INTER-INDUSTRY ANALYSIS OF THE WESTERN AUSTRALIAN ECONOMY*

M. L. PARKER

John Thomson Agricultural Economics Centre
University of Western Australia

Introduction

Input-output or inter-industry analysis provides a means of summarizing, for analytical purposes, the productive activities of an economy in a given period of time. It provides a measure of the interdependence between industries by identifying the disposition of the output of each industry and of the materials and services used to produce that output.

Overseas, input-output analysis has been widely applied as a frame for the presentation of national accounts. In Australia, the entry of the Commonwealth Statistician into this field and the recent publication by the Statistician of a preliminary National input-output table for 1958-59[1] have renewed interest in this technique which previously had been applied at the national level by Cameron.[2] Applications of the technique to economic regions within national boundaries are less common. This paper presents the preliminary results of the first regional tables constructed in Australia.

Input-output tables have been constructed for Western Australia for the years 1954 and 1959. These are Leontief-type, static and open models showing transactions at purchasers' values. The output of each of 54 industries is distributed as inputs to other industries and to a final demand comprising personal consumption, private fixed capital, public authority expenditure, inventories, and foreign and Eastern States exports. Of the 54 producing industries, 27 are manufacturing, 13 cover the primary industries of agriculture, fishing, forestry and mining, and 14 cover the State's building and servicing industries.

With the exception of the agricultural industries, the official statistics in Western Australia are far less comprehensive than for Australia as a whole. This problem was largely overcome by independently surveying a large number of manufacturing establishments in Western Australia.

In this paper an aggregated version of a State input-output table is first used to illustrate the input-output technique. Several applications of a 54-industry table are then presented.

1 Commonwealth Bureau of Census and Statistics. *Input-output Tables, 1958-59.* (mimeo). Canberra, 1964.
2 Cameron, B. The 1946-47 transactions table. *Economic Record,* Vol. 33, No. 66, p. 353, 1957; New aspects of Australia's industrial structure. *Economic Record,* Vol. 34, No. 69, p. 362, 1958; Inter-sector accounts, 1955-56. *Economic Record,* Vol. 36, No. 74, p. 269, 1960.

Sales Patterns

If the productive activities in Western Australia during 1959 were grouped into five major classifications, the pattern of sales would appear as in Table 1. The figures across any one row show the proportion of the output of a particular industry which was sold to other industries for further processing, and the amount delivered to final demand—for export, local consumption or investment. The rural industry, for example, depended upon the manufacturing industries (mainly grain milling, meat processing and milk processing) for 26 per cent of its sales and a further 66 per cent of its sales were to final demand. In return, (column 1), the rural industry purchased 6 per cent of the output of the manufacturing industries, 3 per cent of the output of the building and construction industries, and 7 per cent of the output of the service industries.

TABLE 1

Pattern of Sales: Western Australia: 1959 (per cent)

Sector	Rural	Extractive	Manufacturing	Construction	Services & Govt.	Final demand	Total output %	£m.
Rural	8·5		25·6			65·9	100·0	123·4
Extractive		1·3	19·0	4·5	10·2	65·0	100·0	37·0
Manufacturing	6·3	1·3	12·2	7·2	11·3	61·7	100·0	435·2
Construction	3·4				13·7	82·9	100·0	56·0
Services & Govt.	6·8	3·9	33·0	0·9	17·5	37·9	100·0	305·2

The format of Table 1 is of limited use. A better measure of the interdependence between industries can be derived from Table 2. Here the cost structure of each industry is described in terms of a common unit—input per 100 units of output. Thus 100 units of rural output are shown to require negligible inputs from the extractive industries (fishing, forestry and mining); 22 units of input from the manufacturing industries; less than 2 units of input from the construction industry; and 17 units from the service industries. The remaining inputs adding up to the total cost (equals total output) of the rural industry are wages, 9 per cent; non-wages (return to capital and to management), 24 per cent; depreciation, 14 per cent; and indirect taxes less subsidies, 2 per cent. The 2 per cent of cost attributed to imports is accounted for by the fact that the output of each industry has been inflated by the value of competitive imports.

The transactions shown in Table 2 refer only to purchases on current account since transactions involving items of investment are identified only as a component of final demand. However the input-output co-efficients in Table 2 differ from normal usage in several other respects. Firstly, the products of each industry are valued at the point at which they are consumed and not at the point of production. Thus the wheat component of the total rural output is valued at the flour mill or f.o.b. port of shipment. Secondly, the transport and commercial charges attributed to each industry are the charges concerned in the distribution

of its output rather than in the distribution of the inputs entering into the industry.

TABLE 2

Input-Output Coefficients: Western Australia: 1959

Sector	Rural	Extractive	Manufac-turing	Con-struction	Services & Govt.	Final demand* £m.
Rural	8·539		7·265			81·269
Extractive	0·013	1·297	1·609	2·961	1·235	24·039
Manufacturing	22·165	15·128	12·238	56·255	16·051	268·543
Construction	1·526				2·519	46·427
Services & Govt.	16·695	32·444	23·102	4·987	17·517	115·789
Wages	9·064	30·904	9·046	25·986	36·104	
Non-wages	24·494	14·732	5·338	7·164	17·308	
Depreciation	13·854	3·773	1·134	1·496	4·859	
Indirect tax†	1·578	—0·928	6·124	0·448	3·072	1·289
Imports	2·072	2·650	34·144	0·703	1·336	6·222
Total (per cent)	100·000	100·000	100·000	100·000	100·000	
Total cost (£m.)	123·429	36·961	435·249	56·000	305·189	543·578

* Consumption, public and private investment, stock rise and exports.
† Less subsidies.

The information contained in Table 2 is confined to the *direct* relationships between industries—the inputs directly required per unit of output of a selected industry. Having classified economic transactions in this form, however, it is possible by matrix inversion to derive Table 3 in which the *interdependence coefficients* express the essential characteristic of the input-output system—the *direct* and *indirect* connections between industries. These coefficients can be interpreted as follows: when the final demand for an industry listed in one of the column headings increases by £100, the total output of each of the industries listed at the left will increase by the amounts shown in that column.

TABLE 3

Interdependence Coefficients: Western Australia: 1959*

Sector	Rural	Extractive	Manufac-turing	Con-struction	Services & Govt.
Rural	112·219	2·217	9·892	5·737	2·133
Extractive	1·101	102·416	2·539	4·568	2·166
Manufacturing	36·291	27·915	124·530	72·221	26·857
Construction	2·556	1·259	1·107	100·825	3·314
Services & Govt.	33·466	48·627	37·946	29·281	130·243

* Derived as the inverse of an identity matrix less the matrix of input-output coefficients in Table 2. Each column shows the total purchases required, directly and indirectly, from each of the industries listed at the left, per £100 of sales to final demand of the industry listed for that column.

Each £100 of rural goods *delivered to final demand* is shown in Table 3 to require £112 of rural output and to generate £36 of manufacturing output and £33 of services. That is, each £100 increase in *output* of the rural industry generates £32 of manufacturing output. But *direct* requirements from manufacturing per £100 of rural output were shown in Table 2 to be £22. Hence, £10 or 31 per cent of the manufacturing output, was generated from *indirect* flows.

The delivery of £100 of construction output to final demand generates an increase of £6 in rural output; £5 in extractive output; £72 in manufacturing output and £29 in services. Comparison of these results, representing *direct and indirect* effects with the corresponding coefficients in Table 2 again indicates that a sizeable amount of output is generated indirectly. The generative effect upon the rural industry is entirely indirect; the indirect draw upon the manufacturing industry accounts for 21 per cent of the total draw upon this industry.

Some care is necessary in interpreting Table 3. Firstly, the inter-industry transactions refer only to sales on current account. Secondly, the interdependence coefficients provide an *absolute* measure of the changes in output of one industry induced in the short run by changes in the demand for another—they do not indicate the degree to which an industry's total output depends on the level of output of another. Thirdly, the interdependence between industries measured by the coefficients relate to the total requirements of each industry, regardless of source; that is, locally produced commodities are distributed together with imports. Finally, the classification used to define individual industries can influence the degree of interdependence. For example, a number of rural commodities appear to qualify equally well as flows to processing industries or direct to final demand. Whole-milk, fruit, vegetables and eggs undergo very little processing and in the 54-industry table from which Table 2 was consolidated, these commodities were consigned directly from the rural industries to final demand. Livestock slaughtering on the other hand, was treated as a factory activity and meat was consigned to final demand through the meat processing industry.

Sources of Economic Growth

Table 3 appears to confirm the stimulus which expanding primary output has had upon the Western Australian economy. It shows also the substantial stimulus which the construction industry affords the remainder of the economy through inter-industry demand. In the case of the rural sector, each £100 increase in final demand was shown to lead to derived increases of £36 and £33 in the output of the manufacturing and service industries respectively. The latter industries are sensitive to changes in final demand for both rural and extractive output. In contrast, the rural and extractive industries are little affected by changes in manufacturing and services.

The economic interdependence evidenced in Table 3 between the rural and extractive industries on the one hand, and the manufacturing and service industries on the other, appears to underlie Western Australia's ability to retain its industrial position relative to the nation as a whole (Table 4). Although there have been fluctuations between years, there has been no trend evident in the State's contribution to Australia's total net value of factory production. It has remained stable since the 1920's despite the industrial advantages enjoyed by the Eastern States, and in the absence (until the 1950's) of an overt policy of industrialization. This suggests that strong pressures for induced manufacturing growth have accompanied Western Australia's primary development. Likewise the absence of any marked upward movement accompanying the more recent policy of industrialization verifies the existence of economic forces opposed to any expansion in the manufacturing sector beyond that of the processing and sheltered industries required

to service the local population and the mining, pastoral, agricultural, forestry and fishing industries.

TABLE 4

*Western Australia's Contribution to Australia's Total Net Value of Factory Production (per cent)**

1929	1934	1939	1944	1949	1954	1959	1960	1961	1962	1963	1964
4·83	4·22	4·31	3·42	3·77	4·49	4·27	4·16	4·46	4·47	4·51	4·37

* Year ending June.

The Staple Product Theory Applied to W.A.

The successive waves of population and capital inflow which have characterized the economic growth of Western Australia can be viewed as the outcome of the exploitation of a series of natural resources and their processing for export. Prior to the 1890's, the economic base of the colony centred about the export of wool, sandalwood, jarrah timber, pearls and pearlshell, copper and lead. Despite the offer of free and assisted passages from the United Kingdom, however, the population numbered only 35,000 by 1885. The discovery of gold in that year, followed by a series of further discoveries, led to a substantial inflow of migrants—mainly from the other Australian colonies—and by 1896 the population exceeded 137,000. Associated with this growth was an inflow of capital from the other colonies and the United Kingdom including substantial public and private investment in railway construction.

By 1900, exports of gold, valued at £5·6 million, accounted for 81 per cent of the Colony's total exports. This period saw a recovery in the wool-growing industry and an unprecedented expansion in the timber and pearling industries. Thereafter, gold production and export remained at a high level but with the impetus provided by the food requirements of the local population and government sponsored schemes of land settlement, there was established by 1907 a new export industry in wheat, and subsequently in flour. By 1920, the State's exports were valued at £16·1 million of which the principal components were wheat and flour (32 per cent), greasy and scoured wool and skins (28 per cent), and gold (21 per cent). The further settlement of the wheatbelt, associated with schemes of soldier and civilian settlement and large-scale assisted migration, from 1920, gave still greater emphasis to the rural content of the State's exports. This phase was distinguished by the substantial public and private investment in the farming sector and, by 1931, 20,500 farmers in Western Australia were responsible for indebtedness to banks and Government agencies totalling £31·6 million, an average of £1,540 per settler.

With the introduction of refrigerated shipping, beef, fruit, mutton and lamb were added to the State's major exports. This pattern of predominantly rural production and exports was to remain until the 1950's when asbestos, manganese ore, iron ore, petroleum products and manufactured goods were first exported in significant amounts.

The past economic growth of the State appears to be best interpreted by the staple products theory[3] that the growth of the manufacturing

[3] Watkins, M. H. A staple theory of economic growth. *Canadian Journ. Econ. and Political Sci.*, Vol. 29, No. 2, p. 200, 1963.

and servicing industries has been induced by the prior exploitation of staple commodities for export. This theory has been widely applied to the interpretation of the early economic growth of Canada. In the case of Western Australia, major staples have been wool, pearlshell, timber, grains, meat, gold, lead, asbestos and iron ore. Each has a large natural resource content, has been in international demand as a raw material and has been capable of bearing heavy transport charges. Their exploitation has not required elaborate processing, the acquisition of rare skills, or large amounts of labour. However exploitation has generally required the attraction of both population and investment capital. Natural resources have not been the only source of economic opportunity, but the economic development of Western Australia does appear to have been mainly a process of diversification around a staple export base. As the export industries and their associated servicing industries have developed, so the population and investment opportunities have grown sufficiently to support manufacturing industries producing goods formerly imported.

Growth in a Common Market

Superimposed upon the staple products growth and foremost in shaping the rate and direction of the State's economic growth, however, has been the impact of Federation. In this regard, Schapper and Parker[4] concluded that "the economic development of Western Australia can be accounted for broadly in terms of specialization in accord with net comparative economic advantages which have been permitted full rein within the nation-wide common market. For the biggest and last settled State, independent industrial activity has been an economic impossibility."

The special relevance of the Australian common market to Western Australia arises from the greater economic maturity of the other Austrailan States at the time of Federation and Western Australia's inability to mobilise resources for industrialization in the years following Federation. In the early 1900's, Western Australia had less than 5 per cent of the Australian population and the State's manufacturing activity was confined to 13,000 people employed in flour milling, leather processing, sawmilling, brick and lime works, soap and candle making, gas works, and minor food processing activities. Because of the predominance of primary product processing, manufacturing establishments were spread through the agricultural areas of the State. To some extent Western Australia was in a similar position to Queensland, Tasmania and South Australia. Victoria and New South Wales on the other hand already had a nucleus of manufacturing industry at Federation and were in a position to benefit from the new common market and, from 1908, from a protective tariff.

The initial advantage enjoyed by Victoria and New South Wales was further strengthened during the 1920's when, with tariff support and the benefits of wartime import restrictions, industrial development in the basic engineering industries and in the field of consumer durables was well established. With this growth came internal and external economies of scale denied to Western Australia, Queensland and Tasmania.

[4] Schapper, H. P. and Parker, M. L. *Industrialization in Western Australia: Analysis and Proposals for Policy.* University of Western Australia Press, 1963, p. 22.

With their broader industrial base, the Eastern States were likewise in a position to gain most from wartime demands during the early 1940's. This was true also of South Australia which during the 1930's had undertaken Government sponsored industrial expansion based mainly upon the metal processing and associated engineering industries. Wartime industrial expansion was not without some benefit to Western Australia, however. Production on the basis of "cost-plus" did give stimulus to new forms of industrial output and provided a post-war legacy of new plant, equipment and technical skills which, together with the buoyant consumer demand and post-war scarcities of both producer and consumer goods, temporarily offset the industrial competition of the Eastern States and initiated a phase of industrial growth. The first large-scale expansion was not seen until 1953, however, when construction of an oil refinery, steel rolling mill and cement factory commenced at Kwinana.

This period saw the beginning of a shift in the direction of Government policy. Economic policy which had previously centred about development in mining and agriculture in the primary sector, now gave greater emphasis to the direct inducement of secondary industry and the attraction of Eastern States' and overseas capital to Western Australia. Government inducements included the offer of financial assistance, preferences in tendering and the provision of factory sites, housing, power, water, road and rail facilities. Nevertheless, the lack of subsidiary industries to follow the establishment of the major basic industries meant that factory employment made little advance during this period. The State's primary processing industries and those sheltered industries servicing the local market continued to grow, but there was no significant expansion in the import-competing industries or in the export of manufactured goods.

Notwithstanding the direct stimulus given to the manufacturing industries, the major source of economic growth has continued to be the exploitation of raw materials and their export as staples. From 1961, when the Commonwealth Government relaxed the ban on the export of iron ore, this role reverted to the mining industries. There followed a substantial inflow of private investment capital associated with State and Commonwealth Government expenditures under agreements with local and foreign companies for the long term exploitation of iron ore and bauxite deposits. The most recent development has been the signing of agreements for the export to Japan of 82 million tons of iron ore during a period of 22 years, commencing in 1966. At the same time the rural industries have continued to provide a major source of economic growth and despite an expansion, at the extensive margin, of about 870,000 acres of new clearing each year there remain 21 million acres of unalienated land in the agricultural districts suitable for agricultural development using existing techniques of production.

The Western Australian Input-Output Table

The foregoing 5-sector version of the Western Australian input-output table for 1959 served to illustrate some of the economic linkages associated with the State's primary industries. In the following section an analysis of other aspects of the interdependence between sectors of the Western Australian economy is based upon a complete 54-industry input-output table for 1959. In this table the major agricultural industries

are classified by their geographical location—by the aggregation of farming activities in contiguous statistical districts. The major forms of extensive agriculture are in this way identified as "Wheat-Sheep", "Southern Agriculture", "Dairying", "Pastoral & Trapping" and "Kimberley". The more intensive forms of agriculture—"Orchards & Vineyards", "Market Gardens", and "Poultry"—are not regionally defined although they tend to be located in the region otherwise classified as "Dairying".

Each of the agricultural industries is reasonably homogenous with respect to farming techniques and the type of farming practised. Thus "Dairying" is predominantly dairying throughout and the transition to the less intensive "Southern Agriculture" to the east and the extensive "Wheat-Sheep" farming to the north-east, is fairly abrupt.

This method of classifying the agricultural industries on both a commodity and locational basis commends itself in that it identifies eight readily distinguishable branches of farming. As well, it clarifies, for purposes of analysis, those branches which are conventionally accepted as distinct "industries" in issues of State policy; and it enables full use to be made of the published statistics and various supplementary sources of farming information. The usual procedure in input-output analysis is to sector agriculture by commodities. This was considered to be less meaningful for Western Australia and involved restrictive assumptions with regard to input coefficients where the same resources are used to produce an array of joint, supplementary, complementary and competitive products. Against this, the likelihood of changes in the proportions of classes of output within each industry must be borne in mind when using the present classification.

Market Structure

It will be recalled that the *interdependence coefficient* at the intersection of row 2 and column 1, in Table 3, indicates the amount of output required (directly and indirectly) from the extractive industries if the rural industry is to deliver a unit of rural output to final demand. By reference to the actual deliveries from the rural industry to final demand it is possible to calculate the total amount of extractive output which (directly and indirectly) is embodied in these deliveries. This is the procedure used to derive Table 5, showing the Western Australian market structure for coal, petroleum products, electricity and engineering output.

Column 1 in Table 5 can be interpreted as follows: Sales of coal directly to final demand are negligible—in fact the £88,000 shown in row 8 is largely an increase in stocks of coal during 1959. In other words, sales of coal are largely to other industries which in turn sell their output, directly or indirectly, to final consumers. It is this "final" market for coal which is shown in column 1. The cereals-sheep industry, for example, was responsible for £266,000, or 7 per cent of the market for coal—notwithstanding the fact that coal was not used directly by this industry. Other industries responsible for a major part of the coal market were mining, food processing, engineering, gas and electricity, building, and transport.

In the case of petroleum products, the direct demand for petroleum itself accounted for £32,440,000 (of which £26,060,000 represented petroleum exports and bunker oil). Eliminating this direct sale to final

TABLE 5

Final Market for Fuels and Engineering Output: Western Australia: 1959*

Industry	Coal	Petroleum products	Electricity	General engineering
	£'000	£'000	£'000	£'000
Cereals-Sheep	266	3,871	311	5,073
Dairying	24	379	53	502
Pastoral	11	276	17	396
Horticulture	87	997	199	995
Sub-total (Rural)	388	5,523	580	6,966
Fishing & Forestry	20	502	48	624
Gold & O'r Mining	420	692	1,613	2,809
Coal Mining	88	2	3	14
Sub-total (Extractive)	528	1,196	1,664	3,447
Cereal Foods	100	714	242	845
Milk Processing	60	305	151	541
Meat Processing	132	1,444	380	1,978
Beer & Tobacco	114	706	245	706
O'r Processed Foods	108	450	140	947
Sub-total (Manufacturing: Food Processing)	514	3,619	1,158	5,017
Woodworking	70	307	138	682
Paper & Printing	15	69	47	102
Mineral Oil	88	32,871	185	732
Chem. Fertilizer†	0	0	0	0
O'r Chemicals	31	238	88	249
Cement, Bricks, Etc.	57	91	43	116
Woollen Mills	48	577	101	782
Clothing & Textiles	68	779	218	588
O'r Manufactures	17	103	41	163
Iron & Steel	8	30	22	46
Vehicle Assembly	37	414	119	1,104
Engineering	160	731	387	42,869
Sub-total (Manufacturing: Other)	599	36,210	1,389	47,433
Gas & Electricity	1,137	563	3,447	448
Building & Construction	363	2,467	762	7,140
Transport & Commun.	120	761	67	1,345
Commerce	0	0	0	0
Other Services	258	1,302	678	7,349
Sub-total (Building; Services; Government)	1,878	5,093	4,954	16,282
Unallocated	3	7	10	85
Total sales	3,910	51,648	9,755	79,210

* Computed from a 54-industry input-output table. However, the results have been consolidated for convenient presentation on a 30-industry classification. Rounding errors are not included in the final row showing total sales.
† Due to a fall in stocks in 1959 the market demand for chemical fertilizer was negative.

demand it can be calculated from Table 5 that the cereals-sheep industry was responsible for 21 per cent of the residual market for petroleum products. This linkage between the rural and petroleum industries is further emphasized by the fact that the final demands for all rural products and processed foodstuffs jointly accounted for £9,142,000 of

petroleum sales; if the direct final demand for petroleum is removed this represents 49 per cent of the market for petroleum products.

The close economic ties between the engineering and agricultural industries is similarly evidenced in column 4. In this case much of the linkage is not directly apparent from Table 5 because agricultural implements (and all other sales of a capital nature) appear as a direct delivery from the engineering industry to final demand.

Wage and Non-Wage Content of Final Demand

Recalling again that column 1 in Table 3 showed the output required (directly and indirectly) from each industry to satisfy a unit of output

TABLE 6

Wage and Non-Wage Content per Unit of Final Demand Deliveries of Selected Industries: Western Australia: 1959

	Industry*	Wage content† Total	Direct	Non-wage content Total	Direct
1	Wheat-Sheep	0·2254	0·0789	0·3948	0·3451
2	Southern Agric.	0·3264	0·1426	0·1542	0·0848
3	Dairying	0·3086	0·0837	0·3528	0·2253
4	Pastoral & Trap.	0·4288	0·2941	0·2120	0·1492
5	Kimberley	0·2495	0·1581	0·4230	0·3852
6	Orchards & Vine	0·3207	0·0878	0·2634	0·1503
7	Market Gardens	0·3188	0·0665	0·3036	0·1812
8	Poultry	0·3053	0·0271	0·3899	0·1668
9	Fishing	0·3303	0·1844	0·4438	0·3460
10	Forestry	0·4069	0·1827	0·2718	0·2208
11	Gold Mining	0·6073	0·4282	0·1682	0·1060
12	Coal Mining	0·6206	0·3405	0·0447	0·0396
13	Other Mining	0·4968	0·2619	0·1468	0·0729
14	Grain Milling	0·3046	0·0581	0·3096	0·0442
16	Milk Processing	0·2932	0·0752	0·1980	0·0372
17	Meat Processing	0·3818	0·0839	0·2990	0·0191
19	Beer, Tobacco	0·2039	0·0197	0·1522	0·0428
25	Mineral Oil	0·1246	0·0180	0·1518	0·1047
26	Chem. Fertilizer	0·3333	0·1087	0·1022	0·0560
28	Cement Goods	0·4363	0·1855	0·2992	0·2170
29	Lime, Plaster	0·4247	0·2458	0·1973	0·1257
30	Bricks, Glass etc.	0·3998	0·2052	0·1655	0·0858
32	Woollen Mills	0·2913	0·0577	0·2541	0·0283
36	Iron & Steel	0·1512	0·0442	0·1822	0·1552
41	Gas	0·1512	0·2937	0·0482	0·0010
42	Electricity	0·4401	0·2339	0·1742	0·1319
45	Building & Const.	0·5004	0·2599	0·1826	0·0716
46	Rail Transport	0·7465	0·5718	—0·1225	—0·1789
47	Road Transport	0·4201	0·3387	0·2551	0·2154
50	Commerce	0·4929	0·3788	0·3153	0·2739
52	Personal & Govt.	0·6476	0·5355	0·1669	0·1302

* Industry code numbers refer to the numbering of industries in the complete 54-industry analysis.
† Excludes wages of owner-operators.

of the rural industry delivered to final demand, these figures could be applied in turn to the wage coefficients in Table 2 showing the wages paid per unit of output of each industry. By summation we could then

determine the total wage content (direct and indirect) per unit of final demand deliveries by the rural industry. This procedure has been applied to the 54-industry table for 1959 to derive the results shown in Table 6.

Row 1, for example, in Table 6, can be interpreted as follows: Each £100 of wheat-sheep output delivered to the final consumer, in 1959, embodied a wage content of £23; of this, approximately £8 comprised wages paid directly by farmers and the remaining £15 was paid in industries directly or indirectly servicing the wheat-sheep industry. A further £39 of the £100 was accounted for by non-wage items, of which £35 represented the return to capital and management of the average wheat-sheep farmer, and £4 represented non-wage payments in other industries servicing the wheat-sheep industry.

The contribution to final demand could similarly be derived for imports and the remaining components of "value added"—depreciation and indirect taxes net of subsidies. Alternatively the wage and other factor content could be derived for the individual components of final demand—consumption, investment and exports.

Import Content of Exports

Table 7 shows the import content (direct and indirect) per unit of final demand deliveries of each of 24 industries. The coefficients for competitive imports from the Eastern States and from overseas, and non-competitive imports, are separately distinguished.[5]

By reference to Table 7 and to the actual final demand deliveries of individual industries in 1959, the total direct and indirect imports required by each industry can be calculated. These are summarized in column 1 of Table 8. In the case of the wheat-sheep industry in 1959, £7,420,000 of imports were required—notwithstanding the fact that direct imports of a competitive nature amounted only to £472,000. The totals shown in column 1 can be compared with column 2 showing each industry's total exports as recorded in the official trade statistics. The difference between the two would show the *net* export earnings of each industry.

From a *National* (rather than State) balance of payments viewpoint, however, it is *overseas* trade alone which is important. The *net foreign earnings* of each industry (after direct and indirect overseas imports[6] have been deducted from overseas exports) are shown in column 5 of Table 8. In column 6 these net earnings are shown as a percentage of the *gross* overseas earnings of each industry.

[5] Competitive imports are those having a locally produced counterpart. They have been charged to consuming industries through domestic industries producing the counterpart domestic output. An assumption implicit in this procedure is that the sales of a commodity, in any one row, include the same proportion of competitive imports, regardless of the point of sale.

[6] Unlike competitive imports, non-competitive imports were not identified by origin (overseas or Eastern States). In calculating the direct and indirect overseas imports applying to each industry, the coefficients for non-competitive imports were assumed to refer only to overseas trade. An exception was the iron and steel industry where direct non-competitive imports were eliminated since they comprised steel billets of Eastern States origin. This procedure is likely to over-state the overseas content of non-competitive imports by the small amount of Eastern States imports (non-competitive) indirectly embodied in the final demand deliveries of each industry. In actual fact the only Eastern States imports classified as non-competitive were steel billets and raw sugar and small amounts of crude rubber, refined metals, newsprint and fabrics.

TABLE 7

Import Content per Unit of Final Demand Deliveries of Selected Industries: Western Australia: 1959

Industry	Competitive imports Eastern States Total	Competitive imports Eastern States Direct	Competitive imports Overseas Total	Competitive imports Overseas Direct	Non-competitive imports Eastern States & Overseas Total	Non-competitive imports Eastern States & Overseas Direct	All imports Total	All imports Direct
1 Wheat-Sheep	0·0650	0·0074	0·0267	0·0001	0·0648		0·1565	0·0075
2 Southern Agric.	0·0814	0·0126	0·0536	0·0165	0·1021		0·2371	0·0291
3 Dairying	0·0819	0·0141	0·0301	0·0028	0·0574		0·1694	0·0169
4 Pastoral & Trap.	0·0630	0·0161	0·0219	0·0003	0·0337		0·1186	0·0164
5 Kimberley	0·1753	0·1578	0·0086		0·0269		0·2108	0·1578
6 Orchards & Vine	0·1500	0·0586	0·0449	0·0117	0·0583		0·2532	0·0703
7 Market Garden	0·1311	0·0787	0·0492	0·0191	0·0725		0·2528	0·0978
8 Poultry	0·0738		0·0236		0·0486		0·1460	
9 Fishing	0·0762	0·0323	0·0327	0·0068	0·0516		0·1605	0·0391
10 Forestry	0·1021		0·0696	0·0341	0·0342		0·2059	0·0341
11 Gold Mining	0·1201		0·0371		0·0325		0·1897	
12 Coal Mining	0·1740	0·0937	0·0275		0·0200		0·2215	0·0937
13 Other Mining	0·0951	0·0030	0·0550	0·0232	0·0366		0·1867	0·0262
14 Grain Milling	0·1323	0·0711	0·0357	0·0019	0·0527		0·2207	0·0711
16 Milk Processing	0·3017	0·2422	0·0244	0·0071	0·0358		0·3619	0·2441
17 Meat Processing	0·0869	0·0142	0·0321	0·0009	0·0507		0·1697	0·0213
19 Beer & Tobacco	0·1484	0·1252	0·0104	0·0009	0·0189		0·1777	0·1261
21 Animal Oil	0·1381	0·0789	0·0388	0·0120	0·0425		0·2194	0·0909
22 Saw Mills	0·0940	0·0381	0·0783	0·0506	0·0252		0·1975	0·0887
25 Mineral Oil	0·0373	0·0200	0·0661	0·0604	0·4756	0·4649	0·5790	0·5453
26 Chem. Fertilizer	0·0794	0·0191	0·0805	0·0398	0·3457	0·3225	0·5056	0·3814
32 Woollen Mills	0·1990	0·1430	0·0298	0·0046	0·0511		0·2799	0·1476
36 Iron & Steel	0·2446	0·2049	0·0579	0·0460	0·3026	0·2888	0·6051	0·5397
40 Engineering	0·3657		0·1239		0·0181		0·5077	
45 Building & Constr.	0·1417	0·0060	0·0531	0·0005	0·0436	0·0004	0·2384	0·0069

TABLE 8

Exports and Direct and Indirect Imports: Selected Industries: Western Australia: 1959*

Industry	Total imports (direct & indirect) (1) £'000	Total exports (2) £'000	Overseas imports (direct & indirect) (3) £'000	Total oversea exports (4) £'000	Excess of oversea exports over oversea imports (5) = (4) − (3) £'000	Col. 5 as % of col. 4 (6) %	Oversea import content of oversea exports (7) £'000	Excess of overseas exports over overseas import content of overseas exports (8) = (4) − (7) £'000	Col. 8 as % of col. 4 (9) %
1 Wheat-Sheep	7,420	32,899	4,339	32,595	28,256	87	2,983	29,612	91
2 Southern Agric.	2,171	7,908	1,426	7,713	6,287	82	1,201	6,512	84
3 Dairying	1,062	1,685	549	593	44	7	52	541	91
4 Pastoral & Trap.	507	4,066	238	3,958	3,720	94	220	3,738	94
5 Kimberley	127	450	22	393	371	95	14	379	96
6 Orchards & Vine	1,384	2,358	564	2,333	1,769	76	241	2,092	90
7 Market Gardens	1,532	724	738	289	−449	Neg.	35	254	88
8 Poultry	295	382	146	377	231	61	27	350	93
Sub-Total (Rural)	14,498	50,472	8,022	48,251	40,229	83	4,773	43,478	90
9 Fishing	774	3,466	407	3,392	2,985	88	286	3,106	92
10 Forestry	340	2	172		−172				
11 Gold Mining†	2,598	2,149	953	11,545	10,592	92	804	10,741	93
12 Coal Mining	19	36	4	1	−3	Neg.		1	100
13 Other Mining	7,070	3,522	347	1,898	1,551	82	174	1,724	91
14 Grain Milling	1,370	3,390	549	3,314	2,765	83	293	3,021	91
16 Milk Processing	2,841	689	473	610	137	22	37	573	94
17 Meat Processing	4,044	7,456	1,973	5,910	3,937	67	489	5,421	92
19 Beer & Tobacco	4,849	225	800	75	−725	Neg.	2	73	97
21 Animal Oils	299	1,336	111	1,275	1,164	91	104	1,171	92
22 Sawmills	841	4,419	440	2,385	1,945	82	247	2,138	90
25 Mineral Oil	18,783	26,060	17,573	11,272	−6,301	Neg.	6,106	5,166	46
32 Woollen Mills	3,084	8,805	892	8,578	7,686	90	694	7,884	92
36 Iron & Steel	1,011	1,945	120	379	259	68	27	352	93
40 Engineering	21,256	7,730	5,945	2,373	−3,572	Neg.	337	2,036	86
45 Building & Constr.	11,068	24	4,490	24	−4,466	Neg.	2	22	92

* Exports include ships' stores.
† Gold exports include stock rise.

Table 8 can be interpreted as follows—using as an example the row showing the sub-total for rural industries. In column 1, the imports embodied (directly and indirectly) in rural deliveries to final demand are shown to total £14,498,000. Rural exports (column 2) amount to £50,472,000. The difference of £35,974,000 represents the net overseas and Eastern States earnings of Western Australia's rural industries. But *overseas* imports embodied in rural deliveries to final demand total only £8,022,000 (column 3). This amount has been deducted from *overseas* exports of £48,251,000 (column 4) to show the net *foreign* earnings of the rural industries (column 5). These net earnings of £40,229,000 amount to 83 per cent of the official export earnings of the rural industries. Finally, column 7 shows the overseas import content of rural overseas exports. By deducting this from rural overseas exports we can obtain an estimate of the net foreign exchange earned, on current account, by rural exports.

The import content of primary exports is quite low. From column 9 of Table 8, it can be seen that the net gain in foreign account from £1 million of most rural exports in 1959 exceeded £0·9 million. From £1 million of overseas exports of petroleum products, on the other hand, the net gain was of the order of £0·46 million, and from the engineering industries it was £0·86 million.

These findings clearly have policy implications since the drive for exports is a drive for net-exports. Eighty-five per cent of Western Australia's overseas exports are currently of agricultural origin and these clearly enjoy a substantial net-export content. Moreover, in recent years the State has contributed 11 to 17 per cent of the recorded value of Australia's exports. Some indication of the likely growth in Western Australia's exports, and hence in net exports, is the fact that additional production from the agricultural districts, by 1970, is likely to exceed 18 per cent for cereal crops and 44 per cent for livestock.

Conclusion

In presenting some of the results of the first attempt at regional input-output analysis in Australia, no mention has been made, in this paper, of the theoretical aspects of input-output analysis. The assumptions of constancy of input-output coefficients, linearity and proportionality of relationships have received widespread criticism and are quite restrictive where the model is used as a predictive device. The writer is in agreement with Goldman,[7] however, that "while the usefulness of input-output would be enhanced if the simplifying assumptions originally made were proven to be operationally valid, the value of the system does not hinge upon these assumptions. Input-output can be considered an approach to economic analysis involving an excellent descriptive device and requiring explicit recognition of the factors affecting the results".

[7] Goldman, M. R. *Operations Research Office Seminar.* (mimeo). Office of Business Economics, Washington, Nov. 12, 1959, p. 5.