THE NATURE OF AUSTRALIAN REGIONAL INPUT–OUTPUT MULTIPLIERS

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This paper presents the first general analysis of the multipliers derived from twenty-nine Australian regional (GRIT) input-output tables, ranging from metropolitan areas to quite isolated regions. The study attempts to summarise the formidable array of results, aiming to provide an empirical reference point for research into regional multipliers, to identify any regularities in the multiplier components and to suggest conclusions for general policy purposes.

INTRODUCTION

In 1977 a research team produced, for the Queensland government, a report containing input-output tables for the state and regions of Queensland. The report presented a new "hybrid" technique, involving both survey and non-survey methods of assembling regional input-output tables, and was termed the Generation of Regional Input-Output Tables or simply GRIT.[1] Reports have since been produced for the governments of South Australia and the Northern Territory[2], and for Victoria.[3] These later studies incorporated a significantly modified and improved methodology of table derivation which has been termed GRIT II.[4] These reports present in total twenty-nine regional input-output tables, ranging from metropolitan areas to quite isolated regions. Although these tables are, due to some differences in the methods of derivation, not strictly comparable in a partitive sense, they are regarded here as independent observations of regional economic structure for the purposes of a general analysis of regional multipliers.[5]

Previous studies of multiplier structure or behaviour have been limited to observations of multipliers derived from a small number of tables.[6] These limits have not occurred because of a dearth of regional input-output tables, but due to the problems inherent in comparison of tables derived by different accounting conventions and levels of aggregation. One feature of the GRIT tables has been the production of tables which are uniform in all accounting

aspects; each table has been produced in an eleven-sector format in producers' prices with direct allocation of all imports.[7]

This paper presents the first general analysis of the multipliers derived from the University of Queensland GRIT studies; other tables of GRIT derivation are not included in the analysis.[8] The analysis is based on three objectives, namely (i) to provide an empirical reference point for research involving regional multipliers by the presentation of average values of various multipliers and their components, (ii) to isolate any general features or regularities which exist in the range of multipliers available, in terms of both multiplier components and sectoral multiplier incidence, and (iii) to suggest some major conclusions for policy purposes. These conclusions are relevant to science and technology policy in that they consistently emphasise the relative importance of service and information activities, compared with manufacturing, in employment flow-on effects. The GRIT input-output tables and their associated multipliers have been, and continue to be, applied in numerous empirical and policy studies, most of which are unpublished planning/impact studies by consultants and governments. These studies include impact studies of the information and communication sectors, technical change and innovation, and in the area of policy formation. The non-technical format of the paper is intended to ensure that the results of this general multiplier analysis are more accessible to those primarily concerned with the more empirical and pragmatic aspects of economic policy and analysis.

SOME PRELIMINARY RESERVATIONS

Three points need to be mentioned with respect to the multipliers developed in the GRIT system and used as the empirical basis of this study.[9] Firstly, the multipliers are derived from static input-output tables and are essentially short-term in nature. No element of dynamism in either the Leontief dynamic inverse[10] or the Miernyk[11] simulation sense is present in the multipliers which are estimated also from impacts measured only in terms of current inputs. Although Miernyk has suggested the use of similar multipliers for long-range forecasting, the usual interpretation of the input-output multiplier is in the short-term, for example in the context of regional stabilisation policy.[12] The extent to which it is justifiable to draw longer-term conclusions from these multipliers will vary with individual studies and circumstances.

A second important point refers to the question of the accuracy of

both input-output tables and multipliers. The GRIT system rests on a notion of holistic accuracy which attempts to ensure accuracy of the table as a whole and concentrates research resources on those elements of the table with more influence on the various multipliers. This notion suggests that certain cells in the input-output table are insignificant in an operational sense and do not warrant the attention of expensive research resources. This means that multipliers discussed later in this paper should not be attributed the degree of accuracy suggested by the precision of their expression. Such a caveat should, presumably, accompany all economic research.

A third point refers to more specific aspects of multiplier accuracy. The GRIT procedure can be expected to result in some (yet to be analysed or estimated) systematic multiplier errors. The extent to which these errors are relevant to the peculiar inter-regional trading pattern in Australia is unknown. The research teams involved in the production of the GRIT tables could simply express more confidence in those tables which contained larger proportions of more reliable superior data.[14] Associated with these sources of potential but unknown levels of error are some known sources of error. One of these derives from the definition of household income simply as wages and salaries, and omitting other sources of household income such as drawings, profit and dividends, etc. This was decided as a matter of statistical convenience, but has unquestionably resulted in a significant underestimation of the consumption-induced effect, particularly in the agricultural and pastoral sectors.[15]

For these reasons the decision was taken not to treat the regional tables as homogenous in a derivative sense and as directly comparable region-to-region. Such a comparison would need to await table production on a more uniform basis. Rather the analysis below is limited to a view of the structure of multipliers in a sectoral and disaggregated sense, and on the basis of broad groupings of regional types. The tables available were considered as observations of regional economic structure rather than as comparable in detail.

CHARACTERISTICS OF INPUT-OUTPUT MULTIPLIERS

This section provides some general observations on regional economic structure and then considers in some detail the nature of output, income and employment multipliers. The first observation for the purposes of multiplier comparison draws attention to the

very high degree of variation in the economic structure of the Australian regions represented by available input-output tables (See Appendix I). These range in type from state and metropolitan to very isolated regions with low levels of economic activity. Some regions are dominated by mining, others by rural industries, and others by the supply of services.

The degree of diversity in Australian regions is illustrated in Table 1. In terms of size, the transactions total varies from $210m for the Central West region in Queensland to nearly $46,000m for the Melbourne region; the former is less than one half of one per cent of the latter. Part B of Table 1 shows similarly large disparities in the level of value added by sectors at the regional level, most of which are illustrated again by the same two regions. For example, value added by the Trade sector in the Central West is about $5.5m, and in the Melbourne region about $1534m. These figures illustrate simply one aspect of the diversity between Australian regions by contrasting the small-scale level of operation in remoter regions with the large-scale industry of the metropolitan regional economies.

Part A of Table 1 lists the extremes of the percentage contribution to regional value added by each sector. For example, the Animal Industries sector provides a remarkable 59.4 per cent of total value added in the Central Western region, compared to 0.1 per cent in the metropolitan economies of Adelaide and Darwin. A similarly notable difference occurs in the Mining sector. All sectors show considerable ranges between upper and lower values of contributions. Such striking differences between the economic structure of regions, probably more noticeable than differences between nations, are inevitably accompanied by significant differences in the cost structure of sectors and in sector multipliers between regions. These differences are not discussed in this paper, and tend to be submerged in the discussion below, which is concerned with the identification of regularities in multipliers rather than with differences.[16]

A second observation refers to the important distinction between regional economic 'size' and connectedness in input-output tables. The former could be defined simply in terms of regional value added, or in terms of the transactions total. The latter refers to the degree of interdependence in the regional economy, to the extent to which regional sectors trade with each other or the extent of mutual economic interconnectedness in the regional economy. Various measures of connectedness have previously been used, including the average output multiplier (over all sectors in a table) as one highly favoured. From the point of view of this paper, in which this

TABLE 1. Some Extreme Values of Economic Characteristics over Twenty-five Australian Regions[a]

		PART A		PART B	
		Percent of Regional Value Added	Region	Amount of Value Added ($'m)	Region
1. Animal Industries	Upper	59.4	Central West (Qld.)	143.8	Western (Vic.)
	Lower	0.1	Adelaide (S.A.), Darwin (N.T.)	0.4	Darwin
2. Other Agriculture	Upper	29.3	Central (S.A.)	191.3	Western (Vic.)
	Lower	0.1	Alice Springs (N.T.)	0.1	Alice Springs
3. Mining	Upper	60.7	North West (Qld.)	314.8	Gippsland
	Lower	-	Alice Springs (N.T.),		
		-	Central West (Qld.)	-	Central West
4. Manufacturing	Upper	38.2	Barwon (Vic.)	4493.8	Melbourne
	Lower	1.1	Central West (Qld.)	0.7	Central West
5. Electricity	Upper	12.5	Gippsland (Vic.)	293.1	Melbourne
	Lower	1.1	North West (Qld.)	1.1	Central West
6. Building, Construction	Upper	20.8	Darwin (N.T.)	850.0	Melbourne
	Lower	2.1	Northern (S.A.)	4.3	Central West
7. Trade	Upper	28.6	Alice Springs (N.T.)	1534.4	Melbourne
	Lower	3.9	Gippsland (Vic.)	5.5	Central West
8. Transport,	Upper	13.5	Northern (Qld.)	1080.4	Melbourne
Communication	Lower	2.5	Gippsland (Vic.)	3.1	Central West
9. Finance	Upper	16.5	Adelaide (S.A.)	2010.6	Melbourne
	Lower	2.7	Central West (Qld.)	1.9	Central West
10. Public Administration	Upper	21.4	Top End (N.T.)	578.6	Melbourne
	Lower	1.0	North West (Qld.)	1.8	Central West
11. Personal Services	Upper	30.5	Alice Springs (N.T.)	1708.2	Melbourne
	Lower	3.8	North West (Qld.)	3.8	Central West
Transactions Total ($m)	Upper		-	45919	Melbourne
	Lower		-	210	Central West

[a] including only input-output tables for 'sub-state' regions.

measure is used, it allows comment on both the question of interconnectedness, and of the general structural components of the output multipliers.

The third observation follows from those above. It is clearly wise to expect only a very general relationship between regional economic size and the size or nature of multipliers. On the surface there is some justification for expecting that the larger regions (in economic size) will show lower import coefficients and higher levels of connectedness and therefore exhibit higher multipliers. It does occur frequently however that smaller economies are more connected than larger economies, and that some economies are larger simply in size and not the degree of economic diversity.

OUTPUT MULTIPLIERS

As suggested above the average output multiplier provides both a measure of output impact and an index of economic interconnectedness; the discussion here will address each in turn. Table 2 shows (Part A, Column 1) the average values of the multiplier components over the twenty-nine regions. Columns (2) and (3) give the percentage breakdown. In terms of output impact, it is clear that the various categories of effect play quite different roles. On average, the first round effect contributes 29.2 per cent to the average flow-on effect (11.1 per cent to the average total effects), the industrial support effect contributes 9.7 (3.7) per cent and the consumption induced effect 61.1 (23.2) per cent. This means that the consumption-induced effect can normally be expected to be the dominant effect to the flow-on multiplier.

Some important implications follow from this general picture of multiplier structure. First the results conflict with conventional wisdom associated with general impact expectations and decentralisation policies. It appears to be widely accepted that industries exert their main impacts on regional economies through the first-round effects, i.e. to the extent to which they establish local economic industrial linkages by purchasing inputs from the local regional economy. These results suggest that as a general case, the impact of industrial linkages (direct and indirect) is likely to be less significant and that considerably more attention should be given to consumption-induced effects in the framing of regional policy. In other words, the effects of local purchases by firms of inputs appears to be considerably less important than the economic effects of purchases by their employees. It follows from this that the problem of regional growth and decentralisation could well be less

one of the encouragement of industry *per se*, and more one of population growth linked with industrial growth.

TABLE 2. Relative Sizes of Multiplier Component[a]

	Average Values[b]		
		Percent of	
	Effect (1)	Flow-on (2)	Multiplier (3)
Part A: Output Multipliers			
Calculated Effects:	(Output Multiplier = 1.614)		
1. Initial Impact	1.000	-	62.0
2. First Round	.179	29.2	11.1
3. Industrial Support	.060	9.7	3.7
4. Consumption-Induced	.375	61.1	23.2
5. Flow-on	.614	100.0	38.0
6. Total Multiplier	1.614	-	100.0
Part B: Income Multipliers			
Calculating Effects:	(Income Multiplier = 0.537)		
7. Initial Impact	.347	-	64.7
8. First Round	.052	27.5	9.7
9. Industrial Support	.017	8.5	3.0
10. Consumption Induced	.121	64.0	22.6
11. Flow-on	.190	100.0	35.3
12. Total Multiplier	.537	-	100.0
Part C: Employment Multipliers			
Calculated Effects:	(Employment Multiplier = 0.101)		
13. Initial Impact	.066	-	65.4
14. First Round	.010	28.6	9.9
15. Industrial Support	.003	8.6	3.0
16. Consumption-Induced	.022	62.8	21.8
17. Flow-on	.035	100.0	34.7
18. Total Multiplier	.101	-	100.0

[a] rounding errors occur.
[b] actual mean values of the multiplier components over 29 tables.

This conclusion draws attention again to the question of accuracy in regional input-output tables. Since household data are a major determinant of the consumption-induced effects, one possible problem lies with the certain underestimation of consumption-induced effects by the use of a narrow definition of household income in the form of wages and salaries by sector. Another problem lies with the unknown effect on the consumption-induced impact of the assumption of linear household consumption functions. Given the dominance of the consumption-induced effect

in the multiplier, the importance of assuring a high degree of accuracy in household income and consumption data is clear. Hewings and Romanos show for example, that a high proportion of the 'inverse-important' coefficients, are found in the household row and column in the closed input-output model, pointing again to the importance of ensuring the accuracy of at least those household coefficients which are significant in multiplier calculation.[17]

SECTOR MULTIPLIERS

It is useful to examine the output multipliers on a sectoral basis. Table 3 provides a summary of output multipliers by sector, calculated as average multipliers across the twenty-nine tables; columns (1) to (4) show the characteristics of average sector multipliers and columns (5) to (8) show the components of the average multipliers. Consider the latter first. Column (6) with the average first round effects and rankings, shows a substantial range from a high 0.334 for the Manufacturing sector to a low of about 0.1 for the Electricity and Personal Services sectors. Column (7) shows an expected similarity in sector ranking between first-round and industrial support effects with the Manufacturing, Building and Construction, and Mining sectors ranking high and the Electricity, Personal Services and Finance sectors ranking low. Column (8) provides the consumption-induced effects which are so significant in determining the ultimate multiplier size. Apart from the expected understatement of this effect in the rural sectors (Sectors 1 and 2), the consumption-induced effects reflect the expected degree of labour intensity or contribution to household income by each sector, i.e. the high ranking of the Public Administration, Personal Services, Transport and Communication, and Finance sectors, and the low ranking of the Mining sector.

In all but one case (the Manufacturing sector), the consumption-induced effect is the largest component of the total output flow-on effects, and bears a large influence on the ranking of the total multiplier in Column (1). The highest ranking multipliers are Public Administration, Manufacturing, Building and Personal Services. It is interesting to note the variation of each type of multiplier between tables as shown by columns (3) and (4). The coefficient of variation is lowest, indicating that the multipliers are more relatively uniform between the various tables, for the Electricity, Finance, Manufacturing and Transport sectors. The average coefficient of variation of multipliers between tables (20.1 per cent) is significantly higher than that calculated (11.4 per cent) for variation of multipliers between sectors.

TABLE 3. Average Sectoral Output Multipliers and Component Effects, over Twenty-nine Australian Regional Input-Output Tables[a]

Sector		A. Multiplier Characteristics				B. Multiplier Components			
		Average Multiplier (1)	Median Multiplier (2)	Standard Deviation (3)	Coefficient of Variation (4)	Initial Impact (5)	First Round Effect (6)	Industrial Support Effect (7)	Consumption Induced Effect (8)
Animal Industries	1	1.457(10)	1.408	.300	20.6	1.000	.179(5)	.055(5)	.223(11)
Other Agriculture	2	1.496(9)	1.439	.315	21.1	1.000	.157(7)	.051(7)	.288(9)
Mining	3	1.541(7)	1.475	.313	20.3	1.000	.219(3)	.077(3)	.245(10)
Manufacturing	4	1.783(2)	1.824	.342	19.2	1.000	.334(1)	.121(1)	.328(6)
Electricity etc.	5	1.449(11)	1.374	.245	16.9	1.000	.100(11)	.033(9)	.316(8)
Building, Construction	6	1.726(3)	1.574	.400	23.2	1.000	.228(2)	.098(2)	.400(5)
Trade	7	1.532(8)	1.413	.318	20.8	1.000	.166(6)	.045(8)	.321(7)
Transport, Communication	8	1.636(5)	1.496	.319	19.5	1.000	.152(8)	.054(6)	.430(3)
Finance	9	1.546(6)	1.458	.276	17.9	1.000	.119(9)	.026(11)	.401(4)
Public Administration	10	1.914(1)	1.974	.401	21.0	1.000	.203(4)	.067(4)	.644(1)
Personal Services	11	1.694(4)	1.579	.343	20.2	1.000	.109(10)	.031(10)	.554(2)
Average		1.614	-	-	20.1	1.000	.179	.060	.377
Standard Deviation		.142	-	-	-	-	.064	.028	.122
Coefficient Variation		11.4	-	-	-	-	35.8	46.6	32.4

[a] Figures in brackets are rankings within columsn.

DISAGGREGATED SECTOR MULTIPLIERS

It is possible to disaggregate multiplier effects according to the effect on each sector, i.e. to show the sectoral output incidence of the flow-on effects of changes in the output of each sector in the table. This is given in Part A of Table 4; this shows for example that 1.6 per cent of the flow-on effects of each dollar of output (or change in output) of the Animal Industries sector (Column 1) occurs on average in the same sector, 16.9 per cent in the Other Agriculture sector, 27.1 per cent in the Manufacturing sector, 22.5 per cent in the Trade sector and so on. Similarly the flow-on effects of each dollar of output of the Mining sector (Column 3) go on average mainly to the Manufacturing sector (25.7 per cent), to the Mining sector (19.6 per cent), and to the Trade sector (18.2 per cent).

Although variations occur, a general pattern of sectoral impacts emerges. The main impacted sector is the Manufacturing sector, followed by the Trade sector, and the Finance, and Transport and Communication, and Personal Services sectors. The impacts felt by the Public Administration sector are consistently less than one per cent, and the Electricity sector mostly within the range of 3.0–7.0 per cent. The Mining sector attracts a consistently low impact, except from the Mining, Electricity and Manufacturing sectors.

Secondly it should be recalled that these sectoral impact patterns do not constitute a national average pattern in the sense that they indicate an "average" impact pattern of a national industry. Rather the elements of Table 4 are averages of the various regional impacts of the same sector. Some wide variations are concealed by some of these average impacts. For instance Column (4) shows that 10.6 per cent of the output flow-on effects of the Manufacturing sector occur in each of the Animal Industries and Other Agriculture sectors. A more detailed examination shows that these averages represent impacts ranging from 0.2 per cent to 36.9 per cent in the case of the Animal Industries sector and 0.5 per cent to 49.5 per cent in the case of the Other Agriculture sector. In general terms the majority of regions show much lower percentage impacts on these sectors.

OUTPUT MULTIPLIERS BY REGION TYPE

Although it was considered unwise, for reasons discussed earlier, to make detailed comparisons of multipliers between individual tables, some grouping of regions by broad and general categories was undertaken to identify the main differences in output

TABLE 4. Sectoral Incidence of Flow-on Effects[a, b]

Impacted Sectors	Impacting Sectors 1	2	3	4	5	6	7	8	9	10	11
					A: Output Multipliers						
1. Animal Industries	1.6	1.5	1.4	10.6	1.5	2.3	1.5	1.7	1.5	1.8	1.7
2. Other Agriculture	16.9	12.7	4.3	10.6	4.3	4.5	4.0	4.6	4.3	4.7	4.8
3. Mining	0.4	0.5	19.6	2.6	3.3	1.8	0.4	0.6	0.5	0.4	0.5
4. Manufacturing	27.1	29.2	25.7	34.3	25.0	41.8	24.1	28.7	21.7	27.1	26.4
5. Electricity	4.1	4.0	4.3	3.1	5.1	2.5	3.4	3.0	6.0	4.0	7.6
6. Building	5.6	4.1	4.5	3.0	9.6	2.3	4.6	10.0	6.0	12.4	5.9
7. Trade	22.5	23.3	18.2	15.5	20.7	21.1	27.3	24.1	24.5	18.2	23.5
8. Transport, Communication	7.1	8.1	8.4	7.6	10.4	8.0	8.8	8.0	7.8	6.4	6.6
9. Finance	7.3	9.1	7.9	7.3	11.0	8.7	18.5	10.6	17.4	12.7	12.6
10. Public Administration	0.5	0.6	0.4	0.4	0.7	0.5	0.5	0.7	0.7	3.0	0.8
11. Personal Services	7.1	6.7	5.3	4.9	8.5	6.4	7.0	8.3	9.6	9.3	9.6
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
					Part B: Income Multipliers						
1. Animal Industries	0.8	0.7	0.6	4.9	0.6	1.0	0.6	0.7	0.5	0.7	0.7
2. Other Agriculture	12.1	8.7	2.7	7.8	2.6	2.9	2.2	2.8	2.4	2.8	2.8
3. Mining	0.2	0.3	11.3	1.1	2.0	1.1	0.3	0.3	0.2	0.2	0.3
4. Manufacturing	23.0	24.8	22.7	31.3	19.8	35.6	18.8	22.9	16.4	21.0	20.7
5. Electricity	4.2	4.2	4.4	3.4	5.0	2.5	3.3	3.0	5.7	3.7	7.3
6. Building, Construction	6.6	4.9	6.5	3.9	10.5	2.8	5.2	10.8	6.6	13.1	6.6
7. Trade	19.7	20.3	18.3	15.3	16.4	18.9	22.0	19.7	19.4	14.8	19.0
8. Transport, Communication	9.8	11.1	11.4	11.2	13.1	10.6	11.3	10.4	9.8	8.1	8.4
9. Finance	9.3	11.8	10.7	10.3	13.6	11.6	23.1	13.3	20.9	14.9	15.7
10. Public Administration	0.9	1.2	0.9	0.9	1.3	1.0	1.0	1.2	1.3	4.2	1.4
11. Personal Services	13.6	12.3	10.6	10.0	15.2	12.1	12.3	15.0	16.8	16.2	17.1
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

	Part C: Employment Multipliers										
1. Animal Industries	2.1	1.9	1.8	13.0	1.7	3.0	1.6	1.9	1.5	2.0	1.8
2. Other Agriculture	19.6	15.0	4.6	11.6	4.5	4.9	4.1	4.7	4.3	4.9	5.0
3. Mining	0.1	0.2	10.0	1.0	1.1	1.0	0.2	0.2	0.1	0.2	0.2
4. Manufacturing	13.6	14.9	14.9	19.7	12.5	23.6	12.3	14.3	10.4	13.3	12.8
5. Electricity	2.8	2.7	3.3	2.3	3.6	1.9	2.3	2.1	3.9	3.3	5.2
6. Building, Construction	5.3	4.2	5.7	3.4	9.8	2.7	4.8	9.8	6.2	12.3	6.1
7. Trade	29.2	31.6	30.3	22.5	28.7	31.5	36.1	32.9	33.0	26.8	32.2
8. Transport, Communication	7.7	8.9	10.3	9.2	12.0	9.6	10.3	9.0	8.5	7.2	7.4
9. Finance	5.1	6.8	6.2	6.0	8.3	7.1	13.2	7.9	12.2	8.9	9.3
10. Public Administration	0.6	0.8	0.7	0.6	1.0	0.8	0.8	0.9	1.0	2.9	1.1
11. Personal Services	14.0	13.1	12.3	10.7	16.9	13.9	14.4	16.5	19.0	18.9	19.0
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[a] Rounding errors occur.

[b] Being averages of percentage flow-ons over twenty-nine regions.

TABLE 5. Average Multipliers by Region Type[a]

Multiplier Component	A. Output Multipliers				B. Income Multipliers				C. Employment Multipliers			
	State-Metropolitan (1)	Rural-Urban (2)	Rural (3)	Mining (4)	State-Metropolitan (5)	Rural-Urban (6)	Rural (7)	Mining (8)	State-Metropolitan (9)	Rural-Urban (10)	Rural (11)	Mining (12)
Initial Effect	1.000	1.000	1.000	1.000	.372	.339	.333	.324	.067	.062	.061	.064
First Round	.236	.189	.124	.143	.070	.053	.042	.040	.010	.006	.006	.009
Industrial Support	.120	.062	.030	.033	.033	.017	.010	.009	.005	.002	.001	.002
Consumption-Induced	.717	.378	.230	.201	.244	.113	.074	.063	.039	.014	.013	.014
Total Multiplier	2.073	1.630	1.384	1.377	.719	.522	.459	.436	.120	.084	.081	.089
Flow-on	1.073	.630	.384	.377	.347	.183	.126	.112	.054	.022	.020	.025

[a] The columns of this Table were calculated from groupings of regions according to subjective judgement of 'region type' according to economic dominance, spatial pattern, and symmetry in table construction procedures. The Table is simply of illustrative value rather than of substantial analytical values.

TABLE 6. Average Sectoral Income and Employment Multipliers and Component Effects[a, b]

Sector	Income Multipliers					Employment Multipliers				
	Initial Impact	First Round	Industrial Support	Consumption Induced	Total	Initial Impact	First Round	Industrial Support	Consumption Induced	Total
1. Animal Industries	.178	.053	.015	.077	.323(11)	.082	.012	.003	.012	.109(5)
2. Other Agriculture	.261	.044	.014	.097	.416(9)	.082	.010	.003	.016	.111(4)
3. Mining	.185	.060	.020	.079	.344(10)	.035	.011	.004	.014	.064(1)
4. Manufacturing	.245	.080	.033	.105	.463(6)	.027	.016	.006	.019	.068(9)
5. Electricity, etc.	.313	.029	.009	.101	.453(7)	.039	.005	.002	.019	.065(1)
6. Building, Construction	.350	.062	.026	.127	.565(5)	.062	.010	.005	.024	.101(7)
7. Trade	.260	.054	.014	.102	.430(8)	.089	.009	.002	.020	.121(3)
8. Transport, Communication	.421	.046	.015	.137	.619(3)	.068	.009	.003	.025	.105(6)
9. Finance	.396	.042	.008	.127	.573(4)	.037	.007	.001	.024	.070(8)
10. Public Administration	.634	.068	.019	.204	.925(1)	.090	.009	.003	.038	.140(2)
11. Personal Services	.578	.034	.009	.175	.795(2)	.117	.006	.002	.032	.157(1)
Mean	.347	.052	.016	.121	.536	.066	.009	.003	.022	.101
Median	.313	.053	.015	.105	.463	.068	.009	.003	.020	.104

[a] Rounding error occur.

[b] Figures in brackets are rankings within columns.

multiplier by regional 'type'. These groupings identified four regional types on a basis of economic diversity and dominance, namely (i) State-Metropolitan Regions to represent the more diverse and developed economies, which include metropolitan areas; (ii) Rural-Urban regions to represent those regions with 'provincial' cities, and a medium degree of economic connectedness; (iii) Rural Regions to represent those regions without large urban areas, and predominantly rural in nature; and (iv) Mining Regions, representing those regions with a significant mining component.

The average output multipliers, according to these region types are provided in Part A of Table 5. As expected, each component of the multipliers of the State-Metropolitan regions is the highest of all region types, expressing the higher degree of connectedness in these economies. The flow-on effects of the Rural/Urban regions are about sixty per cent of those of the State-Metropolitan regions, due in large part to an approximate halving of the industrial support and consumption-induced effects. Comparison of columns (2) and (3) allows some indication of the effects of a provincial city on the overall level of economic connectedness in a region; flow-on output effects appear to be about forty per cent lower in the absence of this focus of local economic activity. Comparison of columns (1), (2) and (3) allows some speculation regarding the relative importance of metropolitan areas and provincial cities in the regional economy, and illustrates the dominating effect of the former. Column (4) refers to Mining regions. These regions also have a wide rural base, and are generally without large urban areas. It is therefore to be expected that average multipliers will be low in these regions. It is also to be expected that the existence of the mining industries in these rural regions will not contribute substantially to increasing the level of connectedness in the regional economies.

INCOME AND EMPLOYMENT MULTIPLIERS

In common with all versions of input-output multipliers, the calculation of income and employment multipliers assumes that each disaggregated output effect can be converted in a linear fashion to disaggregated income multipliers by multiplication by a household income coefficient and to disaggregated employment multipliers by similar use of appropriate employment coefficients. The summation of these disaggregated effects can be expected to lead to a general relationship between the components of output multipliers and those of income and employment multipliers.

Since output multipliers seem to represent the inherent purpose

and nature of the input-output table, it is important to consider first any relationships which might exist empirically between the components of output multipliers and those of income and employment multipliers. This is important not only for reasons of intrinsic interest, but for possible prediction of income and employment multipliers. These relationships, for averages over the twenty-nine tables, are shown in Table 2.

These results provide only a general indication of the relationship between components of average multipliers and do not, of course, indicate the inter-multiplier relationships which will exist within any individual table. In particular, it would seem appropriate to add that the table shows relationships which exist in the context of the unique economic structure of Australian regions. Generalisation beyond this context could be quite hazardous.

Table 2 shows that the relative sizes of the various components is maintained from output to income and employment multipliers, with the consumption-induced effect as noticeably dominant, and with the industrial support effects contributing least significantly. In general terms, as expected, the same trends emerge in the three parts of the table with the magnitude of change reasonably uniform between multipliers.

SECTOR MULTIPLIERS

Table 6 provides average income and employment multipliers with the respective components, in parallel with the sector output multipliers of Part B of Table 3. For both the income and employment multipliers the initial impact is invariably the largest of the four components, and the consumption-induced effect is almost invariably the largest of the flow-on effects.

Some appreciation of the differential effects of each sector in output, income and employment impacts can be gained from a comparison of Part B of Table 3 and Table 6. There is no *a priori* reason why the ranking of the various multipliers should be the same for each sector, and why the relationship between the multiplier rankings should be more than quite general in nature. Indeed the rankings of the various multipliers show some important differences. The Manufacturing sector, for example, is ranked second in terms of output multiplier, sixth in terms of income multiplier and ninth in terms of employment multipliers. This reflects the relatively high demand of this sector for intermediate products (output of other sectors), and the relatively low labour intensity of the sector. The Trade sector shows an opposite

multiplier configuration; it is of relatively low rank in output and income multipliers, reflecting less demand for intermediate inputs, and lower wage income spin-off, and more highly ranked in terms of employment multipliers, reflecting a relatively high labour use. The consistent high ranking of the Public Administration and Personal Services sectors reflect the important effect in all multipliers of the consumption-induced effect of high labour use in these sectors.

These comparisons draw attention to a further important point relating to analysis for economic policy. Analysis of policies involving manipulation of the level of output of the various sectors in the economy should, on the evidence presented here, differentiate between the various effects of these policies in terms of output, income and employment. In a regional context particularly, the choice of development policy should be related specifically to specific economic development goals.

DISAGGREGATED SECTOR MULTIPLIERS

Table 4 provides, in Parts B and C respectively, details with respect to the disaggregated effects of income and employment multipliers. An important divergence can be noted in these patterns, and particularly between the patterns of employment and output impacts. Whereas the output impacts (Part A) were dominated mainly by the Manufacturing sector, the employment flow-ons tend to be dominated by the Trade sector, in keeping with the tendency of firms in this sector to have a relatively higher labour input. For similar reasons the Personal Services sector becomes a major recipient of employment flow-on effects.

INCOME AND EMPLOYMENT MULTIPLIERS BY REGIONAL TYPE

These multipliers, according to region type, are provided respectively in Parts B and C of Table 5. Each component of the multipliers of the State/Metropolitan regions is again the highest of all region types. The flow-on effects of income and employment of the rural-urban regions are about fifty per cent and forty per cent respectively of those of the state/metropolitan regions, due mainly to much lower consumption-induced effects. While the relative differences between the rural-urban and rural region output multipliers also show in a comparison of income multipliers

(Columns (6) and (7)), the difference is not evident in the employment multipliers (Columns (10)) and (11)). This probably, at least partially, results from the fact that the output demands in the less diverse economies are more likely to be found in the more labour intensive industries, e.g. the Trade sector.

SUMMARY AND CONCLUSIONS

The results presented in this paper are derived from the first general analysis of the multipliers from twenty-nine Australian regional input-output tables. These tables, although not strictly comparable in terms of method of table construction, are consistent in accounting terms and are assumed to represent independent observations of regional economic structure.

It was the intention of this study to produce a summary of the rather formidable array of the results of empirical input-output research over some years, and to capture the essence of these results in a generalised framework. Much of the interest in these results will be essentially empirical in nature, as analysts seek points of reference and comparison for a variety of research projects. Some important facets of economic interdependence are, however, evident from these empirical results.

The first lies in the relatively large part played by the consumption-induced effect in the degree of total inter-connectedness or interdependence. This feature appears to have been grossly underestimated in discussions of regional policy, which have tended to lean primarily on industrial linkages. The evidence of this paper suggests that this has probably been an inappropriate emphasis.

The second lies in the sectoral disaggregation of flow-on effects. The results show that output, income and employment impacts are not uniform in incidence and indicate the dominance of the Manufacturing sector as a recipient of output flow-on effects, and the dominance of the Trade sector in terms of employment.

The third lies in the comparative multiplier effects of the various region types, and the implicit effect on total economic inter-connectedness of medium and large urban areas. These effects appear to be significant. In the context of regional economic policy implications, these three points have significance in terms of an appropriate approach to the spatial organisation of economic activities and in terms of decentralisation policy.

APPENDIX I

The twenty-nine regions for which input-output tables are available are:

NORTHERN TERRITORY	QUEENSLAND	SOUTH AUSTRALIA	VICTORIA
Northern Territory	Queensland	South Australia	Victoria
Darwin	Moreton	Adelaide	Melbourne
Katherine-Barkly	Central West	Central	Barwon
Top End	Darling Downs	Eastern	Gippsland
Alice Springs	Far North	Northern	North Central
	Fitzroy	South East	North East
	Northern		Western
	Mackay		
	North West		
	South West		
	Wide Bay-Burnett		

NOTES AND REFERENCES

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14. And correspondingly less confidence in those tables with less superior data of a more reliable nature. The research team regards the Victorian tables to be less reliable in this respect. Superior data is the term given to data originating from sources considered to be more reliable than mechanical estimates.
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