecting increasing sector interdependence.

3.5 SUMMARY

This chapter has drawn attention to the significant differences which exist in the structure of the four economies included in this study, namely those of the Gladstone/Calliope sub-region, the Fitzroy region, the State of Queensland and the Australian national economy. These differences can be summarised as follows:

(i) the economy of the Gladstone/Calliope sub-region and Fitzroy regions in earlier years tended to be dominated by rural-oriented industries, in common with other rural regions in the State. Since the establishment of the large coal enterprises, and the alumina refinery, these industries along with associated building and construction have provided the dominant source of economic activity in both the sub-regional and regional economies.

(ii) the State and national economies, as reflected in the input-output tables, are highly diversified typical of the economies of modern developed countries.

It is to be expected that the impact of new large industries will have significantly different effects on each economy under study both in terms of the relative significance of the impact and in terms of the structural significance. One industry which is a relatively major addition to the sub-regional and regional economies would be expected to be much less significant in terms of its effect on relatively larger economies such as that of the State and the nation in particular.

CHAPTER 4

REGIONAL ECONOMIC IMPACT ANALYSIS: AN OVERVIEW OF THE LITERATURE

4.1 THE CONCEPT OF REGIONAL ECONOMIC IMPACT

This section begins by examining the term "impact". To our knowledge the best and most comprehensive discussion of the concept of impact is found in Stone's (1973) review of regional defence impact studies. The discussion here owes a large debt to Stone (1973), Richardson (1972), and Jensen (1976). Jensen's introduction to the concept of impact is worth reiterating here.

> "In a broad and general sense, a great deal of the literature and discussion in the social sciences is concerned with the study of 'impacts', where the term refers to the expected or hypothetical result of an action on the characteristics and pattern of human behaviour. In general use, as a relatively 'new' expression, it has become a collective term, synonymous with an embracing term such as 'effect', 'response', 'result', and 'incidence'. As such, it cannot be expected to be a precise and well-defined expression. Indeed in the discipline of economics, and regional economics in particular where the term is used in a manner which suggests a precise and technical meaning, there exists ambiguity in interpretation of the concept. The discussion below will be restricted to 'impacts' in the general context of regional economics and of the literature which examines impacts at the sub-national level".
>
> (Jensen, 1976, p. 44).

Regional economic impact may be defined as the measured effects on the economy of a region of any difference or change attributable to an impacting agent. The regional economy being the network of individuals and organisations involved in the production, distribution and consumption of goods and services in a particular geographic area. The impacting agent can be any economic stimulus the analyst wishes to examine, and these have traditionally been the introduction of a new industry to the region, or a cutback in the region's exports.

In general, impact studies focus on one of the following:

(1) the impact of an existing industry on the region;

(2) the impact of an expansion or decline in one or more existing sectors on the region;

(3) an introduction of new firms or industries into the region;

(4) new technology.

Impact studies have tended to concentrate on the effects of particular industries, namely defence industries and the space programme, educational institutions, the agricultural or mining sectors, and the steel or aluminium industries. The size of the area included in impact analysis varies from local studies which deal with impacts on individual towns or small cities and their surrounding areas, to State or regional studies. Finally, nation-region studies are generally concerned with analysing the effects of national policy on all the constituent States or regions of a nation.

By defining impact as above, the concept is narrowed considerably to focus on only part of a potentially multi-dimensional concept. Only economic effects are considered, to the exclusion of social, political, psychological, quality of life, and environmental impacts. The emphasis on measurement implies a focusing on the quantitative as distinct from the qualitative aspects of impact.

Another approach to the measurement of impact is to consider it as the net result of any compensated change. That is, instead of measuring the total impact of a particular economic stimulus, the analyst measures only the differences in the study economy which would remain after, say, the decline in a particular industry had been offset by an increase in government expenditure in the area, and the consequences of that hypothetical alternative expenditure has been assessed. An example in the Queensland context would be the analysis of the demise of the sand mining industry on the Maryborough area. First the impact of the loss of the industry would be considered, then the impact of any State or federal compensation to the region would be measured, and finally the difference between the two effects would be the net effects on the region of the loss of the sand mining industry. On the question of whether to use total or net measures of impact, Stone's comments are relevant ... "there is no uniquely 'correct' concept of 'impact'. The analysis to be adopted in any case - whether to consider compensated or uncompensated change (or some variant of these few extremes) - should depend on what questions one seeks to answer and/or on what assumptions about the likelihood and nature of compensatory expenditures are reasonable". (Stone, 1973, p. 6).

Two methodological approaches utilised to measure impacts are (i) descriptive and (ii) use of a formal model. Descriptive studies are useful in providing general background information and an overview of the problems and impacts that may be expected to occur from a given economic stimulus. Australian examples of descriptive studies would be reports prepared by consultants such as Nabalco Engineering (1974). Descriptive studies do not attempt to quantitatively investigate relationships between impact agents and economic indicators that allow reasonably accurate predictions of likely impacts. This more specific and quantitative type of analysis requires the use of a formal model such as economic base, Keynesian, econometric or input-output analysis.

The formal models all rely on the concept of the multiplier which measures the total impact on the region from a given stimulus. Thus initial spending generates further expenditure, or multiplicative effects caused by the inter-relationships between activities in the region. The magnitude of the multiplier is inversely proportional to diversions out of the economy (leakages) in successive rounds of transactions. Leakages include taxes and imports, the latter being more important at the regional than the national level. The indicator variables, in terms of which impact is measured by the multipliers, can be industry output, household incomes, or employment.

Although the formal models and their associated multipliers focus on measuring impacts on output, income and employment, it should be recognised that other economic impact effects can also be measured or described. These would include (a) effects on government revenues, (b) effects on the national balance of payments, (c) agglomeration effects of new support industries being attracted resulting from a particular economic stimulus, (d) income distribution aspects and, of course, (e) the effects analysed in terms of the net public benefits or costs.

From the above introduction to the concept of regional economic impact, we proceed to a brief comparison and contrast of the formal models utilised to measure impacts, and second, to a review of the literature on regional input-output impact analysis, with emphasis on Australian and major overseas studies. In perspective, much of the literature on regional input-output has been preoccupied with the problems of constructing regional input-output tables; so far as possible, this review will focus on aspects of using regional input-output tables for impact assessment purposes.[1]

4.2 METHODOLOGY FOR MEASURING IMPACTS

4.2.1 Comparison and Contrast of Input-Output, Economic Base and Keynesian Approaches

It's useful to compare and contrast input-output with the other formal models such as the economic base and Keynesian approaches. Others have considered this issue in detail, see for example, Butler (1976), McColl and Throsby (1971) or Stone (1973), and a summary has been included here in the interests of making this report self-contained. Only basic concepts will be presented; readers interested in mathematical derivations and theoretical issues associated with these models are referred to the references above.

Economic Base Models

The economic base model arbitrarily divides the regional economy into two sectors: the basic (export) sector and the non-basic (service or local) sector. Exports are regarded as basic in that their growth is seen as the prime mover behind a region's overall development. The economic base multiplier relies on the assumption that a stable functional relationship exists between the level of export activity and the level of total economic activity, or

$$\text{Base multiplier} = \frac{\text{Total employment (or income)}}{\text{Basic employment (or income)}}$$

The multiplier thus reveals total employment (or income) generated in the economy by a unit increase in the basic sector. Operationally, economic base studies (a) often utilise employment as the unit of measurement, (b) attempt to identify the level of basic activity in the regional economy, (c) utilise the base multiplier to evaluate the economic impact of expected or hypothetical change in the level of basic export activity. This analysis often extends to population effects using labour force participation rate data. Australian studies which have utilised economic base multipliers include: McCalden (1969), Reynolds (1971), Schubert et al. (1970).

1. For a review of methods of constructing regional input-output tables, see Richardson (1972) or Jensen, Mandeville and Karunaratne (1977).

Keynesian Regional Multipliers

The economic base model may be alternatively cast in a Keynesian multiplier framework. Stone (1973, p.4) summarises this work as follows..

> "In the U.K. in particular, attention has focused on developing regional Keynesian multipliers. Such multipliers are derived, in the same way as the well known national Keynesian multiplier, from consideration of leakages from the circular flow of income. The one major difference is that 'imports' are defined to include all goods and services coming into the study area from outside the study area. That is, 'imports' include purchases from the other regions comprising the same nation. The multiplier then becomes, after the usual fashion, the reciprocal of the sum of leakages from the system, - savings, taxes and imports (as newly defined) - where these latter are expressed as marginal propensities (sometimes average propensities) out of income. Then, as with economic base methods, once the size of the initial income injection into the study area is determined, an indication of total impact can be obtained from the product of the injection and the multiplier. The works of Archibald (1967), Wilson (1968), Steele (1969) and Greig (1971) stand out as particularly formative in a growing body of literature concerned with regional impact estimation using such analysis."

In Australia the Keynesian multiplier approach was used to examine the impact of the establishment of a major industry (Borg-Warner) on the Albury-Wodonga complex (New South Wales Department of Decentralisation and Development, 1973).

Comparison of the Three Models

Input-output, economic base and the Keynesian approaches to regional multiplier estimation will differ in:

(a) Specification of incidence of impact. The economic base and Keynesian approaches provide an impact measurement in aggregate terms. Input-output multipliers, on the other hand, are disaggregated by sector, allowing the analyst to take account of the fact that impacts of the region will vary according to which sector experiences the initial impact stimulus.

(b) Input-output multipliers allow the identification of direct, indirect, and induced components of the multiplier; the economic base and Keynesian models do not in their standard form provide all of these details.[1]

1. In aggregate form, the input-output and economic base multiplier have been shown to be mathematically identical (Billings, 1969).

(c) Relative costs of implementing the models. Historically, the main disadvantage of input-output, compared to the other formal models, was its higher cost of implementation at the regional level. With the advent of GRIT this cost differential has been narrowed.

4.2.2 Standard Procedures for Measuring Impacts with Input-Output Models

The input-output model has both descriptive and analytical potential, for example:

(1) the transactions table is a set of regional accounts describing the economy for a particular year;

(2) the inverse matrix and multipliers are a measure of the interdependence of the region's economic structure;

(3) regional economic impact analysis;

(4) regional forecasting/long range projections.

Before looking in detail at the methodology of input-output analysis, it is necessary to draw distinctions between the use of input-output in impact analysis and its use in forecasting. In input-output analysis, the effects of any final demand change, real or simulated, can be considered an economic impact on a region. Thus input-output impact analysis is concerned with evaluating the short-run effects of expansion or contraction in one or a few sectors, or the introduction of new industries into the region. Forecasting, on the other hand, overlaps with impact analysis but is the much more ambitious exercise of predicting across the board changes in final demand in order to make a long range forecast of the growth in all industries of the regional economy at a particular date in the future. As the forecasting period lengthens forecasters need to adjust the coefficients matrix to take some account of what the economy is expected to look like at the forecast date. The growing body of literature on regional forecasting utilising the input-output approach is reviewed in Richardson (1972).

The standard procedures for measuring impacts with input-output models require the following information: (a) the inverse matrix and associated output, income and employment multipliers; and (b) estimates of changes in final demand for the sector or sectors under study.

Given (a) and (b) the output, income and employment impacts are obtained as follows. The total regional effects are obtained by multiplying the final demand change by the sector output, income and employment multipliers. The changes required from each sector to produce the total regional output effects are obtained by multiplying the final demand change by each coefficient in the appropriate column of the inverse matrix. Final demand changes may be estimated, given actual changes or simulated changes.

The various types of standard input-output multipliers and their derivation from the inverse is summarised in Appendix I of this report. However in a review of this nature, it is useful to (a) discuss the multipliers in terms of their origins in the literature, and (b) briefly touch on alternative methods of estimating income and employment effects that have been proposed. Both (a) and (b) have been done in Jensen (1976) and the discussion here relies heavily on that source. The output multipliers as the sum of the columns of the inverse have stood the test of time unchanged. Developments and variations have been concerned with the introduction into the model of methods of calculation of income and employment multipliers, the latter effects being more relevant for policy purposes in any case, than industry output.

Income Multipliers

Hirsch (1959) was the first to derive the now standard Type I and Type II income multipliers. The Type II multiplier assumes a linear and homogeneous consumption function since its calculation requires the insertion of households into the endogenous matrix. Several workers have attempted to relax this assumption as it was recognised by Moore and Petersen (1955) and Hirsch (1959) that this type of consumption function would tend to overstate income multiplier effects. Moore and Petersen (1955) took steps to relax the homogeneity assumptions by developing linear non-homogeneous consumption function from national time series data, but ran into data problems regarding the identification of household import consumption by consumers. Miernyk *et al* (1967) went further to develop a non-linear regional community consumption function from a series of aggregate consumption functions for different income groups, enabling the use of marginal rather than average consumption propensities in multiplier calculation. Further, Miernyk distinguished between the spending patterns of established residents and immigrants into the area being studied, yielding what he calls a Type III multiplier (Miernyk, 1967, pp.104-116). Sadler et al (1973), following up an approach refined by Artle (1962), constructed a series of consumption matrices, each of which referred to a sub-class of households. This work involved extensive surveys of the expenditure patterns of consumer sub-classes. This last point emphasises that most deviations from the use of the standard income multiplier reflects a decision on the part of the analyst to devote considerable research resources to generating the data required to permit removal of the assumptions of linearity and homogeneity.

Employment Multipliers

Employment multipliers were pioneered by Moore and Petersen (1955) who developed employment coefficients as the slopes of linear employment production functions for each sector in the input-output table. Miernyk et al. (1967) followed this approach in the Boulder area study.

Another method of calculating employment multipliers has been demonstrated by Hansen and Tiebout (1963). They developed an employment transactions table in which employment rather than money values was used as the unit of measurement. The standard input-output matrix manipulation was then applied to calculate employment multipliers.

The simplest method in an operational sense for calculating employment multipliers was that utilised by Bills and Barr (1968) and Tijoriwala, Martin and Bower (1968). This involves the direct estimation of labour requirements for each sector, information that is usually readily available at the regional level from secondary sources, and the calculation of labour coefficients therefrom. Employment coefficients are thus derived as the number of employees per $1,000 of output for each sector. This approach has also been followed in Australia by Jensen (1976) and Jensen, Mandeville and Karunaratne (1977).

Studies Utilising the Standard Procedures

This section can be concluded with a review of some of the studies that employed standard input-output procedures for measuring impacts, i.e. the effects of changes in final demand are examined with the aid of output, income and employment multipliers.

(i) The St. Louis Study (Hirsch, 1959)

This pioneering 29-sector input-output study of the St. Louis metropolitan area for the year 1955 was not only the first survey-based regional input-output table, but, as mentioned previously, Hirsch was the first to calculate the Type I and Type II income multipliers. Not surprisingly, the bulk of the paper discusses the table and its derivation, and the multipliers and their derivation. Some final demand projections were made and the effects on the St. Louis economy were assessed.

(ii) The Central Macquarie Study (Mandeville and Powell, 1976)

The aim of this study was to investigate the economic linkages between the farm sector and sectors in country towns, in a typical Australian wheat-sheep zone, regional agricultural economy.[1] A 25-sector input-output table for 1968-69 was constructed by survey methods but included the novel feature of building a regional representative farm linear programming model to provide input-output data for the region's farm sector. Most of the report concentrates on the table's construction and the discussion of the results with emphasis on rural-urban interactions in the area. The impact analysis phase involved utilizing the input-output multipliers to analyse the effect on the region of a hypothetical $10 million drop in the output of the region's farm sector.

(iii) The Wichita Study (Reed, 1971)

This study looks at the impact of the aerospace industry on the Wichita metropolitan area economy using the 33-sector, 1965, Wichita survey-based input-output table. The impact of a hypothetical final demand change, i.e. Federal Government defence expenditures in the aerospace sector were assumed to cease, was investigated in the usual manner. In the context of the present study, this paper is interesting since it deals with an industry (the aerospace industry) which is dominant in the area in terms of output and employment, but has few inter-industry interactions with the local economy as illustrated by its simple output multiplier of 1.06.

1. The Central Macquarie Statistical Subdivision (population 65 000) includes the City of Dubbo and surrounding shires.

(iv) The Philadelphia Study (Isard and Langford, 1971)

This is by far the most thorough study utilizing the standard input-output procedures for measuring impacts. Isard and Langford utilize their direct survey, 496-sector, 1959 table for the Philadelphia economy to estimate the impact of Vietnam war expenditures. As is common with defence impact studies, the results indicated the net effect after alternative government expenditures in the area resulting from resources released through a cutback of war expenditures had been considered.

Most of the report is concerned with procedures for building the Philadelphia table. It has become a standard reference manual for building direct survey regional tables.

4.2.3 Methodological Extensions to the Standard Input-Output Procedures for Measuring Impacts

If the analysis involves only the investigation of the effects of an expansion or contraction within one or more existing regional sectors resulting from changes in the final demand for that sector's products, the procedures as outlined in the previous section can be applied. However a good deal of the literature on input-output impact analysis has been concerned with refinement of the above procedures, and/or developing additional procedures to analyse other types of impacts.

The Impact of a New Industry

Tiebout (1967) was the first to suggest that the impact of a new firm or sector in an area can be analysed by augmenting the original transactions table with a new row and column representing the added industry. This technique can be applied as follows: (a) augment the table with a new row and column representing the new sector; (b) invert to calculate new multipliers, including a multiplier for the new sector; (c) use projected final demand sales of the new sector to estimate the effects of the region's output, income and employment as per above. Some additional adjustments may be required in step (a), before recalculating the inverse, to take account of the changes in direct coefficients due to changes in regional trade resulting from the new industry, i.e. some output previously exported, may now be an input to the new sector (Bonner and Fahle, 1967).

(i) The West Virginia Study (Miernyk *et al.* 1970)

The impact analysis phase of this ambitious study is probably the most well known work involving the investigation of the effects of several industries on a large regional economy. The survey based, 1965, 48-sector input-output table for the West Virginia economy was expanded to 54 sectors to analyse the impact of six simulated new industries, four of which were new technology industries considered feasible in the region and the last two of which were anticipated as the result of an improved highway transportation system in the State. The six new industries and data sources for their cost structures are indicated below.

Industry	Data Source
1. Coal conversion to petroleum	- pilot plant existing in the region.
2. Sulphuric acid - using a new process which removes sulphur pyrites from coal prior to burning	- U.S. Bureau of Mines engineering studies. - interviews with out-of-State producers of sulphuric acid.
3. Flyash brick - production of building bricks from waste products of coal-burning utilities	- pilot plant existing in region. - engineering studies.
4. Plastic wood	- engineering studies.
5. Electronics complex	- cost coefficients from the Philadelphia Region Input-Output Study (Isard and Langford, 1971).
6. Commercial printing	- operating plant in a neighbouring State.

The West Virginia study is particularly interesting in relation to this study since (a) it considers new industries which are tied to the coal industry and (b) it measures the impact of the several new sectors simultaneously. In order to compare the relative impacts on the region of the six new industries, Miernyk assumes that each of the simulated sectors would have equal sales to final demand of $100 million. The inverse and associated output and employment multipliers are then used to quantify the respective regional impacts of the six new industries.

(ii) County of Anglesey, Wales Study (Sadler, Archer and Owen, 1973)

In this study Sadler et al. (1973) have added an additional significant refinement to the measurement of the impact of a new industry by considering two phases of impacts: the construction phase and the operating phase. In the construction phase, data used and subsequent results represent the average effect for a year, while in the operating phase, the analyst assesses the effect on the economy of the region of a year's operation of the plant when it's running at normal capacity.

Specifically the authors looked at the impact of an aluminium smelter (under construction at the time of the study) on the rural economy of Anglesey in Wales (population 55 000). The input-output table was constructed by direct survey methods, for the year 1969 and consisted of 33 endogenous sectors. The model also featured a linkup with disaggregated consumption matrices discussed in the previous section. Data on the construction phase was obtained by direct survey of the Anglesey firms which made the sales. In connection with the construction phase, data was not collected on imported capital equipment and materials used since ... "(i) the figures were not available to a meaningful degree of accuracy; (ii) their inclusion would unduly distort the input-output table, and (iii) the information was not essential for the purposes of the analysis", (Sadler, Archer and Owen, 1973, p.107). Data on the operating phase of the smelter was obtained from the company involved.

Sadler et al. have been the only analysts to raise the issue of possible negative multiplier effects. For example, a new industry introduced to an area will often raise incomes which in turn could alter consumption patterns such that demand for consumer goods is transferred outside the region. Thus the net effect of the new industry on the regional economy could, in this instance, be negative. Two of the implications of possible negative multiplier effects are reiterated here. First, the smaller the region, the more vulnerable it will be to negative multiplier effects since a slight change in consumption patterns will have a marked local effect. Second ... "The introduction of industry alone is not sufficient for the regeneration of the regional or sub-regional economy. Attention must equally be paid to the restructuring of the service side so that the increased incomes created will circulate and have a positive multiplying effect on the whole of the economy. Otherwise, if increased incomes in one sector cause reductions in other sectors, the economy of the region will gradually split, and the new industry and its attendant labour will gradually become an enclave in an economy to which it has little economic relation". (Sadler, et al. 1973. p.78).

The results of the study in terms of the differing impacts resulting from the construction and operational phases of the aluminium smelter are interesting. The multiplier effects on personal incomes in the region are almost four times as high during the construction phase as during the operating phase. This was expected since employment on the site during the construction period varied around 2 000 while employment in the smelter during the operating phase was estimated as approximately 600 employees.

In a further, undated, paper, the authors employ similar techniques to those discussed above to estimate the impact on the area of a hypothetical large scale mining operation. Results in this instance indicated that the multiplier effects on personal incomes were just over three times as high during the construction phase as during the operating phase of the mine.

(iii) The Central Queensland Study (Jensen, 1976)

The bulk of the Central Queensland[1] study is concerned with a discussion of the construction of the 26-sector table for the region for the year 1965-66. The impact analysis phase of the study involved measuring the effect of the alumina refinery at Gladstone on the area. This was done by augmenting the matrix with an additional row and column representing the alumina refinery sector's operating phase at full capacity of two million tonnes of alumina per annum. Data for the row and column was obtained from undisclosed industry sources. Output income and employment multipliers were calculated for the alumina sector and discussed in detail.

Since the alumina plant was actually operating in the region

1. Central Queensland was defined for the purpose of the study as consisting of the former statistical divisions of Far Western, Central Western and Rockhampton (population of 135 000). This area is approximately equivalent to the present statistical divisions of Central West and Fitzroy.

in 1972-73 at the 2 million tonne capacity level, Jensen wished to illustrate the relative importance of the industry in the regional economy. In order to do so, a forecasting exercise was performed whereby a vector of final demand was estimated for 1972-73 and resulting industry gross outputs were estimated using the inverse which incorporated the alumina refining sector. This forecasting exercise raises a number of problems. First with respect to the accuracy of the final demand projections and second, no attempt was made to adjust the technical coefficients for possible changes since 1965-66. However, the projected industry outputs for 1972-73 will give a much clearer indication of the relative importance of the alumina refinery sector in the economy than would the 1965-66 industry outputs. An alternative approach would have been to simply deflate the value of output of the alumina refinery to 1965-66 dollars. In some respects a simple deflation to 1965-66 values might have been superior for comparative purposes than a projection to 1972-73, since the 1965-66 'rural economy' of Central Queensland was the focus of analysis (Jensen, 1976. p.231).

Following the example of earlier work by Parker (1967, Jensen supplemented his impact analysis with some preliminary structural analysis. This mainly involved displaying the primary input content of final demand, a table which has been used to identify relationships between the various categories of primary inputs and the level of final demand. Specifically, the value added per unit of final demand deliveries from sector j can be represented by z_{ij} a_{vi}, where z_{ij} is the interdependence coefficient and a_{vi} is the output coefficient representing the value added in the form of the ith category of primary input.

In the context of the Central Queensland study a supplementary table showing the primary input content of final demand was particularly relevant since imports were allocated indirectly in the Central Queensland table. Thus the primary input content of final demand table was required to indicate the ultimate dependence of the alumina refinery sector on imports.

(iv) The Canadian Economy Study (Broadway and Treddenick, 1976)

This study utilizes input-output in the context of an overall econometric model of the Canadian economy to measure the impact of mining. One of the objectives of the study was to examine how the economy would look if mining did not exist. This was accomplished by removing the mining sector rows and columns from the 56-sector Canadian national input-output table and examining the effects on the remaining sectors under various assumptions. Thus the reverse of the technique for examining the impact of a new industry is an interesting approach to measuring the impact of an existing industry.

(v) The Georgia Study (Schaffer, 1976)

In the context of augmenting tables with new rows and columns representing new industries, Schaffer has utilized the direct survey, 28-sector input-output table for the 1970 Georgia economy to illustrate what he terms a "new-industry simulator". This involves utilizing national coefficients to represent the new industry in the first instance. Later these coefficients are regionalised using a non-survey technique and the matrix reinverted in the usual manner. Thus in situations where no data is available to construct the row and column of the new industry, Schaffer has indicated a method of utilizing adjusted national coefficients to represent the new industry.

An Alternative Approach to Measuring the Impact of a New Industry

Some writers have analysed the impact of industries by inserting them into final demand, instead of the endogenous portion of the matrix as discussed previously. Blake and McDowall (1967) utilized this technique to measure the impact of the university on the Scottish town of St. Andrews. Their input-output table was a 12-sector one constructed for the area for the year 1965. In a similar vein, Reynolds (1971) measured the effect of the Queensland Agricultural College on the town of Gatton by inserting the College into the final demand portion of her intersectoral flows table for Gatton. For the purpose of their analysis, Powell and Mandeville (1975) transferred agriculture to the final demand portion of the table in order to assess the impact on the Central Macquarie region in New South Wales of a change in the farm sector's input mix. However, if a sector is treated exogenously as a component of final demand, it will not be an integral sector of the economy and thus all sector multipliers will be underestimated. Thus if the analyst wishes to comprehensively measure the impact of new industries or changes in the input structure of existing industries there is no substitute for inserting a new row and column vector into the matrix and recalculating the sector multipliers.

Measuring Agglomeration Effects

The Greater New York - Philadelphia Study (Isard and Keunne, 1953) and a later study, Miller (1957), used national coefficients and a variety of techniques such as location theory and "informed judgement" to estimate proportions of inputs expected to originate from within the study region. An iterative procedure was then applied to calculate second round and subsequent impacts. This method has since been superseded by the development of regional tables, but another feature of this paper is still of considerable value. That is the author's attempt to take account of the agglomeration effect of the location of a new industry in an area. Agglomeration is a term from location theory referring to the clustering of related economic activities in the vicinity of a large basic industry. Thus some industries locate near the source of supply of their raw materials if this raw material is heavy and bulky with relatively high transportation costs. Isard and Keunne in their analysis of the impact of steel in the Greater New York - Philadelphia region, also took into account the closely related steel fabrication industry. Estimates of the level of satellite industries expected to be attracted to the area were made by analysing the clustering of establishments around similar steel plants in other areas with some of the characteristics of the region under study. This clustering enhanced the direct employment effects considerably. Thus the direct effect of the steel mill was 11 700 workers, while the direct effect of the satellite industries attracted was estimated to be 77 000 workers. When the indirect multiplier effects were considered an additional 70 000 new jobs were estimated, to bring the total employment impact of the steel mill and satellite industries to 158 700 new jobs. A result that needs to be interpreted in the light of (a) the assumptions about the level of satellite industries attracted, and (b) the size and market area of the study region.

Nation - Region Studies

Leontief *et al*. (1965) have devised a method for estimating the regional effects of national policies or other economic stimuli using a minimum of regional data. The national input-output table provides the data base, while the regional dimension is provided by dividing the nation into component regions and estimating, from the national data, the regional distribution of each industry's output. Stone (1973, p.13) summarizes the details of this method as follows:

> "The analysis is properly multi-regional in that the model provides for simultaneous balancing of all input-output flows from the point of view of each individual region as well as for the U.S. economy as a whole. In this respect a good deal turns on the distinction made between local goods (industries), for which a balance between production and consumption tends to be established separately within each region, and national goods, for which such a balance is achieved only for the country as a whole. Leontief and his collaborators arrange the sectors in order of the ratio of inter-regional : intra-regional trade of their products and make an arbitrary cut to isolate local industries (serving mainly users located within the region in which production takes place) from National ones (supplying the entire national or international market)."

In terms of impact analysis this procedure in essence facilitates the regional disaggregation of national input-output model results. The impact considered by Leontief was a hypothetical reduction in defence expenditure or 20 percent compensated in terms of its aggregate employment effect by an increase in non-defence final demand. The 1958 U.S. national input-output table was utilized and the nation was divided into 19 regions. The regional impacts were of considerable magnitude; in 10 of the 19 regions employment contracted, and expanded in the other nine regions. The labour force displacement rate is highest for California at -2.39 percent of the labour force affected, and lowest for the region comprising Minnesota, North Dakota and South Dakota, where the proportion is 0.42 percent.

In Australia Dixon et al. (1977) use the Leontief et al. method, to allocate results from the national IMPACT Project[1] to the States. In their paper the authors analyse the regional, i.e. State, impacts of a hypothetical 25 percent increase in all tariffs. After all multiplier effects had been considered the results were as follows: for Australia as a whole, GNP declined by 8 percent; for Victoria whose economy is relatively intensive in highly protected manufacturing industries, GRP increased 43 percent; South Australia's GRP increased by 6 percent; New South Wales GRP declined by less than 1 percent; while Tasmanian GRP declined by 27 percent. States with an export industry orientation,

1. For an overview of the IMPACT Project, see Powell (1977). Briefly, IMPACT is a large national policy simulation model, one of the modules of which is the national input-output table. The project is jointly sponsored by the IAC, ABS, Employment and Industrial Relations, Industry and Commerce and EHCD.

such as Queensland and Western Australia were the outstanding losers with GRP declining by 70 and 71 percent respectively.

The multiplier analysis phase of the Poole et al (1971) study can also be termed Nation-Region approach. The authors briefly investigated the employment impact of the operating phase of Comalco Limited's aluminium smelter at Manapouri/Bluff, New Zealand. Using the New Zealand national input-output table and the chemical fertilizer industry as a proxy for the aluminium industry, the total employment in New Zealand resulting from the smelter's 750 employees was estimated at circa 2 750 jobs. The regional effect on Southland was estimated, using an economic base multiplier, as a total of 1 650 jobs created.

Other Impact Studies

An interesting variation on the usual impact analysis procedures is the Harvey (1976) small region study. This study examines the impact of the 1971 wool slump on the small town of Bourke and surrounding shire in Western New South Wales by constructing full input-output tables for the years 1968-69 and 1970-71 by direct survey methods. By comparing the two transactions tables (in constant 1968-69 prices) the impact of the wool slump was readily observable as a decline of 40 percent in pastoral sector output, 18 percent in gross regional income and 13 percent in total gross regional output.

Stone's Criticisms of Regional Impact Studies

Stone's (1973) criticisms of the studies employing formal models (including input-output) to measure regional economic impacts are useful.

(i) Ambiguity about the time dimensions of the effects estimated.

Multipliers indicate values for the total eventual impact when the new equilibrium point has been reached. How long this will take is never made clear. This criticism is really in the category of criticising a model for its limiting assumptions. All models are simplifications of reality and are based on assumptions such as ignoring the time dimension, which make simplification possible. Thus analysts should make some comment about the time dimension of projected impacts otherwise users may assume that the multiplier effects are virtually instantaneous.

(ii) Tendency to relate studies of an impact to larger areas than necessary (State or region studies).

Large macro studies fail to clearly identify the actual communities affected. Impacts tend to affect specific areas to a greater or lesser extent rather than to be spread evenly over a State or region. Thus a minor change at the State level may be a major one for a specific LGA. Stone is not suggesting that macro-studies are irrelevant; rather he is arguing for micro-studies to complement the perspective given by macro-studies.

(iii) Emphasis on quantitative, economic effects to the exclusion of qualitative and non-economic effects.

Thus the literature on regional economic impact indicates a developing skill in answering questions like "how many jobs?" .... but important qualitative questions tend to remain overlooked:

- what types of work?
- how easily will local industry be able to adjust to estimated changes?
- what external economies or diseconomies are anticipated?
- what land use and/or environmental constraints exist in the area?
- what are the social, environmental and quality of life effects?
- where are impacts likely to occur in the region?

Stone concludes his paper with the following ...

"This (i.e. the above criticisms) is not to denigrate what has been achieved using impact assessment models of various kinds. Nor does it imply that the techniques used in the works that have been surveyed are inappropriate. Rather it is to emphasize that analyses using formal models, in abstracting from qualitative features for convenience or in the interests of quantification, leave out of account much that may be important; and it is to enter a plea for recognition of this when drawing conclusions from the results of such enquiries. One might go further and register doubts about the balance of effort reflected in the existing literature on the regional aspect of defence spending. Might not some of the time and ingenuity devoted to refining techniques for assessment of employment and income effects have been spent more profitably on examining qualitative aspects?"

Considering the plethora of purely descriptive studies that abound, one finds it difficult to agree with Stone's last point regarding the relative time and effort devoted to quantification of regional economic impacts. However, it is not unreasonable to expect quantitative analysts to recognise the importance of, and comment on, some of the qualitative implications of their results.

Although this study, and thus this literature review, focus on the measurement of regional economic impacts, the literature does contain some examples of the use of the previously reviewed formal models to come to grips with the problem of measuring the non-economic impacts resulting from stimuli. For example, attempts have been made to formally measure (a) water requirements (Tijoriwala, et al. 1968); (b) environmental effects (Cumberland, 1966, Isard, 1969, Leontief, 1970); (c) quality of life (Bergman, 1969, Hirsch et al. 1971); and (d) population (Schubert et al. 1970). A review of this work is beyond the resources of this study, however for a discussion of the uses of input-output in measuring environmental effects, readers are referred to Karunaratne and Jensen (1978) or Richardson (1972).

4.3 THIS STUDY IN PERSPECTIVE

This will be the first major Australian input-output study to concentrate on the application of input-output tables as distinct from table construction. Much of the input-output literature tends to focus on procedures for constructing input-output tables with only a minor emphasis on impact analysis. By utilizing GRIT, this study has the advantage of access to existing input-output tables plus the production of further tables at low cost and with a known methodology fully detailed elsewhere (Jensen, Mandeville, Karunaratne, 1977). Research resources in this study are thus concentrated on impact analysis. This will allow a more ambitious analysis than has been the case with most of the existing impact studies employing an input-output approach. Specifically, this study will draw on the features of each of the major extensions to the input-output impact methodology discussed in the previous sections. In the following chapter the study team has synthesised a system which draws the various approaches together into an overall framework for examining the regional economic impacts of new industries using input-output. This framework includes the following features:

(1) Both construction and operating of new developments are considered (Sadler *et al*. 1973).

(2) The impact of several different industries can be examined. (Mierynk *et al*. 1970).

(3) Local/regional/State/national impacts can be traced. This aspect is similar in concept to Leontief *et al*. (1965), and Dixon, Parmenter and Sutton (1977) except that we begin with local impacts while the literature cited begins with national policies.

(4) Qualitative implications are drawn from quantitative results.

(5) Net effects can be considered.

CHAPTER 5

A SYSTEM FOR MEASURING

NATIONAL-STATE-REGIONAL-LOCAL NEW INDUSTRY IMPACTS

5.1 OUTLINE OF THE SYSTEM

From the national table and the State, regional and sub-regional tables, it is possible to trace the spatial incidence of impacts; (i.e. detail the incidence of economic impact at four levels) to follow Stone's (1973) suggestion of micro-studies to complement the macro picture. From the viewpoint of planning and policy, both perspectives are required. In this study, impacts can be examined from the following four perspectives:

1	2	3	4
sub-area (Gladstone/ Calliope)	region (Fitzroy)	State (Queensland)	nation (Australia)

The relative importance of the impacts will be less as economy size increases; a major effect on Gladstone could be a relatively minor one in Australia as a whole. However since leakages via imports decline as the size of the economy increases, the multiplier effects will progressively increase as we move up the continuum from sub-region to nation (see Chapter 3).

Figure 5.1 outlines the system for measuring impacts designed for this study. Step I involves completion of impact analysis in the sub-region economy. For each development the construction and operating phases are examined separately. The construction phase impact may be measured for a "typical construction year", or the peak year, depending on the objectives of the analyst. Operationally the measurement of the construction phase will require information on construction costs incurred in the study region. If the data is sufficiently detailed the input-output matrix for the area may be augmented with a new row and column representing the building and construction sector associated specifically with construction of the new industry plant. On the other hand, if the construction data is sparse, the construction impact can be measured via the existing building and construction industry multipliers.

FIGURE 5.1

Outline of Impact Analysis System

STEP I Impact Analysis in Economy 1 (the sub-region)

For each new industry or combination of new industries

(i) measure the impact of construction phase during a typical construction year;

(ii) measure the impact of the operational phase during a typical operating year;

(iii) measure the impact of possible satellite industries and/or infrastructure associated with each new industry;

(iv) consider the net result of any compensated change if appropriate.

STEP II Repeat Step I for Economies 2-4 (the region, State and nation)

STEP III Presentation of Results and Discussion

Measurement of the impact of the operating phase will involve augmenting the input-output matrix with a new row and column representing the new industry. Appropriate data relating to those industries will therefore be required. The impact of possible satellite industries and/ or infrastructure associated with the new industry can also be measured. Several estimates could be made with alternative assumptions regarding the level of satellite industries in a continuum from minimum to maximum attraction of these industries. If more than one industry is expected to locate in an area at the same time, the developments can be measured in combination by augmenting the matrix with n rows and columns simultaneously (n being the number of new industries). Economic impacts can be measured in both aggregate and relative terms. In aggregate terms total increases in output, income and employment resulting from the given econonic stimulus can be calculated; in relative terms the increases in output, income and employment can be related to a unit increase in the original stimulus, i.e. the sector multipliers are compared in some detail.

STEP II involves repeating the procedures in Step I for each of the subsequent economies to be analysed, in this case the region, State and nation. In each instance, data requirements will vary, referring to expenditures in the appropriate area. The GRIT tables were designed to be produced at the 11, 19 and 36 sector levels depending on the complexity of the economy under consideration. The decision of the analyst either to (a) measure all impacts at the 11 sector level, or (b) measure impacts at the 19 and 36 sector levels respectively for the sub-area/region and State/nation, or (c) do both (a) and (b) will depend on study resources and objectives. The decision taken will have implications for overall data requirements for the impact analysis.

The detail and content of Step III, presentation of results and discussion will again depend on the analyst's objectives and resources available to him. The presentation of results can range from economy-wide effects to detailed effects on specific industries. Further, it is possible to consider the net effects of any compensated change, or the results could be integrated into a larger cost/benefit analysis framework.

In each economy the relative effects of the construction and operating stage should be illustrated and discussed, and the relative impacts of different new industries (if more than one is being considered) should be analysed. Between economies a comparison and contrast of the relative effects of the developments should be presented. Often the various input-output tables, or the data for the impact analysis will relate to different years. Thus when measuring aggregate impacts, standard dollars for a particular year (ideally the year that the study is being published) should be utilized.

Finally a qualitative assessment of the quantitative results should be made. This will include comments on the timing of the impacts, the various assumptions made, non-economic factors and other aspects that will aid user interpretation of the results.

The system outlined above for measuring national, State, regional and local impacts was designed in the context of this study which is concerned with assessing the impact of new industries. However the overall framework can be easily adapted to the measurement of other types of impacts. For example if the analyst is simply concerned with measuring expansion or decline in an existing industry, then the standard procedures for measuring impacts with input-output models outlined in Chapter 4, may be applied in the context of the above framework as desired. Alternatively some analysis may not require the augmentation of matrices with new rows and columns, but simply involve changing some of the existing coefficients; again this simpler analysis may be applied in the above framework. Finally, a major feature of this system is that it is based on GRIT. Thus not only can the input-output tables be derived quickly and at less expense, but the multipliers for each are directly comparable, both conceptually and by sector definition.

5.2 APPLICATION OF THE SYSTEM TO THIS STUDY

5.2.1 The Aluminium Industry: Overview of Economic and Locational Aspects

It is not the function of this report to provide a detailed description of the aluminium industry. Readers desiring such detail, particularly in the Australian context, are referred to McDonald (1974). Rather a brief synopsis only of the industry is provided at this stage.

The production of the metal aluminium from its ore, bauxite, consists of three distinct phases:

bauxite	→	alumina	→	aluminium
mining and screening	refinery (dissolve out aluminium oxide with caustic soda)		smelter (dissolve alumina in a cryolite flux and electrically reduce with carbon)	

The locational pattern of aluminium production is constrained by the need to minimize transportation and electricity costs.

1. Bauxite is mined and screened at the ore site. Often refining is done at the ore site; Gladstone is an exception to the general case, primarily due to the isolation of Weipa.
2. Smelting is undertaken near a low cost power source.
3. Fabrication plants are normally located close to large markets.

The aluminium industry shows a high degree of vertical integration and is in the hands of a small number of large corporations. The industry exhibits significant economies of scale of production and concomitant large initial capital investment requirements. In addition the production process is one of continuous operation for 24 hours/day throughout the year.

5.2.2 A Glimpse of the Historical Impact of the QAL Alumina Refinery on the Gladstone Economy

How accurate are input-output multipliers as predictors of economic impacts? Perhaps we can gain some insight into this question by examining the historical effect of the alumina refinery on the economy of Gladstone.

We begin this discussion of the historical impact of the alumina refinery in Gladstone by considering the hypothetical case of the situation where neither QAL, nor any other large manufacturing industry had decided to locate at Gladstone. With the closure of the Swift's meatworks in 1964, the town would have been faced with an absolute decline in the manufacturing sector of 700 jobs. Taking into consideration the multiplier effects of this decline on the service sectors, the final result would have been a total decline of approximately 1 400 jobs. This decline would have been slightly offset by the choice of Gladstone as the coal export port for the region. Thus the building of the Moura-Gladstone railway, the upgrading of the Rockhampton-Gladstone railway and the increase in the activities of the Gladstone Harbour Board would have meant some increase in employment in the Building and Construction, and Transport and Storage sectors over the 1961 levels. However, the benefits of these developments would have only slightly offset the loss of 700 permanent, basic jobs. It is also possible that without the alumina refinery, and the possibility of an adjacent smelter, the Gladstone Power Station would not have been located at Gladstone and consequently the current and expected employment at the power station would have been lost to the region. Thus in 1971, if the alumina refinery had not been located in Gladstone, the population and labour force of Gladstone would most likely have been below the 1961 level of 7 181 and 2 696 respectively. In other words, the construction and operating phases of the alumina plant have been directly and indirectly responsible for most of the population and labour force increase in Gladstone during the period 1961-1971.

Industry employment multipliers (Type II) derived from the Gladstone/Calliope input-output table for Metals and Metal Products, and Building and Construction were 2.0 and 1.6 respectively. Assuming a population multiplier of 2.5, do the numbers substantiate the above statement that the alumina refinery was responsible for the population increase in Gladstone during the period 1961-1971? The operating phase of the plant during the period employed approximately 700 workers for a population effect of 3 500 persons (700 x 2 x 2.5). The three stages of plant construction over the period 1966-1971 employed an average of 940 workers per annum for a population effect of 3 760 persons (940 x 1.6 x 2.5). Thus assuming that the employment and population multipliers achieved their total effect over the period, the alumina plant was directly and indirectly responsible for an additional 7 260 people. The actual population growth in Gladstone over the period 1961-1971 was 7 985 persons, so the multipliers appear to be reasonably accurate for prediction purposes.

If we focus simply on labour force increases, the multiplier predictions become even more acceptable. The operating phase creates a total of 1 400 jobs (700 x 2) and the construction phase creates 1 504 jobs (940 x 1.6) for a total of 2 904 jobs. The actual increase in the labour force in Gladstone over the 1961-1971 period was 2 999 jobs.

5.2.3 The Developments Considered

As indicated in Chapter 1, three developments have been included in the analysis:

(i) The proposed aluminium smelter (Comalco Limited);

(ii) The Queensland Cement & Lime Company Limited's planned cement clinker plant;

(iii) The Gladstone Power Station.

The Gladstone Power Station is currently under construction and partly operational, while the other two projects have been announced in principle, but no definite dates on commencement of construction have yet been announced.[1] A brief outline of each project now follows.

The Aluminium Smelter

The Gladstone smelter project had its origin in the 1957 Agreement

1. The earthworks at the smelter site were completed in mid 1978.

between the State of Queensland and Comalco Limited which provided for the development of Weipa bauxite deposits and required the company to establish an alumina refinery within Queensland and to investigate the possibility of siting an aluminium smelter within Queensland or Australia. The production of alumina from Weipa bauxite was achieved by the establishment of the Gladstone alumina refinery operated by Queensland Alumina Limited, in 1967. Recently Comalco increased its interest in this plant from 12.8 percent to 30.3 percent.

The 1972 Gladstone Power Agreement between the State of Queensland and Comalco embodied the commitment by the company to locate a future smelter within the Gladstone region and gave the company the right to opt for blocks of power for a smelter. Prior to this agreement the company had examined a number of sites along the Queensland coast. Gladstone was chosen for the following reasons:

(i) supplies of alumina were available from the Queensland Alumina Limited refinery, thus minimizing alumina handling, transport and storage costs;

(ii) electric power would be available in bulk from the Gladstone Power Station and transmission to a smelter could be achieved with minimum loss;

(iii) Port Curtis was already developed to handle ships larger than those required to service the smelter;

(iv) the Gladstone region could ultimately provide housing and community support facilities, etc. for a further major industry.

Boyne Island near Gladstone was chosen as the smelter site. McDonald (1974) developed estimates of aluminium smelter costs in Australia for 1971-72, in comparison with the United States, Europe and the Middle East. His estimates suggest that, after transport costs were considered, smelting costs in Australia could be higher than in other producing countries. Other estimates have suggested that the cost of building major secondary processing industries in Australia is circa 30-40 percent higher than in Japan and the U.S. (Byrne, 1978).[2] This capital cost disadvantage is offset by the relatively low cost and regional availability, of raw material inputs such as alumina and electricity.

The Gladstone smelter will process alumina transported by a belt conveyor system from the adjacent alumina refinery operated by Queensland

2. This reflects the recent situation where Australia had high inflation. If inflation reduces vis-a-vis the rest of the world, the disadvantage referred to above will not be sustained.

Alumina Limited. Aluminium will be produced by electrolysis of alumina in a melt consisting mainly of cryolite which serves as a solvent for the alumina. The electrolysis will be carried out continuously in pots lined with carbon utilizing prebaked carbon anodes. In the initial operating phase, the plant will consist of two potlines, producing about 182 000 tonnes of cast aluminium product. Investment in the plant is estimated as $485 million. The plant will require 1 080 employees and export the entire output. Electricity inputs of some 320 MW will be required. The major inputs into the process, alumina, electricity, and labour, will be obtained locally, while other raw materials, such as coke, pitch, aluminium fluoride, cryolite, fluorspar, soda ash, and heavy fuel oil will be obtained outside the sub-region.

Assuming conditions are favourable, it is estimated that the smelter will begin operating at some 90 000 tonnes capacity in 1982.

The Cement Clinker Plant

The proposed cement clinker plant of Queensland Cement & Lime Company Limited would be located at Targinie in Calliope Shire, 13 km north-west of Gladstone. Cement clinker, an input into the cement production process, is manufactured by burning lime, silica, iron oxide, and alumina in a kiln to form silicates, aluminates and ferro-aluminates of lime. Anticipated output of the plant is 500 000 tonnes of clinker per annum, which will be shipped to Brisbane where it will be blended with additives such as gypsum to produce cement. Inputs such as limestone, clay, silica, sand, water, electricity, and labour will be obtained locally, while coal will be obtained from the coalfields in the Fitzroy region. The operating labour force will be 146 persons. Limestone and clay will be transported to the plant from the quarries at Bracewell/East End by slurry pipeline. The estimated cost of the plant is $90 million (1976 dollars) and it will take two years to construct.

There were a number of reasons for the selection of the site:

(1) limestone deposits sufficiently extensive to justify the construction of a plant and closest coastal deposits to Brisbane;

(2) plant site is sufficiently distant from population centres to avoid the nuisance problems normally associated with cement plants;

(3) plant site located on the fringe of an area planned for heavy industry;

(4) suitable harbour available;

(5) the plant may be supplied with coal at reasonable cost.

The Gladstone Power Station

The major (1 650 MW) thermal power station is under construction at Gladstone, with the first four 275 MW generators now in operation. Construction will be completed, and the plant fully operational at 1 650 MW in 1982. In full operation, the station is expected to require 4.1 million tonnes of coal, and employ 400 persons. The estimated capital cost of the power station is $500 million (1976) dollars. The power station will form part of the State's interconnected power system, and eventually about 1 050 MW of the electrical energy generating capacity at Gladstone will be exported to the State grid, outside the Gladstone/ Calliope sub-region.

Associated Developments

Both principles of location theory and the advice of experts associated with the aluminium industry suggest that forward linkage industries to the smelter such as aluminium fabrication and finishing plants will not locate in the Gladstone sub-region. Existing aluminium smelters located close to energy sources and away from population concentrations have generally not exerted a locational pull on later fabricating operations. As indicated in Section 5.2.1, aluminium fabrication plants are market-oriented in their location since ingot, being less bulky than aluminium sheet, costs less to transport. Similarly the manufacture of finished goods is market-oriented given the generally higher costs of shipping, handling and marketing finished goods due to their unusual shapes and higher unit value.

Similarly, when backward linkages to the smelter, and forward and backward linkages to the cement clinker plant are considered, these industries are not expected to attract further substantial light or heavy manufacturing industry to Gladstone. However, the smelter and the cement plant may indirectly attract further industry by enhancing Gladstone's reputation as an industrial growth centre.

Thus this section on associated developments will concentrate on some of the infrastructure directly associated with the smelter and the cement clinker plant. As the clinker plant will probably be the first major industrial enterprise to utilize the area north of the Calliope River, it will initiate the need for infrastructure to serve this area. This will involve a bridge over the Calliope River, improved road access, a power feeder line, water and port facilities. The company's contribution to this is estimated at 18 percent of the capital cost of the plant, or $16.2 million (1976 dollars).

Extensive discussions, conducted over several years and involving the State Government, relevant local bodies and the company, have led to a negotiated settlement for the provision of infrastructure associated with the smelter project. The company has agreed to contribute toward the cost of the following facilities:

Road and bridge from Tannum Sands to the smelter and main Gladstone road.

Harbour facilities (including wharf)

Water, sewerage and power facilities.

The company would contribute the major portion of the total cost of all items listed above with the State Government and/or local authorities contributing the remainder.

In infrastructural negotiations conducted to date between the company and the State Government, it has been tentatively agreed that in relation to the first 450 houses required, the company will construct two-thirds and the State Government will construct the remaining one-third. For any additional houses required thereafter the State Government will construct one house for every five built by the company.

Arrangements may be made with leading building companies to build the smelter company's share of employees' houses.

5.2.4 Procedures and Data

Section 5.1 provided a general outline of the system measuring national-State-regional-local new industry impacts. This section details how that system was empirically applied in the context of this study. First, some general comments on the matrices and their augmentation will be made, and then the discussion will proceed to the data used and procedures adopted for the construction and operational phases of the developments. The questionnaire utilized to obtain needed data for the new industries appears in Appendix IV.

The input-output tables for the Gladstone/Calliope sub-region economy in 1974-75, the Fitzroy region economy in 1973-74, the Queensland economy in 1973-74, and the Australian economy in 1968-69 provide the reference point for impact analysis of the three projects. Two of the projects, namely the aluminium smelter and the cement clinker plant did not appear in the respective 1974-75 and 1973-74 tables for Gladstone/ Calliope and Fitzroy. These were therefore analysed in all four economies by the insertion of an additional row and column representing each project.

Both the nature of the 'new industry data' and our interest in manageable presentation of the results dictated that all impacts be measured and analysed at the 11-sector level. Further our objective was to measure the cumulative effect of the three new industries together. Thus the new industries were integrated simultaneously into the 11-sector matrices for Gladstone/Calliope, Fitzroy, Queensland and Australia. The alternative would have been to integrate each industry into the matrices separately. However it could be argued that the total effects will be greater than the sum of the parts and thus the procedure adopted, in producing slightly higher multiplier estimates, will take some account of this synergistic effect. Also when the smelter is likely to be fully operational in the mid 1980's, the three industries will in fact exist in the economy concurrently.

All estimates of aggregate impacts are presented in 1978 dollars, although readers need to bear in mind that, for example, in the Gladstone/ Calliope instance, the procedures are estimating the effect on the 1974-75 economy of Gladstone/Calliope of developments that will be fully operational in the 1980's.

Construction Phase

Again in the interests of manageable presentation of results, it was decided to measure the construction impacts at the sub-region and regional levels only. Data was not available to synthesize a new building and construction sector for any of the three projects, therefore the existing building and construction sectors in the Gladstone/Calliope and Fitzroy tables were assumed to be representative of construction activity associated with the new developments. The Sadler, Archer and Owen (1973) approach of measuring a 'typical' year of the construction phase of a project was modified in this instance to an examination of the peak year.

(i) The Smelter - Data for Construction Impact Analysis

Data set out below on the construction phase of the aluminium smelter was provided by Comalco Limited. The total construction cost of the project has been estimated at $485 million, with a peak year expenditure of approximately 32 percent of this figure. The total to be spent in the Gladstone/Calliope sub-region is estimated at $103 million, disaggregated as follows:

Item	Percent Expenditure
Potline construction	73
Site development, plant utilities, offices, mobile equipment and administration	23
Infrastructure	4
Total	100

When interpreting these estimates, it is important to remember that at the time of this study, contracts had not been let. Estimates therefore of amounts spent in the sub-region are order of magnitude figures based on the knowledge and experience of Comalco staff.

The peak construction year will involve a labour force of 800 persons and 32 percent of total construction costs, or $33 million spent in the sub-region. Considering 32 percent of housing costs directly associated with the smelter, yields an additional $7 million being spent locally during the peak year of construction. In summary, the direct stimulus (1978 dollars) of the smelter's construction during the peak year will be:

	Industry Output	Household Income	Employment
Stimulus	$40 m	$12 m	800

(ii) The Cement Clinker Plant - Data for Construction Impact Analysis

The total construction cost of the cement clinker plant has been estimated at $90 million (1976 dollars), 18 percent of which is related to infrastructure such as electricity, water, roads and port facilities. Construction is expected to take two years with a peak labour force of 280 on site. Assuming that half is spent in the peak year and one-third of that is spent in the region the direct stimulus (1978 dollars) of the construction phase will be:

	Output	Household Income	Employment
Stimulus	$18 m	$4 m	280

(iii) The Gladstone Power Station - Data for Construction Impact Analysis

Work began on the construction of the Gladstone Power Station in 1971 and is expected to be completed in 1982. The total cost of the completed station has been estimated at $500 million (1976 dollars). The peak year has been assumed as 1974-75, during which total expenditure on the project was $65.6 million, with approximately 1 000 construction workers on site. Assuming that one-quarter of expenditure on the Gladstone Power Station occurs in the region, the direct stimulus (1978 dollars) of the construction phase will be:

	Output	Household Income	Employment
Stimulus	$20 m	$15 m	1 000

Operating Phase

(i) Output, Employment, Household Income

In keeping with the GRIT tables, transactions were valued at producers' prices. Gross sector output was therefore valued at plant head prices, i.e., f.o.b. In the case of aluminium and electricity the value of sale prices of the final product to large-scale purchasers has been a matter of strict confidentiality, and therefore could only be estimated indirectly. In the case of the aluminium industry an added difficulty arises in that this product is not commonly a traded product, but is typically an intermediate product in a production process which is vertically integrated through ownership of production facilities.

Similarly, the electricity sector is a State-wide interconnected system consisting of electric power generation, transmission and distribution. In arriving at a nominal value of total electricity to the State grid from the Gladstone Power Station at plant head, the following factors were considered:

(1) The average cost State-wide in 1973-74 was 2.04 cents per kWh generated.

(2) It could be expected that economies of scale and higher load factors would be operating at Gladstone compared to other generating plants in the State.

(3) Total capital expenditure on generation as distinct from transmission and distribution varies from year to year but over the period 1948-78 approximately one-half of Queensland's capital expenditure on electricity capacity has been on generation.

The above discussion illustrates the point that with regard to the aluminium smelter and the Gladstone Power Station considerable error could exist in estimates of the total value of output; these errors will not effect the multipliers derived, but will affect the reliability of aggregate measures of the project's impact on industry output.

For the purpose of this study the value of output of the developments at full capacity was calculated as:

	Value of Output
Aluminium Smelter	$175 million
Gladstone Power Station	$111 million
Cement Clinker Plant	$ 20 million

The number of employees associated with each development at full capacity is a more straightforward matter than the value of output. This is expected to be:

	Employees (all categories)
Aluminium Smelter	1 080
Gladstone Power Station	400
Cement Clinker Plant	146

The total cost of salaries and wages associated with each development at full capacity can be estimated in at least two ways. First the wages and salaries coefficient can be applied to the value of output, or second, an average wage can be assumed. Given our reservations above about the value of output, the second approach seems preferable. Assuming that average annual wages and salaries in the smelter is $15,000 and in the Gladstone Power Station and Cement Clinker Plant is $11,000 the value of salaries and wages associated with each development at full capacity will be:

	Wages and Salaries
Aluminium Smelter	$16.2 million
Gladstone Power Station	$ 4.4 million
Cement Clinker Plant	$ 1.6 million

(ii) Input Coefficients

Input coefficients associated with the smelter and cement clinker plant appear in Table 5.1. The smelter's input coefficients were calculated from data provided by Comalco Limited, while the input coefficients associated with the cement clinker plant were estimated from national coefficients and engineering estimates of input requirements from Darra Exploration (1976). The existing Electricity sector in the respective input-output tables was assumed to be representative of this sector's cost structure when the Gladstone Power Station is included. This assumption is less than satisfactory but unavoidable in the light of the lack of actual data pertaining to the Gladstone Power Station.

The smelter input coefficients are assumed to be the same for all four economies, while in the case of the cement clinker plant, input purchases will differ somewhat between economies. For example, the production process requires coal, which is an import to Gladstone/Calliope, but not to Fitzroy, Queensland or Australia.

Note also that the production process of cement clinker requires a considerable input of clay and limestone. However in this particular case this is not a purchase from a separate "Mining sector" but an operation internal to the firm; thus the zero coefficient opposite Mining in Gladstone/Calliope in Table 5.1. Mining coefficients for Fitzroy, Queensland and Australia refer mainly to coal inputs.

TABLE 5.1

Input Coefficients for Projects Included in the Impact Analysis

Sector	Aluminium Smelter	Cement Clinker Plant		
		Gladstone/ Calliope	Fitzroy	Q'land & Australia
1. Animal industries	-	-	-	-
2. Other primary industries	-	-	-	-
3. Mining	-	-	.0518	.0519
4. Manufacturing	.3271	-	-	.0840
4.1 Aluminium smelter	-	-	-	-
4.2 Cement clinker plant	-	-	-	-
5. Electricity, gas and water	.1274	.0588	.0588	.0595
6. Building and construction	-	.0194	.0194	.0194
7. Trade	.0010	.0269	.0269	.0269
8. Transport and communication	.0052	.0300	.0300	.0300
9. Finance	.0001	.0015	.0015	.0058
10. Public administration and defence	.0010	-	-	-
11. Community services, entertainment etc.	.0034	-	-	-
12. Households	.0858	.1738	.1738	.1738
13. Other value added	.2438	.3446	.3446	.3446
14. Imports	.2052	.3450	.2932	.2041
Total	1.0000	1.0000	1.0000	1.0000

Qualitative Aspects

It is not the function of this report to provide detailed qualitative comment either on the economic impact of the new projects on the economies concerned or on non-economic impacts of the smelter on the region or sub-region. With regard to the latter, and environmental effects in particular, reference is made to planned Environmental Impact Statements for the smelter (Peter Hollingsworth et al. 1978) and the planned cement clinker plant.

It is, however, vitally important that any formal numerical analysis of the type undertaken in this report should be cast in a realistic economic context, and recognize particularly any unique or important features of the impacted economies which are likely to modify the reported results. The study team undertook a visit to the region for this purpose. Interviews with a number of persons with general or specialized knowledge or experience were undertaken, with a view to gaining an appreciation of:-

(1) the characteristics of the local economies as seen by residents with various interests;

(2) isolation of potential constraints on development;

(3) identification of factors likely to modify multiplier effects, e.g. the existence of short-term or long-term excess capacity;

(4) identification of the likely local spatial incidence of the multiplier effects;

(5) expected infrastructure and administrative problems.

The results of this enquiry appear as qualitative comment on the discussion of empirical results in Chapter 6.

CHAPTER 6

THE ECONOMIC IMPACT OF EXPECTED INDUSTRIES ON THE ECONOMIES OF GLADSTONE/CALLIOPE, FITZROY, QUEENSLAND AND AUSTRALIA

This chapter provides the empirical results of the impact analysis. Section 6.1 details these results in relative terms by discussion of the input-output multipliers in some detail. Section 6.2 examines the expected aggregate increase in output, income and employment.

6.1 MULTIPLIER EFFECTS

6.1.1 The Construction Phase of the Projects

On the assumption that the construction phase of the new industries can be represented by the Building and Construction sectors from the existing input-output tables for Gladstone/Calliope and Fitzroy, the multiplier effects of construction are summarized in Table 6.1.

Output Effects

Each dollar invested in the construction of the new projects can be expected to produce an immediate, direct or 'first-round' effect on the output of other intermediate sectors of \$0.194 on industries in the sub-region, and \$0.231 on these industries at the regional level.

Further industrial support requirements (indirect effects) associated with each dollar of construction activity will require an additional \$0.029 from sub-region industries and \$0.072 from regional industries. The induced effect of each dollar invested, i.e. those effects on output originating from increased personal consumption arising from increased output will be \$0.254 in Gladstone/Calliope and \$0.279 in the Fitzroy region.

The total (direct, indirect and induced) effect of each dollar invested in the developments will be \$1.477 at the sub-regional level and \$1.582 at the regional level, i.e. each dollar invested can be expected to bring forth an additional 47.7 cents in output of industries in the sub-region and an additional 58.2 cents at the regional level. If only direct and indirect effects are being considered the multipliers become 1.223 and 1.303 respectively for the sub-region and the region.

TABLE 6.1

Construction Phase of the New Industries -
Summary of Building and Construction Sector Multipliers:
Gladstone/Calliope and Fitzroy

Multipliers	Gladstone/Calliope Sub-region	Fitzroy Region
Output		
Direct	.194	.231
Indirect	.029	.072
Induced	.254	.279
Total	.477	.582
Total Output Multiplier	1.477	1.582
Simple Output Multiplier	1.223	1.303
Income		
Direct	.306	.304
Indirect	.057	.082
Induced	.095	.083
Total	.458	.469
Type I	1.185	1.269
Type II	1.495	1.542
Employment		
Direct	.052	.058
Indirect	.010	.021
Induced	.018	.024
Total	.080	.103
Type I	1.193	1.382
Type II	1.542	1.774

Income Effects

The income multipliers from Table 6.1 indicate the effects on household income (from wages, salaries and supplements) which can be expected to accrue as a result of each dollar invested in the construction phases of the new industries. They show, for example, that each dollar invested would directly increase household income in the sub-region through payments to the construction workforce of $0.306 and indirectly through industrial support linkages locally by $0.057, with an induced effect of $0.095, for a total effect of $0.458. The Type I and II income multipliers show respectively that for each dollar change in household income of construction employees, there will occur at the sub-regional level a change of $1.185 (direct and indirect effects only) and $1.495 (direct, indirect and induced effects). In the Fitzroy region, the Type I and II income multipliers become respectively $1.269 and $1.542.

Employment Effects

The employment multipliers from Table 6.1 indicate the increases in employment measured in persons which can be expected to occur as a result of each $1,000 invested in construction. They show, for example, that each $1,000 invested in the new projects could result in the employment of 0.052 persons in the sub-region as the direct effect, of 0.010 persons as the indirect industrial support effect, and 0.018 persons from the induced consumption effect; thus a total of 0.080 persons could be employed for each $1,000 spent on the new industries. At the regional level, a total of 0.103 persons would be expected to be employed for each $1,000 of investment. The Type I multiplier indicates that for each person employed in the construction phase of the project, an additional 0.193 persons will be employed in industries in the sub-region taking into account only direct and indirect effects. When induced effects are also included (Type II), this becomes an additional 0.542 persons.

The foregoing discussion illustrates the point that multiplier effects arising from construction activity are not particularly high in both the sub-region and regional economies. This is to be expected as a large proportion of inputs to the construction process will originate outside the Fitzroy regional economy.

6.1.2 The Operating Phase of the Projects

Detailed breakdowns of the output, income and employment multipliers relating to the operational phases of the three projects in each of the four economies are presented in Tables 6.2, 6.4 and 6.5. The aluminium smelter multipliers are quite high and require careful

TABLE 6.2

Aluminium Smelter - Summary of Sector Multipliers:
Gladstone/Calliope, Fitzroy, Queensland, Australia

Multipliers	Gladstone/ Calliope (1)	Fitzroy (2)	Queensland (3)	Australia (4)
Output				
Direct	.464	.464	.464	.464
Indirect	.048	.149	.295	.341
Induced	.131	.159	.403	.444
Total	.643	.772	1.162	1.249
Total direct, indirect, induced incl. unit initial stimulus	1.643	1.772	2.162	2.249
Total direct and indirect incl. unit initial stimulus	1.512	1.613	1.759	1.805
Income				
Direct	.086	.086	.086	.086
Indirect	.101	.134	.166	.201
Type I	2.170	2.558	2.934	3.347
Type II	2.739	3.109	4.308	4.748
Employment				
Direct	.006	.006	.006	.006
Indirect	.010	.026	.036	.067
Induced	.009	.013	.031	.045
Total	.025	.045	.073	.118
Type I	2.676	5.372	7.138	12.268
Type II	4.249	7.542	12.319	19.903

interpretation. In order to provide some perspective, details on the multipliers for the aggregate Manufacturing sector are provided in Table 6.3.

The Aluminium Smelter

(i) Output Effects

Table 6.2 shows that each dollar of output of the smelter will produce an immediate first round and or direct effect on the output of industries within the four economies of $0.464. In other words, 46.4 percent of the smelter's inputs are purchased locally. For the sub-regional economy these are massive direct linkages and consist mainly of the smelter's use of electricity and alumina. In perspective the existing aggregate Manufacturing sector in Gladstone/Calliope purchases only 7.8 percent of its inputs locally (Table 6.3). Comparing Tables 6.2 and 6.3 it can be seen that at the State and national levels on the other hand, the smelter's direct effects are similar to the aggregate Manufacturing sector's direct effects.

Further industrial support or indirect effects are naturally small in the sub-region at $0.048, rising to a significant $0.341 for Australia. It's useful to concentrate on the indirect effects briefly, to illustrate some of the actual linkages existing as the analysis shifts from one economy to another. In Gladstone/Calliope the indirect effects are a small $0.048 since neither the alumina refinery, nor the power station purchase major inputs locally. At the Fitzroy level the indirect effects become a more significant $0.149 with the power station purchasing locally produced coal. In Queensland and Australia the indirect effects move up to $0.295 and $0.341, for now, among other things, the alumina refinery is purchasing its bauxite within the local economy.

Compared to the indirect effects, the induced effects of the smelter in the sub-region are relatively high at $0.131. The simple output multiplier for the smelter in Gladstone/Calliope is 1.512, the highest in the sub-region, reflecting the strong linkage between the project and the local power generating and alumina refining industries. In the more complex economies of the State and the nation, a comparison of Tables 6.2 and 6.3 indicates that the output multipliers for the smelter are similar to the average multipliers for the aggregate Manufacturing sector.

(ii) Income Effects

The smelter's income multipliers in Table 6.2 illustrate the effects of a highly capital intensive industry with strong linkages at the sub-region, region, State and national levels. The small

TABLE 6.3

Aggregate Manufacturing Sector Multipliers:
Gladstone/Calliope, Fitzroy, Queensland, Australia

Multipliers	Gladstone/ Calliope (1)	Fitzroy (2)	Queensland (3)	Australia (4)
Output				
Direct	.078	.274	.497	.496
Indirect	.012	.076	.264	.359
Induced	.123	.195	.571	.698
Total	.213	.545	1.332	1.553
Total direct, indirect, induced incl. unit initial stimulus	1.213	1.545	2.332	2.553
Total direct and indirect incl. unit initial stimulus	1.090	1.352	1.761	1.855
Income				
Direct	.151	.202	.204	.243
Indirect	.025	.068	.153	.208
Type I	1.163	1.342	1.752	1.858
Type II	1.468	1.629	2.573	2.637
Employment				
Direct	.014	.026	.040	.073
Indirect	.005	.025	.047	.079
Induced	.008	.016	.043	.071
Total	.028	.067	.130	.223
Type I	1.341	1.933	2.200	2.074
Type II	1.968	2.535	3.306	3.046

direct income effect, representing 8.6 percent of the smelter's cost structure reflects the capital intensity of aluminium production. In comparison, Australian Manufacturing industry in aggregate is highly labour intensive at 24.3 percent of total costs. Indirect and induced effects of the project are relatively high reflecting the smelter's strong linkages with other industries. When the small direct effect is combined with high indirect and induced effects, as reflected in the method of calculating Type I and II income multipliers, these become relatively high in all four economics compared to the aggregate Manufacturing Type I and II income multipliers. Thus the smelter's Type I income multipliers in Gladstone/Calliope and Australia are respectively 2.170 and 3.347 while for the Manufacturing sector in aggregate, these become respectively 1.163 and 1.858.

(iii) Employment Effects

The capital intensive nature of the smelter and its strong direct linkages are reflected even more dramatically in the employment multipliers in Table 6.2. Each $1,000 of turnover of the project could be expected to result directly in the employment of 0.006 persons in all four economies. In sharp contrast each $1,000 of turnover of the aggregate Manufacturing sector would employ 0.014, 0.026, 0.040 and 0.073 persons respectively in the sub-region, region, State and nation (Table 6.3). Thus the direct employment per $1,000 of turnover of the smelter is very small indeed and when this is combined as a ratio with high indirect and induced effects, the Type I and II employment multipliers look unrealistically high. While the multipliers may be true in a theoretical sense, it was felt that they required careful interpretation and indeed, adjustment, when they came to be applied to estimate the aggregate effects of the smelter on the four economies. This point is elaborated in Section 6.1.3.

The Cement Clinker Plant

(i) Output and Income Effects

Table 6.4 illustrates the multipliers derived for the cement clinker plant. Comparing Tables 6.3 and 6.4 indicates that the cement clinker plant in comparison to the aggregate Manufacturing sector has relatively high linkages in the sub-region but somewhat lesser linkages at the State and national levels. While the cement clinker plant's linkages in the sub-region are not as large as those for the smelter, these linkages are considerably larger than those for the existing aggregate Manufacturing sector. Thus in Gladstone/Calliope the simple and total output multipliers and the Type I and Type II income multipliers for the cement clinker plant are respectively 1.161, 1.318 and 1.295, 1.635; while for the Manufacturing sector in aggregate these figures become a smaller 1.090, 1.213, and 1.163, 1.468 respectively.

(ii) Employment Effects

In a similar manner to the smelter, the capital intensive nature of the cement clinker plant combined with its linkage effects result in the quite high Type I and II employment multipliers in all four economies.

TABLE 6.4

Operational Phase of the Cement Clinker Plant - Summary of Sector Multipliers: Gladstone/Calliope, Fitzroy, Queensland, Australia

Multipliers	Gladstone/ Calliope (1)	Fitzroy (2)	Queensland (3)	Australia (4)
Output				
Direct	.137	.189	.278	.278
Indirect	.024	.049	.149	.176
Induced	.157	.172	.443	.462
Total	.318	.410	.870	.916
Total direct, indirect induced incl. unit initial stimulus	1.318	1.410	1.870	1.916
Total direct and indirect incl. unit initial stimulus	1.161	1.238	1.427	1.454
Income				
Direct	.174	.174	.174	.174
Indirect	.051	.063	.103	.126
Type I	1.295	1.364	1.595	1.724
Type II	1.635	1.658	2.342	2.446
Employment				
Direct	.007	.007	.007	.007
Indirect	.008	.017	.023	.041
Induced	.011	.014	.033	.048
Total	.026	.038	.063	.096
Type I	2.099	3.408	4.229	6.893
Type II	3.711	5.394	9.063	13.640

The Gladstone Power Station

Table 6.5 indicates the output, income and employment multipliers relating to the existing Electricity sectors in the respective input-output tables that are utilized in this report in connection with the Gladstone Power Station.

TABLE 6.5

Operational Phase of the Gladstone Power Station - Summary of Sector Multipliers: Gladstone/Calliope, Fitzroy, Queensland, Australia

Multipliers	Gladstone/ Calliope (1)	Fitzroy (2)	Queensland (3)	Australia (4)
Output				
Direct	.099	.189	.210	.234
Indirect	.021	.052	.115	.178
Induced	.206	.225	.543	.581
Total	.326	.466	.868	.993
Total direct, indirect, induced incl. unit initial stimulus	1.326	1.466	1.868	1.993
Total direct and indirect incl. unit initial stimulus	1.120	1.241	1.325	1.412
Income				
Direct	.254	.253	.256	.260
Indirect	.040	.058	.084	.116
Type I	1.158	1.229	1.326	1.446
Type II	1.462	1.494	1.948	2.052
Employment				
Direct	.042	.042	.033	.079
Indirect	.007	.016	.018	.039
Induced	.015	.018	.042	.060
Total	.064	.076	.093	.178
Type I	1.167	1.374	1.557	1.504
Type II	1.524	1.805	2.813	2.258

6.1.3 Interpretation of the Multipliers

In general the multipliers need to be interpreted in the light of the following factors: (a) the assumptions underlying the input-output model; (b) the existence of slack capacity in the economy; (c) the input-output tables. The large smelter multipliers, in particular, need to be interpreted in the context of the prior existence of large scale support industries. These factors are discussed in turn below.

Assumptions of the Input-Output Model

The assumptions underlying the input-output multipliers are outlined in Appendix I. Although they are restrictive, the assumptions simplify the model and thereby make the empirical derivation of the multipliers feasible. There is a large body of early input-output literature criticising the assumptions; some of the main points are worth reiterating here. The assumption of linearity is considered to be a fairly reasonable approximation of industry production functions. When we introduce households into the matrix to calculate induced effects, and when we attempt to calculate employment effects, the linearity assumption becomes less realistic. Thus, generally speaking, (a) the output and income multipliers are expected to be more reliable than employment multipliers, and (b) the simple output multiplier and the Type I income and employment multipliers are expected to be more reliable than the total output multiplier and the Type II income and employment multipliers. Finally, input-output multipliers, or indeed any multipliers, are designed to provide order of magnitude estimations rather than precise predictions of impacts.

Slack Capacity

The linearity assumption underlying input-output analysis implies that no slack capacity exists in the economy and thus if excess capacity is observed in the economy, the implication is that the input-output multipliers will overestimate impacts. During the study team's visit to Gladstone, the general impression was of relatively low levels of economic activity, with slack capacity in most sectors. Gladstone has been used to catering for boom conditions and most existing businesses were built up during times of expansion. Over the last five years there has been a gearing toward the Comalco aluminium smelter in the local business community.

One respondent suggested that economic activity in Gladstone is now at a "normal" level, i.e. the level that applies generally throughout the State. Most respondents observed that the most depressed local industries were Engineering/metal fabricating, Building and builders' supplies, and the Wholesale-retail sectors.

The Input-Output Tables

The years which the input-output tables are based on have considerable implications for the interpretation of the employment multipliers. Since the Gladstone/Calliope tables pertain to 1974-75, Fitzroy and Queensland to 1973-74, and Australia to 1968-69, we should expect that the employment multipliers calculated from these tables will overestimate impacts pertaining to 1978 and beyond. That is, all industries are becoming more capital intensive over time with automation displacing workers and thus dated employment multipliers will tend to overestimate employment impacts.

Large Smelter Multipliers

The aluminium smelter multipliers in particular require careful interpretation in the light of local conditions. Normally the impact agent, the industry represented by the multiplier is viewed as creating additional economic activity through its demand for industrial support requirements and the further round by round effects subsequently generated. Thus the smelter multipliers for Gladstone/Calliope in Table 6.2 are suggesting that for every $1 of smelter output, an additional $0.512 worth of economic activity will be created and for every worker in the smelter the Type I employment multiplier suggests that an additional 1.676 jobs will be created in other industries. However in this instance the major local inputs to the smelter, the electricity and alumina industries, existed prior to the smelter and sold their products to established markets, respectively the State grid and overseas smelters. Thus in the context of this study, the smelter will not directly stimulate increased local production of electricity or alumina, but will simply divert part of the output of these industries from other markets to itself and thus help maintain support activity that already exists. However, to the extent that over time it will be necessary to establish new electricity generation and alumina refining capacity, the smelter has a direct effect in stimulating this increased economic activity. The timing and location of this increased capacity will depend on the development of the State grid, and in the case of alumina, movements in world aluminium markets, and whether increased production is located in Australia or overseas. Thus given the passage of time, it is likely that the multipliers in Table 6.2 will work their effects through the State and national economies.

In the context of this study, is the point that needs to be stressed, however, for in the next section we will be attempting to measure the aggregate impact in dollars of the smelter when it becomes fully operational in the mid 1980's. In the light of the above comments, the smelter multipliers in Table 6.2 will considerably overestimate the smelter's impact and therefore need to be adjusted downward for the purposes of the analysis in Section 6.2. However, in a theoretical sense in comparison with other industries and in the long run, the smelter multipliers are still valid. In the Australian, Queensland, Fitzroy and Gladstone/Calliope economies, the production of aluminium has relatively high output, income and employment generating effects compared to other industries.

Adjusting the Smelter Multipliers for Calculation of Additional Aggregate Impacts

The historical pattern of development of the smelter support industries at Gladstone has been such that a large proportion of the output, income and employment impacts that will be attributable to the smelter already exist in the sub-region. Thus the Gladstone Power Station was located at Gladstone with the aluminium industry in mind. However our problem in the next section will be to estimate the additional aggregate impacts in dollars resulting from the smelter. One way of doing this is to recalculate the smelter multipliers, leaving out the direct inputs provided by electricity and alumina. This has been done in Table 6.6. The multipliers in Table 6.6 can be interpreted as the additional effects on the four economies generated by the smelter. The multipliers appearing in Table 6.2, on the other hand, provide an estimate of the total effects attributable to the smelter. The difference obtained by subtracting figures in Table 6.6 from those in Table 6.2 is a measure of the smelter impacts already accounted for in the region's output, income and employment.

TABLE 6.6

Operational Phase of the Aluminium Smelter -
Adjusted Sector Multipliers:
Gladstone/Calliope, Fitzroy, Queensland, Australia

Multipliers	Gladstone/ Calliope (1)	Fitzroy (2)	Queensland (3)	Australia (4)
Output				
Direct	.010	.010	.010	.010
Indirect	.003	.004	.005	.008
Induced	.064	.066	.146	.141
Total	.077	.080	.161	.159
Total, direct, indirect, induced incl. unit initial stimulus	1.077	1.080	1.161	1.159
Total direct and indirect incl. unit initial stimulus	1.013	1.014	1.015	1.018
Income				
Direct	.086	.086	.086	.086
Indirect	.005	.006	.006	.006
Type I	1.063	1.067	1.067	1.067
Type II	1.342	1.398	1.567	1.514
Employment				
Direct	.006	.006	.006	.006
Indirect	.001	.002	.002	.002
Induced	.004	.005	.012	.014
Total	.011	.013	.019	.022
Type I	1.148	1.324	1.331	1.344
Type II	1.919	2.229	3.133	3.778

6.2 AGGREGATE EFFECTS

The multipliers presented in the previous section indicate the output and income effects on Gladstone/Calliope, Fitzroy, Queensland and Australia, per dollar of construction expenditure in the respective areas and per dollar of turnover of the new industries during their operational phase. The employment multipliers provide the expected employment impacts per $1,000 of construction expenditure or industry turnover.

Aggregate output and income effects in each economy can be estimated by multiplying the per dollar estimates of output and income (i.e. the multipliers) respectively by the anticipated total construction expenditure and the anticipated turnover of the projects during their operational phase. Similarly it is possible to produce estimates of total employment generated in each area by application of the employment multipliers.

It is appropriate here to reinforce the point stressed in the last section that multipliers cannot be mechanistically applied but require careful interpretation and, indeed, adjustment in some circumstances if they are to realistically predict real world economic impacts.

The aggregate construction impacts estimated to arise from the three projects are presented in Section 6.2.1, while the operating phase impacts appear in Section 6.2.2. In each of these sections, the numerical results are first presented, compared and contrasted, followed by commentary that will aid in the interpretation of the aggregate results. In Chapter 7 the aggregate impact results are summarized in the form of a range from lower to higher estimates.

6.2.1 The Construction Phase of the Projects

The economy wide impacts of the construction phase of the three projects on Gladstone/Calliope and the Fitzroy Statistical Division are illustrated in Tables 6.7, 6.8 and 6.9. In each Table, column (1) indicates the impacts on industry output, while columns (2) and (3) indicate the effects on household income and employment respectively. Rows (a) through to (g) are interpreted as follows. Row (a) refers to the initial stimulus which initiates the eventual multiplier effects. This information was presented and discussed in Section 5.2.4 and, in the case of the smelter, is $40 million spent in the area during the peak year, with an associated labour force of 800 persons and $12 million paid in wages and salaries. Figures in rows (b) through to (f) are obtained by multiplying the initial stimulus by the appropriate multipliers appearing in Table 6.1. Thus row (b) in Table 6.7 indicates that in Gladstone/Calliope the aggregate direct or "first round" effects on industry output are $8 million. The indirect effects, indicated in row (c) are $1 million in the sub-region. Row (d) is the sub-total of rows (a), (b), (c) and in the case of industry output is also the effect obtained by applying the simple output multiplier, or $49 million in Gladstone/Calliope. In terms of income and employment effects, row (d) is obtained by applying the initial stimulus to the respective Type I income and employment multipliers, and is $14 million and 954 jobs in the sub-region. Induced effects on output, income and employment in the economy arising from increased personal consumption are measured in row (e) and appear as $10 million, $4 million and 280 jobs in the sub-region. Row (f) is the measure obtained by applying the total output multiplier and the total or Type II income and employment multipliers.

Thus in Gladstone/Calliope the aggregate direct, indirect and induced impacts of the peak year of the construction phase of the smelter on industry output, household income and employment is estimated as $59 million, $18 million and 1 234 jobs respectively. When the Fitzroy region as a whole is considered, these effects become a slightly larger $63 million, $19 million and 1 419 jobs respectively.

In the context of this study the aggregate impact measure on industry output is the least reliable, since in the case of all three developments, only a crude estimate was available of the amount to be spent in the region. It is considered that the estimates of peak employment associated with each project are fairly reliable and thus more credence can be placed on the aggregate employment and household income impacts, than on the industry output impacts.

Although the aggregate impacts are measured in 1978 dollars, the reference points to which impacts are being measured are the Gladstone/ Calliope economy in 1974-75 and the Fitzroy economy in 1973-74, as per the GRIT input-output tables. Thus row (g) puts the total impacts in perspective by considering them as a percent of industry output and income and employment in the reference point economies.[1] The impact of the smelter's peak year construction on Gladstone/Calliope will be to increase total output by 17 percent, household income by 22 percent and employment by 13 percent. In the overall Fitzroy economy the smelter impacts become relatively smaller at an increase of 5 percent on output, 6 percent on household income and 3 percent on employment.

1. Total output and income in the GRIT tables was adjusted to 1978 dollars to allow the appropriate calculation of percent impacts in standard terms.

TABLE 6.7

Economic Impact of the Smelter - Summary of Construction Phase: Gladstone/Calliope, Fitzroy

	Industry Output ($m)	Household Income ($m)	Employment (persons)
Gladstone/Calliope			
(a) stimulus	40	12	800
(b) direct effects	8	n.a.	n.a.
(c) indirect effects	1		
(d) total above	49	14	954
(e) induced effects	10	4	280
(f) total effects	59	18	1 234
(g) percent total effects	17%	22%	13%
Fitzroy			
(a) stimulus	40	12	800
(b) direct effects	9	n.a.	n.a.
(c) indirect effects	3		
(d) total above	52	15	1 106
(e) induced effects	11	4	313
(f) total effects	63	19	1 419
(g) percent total effects	5%	6%	3%

TABLE 6.8

Economic Impact of the Cement Clinker Plant - Summary of Construction Phase: Gladstone/Calliope, Fitzroy

	Industry Output ($m)	Household Income ($m)	Employment (persons)
Gladstone/Calliope			
(a) stimulus	18	4	280
(b) direct effects	3	n.a.	n.a.
(c) indirect effects	1		
(d) total above	22	5	334
(e) induced effects	5	1	98
(f) total effects	27	6	432
(g) percent total effects	8%	7%	5%
Fitzroy			
(a) stimulus	18	4	280
(b) direct effects	4	n.a.	n.a.
(c) indirect effects	1		
(d) total above	23	5	387
(e) induced effects	6	1	110
(f) total effects	29	6	497
(g) percent total effects	2%	2%	1%

TABLE 6.9

Economic Impact of the Gladstone Power Station - Summary of Construction Phase: Gladstone/Calliope, Fitzroy

	Industry Output ($m)	Household Income ($m)	Employment (persons)
Gladstone/Calliope			
(a) stimulus	20	15	1 000
(b) direct effects	4	n.a.	n.a.
(c) indirect effects	1		
(d) total above	25	18	1 193
(e) induced effects	5	4	349
(f) total effects	30	22	1 542
(g) percent total effects	9%	27%	17%
Fitzroy			
(a) stimulus	20	15	1 000
(b) direct effects	5	n.a.	n.a.
(c) indirect effects	1		
(d) total above	26	19	1 382
(e) induced effects	6	4	392
(f) total effects	32	23	1 774
(g) percent total effects	3%	8%	4%

Comparing the relative effects of the three developments on the sub-regional economy, the Gladstone Power Station has the largest peak year construction effects, increasing employment by 17 percent and household income by 27 percent. The impact of the other major project, the aluminium smelter, will be slightly less at 13 percent on employment and 22 percent on household income. Compared to these two developments, the cement clinker plant's peak year construction impact will be relatively small, increasing employment and household income in the sub-region by 5 percent and 7 percent respectively.

Reference can be made to the Building and Construction column of the inverse matrices in Appendices X to XIII to disaggregate the economy wide effects presented and discussed above to individual sectors comprising the economy. Thus the sectors most affected by construction activity in both the Gladstone/Calliope and Fitzroy economies, apart from Building and Construction itself, will be, in order of importance, the Manufacturing (local engineering firms), Trade, and the Transport and Communication sectors.

Interpreting the Aggregate Construction Phase Impacts

In addition to the issues discussed above and those raised in Section 6.1.3, there are a number of points that need to be borne in mind when interpreting the aggregate construction phase impacts:

(i) The impacts of the construction phase are not permanent, but occur only as a result of current construction activity. The time sequence of these effects will be determined by the construction programme; if this programme does not provide for a continuous development programme, the economic impacts will be discontinuous, providing only ephemeral boosts in output, income and employment to the sectors which will be affected. Thus Sadler pioneered the procedure of measuring a "typical" year of a project's construction phase and this has been modified here to an examination of the peak year of construction activity in each instance. Thus the results indicate the maximum impacts arising from a particular year during the construction phase.

(ii) The assumption that the Building and Construction sectors in the existing Gladstone/Calliope and Fitzroy input-output tables are representative of the construction phases of the new industries considered.

(iii) The realism of the estimates of the proportion of total construction expenditure spent locally. For example, if most of the smelter fabrication were to be done elsewhere when tenders are actually let, leaving only plant erection to be carried out locally, then impacts on the sub-regional and regional economies will be much less than the figures estimated in Table 6.7.

(iv) The timing of construction of the various developments has a considerable bearing on the interpretation of the results. The Gladstone Power Station construction workforce is now 800. In two years it will be reduced to 400 and in four years power house construction will be completed. There is potential for smooth "dovetailing" of the construction workforce off the power station and on to other development sites if the timing is right. If this occurs the multiplier effects of the smelter and cement clinker plant's construction phases cannot, for the most part, be considered as additional effects, but will act to maintain the high levels of construction activity that exist in the Gladstone/Calliope and Fitzroy economies. Another way of looking at the aggregate construction impacts of the smelter and cement clinker plant is that they are a measure of the negative multiplier effects that will occur in the Gladstone and Fitzroy economies if the new construction projects do not eventuate when power station construction finishes.

(v) Although this study focuses on the smelter, cement plant and power station, other developments and potential developments that will/could effect the local construction industry in particular, and the Gladstone/Calliope/Fitzroy economy in general include:

(a) the BHP Gregory Coal Project ———→ Clinton Coal Facility at Gladstone and associated rail developments;

(b) other Coal Projects in Central Queensland, for example,
- the Houston Oil and Minerals' Oaky Creek Coal Project
- the Capricorn Coal Development's German Creek Coal Project;

(c) a possible further expansion of QAL;

(d) the Rundle Shale Oil Project.

The Clinton Coal Facility is estimated to cost $26 million plus a further $20 million for harbour dredging. It is scheduled to be completed in April 1980 with a construction labour force peaking at 100 (for the majority of the time the labour force will be considerably less than 100). Thus this development is fairly small compared to the projects considered in this report.

QAL is presently undertaking a routine review study to investigate the practicability of a further expansion of the plant. No information is available at this stage regarding the timing or possible size of the expansion.

If developments (a) to (d) above were to proceed simultaneously with the smelter and cement clinker plant, this would result in a large influx of temporary construction workers and concomitant local boom situation and pressure on resources. This in turn could affect the multipliers and therefore the aggregate results indicated in Tables 6.7, 6.8 and 6.9.

6.2.2 Operating Phase of the Projects

While the construction phase of the new industries will cause some economic impacts, these are as mentioned earlier, ephemeral in nature. The permanent effect of these industries will be during their operational phase, as they assume a normal operating pattern within the four economies being studied.

Projections of the economy wide impacts of the operating phase of the three projects on the Gladstone/Calliope sub-region, Fitzroy Statistical Division, the State of Queensland and Australia are illustrated in Tables 6.10, 6.12 and 6.13 which are in the same format as the aggregate construction impact tables in the previous section.

Table 6.10 indicates that in Gladstone/Calliope the aggregate direct, indirect and induced impact of the operating phase of the smelter at full capacity would increase industry output by 55 percent ($188.5 million), household income by 26 percent ($21.7 million) and employment by 22 percent (2 073 jobs). When Queensland as a whole is considered, the aggregate impacts become larger as the effects of the smelter work their way through the State economy. State-wide industry output is increased by 1.3 percent ($203.2 million), household income by .6 percent ($25.4 million) and employment by .5 percent (3 384 jobs).

Table 6.10 provides a forecast of the expected increase in output, employment and income resulting from the operating phase of the smelter. However, following on from the discussion in Section 6.1.3, it is also useful to present the total impacts of the smelter which includes the effects in Table 6.10, plus the effects the smelter will exert in maintaining existing output, income and employment. These total effects of the smelter on the four economies are presented in Table 6.11.

Focussing on employment, we can compare the relative effects of the smelter on the four economies. In Gladstone/Calliope employment will increase by 22 percent or 2 073 jobs. In other words in addition to the 1 080 workers directly employed at the smelter, an additional 993 jobs will be created in the sub-region in other industries. Further the smelter will be maintaining a significant proportion of existing jobs in the sub-region as indicated by the figures in Table 6.11. Subtracting the additional effects in Table 6.10 from the total effects in Table 6.11

gives an indication of the influence that will be exerted by the smelter in maintaining existing economic activity. In Gladstone/Calliope the smelter will maintain 2 516 jobs.

Moving to a consideration of the other three economies, in the Fitzroy economy, employment will increase by 6 percent or 2 407 jobs and the smelter will maintain 5 738 existing jobs in the region. In Queensland, employment will increase by .5 percent or 3 384 jobs, and a further 9 921 jobs are estimated to be maintained by the smelter. Finally, in Australia, employment will increase by .08 percent or 4 080 jobs, and a further 17 415 jobs are estimated to be maintained by the smelter.

While the discussion above has focussed on the total, or Type II employment effects, the study team would argue, based on the discussion in Section 6.1.3, that the lower Type I employment estimates given in row (d) of the tables provide a more reliable indication of the order of magnitude of expected employment impacts. Thus the total effects on employment (and output and income) indicated in row (f) of the tables can be interpreted as the absolute maximum effects that can be expected to occur, while the effects indicated in row (d) are the most likely order of magnitude effects. The minimum effects could be considerably less than those indicated in row (d). Table 6.14 summarizes the expected or 'most likely' economic impacts resulting from the three projects in the four economies considered.

Thus the study team expect that the smelter at full capacity in Gladstone/Calliope will increase industry output by $177.3 million or 52 percent, household income by $17.2 million or 21 percent, and employment by 1 240 jobs or 13 percent. In addition the smelter will exert an influence in maintaining existing economic activity to the extent of $87.3 million or 25 percent of industry output, $18.0 million or 22 percent of household income and 1 650 jobs or 18 percent of the sub-region's employment. Table 6.14 indicates that the smelter will have by far the largest impact of the three developments considered. The next development in terms of magnitude of impacts is the Gladstone Power Station which at full capacity is expected to increase output, income and employment in the sub-region by $124.3 million or 36 percent, $5.1 million or 6 percent, and 467 jobs or 5 percent respectively. Compared to the aluminium smelter and the Gladstone Power Station, the cement clinker plant is a relatively small development.

TABLE 6.10

Economic Impact of the Smelter - Summary of Operational Phase: Gladstone/Calliope, Fitzroy, Queensland, Australia

	Industry Output ($m)	Household Income ($m)	Employment (persons)
Gladstone/Calliope			
(a) stimulus	175	16.2	1 080
(b) direct effects	1.8	n.a.	n.a.
(c) indirect effects	.5		
(d) total above	177.3	17.2	1 240
(e) induced effects	11.2	4.5	833
(f) total effects	188.5	21.7	2 073
(g) percent total effects	55%	26%	22%
Fitzroy			
(a) stimulus	175	16.2	1 080
(b) direct effects	1.8	n.a.	n.a.
(c) indirect effects	.7		
(d) total above	177.5	17.3	1 430
(e) induced effects	11.5	5.4	977
(f) total effects	189	22.7	2 407
(g) percent total effects	15%	8%	6%
Queensland			
(a) stimulus	175	16.2	1 080
(b) direct effects	1.8	n.a.	n.a.
(c) indirect effects	.8		
(d) total above	177.6	17.3	1 438
(e) induced effects	25.6	8.1	1 946
(f) total effects	203.2	25.4	3 384
(g) percent total effects	1.3%	.6%	.5%
Australia			
(a) stimulus	175	16.2	1 080
(b) direct effects	1.8	n.a.	n.a.
(c) indirect effects	1.4		
(d) total above	178.2	17.3	1 452
(e) induced effects	24.6	7.2	2 628
(f) total effects	202.9	24.5	4 080
(g) percent total effects	.2%	.08%	.08%

TABLE 6.11

Total Impact of the Smelter - Summary of Operational Phase: Gladstone/Calliope, Fitzroy, Queensland, Australia

	Industry Output ($m)	Household Income ($m)	Employment (persons)
Gladstone/Calliope			
(a) stimulus	175	16.2	1 080
(b) direct effects	81.2	n.a.	n.a.
(c) indirect effects	8.4		
(d) total above	264.6	35.2	2 890
(e) induced effects	22.9	9.2	1 699
(f) total effects	287.5	44.4	4 589
(g) percent total effects	84%	54%	50%
Fitzroy			
(a) stimulus	175	16.2	1 080
(b) direct effects	81.2	n.a.	n.a.
(c) indirect effects	26.1		
(d) total above	282.3	41.4	5 802
(e) induced effects	27.8	9.0	2 343
(f) total effects	310.1	50.4	8 145
(g) percent total effects	24%	17%	19%
Queensland			
(a) stimulus	175	16.2	1 080
(b) direct effects	81.2	n.a.	n.a.
(c) indirect effects	51.5		
(d) total above	307.7	47.5	7 709
(e) induced effects	70.5	22.3	5 596
(f) total effects	378.2	69.8	13 305
(g) percent total effects	2.3%	1.5%	2.9%
Australia			
(a) stimulus	175	16.2	1 080
(b) direct effects	81.2	n.a.	n.a.
(c) indirect effects	59.7		
(d) total above	315.9	54.2	13 249
(e) induced effects	77.7	22.7	8 246
(f) total effects	393.6	76.9	21 495
(g) percent total effects	.4%	.2%	.4%

TABLE 6.12

Economic Impact of the Cement Clinker Plant - Summary of Operational Phase: Gladstone/Calliope, Fitzroy, Queensland, Australia

	Industry Output ($m)	Household Income ($m)	Employment (persons)
Gladstone/Calliope			
(a) stimulus	20	1.6	146
(b) direct effects	2.7	n.a.	n.a.
(c) indirect effects	.5		
(d) total above	23.2	2.1	306
(e) induced effects	3.2	.5	236
(f) total effects	26.4	2.6	542
(g) percent total effects	8%	3%	6%
Fitzroy			
(a) stimulus	20	1.6	146
(b) direct effects	3.8	n.a.	n.a.
(c) indirect effects	1		
(d) total above	24.8	2.2	498
(e) induced effects	3.4	.5	290
(f) total effects	28.2	2.7	788
(g) percent total effects	2%	1%	2%
Queensland			
(a) stimulus	20	1.6	146
(b) direct effects	5.6	n.a.	n.a.
(c) indirect effects	3		
(d) total above	28.6	2.6	617
(e) induced effects	8.9	1.1	706
(f) total effects	37.5	3.7	1 323
(g) percent total effects	.2%	.08%	.2%
Australia			
(a) stimulus	20	1.6	146
(b) direct effects	5.6	n.a.	n.a.
(c) indirect effects	3.5		
(d) total above	29.1	2.8	1 006
(e) induced effects	9.2	1.1	985
(f) total effects	38.3	3.9	1 991
(g) percent total effects	.03%	.01%	.04%

TABLE 6.13

Economic Impact of the Gladstone Power Station - Summary of Operational Phase: Gladstone/Calliope, Fitzroy, Queensland, Australia

	Industry Output ($m)	Household Income ($m)	Employment (persons)
Gladstone/Calliope			
(a) stimulus	111	4.4	400
(b) direct effects	11	n.a.	n.a.
(c) indirect effects	2.3		
(d) total above	124.3	5.1	467
(e) induced effects	22.9	1.3	143
(f) total effects	147.2	6.4	610
(g) percent total effects	42%	8%	7%
Fitzroy			
(a) stimulus	111	4.4	400
(b) direct effects	21	n.a.	n.a.
(c) indirect effects	5.8		
(d) total above	137.8	5.4	550
(e) induced effects	24.9	1.2	172
(f) total effects	162.7	6.6	722
(g) percent total effects	13%	2%	2%
Queensland			
(a) stimulus	111	4.4	400
(b) direct effects	23.3	n.a.	n.a.
(c) indirect effects	12.8		
(d) total above	147.1	5.8	623
(e) induced effects	60.3	2.8	502
(f) total effects	207.4	8.6	1 125
(g) percent total effects	1.3%	.2%	.2%
Australia			
(a) stimulus	111	4.4	400
(b) direct effects	26	n.a.	n.a.
(c) indirect effects	19.8		
(d) total above	156.8	6.4	602
(e) induced effects	64.5	2.6	301
(f) total effects	221.3	9	903
(g) percent total effects	.2%	.03%	.02%

TABLE 6.14

Expected Economic Impact of the Operational Phase of the Smelter, Cement Clinker Plant, and the Gladstone Power Station: Gladstone/Calliope, Fitzroy, Queensland, Australia

	Industry Output ($m)	Household Income ($m)	Employment (persons)
Gladstone/Calliope			
Smelter (increases)	177.3	17.2	1 240
Percent	(52%)	(21%)	(13%)
Smelter (maintaining)	87.3	18.0	1 650
Percent	(25%)	(22%)	(18%)
Cement Clinker Plant	23.2	2.1	306
Percent	(7%)	(2%)	(3%)
Gladstone Power Station	124.3	5.1	467
Percent	(36%)	(6%)	(5%)
Fitzroy			
Smelter (increases)	177.5	17.3	1 430
Percent	(14%)	(6%)	(3%)
Smelter (maintaining)	104.8	24.1	4 372
Percent	(8%)	(8%)	(10%)
Cement Clinker Plant	24.8	2.2	498
Percent	(2%)	(.7%)	(1%)
Gladstone Power Station	137.8	5.4	550
Percent	(11%)	(2%)	(1%)
Queensland			
Smelter (increases)	177.6	17.3	1 438
Percent	(1.1%)	(.4%)	(.2%)
Smelter (maintaining)	130.1	30.2	6 271
Percent	(.8%)	(.6%)	(.9%)
Cement Clinker Plant	28.6	2.6	617
Percent	(.2%)	(.05%)	(.09%)
Gladstone Power Station	147.1	5.8	623
Percent	(.9%)	(.1%)	(.09%)
Australia			
Smelter (increases)	178.2	17.3	1 452
Percent	(.16%)	(.05%)	(.03%)
Smelter (maintaining)	137.7	36.9	11 797
Percent	(.12%)	(.11%)	(.23%)
Cement Clinker Plant	29.1	2.8	1 006
Percent	(.03%)	(.01%)	(.02%)
Gladstone Power Station	156.8	6.4	602
Percent	(.14%)	(.02%)	(.01%)

Still, in the context of the sub-region, the impacts of this development will be a considerable $23.2 million or 7 percent on industry output, $2.1 million or 2 percent on household income, and 306 jobs or 3 percent on employment. In comparing impacts associated with the three developments, the most reliable estimates are those associated with the smelter, due to the reliability of the original data associated with this project. On the other hand, data available pertaining to the Gladstone Power Station and the cement clinker plant were sketchy and the results need to be interpreted accordingly.

By adding figures in Table 6.14, we can estimate the impact of the three developments, taken together, on the four economies. In Gladstone/Calliope the three projects together will increase industry output by $324.8 million or 94 percent, household income by $24.4 million or 29 percent, and employment by 2 013 jobs or 21 percent. Focusing on employment only, in the remaining three economies, the three projects together will increase employment respectively in Fitzroy, Queensland and Australia by 2 478 jobs or 5 percent, 2 678 or .38 percent, and 3 060 jobs or .06 percent.

Further Perspectives on the Aggregate Impacts

In addition to the issues raised in Section 6.1.3, and interpretations of the results above in the presentation of construction and operating phase impacts, a number of further considerations should be pointed out in this report.

(i) Multiplier effects are not instantaneous. The time period required for these effects to be fully realized will vary with the economy being considered. In theoretical terms little is known concerning the timing of multiplier effects. Based on the rudimentary analysis of the effects on Gladstone of the alumina refinery in Section 5.2.2, the study team would suggest that five years may be an appropriate time period for multiplier effects to be realized. In connection with time horizons it should also be pointed out that input-output multipliers are intended mainly for use in the measurement of short run (i.e. less than ten years) impacts, since the analysis ignores the effects of technological change and long run growth or decline that becomes increasingly important over time.

(ii) Will economic expansion in the sub-region be due to new businesses or expansion of existing businesses? During their visit to Gladstone, the study team observed some evidence of large companies running "holding operations" in Gladstone in anticipation of future developments and the long term potential of the area. This factor along with the historical experience of the Gladstone business community with the QAL development, and the general high level gearing in anticipation of the smelter should imply that most economic expansion resulting from new developments will be due to the expansion of existing businesses. However, most respondents thought that some new businesses would likely establish during the construction phase and then leave when their contract was completed, as happened during the QAL construction phase.

(iii) Locational aspects of sub-region impacts. The impact results consider the sub-region as a whole. However some comment on the locational aspects of the impacts within the sub-region is desirable. Considering the smelter first, according to an agreement between Comalco, Queensland Government and Calliope Shire, it is the intention that 80 percent of the housing requirements for the smelting operating labour force will be built at Boyne Island and Tannum Sands (plans are also underway for a bridge to link these communities). Land has been set aside for this and associated service and infrastructure requirements. The factors that will influence the locational aspects of the impacts, Gladstone vis a vis Calliope are:-

(a) where people want to live;

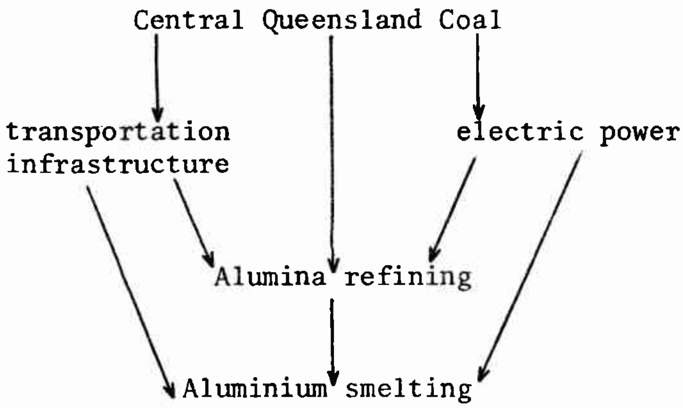
(b) people's attitudes to commuting;

(c) Comalco's policy regarding housing incentives;

(d) levels and timing of services and infrastructure provision at Boyne Island/Tannum Sands.

Turning to the locational aspects of impacts associated with the cement clinker plant, Calliope Shire has no plans to allow for expansion of residential accommodation at Yarwun due to environmental and cost factors. Thus the bulk of the operating labour force will live in Gladstone. The exception will be the labour force at the mine at Mount Larcom. Calliope Shire estimates that these people will originate in the local area. Finally, most local respondents expressed the view that most additional higher order services accruing to the sub-region - high school, technical college, hospital, theatre, social welfare, engineering and specialized shopping - would locate in Gladstone.

(iv) Agglomeration economies. These are benefits associated with the clustering of economic activities. Overall costs are reduced as use of infrastructure is increased and other external economies take effect. Thus once an industry becomes established, it often affects the potential of other industries via forward and backward linkages, or by the availability of infrastructure and services which can then be used by other industries. For example, in the historical development of Gladstone:-



An important economy accruing to the area resulting from the QCL development will be the proposed bridge over the Calliope River. This will not only shorten the road to Rockhampton, but will open up the whole area north-west of Gladstone for potential development. Large tracts of land next to good harbour and transportation facilities will become available, thus increasing the attractiveness of the sub-region for the location of further major industries.

(v) Our knowledge of existing inter-regional trade flows in Queensland (Huxley, 1973) indicates that most of the multiplier effects occurring in Queensland outside the Fitzroy region will accrue to the Brisbane area.

CHAPTER 7

SUMMARY AND CONCLUSIONS

As an application of input-output analysis, this report is broad in scope and it is therefore necessary to summarize the major issues raised and findings of this study. First, it was found that the GRIT methodology, only applied previously at the State and statistical division level, could also be applied to generate an input-output table for the economy of a sub-region. It is the view of the study team that the Gladstone/Calliope input-output table is a substantially accurate representation of the economy of the sub-region for the year 1974-75.

Second, a comparison was made of the economies of the Gladstone/Calliope sub-region, the Fitzroy region, the State of Queensland and Australia in terms of their relative industrial composition, patterns of imports and exports, and linkages between sectors (Chapter 3). This analysis required some adjustments to the existing GRIT tables for Fitzroy and Queensland, and aggregation of the Australian national table to the GRIT sector format. The findings of this structural analysis were consistent with regional economic concepts, namely that sub-region and regional economies tend to emphasize the primary and secondary sectors, while the State and national economies emphasize the secondary and tertiary sectors. Further, as the economy considered increases in size, the multiplier effects also increase, reflecting increasing sector inter-dependence. These aspects of structure have been quantified with respect to the four economies under study.

Third, based on a review of the regional economic impact literature, a system for measuring with input-output models the regional economic impacts of new industries was synthesised incorporating the following technical features:

(a) both the construction and operating phase impacts of new industries can be considered;

(b) the impact of several different industries can be examined;

(c) the sub-regional, regional, State and national impacts can be traced.

Other features of the system are that it is based on GRIT which facilitates conceptually comparable input-output tables to be derived quickly and at low cost, and qualitative comments to aid user interpretation of the quantitative results are stressed.

Fourth, the above system was empirically applied to assess the impacts in terms of industry output, household income, and employment on the economies of the Gladstone/Calliope sub-region, the Fitzroy region, the State of Queensland, and Australia of the following developments:-

(a) Comalco Limited's proposed aluminium smelter at the two potline stage producing 182 000 tonnes of cast aluminium product per annum;

(b) The Queensland Cement and Lime Company Limited's planned cement clinker plant producing 500 000 tonnes of cement clinker per annum;

(c) The Gladstone Power Station at 1 650 MW capacity.

These projects are all likely to be in operation by the mid 1980's.

Impacts can be assessed by analysing the multipliers, or presented in an aggregate sense by applying the multipliers to the initial stimulus associated with the impact agent. The impact results of the study, presented in Chapter 6, utilize both the above approaches. After a careful analysis of the multipliers, the main consideration that impressed itself on the study team was that input-output multipliers cannot be mechanistically applied, but require careful interpretation and indeed, adjustment in some circumstances if they are to predict realistically real world economic impacts. The issues behind this statement were discussed in Section 6.1.3.

In the summary below of the aggregate impact results from Chapter 6, the projected impacts will be presented in the form of a range from likely minimum to absolute maximum effects resulting from a year of operation of the industry concerned. The study team considers that estimates on the lower side of the range will in most instances be the most reliable predictions.

7.1 CONSTRUCTION PHASE

The effects resulting from the peak year of the construction phase of the projects were measured for Gladstone/Calliope and Fitzroy and are summarized in Table 7.1. Comparing the relative effects of the peak year construction of the three developments on the sub-regional economy, the Gladstone Power Station has the largest effects, increasing employment in the range of 1 193 to 1 542 persons or 13 to 17 percent, household income in the range of $18 million to $22 million or 22 to 27 percent, and industry output in the region in the range of $25 million to $30 million or 7 to 9 percent. The impact of the aluminium smelter's peak year construction will be slightly less at 954 to 1 234 persons or 11 to 13 percent, $14 million to $18 million or 17 to 22 percent on household income, and $49 million to $59 million or 14 to 17 percent on industry output.

Compared to the above two developments, the cement clinker plant's peak year construction impact will be relatively small, increasing employment in the range of 334 to 432 persons or 4 to 5 percent, household income in the sub-region in the range $5 million to $6 million, or 6 to 7 percent, and industry output in the range of $22 million to $27 million, or 6 to 8 percent. The effects on the Fitzroy region of the peak year construction phase of the three projects are slightly higher in numerical terms reflecting greater inter-industry linkages, but correspondingly smaller in terms of the percentage effect on the economy as a whole. In perspective the effects of the peak year of the construction phase of the existing major industry in the sub-region, the alumina refinery, are estimated to have been much greater than any of the above projects, increasing employment in Gladstone/Calliope in the range of 2 624 to 3 392 persons.

7.2 OPERATING PHASE

Construction phase impacts are necessarily temporary in nature; the permanent effect of these industries will be during their operational phase, as they assume a normal operating pattern within the four economies being studies. Operational phase impacts are summarized in Table 7.2. In Chapter 6 the distinction was drawn between the smelter's impacts in terms of increased economic activity, and its influence in maintaining activity that already exists in the sub-region. It was argued that in the context of this study, the smelter will not directly stimulate increased local production of electricity or alumina, but will divert part of the output of these industries from other markets to itself and thus help maintain support activity that already exists. The study team expect that the smelter at full two potline capacity in Gladstone/Calliope will increase employment in the range of 1 240 to 2 073 jobs or 13 to 22 percent, household income by $17.2 million to $21.7 million or 21 to 26 percent, and industry output by $177 million to $189 million or 52 to 55 percent. In addition the smelter will exert an influence in maintaining existing levels of economic activity (not shown on Table 7.2) to the extent of 1 650 to 2 516 or 18 to 27 percent of employment in the sub-region, $18.0 million to $22.7 million or 22 to 27 percent of household income and $87.3 million to $98.5 million or 25 to 29 percent of industry output.

An addition of the contributions the smelter is estimated to make in increasing and maintaining economic activity will give an indication of the total impact of the smelter. The total effect of the smelter on employment in the sub-region will be in the range of 2 890 to 4 589 jobs, or 31 to 50 percent, $35.2 million to $44.4 million, or 42 to 54 percent on household income and $264.6 million to $287.5 million or 77 to 84 percent of industry output. The smelter will have the largest operating phase impacts of the three developments considered in this report. In the longer term, as it becomes necessary to establish new electricity generation and alumina refinery capacity, the smelter will have had an effect in stimulating further increased economic activity, as measured by the total impact effects.

The next most significant development in terms of impact is the Gladstone Power Station which at full capacity is expected to increase employment in the sub-region in the range of 467 to 610 jobs or 5 to 7 percent, household income by $5.1 million to $6.4 million or 6 to 8 percent, and industry output $124.3 million to $147.2 million or 36 to 42 percent. Compared to the aluminium smelter and the power station, the cement clinker plant is a relatively smaller development in terms of impact, increasing employment in the sub-region in the range of 306 to 542 jobs, or 3 to 6 percent, household income by $2.1 million to $2.6 million or 2 to 3 percent, and industry output by $23.2 million to $26.4 million or 7 to 8 percent.

In perspective, for the purposes of comparison, the impact of the operating phase of the existing alumina refinery is estimated as 1 655 to 2 609 on employment, and $22.5 million to $28.4 million on household income.

A comparison of the impacts over the four economies can be illustrated briefly with regard to the employment effects of the three developments taken together.

TABLE 7.1

Summary of Range of Impacts: Construction Phase of Projects

	Industry Output ($m)	Household Income ($m)	Employment (persons)
Gladstone/Calliope			
Smelter	49-59	14-18	954-1 234
Percent	14%-17%	17%-22%	11%-13%
Cement Clinker Plant	22-27	5-6	334-432
Percent	6%-8%	6%-7%	4%-5%
Gladstone Power Station	25-30	18-22	1 193-1 542
Percent	7%-9%	22%-27%	13%-17%
Fitzroy			
Smelter	52-63	15-19	1 106-1 419
Percent	4%-5%	5%-6%	3%
Cement Clinker Plant	23-29	5-6	387-497
Percent	2%	2%	1%
Gladstone Power Station	26-32	19-23	1 382-1 774
Percent	2%-3%	6%-8%	3%-4%

In Gladstone/Calliope the three projects together will affect total employment in the range of 3 663 to 5 741 jobs or 39 to 62 percent of the labour force in the sub-region. Of this total effect, the actual increase in jobs in the sub-region is estimated to be in the range of 2 013 to 3 225 jobs or 22 to 35 percent of the sub-region's labour force. In Fitzroy the total employment effect becomes 6 850 to 9 655 jobs or 16 to 23 percent of the region's labour force, while the increase in jobs is estimated to be in the range of 2 478 to 3 917 or 6 to 9 percent. In Queensland as a whole the employment impact will be 8 949 to 15 753 jobs or 1 to 3 percent with an increase component of 2 678 to 5 832 jobs, or .4 to .9 percent. For Australia, the three developments will affect 14 857 to 24 389 jobs or .3 to .5 percent of the nation's labour force. The increase component for the nation is 3 060 to 6 974 jobs or .06 to .14 percent. Thus the impacts become absolutely greater but relatively smaller as larger size economies are considered.

The point was made earlier that, in terms of reliability, the study team favour the estimates toward the lower end of the range of impact results.

TABLE 7.2

Summary of Range of Impacts: Operating Phase of Projects

	Industry Output ($m)	Household Income ($m)	Employment (persons)
Gladstone/Calliope			
Smelter (increases)	177.3-188.5	17.2-21.7	1 240-2 073
Percent	52%-55%	21%-26%	13%-22%
Smelter (total)	264.6-287.5	35.2-44.4	2 890-4 589
Percent	77%-84%	42%-54%	31%-50%
Cement Clinker Plant	23.2-26.4	2.1-2.6	306-542
Percent	7%-8%	2%-3%	3%-6%
Gladstone Power Station	124.3-147.2	5.1-6.4	467-610
Percent	36%-42%	6%-8%	5%-7%
Fitzroy			
Smelter (increases)	177.5-189	17.3-22.7	1 430-2 407
Percent	14%-15%	6%-8%	3%-6%
Smelter (total)	282.3-310.1	41.4-50.4	5 802-8 145
Percent	22%-24%	14%-17%	14%-19%
Cement Clinker Plant	24.8-28.2	2.2-2.7	498-788
Percent	2%-2%	.7%-1%	1%-2%
Gladstone Power Station	137.8-162.7	5.4-6.6	550-722
Percent	11%-13%	2%-2%	1%-2%
Queensland			
Smelter (increases)	177.6-203.2	17.3-25.4	1 438-3 384
Percent	1.1%-1.3%	.4%-.6%	.2%-.5%
Smelter (total)	307.7-378.2	47.5-69.8	7 709-13 305
Percent	1.9%-2.3%	1%-1.5%	1.1%-2.9%
Cement Clinker Plant	28.6-37.5	2.6-3.7	617-1 323
Percent	.2%-.2%	.05%-.08%	.09%-.2%
Gladstone Power Station	147.1-207.4	5.8-8.6	623-1 125
Percent	.9%-1.3%	.1%-.2%	.09%-.2%
Australia			
Smelter (increases)	178.2-202.9	17.3-24.5	1 452-4 080
Percent	.16%-.2%	.05%-.08%	.03%-.08%
Smelter (total)	315.9-393.6	54.2-76.9	13 249-21 495
Percent	.3%-.4%	.17%-.2%	.3%-.4%
Cement Clinker Plant	29.1-38.3	2.8-3.9	1 006-1 991
Percent	.03%-.03%	.01%-.01%	.02%-.04%
Gladstone Power Station	156.8-221.3	6.4-9	602-903
Percent	.14%-.2%	.02%-.03%	.01%-.02%

The reasons for this were discussed in Chapter 6 but can be listed here for summary purposes as the following:-

(a) assumptions underlying the input-output model;

(b) evidence of slack capacity in the economy; and

(c) the years on which the input-output tables are based.

The time period required for the multiplier effects to be fully realized in the four economies is not precisely known. Multiplier effects are not instantaneous, but may require some years to work their way through an economy.

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APPENDIX I

AN INTRODUCTION TO INPUT-OUTPUT ANALYSIS

APPENDIX I

AN INTRODUCTION TO INPUT-OUTPUT ANALYSIS*

The Input-Output Transactions Table

Input-output economics involves dividing the economy to be studied into industrial groupings (sectors) and tracing out the transactions (dollar) flows between the sectors for a given year. Industries sell goods and services to other industries and to final users and buy their inputs from other industries and primary sources. The transactions table summarizes the inter-industry flows in a given year and is conventionally presented in matrix form. A hypothetical transactions table for a 3 sector economy is shown in Table I-1. To interpret this table it is desirable to define 4 quadrants (Quadrants I to IV) and consider each in turn. Quadrant I is termed the "processing" or intermediate matrix; it shows the flows of transactions between the sectors. Each row indicates the flows from one sector to the other sectors. From Table I-1, sector 1 sells $20,000 of its output to sector 2 and $15,000 of its output to sector 3. The columns show the purchases of each sector from the other sectors. Thus sector 3 purchases $15,000 of goods from sector 1 and $10,000 of goods from sector 2 and $43,000 from firms in sector 3. In practice the number of sectors shown in a particular table is determined mainly by the availability of data, the objectives of the study and the resources available to the analyst.

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* This Appendix is similar to Chapter 2 of Jensen, Mandeville and Karunaratne (1977).

Table I-1 Hypothetical Transactions Table ($'000)

Purchasing Sectors / Selling Sectors	Intermediate Sectors (Processing Matrix) 1	2	3	Final Demand	Total Output
1	25	20	15	40	100
	(Quadrant I)			(Quadrant II)	
2	14	6	10	20	50
3	20	12	43	25	100
	(Quadrant III)			(Quadrant IV)	
Primary Inputs	41	12	32	12	97
Total Outlay	100	50	100	97	

Quadrant II indicates sales by each sector to final demand. Final demand traditionally includes personal consumption, investment, some government expenditure and exports. Quadrant III lists the primary inputs into each industry and represents the actual value added in production. Included here are wages and salaries, gross operating surplus, imports and other value added items. Quadrant IV shows primary inputs absorbed by final demand and includes such transactions as indirect taxes paid by consumers.

All "endogenous" sectors of the economy are included within the processing matrix of the table and all "exogenous" sectors outside it. Endogenous sectors are those which are assumed to be influenced by the internal structure of the economy, while exogenous sectors are those governed by external independent influences. Thus exports, capital expenditure and government spending are treated as exogenous since these are influenced primarily by factors external to the economy. Personal consumption expenditure is treated as exogenous in one type of input-output table, the standard or 'open' model, but as endogenous in the 'closed' or induced-consumption model.

The transactions table provides a matrix representation or picture of an economy. It is in effect a disaggregated and consistent accounting system for the economy, and provides measurement of Gross National or Regional product if these are desired. The input-output model can be applied to any economy capable of a separate identification, from national and international economies, to large and small regions, cities, towns, villages and communities.

The compilation of an input-output table is a major empirical undertaking. Once compiled, it is possible to derive multipliers with respect to output, income and employment. The following summary provides a mathematical exposition of the input-output model and the derivation of multipliers from the model.

Input-Output Multipliers

The transactions table can be expressed as a set of equations:

$$X_1 = X_{11} + X_{12} + \ldots\ldots + X_{1n} + Y_1$$

$$X_2 = X_{21} + X_{22} + \ldots\ldots + X_{2n} + Y_2$$

$$\vdots$$

$$X_n = X_{n1} + X_{n2} + \ldots\ldots + X_{nn} + Y_n$$

where

X_i = Total output of intermediate sector i (column and row totals)

X_{ij} = Output of sector i purchased by sector j (elements of intermediate sector)

Y_i = Total final demand for the output of sector i .

It is conventional to divide the elements of the intermediate columns of the transactions table by the respective column totals to derive coefficients which represent the direct purchasing pattern of each sector. These coefficients, variously termed 'direct' or 'input-output' coefficients or less appropriately 'technical coefficients', are normally notated as the a_{ij}, and represent the direct or first round requirements from each sector following an increase in output of any sector.

In equation terms:

$$X_1 = a_{11}X_1 + a_{12}X_2 + \ldots\ldots + a_{1n}X_n + Y_1$$

$$X_2 = a_{21}X_1 + a_{22}X_2 + \ldots\ldots + a_{2n}X_n + Y_2$$

$$\vdots$$

$$X_n = a_{n1}X_1 + a_{n2}X_2 + \ldots\ldots + a_{nn}X_n + Y_n$$

where a_{ij} (= X_{ij}/X_j) is the input-output coefficient. In matrix terms:

$X = AX + Y$ where $A = [a_{ij}]$, the matrix of input-output coefficients and extended to:

$X(I-A) = Y$ where I-A is termed the Leontief matrix

or $X = (I-A)^{-1}Y$ where $(I-A)^{-1}$ is termed the 'general solution' (or simply the inverse of the open model).

Sector Output Multipliers

Let $Z = (I-A)^{-1} = [z_{ij}]$.

The matrix Z is termed the matrix of interdependence coefficients. Each element z_{ij} indicates the total direct and indirect requirements from sector i arising from an increase in sales of one dollar to final demand by sector j. The Z matrix provides therefore, extremely important structural information relating to the economy under study, by indicating the strength of intersectoral economic linkages. The coefficients z_{ij} indicate the extent to which changes in the level of activity of one sector will affect, directly or indirectly, the level of output of all other sectors. The indirect effects could appropriately be termed 'local industrial support' effects.

Each element z_{ij} shows the direct and indirect effects on the output of each sector from an increase in sales of one dollar to final demand by sector j. It follows that the $\sum_i z_{ij}$, or the column sums of the inverse of the open model, will show the total effect on all sectors in the table (i.e. the total output effect on the local economy), of an increase in sales of one dollar by sector j to final demand. For this reason $\sum_i z_{ij}$ is termed the simple output multiplier.

When the model is closed with respect to households, i.e. the household rows are included in the processing sector, the inverse $Z^* = [z^*_{ij}] = (I-A^*)^{-1}$ may be obtained where each element z^*_{ij} provides, in the non-household rows of the inverse, the direct, indirect and induced effect on the output of each sector of an increase in sales to final demand by sector j. The column sums of the non-household z^*_{ij} provide a measure of the total output multiplier for each sector.

Hence it is possible to distinguish three effects in the output mutliplier:

(i) the direct effect. This is shown by the direct coefficients a_{ij}, and represent the immediate or first-round effects on each sector of an increase in output of sector j.

(ii) the indirect effect. This is shown, together with the direct effect in the z_{ij}, or elements of the inverse of the open model, and represent the second and subsequent-round industrial support requirements from each sector following an increase in sales to final demand of any sector. The indirect effect for any sector can be calculated simply as $z_{ij} - a_{ij}$.

(iii) the induced effect. This is shown, together with the direct and indirect effects in the non-household rows of z^*_{ij}, or elements of the inverse of the closed model, and represent the effect on the output of each sector occasioned by increased household consumption as a result of increased sales to final demand of any sector. The induced effect for any sector can be calculated simply as $z^*_{ij} - z_{ij}$.

The facility to disaggregate multipliers into direct, indirect and induced effects is an important advantage of the input-output approach, in that the different components of an impact may be recognised and compared. This facility is applicable also to both income and employment multipliers.

Sector Income Multipliers

Income multipliers measure increases in income occasioned by a specified change in the economy. In this study, 'income' was interpreted as household income, and specifically as wages, salaries and supplements. This definition of income excludes some items normally classified as household income, namely dividends and interest received; the narrower definition of income was adopted because of the difficulty of isolating other components of household income at the regional level.

The direct effect of increases in output on household income is given by the household row coefficient a_{Hi} for each sector, where a_{Hi} is the appropriate entry in the household row of the A matrix. The direct and indirect effect of an increase in sales of any sector to final demand is derived by multiplying the direct and indirect output changes (the elements of the Z matrix) by the corresponding household row coefficient, i.e. obtaining $z_{ij}\, a_{Hi}$ for each element. The direct and indirect income multiplier for sector i is obtained simply as $\sum_i z_{ij}\, a_{Hi}$. The indirect income effect on each sector is calculated as $z_{ij}\, a_{Hi} - a_{Hi}$.

The direct, indirect and induced income multiplier (total regional income multiplier) is obtained from the household row of the Z* matrix. The induced effect can be calculated as $z^*_{ij} - z_{ij}\, a_{Hi}$.

Sector Employment Multipliers

Both output and income multipliers are calculated from elements within the input-output tables. These tables, however, do not contain elements relating to employment *per se*. It is necessary therefore to derive, independently of the tables, an employment coefficient. The simplest method of obtaining this coefficient is the expression of the number of employees per unit of output. Once this coefficient has been obtained, the calculation of employment multipliers parallels to some extent the calculation of income mutlipliers. The direct effect on employment in each sector of a change in output of sector i will be given by a_{Ei}, the 'employment equivalent' of the household row. The direct and indirect employment effects will be shown as $z_{ij}\ a_{Ei}$ for each sector and as $\sum_{i} z_{ij}\ a_{Ei}$ for all sectors. The direct, indirect and induced effects are calculated as $z^*_{ij}\ a_{Ei}$, and as $\sum_{i=1}^{n-1} z^*_{ij}\ a_{Ei}$, i.e. over non-household sectors for the total employment multiplier.

Type I and Type II Multipliers

It has been conventional in input-output analysis for some time to calculate Type I and Type II income and employment multipliers. Type I multipliers are expressed as:

$$\frac{\text{Direct and indirect effects}}{\text{Direct effects}}$$

and Type II multipliers as:

$$\frac{\text{Direct, indirect and induced effects}}{\text{Direct effects}}$$

It is important to establish the distinction between the types of multipliers which have been mentioned. For example, the income multipliers described in the sections above measure the direct and indirect, or direct, indirect and induced effects of a change in *sales* of one dollar of the output of a sector to final demand. Type I and II income multipliers measure the income generated following a dollar change in *household payments*, as a result of a change in final demand for the relevant sector. In other words the regional income multipliers measure the income impact of a change in sales to final demand, while the Type I and II income multipliers measure the income impact of a change in income. Similarly the regional employment multipliers measure the employment impact of a change in sales to final demand, and the Type I and II employment multipliers measure the employment impact of a change in employment.

When interpreting input-output multipliers, it is important to bear in mind that their use is subject to the following assumptions.

(a) fixed coefficients of production - the production function is assumed to be linear implying constant returns to scale, no substitution between inputs, no price reactions to output changes, and no investment capacity or labour supply constraints;

(b) homogeneity - each sector has a fixed set of products that are not produced by any other sector;

(c) additivity - the total effect of carrying on several types of production is assumed to be the sum of the separate effects. Thus external economies and diseconomies, along with the synergistic effect are assumed away.

The assumptions, although restrictive, simplify the model and thereby make empirical implementation feasible.

APPENDIX II

GRIT

APPENDIX II

GRIT

While the GRIT system is fully documented elsewhere (Jensen, Mandeville, Karunaratne, 1977), it is necessary to provide a brief summary of the GRIT procedures here in the interests of making this report self-contained. GRIT is an attempt to elevate regional input-output from the stature of an expensive and time consuming 'research' technique to that of an operational planning technique. It is intended for use by planning authorities which seek methods of developing regional input-output tables of acceptable levels of accuracy, and at lower cost, for individual regions or for systems of regions.

The GRIT method is a natural development of recent attempts to develop non-survey input-output tables. The method is 'variable-interference' in that provision is made for the replacement of mechanically produced input-output coefficients by survey or other more acceptable data, to the degree determined by the analyst. This replacement contributes towards the holistic accuracy of the overall table.

The GRIT project was of 18 months duration beginning June 1976. The first three stages of the project were funded by the Queensland Co-ordinator General's Department; the fourth stage was funded jointly by that same department and the Department of Commerical and Industrial Development. The Department of Economics at the University of Queensland provided material assistance.

The following two sections briefly outline the methodology and emprpicial application of the procedures.

Methodology

The GRIT methodology was designed to incorporate the following features:

(a) that input-output tables and their attendant multipliers could be calculated for any region for which certain minimum levels of data are available[1], from local government areas, to the 'planning' regions[2], to any ad hoc region devised for a specific purpose.

(b) that, although the basic GRIT methodology for producing both state and regional tables is a combination of procedures for converting national tables to regional tables, sufficient flexibility exists to allow the insertion of other data at the discretion of the analyst. This facility will be applied where users have 'superior data', i.e. estimates of higher quality than those generated from national tables.

(c) that the system be capable of updating with minimum effort, as new data sources become available.

(d) that the input-output tables and multipliers derived for the state and for each region be directly comparable, both conceptually and by sector definition, and internally consistent within the system.

(e) the the application of the system in an empirical context involve a minimum of expense and time, consistent with a reasonable degree of accuracy, while allowing the subjective judgement of the analyst to be incorporated without difficulty.

(f) that the application of the system be sufficiently uncomplicated to encourage adoption by analysts without a high level of expertise in 'conventional' approaches in the preparation of input-output tables.

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1. Namely data referring to the value of output of the manufacturing, rural and mining industries, and employment by industry.

2. The planning regions of Queensland are those previously gazetted by the Co-Ordinator General's Department for this purpose, and now termed simply 'statistical divisions', or regions in this study.

(g) that the system be designed as a series of modular components each of which might be modified by the analyst.

The GRIT methodological system is basically a combination and adaptation of non-survey methods[3] in the literature reinforced by new approaches formulated by the study team into an overall framework for application to a given region. For each sector the objective was to convert the national input structure (cost coefficients) into the regional input structure. The national sector will differ from the regional one by three main factors: (a) imports (the main difference arising from the greater "openness" of regional economies), (b) industrial mix, and (c) production functions. The GRIT methodology accounts for these differences and has been expressed in a sequence of fifteen steps which are arranged in five phases.

Phase I of the sequence provides for adjustments to the Australian national input-output table which supplies the basic input into GRIT; these comprise adjustments for price changes, updating and for international trade. In Phase II the difficult task of estimating regional imports for each region for which tables are desired, is undertaken. Sectors which do not exist in the region in question are removed from the national table and purchases from these sectors in the national table are redefined as imports into the regional table. Further, some of the coefficients of the sectors which exist in the region are adjusted downwards to eliminate that portion of purchases ascribed to these sectors in the national table, which become imports at the regional level.

Phase III provides for the insertion of 'disaggregated superior data', i.e. estimates which the operator considers superior to these produced by the mechanical operations of Phases I and II, and which are available at the disaggregated level. Adjustments are also made in Phase III for region -

3. A review of non-survey techniques is provided in Jensen, Mandeville and Karunaratne (1977).

unique industrial mix and production functions by weighted aggregation to smaller tables which are more commensurate with the simpler economic structure of the regions. Phase IV provides a further opportunity for the insertion of superior data, when this data is available only in a more aggregated form. From the coefficients developed from earlier phases, an initial transactions table is developed for each region by applying regional output estimates to the coefficients to produce first estimates of transactions. Either manual or constrained-matrix iterative adjustments are applied to produce a consistent prototype transactions table. Finally, Phase V allows for the inspection of each prototype table, the insertion of further superior data and other adjustments to improve the accuracy of the table or to remove anomalies. This phase produces final transactions tables and the associated multipliers for the region concerned.

Empirical Application

Early in 1977, the Bowen Basin region of Central Queensland consisting of the Mackay and Fitzroy statistical divisions was selected for the initial empirical application of the methodology. This work paved the way for the generation of input-output tables for the ten regions of Queensland and the state as a whole. For each region, two sets of regional tables were produced, one set with three different levels of aggregation to accommodate the variety in regional economic complexity, and one set at a uniform level of aggregation to allow direct comparisons between regions, and between regions and the state, for all sectors.[4] The empirical application to Queensland and its regions has been fully documented in Jensen, Mandeville and

4. The three differing levels of aggregation were 36, 19 and 11 sectors to accommodate, respectively the economies of regions defined as metropolitan, provincial and rural. The uniform level of aggregation was at the 11 sector level.

Karunaratne (1977). This report also contains all regional transactions tables, tables of direct coefficients, the inverse matrices, and attendant output, income and employment multipliers.

In this present report, the GRIT procedures have been further applied to generate a table for the Gladstone/Calliope subregion, regenerate the Fitzroy and Queensland tables, and the Australian national input-output table was adjusted to the GRIT sector format. The GRIT sequence will be subject to professional criticism, evaluation, improvement and ultimately replacement. In the mean time the authors have been encouraged by the number of inquiries for possible application of the system outside the state of Queensland.

APPENDIX III

SECTOR CLASSIFICATION

APPENDIX III

SECTOR CLASSIFICATION

Rural Regions	Provincial Regions	Metropolitan Region & State	National Sectors Included
1. Animal industries	1. Animal industries	1. Animal industries	01.01 Sheep 01.03 Meat cattle 01.04 Milk cattle and pigs
2. Other primary industries	2A. Other agriculture	2A. Other agriculture	01.02 Cereal grains 01.05 Poultry 01.06 Other farming 02.00 Services to agriculture
	2B. Forestry, fishing	2B. Forestry, fishing	03.00 Forestry and logging 04.00 Fishing, trapping & hunting
3. Mining	3A. Coal & crude petroleum mining	3A. Coal & crude petroleum mining	12.00 Coal & crude petroleum mining
	3B. Other mining	3B. Other mining	11.01 Iron 11.02 Other metallic minerals 14.00 Non-metallic n.e.c. 16.00 Services to mining
4. Manufacturing	4A. Food manufacturing	4A1 Meat & milk products	21.01 Meat products 21.02 Milk products
		4A2 Fruit & vegetable products, oils and fats	21.03 Fruit & vegetable products 21.04 Margarines, oils & fats
		4A3 Flour, cereals, bread	21.05 Flour mill & cereal food products 21.06 Bread, cakes & biscuits
		4A4 Confectionery & other food n.e.c.	21.07 Confectionery & cocoa products 21.08 Food products n.e.c. (including fish and sugar)
		4A5 Beverages & tobacco	21.09 Soft drinks, cordials & syrups 21.10 Beer and malt 21.11 Alcoholic beverages n.e.c. 22.01 Tobacco products
	4B. Wood & paper manufacturing	4B1 Sawmills, plywoods	25.01 Sawmill products 25.02 Plywood, veneers & manufactured boards

Rural Regions	Provincial Regions	Metropolitan Region & State	National Sectors Included
		4B2 Joinery, furniture	25.03 Joinery & wood products n.e.c. 25.04 Furniture, mattresses, brooms & brushes
		4B3 Paper products	26.01 Pulp, paper & paperboard 26.02 Fibreboard & paper containers 26.03 Paper products n.e.c.
		4B4 Newspapers, printing	26.04 Newspapers & books 26.05 Commercial & job printing & printing trade services
	4C. Machinery, appliances, equipment	4C1 Household appliances, machinery & equipment	33.01 Photographic, scientific equipment etc. 33.02 Television sets, radios, communication & electronic equipment n.e.c. 33.03 Household appliances n.e.c. 33.04 Electrical machinery & equipment n.e.c. 33.05 Agricultural machinery and equipment 33.06 Construction, earthmoving & materials handling machinery & equipment 33.07 Other machinery & equipment
		4C2 Motor vehicles, ships, locomotives & aircraft	32.01 Motor vehicles & parts & transport equipment n.e.c. 32.02 Ship & boat building & repair 32.03 Locomotives, rolling stock & repair 32.04 Aircraft building & repair
	4D. Metals, metal products	4D1 Basic iron and steel	29.01 Basic iron & steel
		4D2 Non-ferrous metal basic products	29.02 Non-ferrous metal basic products
		4D3 Fabricated and other metal products	31.01 Fabricated structural metal products 31.02 Metal containers, sheet metal products 31.03 Cutlery & hand tools, metal coating & finishing & metal products n.e.c.

Rural Regions	Provincial Regions	Metropolitan Region & State	National Sectors Included
	4E. Non-metallic mineral products	4E. Non-metallic mineral products	28.01 Glass & glass products 28.02 Clay products 28.03 Cement 28.04 Ready-mixed concrete 28.05 Concrete products 28.06 Gypsum, plaster & other non-metallic mineral products
	4F. Other manufacturing	4F1 Chemicals, petroleum products	27.01 Chemical fertilizers 27.02 Industrial chemicals n.e.c. (plastic materials, synthetic resins, industrial gases, synthetic rubber, other basic chemicals) 27.03 Paints, varnishes & lacquers 27.04 Pharmaceutical & veterinary products, agricultural chemicals. 27.05 Soap & other detergents 27.06 Cosmetic and toilet preparations 27.07 Chemical products n.e.c. (incl. ammunition, explosives & fireworks) 27.08 Petroleum & coal products
		4F2 Textiles	23.01 Prepared fibres (cotton ginning, wool scouring, top-making) 23.02 Man-made fibres, yarns & fabrics 23.03 Cotton, silk & flax yarns, fabrics & household textiles 23.04 Wool & worsted yarns & fabrics 23.05 Textile finishing 23.06 Textile floor covering, felt & felt products 23.07 Textile products n.e.c. (incl. canvas, rope, etc.)
		4F3 Knitting mills, clothing, footwear	24.01 Knitting mills 24.02 Clothing 24.03 Footwear

Rural Regions	Provincial Regions	Metropolitan Region & State	National Sectors Included
		4F4 Leather, rubber & plastic products	34.01 Leather tanning, leather & leather substitute products n.e.c. 34.02 Rubber products 34.03 Plastic & related products
		4F5 Other manufacturing	34.04 Signs, advertising displays, writing & marking equipment 34.05 Ophthalmic articles, jewellery, silverware & other manufacturing
5. Electricity, gas & water	5. Electricity, gas & water	5A1 Electricity	36.01 Electricity generation & distribution
		5A2 Gas	36.02 Gas production & distribution
		5A3 Water, sewerage	27.01 Water, sewerage & drainage
6. Building & construction	6. Building & construction	6. Building & construction	41.01 Residential buildings 41.02 Other building & construction
7. Trade	7. Trade	7. Trade	46.01 Wholesale trade 48.01 Retail trade 48.02 Motor vehicle repairs 48.03 Other repairs
8. Transport & communication	8. Transport & communication	8A1 Transport	51.01 Road transport 52.01 Railway transport, other transport & storage 53.01 Water transport 54.01 Air transport
		8A2 Communication	55.01 Communication
9. Finance	9. Finance	9A1 Finance	61.01 Banking 61.02 Finance & life insurance 61.03 Other insurance 61.04 Investment, real estate & leasing 61.05 Technical & other business services 61.06 Ownership of dwellings

Rural Regions	Provincial Regions	Metropolitan Region & State	National Sectors Included
10. Public administration & defence	10. Public administration & defence	10. Public administration & defence	71.01 Public administration 72.01 Defence
11. Community services, entertainment	11A Community services	11A Community services	81.01 Health 82.01 Education, libraries, etc. 83.01 Welfare services, religious & community organizations
	11B Entertainment etc.	11B Entertainment etc.	91.01 Entertainment & recreational services 92.01 Restaurants, hotels & clubs 93.01 Personal services

APPENDIX IV

TECHNICAL APPENDIX

APPENDIX IV

TECHNICAL APPENDIX

Constructing the Gladstone/Calliope Input-Output Table

The Gladstone/Calliope table is based on the GRIT procedures fully documented elsewhere (Jensen, Mandeville and Karunaratne, 1977). Discussion here will focus briefly on specifically unique situations encountered in applying GRIT to the Gladstone/Calliope subregional economy. After consultations with the Steering Committee and the Australian Bureau of Statistics (ABS), 1974/75 was chosen as the year for which the GRIT application to Gladstone/Calliope would apply. This was the latest year for which data on sector outputs were available from the ABS.

Previous applications of GRIT had been at the regional (statistical division) or State levels while in this application, the subregional economy of Gladstone/Calliope consisted of two local government areas (LGA's). Sparse data due to ABS confidentiality at the LGA level was offset by recourse to the existing Fitzroy table which could be utilised for superior data, and in the estimation of Gladstone/Calliope industry outputs where necessary.

In a small, fast-growing area such as Gladstone/Calliope the latest employment by industry figures available at the time of table construction, i.e. the 1971 employment statistics, were regarded as inadequate since employment/output ratios would be utilised to calculate tertiary sector industry outputs. Thus for the purpose of calculating tertiary sector outputs, an estimate was required of the labour force by industry for 1974-75. This was done based on the following information (a) knowledge of the local Building and Construction industry, (b) an ABS population estimate for 1974/75 for Gladstone/Calliope, (c) ABS 1971 labour force by industry and labour force participation rate for Gladstone/Calliope.

Adjusting the Fitzroy and Queensland Input-Output Tables

During the course of this study it was discovered that the original GRIT table for Fitzroy contained an error in connection with sector 4D, Metals and Metal Products. Total final demand for this sector should have been $80m, all of which is exported instead of the $63m split between Households and Other Final Demand, appearing in the original GRIT table. Further, although the alumina refinery at Gladstone acts as a processor for parent companies, it was considered that in the context of this study the tables should include bauxite as an input to the region and the value of output adjusted accordingly. Thus the original Fitzroy and Queensland tables had to be adjusted to account for this.

Data Requirements for the Analysis of New Industry Impacts

If the analyst is seeking data from the company or organisation concerned in connection with the analysis of new industry impacts, the following questionnaires indicate the kind of format this data request may take. The first questionnaire entitled "Data Needs for Impact Analysis" applies to specifically the Comalco Limited's aluminium smelter. This questionnaire was designed early in the study and contains considerable preamble and alternative formats for data collection. The second questionnaire entitled "Data Needs for 1650 MW Gladstone Power Station" contains a basic outline of data requirements.

INPUT-OUTPUT STUDY OF THE GLADSTONE/CALLIOPE AREA

DATA NEEDS FOR IMPACT ANALYSIS

I INTRODUCTION

The Study Team has been commissioned by Comalco and D.C.I.D. to analyse the impact on the economies of Gladstone/Calliope, the Fitzroy Region and the State of Queensland in terms of output, income and employment of establishing the following new industries by augmenting the respective input-output tables of Gladstone/Calliope, Fitzroy and Queensland with a new row and column representing the added industry - Comalco Ltd's proposed aluminium smelter,

- Queensland Cement & Lime Co. Ltd's planned cement clinker plant,
- two additional notional industries.

This document outlines ideal data requirements with respect to each development. I stress "ideal" for two reasons: (1) it is recognised at the outset that in certain instances it will be likely that less than ideal information will have to be incorporated into the study, and (2) with regard to the two notional industries, it may not be practicable to pursue the analysis in the same detail as will be carried out for the smelter and the cement clinker plant.

II SUMMARY OF DATA NEEDS FOR EACH DEVELOPMENT, FOR EXAMPLE, COMALCO LTD'S PROPOSED ALUMINIUM SMELTER

(A) Construction Phase - Aluminium Smelter

1. Total construction cost, duration of construction phase, per cent of total construction cost incurred in each year.
2. Labour force in each year of the construction phase.
3. Construction costs spent in Gladstone/Calliope
   - wages and salaries

- local materials (specified by major categories)
- electricity, water and other local services

4. Construction costs spent in Fitzroy (other than Gladstone/Calliope)
   - breakdown as per item 3 above
5. Construction costs spent in Queensland (other than Fitzroy)
   - breakdown as per item 3 above

(B) Full Production Phase During A "Typical" Year - Aluminium Smelter

1. Capacity in tonnes per year of cast aluminium product and total value of output at plant head.
2. Labour force by categories of labour.
3. Production costs spent in Gladstone/Calliope
   - local materials
   - electricity, water and other local services
   - wages and salaries
   - other major categories of inputs
   - other value added, i.e. gross operating surplus
4. Production costs spent in Fitzroy (other than Gladstone/Calliope)
   - breakdown as per items above
5. Production costs spent in Queensland (other than Fitzroy)
   - breakdown as per item 3 above

(C) Infrastructure - Associated with Aluminium Smelter

Additional infrastructure required, but not included in item (A) above, can also be costed and the multiplier effects of this associated development examined. Infrastructure could include additional port, road, rail, water supply, or housing facilities. For a summary of data requirements, see item (A) above.

(D) Satellite Industries - Associated with Aluminium Smelter

What sort of industries would we expect to be attracted to an alumina refinery/aluminium smelter complex in an area such as Central Queensland which has cheap electricity, plentiful coal supplies, and adequate transportation networks, but is relatively isolated from major population centers? We anticipate making several runs with various alternative assumptions re: the level of satellite industries attracted, from a minimum of none to a maximum of the most optimistic forecast.

Examples of satellite industries:

(1) industries utilising the output of the smelter - e.g. fabrication industries using aluminium inputs.

(2) industries providing inputs to the smelter.

(3) service industries to provide for the expanded labour force and thus the population of the area.

Data requirements for the satellite industries will be similar to breakdowns in items (A),(B), (C) above and detailed in the following section, with emphasis on (B),the production phase, in each case.

(E) Historical Information

In order to provide a basis for comparison, the historical effect of the existing Q.A.L. plant on the area should be examined. In particular, what existing industries have expanded and what new industries have been attracted to the area during the period 1967-1977.

III DETAILS OF DATA NEEDS FOR EACH DEVELOPMENT, FOR EXAMPLE, COMALCO LTD'S PROPOSED ALUMINIUM SMELTER

For insertion into the input-output table all data needs to be ultimately in the form of cost coefficients, i.e. inputs per dollar of output. (In input-output accounts total output of an industry, i.e. value of goods and services produced for a year equals total outlay, i.e. all costs plus gross operating surplus).

COST COEFFICIENTS

Industry	Purchases in Gladstone/ Calliope ¢/dollar	Purchases in Fitzroy-other than Gladstone/ Calliope ¢/dollar	Purchases in Queensland other than Fitzroy ¢/dollar	Purchases outside Queensland ¢/dollar
1. Animal industries				
2. Other agriculture				
3. Forestry, fishing				
4. Coal and crude petroleum mining				
5. Other mining				
6. Food manufacturing				
7. Wood and paper manufacturing				
8. Machinery, appliances, equipment				
9. Metals, metal products				
10. Non-metallic mineral products				
11. Other manufacturing				
12. Electricity, gas and water				
13. Building & construction				
14. Trade				
15. Transport & communication				
16. Finance				
17. Public				
18. Community services				
19. Entertainment, recreation, personal services				

contd.

Industry	Purchases in Gladstone/ Calliope ¢/dollar	Purchases in Fitzroy-other than Gladstone/ Calliope ¢/dollar	Purchases in Queensland other than Fitzroy ¢/dollar	Purchases outside Queensland ¢/dollar
Other costs				
Depreciation				
Salaries & wages				
Other value added*				

* other value added is gross operating surplus and includes operational profits, net interest payments, direct taxes on income, dividends and similar items.

It has been the experience of the Study Team that respondents often find it difficult to reconcile the above cost coefficients format with their accounting systems. Thus we will suggest other formats which are more in line with industry accounting procedures and which enable indirect conversion to cost coefficients by the Study Team.

(A) Costruction Phase - Aluminium Smelter - Details of Data Requirements

1. Total construction cost $

2. Schedule of construction costs

Year	% total construction cost each year
1	%
2	%
3	%
.	.
.	.
.	.
n	%
	100 %

3. Labour force ____________

in each year of the construction phase

4. Construction Costs

Item	Purchases in Gladstone/ Calliope $	Purchases in Fitzroy-other than Gladstone/ Calliope $	Purchases in Queensland- other than Fitzroy $	Purchases outside Queensland $
a) Materials and supplies purchased (list major items)				
b) subcontractors				
c) electricity,gas,water				
d) rates				
e) postage, telephone, telex				
f) business services				
g) motor vehicle running expenses (exclude depreciation, leasing charges and wages of own employees)				
h) other expenses				
i) depreciation during year on all fixed assets				
j) wages & salaries				
k) gross operating surplus				

(B) <u>Full Production Phase During A Typical Year - Aluminium Smelter - Details of Data Requirements</u>

1. Capacity in tonnes per year of cast aluminium product ___________.

2. Valuation of cast aluminium product per tonne $___________.

3. Labour force _______ by categories of labour.

4. Engineering estimates of input requirements for aluminium smelter, per tonne of output.

Item		Requirements
Electric power	(Kwh)	
Alumina	(tonnes)	
Fluorides	(Kg)	
Calcinated coke	(Kg)	
Total labour	(man hours)	
Water	(litres per day)	
Pitch	(Kg)	
Fuel oil	(litres)	
Other major items	(list)	

5. Production costs (costs may be expressed as totals or as costs per tonne of product).

Item	Purchases in Gladstone/ Calliope $	Purchases in Fitzroy-other than Gladstone/ Calliope $	Purchases in Queensland-other than Fitzroy $	Purchases outside Queensland $
a) Alumina				
b) Fluroides				
c) Calcinated coke				
d) Pitch				
e) Fuel oil				
f) Other materials & supplies purchased (list items)				
g) Electricity				
h) Water				
i) Postage, telephone, telex				
j) Rates				
k) Business services				
l) Motor vehicle running expenses (exclude depreciation, leasing charges and wages of own employees).				

contd

Item	Purchases in Gladstone/ Calliope $	Purchases in Fitzroy-other than Gladstone/ Calliope $	Purchases in Queensland-other than Fitzroy $	Purchases outside Queensland $
continued				
m) Depreciation during year on all fixed assets				
n) wages and salaries				
o) gross operating surplus				

INPUT-OUTPUT STUDY OF THE GLADSTONE/CALLIOPE AREA

Data Needs for 1650 MW Gladstone Power Station

(A) Full Operating Phase at 1650 MW During A Typical Year (all costs to be expressed in standard dollars, e.g. 1978 dollars).

1. Value of output $__________
2. Labour force __________ employees (all categories)
3. Coal required __________ tonnes
4. Production costs

Item	Purchases in Gladstone/ Calliope $	Purchases in Fitzroy-other than Glad-stone/ Calliope $	Purchases in Queensland-other than Fitzroy $	Purchases outside Queensland $
(a) coal				
(b) other materials & supplies purchases (list items)				
(c) electricity				
(d) water				
(e) postage, telephone, telex				
(f) rates				
(g) business services				
(h) motorvehicle running expenses (exclude depreciation, leasing charges and wages of own employees.)				
(i) other transport costs				
(j) Depreciation during year on all fixed assets				
(k) wages and salaries				
(l) gross operating surplus				

III Construction Phase (all costs to be expressed in standard dollars e.g. 1978 dollars)

1. Total construction cost $

2. Schedule of construction costs

Year	% total construction cost each year
1	%
2	%
3	%
.	.
.	.
.	.
n	%
	100 %

3. Labour force

in each year of the construction phase

4. Construction Costs

Item	Purchases in Gladstone/ Calliope $	Purchases in Fitzroy-other than Glad-stone/ Calliope $	Purchases in Queensland-other than Fitzroy $	Purchases out-side Queensland $
a) Materials and supplies purchased (list major items)				
b) subcontractors				
c) electricity, gas, water				
d) rates				
e) postage, telephone, telex				
f) business services				
g) motor vehicle running expenses (exclude dep-reciation, leasing charges and wages of own employees)				
h) other expenses				
i) depreciation during year on all fixed assets				
j) wages & salaries				
k) gross operating surplus				

APPENDIX V

COMPUTER PROGRAMME

```
C     IMPACT- A PROGRAM TO PERFORM IMPACT ANALYSIS
C     AUTHOR: A. N. BROUGHTON  U. OF Q.
C
C     IMPACT  IS DESIGNED TO SHOW THE IMPACT OF ADDING NEW INDUSTRY
C     COEFFICIENTS TO A REGIONAL COEFFICIENT TABLE.  THE MULTIPLIERS
C     ARE DERIVED BOTH BEFORE THE ADDITION OF THE NEW INDUSTRY, AS
C     WELL AS AFTER SO THAT ANY IMPACT CAN BE EASILY SEEN.
C
C     THE TABLES USED FOR THIS PROGRAM ARE OF SIMILAR FORMAT TO THOSE USED
C     IN THE GRIT STUDY. SECTOR LABELLING FOLLOWS THE GRIT FORMAT ALSO.
C     IMPACT HAS BEEN DESIGNED SO THAT VARIABLE SIZE TABLES MAY BE USED
C     WITH THE DIFFERENT REGIONS UNDER ANALYSIS.  THE NUMBER OF REGIONS
C     MAY ALSO BE VARIED QUITE EASILY, HOWEVER THE INITIAL DESIGN OF THE
C     PROGRAM HAS BEEN FOR FOUR TABLES (NATIONAL, STATE, REGIONAL, AND
C     A CENTRE WITHIN THE REGION).  SHOULD YOU WISH TO CHANGE THE PROGRAM
C     TO ALLOW STUDY OF MORE REGIONS YOU SHOULD ALTER THE MAXIMUM DIMENSIONS
C     OF THE ARRAYS USED, AS WELL AS THE VARIOUS FORMAT STATEMENTS.
C
C     TWO FILES ARE NECESSARY TO RUN THIS PROGRAM. THESE ARE A FILE
C     CONTAINING THE COEFFICIENT TABLES, AND THE EMPLOYMENT COEFFICIENTS;
C     AND A FILE CONTAINING THE IMPACT DATA AND OTHER RUN-DEPENDENT
C     INFORMATION. THE COEFFICIENT TABLES SHOULD BE CONTAINED IN A DISK FILE
C     AND THE OTHER VARIABLE DATA IN A CDR FILE.
C
C     THE FILE FORMATS ARE AS FOLLOWS:
C
C             DISK FILE-  THE ORDER WITHIN THE FILE IS COEFF. TABLE, EMPLOYMENT
C                     COEFFS., COEFF. TABLE, ETC. THE TABLES USED MUST
C                     INCLUDE THE HOUSEHOLDS COEFFS. THERE SHOULD
C                     BE 12 REAL VALUED COEFFS. PER LINE WITHIN EACH
C                     TABLE-EMPL. COEFF. SET.
C
C             CDR FILE-  THE ELEMENTS WITHIN THIS FILE ARE LISTED BELOW
C                     IN THE ORDER WHICH THEY SHOULD APPEAR
C                     (1)  FILENAME OF DISK FILE
C                     (2)  THE NUMBER OF TABLES USED
C                     (3)  THE NAME OF EACH TABLE. E.G. "NATIONAL"
C                     (4)  THE NUMBER OF SECTORS IN EACH TABLE
C                     (5)  THE NUMBER OF EXTRA SECTORS TO BE ADDED
C                     (6)  THE SECTOR NUMBERS OF THE ADDED SECTORS (GRIT LABELLING)
C                     (7)  FOR EACH ADDED SECTOR-
C                             (I) COL. IMPACT COEFFS.
C                             (II) ROW IMPACT COEFFS.
C                             (III) EXTRA EMPL. COEFF.
C                          THERE SHOULD BE 12 REAL VALUES PER LINE
C
      REAL COFTAB(50,50),EM(50)
      INTEGER NUMS(50),NSECTS(4),SECTNO(4),TBNAMS(4,2)
      INTEGER LPT,CDR,DSK,XSECTS,FILNAM,P,TSIZE,NTABS
      COMMON LPT,CDR,DSK
      DATA LPT,CDR,DSK,TSIZE/3,2,1,50/

C
C     INPUT NON-REGIONAL DEPENDENT VARIABLES
C

      READ(CDR,10)FILNAM,NTABS,((TBNAMS(I,J),J=1,2),I=1,NTABS),
      1 (NSECTS(I),I=1,NTABS),XSECTS,(SECTNO(I),I=1,XSECTS)
   10 FORMAT(A5/I/4(2A5/),4I/5I)
      OPEN(UNIT=DSK,ACCESS='SEQIN',FILE=FILNAM)
```

```
C
C      OUTPUT THE NUMBER OF SECTORS TO BE ADDED AS WELL AS THE
C      LABELS OF THE ADDED SECTORS. E.G. IF A SECTOR IS TO BE
C      ADDED INTO THE TABLE AS AN EXTRA SECTOR 4, THE NUMBER
C      4 WILL BE OUTPUT, AND WITHIN THE TABLES OUTPUT THIS
C      NEW SECTOR WILL BE CALLED 4*, WITH SUCCESSIVE REPEATS
C      BEING LABELLED 4**, 4***, ETC.
C

       WRITE(LPT,12)XSECTS,(SECTNO(I),I=1,XSECTS)
  12   FORMAT('NO. OF SECTORS ADDED = '12//' LABELS OF ADDED SECTORS '
       1 4(I5,','))

C
C      PERFORM IMPACT ANALYSIS FOR EACH REGION
C

       DO 130 K=1,NTABS
        WRITE(LPT,15)(TBNAMS(K,L),L=1,2)
  15    FORMAT('3***** ',2A5,' TABLE *****')

C
C      SET UP INITIAL VARIABLE SECTOR LABELS
C

       LIM=NSECTS(K)
       DO 20 I=1,LIM
        NUMS(I)=I
  20   CONTINUE

C
C      INPUT COEFF. TABLE AND EMPL. COEFFS.
C

       DO 40 J=1,LIM
        READ (DSK,30)(COFTAB(I,J),I=1,LIM)
  30    FORMAT(12F)
  40   CONTINUE
       READ(DSK,30)(EM(I),I=1,LIM-1)

C
C      CALCULATE MULTIPLIERS
C

       CALL MULTS(COFTAB,TSIZE,LIM,EM,TSIZE,NUMS,TSIZE)

C
C      ADD IN EXTRA SECTOR(S) AND RECALCULATE MULTIPLIERS
C

        DO 120 L=1,XSECTS
         DO 60 I=1,LIM
          IF(NUMS(I).GT.SECTNO(L))GO TO 70
  60     CONTINUE
  70     P=I
         LIM=LIM+1
         DO 90 J=LIM,P+1,-1
          DO 80 I=1,LIM-1
           COFTAB(I,J)=COFTAB(I,J-1)
```

```
80        CONTINUE
          NUMS(J)=NUMS(J-1)
          EM(J)=EM(J-1)
90        CONTINUE
          NUMS(P)=SECTNO(L)
          DO 110 I=LIM,P+1,-1
           DO 100 J=1,LIM
            COFTAB(I,J)=COFTAB(I-1,J)
100        CONTINUE
110       CONTINUE
          READ(CDR,30)(COFTAB(I,P),I=1,LIM),
        1 (COFTAB(P,J),J=1,LIM)
          READ(CDR,30)EM(P)
120      CONTINUE
         CALL MULTS(COFTAB,TSIZE,LIM,EM,TSIZE,NUMS,TSIZE)
130     CONTINUE
        STOP
        END



        SUBROUTINE MULTS(TAB,M1,HH,EM,M2,NUM,M3)
C
C      THIS ROUTINE DOES MOST OF THE WORK FOR THE IMPACT PROGRAM. ALL
C      COEFFICIENT MATRICES ARE DERIVED AND THE MULTIPLIERS CALCULATED.
C      THE ARGUMENTS ARE AS FOLLOWS
C              TAB-TABLE WHICH CONTAINS THE COEFFICIENT TABLE TO
                   BE PRINTED, AND FROM WHICH THE MULTIPLIERS ARE
                   CALCULATED.
C              M1-ACTUAL DIMENSION OF TAB, USED IN CALLS TO
                   COFOUT. (SQUARE ARRAY MUST BE USED).
C              EM-EMPLOYMENTS COEFFS. USED IN DERIVING MULTS.
C              M2-DIMENSION OF EM
C              HH-POSITION OF HH ROW IN CURRENT COEFFS. TABLE.
C              NUM-ARRAY CONTAINING SECTOR NUMBERS FOR COFOUT
C              M3-DIMENSION OF NUM
C
       REAL TAB (M1,M1),EM(M2),WORK(50,50),WORK1(50),WORK2(50),WORK3(50)
       REAL T1OM(50),T1IM(50),T1EM(50),T2OM(50),T2IM(50),T2EM(50)
       REAL DIIC(50),DIEC(50),DIIEC(50),Z(50,50)
       INTEGER WSIZE,NUM(M3),HH,STARS(6),CNT(50)
       COMMON LPT
       DATA WSIZE/50/
       DATA STARS/'      ','*     ','**    ','***   ','****  ','*****'/

C
C      CALCULATE COUNT OF MULTIPLE SECTORS
C

       K=1
       DO 20 I=1,HH
        IF(I.EQ.0)GO TO 10
        IF(NUM(I).NE.NUM(I-1))K=1
        IF(NUM(I).EQ.NUM(I-1))K=K+1
 10     CNT(I)=K
 20    CONTINUE
```

```
C
C      OUTPUT ENDOG. COEFFS. MATRIX
C

       L=HH-1
       WRITE(LPT,40)L
   40  FORMAT(//' *****NO. OF SECTORS = ',I3/
       1  ' ENDOG. COEFFS. MATRIX FOLLOWS')
       CALL COFOUT(TAB,M1,WORK,WSIZE,NUM,CNT,M3,L)

C
C      DERIVE EXOGENOUS LEONTIEF MATRIX
C

       DO 60 I=1,L
        DO 50 J=1,L
         Z(I,J)=-TAB(I,J)
   50   CONTINUE
   60  CONTINUE
       DO 70 I=1,L
        Z(I,I)=1+Z(I,I)
   70  CONTINUE

C

       CALL INVERT(Z,WSIZE,WSIZE,L,WORK1,WORK2,WORK3,.00001,D)
       WRITE(LPT,80)D
   80  FORMAT(//' *****EXOG. INVERTED MATRIX FOLLOWS'/' DET=',F16.8)
       CALL COFOUT(Z,WSIZE,WORK,WSIZE,NUM,CNT,M3,L)

C
C      DERIVE TYPE 1 MULTIPLIERS
C
       DO 120 J=1,L
        SUM=0.0
        SUM1=0.0
        SUM2=0.0
        IF(EM(J).NE.0.0)GO TO 90
        T1IM(J)=0.0
        T1EM(J)=0.0
        GO TO 110
   90   DO 100 I=1,L
         C=Z(I,J)
         SUM=SUM+C
         SUM1=SUM1+C*TAB(HH,I)
         SUM2=SUM2+C*EM(I)
  100   CONTINUE
        T1IM(J)=SUM1/TAB(HH,J)
        T1EM(J)=SUM2/EM(J)
  110   T1OM(J)=SUM
        DIIC(J)=SUM1
        DIEC(J)=SUM2
  120  CONTINUE

C
C      DERIVE ENDOGENOUS LEONTIEF MATRIX
C

       DO 140 I=1,HH
```

```
        DO 130 J=1,HH
         Z(I,J)=-TAB(I,J)
  130   CONTINUE
  140  CONTINUE
       DO 150 I=1,HH
        Z(I,I)=1+Z(I,I)
  150  CONTINUE
C
       CALL INVERT (Z,WSIZE,WSIZE,HH,WORK1,WORK2,WORK3,.00001,D)
       WRITE(LPT,160)D
  160  FORMAT(//' *****ENDOG. INVERTED MATRIX FOLLOWS'/' DET=',F16.8)
       CALL COFOUT(Z,WSIZE,WORK,WSIZE,NUM,CNT,M3,HH)
C
C      DERIVE TYPE 2 MULTIPLIERS
C
       DO 200 J=1,L
        SUM=0.0
        SUM1=0.0
        IF(EM(J).NE.O.O)GO TO 170
        T2IM(J)=0.0
        T2EM(J)=0.0
        GO TO 190
  170   DO 180 I=1,L
         SUM=SUM+Z(I,J)
         SUM1=SUM1+Z(I,J)*EM(I)
  180   CONTINUE
        T2IM(J)=Z(HH,J)/TAB(HH,J)
        T2EM(J)=SUM1/EM(J)
  190   T2OM(J)=SUM
        DIIEC(J)=SUM1
  200  CONTINUE
C
       WRITE(LPT,210)
  210  FORMAT(1H1,' *****MULTIPLIERS,ETC.'//'       #',7X,'DIC',
       1 6X,'EC',6X,'DIIC',6X,'DIEC',6X,'T1OM',6X,'T1IM',6X,
       2 'T1EM',5X,'DIIIC',5X,'DIIEC',6X,'T2OM',6X,'T2IM',6X,'T2EM')
C
C      ABBREVIATIONS-
C      T1,T2 - TYPE 1 , TYPE 2
C      OM,IM,EM - OUTPUT,INCOME,EMPLOY. MULTIPLIERS
C      IC,EC - INCOME,EMPLOY. CHANGE
C      (((D)I)I) - (((DIEMCT),INDIEMCT)& INDUCED)
C
       WRITE(LPT,220)(NUM(J),STARS(CNT(J)),TAB(HH,J),EM(J),DIIC(J),
       1DIEC(J),T1OM(J),T1IM(J),T1EM(J),Z(LIM,J),DIIEC(J),T2OM(J),
       2T2IM(J),T2EM(J),J=1,L)
  220  FORMAT(//(1X,I2,A5,12(1X,F9.5)))
       RETURN
       END
```

```
      SUBROUTINE COFOUT(A,MA,Z,MZ,N,C,MN,M1)
C
C     THIS ROUTINE IS FOR PRINTING OUT COEFFICIENT-TYPE TABLES.
C     THE DATA WILL BE ROUNDED TO 3 DECIMAL PLACES. VARIABLE
C     SECTOR NUMBERING IS ALSO ALLOWED FOR.
C
C     ARGUMENTS-
C     A(MA,MA) - THE REAL ARRAY CONTAINING THE DATA
C     Z(MZ,MZ) - A WORK ARRAY SUPPLIED BY CALLER
C     N(MN) - ARRAY CONTAINING SECTOR NUMBERS
C     C(MN) - ARRAY CONTAINING THE INCREMENTAL SECTOR COUNT
C     M1 - THE DIMENSION OF THE SUB-MATRIX OF A TO BE PRINTED
C
      REAL A(MA,MA),Z(MZ,MZ)
      INTEGER STARS(6),C(MN),N(MN)
      COMMON LPT
      DATA STARS/'     ','*    ','**   ','***  ','**** ','*****'/
C
      DO 20 I=1,M1
       DO 10 J=1,M1
        IF(A(I,J).GT.0.0004)GO TO 5
        Z(I,J)=0.0
        GO TO 10
 5      Z(I,J)=(FLOAT(IFIX(A(I,J)*1000.+0.5)))/1000.
 10    CONTINUE
 20   CONTINUE
C
      L2=0
 30   L1=L2+1
      L2=L2+16
      IF(L2.GT.M1)L2=M1
C
      WRITE(LPT,45)(N(J),STARS(C(J)),J=L1,L2)
 45   FORMAT(1H1,(10X,16(I2,A5)))
C
      DO 60 I=1,M1
       WRITE(LPT,55)N(I),STARS(C(I)),(Z(I,J),J=L1,L2)
55     FORMAT(/1X,I2,A5,': ',16F7.3)
 60   CONTINUE
C
      IF(L2.LT.M1)GO TO 30
      RETURN
      END
```

```
      SUBROUTINE INVERT(A,MA,NA,N,B,C,Z,EPS,D)
C
C     ADAPTED FROM C.A.C.M. ALGORITHM 120
C      BY M. BENJAMIN FEB,'77
C
C     ARGUMENTS-
C     A(MA,NA) - CONTAINS THE MATRIX TO BE INVERTED
C     N - THE ORDER OF THE MATRIX
```

```
C       B,C,Z - WORK VECTORS SUPPLIED BY CALLER
C       EPS - TOLERANCE VALUE
C       D - = DETERMINANT ON NORMAL RETURN
C        = 0 OR SMALL NO. ON ERROR RETURN
C
        REAL A(MA,NA),B(N),C(N)
        INTEGER Z(N),P
C
        N1=N-1
C
        D=1.0
        DO 10 J=1,N
 10     Z(J)=J
C
        DO 60 I=1,N
        K=I
        V=A(I,I)
        L=I-1
        P=I+1
C
        IF(P.GT.N)GO TO 25
        DO 20 J=P,N
        W=A(I,J)
        IF(ABS(W).LE.ABS(Y))GO TO 20
        K=J
        Y=W
 20     CONTINUE
C
 25     D=D*Y
        IF(ABS(Y).LT.EPS)GO TO 90
        Y=1.0/Y
C
        DO 30 J=1,N
        C(J)=A(J,K)
        A(J,K)=A(J,I)
        A(J,I)=-C(J)*Y
        A(I,J)=A(I,J)*Y
 30     B(J)=A(I,J)
C
        A(I,I)=Y
        J=Z(I)
        Z(I)=Z(K)
        Z(K)=J
C
        IF(L.LT.1)GO TO 57
        K1=1
        K2=L
 40     DO 55 K=K1,K2
        CC=C(K)
        IF(L.LT.1)GO TO 52
        J1=1
        J2=L
 45     DO 50 J=J1,J2
 50     A(K,J)=A(K,J)-B(J)*CC
        IF(J2.GE.N1)GO TO 55
 52     J1=P
        J2=N
        GO TO 45
 55     CONTINUE
        IF(K2.GE.N1)GO TO 60
 57     K1=P
        K2=N
        GO TO 40
C
 60     CONTINUE
C
        DO 80 I=1,N
 65     K=Z(I)
        IF(K.EQ.I)GO TO 80
        DO 70 J=1,N
        W=A(I,J)
        A(I,J)=A(K,J)
 70     A(K,J)=W
C
        P=Z(I)
        Z(I)=Z(K)
        Z(K)=P
        D=-D
        GO TO 65
 80     CONTINUE
        RETURN
C
 90     D=0.0
        RETURN
        END
```

APPENDIX VI

DISAGGREGATED TRANSACTIONS TABLES (19 AND 36 SECTOR) FOR GLADSTONE/CALLIOPE, FITZROY, QUEENSLAND, AUSTRALIA

TABLE VI-1 19-SECTOR TRANSACTIONS TABLE: GLADSTONE/CALLIOPE SUB-REGION 1974-75 ($'000)

	1	2A	2B	3A	3B	4A	4B	4C	4D	4E	4F	5	6	7	8	9	10	11A	11B	House-holds	Other Final Demand	Exports	Total
1	0	0	0	0	0	922	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	1380	2322
2A	85	45	0	0	0	33	0	0	0	0	0	0	0	0	0	0	0	0	2	432	0	481	1078
2B	0	0	0	0	1	1	133	0	1	2	0	2	2	0	83	0	0	0	0	30	0	340	595
3A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3B	0	0	1	0	3	0	0	0	605	160	0	0	552	1	3	0	0	0	1	0	0	377	1703
4A	23	0	1	0	0	85	0	0	306	0	0	0	0	5	0	0	0	9	0	1243	0	1846	3518
4B	0	7	3	0	0	3	86	3	84	1	0	0	1288	27	38	0	35	27	0	458	0	0	2060
4C	3	1	4	0	34	1	2	2	155	1	0	1	313	9	14	1	9	1	6	163	247	0	967
4D	0	0	1	0	6	2	15	64	1647	2	0	7	2118	13	7	0	21	5	6	0	0	125673	129587
4E	0	0	0	0	0	0	1	0	33	2	0	0	1292	0	3	0	0	0	0	0	0	0	1331
4F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	5	3	0	0	5	8	4	3	2333	2	0	9	40	25	26	71	13	22	53	284	0	0	2906
6	35	14	4	0	24	27	22	5	154	17	0	111	0	191	1861	432	479	169	13	0	44251	0	47629
7	93	39	57	0	150	114	74	27	799	50	0	29	2214	1012	476	405	24	83	117	9678	0	660	16101
8	41	31	10	0	63	116	62	26	762	184	0	118	1339	327	135	70	14	20	22	7018	1107	3325	14790
9	1	1	0	0	86	29	37	21	477	14	0	9	81	1173	231	316	58	6	189	4140	1683	905	9457
10	0	0	0	0	0	0	0	0	496	0	0	0	0	0	0	0	0	0	0	161	3450	0	4107
11A	2	0	0	0	0	0	0	0	383	0	0	0	0	0	0	2	18	0	0	404	2875	0	3684
11B	0	0	0	0	0	0	0	0	75	1	0	1	4	33	2	3	0	0	8	3257	0	738	4122
Households	122	104	146	0	227	709	657	327	18826	205	0	738	14584	6250	5779	3431	2642	2333	1565	0	0	0	58665
Other Value Added	1402	573	226	0	348	364	343	126	40058	187	0	1547	5941	4815	3055	3716	67	504	1235	0	0	0	64507
Imports	510	260	142	0	756	1104	624	363	62393	503	0	335	17861	2220	3237	1010	727	505	905	30773	0	0	124228
Total	2322	1078	595	0	1703	3518	2060	967	129587	1331	0	2907	47629	16101	14790	9457	4107	3684	4122	58061	53613	135725	0

TABLE VI-2 19-SECTOR TRANSACTIONS TABLE: FITZROY REGION 1973-74 ($'000)

	1	2A	2B	3A	3B	4A	4B	4C	4D	4E	4F	5	6	7	8	9	10	11A	11B	Households	Other Final Demand	Exports	Total
1	0	0	0	0	0	24214	0	0	0	1	38	0	0	0	0	0	0	0	0	451	0	31097	55801
2A	4436	3005	0	0	0	3313	1	0	0	0	63	0	0	0	0	0	0	0	7	9234	0	10259	30318
2B	0	0	0	1632	41	25	111	0	1	1	1	3	1	0	25	0	0	1	0	18	4	10	1874
3A	0	0	0	0	6	150	0	17	4225	234	17	2000	49	90	95	0	2	29	30	0	0	147559	154503
3B	0	2	3	972	545	3	0	15	377	1096	32	0	1093	2	5	1	0	3	3	0	0	26763	30915
4A	1824	129	19	5	1	2699	6	1	171	2	137	1	1	74	4	1	7	236	94	23468	0	34853	63733
4B	3	404	11	918	67	90	472	286	175	54	26	1	5342	365	90	1	198	235	7	720	1090	0	10555
4C	171	75	22	1486	651	29	22	565	328	28	15	96	741	47	1750	6	83	12	20	9659	14629	0	30435
4D	3	6	2	673	132	144	51	1058	1845	20	103	20	2360	33	13	0	36	25	9	0	0	100000	106533
4E	0	0	0	1553	483	0	3	3	27	527	0	0	2923	0	7	0	0	1	0	1736	2633	0	9896
4F	68	51	4	35	210	43	23	59	407	18	83	3	45	45	14	13	21	111	33	1184	1791	0	4261
5	460	297	6	5071	668	423	76	332	2286	233	90	192	309	370	137	659	152	682	548	2940	4900	1200	22031
6	852	400	11	3310	239	324	112	163	356	191	70	732	0	793	2625	881	1488	1071	38	1526	81636	0	96818
7	2834	1474	222	6427	2970	2511	595	1550	1621	419	225	288	6998	4312	972	1309	107	1007	415	23618	1609	0	61483
8	814	673	27	4064	944	2123	262	626	1292	890	80	771	2363	1350	211	197	75	148	54	3235	511	1533	22243
9	15	20	0	483	754	219	113	226	489	55	49	43	153	4073	108	1199	290	41	295	11189	4546	2447	26807
10	0	0	0	6	0	0	0	0	274	0	0	1	0	0	0	0	0	0	0	574	12235	0	13090
11A	129	1	0	111	10	0	0	0	211	0	0	0	0	0	10	24	163	8	0	3376	24005	0	28048
11B	4	0	0	0	12	0	0	1	42	3	0	10	10	148	13	11	1	4	30	8955	0	2030	11274
Households	3094	2856	452	16421	4852	10470	3274	8300	21205	1571	775	5571	29436	23674	8637	10315	8243	17534	4249	0	0	0	180929
Other Value Added	33546	16577	718	75247	7421	4740	1747	3700	27752	2418	859	11036	12072	18915	4572	10231	201	4018	3418	0	0	0	239188
Imports	7548	4348	377	36089	10909	12213	3687	13533	43449	2135	1598	1263	32922	7192	2955	1959	2023	2882	2024	116117	0	0	305223
Total	55801	30318	1874	154503	30915	63733	10555	30435	106533	9896	4261	22031	96818	61483	22243	26807	13090	28048	11274	218000	149589	357751	0

TABLE VI-3 36-SECTOR TRANSACTIONS TABLE: QUEENSLAND, 1973-74 ($'000)

	1	2A	2B	3A	3B	4A1	4A2	4A3	4A4	4A5	4B1	4B2	4B3	4B4	4C1	4C2	4D1	4D2	4D3	4E
1	0	0	0	0	0	309819	0	0	0	0	0	0	0	0	0	0	0	0	0	12
2A	41501	61381	0	0	0	18355	15229	8818	245856	2802	0	82	0	0	0	0	0	0	0	0
2B	0	1	0	9356	1966	771	110	1	0	2	16287	88	777	0	24	1	13	0	7	55
3A	0	0	0	0	80	1697	72	18	5	29	120	0	431	2	9	97	2530	10196	7	2575
3B	1	48	63	7636	7089	0	0	0	196	1	0	1	58	3	83	73	634	57879	36	11566
4A1	4448	154	126	3	1	55	5451	4223	282	43	2	340	1	0	4	4	0	0	1	14
4A2	51	28	4	1	10	311	248	2043	65	1676	18	2	6	1	14	10	575	0	11	12
4A3	5760	724	158	2	7	336	391	19387	207	39	5	4	540	1	1	2	11	423	1	40
4A4	16217	8041	158	7	5	1457	4601	4116	833	6945	7	7	7	2	83	3	5	0	4	6
4A5	294	2	0	0	1	201	30	12	0	50	1	0	0	0	0	0	19	0	0	3
4B1	1	4360	130	1589	357	20	0	0	13	253	6461	22100	417	1	371	3671	205	12	418	246
4B2	22	300	103	32	4	74	9	3	14	71	3036	1376	7	10	414	1423	32	12	319	33
4B3	207	13937	3	9	2154	530	801	1284	122	899	187	477	7019	6623	785	267	5	12	473	2319
4B4	1	339	0	2	78	113	180	132	16	670	3	10	875	2036	230	3	0	12	151	31
4C1	4227	3952	664	3409	19478	370	122	98	14	82	691	146	291	244	4888	10723	529	132	2173	1073
4C2	158	300	658	1824	1707	500	212	105	17	159	1313	212	615	265	1213	1204	255	132	815	1345
4D1	43	148	8	842	4463	1	49	3	39	4	97	772	17	48	5292	9317	0	0	13214	1709
4D2	3	3	2	63	1847	19	23	1	35	0	53	1096	147	303	10341	5862	2187	0	11175	253
4D3	111	364	125	3578	1678	6768	5827	310	151	3397	900	2384	355	207	6776	18262	799	1387	6614	1178
4E	4	4	2	6203	14563	719	564	3	80	1561	83	908	9	4	443	524	949	72	495	14251
4F1	28967	34902	1849	1459	12549	861	419	536	17	406	2039	1300	1103	579	1883	4001	1033	622	1634	2390
4F2	253	655	118	4	25	45	214	53	6	30	167	972	150	16	121	221	102	0	424	343
4F3	7	15	14	0	162	1	1	1	0	1	1	68	81	4	37	209	48	0	21	10
4F4	11	145	291	93	6352	567	852	502	122	335	44	977	193	276	1229	2729	18	0	481	96
4F5	5	17	24	4	61	21	18	23	4	4	21	54	88	67	60	55	13	0	52	26
5A1	4080	6665	157	13250	10158	3956	941	1260	572	814	2926	798	1198	822	2552	3655	2622	6802	2896	4543
5A2	13	38	0	4	8	47	11	324	501	7	10	15	9	32	242	242	136	0	410	401
5A3	2059	2881	0	424	1920	239	105	88	516	257	57	19	79	16	66	65	84	0	139	326
6	7461	7885	217	5082	2458	2002	1210	790	137	967	2469	699	1261	965	1177	1259	258	0	1919	3648
7	21512	26388	3311	9291	38686	20383	5010	6775	4054	5207	2246	5429	2311	11270	11347	15860	1802	425	9058	8900
8A1	10485	19871	799	9466	19802	27154	6234	5549	11874	2827	7061	4070	2013	1814	8719	6871	7163	118	7470	18041
8A2	0	0	0	0	0	0	0	0	1999	0	0	0	0	0	0	0	0	118	0	0
9	221	660	0	1158	18765	2284	819	968	3685	515	3035	1702	803	1987	2966	2277	389	297	2994	2017
10	0	0	0	11	0	1	0	0	157	0	0	0	0	0	0	0	1	685	0	1
11A	1422	23	2	168	154	0	0	0	392	0	0	0	0	0	0	0	0	529	0	0
11B	25	3	1	0	154	0	0	0	1176	0	0	0	0	9	10	5	1	104	0	38
Households	28669	68866	8648	25216	60175	71166	13638	24870	36403	9758	29956	28759	11979	38426	54824	79250	12915	16998	60012	43456
Other Value Added	303288	331894	13387	113709	92037	28764	8331	13233	67834	11791	19783	12685	9945	16977	22098	44918	17841	51203	33855	40754
Imports	24005	27251	4245	23363	100661	16664	8487	7143	19147	6599	14427	13865	19858	19127	43491	67423	10395	265	66558	16004
Total	505532	622245	35267	237257	419615	516270	80209	102673	396541	58201	113505	101417	62643	102137	181794	280487	63571	148435	223837	177716

	4F1	4F2	4F3	4F4	4F5	5A1	5A2	5A3	6	7	8A1	8A2	9	10	11A	11B	Households	Other Final Demand	Exports	Total
1	0	1487	0	777	0	0	0	0	3	0	1	0	0	0	0	0	10111	0	183322	505532
2A	23	309	6	0	30	0	0	0	0	0	0	0	0	9	0	148	136894	0	90802	622245
2B	25	1	110	166	0	120	0	0	23	1	1521	67	0	0	26	1	3746	0	0	35267
3A	2323	43	3	28	68	12482	1172	109	491	1604	2023	0	0	61	427	538	0	0	198018	237257
3B	819	0	0	14	126	0	0	4	11394	41	173	0	21	1	33	65	0	0	321557	419615
4A1	2602	100	62	6164	2	1	0	4	2	1279	18	1	18	282	3301	20	278785	0	208478	516270
4A2	1216	2	2	96	1	0	0	8	217	172	18	2	10	20	1039	2	43313	0	29005	80209
4A3	1118	52	0	26	0	0	0	1	0	12	6	0	2	16	211	0	55445	0	17745	102673
4A4	488	1	1	8	2	2	0	9	46	132	33	2	22	85	72	28	214131	0	138975	396535
4A5	153	0	0	0	0	0	0	1	1	19	51	0	1	0	5	1944	31428	0	23976	58201
4B1	200	6	1	317	70	0	0	1	49492	1111	1488	1	2	52	12	0	11546	8582	0	113505
4B2	289	16	27	137	27	2	0	10	30093	3733	153	20	10	2911	1234	61	12170	8884	34346	101417
4B3	2671	265	730	421	259	2	0	23	193	13013	3026	245	58	613	232	647	2132	0	0	62643
4B4	1175	92	33	108	7	1	0	2	1	1239	49	4	87	9765	4102	9	65000	0	15581	102137
4C1	1607	54	49	219	116	40	134	193	30080	2907	509	6961	495	5474	870	2519	30905	0	45355	181794
4C2	3467	115	85	217	47	5561	8	51	1210	1757	40692	41	59	11430	58	36	47683	24571	130390	280487
4D1	520	3	7	36	114	33	0	5	4941	64	21	10	3	123	7	3	0	5569	16046	63571
4D2	3855	132	20	440	997	0	0	27	9421	11	3	14	2	76	10	19	0	0	100000	148437
4D3	5870	109	130	1290	466	1	124	1777	81159	2539	326	2874	49	4514	1492	680	4477	19608	35181	223837
4E	1008	40	45	129	8	45	0	10	101351	28	20	1057	7	72	189	259	0	15568	16437	177716
4F1	12981	427	191	3562	364	662	62	368	18082	4802	13448	134	2290	4314	2834	2588	14675	5843	0	186176
4F2	90	3184	3871	796	106	0	0	2	48	503	1041	6	2	323	893	1025	7239	0	9857	32905
4F3	5	32	334	149	4	0	0	2	56	447	73	3	1	1493	40	36	12361	0	40466	56183
4F4	2556	83	3134	397	434	3	14	28	2124	2078	2760	448	10	1162	582	563	14390	0	19331	65410
4F5	93	2	48	201	30	5	0	9	143	1279	5	12	1	95	458	37	3940	1569	9361	17908
5A1	4393	578	496	1218	187	0	940	5222	3570	9052	3410	1709	25226	5904	9968	11869	64000	1011	0	219420
5A2	207	10	18	23	27	208	0	6	327	564	200	1	42	213	758	129	5000	3764	0	13947
5A3	339	60	36	48	9	31	4	0	896	18	390	83	7530	118	4656	2839	18448	18769	0	63614
6	2925	422	462	792	170	4375	488	8780	0	15024	44502	1864	28008	44375	14889	794	24136	857951	0	1091821
7	13984	753	1462	4879	1288	2449	767	1458	99505	41522	26371	8222	43209	3606	18304	9800	629572	0	0	1116417
8A1	6165	745	1057	1234	436	11757	1647	304	40517	38181	7517	6715	5286	5023	3481	1462	133713	41403	50811	534853
8A2	0	0	0	0	0	0	0	0	0	0	0	0	4256	702	0	98	46801	133225	0	187202
9	2453	415	1432	1148	440	676	153	0	2750	105563	5298	447	59842	11708	775	8520	324634	0	280210	854301
10	0	0	0	0	0	8	1	0	0	2	14	0	0	0	0	0	8381	409783	0	419042
11A	0	0	0	0	0	0	0	0	0	0	704	0	913	4330	119	0	119622	270362	0	398741
11B	1	0	0	0	0	124	0	0	103	2360	810	0	348	74	59	675	170778	0	39315	216175
Households	24359	7826	19785	15905	5113	54269	4530	17183	325614	427912	187563	69148	323647	249265	247053	79829	0	0	0	2782985
Other Value Added	38804	4653	3992	9395	2970	125029	3381	26131	136021	348767	138248	55724	324300	5371	58698	66291	0	0	0	2602102
Imports	47393	10888	18554	15070	3990	1534	522	1886	141949	88680	52370	31382	28543	45456	21853	22639	908881	0	0	1950501
Total	186176	32905	56183	65410	17908	219420	13947	63614	1091823	116416	534854	187200	854300	419045	398740	216173	3454336	1826462	2054565	

TABLE VI-4 36-SECTOR TRANSACTIONS TABLE: AUSTRALIA 1968-69 ($'000)

	1	2A	2B	3A	3B	4A1	4A2	4A3	4A4	4A5	4B1	4B2	4B3	4B4	4C1	4C2	4D1	4D2	4D3	4E	4F1	4F2	4F3	4F4	4F5	5A1	5A2	5A3	6	7	8A1	8A2	9	10	11A	11B	Households	Other Final Demand	Exports	Total
1	0	0	1	0	0	1109220	0	0	10	0	0	0	0	0	0	0	1	0	0	57	0	74617	0	2026	0	0	0	0	14	1	3	0	0	0	0	0	43769	21993	622232	1873946
2A	193476	92850	0	0	0	53173	54356	102580	190679	60977	0	364	0	0	0	0	0	0	0	0	193	22285	67	0	197	0	0	0	0	0	0	0	0	28	0	3424	307029	318914	267083	1667675
2B	0	1	0	10867	4574	3166	711	9	5411	28	66821	530	11933	3	375	6	245	11	49	348	290	21	1774	560	0	586	0	0	157	4	7506	389	1	0	195	703	28499	14349	34052	194174
3A	0	0	0	0	136	7053	310	132	738	314	218	0	4490	16	87	228	32236	4031	35	9049	42440	1069	33	150	384	43012	8820	505	2358	7215	9833	0	0	336	2348	3884	7276	16307	71400	276442
3B	1	57	338	6279	11948	2	0	1	900	5	1	3	605	22	877	137	72988	231272	192	53013	6282	1	1	187	710	0	137	17	53212	134	809	1	147	3	181	665	867	32253	249934	724179
4A1	11903	1016	654	2	3	291	17289	15730	21720	174	2	1322	5	2	47	14	2	1	4	47	6711	4516	496	11613	9	4	1	15	8	5729	61	3	171	1064	14064	26665	1181103	23438	448324	1794219
4A2	129	56	20	1	16	1467	788	8499	2889	6098	19	8	22	5	115	41	4664	2	52	27	3059	37	20	679	5	1	0	25	946	878	61	6	61	54	4434	2196	222018	3461	40730	303588
4A3	13045	6490	813	1	6	1260	1294	68594	10929	317	5	13	1878	4	5	5	90	282	4	136	3441	757	5	82	2	2	0	4	0	98	20	1	40	31	896	7430	384471	4550	41440	548442
4A4	25901	73013	812	6	9	9192	15343	20231	10053	30338	7	25	26	11	464	9	39	8	19	16	1963	16	17	28	14	9	2	38	166	938	119	7	298	172	301	3904	228157	7519	145930	575114
4A5	458	5	0	1	2	1302	200	137	429	306	5	1	3	1	2	1	171	1	1	11	700	1	8	4	0	2	0	5	4	155	212	1	51	33	25	29836	463739	18508	16090	532412
4B1	4	4244	666	1217	433	121	1	1	79	2092	7157	74482	1580	6	3676	7423	1665	647	1933	402	502	39	12	1336	545	2	0	5	183528	7037	4986	3	48	81	39	236	11698	2999	4958	325883
4B2	95	401	610	29	8	507	32	17	38	506	3191	6103	30	53	8038	3798	277	40	1680	125	1424	126	380	350	147	7	2	41	133581	15946	598	70	223	4435	4525	3084	179870	65940	8429	444755
4B3	2705	23907	21	10	904	4680	4613	13984	5835	7931	332	2580	83612	80048	9777	1385	164	925	2810	9482	13788	4154	10303	4465	2867	9	1	94	858	79380	12417	890	1026	1390	1811	29771	25644	7403	4895	456870
4B4	4	578	3	2	53	1008	905	1044	211	13783	5	57	4685	9443	3423	24	1	135	1038	164	8384	1060	1350	1191	55	3	1	10	6	9137	246	18	466	19740	15776	446035	114028	7359	5257	666683
4C1	21198	14393	5426	6272	24543	3030	943	1622	2181	1400	1394	1228	2282	3004	104396	47672	9882	5378	21436	5940	5500	2157	1371	2789	1391	287	1699	1390	280299	61001	4320	105610	4235	57339	9299	46041	259297	749112	71172	1947930
4C2	2174	4752	3466	2430	4955	2115	825	789	1445	1344	1379	1113	2413	1268	14968	5015	2784	1636	5501	3906	5758	1884	1291	1400	307	18543	55	252	8698	133177	211626	286	1022	92294	316	3113	319742	617194	60650	1541885
4D1	979	986	148	2934	10040	33	754	73	197	130	458	13260	267	1058	167916	100227	0	11141	294009	12791	6603	233	292	1288	3410	493	10	84	93850	2689	357	142	193	2167	126	64	880	27032	146388	903703
4D2	14	7	9	81	3213	193	126	7	1015	2	100	5965	833	2447	155874	31898	29622	0	88051	1114	13558	1588	324	4036	7151	1	0	161	65110	119	18	72	97	435	60	159	3934	11327	255752	684475
4D3	1181	2069	750	3564	2044	29620	29747	1864	14147	30229	1046	12829	1559	1168	77981	59964	8868	4585	41557	4371	15235	1918	2022	6601	3026	5	881	8576	438879	17124	1671	13670	2992	14109	7898	16375	54698	256424	44387	1235631
4E	16	13	13	5000	12111	9428	4150	20	1206	24560	189	5685	66	41	6533	4744	11604	6055	4538	46233	10067	616	786	1698	102	204	1	61	507385	368	95	3360	201	206	1229	3931	12036	2702	6513	693766
4F1	126612	115781	11018	3842	25187	5892	2538	4225	4658	4454	4732	8803	13353	10467	38706	21860	19499	14762	17443	16201	87826	32973	6651	83177	5541	3614	601	2153	114934	51999	86639	710	17829	44124	54062	47198	319745	30107	107093	1567007
4F2	1799	2224	1478	7	26	522	1989	839	976	1201	459	16290	1541	187	2950	5987	2172	1019	5362	2579	1356	114564	185790	34321	2129	4	1	19	733	5443	10605	54	179	3105	9422	25407	152389	20627	104897	720649
4F3	46	45	105	0	196	5	4	9	257	27	2	517	427	27	673	668	637	8	178	81	21	5936	61170	475	53	1	1	10	446	3279	425	16	25	12684	357	38743	716200	12243	8471	864467
4F4	68	598	3723	214	11528	11238	9378	6582	11436	4515	143	11239	2578	4422	33647	33693	349	724	7278	1046	26853	3067	47825	3729	7407	38	280	327	29486	38440	31273	4752	136	12576	6766	29175	155326	16215	25510	593580
4F5	18	34	192	5	143	177	90	182	148	45	38	338	565	476	980	301	173	7	384	108	349	41	1016	1186	373	26	2	49	955	9035	29	78	31	488	2619	33704	49695	12041	8560	124680
5A1	9778	13924	763	11176	17327	12827	2395	5462	3838	4286	5490	2635	8741	3768	15715	14915	32865	21880	10922	14976	25497	8558	4739	9115	851	0	3024	19742	14802	23381	11769	6455	19753	22447	26197	63159	282841	16	54	756083
5A2	66	96	1	4	22	234	37	1271	243	53	24	72	67	210	2180	1639	2438	1015	2287	2324	1770	244	225	253	173	667	0	34	1918	1733	1020	7	347	1244	2850	1005	73364	3629	233	104996
5A3	8008	9157	0	517	3816	966	406	340	747	2037	115	90	1006	100	606	451	1521	200	736	1918	3206	1421	325	228	52	101	20	0	5362	70	1926	450	170729	1789	21312	20705	10592	25143	0	296168
6	23436	18880	1007	3836	5350	6101	2688	3124	4441	4315	4344	2066	7373	3787	6918	4961	2911	2566	6647	10855	13114	5767	4202	4183	677	8796	1404	29709	0	29546	119270	6301	278303	172445	44266	4325	0	3997780	1	4845692
7	100211	88555	22366	9215	36106	52738	11803	28649	21580	20984	5336	16983	16779	43533	75543	41802	21179	20034	32492	30865	51002	19902	13390	31414	6155	5889	2438	4935	385348	191044	129132	33051	48228	24171	46235	133008	3533705	503924	196996	6056729
8A1	30146	35914	3625	7163	17718	74464	13533	36096	25058	17962	13190	12097	9152	6932	42655	23246	80446	41165	25243	61459	40728	14238	8331	7008	1834	23639	4743	1032	148826	89373	24642	23460	5583	31629	8435	161725	682276	149096	607111	2610972
8A2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3904	6723	0	423260	145895	184368	9874	774024
9	922	949	2	1186	8041	8605	2476	4093	4042	3369	6422	6828	5081	10630	20829	11946	5802	3288	13719	6977	11928	5683	13712	9398	2588	1845	599	0	12269	239213	25066	2047	97148	45648	3123	1598293	2524648	232167	40109	4990694
10	0	0	0	9	0	3	0	0	0	0	0	0	2	0	0	0	16	2	0	4	1	0	0	0	0	15	4	0	1	3	70	0	0	0	1	22930	37414	1945000	44736	2050210
11A	4664	198	10	129	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3770	0	1589	12654	308	76747	849151	1239410	0	2188679
11B	25869	26596	6028	2965	24903	48746	22922	34006	26199	47872	16897	18942	25101	49172	126014	39325	19990	20599	54084	27775	98251	23184	41715	31000	7164	29661	19735	20843	120418	769738	156832	16032	524369	31400	169501	343229	1264432	90216	450	4422175
Households	161033	194950	47000	102100	217700	217341	53888	118463	91694	84209	100195	128713	102563	248926	620987	490415	258245	95339	360426	182272	234290	165938	268836	162812	37747	187000	34100	80000	1462987	2279173	877235	285906	1041000	1099426	1356330	580260	0	0	0	14029499
Other Value Added	1082885	924352	70575	93832	263417	129234	29927	62556	69163	114396	55741	54382	71735	109830	225706	280031	222470	176293	179026	144609	297382	95313	69352	85513	20163	428272	24307	120519	582075	1885387	681938	229899	2755381	16363	318725	-63127	1065440	-62004	22182	13044672
Imports	25101	10585	12532	1549	17653	-11733	17128	7210	40521	42158	30426	39194	74518	75618	179266	308053	57688	19415	56497	42483	527538	106726	116639	89287	11451	3348	2128	5519	196074	98741	194372	40277	14891	317378	54646	254916	1828735	756707	195786	5861020
Total	1873946	1667675	194174	276442	724179	1794219	303588	548442	575114	532412	325883	444755	456870	666683	1947930	1541885	903703	684475	1235631	693766	1567007	720649	864467	593580	124680	756083	104996	296168	4845692	6056729	2610972	774024	4990694	2050210	2188679	4422175	16482690	11316898	3904399	82062566

APPENDIX VII

DISAGGREGATED MULTIPLIERS FOR THE FOUR ECONOMIES

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TABLE VII.1 THIRTY-SIX SECTOR OUTPUT MULTIPLIERS: AUSTRALIA & STATE OF QUEENSLAND

Sector	AUSTRALIA		STATE OF QUEENSLAND	
	Direct & Indirect	Total	Direct & Indirect	Total
1	1.540	2.065	1.466	1.718
2A	1.555	2.176	1.467	1.817
2B	1.567	2.577	1.377	1.947
3A	1.467	2.745	1.455	1.832
3B	1.531	2.662	1.574	2.079
4A1	2.292	3.147	2.128	2.615
4A2	2.227	3.369	1.978	2.591
4A3	2.220	3.439	1.960	2.707
4A4	2.121	3.104	2.008	2.424
4A5	2.007	3.006	1.826	2.408
4B1	1.721	2.979	1.633	2.349
4B2	1.887	3.228	1.704	2.482
4B3	1.810	2.898	1.489	2.009
4B4	1.638	3.001	1.378	2.177
4C1	1.864	3.245	1.505	2.215
4C2	1.533	2.711	1.468	2.134
4D1	1.663	2.862	1.524	2.076
4D2	1.915	2.928	1.821	2.280
4D3	1.914	3.272	1.428	2.041
4E	1.788	3.016	1.652	2.337
4F1	1.575	2.323	1.617	2.084
4F2	1.846	2.891	1.420	1.966
4F3	1.877	3.211	1.359	2.089
4F4	1.759	2.900	1.620	2.244
4F5	1.797	3.073	1.490	2.160
5A1	1.314	2.176	1.258	1.770
5A2	1.806	3.160	1.559	2.340
5A3	1.565	2.634	1.433	2.069
6	1.955	3.405	1.676	2.470
7	1.570	2.883	1.310	2.097
8A1	1.580	2.834	1.440	2.216
8A2	1.508	2.827	1.237	1.956
9	1.470	2.295	1.284	2.051
10	1.525	3.279	1.428	2.606
11A	1.406	3.244	1.264	2.395
11B	2.337	3.567	1.302	2.041

TABLE VII-2 19-SECTOR OUTPUT MULTIPLIERS: GLADSTONE/CALLIOPE AND FITZROY

Sector	Gladstone/Calliope		Fitzroy	
	Direct and Indirect	Total	Direct and Indirect	Total
1	1.151	1.219	1.279	1.371
2A	1.157	1.258	1.276	1.398
2B	1.166	1.384	1.224	1.467
3A	-	-	1.220	1.354
3B	1.262	1.424	1.317	1.515
4A	1.451	1.645	1.748	1.957
4B	1.254	1.539	1.218	1.512
4C	1.180	1.457	1.198	1.455
4D	1.075	1.194	1.165	1.349
4E	1.405	1.601	1.504	1.729
4F	-	-	1.319	1.521
5	1.120	1.330	1.237	1.475
6	1.236	1.502	1.295	1.596
7	1.209	1.539	1.236	1.597
8	1.223	1.554	1.343	1.721
9	1.166	1.465	1.200	1.547
10	1.199	1.702	1.253	1.799
11A	1.114	1.591	1.166	1.684
11B	1.119	1.419	1.178	1.508

TABLE VII.3 THIRTY-SIX SECTOR INCOME MULTIPLIERS: AUSTRALIA & STATE OF QUEENSLAND

Sector	AUSTRALIA			STATE OF QUEENSLAND		
	Direct	Direct & Indirect	Total	Direct	Direct & Indirect	Total
1	0.086	0.204	0.338	0.057	0.156	0.226
2A	0.117	0.242	0.401	0.111	0.214	0.311
2B	0.242	0.393	0.651	0.245	0.351	0.510
3A	0.369	0.497	0.824	0.106	0.232	0.337
3B	0.301	0.440	0.729	0.143	0.311	0.452
4A1	0.121	0.333	0.552	0.138	0.300	0.436
4A2	0.178	0.442	0.733	0.170	0.377	0.548
4A3	0.216	0.474	0.787	0.242	0.460	0.667
4A4	0.159	0.382	0.634	0.092	0.256	0.372
4A5	0.158	0.389	0.645	0.168	0.358	0.520
4B1	0.308	0.489	0.812	0.264	0.441	0.640
4B2	0.289	0.522	0.865	0.284	0.479	0.696
4B3	0.225	0.423	0.702	0.191	0.320	0.465
4B4	0.373	0.530	0.880	0.376	0.492	0.715
4C1	0.319	0.537	0.891	0.301	0.437	0.634
4C2	0.318	0.458	0.760	0.283	0.411	0.596
4D1	0.286	0.466	0.774	0.203	0.340	0.493
4D2	0.139	0.394	0.654	0.115	0.283	0.410
4D3	0.292	0.528	0.877	0.268	0.378	0.548
4E	0.263	0.477	0.792	0.245	0.422	0.613
4F1	0.150	0.291	0.483	0.131	0.288	0.417
4F2	0.230	0.406	0.674	0.238	0.337	0.488
4F3	0.311	0.519	0.861	0.352	0.450	0.653
4F4	0.274	0.444	0.736	0.243	0.385	0.558
4F5	0.303	0.496	0.824	0.286	0.413	0.600
5A1	0.247	0.335	0.556	0.247	0.315	0.458
5A2	0.325	0.526	0.873	0.325	0.481	0.698
5A3	0.270	0.416	0.689	0.270	0.392	0.569
6	0.301	0.564	0.936	0.298	0.489	0.710
7	0.376	0.511	0.847	0.383	0.485	0.704
8A1	0.336	0.488	0.810	0.351	0.478	0.694
8A2	0.369	0.513	0.851	0.369	0.443	0.643
9	0.209	0.320	0.532	0.379	0.473	0.686
10	0.536	0.682	1.131	0.595	0.725	1.053
11A	0.620	0.715	1.186	0.620	0.696	1.010
11B	0.131	0.478	0.794	0.369	0.458	0.664

TABLE VII-4 19-SECTOR INCOME MULTIPLIERS: GLADSTONE/CALLIOPE AND FITZROY

Sector	Gladstone/Calliope			Fitzroy		
	Direct	Direct & Indirect	Total	Direct	Direct & Indirect	Total
1	0.053	0.095	0.120	0.055	0.120	0.145
2A	0.097	0.142	0.179	0.094	0.160	0.194
2B	0.245	0.306	0.386	0.241	0.318	0.385
3A	-	-	-	0.106	0.174	0.211
3B	0.133	0.228	0.287	0.157	0.259	0.314
4A	0.201	0.272	0.343	0.164	0.272	0.330
4B	0.319	0.400	0.504	0.310	0.383	0.465
4C	0.339	0.389	0.491	0.273	0.335	0.406
4D	0.145	0.168	0.211	0.199	0.241	0.291
4E	0.154	0.275	0.346	0.159	0.293	0.355
4F	-	-	-	0.182	0.264	0.319
5	0.254	0.295	0.372	0.253	0.311	0.377
6	0.306	0.373	0.470	0.304	0.393	0.477
7	0.388	0.464	0.585	0.385	0.470	0.570
8	0.392	0.464	0.585	0.388	0.494	0.599
9	0.363	0.420	0.429	0.385	0.453	0.549
10	0.643	0.706	0.889	0.630	0.712	0.863
11A	0.633	0.670	0.844	0.625	0.675	0.818
11B	0.380	0.421	0.531	0.377	0.431	0.522

TABLE VII.5 THIRTY-SIX SECTOR EMPLOYMENT MULTIPLIERS: AUSTRALIA & STATE OF QUEENSLAND

Sector	AUSTRALIA			STATE OF QUEENSLAND		
	Direct (a)	Direct & Indirect	Total	Direct	Direct & Indirect	Total
1	0.041	0.109	0.162	0.054	0.083	0.102
2A	0.173	0.237	0.300	0.078	0.107	0.134
2B	0.105	0.168	0.270	0.122	0.148	0.192
3A	0.027	0.069	0.199	0.014	0.043	0.071
3B	0.095	0.145	0.260	0.024	0.060	0.099
4A1	0.040	0.141	0.228	0.029	0.097	0.134
4A2	0.049	0.164	0.280	0.030	0.092	0.139
4A3	0.076	0.204	0.328	0.054	0.114	0.171
4A4	0.047	0.178	0.278	0.023	0.097	0.128
4A5	0.048	0.144	0.245	0.043	0.094	0.138
4B1	0.031	0.100	0.228	0.050	0.098	0.152
4B2	0.049	0.123	0.259	0.061	0.105	0.164
4B3	0.035	0.100	0.211	0.030	0.058	0.097
4B4	0.124	0.178	0.316	0.073	0.101	0.161
4C1	0.060	0.122	0.262	0.060	0.089	0.143
4C2	0.054	0.093	0.212	0.045	0.073	0.123
4D1	0.016	0.074	0.195	0.031	0.059	0.101
4D2	0.100	0.096	0.199	0.021	0.053	0.088
4D3	0.017	0.074	0.212	0.048	0.071	0.117
4E	0.073	0.144	0.269	0.033	0.069	0.121
4F1	0.191	0.245	0.321	0.017	0.051	0.087
4F2	0.223	0.330	0.436	0.059	0.084	0.126
4F3	0.093	0.210	0.345	0.112	0.134	0.189
4F4	0.075	0.166	0.282	0.043	0.079	0.126
4F5	0.190	0.261	0.391	0.111	0.140	0.191
5A1	0.079	0.103	0.191	0.033	0.047	0.086
5A2	0.074	0.138	0.276	0.047	0.080	0.139
5A3	0.079	0.125	0.234	0.031	0.055	0.104
6	0.085	0.160	0.307	0.061	0.102	0.162
7	0.163	0.212	0.345	0.126	0.146	0.206
8A1	0.104	0.158	0.285	0.074	0.101	0.160
8A2	0.134	0.174	0.308	0.074	0.091	0.146
9	0.073	0.112	0.196	0.050	0.069	0.127
10	0.155	0.201	0.379	0.112	0.139	0.228
11A	0.242	0.281	0.467	0.175	0.193	0.278
11B	0.067	0.192	0.317	0.175	0.193	0.250

(a) Direct employment requirement per $1,000 of output

TABLE VII-6 19-SECTOR EMPLOYMENT MULTIPLIERS: GLADSTONE/CALLIOPE AND FITZROY

Sector	Gladstone/Calliope			Fitzroy		
	Direct	Direct & Indirect	Total	Direct	Direct & Indirect	Total
1	0.146	0.164	0.169	0.051	0.077	0.085
2A	0.249	0.268	0.275	0.106	0.134	0.145
2B	0.111	0.125	0.141	0.129	0.152	0.173
3A	-	-	-	0.009	0.029	0.040
3B	0.045	0.063	0.075	0.043	0.071	0.088
4A	0.044	0.099	0.113	0.038	0.092	0.110
4B	0.055	0.074	0.096	0.063	0.084	0.109
4C	0.066	0.074	0.095	0.033	0.049	0.071
4D	0.012	0.015	0.024	0.013	0.023	0.039
4E	0.023	0.046	0.061	0.028	0.069	0.089
4F	-	-	-	0.041	0.065	0.083
5	0.016	0.023	0.038	0.042	0.058	0.078
6	0.052	0.065	0.084	0.058	0.082	0.108
7	0.104	0.117	0.142	0.121	0.144	0.175
8	0.051	0.065	0.089	0.180	0.203	0.237
9	0.035	0.045	0.068	0.066	0.082	0.112
10	0.059	0.070	0.108	0.134	0.152	0.199
11A	0.109	0.116	0.152	0.134	0.147	0.192
11B	0.086	0.093	0.115	0.196	0.209	0.238

APPENDIX VIII

MATRICES OF DIRECT COEFFICIENTS FOR THE 11-SECTOR TABLES

TABLE VIII-1 DIRECT COEFFICIENTS, 11-SECTOR TABLE: GLADSTONE/CALLIOPE SUB-REGION

	1	2	3	4	5	6	7	8	9	10	11	House-holds
1	0.000	0.000	0.000	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	0.037	0.027	0.001	0.001	0.001	0.000	0.000	0.006	0.000	0.000	0.000	0.008
3	0.000	0.001	0.002	0.006	0.000	0.012	0.000	0.000	0.000	0.000	0.000	0.000
4	0.011	0.011	0.024	0.018	0.003	0.015	0.003	0.004	0.000	0.016	0.007	0.032
5	0.002	0.002	0.003	0.017	0.003	0.001	0.002	0.002	0.008	0.003	0.010	0.005
6	0.015	0.011	0.014	0.002	0.038	0.000	0.012	0.114	0.046	0.117	0.023	0.000
7	0.040	0.057	0.088	0.008	0.010	0.046	0.063	0.032	0.043	0.006	0.026	0.167
8	0.017	0.024	0.037	0.008	0.041	0.028	0.020	0.009	0.007	0.003	0.005	0.121
9	0.000	0.001	0.051	0.004	0.003	0.002	0.073	0.016	0.033	0.014	0.025	0.071
10	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003
11	0.001	0.000	0.000	0.003	0.000	0.000	0.002	0.000	0.001	0.004	0.001	0.063
Households	0.053	0.149	0.133	0.151	0.254	0.306	0.388	0.392	0.363	0.643	0.499	0.000

TABLE VIII-2 DIRECT COEFFICIENTS, 11-SECTOR TABLE: FITZROY REGION

	1	2	3	4	5	6	7	8	9	10	11	House-holds
1	0.000	0.000	0.000	0.108	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
2	0.079	0.093	0.009	0.016	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.042
3	0.000	0.000	0.008	0.027	0.091	0.012	0.002	0.004	0.000	0.000	0.002	0.000
4	0.037	0.022	0.034	0.042	0.006	0.118	0.009	0.084	0.001	0.026	0.020	0.169
5	0.008	0.009	0.031	0.015	0.009	0.003	0.006	0.006	0.025	0.012	0.031	0.013
6	0.015	0.013	0.019	0.005	0.033	0.000	0.013	0.118	0.033	0.114	0.028	0.007
7	0.051	0.053	0.051	0.031	0.013	0.072	0.070	0.044	0.049	0.008	0.036	0.108
8	0.015	0.022	0.027	0.023	0.035	0.024	0.022	0.009	0.007	0.006	0.005	0.015
9	0.000	0.001	0.007	0.005	0.002	0.002	0.066	0.005	0.045	0.022	0.009	0.051
10	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003
11	0.002	0.000	0.001	0.001	0.000	0.000	0.002	0.001	0.001	0.013	0.001	0.057
Households	0.055	0.103	0.115	0.202	0.253	0.304	0.385	0.388	0.385	0.630	0.554	0.000

TABLE VIII-3 DIRECT COEFFICIENTS, 11-SECTOR TABLE: QUEENSLAND

	1	2	3	4	5	6	7	8	9	10	11	House-holds
1	0.000	0.000	0.000	0.106	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003
2	0.082	0.093	0.017	0.106	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.041
3	0.000	0.000	0.023	0.023	0.046	0.011	0.001	0.003	0.000	0.000	0.002	0.000
4	0.120	0.111	0.131	0.142	0.031	0.306	0.033	0.105	0.004	0.102	0.046	0.246
5	0.012	0.015	0.039	0.016	0.022	0.004	0.009	0.008	0.038	0.015	0.049	0.025
6	0.015	0.012	0.011	0.008	0.046	0.000	0.013	0.064	0.033	0.106	0.026	0.007
7	0.043	0.045	0.073	0.046	0.016	0.091	0.037	0.048	0.051	0.009	0.046	0.181
8	0.021	0.031	0.045	0.047	0.046	0.037	0.034	0.020	0.011	0.014	0.008	0.052
9	0.000	0.001	0.030	0.011	0.003	0.003	0.095	0.008	0.070	0.028	0.015	0.094
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
11	0.003	0.000	0.001	0.001	0.000	0.000	0.002	0.002	0.001	0.011	0.001	0.084
House-holds	0.057	0.118	0.130	0.211	0.256	0.298	0.383	0.356	0.379	0.595	0.532	0.000

TABLE VIII-4 DIRECT COEFFICIENTS, 11-SECTOR TABLE: AUSTRALIA

	1	2	3	4	5	6	7	8	9	10	11	House-holds
1	0.000	0.000	0.000	0.072	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
2	0.103	0.050	0.015	0.035	0.001	0.000	0.000	0.002	0.000	0.000	0.001	0.015
3	0.000	0.000	0.018	0.028	0.045	0.011	0.001	0.003	0.000	0.000	0.001	0.000
4	0.111	0.151	0.121	0.215	0.035	0.384	0.073	0.146	0.006	0.130	0.140	0.213
5	0.010	0.013	0.033	0.015	0.020	0.005	0.004	0.006	0.038	0.012	0.020	0.016
6	0.013	0.011	0.009	0.006	0.034	0.000	0.005	0.037	0.056	0.084	0.007	0.000
7	0.053	0.060	0.045	0.034	0.011	0.080	0.032	0.048	0.010	0.012	0.027	0.155
8	0.016	0.021	0.025	0.034	0.025	0.031	0.015	0.014	0.002	0.019	0.090	0.036
9	0.000	0.001	0.009	0.010	0.002	0.003	0.039	0.008	0.019	0.022	0.242	0.111
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.002
11	0.016	0.018	0.028	0.047	0.061	0.025	0.127	0.052	0.105	0.021	0.089	0.093
House-holds	0.086	0.130	0.320	0.243	0.260	0.302	0.376	0.344	0.209	0.536	0.293	0.000

APPENDIX IX

MATRICES OF DIRECT COEFFICIENTS FOR THE DISAGGREGATED TABLES

TABLE IX-1 DIRECT CO-EFFICIENTS, 19-SECTOR TABLE: GLADSTONE/CALLIOPE SUB-REGION

	1	2A	2B	3A	3B	4A	4B	4C	4D	4E	4F	5	6	7	8	9	10	11A	11B	House-holds
1	0.000	0.000	0.000	0.000	0.000	0.262	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2A	0.037	0.042	0.000	0.000	0.000	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007
2B	0.000	0.000	0.000	0.000	0.001	0.000	0.065	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.001
3A	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3B	0.000	0.000	0.002	0.000	0.002	0.000	0.000	0.000	0.005	0.120	0.000	0.000	0.012	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4A	0.010	0.000	0.002	0.000	0.000	0.024	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.021
4B	0.000	0.006	0.006	0.000	0.000	0.001	0.042	0.003	0.001	0.001	0.000	0.000	0.027	0.002	0.003	0.000	0.009	0.007	0.000	0.008
4C	0.001	0.001	0.007	0.000	0.020	0.000	0.001	0.002	0.001	0.001	0.000	0.000	0.007	0.001	0.001	0.000	0.002	0.000	0.001	0.003
4D	0.000	0.000	0.002	0.000	0.004	0.001	0.007	0.066	0.013	0.002	0.000	0.002	0.044	0.001	0.000	0.000	0.005	0.001	0.001	0.000
4E	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.002	0.000	0.000	0.027	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4F	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	0.002	0.003	0.000	0.000	0.003	0.002	0.002	0.003	0.018	0.002	0.000	0.003	0.001	0.002	0.002	0.008	0.003	0.006	0.013	0.005
6	0.015	0.013	0.006	0.000	0.014	0.008	0.011	0.005	0.001	0.013	0.000	0.038	0.000	0.012	0.114	0.046	0.117	0.046	0.003	0.000
7	0.040	0.036	0.096	0.000	0.008	0.032	0.036	0.028	0.006	0.038	0.000	0.010	0.046	0.063	0.032	0.043	0.006	0.023	0.028	0.167
8	0.017	0.029	0.016	0.000	0.037	0.033	0.030	0.027	0.006	0.138	0.000	0.041	0.028	0.020	0.009	0.007	0.003	0.005	0.005	0.121
9	0.000	0.001	0.000	0.000	0.051	0.008	0.018	0.022	0.004	0.011	0.000	0.003	0.002	0.073	0.016	0.033	0.014	0.002	0.046	0.071
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003
11A	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.007
11B	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.002	0.056
House-holds	0.053	0.097	0.245	0.000	0.133	0.210	0.319	0.339	0.145	0.154	0.000	0.254	0.306	0.388	0.392	0.363	0.643	0.633	0.380	0.000

TABLE IX-2 DIRECT CO-EFFICIENTS, 19-SECTOR TABLE : FITZROY REGION

	1	2A	2B	3A	3B	4A	4B	4C	4D	4E	4F	5	6	7	8	9	10	11A	11B	House-holds
1	0.000	0.000	0.000	0.000	0.000	0.380	0.000	0.000	0.000	0.000	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
2A	0.079	0.099	0.000	0.000	0.000	0.052	0.000	0.000	0.000	0.000	0.015	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.042
2B	0.000	0.000	0.000	0.011	0.001	0.000	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000
3A	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.001	0.040	0.024	0.004	0.091	0.001	0.001	0.004	0.000	0.000	0.001	0.003	0.000
3B	0.000	0.000	0.002	0.006	0.018	0.000	0.000	0.001	0.004	0.111	0.007	0.000	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4A	0.033	0.004	0.010	0.000	0.000	0.042	0.001	0.000	0.002	0.000	0.032	0.000	0.000	0.001	0.000	0.000	0.001	0.008	0.008	0.108
4B	0.000	0.013	0.006	0.006	0.002	0.001	0.045	0.009	0.002	0.005	0.006	0.000	0.055	0.006	0.004	0.000	0.015	0.008	0.001	0.003
4C	0.003	0.002	0.012	0.010	0.021	0.000	0.002	0.019	0.003	0.003	0.004	0.004	0.008	0.001	0.079	0.000	0.006	0.000	0.002	0.044
4D	0.000	0.000	0.001	0.004	0.004	0.002	0.005	0.035	0.017	0.002	0.024	0.001	0.024	0.001	0.001	0.000	0.003	0.001	0.001	0.000
4E	0.000	0.000	0.000	0.010	0.016	0.000	0.000	0.000	0.000	0.053	0.000	0.000	0.030	0.000	0.000	0.000	0.000	0.000	0.000	0.008
4F	0.001	0.002	0.002	0.000	0.007	0.001	0.002	0.002	0.004	0.002	0.019	0.000	0.000	0.001	0.001	0.000	0.002	0.004	0.003	0.005
5	0.008	0.010	0.003	0.033	0.022	0.007	0.007	0.011	0.021	0.024	0.021	0.009	0.003	0.006	0.006	0.025	0.012	0.024	0.049	0.013
6	0.015	0.013	0.006	0.021	0.008	0.005	0.011	0.005	0.003	0.019	0.016	0.033	0.000	0.013	0.118	0.033	0.114	0.038	0.003	0.007
7	0.051	0.049	0.119	0.042	0.096	0.039	0.056	0.051	0.015	0.042	0.053	0.013	0.072	0.070	0.044	0.049	0.008	0.036	0.037	0.108
8	0.015	0.022	0.014	0.026	0.031	0.033	0.025	0.021	0.012	0.090	0.019	0.035	0.024	0.022	0.009	0.007	0.006	0.005	0.005	0.015
9	0.000	0.001	0.000	0.003	0.024	0.003	0.011	0.007	0.005	0.006	0.012	0.002	0.002	0.066	0.005	0.045	0.022	0.001	0.026	0.051
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003
11A	0.002	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.012	0.000	0.000	0.015
11B	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.001	0.000	0.000	0.000	0.003	0.041
House-holds	0.055	0.094	0.241	0.106	0.157	0.164	0.310	0.273	0.199	0.159	0.182	0.253	0.304	0.385	0.388	0.385	0.630	0.625	0.377	0.000

TABLE IX-3 DIRECT COEFFICIENTS, 36-SECTOR TABLE: QUEENSLAND

	1	2A	2B	3A	3B	4A1	4A2	4A3	4A4	4A5	4B1	4B2	4B3	4B4	4C1	4C2	4D1	4D2	4D3	4E	4F1	4F2	4F3	4F4	4F5	5A1	5A2	5A3	6	7	8A1	8A2	9	10	11A	11B	House-holds
1	0.000	0.000	0.000	0.000	0.000	0.600	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.045	0.000	0.012	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003
2A	0.082	0.099	0.000	0.000	0.000	0.036	0.190	0.086	0.625	0.048	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.009	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.040
2B	0.000	0.000	0.000	0.039	0.005	0.001	0.001	0.000	0.000	0.000	0.143	0.001	0.012	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.003	0.000	0.001	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.001
3A	0.000	0.000	0.000	0.000	0.000	0.003	0.001	0.000	0.000	0.001	0.001	0.000	0.007	0.000	0.000	0.000	0.040	0.006	0.000	0.014	0.012	0.001	0.000	0.000	0.004	0.057	0.084	0.002	0.000	0.001	0.004	0.000	0.000	0.000	0.001	0.002	0.000
3B	0.000	0.000	0.002	0.032	0.017	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.010	0.336	0.000	0.065	0.004	0.000	0.000	0.000	0.007	0.000	0.000	0.000	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4A1	0.009	0.000	0.004	0.000	0.000	0.000	0.068	0.041	0.001	0.001	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.014	0.003	0.001	0.094	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.008	0.000	0.081
4A2	0.000	0.000	0.000	0.000	0.000	0.001	0.003	0.020	0.000	0.029	0.000	0.000	0.000	0.000	0.000	0.000	0.009	0.000	0.000	0.000	0.007	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.013
4A3	0.011	0.001	0.004	0.000	0.000	0.001	0.005	0.189	0.001	0.001	0.000	0.000	0.009	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.006	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.016
4A4	0.032	0.013	0.004	0.000	0.000	0.003	0.057	0.040	0.002	0.119	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.062
4A5	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.009	0.009
4B1	0.000	0.007	0.004	0.007	0.001	0.000	0.000	0.000	0.000	0.004	0.057	0.218	0.007	0.000	0.002	0.013	0.003	0.001	0.002	0.001	0.001	0.000	0.000	0.005	0.004	0.000	0.000	0.000	0.045	0.001	0.003	0.000	0.000	0.000	0.000	0.000	0.003
4B2	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.027	0.014	0.000	0.000	0.002	0.005	0.000	0.000	0.001	0.000	0.002	0.000	0.000	0.002	0.001	0.000	0.000	0.000	0.028	0.003	0.000	0.000	0.000	0.007	0.003	0.000	0.004
4B3	0.000	0.022	0.000	0.000	0.005	0.001	0.010	0.013	0.000	0.015	0.002	0.005	0.112	0.065	0.004	0.001	0.000	0.001	0.002	0.013	0.014	0.008	0.013	0.006	0.014	0.000	0.000	0.000	0.000	0.012	0.006	0.001	0.000	0.001	0.001	0.003	0.001
4B4	0.000	0.001	0.000	0.000	0.000	0.000	0.002	0.001	0.000	0.012	0.000	0.000	0.014	0.020	0.001	0.000	0.000	0.000	0.001	0.000	0.006	0.003	0.001	0.002	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.023	0.010	0.000	0.019
4C1	0.008	0.006	0.019	0.014	0.046	0.001	0.002	0.001	0.000	0.001	0.006	0.001	0.005	0.002	0.027	0.038	0.008	0.004	0.010	0.006	0.009	0.002	0.001	0.003	0.006	0.000	0.010	0.003	0.028	0.003	0.001	0.037	0.001	0.013	0.002	0.012	0.009
4C2	0.000	0.000	0.019	0.008	0.004	0.001	0.003	0.001	0.000	0.003	0.012	0.002	0.010	0.003	0.007	0.004	0.004	0.003	0.004	0.008	0.019	0.003	0.002	0.003	0.003	0.025	0.001	0.001	0.001	0.002	0.076	0.000	0.000	0.027	0.000	0.000	0.014
4D1	0.000	0.000	0.000	0.004	0.011	0.000	0.001	0.000	0.000	0.000	0.001	0.008	0.000	0.000	0.029	0.033	0.000	0.005	0.059	0.010	0.003	0.000	0.000	0.001	0.006	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4D2	0.000	0.000	0.000	0.000	0.007	0.000	0.000	0.000	0.000	0.000	0.001	0.017	0.004	0.005	0.092	0.034	0.055	0.000	0.080	0.002	0.033	0.006	0.001	0.011	0.090	0.000	0.000	0.001	0.014	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4D3	0.000	0.001	0.004	0.015	0.004	0.013	0.073	0.003	0.000	0.058	0.008	0.024	0.006	0.002	0.037	0.065	0.013	0.007	0.030	0.007	0.032	0.003	0.002	0.020	0.026	0.000	0.009	0.028	0.074	0.002	0.001	0.015	0.000	0.011	0.004	0.003	0.001
4E	0.000	0.000	0.000	0.026	0.035	0.001	0.007	0.000	0.000	0.027	0.001	0.009	0.000	0.000	0.002	0.002	0.015	0.009	0.002	0.080	0.005	0.001	0.001	0.002	0.000	0.000	0.000	0.000	0.093	0.000	0.000	0.006	0.000	0.000	0.000	0.001	0.000
4F1	0.057	0.056	0.052	0.006	0.030	0.002	0.005	0.005	0.000	0.007	0.018	0.013	0.018	0.006	0.010	0.014	0.016	0.012	0.007	0.013	0.070	0.013	0.003	0.054	0.020	0.003	0.004	0.006	0.017	0.004	0.025	0.001	0.003	0.010	0.007	0.012	0.004
4F2	0.001	0.001	0.003	0.000	0.000	0.000	0.003	0.001	0.000	0.001	0.001	0.010	0.002	0.000	0.001	0.001	0.002	0.001	0.002	0.002	0.000	0.097	0.069	0.012	0.006	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.001	0.002	0.005	0.002
4F3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.000	0.000	0.001	0.001	0.000	0.000	0.000	0.000	0.001	0.006	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.004
4F4	0.000	0.000	0.008	0.000	0.015	0.001	0.011	0.005	0.000	0.006	0.000	0.010	0.003	0.003	0.007	0.010	0.000	0.000	0.002	0.001	0.014	0.003	0.056	0.006	0.024	0.000	0.001	0.000	0.002	0.002	0.005	0.002	0.000	0.003	0.001	0.003	0.004
4F5	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.003	0.002	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.000	0.001
5A1	0.008	0.011	0.004	0.056	0.024	0.008	0.012	0.012	0.001	0.014	0.026	0.008	0.019	0.008	0.014	0.013	0.041	0.035	0.013	0.026	0.024	0.018	0.009	0.019	0.010	0.000	0.067	0.082	0.003	0.008	0.006	0.009	0.030	0.014	0.025	0.055	0.019
5A2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.002	0.001	0.002	0.002	0.001	0.000	0.000	0.000	0.002	0.001	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.002	0.001	0.001
5A3	0.004	0.005	0.000	0.002	0.005	0.000	0.001	0.001	0.001	0.004	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.001	0.002	0.002	0.002	0.001	0.001	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.000	0.009	0.000	0.012	0.013	0.005
6	0.015	0.013	0.006	0.021	0.006	0.004	0.015	0.008	0.000	0.017	0.022	0.007	0.020	0.009	0.006	0.004	0.004	0.005	0.009	0.011	0.016	0.013	0.008	0.012	0.010	0.020	0.035	0.138	0.000	0.013	0.083	0.010	0.033	0.106	0.037	0.004	0.007
7	0.043	0.042	0.094	0.039	0.092	0.039	0.062	0.066	0.010	0.089	0.020	0.054	0.037	0.110	0.062	0.057	0.028	0.034	0.040	0.050	0.075	0.023	0.026	0.075	0.072	0.011	0.055	0.023	0.091	0.037	0.049	0.044	0.051	0.009	0.046	0.045	0.181
8A1	0.021	0.032	0.023	0.040	0.047	0.053	0.078	0.054	0.030	0.049	0.062	0.040	0.032	0.018	0.048	0.024	0.113	0.073	0.033	0.102	0.033	0.023	0.019	0.019	0.024	0.054	0.118	0.005	0.037	0.034	0.014	0.036	0.006	0.012	0.009	0.007	0.039
8A2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.002	0.000	0.000	0.014
9	0.000	0.001	0.000	0.005	0.045	0.004	0.010	0.009	0.009	0.009	0.027	0.017	0.013	0.019	0.016	0.008	0.006	0.004	0.013	0.011	0.013	0.013	0.025	0.018	0.025	0.003	0.011	0.000	0.003	0.095	0.010	0.002	0.070	0.028	0.002	0.039	0.094
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
11A	0.003	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.010	0.000	0.000	0.035
11B	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.002	0.002	0.000	0.000	0.000	0.000	0.003	0.050
House-holds	0.057	0.111	0.245	0.106	0.143	0.138	0.170	0.242	0.128	0.168	0.264	0.284	0.191	0.376	0.302	0.283	0.203	0.144	0.268	0.245	0.131	0.238	0.352	0.243	0.285	0.247	0.325	0.270	0.298	0.383	0.351	0.369	0.379	0.595	0.620	0.369	0.000

TABLE IX-4 DIRECT COEFFICIENTS 36-SECTOR TABLE: AUSTRALIA

	1	2A	2B	3A	3B	4A1	4A2	4A3	4A4	4A5	4B1	4B2	4B3	4B4	4C1	4C2	4D1	4D2	4D3	4E	4F1	4F2	4F3	4F4	4F5	5A1	5A2	5A3	6	7	8A1	8A2	9	10	11A	11B	House-holds
1	0.000	0.000	0.000	0.000	0.000	0.618	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.104	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003
2A	0.103	0.056	0.000	0.000	0.000	0.030	0.179	0.187	0.332	0.115	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.031	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.019
2B	0.000	0.000	0.000	0.039	0.006	0.002	0.002	0.000	0.009	0.000	0.205	0.001	0.026	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.002	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.003	0.001	0.000	0.000	0.000	0.000	0.002
3A	0.000	0.000	0.000	0.000	0.000	0.004	0.001	0.000	0.001	0.001	0.001	0.000	0.010	0.000	0.000	0.000	0.036	0.006	0.000	0.013	0.027	0.001	0.000	0.000	0.003	0.057	0.084	0.002	0.000	0.001	0.004	0.000	0.000	0.000	0.001	0.001	0.000
3B	0.000	0.000	0.002	0.023	0.016	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.081	0.338	0.000	0.076	0.004	0.000	0.000	0.000	0.006	0.000	0.001	0.000	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4A1	0.006	0.001	0.003	0.000	0.000	0.000	0.057	0.029	0.038	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.006	0.001	0.020	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.006	0.006	0.072
4A2	0.000	0.000	0.000	0.000	0.000	0.001	0.003	0.015	0.005	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.002	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.013
4A3	0.007	0.004	0.004	0.000	0.000	0.001	0.004	0.125	0.019	0.001	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.023
4A4	0.014	0.044	0.004	0.000	0.000	0.005	0.051	0.037	0.017	0.057	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.014
4A5	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.000	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.028
4B1	0.000	0.003	0.003	0.004	0.001	0.000	0.000	0.000	0.000	0.004	0.022	0.167	0.003	0.000	0.002	0.005	0.002	0.001	0.002	0.001	0.000	0.000	0.000	0.002	0.004	0.000	0.000	0.000	0.038	0.001	0.002	0.000	0.000	0.000	0.000	0.000	0.001
4B2	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.010	0.014	0.000	0.000	0.004	0.002	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.001	0.001	0.000	0.000	0.000	0.028	0.003	0.000	0.000	0.000	0.002	0.002	0.001	0.011
4B3	0.001	0.014	0.000	0.000	0.001	0.003	0.015	0.025	0.010	0.015	0.001	0.006	0.183	0.120	0.005	0.001	0.000	0.001	0.002	0.014	0.009	0.006	0.012	0.008	0.023	0.000	0.000	0.000	0.000	0.013	0.005	0.001	0.000	0.001	0.001	0.007	0.002
4B4	0.000	0.000	0.000	0.000	0.000	0.001	0.003	0.002	0.000	0.026	0.000	0.000	0.010	0.014	0.002	0.000	0.000	0.000	0.001	0.000	0.005	0.001	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.010	0.007	0.101	0.007
4C1	0.011	0.009	0.028	0.023	0.034	0.002	0.003	0.003	0.004	0.003	0.004	0.003	0.005	0.005	0.054	0.031	0.011	0.008	0.017	0.009	0.004	0.003	0.002	0.005	0.011	0.000	0.016	0.005	0.058	0.010	0.002	0.136	0.001	0.028	0.004	0.010	0.016
4C2	0.001	0.003	0.018	0.009	0.007	0.001	0.003	0.001	0.003	0.003	0.004	0.003	0.005	0.002	0.008	0.003	0.003	0.002	0.004	0.006	0.004	0.003	0.001	0.002	0.002	0.025	0.001	0.001	0.002	0.022	0.081	0.000	0.000	0.045	0.000	0.001	0.019
4D1	0.001	0.001	0.001	0.011	0.014	0.000	0.002	0.000	0.000	0.000	0.001	0.030	0.001	0.002	0.086	0.065	0.000	0.016	0.238	0.018	0.004	0.000	0.000	0.002	0.027	0.001	0.000	0.000	0.019	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000
4D2	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.002	0.000	0.000	0.013	0.002	0.004	0.080	0.021	0.033	0.000	0.071	0.002	0.009	0.002	0.000	0.007	0.057	0.000	0.000	0.001	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4D3	0.001	0.001	0.004	0.013	0.003	0.017	0.098	0.003	0.025	0.057	0.003	0.029	0.003	0.002	0.040	0.039	0.010	0.007	0.034	0.006	0.010	0.003	0.002	0.011	0.024	0.000	0.008	0.029	0.091	0.003	0.001	0.018	0.001	0.007	0.004	0.004	0.003
4E	0.000	0.000	0.000	0.018	0.017	0.005	0.014	0.000	0.002	0.046	0.001	0.013	0.000	0.000	0.003	0.003	0.013	0.009	0.004	0.067	0.006	0.001	0.001	0.003	0.001	0.000	0.000	0.000	0.105	0.000	0.000	0.004	0.000	0.000	0.001	0.001	0.001
4F1	0.068	0.069	0.057	0.014	0.035	0.003	0.008	0.008	0.008	0.008	0.015	0.020	0.029	0.016	0.020	0.014	0.022	0.022	0.014	0.023	0.056	0.046	0.008	0.140	0.044	0.005	0.006	0.007	0.024	0.009	0.033	0.001	0.004	0.022	0.025	0.011	0.019
4F2	0.001	0.001	0.008	0.000	0.000	0.000	0.007	0.002	0.002	0.002	0.001	0.037	0.003	0.000	0.002	0.004	0.002	0.001	0.004	0.004	0.001	0.159	0.215	0.058	0.017	0.000	0.000	0.000	0.000	0.001	0.004	0.000	0.000	0.002	0.004	0.006	0.009
4F3	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.008	0.071	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.006	0.000	0.009	0.043
4F4	0.000	0.000	0.019	0.001	0.016	0.006	0.031	0.012	0.020	0.008	0.000	0.025	0.006	0.007	0.017	0.022	0.000	0.001	0.006	0.002	0.017	0.004	0.055	0.006	0.059	0.000	0.003	0.001	0.006	0.006	0.012	0.006	0.000	0.006	0.003	0.007	0.009
4F5	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.002	0.003	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.008	0.003
5A1	0.005	0.008	0.004	0.040	0.024	0.007	0.008	0.010	0.007	0.008	0.017	0.006	0.019	0.006	0.008	0.010	0.036	0.032	0.009	0.022	0.016	0.012	0.005	0.015	0.007	0.000	0.029	0.067	0.003	0.004	0.005	0.008	0.004	0.011	0.012	0.014	0.017
5A2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.003	0.001	0.002	0.003	0.001	0.000	0.000	0.000	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.000	0.004
5A3	0.004	0.005	0.000	0.002	0.005	0.001	0.001	0.001	0.001	0.004	0.000	0.000	0.002	0.000	0.000	0.000	0.002	0.000	0.001	0.003	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.001	0.034	0.001	0.010	0.005	0.001
6	0.013	0.011	0.005	0.014	0.007	0.003	0.009	0.006	0.008	0.008	0.013	0.005	0.016	0.006	0.004	0.003	0.003	0.004	0.005	0.016	0.008	0.008	0.005	0.007	0.005	0.012	0.013	0.100	0.000	0.005	0.046	0.008	0.056	0.084	0.020	0.001	0.000
7	0.053	0.053	0.115	0.033	0.050	0.029	0.039	0.052	0.038	0.039	0.016	0.038	0.037	0.065	0.039	0.027	0.023	0.029	0.026	0.044	0.033	0.028	0.015	0.053	0.049	0.008	0.023	0.017	0.080	0.032	0.049	0.043	0.010	0.012	0.021	0.030	0.214
8A1	0.016	0.022	0.019	0.026	0.024	0.042	0.045	0.066	0.044	0.034	0.040	0.027	0.020	0.010	0.022	0.015	0.089	0.060	0.020	0.089	0.026	0.020	0.010	0.012	0.015	0.031	0.045	0.003	0.031	0.015	0.009	0.030	0.001	0.015	0.004	0.037	0.041
8A2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.003	0.000	0.096	0.009
9	0.000	0.001	0.000	0.004	0.011	0.005	0.008	0.007	0.007	0.006	0.020	0.015	0.011	0.016	0.011	0.008	0.006	0.005	0.011	0.010	0.008	0.008	0.016	0.016	0.021	0.002	0.006	0.000	0.003	0.039	0.010	0.003	0.019	0.022	0.001	0.361	0.153
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.002
11A	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.006	0.000	0.017	0.052
11B	0.014	0.016	0.031	0.011	0.034	0.027	0.076	0.062	0.046	0.090	0.052	0.043	0.055	0.074	0.065	0.026	0.022	0.030	0.044	0.040	0.063	0.032	0.048	0.052	0.057	0.039	0.188	0.070	0.025	0.127	0.060	0.021	0.105	0.015	0.077	0.078	0.077
House-holds	0.086	0.117	0.242	0.369	0.301	0.121	0.178	0.216	0.159	0.158	0.307	0.289	0.224	0.373	0.319	0.318	0.286	0.139	0.292	0.263	0.150	0.230	0.311	0.274	0.303	0.247	0.325	0.270	0.302	0.376	0.336	0.369	0.209	0.536	0.620	0.131	0.000

APPENDIX X

INVERSE MATRICES FOR THE 11-SECTOR TABLES (OPEN MODEL)

TABLE X-1 INVERSE MATRIX, 11-SECTOR OPEN MODEL: GLADSTONE/CALLIOPE SUB-REGION

	1	2	3	4	5	6	7	8	9	10	11
1	1.000	0.000	0.000	0.007	0.000	0.001	0.000	0.000	0.000	0.000	0.000
2	0.038	1.028	0.001	0.002	0.001	0.000	0.000	0.006	0.000	0.000	0.000
3	0.000	0.001	1.002	0.006	0.001	0.012	0.000	0.002	0.001	0.002	0.001
4	0.014	0.013	0.027	1.019	0.008	0.108	0.006	0.017	0.006	0.029	0.010
5	0.003	0.002	0.004	0.018	1.003	0.003	0.002	0.002	0.008	0.004	0.010
6	0.019	0.015	0.023	0.005	0.044	1.005	0.019	0.117	0.050	0.119	0.026
7	0.047	0.065	0.100	0.011	0.015	0.053	1.073	0.042	0.050	0.014	0.031
8	0.020	0.027	0.041	0.010	0.043	0.031	0.023	1.014	0.011	0.008	0.008
9	0.004	0.006	0.061	0.006	0.005	0.007	0.081	0.020	1.039	0.016	0.028
10	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.000	1.000	0.000
11	0.001	0.000	0.001	0.003	0.000	0.001	0.002	0.000	0.001	0.005	1.001

TABLE X-2 INVERSE MATRIX, 11-SECTOR OPEN MODEL: FITZROY REGION

	1	2	3	4	5	6	7	8	9	10	11
1	1.005	0.003	0.005	0.114	0.002	0.014	0.002	0.011	0.001	0.005	0.003
2	0.089	1.104	0.011	0.028	0.002	0.004	0.000	0.004	0.000	0.001	0.001
3	0.003	0.003	1.013	0.031	0.094	0.016	0.003	0.010	0.003	0.004	0.006
4	0.046	0.032	0.043	1.055	0.018	0.129	0.015	0.106	0.007	0.044	0.027
5	0.011	0.012	0.033	0.019	1.013	0.007	0.009	0.009	0.027	0.014	0.033
6	0.021	0.019	0.026	0.014	0.041	1.007	0.020	0.123	0.038	0.117	0.032
7	0.065	0.067	0.062	0.048	0.026	0.086	1.083	0.063	0.060	0.022	0.044
8	0.020	0.028	0.032	0.030	0.040	0.031	0.026	1.017	0.011	0.011	0.009
9	0.005	0.006	0.012	0.009	0.005	0.009	0.075	0.010	1.051	0.025	0.012
10	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	1.000	0.000
11	0.003	0.000	0.001	0.002	0.001	0.001	0.003	0.001	0.002	0.013	1.001

TABLE X-3 INVERSE MATRIX, 11-SECTOR OPEN MODEL: QUEENSLAND

	1	2	3	4	5	6	7	8	9	10	11
1	1.018	0.018	0.020	0.130	0.008	0.041	0.006	0.017	0.003	0.018	0.008
2	0.113	1.124	0.043	0.156	0.011	0.050	0.007	0.023	0.004	0.022	0.010
3	0.005	0.006	1.030	0.031	0.051	0.022	0.004	0.009	0.003	0.007	0.007
4	0.174	0.165	0.188	1.231	0.075	0.391	0.057	0.162	0.027	0.173	0.075
5	0.019	0.022	0.049	0.027	1.027	0.015	0.015	0.014	0.044	0.022	0.054
6	0.022	0.021	0.023	0.022	0.053	1.012	0.022	0.071	0.040	0.113	0.032
7	0.064	0.067	0.099	0.082	0.034	0.125	1.053	0.070	0.064	0.035	0.059
8	0.038	0.049	0.065	0.073	0.058	0.066	0.043	1.035	0.020	0.031	0.019
9	0.010	0.011	0.047	0.025	0.010	0.022	0.108	0.018	1.083	0.037	0.024
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000
11	0.003	0.000	0.001	0.001	0.001	0.001	0.003	0.003	0.002	0.011	1.002

TABLE X-4 INVERSE MATRIX, 11-SECTOR OPEN MODEL: AUSTRALIA

	1	2	3	4	5	6	7	8	9	10	11
1	1.014	0.017	0.014	0.097	0.007	0.039	0.011	0.018	0.005	0.017	0.019
2	0.118	1.064	0.026	0.061	0.006	0.025	0.007	0.014	0.004	0.011	0.013
3	0.007	0.009	1.027	0.041	0.051	0.029	0.007	0.012	0.005	0.009	0.012
4	0.199	0.241	0.200	1.349	0.101	0.547	0.146	0.244	0.073	0.236	0.264
5	0.017	0.021	0.041	0.028	1.028	0.018	0.014	0.015	0.046	0.020	0.042
6	0.019	0.017	0.016	0.017	0.040	1.010	0.014	0.044	0.063	0.091	0.034
7	0.075	0.080	0.063	0.066	0.027	0.113	1.048	0.069	0.024	0.034	0.056
8	0.033	0.039	0.042	0.061	0.041	0.062	0.037	1.035	0.021	0.036	0.120
9	0.018	0.019	0.030	0.040	0.026	0.034	0.086	0.036	1.056	0.040	0.294
10	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	1.000	0.004
11	0.047	0.051	0.061	0.094	0.086	0.082	0.168	0.089	0.136	0.052	1.165

APPENDIX XI

INVERSE MATRICES FOR THE 11-SECTOR TABLES (CLOSED MODEL)

TABLE XI-1 INVERSE MATRIX, 11-SECTOR CLOSED MODEL: GLADSTONE/CALLIOPE SUB-REGION

	1	2	3	4	5	6	7	8	9	10	11	House-holds
1	1.000	0.000	0.000	0.007	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.001
2	0.039	1.030	0.003	0.004	0.004	0.005	0.005	0.011	0.005	0.008	0.006	0.011
3	0.000	0.001	1.002	0.006	0.001	0.013	0.001	0.002	0.001	0.002	0.001	0.001
4	0.019	0.022	0.037	1.028	0.022	0.125	0.028	0.039	0.025	0.062	0.035	0.047
5	0.004	0.004	0.006	0.019	1.006	0.006	0.007	0.007	0.012	0.011	0.015	0.009
6	0.022	0.021	0.029	0.010	0.052	1.016	0.033	0.130	0.062	0.139	0.042	0.029
7	0.070	0.113	0.153	0.053	0.085	0.141	1.184	0.153	0.151	0.182	0.160	0.240
8	0.036	0.060	0.077	0.039	0.091	0.090	0.098	1.089	0.079	0.122	0.095	0.162
9	0.015	0.029	0.087	0.026	0.040	0.050	0.135	0.074	1.088	0.098	0.091	0.116
10	0.000	0.001	0.001	0.004	0.001	0.002	0.002	0.002	0.002	1.003	0.002	0.004
11	0.009	0.016	0.019	0.018	0.024	0.030	0.040	0.037	0.034	0.061	1.045	0.080
House-holds	0.120	0.252	0.282	0.221	0.371	0.458	0.585	0.582	0.529	0.885	0.678	1.262

TABLE XI-2 INVERSE MATRIX, 11-SECTOR CLOSED MODEL: FITZROY REGION

	1	2	3	4	5	6	7	8	9	10	11	House-holds
1	1.008	0.008	0.010	0.121	0.010	0.024	0.014	0.025	0.013	0.024	0.019	0.027
2	0.097	1.115	0.023	0.046	0.021	0.028	0.030	0.035	0.029	0.046	0.039	0.063
3	0.004	0.004	1.015	0.034	0.097	0.020	0.008	0.015	0.008	0.011	0.012	0.009
4	0.073	0.070	0.084	1.116	0.088	0.216	0.122	0.217	0.110	0.204	0.163	0.226
5	0.014	0.016	0.038	0.026	1.021	0.017	0.022	0.022	0.039	0.033	0.049	0.027
6	0.023	0.023	0.030	0.020	0.048	1.015	0.031	0.134	0.048	0.134	0.046	0.023
7	0.084	0.095	0.093	0.092	0.077	0.150	1.161	0.144	0.134	0.139	0.144	0.165
8	0.024	0.033	0.038	0.039	0.050	0.043	0.041	1.033	0.026	0.034	0.028	0.032
9	0.015	0.019	0.026	0.031	0.029	0.039	0.113	0.049	1.087	0.081	0.060	0.079
10	0.000	0.001	0.001	0.002	0.001	0.001	0.002	0.002	0.002	1.003	0.002	0.003
11	0.011	0.012	0.014	0.021	0.022	0.027	0.036	0.035	0.033	0.062	1.043	0.070
House-holds	0.146	0.204	0.224	0.329	0.378	0.469	0.571	0.593	0.551	0.861	0.735	1.216

TABLE XI-3 INVERSE MATRIX, 11-SECTOR CLOSED MODEL: QUEENSLAND

	1	2	3	4	5	6	7	8	9	10	11	House-holds
1	1.028	0.031	0.036	0.152	0.028	0.069	0.034	0.044	0.030	0.060	0.043	0.058
2	0.134	1.154	0.080	0.205	0.056	0.113	0.071	0.084	0.066	0.117	0.090	0.132
3	0.008	0.009	1.035	0.037	0.057	0.030	0.012	0.016	0.011	0.019	0.017	0.017
4	0.257	0.281	0.329	1.418	0.248	0.633	0.303	0.398	0.266	0.537	0.385	0.507
5	0.030	0.037	0.068	0.053	1.050	0.048	0.048	0.046	0.076	0.071	0.095	0.068
6	0.030	0.031	0.036	0.038	0.068	1.033	0.043	0.091	0.060	0.144	0.058	0.043
7	0.120	0.145	0.194	0.208	0.150	0.288	1.218	0.229	0.225	0.279	0.267	0.341
8	0.059	0.078	0.101	0.121	0.102	0.128	0.106	1.096	0.081	0.124	0.098	0.129
9	0.042	0.055	0.101	0.097	0.076	0.115	0.203	0.109	1.175	0.177	0.143	0.195
10	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	1.003	0.002	0.004
11	0.024	0.029	0.037	0.048	0.044	0.061	0.064	0.061	0.062	0.102	1.079	0.126
House-holds	0.242	0.337	0.412	0.548	0.503	0.708	0.717	0.690	0.699	1.062	0.904	1.478

TABLE XI-4 INVERSE MATRIX, 11-SECTOR CLOSED MODEL: AUSTRALIA

	1	2	3	4	5	6	7	8	9	10	11	House-holds
1	1.023	0.028	0.032	0.115	0.022	0.061	0.031	0.037	0.018	0.044	0.041	0.039
2	0.128	1.076	0.047	0.082	0.023	0.050	0.031	0.037	0.019	0.042	0.039	0.046
3	0.011	0.014	1.035	0.049	0.058	0.039	0.016	0.021	0.011	0.022	0.022	0.019
4	0.311	0.381	0.433	1.579	0.293	0.828	0.412	0.498	0.240	0.583	0.548	0.509
5	0.028	0.034	0.063	0.050	1.046	0.046	0.040	0.039	0.062	0.054	0.069	0.049
6	0.025	0.024	0.029	0.029	0.050	1.025	0.028	0.057	0.072	0.109	0.048	0.026
7	0.135	0.154	0.187	0.188	0.128	0.262	1.188	0.203	0.112	0.217	0.207	0.269
8	0.055	0.066	0.088	0.106	0.079	0.118	0.090	1.085	0.054	0.105	0.176	0.101
9	0.070	0.085	0.139	0.148	0.117	0.166	0.210	0.155	1.134	0.203	0.428	0.239
10	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002	1.002	0.006	0.003
11	0.102	0.119	0.175	0.206	0.179	0.220	0.297	0.213	0.217	0.221	1.304	0.248
House-holds	0.313	0.390	0.652	0.642	0.535	0.787	0.741	0.708	0.466	0.967	0.794	1.420

APPENDIX XII

INVERSE MATRICES FOR THE DISAGGREGATED TABLES (OPEN MODEL)

TABLE XII-1 INVERSE MATRIX, 19-SECTOR OPEN MODEL: GLADSTONE/CALLIOPE SUBREGION

	1	2A	2B	3A	3B	4A	4B	4C	4D	4E	4F	5	6	7	8	9	10	11A	11B
1	1.003	0.000	0.001	0.000	0.000	0.269	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000
2A	0.039	1.044	0.000	0.000	0.000	0.020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2B	0.000	0.001	1.001	0.000	0.001	0.001	0.068	0.000	0.000	0.002	0.000	0.001	0.002	0.000	0.006	0.000	0.001	0.001	0.000
3A	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3B	0.000	0.000	0.002	0.000	1.002	0.000	0.001	0.001	0.005	0.121	0.000	0.001	0.015	0.000	0.002	0.001	0.002	0.001	0.000
4A	0.010	0.000	0.002	0.000	0.000	1.028	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000
4B	0.001	0.008	0.006	0.000	0.001	0.002	1.045	0.003	0.001	0.003	0.000	0.001	0.029	0.002	0.006	0.002	0.012	0.009	0.000
4C	0.002	0.001	0.007	0.000	0.020	0.001	0.002	1.002	0.001	0.004	0.000	0.001	0.007	0.001	0.002	0.001	0.003	0.001	0.002
4D	0.001	0.001	0.003	0.000	0.006	0.002	0.009	0.068	1.013	0.004	0.000	0.005	0.046	0.002	0.006	0.002	0.011	0.004	0.002
4E	0.001	0.001	0.000	0.000	0.001	0.001	0.001	0.000	0.000	1.002	0.000	0.001	0.027	0.001	0.003	0.001	0.003	0.001	0.000
4F	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	0.002	0.003	0.000	0.000	0.004	0.003	0.003	0.005	0.018	0.003	0.000	1.003	0.002	0.002	0.002	0.008	0.004	0.006	0.013
6	0.019	0.018	0.010	0.000	0.023	0.018	0.017	0.011	0.004	0.034	0.000	0.044	1.006	0.019	0.117	0.050	0.119	0.048	0.007
7	0.047	0.043	0.105	0.000	0.100	0.051	0.051	0.034	0.008	0.060	0.000	0.015	0.056	1.073	0.043	0.051	0.014	0.028	0.034
8	0.021	0.032	0.019	0.000	0.042	0.042	0.035	0.029	0.008	0.147	0.000	0.043	0.036	0.023	1.015	0.011	0.009	0.008	0.007
9	0.004	0.005	0.009	0.000	0.061	0.013	0.024	0.026	0.005	0.025	0.000	0.005	0.009	0.081	0.020	1.039	0.017	0.004	0.050
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000
11A	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	1.000	0.000
11B	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	1.002

TABLE XII-2 INVERSE MATRIX, 19-SECTOR OPEN MODEL: FITZROY REGION

	1	2A	2B	3A	3B	4A	4B	4C	4D	4E	4F	5	6	7	8	9	10	11A	11B
1	1.013	0.002	0.004	0.000	0.000	0.402	0.000	0.000	0.001	0.000	0.023	0.000	0.000	0.001	0.000	0.000	0.000	0.004	0.003
2A	0.091	1.111	0.001	0.000	0.000	0.097	0.000	0.000	0.000	0.000	0.021	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.002
2B	0.000	0.000	1.000	0.011	0.001	0.001	0.011	0.000	0.001	0.001	0.000	0.001	0.001	0.000	0.001	0.000	0.000	0.000	0.000
3A	0.001	0.001	0.001	1.004	0.004	0.004	0.001	0.003	0.043	0.029	0.008	0.092	0.003	0.003	0.006	0.003	0.002	0.004	0.008
3B	0.000	0.000	0.002	0.008	1.020	0.000	0.000	0.001	0.004	0.120	0.008	0.001	0.015	0.000	0.002	0.001	0.002	0.001	0.001
4A	0.035	0.005	0.011	0.000	0.000	1.059	0.001	0.000	0.002	0.001	0.035	0.000	0.000	0.001	0.000	0.000	0.001	0.009	0.009
4B	0.003	0.017	0.008	0.009	0.005	0.005	1.048	0.011	0.003	0.010	0.009	0.003	0.059	0.008	0.013	0.003	0.023	0.012	0.002
4C	0.005	0.005	0.014	0.013	0.025	0.006	0.005	1.021	0.005	0.015	0.007	0.009	0.011	0.003	0.083	0.002	0.009	0.002	0.003
4D	0.001	0.001	0.002	0.006	0.006	0.003	0.006	0.037	1.018	0.005	0.026	0.003	0.026	0.001	0.007	0.001	0.006	0.002	0.001
4E	0.001	0.001	0.000	0.012	0.017	0.001	0.001	0.001	0.001	1.060	0.001	0.002	0.032	0.001	0.004	0.001	0.004	0.001	0.000
4F	0.002	0.002	0.002	0.000	0.007	0.002	0.002	0.002	0.004	0.003	1.020	0.000	0.001	0.001	0.001	0.001	0.002	0.004	0.003
5	0.011	0.012	0.005	0.035	0.025	0.013	0.009	0.013	0.024	0.031	0.025	1.013	0.007	0.009	0.009	0.027	0.014	0.026	0.051
6	0.021	0.020	0.011	0.028	0.017	0.020	0.017	0.010	0.008	0.037	0.023	0.041	1.007	0.020	0.122	0.038	0.118	0.041	0.008
7	0.065	0.063	0.132	0.054	0.114	0.078	0.069	0.060	0.022	0.073	0.069	0.025	0.088	1.083	0.064	0.060	0.023	0.045	0.045
8	0.021	0.028	0.019	0.032	0.038	0.047	0.029	0.024	0.016	0.105	0.026	0.040	0.033	0.026	1.017	0.011	0.011	0.009	0.009
9	0.005	0.006	0.010	0.008	0.035	0.010	0.017	0.013	0.007	0.015	0.018	0.005	0.009	0.076	0.011	1.051	0.026	0.005	0.031
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000
11A	0.002	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.013	1.000	0.000
11B	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.000	0.003	0.001	0.001	0.000	0.000	1.003

TABLE XII-3 INVERSE MATRIX, 36-SECTOR OPEN MODEL: QUEENSLAND

	1	2A	2B	3A	3B	4A1	4A2	4A3	4A4	4A5	4B1	4B2	4B3	4B4	4C1	4C2	4D1	4D2	4D3	4E	4F1	4F2	4F3	4F4	4F5	5A1	5A2	5A3	6	7	8A1	8A2	9	10	11A	11B
1	1.007	0.001	0.004	0.000	0.002	0.604	0.043	0.033	0.001	0.003	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.011	0.053	0.008	0.071	0.003	0.000	0.000	0.000	0.001	0.001	0.001	0.000	0.000	0.001	0.006	0.001
2A	0.118	1.120	0.005	0.000	0.001	0.113	0.263	0.166	0.702	0.146	0.001	0.002	0.002	0.000	0.001	0.001	0.003	0.001	0.000	0.000	0.007	0.018	0.002	0.013	0.003	0.000	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.001	0.002	0.002
2B	0.001	0.002	1.001	0.041	0.006	0.003	0.003	0.001	0.002	0.002	0.154	0.036	0.016	0.001	0.002	0.003	0.004	0.003	0.001	0.003	0.002	0.001	0.003	0.004	0.002	0.003	0.005	0.002	0.009	0.001	0.005	0.001	0.001	0.002	0.001	0.001
3A	0.002	0.003	0.002	1.005	0.004	0.006	0.004	0.003	0.002	0.004	0.004	0.003	0.010	0.002	0.004	0.004	0.045	0.011	0.005	0.020	0.017	0.004	0.002	0.004	0.007	0.058	0.090	0.007	0.004	0.003	0.006	0.001	0.002	0.002	0.003	0.007
3B	0.003	0.003	0.005	0.038	1.026	0.003	0.005	0.002	0.002	0.006	0.004	0.010	0.005	0.003	0.037	0.018	0.034	0.347	0.032	0.077	0.021	0.004	0.002	0.007	0.041	0.004	0.006	0.006	0.027	0.001	0.005	0.003	0.001	0.005	0.002	0.002
4A1	0.011	0.002	0.006	0.001	0.002	1.007	0.071	0.054	0.002	0.004	0.002	0.005	0.002	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.018	0.005	0.007	0.097	0.003	0.000	0.001	0.000	0.001	0.002	0.001	0.000	0.000	0.002	0.009	0.001
4A2	0.001	0.001	0.001	0.000	0.000	0.001	1.004	0.025	0.001	0.029	0.001	0.000	0.001	0.000	0.001	0.001	0.009	0.000	0.001	0.000	0.007	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.003	0.000
4A3	0.015	0.003	0.006	0.000	0.001	0.010	0.008	1.234	0.002	0.002	0.001	0.001	0.012	0.001	0.000	0.000	0.001	0.001	0.000	0.001	0.009	0.003	0.001	0.002	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000
4A4	0.035	0.015	0.005	0.000	0.000	0.024	0.063	0.054	1.012	0.124	0.001	0.001	0.001	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.004	0.002	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001
4A5	0.001	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	1.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.009
4B1	0.003	0.011	0.006	0.010	0.003	0.003	0.005	0.004	0.007	0.009	1.071	0.238	0.011	0.002	0.005	0.017	0.006	0.004	0.004	0.005	0.005	0.002	0.002	0.008	0.007	0.003	0.005	0.008	0.057	0.004	0.010	0.001	0.002	0.009	0.004	0.001
4B2	0.001	0.002	0.004	0.002	0.001	0.002	0.002	0.001	0.001	0.003	0.031	1.021	0.002	0.001	0.004	0.007	0.002	0.001	0.003	0.002	0.003	0.001	0.001	0.004	0.003	0.001	0.002	0.005	0.031	0.004	0.004	0.001	0.001	0.011	0.005	0.001
4B3	0.006	0.031	0.003	0.002	0.010	0.007	0.022	0.025	0.020	0.026	0.004	0.009	1.130	0.077	0.008	0.004	0.003	0.006	0.005	0.019	0.021	0.012	0.017	0.011	0.019	0.001	0.003	0.002	0.005	0.015	0.009	0.003	0.001	0.005	0.003	0.005
4B4	0.001	0.002	0.001	0.000	0.001	0.001	0.003	0.002	0.001	0.013	0.000	0.001	0.016	1.022	0.002	0.000	0.000	0.001	0.001	0.001	0.008	0.004	0.001	0.003	0.001	0.000	0.000	0.000	0.001	0.001	0.001	0.000	0.000	0.024	0.011	0.000
4C1	0.012	0.010	0.022	0.020	0.052	0.009	0.008	0.005	0.007	0.006	0.013	0.007	0.009	0.005	1.032	0.043	0.014	0.024	0.014	0.014	0.014	0.004	0.003	0.007	0.011	0.004	0.014	0.009	0.034	0.004	0.008	0.040	0.003	0.019	0.004	0.013
4C2	0.005	0.007	0.024	0.016	0.013	0.010	0.014	0.010	0.007	0.011	0.024	0.013	0.017	0.007	0.015	1.010	0.017	0.015	0.010	0.021	0.027	0.008	0.005	0.010	0.009	0.031	0.015	0.006	0.010	0.006	0.080	0.005	0.002	0.031	0.003	0.004
4D1	0.001	0.002	0.003	0.007	0.014	0.002	0.007	0.002	0.001	0.005	0.004	0.011	0.002	0.001	0.034	0.040	1.003	0.011	0.063	0.014	0.008	0.001	0.001	0.003	0.010	0.002	0.003	0.004	0.013	0.001	0.005	0.003	0.001	0.004	0.001	0.001
4D2	0.005	0.005	0.006	0.006	0.016	0.005	0.011	0.003	0.003	0.008	0.007	0.024	0.008	0.007	0.102	0.047	0.061	1.008	0.090	0.009	0.043	0.010	0.003	0.018	0.096	0.003	0.005	0.008	0.027	0.002	0.008	0.006	0.002	0.008	0.003	0.003
4D3	0.006	0.007	0.010	0.022	0.012	0.019	0.083	0.011	0.005	0.068	0.017	0.032	0.012	0.006	0.045	0.073	0.020	0.014	1.036	0.015	0.042	0.008	0.006	0.028	0.033	0.006	0.017	0.042	0.084	0.006	0.015	0.020	0.004	0.024	0.009	0.007
4E	0.003	0.003	0.002	0.034	0.042	0.005	0.012	0.003	0.003	0.034	0.006	0.014	0.004	0.002	0.008	0.006	0.022	0.026	0.008	1.095	0.011	0.004	0.003	0.006	0.006	0.005	0.008	0.016	0.105	0.003	0.010	0.008	0.004	0.012	0.005	0.003
4F1	0.072	0.071	0.061	0.015	0.040	0.050	0.032	0.024	0.046	0.023	0.035	0.027	0.026	0.010	0.019	0.022	0.026	0.030	0.015	0.025	1.083	0.023	0.011	0.069	0.030	0.007	0.012	0.012	0.027	0.008	0.033	0.004	0.005	0.017	0.011	0.015
4F2	0.001	0.002	0.004	0.001	0.001	0.001	0.004	0.002	0.001	0.002	0.003	0.012	0.004	0.001	0.001	0.002	0.002	0.001	0.003	0.003	0.001	1.108	0.078	0.014	0.007	0.000	0.001	0.000	0.001	0.001	0.003	0.000	0.000	0.002	0.003	0.005
4F3	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.002	0.000	0.000	0.001	0.001	0.000	0.000	0.000	0.000	0.001	1.006	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.000
4F4	0.002	0.002	0.010	0.002	0.018	0.003	0.013	0.008	0.002	0.008	0.004	0.012	0.005	0.004	0.009	0.012	0.003	0.007	0.004	0.004	0.017	0.004	0.057	1.008	0.026	0.001	0.003	0.001	0.004	0.003	0.007	0.003	0.000	0.004	0.002	0.003
4F5	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.002	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.003	1.002	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.000
5A1	0.014	0.017	0.010	0.062	0.034	0.019	0.023	0.023	0.014	0.024	0.034	0.021	0.027	0.013	0.025	0.022	0.051	0.050	0.023	0.037	0.034	0.024	0.014	0.027	0.021	1.006	0.077	0.086	0.015	0.014	0.012	0.012	0.034	0.020	0.029	0.060
5A2	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.004	0.002	0.001	0.000	0.000	0.000	0.000	0.002	0.001	0.003	0.001	0.002	0.003	0.002	0.001	0.000	0.001	0.002	0.001	1.000	0.000	0.001	0.001	0.001	0.000	0.000	0.001	0.002	0.001
5A3	0.005	0.006	0.000	0.002	0.006	0.004	0.003	0.003	0.005	0.006	0.001	0.001	0.002	0.001	0.001	0.001	0.002	0.002	0.001	0.003	0.003	0.003	0.001	0.002	0.001	0.000	0.001	1.000	0.002	0.001	0.001	0.001	0.010	0.001	0.012	0.014
6	0.024	0.023	0.013	0.032	0.020	0.026	0.035	0.025	0.019	0.032	0.036	0.023	0.031	0.018	0.018	0.014	0.021	0.021	0.018	0.039	0.028	0.021	0.016	0.023	0.020	0.028	0.053	0.144	1.015	0.023	0.090	0.016	0.040	0.113	0.043	0.012
7	0.065	0.065	0.113	0.063	0.122	0.090	0.106	0.113	0.056	0.125	0.057	0.083	0.062	0.129	0.090	0.080	0.055	0.089	0.063	0.085	0.108	0.041	0.043	0.104	0.099	0.025	0.081	0.047	0.124	1.053	0.075	0.056	0.064	0.035	0.059	0.058
8A1	0.037	0.048	0.036	0.059	0.070	0.082	0.111	0.091	0.062	0.078	0.083	0.072	0.048	0.030	0.074	0.047	0.135	0.107	0.058	0.130	0.058	0.035	0.028	0.041	0.047	0.062	0.137	0.023	0.070	0.042	1.029	0.045	0.014	0.027	0.018	0.017
8A2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	1.000	0.005	0.002	0.000	0.001
9	0.010	0.011	0.015	0.016	0.066	0.018	0.028	0.028	0.019	0.028	0.040	0.037	0.025	0.037	0.032	0.022	0.018	0.034	0.026	0.029	0.031	0.021	0.035	0.034	0.042	0.008	0.024	0.008	0.024	0.109	0.022	0.010	1.083	0.037	0.010	0.050
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000
11A	0.003	0.000	0.000	0.001	0.001	0.002	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.010	1.000	0.000
11B	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.001	0.003	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.001	0.002	0.002	0.000	0.001	0.000	0.000	1.003

TABLE XII-4 INVERSE MATRIX, 36-SECTOR OPEN MODEL: AUSTRALIA

	1	2A	2B	3A	3B	4A1	4A2	4A3	4A4	4A5	4B1	4B2	4B3	4B4	4C1	4C2	4D1	4D2	4D3	4E	4F1	4F2	4F3	4F4	4F5	5A1	5A2	5A3	6	7	8A1	8A2	9	10	11A	11B
1	1.005	0.003	0.005	0.001	0.001	0.623	0.040	0.024	0.027	0.004	0.002	0.008	0.002	0.001	0.002	0.002	0.001	0.001	0.002	0.002	0.004	0.130	0.032	0.025	0.005	0.000	0.002	0.001	0.001	0.002	0.002	0.001	0.001	0.001	0.005	0.006
2A	0.119	1.078	0.004	0.000	0.001	0.109	0.221	0.255	0.375	0.149	0.001	0.004	0.002	0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.003	0.056	0.014	0.007	0.004	0.000	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.002	0.005
2B	0.001	0.002	1.002	0.041	0.007	0.003	0.005	0.003	0.012	0.003	0.211	0.038	0.034	0.005	0.002	0.002	0.004	0.004	0.002	0.003	0.003	0.001	0.003	0.003	0.003	0.004	0.004	0.002	0.010	0.001	0.005	0.001	0.001	0.002	0.001	0.002
3A	0.004	0.004	0.003	1.005	0.005	0.008	0.006	0.005	0.005	0.005	0.004	0.005	0.016	0.004	0.008	0.006	0.041	0.012	0.013	0.019	0.032	0.006	0.003	0.007	0.009	0.058	0.088	0.007	0.007	0.003	0.007	0.002	0.002	0.003	0.004	0.005
3B	0.003	0.003	0.005	0.029	1.024	0.004	0.010	0.003	0.006	0.009	0.003	0.012	0.006	0.004	0.043	0.018	0.099	0.350	0.052	0.090	0.011	0.003	0.003	0.007	0.033	0.003	0.007	0.006	0.036	0.002	0.005	0.008	0.003	0.006	0.002	0.005
4A1	0.008	0.004	0.005	0.001	0.001	1.006	0.062	0.038	0.042	0.005	0.002	0.005	0.002	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.006	0.010	0.005	0.022	0.003	0.001	0.002	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.008	0.008
4A2	0.001	0.001	0.001	0.000	0.000	0.001	1.004	0.018	0.006	0.012	0.000	0.000	0.000	0.000	0.001	0.001	0.005	0.000	0.002	0.000	0.002	0.000	0.000	0.002	0.001	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.002	0.001
4A3	0.009	0.006	0.005	0.000	0.000	0.007	0.008	1.146	0.025	0.003	0.001	0.001	0.006	0.001	0.001	0.000	0.000	0.001	0.000	0.001	0.003	0.003	0.001	0.001	0.001	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.003
4A4	0.020	0.049	0.005	0.000	0.000	0.019	0.063	0.056	1.037	0.066	0.001	0.001	0.001	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.002	0.005	0.001	0.001	0.001	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.002
4A5	0.001	0.000	0.001	0.000	0.001	0.001	0.002	0.001	0.002	1.002	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.002	0.001	0.001	0.001	0.001	0.000	0.001	0.000	0.001	0.008
4B1	0.002	0.004	0.005	0.006	0.002	0.002	0.003	0.003	0.003	0.006	1.027	0.175	0.006	0.002	0.004	0.006	0.003	0.003	0.004	0.003	0.002	0.002	0.001	0.004	0.006	0.001	0.002	0.005	0.045	0.003	0.005	0.001	0.003	0.005	0.002	0.003
4B2	0.001	0.001	0.004	0.001	0.001	0.001	0.002	0.001	0.001	0.002	0.012	1.017	0.001	0.001	0.005	0.003	0.001	0.001	0.002	0.002	0.002	0.001	0.001	0.002	0.002	0.001	0.001	0.004	0.030	0.004	0.002	0.001	0.002	0.005	0.003	0.002
4B3	0.008	0.024	0.006	0.003	0.006	0.012	0.031	0.048	0.026	0.033	0.006	0.013	1.231	0.155	0.012	0.005	0.005	0.007	0.008	0.023	0.017	0.014	0.023	0.017	0.035	0.002	0.008	0.004	0.008	0.022	0.011	0.006	0.005	0.005	0.006	0.031
4B4	0.005	0.006	0.008	0.004	0.008	0.009	0.018	0.017	0.012	0.042	0.010	0.011	0.024	1.029	0.014	0.006	0.007	0.009	0.011	0.010	0.016	0.010	0.013	0.014	0.013	0.006	0.025	0.011	0.009	0.019	0.011	0.006	0.014	0.015	0.018	0.122
4C1	0.018	0.015	0.036	0.031	0.042	0.017	0.017	0.014	0.016	0.014	0.017	0.012	0.015	0.012	1.067	0.039	0.021	0.027	0.030	0.020	0.011	0.011	0.009	0.012	0.021	0.006	0.029	0.017	0.072	0.018	0.012	0.149	0.010	0.040	0.010	0.036
4C2	0.007	0.009	0.025	0.016	0.014	0.011	0.014	0.015	0.013	0.012	0.015	0.012	0.013	0.008	0.016	1.009	0.016	0.015	0.014	0.019	0.010	0.009	0.007	0.009	0.009	0.029	0.010	0.006	0.013	0.026	0.086	0.007	0.003	0.050	0.003	0.010
4D1	0.005	0.005	0.009	0.020	0.022	0.009	0.033	0.007	0.012	0.021	0.008	0.043	0.007	0.006	0.108	0.081	1.010	0.029	0.255	0.029	0.011	0.005	0.005	0.010	0.040	0.005	0.009	0.015	0.056	0.007	0.011	0.021	0.005	0.015	0.004	0.009
4D2	0.003	0.003	0.006	0.006	0.010	0.005	0.013	0.004	0.007	0.008	0.004	0.020	0.006	0.007	0.094	0.031	0.037	1.007	0.086	0.007	0.012	0.006	0.004	0.012	0.065	0.002	0.005	0.007	0.030	0.004	0.005	0.015	0.003	0.008	0.003	0.006
4D3	0.006	0.008	0.010	0.019	0.009	0.024	0.112	0.014	0.034	0.068	0.010	0.037	0.011	0.007	0.050	0.046	0.016	0.013	1.043	0.014	0.016	0.008	0.008	0.018	0.032	0.005	0.017	0.043	0.103	0.008	0.012	0.027	0.010	0.021	0.009	0.015
4E	0.003	0.003	0.003	0.023	0.021	0.009	0.020	0.004	0.007	0.054	0.004	0.018	0.005	0.003	0.010	0.007	0.019	0.019	0.012	1.078	0.011	0.004	0.004	0.007	0.006	0.004	0.006	0.013	0.117	0.003	0.007	0.008	0.008	0.012	0.004	0.007
4F1	0.086	0.086	0.071	0.025	0.048	0.066	0.047	0.044	0.052	0.035	0.037	0.043	0.049	0.029	0.040	0.028	0.037	0.046	0.034	0.042	1.071	0.078	0.041	0.163	0.070	0.011	0.019	0.017	0.044	0.018	0.046	0.012	0.011	0.033	0.033	0.029
4F2	0.003	0.003	0.013	0.002	0.003	0.004	0.014	0.007	0.007	0.007	0.006	0.049	0.008	0.003	0.006	0.008	0.005	0.004	0.009	0.007	0.004	1.194	0.282	0.072	0.027	0.001	0.004	0.002	0.005	0.004	0.008	0.002	0.002	0.006	0.007	0.013
4F3	0.001	0.001	0.002	0.000	0.001	0.001	0.002	0.002	0.002	0.002	0.001	0.003	0.002	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.011	1.080	0.003	0.002	0.001	0.002	0.001	0.001	0.002	0.001	0.001	0.001	0.007	0.001	0.011
4F4	0.004	0.005	0.024	0.005	0.020	0.011	0.039	0.021	0.026	0.015	0.008	0.031	0.012	0.011	0.023	0.026	0.006	0.011	0.011	0.008	0.022	0.010	0.064	1.013	0.065	0.002	0.008	0.005	0.013	0.010	0.017	0.011	0.003	0.011	0.006	0.014
4F5	0.001	0.001	0.002	0.000	0.001	0.001	0.002	0.002	0.001	0.002	0.001	0.002	0.003	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.003	1.004	0.001	0.002	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.002	0.009
5A1	0.011	0.014	0.010	0.046	0.030	0.017	0.021	0.021	0.017	0.019	0.023	0.017	0.030	0.013	0.022	0.018	0.046	0.047	0.027	0.032	0.024	0.020	0.015	0.024	0.018	1.005	0.040	0.072	0.016	0.010	0.011	0.014	0.011	0.016	0.017	0.026
5A2	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.003	0.001	0.001	0.000	0.001	0.000	0.001	0.002	0.002	0.003	0.002	0.003	0.004	0.001	0.001	0.001	0.001	0.002	0.001	1.000	0.000	0.001	0.001	0.001	0.000	0.000	0.001	0.001	0.001
5A3	0.006	0.007	0.002	0.003	0.008	0.006	0.006	0.006	0.006	0.008	0.003	0.003	0.006	0.004	0.004	0.002	0.004	0.004	0.004	0.006	0.005	0.005	0.004	0.004	0.004	0.002	0.005	1.002	0.004	0.005	0.003	0.002	0.038	0.003	0.012	0.021
6	0.019	0.019	0.012	0.020	0.015	0.021	0.025	0.022	0.022	0.022	0.023	0.017	0.028	0.015	0.013	0.009	0.014	0.016	0.015	0.029	0.017	0.019	0.015	0.017	0.015	0.017	0.026	0.106	1.012	0.015	0.052	0.014	0.065	0.090	0.026	0.036
7	0.075	0.074	0.135	0.052	0.068	0.088	0.086	0.102	0.085	0.078	0.057	0.068	0.068	0.087	0.067	0.044	0.048	0.066	0.055	0.074	0.052	0.058	0.044	0.078	0.076	0.019	0.050	0.038	0.113	1.049	0.070	0.061	0.026	0.033	0.035	0.070
8A1	0.029	0.035	0.032	0.039	0.039	0.068	0.077	0.101	0.071	0.062	0.056	0.054	0.038	0.024	0.052	0.033	0.106	0.084	0.061	0.112	0.041	0.038	0.027	0.030	0.037	0.039	0.065	0.020	0.064	0.027	1.023	0.043	0.013	0.029	0.014	0.059
8A2	0.004	0.005	0.007	0.004	0.007	0.007	0.013	0.013	0.010	0.014	0.009	0.009	0.010	0.012	0.011	0.005	0.006	0.008	0.009	0.008	0.010	0.007	0.009	0.010	0.010	0.005	0.023	0.010	0.008	0.016	0.009	1.005	0.014	0.008	0.010	0.113
9	0.022	0.025	0.035	0.023	0.043	0.040	0.069	0.065	0.051	0.069	0.060	0.061	0.058	0.068	0.061	0.034	0.035	0.044	0.052	0.050	0.050	0.042	0.059	0.060	0.069	0.026	0.099	0.042	0.045	0.107	0.051	0.029	1.073	0.044	0.043	0.443
10	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.000	0.000	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.001	0.001	0.000	0.001	0.001	0.000	0.001	0.001	0.000	0.001	1.000	0.001	0.006
11A	0.003	0.001	0.001	0.001	0.001	0.003	0.003	0.003	0.002	0.003	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.004	0.002	0.002	0.003	0.003	0.001	0.003	0.007	1.002	0.021
11B	0.045	0.050	0.073	0.038	0.069	0.077	0.139	0.130	0.099	0.148	0.094	0.094	0.106	0.120	0.115	0.056	0.059	0.079	0.089	0.087	0.099	0.073	0.095	0.100	0.107	0.056	0.240	0.102	0.083	0.169	0.096	0.055	0.137	0.045	0.105	1.179

APPENDIX XIII

INVERSE MATRICES FOR THE DISAGGREGATED TABLES (CLOSED MODEL)

TABLE XIII-1 INVERSE MATRIX, 19-SECTOR CLOSED MODEL: GLADSTONE/CALLIOPE SUBREGION

	1	2A	2B	3A	3B	4A	4B	4C	4D	4E	4F	5	6	7	8	9	10	11A	11B	House-holds
1	1.003	0.001	0.003	0.000	0.002	0.271	0.003	0.003	0.002	0.002	0.000	0.002	0.003	0.004	0.004	0.003	0.005	0.006	0.003	0.008
2A	0.040	1.045	0.003	0.000	0.002	0.023	0.004	0.004	0.002	0.003	0.000	0.003	0.004	0.005	0.005	0.004	0.007	0.007	0.005	0.010
2B	0.000	0.001	1.001	0.000	0.001	0.001	0.069	0.001	0.001	0.003	0.000	0.002	0.003	0.001	0.007	0.001	0.003	0.002	0.001	0.002
3A	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3B	0.000	0.000	0.002	0.000	1.002	0.000	0.001	0.001	0.005	0.121	0.000	0.001	0.015	0.001	0.002	0.001	0.002	0.001	0.001	0.001
4A	0.013	0.004	0.011	0.000	0.006	1.035	0.011	0.011	0.007	0.008	0.000	0.008	0.011	0.013	0.013	0.012	0.020	0.021	0.012	0.028
4B	0.002	0.009	0.010	0.000	0.004	0.005	1.050	0.008	0.003	0.006	0.000	0.005	0.033	0.008	0.012	0.007	0.021	0.017	0.005	0.012
4C	0.002	0.002	0.008	0.000	0.021	0.002	0.003	1.004	0.002	0.005	0.000	0.002	0.009	0.003	0.004	0.002	0.006	0.003	0.003	0.004
4D	0.001	0.001	0.003	0.000	0.007	0.002	0.010	0.069	1.014	0.004	0.000	0.005	0.047	0.003	0.007	0.003	0.012	0.005	0.003	0.002
4E	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.001	1.003	0.000	0.001	0.028	0.001	0.004	0.002	0.004	0.002	0.001	0.001
4F	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	0.003	0.004	0.003	0.000	0.006	0.006	0.006	0.008	0.020	0.005	0.000	1.006	0.005	0.007	0.006	0.012	0.010	0.012	0.017	0.009
6	0.022	0.022	0.019	0.000	0.029	0.026	0.029	0.022	0.009	0.041	0.000	0.052	1.017	0.033	0.130	0.062	0.139	0.067	0.019	0.029
7	0.070	0.077	0.179	0.000	0.155	0.117	0.147	0.128	0.049	0.126	0.000	0.086	0.146	1.185	0.155	0.152	0.185	0.190	0.135	0.242
8	0.036	0.055	0.069	0.000	0.079	0.086	0.100	0.092	0.035	0.192	0.000	0.091	0.096	0.099	1.090	0.079	0.124	0.118	0.076	0.163
9	0.016	0.022	0.045	0.000	0.088	0.046	0.071	0.072	0.025	0.057	0.000	0.040	0.053	0.136	0.075	1.088	0.100	0.083	0.100	0.118
10	0.000	0.001	0.001	0.000	0.001	0.001	0.001	0.002	0.004	0.001	0.000	0.001	0.001	0.002	0.002	0.001	1.003	0.002	0.001	0.004
11A	0.002	0.001	0.003	0.000	0.002	0.003	0.004	0.004	0.004	0.002	0.000	0.003	0.003	0.004	0.004	0.004	0.011	1.006	0.004	0.009
11B	0.007	0.010	0.022	0.000	0.017	0.020	0.029	0.028	0.013	0.020	0.000	0.021	0.027	0.035	0.033	0.030	0.050	0.048	1.032	0.071
House-holds	0.119	0.179	0.386	0.000	0.287	0.343	0.504	0.490	0.211	0.346	0.000	0.371	0.470	0.585	0.585	0.529	0.889	0.844	0.531	1.260

TABLE XIII-2 INVERSE MATRIX, 19-SECTOR CLOSED MODEL: FITZROY REGION

	1	2A	2B	3A	3B	4A	4B	4C	4D	4E	4F	5	6	7	8	9	10	11A	11B	House-holds
1	1.020	0.011	0.022	0.010	0.015	0.417	0.022	0.019	0.014	0.017	0.037	0.017	0.022	0.027	0.028	0.025	0.040	0.041	0.027	0.056
2A	0.100	1.122	0.023	0.012	0.018	0.116	0.027	0.024	0.017	0.021	0.039	0.022	0.028	0.033	0.035	0.032	0.050	0.048	0.032	0.070
2B	0.000	0.000	1.000	0.011	0.002	0.001	0.011	0.000	0.001	0.001	0.001	0.001	0.001	0.000	0.002	0.000	0.001	0.000	0.000	0.000
3A	0.002	0.002	0.002	1.005	0.005	0.005	0.003	0.005	0.044	0.030	0.009	0.094	0.005	0.004	0.008	0.004	0.005	0.006	0.009	0.004
3B	0.001	0.001	0.003	0.008	1.021	0.001	0.001	0.001	0.005	0.121	0.009	0.002	0.016	0.001	0.003	0.001	0.003	0.002	0.001	0.002
4A	0.052	0.028	0.056	0.025	0.037	1.097	0.054	0.047	0.036	0.041	0.072	0.043	0.055	0.067	0.069	0.063	0.100	0.103	0.069	0.140
4B	0.004	0.019	0.011	0.010	0.007	0.007	1.052	0.014	0.005	0.012	0.011	0.006	0.063	0.012	0.017	0.007	0.029	0.018	0.005	0.009
4C	0.012	0.015	0.033	0.023	0.041	0.022	0.027	1.041	0.019	0.032	0.022	0.027	0.034	0.031	0.112	0.028	0.050	0.041	0.028	0.059
4D	0.001	0.002	0.003	0.006	0.007	0.004	0.007	0.038	1.019	0.006	0.027	0.004	0.027	0.003	0.008	0.003	0.009	0.005	0.003	0.003
4E	0.002	0.002	0.004	0.014	0.020	0.004	0.005	0.004	0.004	1.063	0.004	0.006	0.037	0.006	0.010	0.006	0.012	0.009	0.005	0.011
4F	0.002	0.003	0.005	0.002	0.009	0.004	0.005	0.005	0.006	0.005	1.022	0.003	0.004	0.005	0.005	0.004	0.007	0.009	0.006	0.008
5	0.014	0.016	0.013	0.039	0.032	0.020	0.019	0.022	0.031	0.038	0.032	1.021	0.017	0.021	0.022	0.039	0.033	0.043	0.062	0.026
6	0.024	0.023	0.018	0.032	0.023	0.027	0.025	0.018	0.014	0.044	0.029	0.048	1.016	0.031	0.134	0.048	0.134	0.057	0.018	0.023
7	0.086	0.091	0.186	0.083	0.158	0.124	0.134	0.117	0.063	0.123	0.113	0.078	0.155	1.163	0.148	0.137	0.144	0.159	0.118	0.170
8	0.025	0.034	0.030	0.038	0.047	0.056	0.042	0.036	0.024	0.115	0.035	0.051	0.046	0.042	1.034	0.027	0.036	0.032	0.024	0.034
9	0.015	0.018	0.035	0.022	0.055	0.032	0.047	0.039	0.026	0.039	0.039	0.029	0.041	0.113	0.050	1.087	0.083	0.059	0.065	0.080
10	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.002	0.002	0.001	1.002	0.002	0.001	0.003
11A	0.005	0.003	0.006	0.004	0.005	0.006	0.007	0.006	0.007	0.006	0.005	0.006	0.008	0.009	0.010	0.010	0.026	1.013	0.008	0.019
11B	0.006	0.008	0.016	0.009	0.014	0.014	0.020	0.017	0.013	0.015	0.014	0.016	0.020	0.026	0.026	0.023	0.036	0.034	1.025	0.050
House-holds	0.145	0.194	0.385	0.211	0.313	0.330	0.465	0.406	0.292	0.355	0.319	0.377	0.477	0.570	0.599	0.549	0.863	0.818	0.522	1.212

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TABLE XIII-3 INVERSE MATRIX, 36-SECTOR CLOSED MODEL: QUEENSLAND

	1	2A	2B	3A	3B	4A1	4A2	4A3	4A4	4A5	4B1	4B2	4B3	4B4	4C1	4C2	4D1	4D2
1	1.019	0.018	0.032	0.019	0.026	0.628	0.073	0.069	0.024	0.031	0.036	0.042	0.027	0.039	0.037	0.034	0.029	0.027
2A	0.142	1.153	0.059	0.036	0.049	0.159	0.321	0.237	0.747	0.202	0.069	0.076	0.052	0.076	0.070	0.065	0.056	0.052
2B	0.001	0.003	1.003	0.042	0.007	0.004	0.005	0.003	0.003	0.004	0.156	0.038	0.018	0.004	0.004	0.005	0.005	0.005
3A	0.003	0.004	0.004	1.006	0.006	0.007	0.006	0.006	0.004	0.006	0.007	0.006	0.012	0.005	0.007	0.007	0.047	0.013
3B	0.003	0.003	0.006	0.039	1.027	0.004	0.007	0.004	0.004	0.007	0.005	0.012	0.006	0.005	0.038	0.019	0.036	0.349
4A1	0.030	0.028	0.049	0.030	0.041	1.044	0.118	0.111	0.038	0.049	0.056	0.065	0.041	0.062	0.057	0.053	0.045	0.043
4A2	0.004	0.005	0.008	0.005	0.007	0.007	1.011	0.034	0.006	0.036	0.009	0.010	0.007	0.010	0.010	0.009	0.016	0.007
4A3	0.020	0.009	0.017	0.008	0.010	0.019	0.019	1.248	0.011	0.013	0.015	0.016	0.022	0.016	0.014	0.013	0.011	0.011
4A4	0.051	0.036	0.040	0.024	0.032	0.055	0.101	0.101	1.041	0.160	0.045	0.049	0.033	0.049	0.046	0.042	0.036	0.034
4A5	0.003	0.003	0.005	0.003	0.004	0.005	0.006	0.007	0.004	1.006	0.006	0.007	0.005	0.007	0.006	0.006	0.005	0.005
4B1	0.005	0.013	0.011	0.013	0.007	0.007	0.010	0.009	0.011	0.013	1.076	0.244	0.014	0.008	0.010	0.022	0.010	0.008
4B2	0.003	0.004	0.007	0.004	0.004	0.004	0.005	0.005	0.004	0.006	0.035	1.026	0.005	0.005	0.007	0.010	0.005	0.004
4B3	0.009	0.034	0.009	0.006	0.014	0.012	0.027	0.032	0.025	0.031	0.011	0.016	1.134	0.084	0.014	0.010	0.008	0.011
4B4	0.006	0.008	0.011	0.007	0.010	0.010	0.015	0.016	0.010	0.024	0.014	0.015	0.026	1.036	0.015	0.013	0.011	0.011
4C1	0.015	0.014	0.030	0.025	0.059	0.016	0.016	0.015	0.013	0.014	0.023	0.017	0.016	0.015	1.042	0.052	0.021	0.031
4C2	0.010	0.014	0.035	0.023	0.023	0.019	0.026	0.025	0.016	0.023	0.038	0.028	0.027	0.022	0.029	1.024	0.029	0.026
4D1	0.002	0.002	0.004	0.008	0.015	0.003	0.008	0.003	0.002	0.007	0.005	0.013	0.003	0.003	0.036	0.041	1.005	0.012
4D2	0.006	0.006	0.009	0.008	0.018	0.007	0.013	0.007	0.006	0.011	0.010	0.027	0.011	0.011	0.105	0.050	0.063	1.011
4D3	0.009	0.010	0.016	0.025	0.017	0.024	0.089	0.019	0.010	0.074	0.024	0.040	0.018	0.014	0.052	0.080	0.026	0.020
4E	0.004	0.004	0.005	0.035	0.044	0.007	0.015	0.006	0.005	0.036	0.008	0.017	0.006	0.005	0.011	0.008	0.024	0.028
4F1	0.077	0.078	0.072	0.022	0.050	0.060	0.044	0.039	0.055	0.035	0.049	0.042	0.037	0.026	0.034	0.035	0.037	0.041
4F2	0.002	0.003	0.006	0.002	0.003	0.003	0.006	0.004	0.003	0.004	0.005	0.015	0.005	0.003	0.004	0.004	0.004	0.003
4F3	0.001	0.001	0.002	0.001	0.002	0.002	0.002	0.003	0.002	0.002	0.003	0.004	0.003	0.003	0.003	0.003	0.003	0.002
4F4	0.003	0.004	0.014	0.005	0.021	0.006	0.017	0.012	0.005	0.011	0.008	0.017	0.008	0.009	0.013	0.016	0.006	0.011
4F5	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.001	0.001	0.001
5A1	0.022	0.028	0.028	0.074	0.050	0.035	0.042	0.047	0.029	0.042	0.056	0.046	0.043	0.039	0.048	0.043	0.069	0.067
5A2	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.006	0.002	0.002	0.002	0.002	0.001	0.002	0.003	0.003	0.004	0.002
5A3	0.007	0.008	0.005	0.005	0.010	0.008	0.008	0.008	0.009	0.011	0.007	0.007	0.006	0.007	0.007	0.006	0.006	0.007
6	0.030	0.032	0.028	0.041	0.033	0.038	0.051	0.045	0.031	0.048	0.054	0.044	0.045	0.038	0.037	0.031	0.036	0.035
7	0.118	0.138	0.232	0.142	0.228	0.192	0.234	0.269	0.155	0.247	0.206	0.246	0.170	0.295	0.242	0.221	0.173	0.201
8A1	0.053	0.070	0.073	0.083	0.103	0.114	0.151	0.140	0.093	0.117	0.130	0.122	0.082	0.082	0.121	0.091	0.172	0.142
8A2	0.004	0.005	0.008	0.005	0.007	0.007	0.009	0.010	0.012	0.009	0.010	0.010	0.007	0.011	0.010	0.009	0.008	0.007
9	0.040	0.053	0.083	0.061	0.126	0.076	0.101	0.117	0.076	0.099	0.125	0.130	0.087	0.132	0.120	0.103	0.085	0.098
10	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.002	0.002	0.001	0.002	0.002	0.002	0.001	0.001
11A	0.011	0.011	0.018	0.013	0.017	0.017	0.020	0.024	0.016	0.019	0.023	0.025	0.017	0.025	0.023	0.022	0.018	0.017
11B	0.012	0.016	0.026	0.017	0.024	0.023	0.029	0.035	0.025	0.028	0.033	0.036	0.024	0.037	0.034	0.031	0.026	0.025
House-holds	0.230	0.314	0.514	0.340	0.458	0.440	0.556	0.674	0.430	0.531	0.645	0.704	0.469	0.720	0.660	0.610	0.509	0.488

	4D3	4E	4F1	4F2	4F3	4F4	4F5	5A1	5A2	5A3	6	7	8A1	8A2	9	10	11A	11B	House-holds
1	0.031	0.034	0.034	0.080	0.044	0.101	0.036	0.025	0.038	0.031	0.040	0.039	0.039	0.035	0.037	0.058	0.060	0.037	0.079
2A	0.061	0.066	0.052	0.070	0.072	0.073	0.069	0.049	0.074	0.061	0.076	0.075	0.074	0.068	0.073	0.112	0.109	0.073	0.154
2B	0.003	0.005	0.003	0.002	0.005	0.006	0.004	0.005	0.007	0.003	0.011	0.003	0.007	0.003	0.003	0.005	0.004	0.003	0.004
3A	0.007	0.022	0.019	0.005	0.004	0.006	0.010	0.060	0.092	0.010	0.007	0.006	0.008	0.004	0.005	0.006	0.007	0.009	0.006
3B	0.034	0.078	0.023	0.005	0.003	0.009	0.043	0.005	0.008	0.007	0.029	0.003	0.007	0.005	0.003	0.008	0.005	0.004	0.004
4A1	0.049	0.053	0.054	0.047	0.063	0.145	0.056	0.039	0.060	0.049	0.062	0.062	0.061	0.055	0.059	0.091	0.095	0.057	0.124
4A2	0.009	0.009	0.013	0.007	0.009	0.010	0.009	0.006	0.010	0.008	0.010	0.010	0.010	0.009	0.010	0.015	0.017	0.010	0.020
4A3	0.012	0.014	0.018	0.014	0.015	0.014	0.014	0.010	0.015	0.012	0.016	0.015	0.015	0.014	0.015	0.023	0.022	0.014	0.031
4A4	0.039	0.043	0.034	0.036	0.045	0.042	0.043	0.032	0.048	0.040	0.050	0.049	0.048	0.044	0.047	0.073	0.070	0.047	0.100
4A5	0.006	0.006	0.005	0.005	0.006	0.006	0.006	0.004	0.007	0.006	0.007	0.007	0.007	0.006	0.007	0.010	0.010	0.016	0.014
4B1	0.009	0.010	0.008	0.006	0.007	0.013	0.012	0.006	0.010	0.013	0.063	0.009	0.015	0.007	0.008	0.017	0.012	0.007	0.012
4B2	0.006	0.006	0.006	0.004	0.005	0.007	0.007	0.004	0.006	0.008	0.035	0.009	0.008	0.005	0.006	0.017	0.011	0.005	0.009
4B3	0.010	0.025	0.025	0.017	0.024	0.017	0.026	0.006	0.010	0.008	0.012	0.022	0.016	0.010	0.008	0.016	0.013	0.012	0.015
4B4	0.013	0.013	0.016	0.014	0.015	0.014	0.014	0.010	0.015	0.012	0.015	0.016	0.015	0.014	0.014	0.046	0.032	0.014	0.030
4C1	0.023	0.023	0.021	0.012	0.013	0.016	0.021	0.011	0.025	0.017	0.044	0.015	0.019	0.049	0.013	0.035	0.020	0.023	0.022
4C2	0.023	0.035	0.036	0.019	0.020	0.022	0.022	0.041	0.030	0.018	0.026	0.021	0.096	0.019	0.018	0.054	0.025	0.018	0.032
4D1	0.064	0.015	0.009	0.002	0.003	0.005	0.012	0.003	0.004	0.005	0.014	0.003	0.006	0.004	0.002	0.007	0.003	0.003	0.003
4D2	0.092	0.012	0.045	0.012	0.007	0.020	0.099	0.005	0.008	0.011	0.030	0.005	0.011	0.009	0.005	0.013	0.008	0.006	0.007
4D3	1.042	0.022	0.047	0.013	0.014	0.034	0.040	0.011	0.025	0.048	0.092	0.014	0.023	0.027	0.012	0.036	0.021	0.014	0.017
4E	0.010	1.098	0.013	0.006	0.006	0.008	0.008	0.007	0.011	0.018	0.108	0.006	0.013	0.011	0.007	0.017	0.010	0.006	0.006
4F1	0.027	0.039	1.093	0.033	0.025	0.081	0.044	0.017	0.027	0.024	0.043	0.023	0.048	0.018	0.020	0.040	0.033	0.030	0.032
4F2	0.005	0.005	0.003	1.109	0.080	0.016	0.010	0.002	0.003	0.003	0.004	0.004	0.005	0.003	0.003	0.006	0.007	0.008	0.005
4F3	0.002	0.003	0.002	0.003	1.009	0.005	0.003	0.002	0.003	0.002	0.003	0.003	0.003	0.003	0.003	0.008	0.004	0.003	0.006
4F4	0.008	0.008	0.020	0.007	0.062	1.012	0.031	0.004	0.007	0.005	0.009	0.007	0.012	0.008	0.005	0.012	0.009	0.008	0.010
4F5	0.001	0.001	0.001	0.001	0.002	0.004	1.003	0.001	0.001	0.001	0.002	0.002	0.001	0.001	0.001	0.002	0.003	0.001	0.002
5A1	0.044	0.058	0.049	0.041	0.038	0.047	0.043	1.022	0.101	0.106	0.040	0.039	0.037	0.035	0.059	0.057	0.064	0.084	0.051
5A2	0.003	0.004	0.002	0.002	0.002	0.002	0.003	0.002	1.002	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.004	0.002	0.003
5A3	0.006	0.008	0.006	0.007	0.007	0.007	0.007	0.004	0.007	1.005	0.008	0.007	0.007	0.006	0.016	0.010	0.021	0.020	0.013
6	0.035	0.057	0.041	0.036	0.035	0.039	0.038	0.041	0.073	0.161	1.035	0.043	0.110	0.035	0.060	0.143	0.073	0.031	0.042
7	0.195	0.228	0.207	0.155	0.195	0.235	0.244	0.131	0.243	0.179	0.290	1.216	0.237	0.206	0.224	0.281	0.294	0.213	0.337
8A1	0.100	0.175	0.089	0.071	0.076	0.082	0.092	0.095	0.188	0.065	0.122	0.093	1.080	0.091	0.064	0.103	0.092	0.065	0.105
8A2	0.008	0.009	0.006	0.007	0.010	0.008	0.009	0.007	0.010	0.008	0.011	0.011	0.010	1.010	0.015	0.017	0.015	0.010	0.021
9	0.101	0.111	0.088	0.086	0.122	0.108	0.125	0.069	0.117	0.083	0.119	0.202	0.114	0.096	1.174	0.177	0.144	0.138	0.193
10	0.001	0.002	0.001	0.001	0.002	0.001	0.002	0.001	0.002	0.001	0.002	0.002	0.002	0.002	0.002	1.003	0.003	0.002	0.004
11A	0.020	0.022	0.015	0.018	0.023	0.020	0.022	0.016	0.025	0.020	0.025	0.025	0.026	0.023	0.025	0.048	1.036	0.024	0.051
11B	0.029	0.032	0.022	0.025	0.033	0.029	0.032	0.024	0.036	0.029	0.037	0.038	0.037	0.033	0.035	0.054	0.052	1.037	0.074
House-holds	0.571	0.618	0.429	0.493	0.657	0.565	0.624	0.460	0.702	0.573	0.719	0.708	0.699	0.648	0.689	1.059	1.016	0.668	1.458

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TABLE XIII-4 INVERSE MATRIX, 36-SECTOR CLOSED MODEL: AUSTRALIA

	1	2A	2B	3A	3B	4A1	4A2	4A3	4A4	4A5	4B1	4B2	4B3	4B4	4C1	4C2	4D1	4D2
1	1.024	0.024	0.039	0.045	0.040	0.652	0.079	0.066	0.061	0.038	0.045	0.055	0.039	0.048	0.049	0.042	0.043	0.036
2A	0.136	1.098	0.036	0.041	0.036	0.135	0.257	0.293	0.406	0.180	0.041	0.046	0.037	0.044	0.045	0.038	0.039	0.033
2B	0.003	0.004	1.004	0.045	0.011	0.006	0.008	0.006	0.014	0.006	0.215	0.042	0.037	0.009	0.006	0.005	0.007	0.007
3A	0.006	0.006	0.007	1.010	0.009	0.011	0.011	0.009	0.009	0.009	0.009	0.010	0.020	0.009	0.013	0.010	0.046	0.016
3B	0.004	0.005	0.008	0.033	1.028	0.007	0.013	0.007	0.009	0.013	0.007	0.017	0.009	0.008	0.047	0.022	0.102	0.354
4A1	0.034	0.035	0.056	0.064	0.058	1.049	0.119	0.099	0.091	0.055	0.065	0.072	0.056	0.069	0.070	0.060	0.061	0.052
4A2	0.006	0.007	0.010	0.013	0.011	0.010	1.014	0.030	0.015	0.022	0.012	0.013	0.011	0.013	0.014	0.012	0.017	0.010
4A3	0.019	0.018	0.024	0.024	0.021	0.023	0.029	1.169	0.043	0.022	0.025	0.026	0.026	0.026	0.026	0.022	0.023	0.020
4A4	0.027	0.057	0.019	0.018	0.016	0.031	0.079	0.073	1.050	0.080	0.019	0.019	0.016	0.019	0.020	0.016	0.017	0.014
4A5	0.011	0.012	0.020	0.025	0.022	0.018	0.023	0.025	0.020	1.021	0.025	0.026	0.022	0.027	0.027	0.023	0.024	0.020
4B1	0.003	0.006	0.009	0.010	0.006	0.005	0.007	0.007	0.006	0.010	1.031	0.180	0.010	0.006	0.009	0.010	0.007	0.006
4B2	0.006	0.007	0.013	0.012	0.011	0.009	0.011	0.012	0.010	0.011	0.023	1.028	0.011	0.013	0.017	0.013	0.011	0.010
4B3	0.014	0.031	0.018	0.018	0.019	0.022	0.045	0.063	0.038	0.045	0.021	0.029	1.244	0.170	0.029	0.018	0.019	0.019
4B4	0.015	0.018	0.027	0.028	0.029	0.025	0.040	0.040	0.030	0.061	0.034	0.036	0.045	1.054	0.040	0.028	0.029	0.028
4C1	0.029	0.028	0.057	0.057	0.066	0.034	0.041	0.040	0.036	0.035	0.043	0.040	0.037	0.040	1.096	0.064	0.046	0.048
4C2	0.018	0.023	0.047	0.044	0.039	0.030	0.039	0.042	0.035	0.034	0.043	0.041	0.037	0.038	0.047	1.035	0.042	0.038
4D1	0.009	0.010	0.017	0.030	0.031	0.016	0.042	0.016	0.020	0.028	0.017	0.053	0.015	0.016	0.119	0.090	1.019	0.036
4D2	0.006	0.006	0.010	0.012	0.016	0.009	0.018	0.009	0.012	0.013	0.010	0.026	0.011	0.013	0.100	0.036	0.043	1.011
4D3	0.013	0.015	0.022	0.034	0.023	0.034	0.125	0.029	0.046	0.080	0.025	0.053	0.024	0.023	0.067	0.060	0.031	0.026
4E	0.006	0.006	0.008	0.029	0.027	0.014	0.026	0.010	0.011	0.059	0.011	0.025	0.010	0.009	0.016	0.013	0.025	0.024
4F1	0.103	0.106	0.103	0.065	0.084	0.093	0.083	0.083	0.083	0.067	0.077	0.085	0.084	0.072	0.083	0.065	0.075	0.078
4F2	0.013	0.015	0.032	0.026	0.024	0.020	0.035	0.030	0.025	0.026	0.030	0.075	0.028	0.029	0.032	0.030	0.028	0.023
4F3	0.017	0.020	0.034	0.041	0.037	0.028	0.038	0.040	0.033	0.033	0.041	0.045	0.037	0.045	0.046	0.039	0.039	0.033
4F4	0.012	0.014	0.039	0.023	0.036	0.023	0.055	0.038	0.040	0.030	0.026	0.050	0.027	0.030	0.043	0.042	0.023	0.025
4F5	0.002	0.003	0.005	0.005	0.005	0.004	0.006	0.006	0.005	0.005	0.005	0.006	0.006	0.007	0.006	0.005	0.005	0.004
5A1	0.021	0.027	0.030	0.071	0.053	0.034	0.043	0.045	0.037	0.039	0.048	0.044	0.051	0.040	0.049	0.041	0.070	0.067
5A2	0.002	0.002	0.004	0.005	0.004	0.003	0.005	0.007	0.004	0.004	0.004	0.005	0.004	0.005	0.006	0.005	0.007	0.005
5A3	0.010	0.012	0.009	0.013	0.016	0.012	0.015	0.015	0.014	0.016	0.013	0.013	0.014	0.014	0.014	0.011	0.013	0.012
6	0.028	0.029	0.029	0.041	0.034	0.035	0.044	0.043	0.039	0.039	0.044	0.039	0.046	0.038	0.037	0.029	0.034	0.033
7	0.164	0.180	0.306	0.269	0.260	0.233	0.279	0.310	0.252	0.247	0.271	0.296	0.252	0.319	0.301	0.245	0.251	0.238
8A1	0.054	0.065	0.080	0.100	0.093	0.108	0.131	0.159	0.118	0.110	0.116	0.117	0.090	0.089	0.118	0.090	0.164	0.132
8A2	0.014	0.016	0.025	0.026	0.027	0.022	0.033	0.034	0.027	0.032	0.031	0.033	0.029	0.036	0.035	0.026	0.027	0.025
9	0.105	0.122	0.194	0.223	0.220	0.174	0.247	0.257	0.205	0.226	0.257	0.271	0.229	0.282	0.278	0.219	0.223	0.203
10	0.001	0.002	0.003	0.003	0.003	0.002	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.004	0.003	0.003	0.003
11A	0.022	0.023	0.037	0.047	0.042	0.033	0.043	0.046	0.037	0.038	0.047	0.050	0.041	0.051	0.051	0.043	0.044	0.038
11B	0.110	0.126	0.197	0.195	0.208	0.182	0.278	0.280	0.220	0.271	0.248	0.259	0.240	0.287	0.284	0.201	0.206	0.204
Households	0.338	0.401	0.651	0.824	0.729	0.552	0.733	0.787	0.634	0.644	0.812	0.865	0.702	0.880	0.891	0.760	0.773	0.654

	4D3	4E	4F1	4F2	4F3	4F4	4F5	5A1	5A2	5A3	6	7	8A1	8A2	9	10	11A	11B	Households
1	0.049	0.044	0.030	0.166	0.078	0.064	0.049	0.030	0.048	0.038	0.051	0.047	0.045	0.046	0.029	0.062	0.069	0.049	0.089
2A	0.044	0.040	0.026	0.089	0.056	0.043	0.044	0.027	0.044	0.034	0.046	0.042	0.040	0.042	0.027	0.056	0.060	0.043	0.081
2B	0.006	0.007	0.005	0.004	0.007	0.006	0.007	0.006	0.008	0.005	0.014	0.005	0.008	0.005	0.003	0.006	0.006	0.006	0.007
3A	0.018	0.024	0.035	0.010	0.008	0.012	0.014	0.061	0.093	0.011	0.013	0.008	0.011	0.008	0.005	0.010	0.011	0.009	0.010
3B	0.057	0.093	0.014	0.007	0.007	0.010	0.037	0.006	0.011	0.010	0.040	0.007	0.009	0.012	0.006	0.012	0.008	0.008	0.008
4A1	0.069	0.062	0.043	0.062	0.071	0.079	0.066	0.043	0.069	0.054	0.074	0.068	0.064	0.066	0.042	0.089	0.099	0.069	0.128
4A2	0.015	0.012	0.010	0.010	0.013	0.013	0.013	0.008	0.013	0.011	0.015	0.013	0.012	0.013	0.008	0.017	0.020	0.013	0.025
4A3	0.026	0.023	0.017	0.023	0.026	0.022	0.024	0.016	0.026	0.020	0.027	0.025	0.024	0.025	0.016	0.033	0.035	0.025	0.047
4A4	0.019	0.017	0.012	0.019	0.020	0.017	0.018	0.012	0.019	0.015	0.020	0.019	0.018	0.018	0.012	0.024	0.026	0.019	0.035
4A5	0.027	0.024	0.015	0.021	0.026	0.023	0.025	0.017	0.027	0.021	0.028	0.026	0.025	0.026	0.017	0.034	0.036	0.031	0.049
4B1	0.008	0.007	0.004	0.005	0.006	0.008	0.011	0.004	0.007	0.009	0.050	0.007	0.009	0.006	0.006	0.011	0.008	0.007	0.009
4B2	0.014	0.012	0.008	0.010	0.013	0.011	0.013	0.008	0.013	0.013	0.042	0.015	0.013	0.013	0.009	0.020	0.019	0.013	0.022
4B3	0.024	0.037	0.025	0.027	0.038	0.030	0.050	0.012	0.024	0.017	0.025	0.037	0.025	0.021	0.014	0.026	0.028	0.046	0.030
4B4	0.036	0.033	0.030	0.030	0.038	0.035	0.036	0.022	0.050	0.031	0.036	0.044	0.034	0.031	0.030	0.048	0.053	0.145	0.048
4C1	0.058	0.046	0.026	0.033	0.036	0.036	0.048	0.024	0.057	0.039	0.102	0.046	0.039	0.177	0.027	0.077	0.049	0.061	0.054
4C2	0.044	0.046	0.027	0.032	0.036	0.034	0.038	0.048	0.039	0.030	0.045	0.055	0.114	0.036	0.021	0.088	0.044	0.037	0.057
4D1	0.265	0.038	0.017	0.013	0.015	0.018	0.050	0.012	0.019	0.023	0.066	0.016	0.021	0.031	0.011	0.028	0.018	0.018	0.019
4D2	0.093	0.013	0.016	0.010	0.010	0.017	0.070	0.006	0.011	0.012	0.037	0.010	0.011	0.021	0.007	0.016	0.011	0.012	0.012
4D3	1.060	0.029	0.025	0.021	0.024	0.032	0.047	0.015	0.033	0.055	0.120	0.024	0.027	0.043	0.020	0.042	0.031	0.030	0.031
4E	0.019	1.084	0.015	0.010	0.011	0.013	0.012	0.008	0.012	0.019	0.124	0.009	0.014	0.014	0.012	0.020	0.013	0.013	0.013
4F1	0.077	0.081	1.094	0.011	0.083	0.199	0.110	0.038	0.061	0.051	0.090	0.060	0.086	0.053	0.037	0.089	0.091	0.068	0.081
4F2	0.034	0.030	0.018	1.214	0.307	0.093	0.051	0.017	0.029	0.022	0.033	0.029	0.032	0.027	0.017	0.039	0.042	0.036	0.048
4F3	0.044	0.040	0.025	0.045	1.122	0.039	0.042	0.028	0.045	0.035	0.047	0.044	0.041	0.043	0.027	0.063	0.060	0.050	0.082
4F4	0.030	0.025	0.032	0.025	0.083	1.029	0.083	0.015	0.027	0.020	0.034	0.029	0.035	0.030	0.014	0.036	0.032	0.032	0.037
4F5	0.006	0.005	0.004	0.004	0.007	0.007	1.008	0.003	0.007	0.005	0.006	0.007	0.005	0.005	0.004	0.007	0.008	0.013	0.009
5A1	0.054	0.057	0.039	0.041	0.041	0.047	0.044	1.022	0.066	0.093	0.045	0.036	0.035	0.040	0.027	0.051	0.053	0.050	0.051
5A2	0.007	0.008	0.004	0.004	0.005	0.005	0.006	0.004	1.005	0.004	0.006	0.005	0.005	0.005	0.003	0.007	0.008	0.005	0.008
5A3	0.014	0.015	0.010	0.013	0.014	0.012	0.014	0.008	0.015	1.010	0.015	0.015	0.013	0.012	0.044	0.016	0.026	0.031	0.019
6	0.038	0.049	0.029	0.036	0.038	0.036	0.037	0.031	0.049	0.124	1.036	0.037	0.073	0.036	0.079	0.120	0.057	0.056	0.043
7	0.286	0.283	0.179	0.236	0.270	0.272	0.293	0.165	0.279	0.219	0.359	1.272	0.283	0.285	0.166	0.331	0.347	0.279	0.437
8A1	0.126	0.171	0.076	0.088	0.091	0.085	0.098	0.080	0.129	0.071	0.133	0.090	1.083	0.106	0.052	0.112	0.102	0.117	0.123
8A2	0.032	0.030	0.023	0.025	0.033	0.030	0.033	0.021	0.047	0.029	0.033	0.039	0.031	1.028	0.028	0.038	0.042	0.135	0.045
9	0.265	0.243	0.167	0.205	0.268	0.239	0.269	0.161	0.312	0.209	0.272	0.313	0.248	0.236	1.202	0.319	0.332	0.636	0.403
10	0.003	0.003	0.002	0.003	0.003	0.003	0.003	0.002	0.004	0.003	0.003	0.004	0.003	0.003	0.002	1.004	0.004	0.009	0.005
11A	0.050	0.045	0.028	0.039	0.049	0.042	0.047	0.032	0.053	0.040	0.053	0.050	0.048	0.048	0.032	0.069	1.067	0.065	0.092
11B	0.256	0.238	0.191	0.202	0.258	0.240	0.264	0.162	0.406	0.234	0.261	0.330	0.251	0.217	0.238	0.260	0.331	1.330	0.316
Households	0.877	0.792	0.483	0.674	0.861	0.736	0.823	0.556	0.873	0.689	0.936	0.847	0.810	0.851	0.532	1.131	1.186	0.793	1.659