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Australian National Accounts Input-Output Multipliers

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Australian National Accounts Input-Output Multipliers 1989-90

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INQUIRIES

- *for further information about statistics in this publication, and the availability of related unpublished statistics*, contact Dr Annette Barbetti on Canberra (06) 252 6908, Mrs Doris de Zilva on (06) 252 6643 or any ABS State office.

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PREFACE

This publication contains Australian input-output multipliers for 1989-90 at a 28 industry level. They are derived from the Australian input-output tables which are an important component of the Australian national accounts.

Input-output tables provide a further breakdown of the production account and present a comprehensive view of the structure of the Australian economy. Detailed data on supply and use of commodities, inter-industry flows and a range of derived information are provided for economic planning and analysis, and construction of models for forecasting purposes. The data can also be useful for non-economists seeking a thorough knowledge of relationships in the Australian economy.

Explanatory notes providing detail about the construction of input-output multipliers and their interpretation are on page 9.

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TABLE 1. OUTPUT MULTIPLIERS, DIRECT ALLOCATION OF COMPETING IMPORTS, 1989-90

	Industry	*Initial effects*	*First round effects*	*Industrial support effects*	*Production induced effects*	*Consumption induced effects*	*Simple multipliers*	*Total multipliers*	*Type 1A multipliers*	*Type 1B multipliers*	*Type 2A multipliers*	*Type 2B multipliers*
1	Agriculture	1.000	0.376	0.273	0.649	0.529	1.649	2.178	1.376	1.649	2.178	1.178
2	Forestry, fishing, hunting	1.000	0.329	0.255	0.584	0.901	1.584	2.485	1.329	1.584	2.485	1.485
3	Mining	1.000	0.327	0.213	0.540	0.596	1.540	2.136	1.327	1.540	2.136	1.136
4	Meat and milk products	1.000	0.752	0.544	1.296	0.712	2.296	3.008	1.752	2.296	3.008	2.008
5	Food products nec	1.000	0.616	0.491	1.107	0.819	2.107	2.926	1.616	2.107	2.926	1.926
6	Beverages, tobacco products	1.000	0.530	0.409	0.939	0.690	1.939	2.629	1.530	1.939	2.629	1.629
7	Textiles	1.000	0.553	0.414	0.967	0.811	1.967	2.778	1.553	1.967	2.778	1.778
8	Clothing and footwear	1.000	0.446	0.338	0.784	0.965	1.784	2.749	1.446	1.784	2.749	1.749
9	Wood, wood products etc	1.000	0.507	0.388	0.895	0.982	1.895	2.877	1.507	1.895	2.877	1.877
10	Paper, printing etc	1.000	0.417	0.277	0.694	0.901	1.694	2.595	1.417	1.694	2.595	1.595
11	Chemicals	1.000	0.501	0.382	0.883	0.714	1.883	2.597	1.501	1.883	2.597	1.597
12	Petroleum and coal products	1.000	0.604	0.361	0.965	0.473	1.965	2.438	1.604	1.965	2.438	1.438
13	Non-metallic min. products	1.000	0.500	0.344	0.844	0.786	1.844	2.630	1.500	1.844	2.630	1.630
14	Basic metals and products	1.000	0.570	0.426	0.996	0.646	1.996	2.642	1.570	1.996	2.642	1.642
15	Fabricated metal products	1.000	0.548	0.472	1.020	0.891	2.020	2.911	1.548	2.020	2.911	1.911
16	Transport equipment	1.000	0.440	0.345	0.785	0.769	1.785	2.554	1.440	1.785	2.554	1.554
17	Machinery etc nec	1.000	0.432	0.336	0.768	0.881	1.768	2.649	1.432	1.768	2.649	1.649
18	Miscell. manufacturing	1.000	0.458	0.344	0.802	0.839	1.802	2.641	1.458	1.802	2.641	1.641
19	Electricity, gas, water	1.000	0.448	0.298	0.746	0.640	1.746	2.386	1.448	1.746	2.386	1.386
20	Construction	1.000	0.459	0.354	0.813	0.881	1.813	2.694	1.449	1.813	2.694	1.694
21	Wholesale, retail trade	1.000	0.363	0.217	0.580	1.076	1.580	2.656	1.363	1.580	2.656	1.656
22	Repairs	1.000	0.290	0.202	0.492	1.057	1.492	2.549	1.290	1.492	2.549	1.549
23	Transport, communication	1.000	0.343	0.230	0.573	0.890	1.573	2.463	1.343	1.573	2.463	1.463
24	Finance, property etc	1.000	0.323	0.192	0.515	1.096	1.515	2.611	1.323	1.515	2.611	1.611
25	Ownership of dwellings	1.000	0.217	0.146	0.363	0.195	1.363	1.558	1.217	1.363	1.558	0.558
26	Public admin., defence	1.000	0.523	0.385	0.908	1.325	1.908	3.233	1.523	1.908	3.233	2.233
27	Community services	1.000	0.223	0.144	0.367	1.616	1.367	2.983	1.223	1.367	2.983	1.983
28	Recreational etc services	1.000	0.424	0.297	0.721	1.041	1.721	2.762	1.424	1.721	2.762	1.762

TABLE 2. INCOME MULTIPLIERS, DIRECT ALLOCATION OF COMPETING IMPORTS, 1989–90

	Industry	*Initial effects*	*First round effects*	*Industrial support effects*	*Production induced effects*	*Consumption induced effects*	*Simple multipliers*	*Total multipliers*	*Type 1A multipliers*	*Type 1B multipliers*	*Type 2A multipliers*	*Type 2B multipliers*
1	Agriculture	0.109	0.076	0.062	0.138	0.133	0.247	0.380	1.693	2.266	3.480	2.480
2	Forestry, fishing, hunting	0.289	0.072	0.060	0.132	0.225	0.421	0.646	1.250	1.454	2.234	1.234
3	Mining	0.151	0.076	0.052	0.128	0.149	0.279	0.428	1.507	1.849	2.839	1.839
4	Meat and milk products	0.108	0.109	0.116	0.225	0.178	0.333	0.511	2.005	3.068	4.712	3.712
5	Food products nec	0.154	0.119	0.110	0.229	0.205	0.383	0.588	1.774	2.481	3.811	2.811
6	Beverages, tobacco products	0.119	0.110	0.093	0.203	0.173	0.322	0.495	1.925	2.718	4.174	3.174
7	Textiles	0.158	0.120	0.101	0.221	0.203	0.379	0.582	1.762	2.397	3.682	2.682
8	Clothing and footwear	0.255	0.112	0.084	0.196	0.241	0.451	0.692	1.438	1.769	2.717	1.717
9	Wood, wood products etc	0.235	0.129	0.094	0.223	0.246	0.458	0.704	1.548	1.953	3.000	2.000
10	Paper, printing etc	0.234	0.115	0.072	0.187	0.225	0.421	0.646	1.490	1.797	2.760	1.760
11	Chemicals	0.134	0.110	0.090	0.200	0.178	0.334	0.512	1.823	2.498	3.836	2.836
12	Petroleum and coal products	0.026	0.108	0.087	0.195	0.118	0.221	0.339	5.158	8.497	13.049	12.049
13	Non-metallic min. products	0.175	0.110	0.082	0.192	0.197	0.367	0.564	1.628	2.097	3.220	2.220
14	Basic metals and products	0.115	0.095	0.092	0.187	0.161	0.302	0.463	1.832	2.632	4.042	3.042
15	Fabricated metal products	0.204	0.111	0.101	0.212	0.223	0.416	0.639	1.545	2.038	3.130	2.130
16	Transport equipment	0.179	0.101	0.079	0.180	0.193	0.359	0.552	1.564	2.009	3.085	2.085
17	Machinery etc nec	0.235	0.100	0.076	0.176	0.220	0.411	0.631	1.424	1.750	2.688	1.688
18	Miscell. manufacturing	0.205	0.105	0.081	0.186	0.210	0.391	0.601	1.511	1.912	2.936	1.936
19	Electricity, gas, water	0.149	0.083	0.067	0.150	0.160	0.299	0.459	1.561	2.010	3.087	2.087
20	Construction	0.218	0.110	0.083	0.193	0.221	0.411	0.632	1.502	1.888	2.899	1.899
21	Wholesale, retail trade	0.332	0.112	0.058	0.170	0.270	0.502	0.772	1.337	1.513	2.323	1.323
22	Repairs	0.372	0.071	0.051	0.122	0.265	0.494	0.759	1.192	1.326	2.037	1.037
23	Transport, communication	0.269	0.089	0.058	0.147	0.222	0.416	0.638	1.331	1.542	2.369	1.369
24	Finance, property etc	0.360	0.101	0.051	0.152	0.274	0.512	0.786	1.280	1.423	2.186	1.186
25	Ownership of dwellings	—	0.055	0.036	0.091	0.049	0.091	0.140	—	—	—	—
26	Public admin., defence	0.362	0.156	0.101	0.257	0.332	0.619	0.951	1.431	1.712	2.629	1.629
27	Community services	0.652	0.066	0.037	0.103	0.404	0.755	1.159	1.101	1.157	1.778	0.778
28	Recreational etc services	0.300	0.114	0.073	0.187	0.260	0.487	0.747	1.382	1.624	2.495	1.495

TABLE 3. EMPLOYMENT (FULL-TIME EQUIVALENT) MULTIPLIERS, DIRECT ALLOCATION OF COMPETING IMPORTS, 1989–90

	Industry	*Initial effects*	*First round effects*	*Industrial support effects*	*Production induced effects*	*Consumption induced effects*	*Simple multipliers*	*Total multipliers*	*Type 1A multipliers*	*Type 1B multipliers*	*Type 2A multipliers*	*Type 2B multipliers*
1	Agriculture	15	4	3	7	6	22	27	1.266	1.446	1.828	0.828
2	Forestry, fishing, hunting	11	3	2	6	10	16	26	1.289	1.516	2.424	1.424
3	Mining	4	3	2	5	6	9	15	1.753	2.276	3.977	2.977
4	Meat and milk products	5	10	6	16	8	20	28	3.082	4.301	5.922	4.922
5	Food products nec	6	7	5	12	9	18	26	2.105	2.955	4.427	3.427
6	Beverages, tobacco products	5	6	4	10	7	14	22	2.250	3.124	4.760	3.760
7	Textiles	7	6	4	10	9	17	26	1.907	2.550	3.858	2.858
8	Clothing and footwear	15	5	4	9	10	24	34	1.353	1.597	2.301	1.301
9	Wood, wood products etc	13	6	4	10	11	23	34	1.446	1.738	2.528	1.528
10	Paper, printing etc	9	5	3	7	10	16	26	1.505	1.820	2.903	1.903
11	Chemicals	5	4	4	8	8	13	20	1.968	2.761	4.441	3.441
12	Petroleum and coal products	1	3	3	7	5	8	13	5.249	9.304	15.595	14.595
13	Non-metallic min. products	7	4	3	7	8	14	23	1.609	2.065	3.307	2.307
14	Basic metals and products	3	3	3	7	7	10	17	1.922	2.885	4.887	3.887
15	Fabricated metal products	9	4	4	8	10	17	27	1.472	1.884	2.922	1.922
16	Transport equipment	7	4	3	7	8	14	23	1.570	1.991	3.128	2.128
17	Machinery etc nec	10	4	3	7	9	17	26	1.429	1.731	2.720	1.720
18	Miscell. manufacturing	10	4	3	8	9	18	27	1.423	1.744	2.614	1.614
19	Electricity, gas, water	5	3	2	5	7	10	17	1.567	2.065	3.476	2.476
20	Construction	10	5	3	8	9	18	27	1.457	1.781	2.727	1.727
21	Wholesale, retail trade	17	4	2	6	12	24	35	1.238	1.367	2.036	1.036
22	Repairs	17	3	2	5	11	22	34	1.180	1.293	1.954	0.954
23	Transport, communication	11	4	2	6	10	17	26	1.337	1.541	2.429	1.429
24	Finance, property etc	12	4	2	6	12	17	29	1.312	1.480	2.491	1.491
25	Ownership of dwellings	—	2	1	3	2	3	5	—	—	—	—
26	Public admin., defence	12	6	4	10	14	21	36	1.475	1.798	2.995	1.995
27	Community services	21	3	1	4	17	25	42	1.122	1.191	2.020	1.020
28	Recreational etc services	17	5	3	8	11	24	36	1.290	1.476	2.153	1.153

TABLE 4. OUTPUT MULTIPLIERS, INDIRECT ALLOCATION OF COMPETING IMPORTS, 1989–90

	Industry	*Initial effects*	*First round effects*	*Industrial support effects*	*Production induced effects*	*Consumption induced effects*	*Simple multipliers*	*Total multipliers*	*Type 1A multipliers*	*Type 1B multipliers*	*Type 2A multipliers*	*Type 2B multipliers*
1	Agriculture	1.000	0.409	0.395	0.804	0.785	1.804	2.589	1.409	1.804	2.589	1.589
2	Forestry, fishing, hunting	1.000	0.381	0.406	0.787	1.301	1.787	3.088	1.388	1.787	3.088	2.088
3	Mining	1.000	0.382	0.349	0.731	0.899	1.731	2.63	1.382	1.731	2.630	1.630
4	Meat and milk products	1.000	0.760	0.673	1.433	1.015	2.433	3.448	1.760	2.433	3.448	2.448
5	Food products nec	1.000	0.656	0.657	1.313	1.197	2.313	3.510	1.656	2.313	3.510	2.510
6	Beverages, tobacco products	1.000	0.577	0.578	1.155	1.031	2.155	3.186	1.577	2.155	3.186	2.186
7	Textiles	1.000	0.691	0.754	1.445	1.335	2.445	3.780	1.691	2.445	3.780	2.780
8	Clothing and footwear	1.000	0.628	0.744	1.372	1.603	2.372	3.975	1.628	2.372	3.975	2.975
9	Wood, wood products etc	1.000	0.605	0.651	1.256	1.507	2.256	3.763	1.605	2.256	3.763	2.763
10	Paper, printing etc	1.000	0.553	0.542	1.095	1.445	2.095	3.540	1.553	2.095	3.540	2.540
11	Chemicals	1.000	0.649	0.714	1.363	1.196	2.363	3.559	1.649	2.363	3.559	2.559
12	Petroleum and coal products	1.000	0.762	0.660	1.422	0.856	2.422	3.278	1.762	2.422	3.278	2.278
13	Non-metallic min. products	1.000	0.560	0.517	1.077	1.165	2.077	3.242	1.560	2.077	3.242	2.242
14	Basic metals and products	1.000	0.636	0.623	1.259	0.986	2.259	3.245	1.636	2.259	3.245	2.245
15	Fabricated metal products	1.000	0.635	0.718	1.353	1.349	2.353	3.702	1.635	2.353	3.702	2.702
16	Transport equipment	1.000	0.621	0.715	1.336	1.326	2.336	3.662	1.621	2.336	3.662	2.662
17	Machinery etc nec	1.000	0.596	0.661	1.257	1.448	2.257	3.705	1.596	2.257	3.705	2.705
18	Miscell. manufacturing	1.000	0.595	0.658	1.253	1.350	2.253	3.603	1.595	2.253	3.603	2.603
19	Electricity, gas, water	1.000	0.464	0.387	0.851	0.902	1.851	2.753	1.464	1.851	2.753	1.753
20	Construction	1.000	0.524	0.557	1.081	1.313	2.081	3.394	1.524	2.081	3.394	2.394
21	Wholesale, retail trade	1.000	0.385	0.306	0.691	1.486	1.691	3.177	1.385	1.691	3.177	2.177
22	Repairs	1.000	0.370	0.398	0.768	1.554	1.768	3.322	1.370	1.768	3.322	2.322
23	Transport, communication	1.000	0.392	0.368	0.760	1.282	1.760	3.042	1.392	1.760	3.042	2.042
24	Finance, property etc	1.000	0.342	0.259	0.601	1.498	1.601	3.099	1.342	1.601	3.099	2.099
25	Ownership of dwellings	1.000	0.225	0.109	0.415	0.287	1.415	1.702	1.225	1.415	1.702	0.702
26	Public admin., defence	1.000	0.581	0.571	1.152	1.896	2.152	4.048	1.581	2.152	4.048	3.048
27	Community services	1.000	0.252	0.222	0.474	2.190	1.474	3.664	1.252	1.474	3.664	2.664
28	Recreational etc services	1.000	0.474	0.427	0.901	1.481	1.901	3.382	1.474	1.901	3.382	2.382

TABLE 5. INCOME MULTIPLIERS, INDIRECT ALLOCATION OF COMPETING IMPORTS, 1989–90

	Industry	*Initial effects*	*First round effects*	*Industrial support effects*	*Production induced effects*	*Consumption induced effects*	*Simple multipliers*	*Total multipliers*	*Type 1A multipliers*	*Type 1B multipliers*	*Type 2A multipliers*	*Type 2B multipliers*
1	Agriculture	0.109	0.082	0.088	0.170	0.191	0.279	0.470	1.748	2.553	4.310	3.310
2	Forestry, fishing, hunting	0.289	0.082	0.091	0.173	0.318	0.462	0.780	1.285	1.598	2.698	1.698
3	Mining	0.151	0.088	0.080	0.168	0.220	0.319	0.539	1.585	2.119	3.577	2.577
4	Meat and milk products	0.108	0.111	0.142	0.253	0.248	0.361	0.609	2.020	3.327	5.615	4.615
5	Food products nec	0.154	0.127	0.144	0.271	0.292	0.425	0.717	1.822	2.755	4.650	3.650
6	Beverages, tobacco products	0.119	0.118	0.129	0.247	0.252	0.366	0.618	1.993	3.087	5.211	4.211
7	Textiles	0.158	0.143	0.173	0.316	0.327	0.474	0.801	1.907	3.001	5.066	4.066
8	Clothing and footwear	0.255	0.143	0.171	0.314	0.392	0.569	0.961	1.562	2.235	3.772	2.772
9	Wood, wood products etc	0.235	0.149	0.151	0.300	0.369	0.535	0.904	1.633	2.281	3.850	2.850
10	Paper, printing etc	0.234	0.145	0.134	0.279	0.354	0.513	0.867	1.621	2.192	3.700	2.700
11	Chemicals	0.134	0.132	0.159	0.291	0.292	0.425	0.717	1.986	3.179	5.365	4.365
12	Petroleum and coal products	0.026	0.128	0.150	0.278	0.209	0.304	0.513	5.913	11.690	19.733	18.733
13	Non-metallic min. products	0.175	0.120	0.119	0.239	0.284	0.414	0.698	1.687	2.364	3.990	2.990
14	Basic metals and products	0.115	0.105	0.130	0.235	0.242	0.350	0.592	1.913	3.058	5.162	4.162
15	Fabricated metal products	0.204	0.126	0.149	0.275	0.330	0.479	0.809	1.615	2.347	3.962	2.962
16	Transport equipment	0.179	0.134	0.158	0.292	0.324	0.471	0.795	1.750	2.632	4.443	3.443
17	Machinery etc nec	0.235	0.134	0.145	0.279	0.354	0.514	0.868	1.571	2.189	3.695	2.695
18	Miscell. manufacturing	0.205	0.127	0.148	0.275	0.329	0.480	0.809	1.622	2.342	3.953	2.953
19	Electricity, gas, water	0.149	0.086	0.085	0.171	0.221	0.320	0.541	1.581	2.156	3.640	2.640
20	Construction	0.218	0.122	0.126	0.248	0.321	0.466	0.787	1.561	2.140	3.612	2.612
21	Wholesale, retail trade	0.332	0.117	0.079	0.196	0.363	0.528	0.891	1.354	1.589	2.682	1.682
22	Repairs	0.372	0.088	0.092	0.180	0.380	0.552	0.932	1.236	1.483	2.503	1.503
23	Transport, communication	0.269	0.099	0.087	0.186	0.313	0.455	0.768	1.368	1.689	2.851	1.851
24	Finance, property etc	0.360	0.106	0.066	0.172	0.366	0.532	0.898	1.293	1.479	2.496	1.496
25	Ownership of dwellings	—	0.057	0.045	0.102	0.070	0.102	0.172	—	—	—	—
26	Public admin., defence	0.362	0.169	0.142	0.311	0.463	0.673	1.136	1.467	1.861	3.141	2.141
27	Community services	0.652	0.072	0.054	0.126	0.535	0.778	1.313	1.110	1.193	2.01	1.014
28	Recreational etc services	0.300	0.125	0.101	0.226	0.362	0.526	0.888	1.418	1.756	2.964	1.964

TABLE 6. EMPLOYMENT (FULL-TIME EQUIVALENT) MULTIPLIERS, INDIRECT ALLOCATION OF COMPETING IMPORTS, 1989–90

	Industry	*Initial effects*	*First round effects*	*Industrial support effects*	*Production induced effects*	*Consumption induced effects*	*Simple multipliers*	*Total multipliers*	*Type 1A multipliers*	*Type 1B multipliers*	*Type 2A multipliers*	*Type 2B multipliers*
1	Agriculture	15	4	4	8	8	23	31	1.282	1.529	2.079	1.079
2	Forestry, fishing, hunting	11	4	3	7	13	18	31	1.331	1.675	2.950	1.950
3	Mining	4	3	3	6	10	10	20	1.873	2.697	5.189	4.189
4	Meat and milk products	5	10	6	16	11	21	32	3.096	4.541	6.787	5.787
5	Food products nec	6	7	6	13	13	19	32	2.158	3.250	5.339	4.339
6	Beverages, tobacco products	5	6	5	11	11	16	27	2.351	3.542	5.917	4.917
7	Textiles	7	7	7	14	14	21	35	2.051	3.161	5.255	4.255
8	Clothing and footwear	15	7	7	14	16	29	45	1.448	1.950	3.088	2.088
9	Wood, wood products etc	13	7	7	14	15	27	42	1.521	1.990	3.169	2.169
10	Paper, printing etc	9	6	5	11	15	20	35	1.638	2.225	3.914	2.914
11	Chemicals	5	5	6	11	13	16	29	2.134	3.523	6.255	5.255
12	Petroleum and coal products	1	4	6	10	8	11	19	5.986	13.043	24.106	23.106
13	Non-metallic min. products	7	5	4	9	12	16	28	1.662	2.327	4.115	3.115
14	Basic metals and products	3	3	6	9	10	12	22	2.006	3.402	6.375	5.375
15	Fabricated metal products	9	5	6	11	14	20	34	1.531	2.138	3.675	2.675
16	Transport equipment	7	6	6	12	14	19	33	1.759	2.606	4.512	3.512
17	Machinery etc nec	10	5	6	11	15	21	36	1.574	2.156	3.736	2.736
18	Miscell. manufacturing	10	5	7	12	14	22	36	1.515	2.088	3.451	2.451
19	Electricity, gas, water	5	3	3	6	9	11	20	1.591	2.238	4.172	3.172
20	Construction	10	5	5	10	14	20	34	1.511	2.000	3.371	2.371
21	Wholesale, retail trade	17	4	4	8	15	25	40	1.251	1.425	2.323	1.323
22	Repairs	17	4	4	8	16	25	41	1.219	1.428	2.373	1.373
23	Transport, communication	11	4	3	7	14	18	32	1.375	1.685	2.929	1.929
24	Finance, property etc	12	4	2	6	16	18	34	1.328	1.546	2.889	1.889
25	Ownership of dwellings	—	2	2	4	3	4	7	—	—	—	—
26	Public admin., defence	12	6	6	12	19	24	43	1.518	1.978	3.641	2.641
27	Community services	21	3	2	5	23	26	49	1.134	1.235	2.327	1.327
28	Recreational etc services	17	5	4	9	16	26	42	1.319	1.574	2.510	1.510

TABLE 7. COMPETING AND COMPLEMENTARY IMPORT MULTIPLIERS, 1989–90

	Industry	*Initial effects*	*First round effects*	*Industrial support effects*	*Production induced effects*	*Consumption induced effects*	*Simple multipliers*	*Total multipliers*	*Type 1A multipliers*	*Type 1B multipliers*	*Type 2A multipliers*	*Type 2B multipliers*
1	Agriculture	0.032	0.022	0.016	0.038	0.024	0.070	0.094	1.675	2.167	2.918	1.918
2	Forestry, fishing, hunting	0.048	0.024	0.015	0.039	0.041	0.087	0.128	1.493	1.808	2.663	1.663
3	Mining	0.054	0.020	0.013	0.033	0.027	0.087	0.114	1.372	1.611	2.120	1.120
4	Meat and milk products	0.010	0.024	0.030	0.054	0.033	0.064	0.097	3.447	6.419	9.671	8.671
5	Food products nec	0.045	0.028	0.027	0.055	0.037	0.100	0.137	1.617	2.213	3.045	2.045
6	Beverages, tobacco products	0.046	0.030	0.025	0.055	0.031	0.101	0.132	1.659	2.182	2.868	1.868
7	Textiles	0.136	0.040	0.026	0.066	0.037	0.202	0.239	1.296	1.486	1.761	0.761
8	Clothing and footwear	0.172	0.043	0.023	0.066	0.044	0.238	0.282	1.250	1.382	1.640	0.640
9	Wood, wood products etc	0.095	0.037	0.025	0.062	0.045	0.157	0.202	1.390	1.654	2.125	1.125
10	Paper, printing etc	0.133	0.034	0.018	0.052	0.041	0.185	0.226	1.253	1.388	1.700	0.700
11	Chemicals	0.146	0.041	0.024	0.065	0.032	0.211	0.243	1.278	1.443	1.668	0.668
12	Petroleum and coal products	0.158	0.037	0.022	0.059	0.022	0.217	0.239	1.235	1.375	1.513	0.513
13	Non-metallic min. products	0.061	0.028	0.020	0.048	0.036	0.109	0.145	1.453	1.786	2.382	1.382
14	Basic metals and products	0.067	0.032	0.025	0.057	0.030	0.124	0.154	1.483	1.851	2.293	1.293
15	Fabricated metal products	0.084	0.036	0.028	0.064	0.041	0.148	0.189	1.431	1.764	2.251	1.251
16	Transport equipment	0.170	0.038	0.022	0.060	0.035	0.230	0.265	1.223	1.352	1.560	0.560
17	Machinery etc nec	0.156	0.034	0.021	0.055	0.041	0.211	0.252	1.219	1.352	1.610	0.610
18	Miscell. manufacturing	0.137	0.041	0.023	0.064	0.038	0.201	0.239	1.298	1.463	1.744	0.744
19	Electricity, gas, water	0.016	0.017	0.015	0.032	0.030	0.048	0.078	2.060	3.023	4.874	3.874
20	Construction	0.063	0.033	0.022	0.055	0.040	0.118	0.158	1.524	1.870	2.511	1.511
21	Wholesale, retail trade	0.024	0.019	0.012	0.031	0.050	0.055	0.105	1.789	2.315	4.403	3.443
22	Repairs	0.076	0.028	0.013	0.041	0.048	0.117	0.165	1.362	1.534	2.172	1.172
23	Transport, communication	0.048	0.025	0.014	0.039	0.041	0.087	0.128	1.509	1.807	2.657	1.657
24	Finance, property etc	0.020	0.013	0.010	0.023	0.051	0.043	0.094	1.648	2.159	4.678	3.678
25	Ownership of dwellings	0.008	0.008	0.008	0.016	0.008	0.024	0.032	1.963	2.887	3.975	2.975
26	Public admin., defence	0.074	0.035	0.024	0.059	0.061	0.133	0.194	1.471	1.790	2.608	1.608
27	Community services	0.029	0.012	0.008	0.020	0.075	0.049	0.124	1.421	1.714	4.309	3.309
28	Recreational etc services	0.048	0.019	0.016	0.035	0.048	0.083	0.131	1.402	1.732	2.720	1.720

TABLE 8. COMPETING IMPORT MULTIPLIERS, 1989–90

	Industry	*Initial effects*	*First round effects*	*Industrial support effects*	*Production induced effects*	*Consumption induced effects*	*Simple multipliers*	*Total multipliers*	*Type 1A multipliers*	*Type 1B multipliers*	*Type 2A multipliers*	*Type 2B multipliers*
1	Agriculture	0.032	0.021	0.016	0.037	0.023	0.069	0.092	2.000	2.702	3.715	2.715
2	Forestry, fishing, hunting	0.048	0.023	0.015	0.038	0.040	0.086	0.126	1.711	2.122	2.860	1.860
3	Mining	0.053	0.020	0.012	0.032	0.026	0.085	0.111	1.392	1.676	2.394	1.394
4	Meat and milk products	0.008	0.024	0.029	0.053	0.031	0.061	0.092	2.758	5.457	8.374	7.374
5	Food products nec	0.039	0.026	0.026	0.052	0.037	0.091	0.128	1.565	2.170	3.004	2.004
6	Beverages, tobacco products	0.044	0.029	0.024	0.053	0.030	0.097	0.127	1.673	2.276	3.140	2.140
7	Textiles	0.134	0.039	0.025	0.064	0.036	0.198	0.234	1.291	1.515	1.810	0.810
8	Clothing and footwear	0.169	0.042	0.022	0.064	0.043	0.233	0.276	1.312	1.502	1.850	0.850
9	Wood, wood products etc	0.094	0.036	0.025	0.061	0.043	0.155	0.198	1.407	1.724	2.299	1.299
10	Paper, printing etc	0.131	0.033	0.017	0.050	0.040	0.181	0.221	1.251	1.390	1.732	0.732
11	Chemicals	0.144	0.04	0.023	0.063	0.032	0.207	0.239	1.291	1.475	1.739	0.739
12	Petroleum and coal products	0.155	0.036	0.022	0.058	0.021	0.213	0.234	1.226	1.363	1.506	0.506
13	Non-metallic min. products	0.059	0.027	0.019	0.046	0.035	0.105	0.140	1.527	1.954	2.750	1.750
14	Basic metals and products	0.065	0.032	0.023	0.055	0.029	0.120	0.149	1.756	2.467	3.444	2.444
15	Fabricated metal products	0.082	0.035	0.027	0.062	0.040	0.144	0.184	1.467	1.963	2.785	1.785
16	Transport equipment	0.168	0.037	0.021	0.058	0.034	0.226	0.260	1.256	1.396	1.631	0.631
17	Machinery etc nec	0.154	0.033	0.021	0.054	0.039	0.208	0.247	1.210	1.365	1.697	0.697
18	Miscell. manufacturing	0.130	0.04	0.022	0.062	0.037	0.192	0.229	1.384	1.643	2.051	1.051
19	Electricity, gas, water	0.015	0.016	0.015	0.031	0.028	0.046	0.074	2.338	3.596	7.018	6.018
20	Construction	0.061	0.032	0.021	0.053	0.039	0.114	0.153	1.556	1.974	2.815	1.815
21	Wholesale, retail trade	0.022	0.018	0.012	0.030	0.048	0.052	0.100	1.930	2.564	4.949	3.949
22	Repairs	0.075	0.027	0.013	0.040	0.047	0.115	0.162	1.303	1.485	2.212	1.212
23	Transport, communication	0.047	0.024	0.014	0.038	0.039	0.085	0.124	1.689	2.090	3.425	2.425
24	Finance, property etc	0.019	0.012	0.010	0.022	0.049	0.041	0.090	1.724	2.299	4.695	3.695
25	Ownership of dwellings	0.008	0.008	0.007	0.015	0.009	0.023	0.032	2.325	3.774	5.557	4.557
26	Public admin., defence	0.057	0.032	0.022	0.054	0.059	0.111	0.170	1.247	1.409	2.147	1.147
27	Community services	0.028	0.012	0.008	0.020	0.071	0.048	0.119	1.417	1.720	4.564	3.564
28	Recreational etc services	0.047	0.019	0.015	0.034	0.046	0.081	0.127	1.353	1.655	2.515	1.515

EXPLANATORY NOTES

Introduction

An important application of input-output tables is in calculating inputs as a percentage of the output of an industry and using these percentages for estimating the input requirements for any given output of that industry. The percentages are known as *direct requirements coefficients* and are the core of input-output analysis. However, direct requirements coefficients have different meanings depending on the treatment of imports in the input-output table from which they are derived. For a table with direct allocation of competing imports, the coefficients only refer to the requirements for local production. Imports are recorded as a direct cost to the industry using them. On the other hand, for a table with indirect allocation of competing imports, the coefficients include the usage of both imported and locally produced commodities. This implies that substitution can take place between imports and domestic production without affecting the size of the coefficients. The direct requirements coefficients in the indirect allocation tables are known as *technical coefficients*. By further manipulating the direct requirements coefficients, we can derive measures known as *input-output multipliers* which are described in the following paragraphs. It is important to note that the direct requirements coefficients, and hence the multipliers, describe **average** effects and not marginal effects.

2 The main application of input-output multipliers is to examine the effects on an economy of an *exogenous* (i.e. determined by factors outside the productive system) change in *final demand* (private and government final consumption expenditure; private, public enterprise and general government gross fixed capital expenditure; increase in stocks; exports). The three most commonly used are *output, income* and *employment* multipliers. They provide, respectively, a measure of the effects of an exogenous change in final demand on:

- output of industries in the economy,
- income earned by households because of new outputs, and
- employment that is expected to be generated because of new outputs.

3 Import multipliers are another important type of input-output multiplier. They provide a measure of the effects on usage of imports by all industries in the economy resulting from a change in final demand for the output of a given industry.

4 Input-output multipliers derived from the direct allocation tables can be interpreted as showing the domestic effects of a change in final demand. Multipliers calculated from the indirect allocation tables can be considered as showing the global effects of a change in final demand, assuming competing imports to be produced using a technology similar to that used in Australia. Output, income and employment multipliers are derived for both direct and indirect allocation. Import multipliers can only be derived in the case of direct allocation (see Appendix A for explanation).

5 Multipliers at a 109 industry level for 1986-87 and 1989-90 and at the 28 and 109 industry levels for 1983-84 are available at specified prices from the ABS Input-Output Section.

Multipliers in input-output models

6 The input-output model relates industry outputs to final demand. In matrix notation, the model is expressed as $X = (I - A)^{-1} * Y$, where X is the column vector of industry outputs, Y the column vector of final demand, I is the identity matrix and A the direct requirements coefficients matrix. $(I - A)^{-1}$ is the 'open' Leontief inverse which is frequently referred to as the *total requirements coefficients* matrix. The term 'open' indicates that all final demand sectors are assumed to be exogenous. The open inverse $(I - A)^{-1}$ contains only information about the *production-induced effects* (see 8b) resulting from a given change in final demand. The multipliers which are derived from an open input-output model are known as *simple multipliers*.

7 The household sector, receiving income (wages, salaries and supplements) for work done in the production process, will spend this income on some local products (part of private final consumption expenditure). This in turn will influence domestic consumption and hence the level of output of each domestic industry. Because of these *consumption-induced effects* (see 8c) most input-output analysts prefer to treat the household sector as an *endogenous* (determined by factors inside the productive system) component of the economy. This can be done by including in matrix A one more column and row, for household consumption and income, respectively. In this case the input-output model is said to be closed with respect to households. The multipliers which are derived when the household sector is endogenous are called *total multipliers*.

8 An industry's *output multiplier* is defined as the total value of production by all industries of the economy that is necessary to satisfy a one dollar change in final demand for the output of that industry. *Income, employment* and *import multipliers* estimate the total change in household income, employment and imports generated as a result of the change in output. The multipliers can be decomposed into their various *multiplier effects* which are *initial; first round and industrial support*; and *consumption-induced effects*.

(a) *Initial effects:*
The *initial effect* on the output of an industry is a one dollar change in output to meet the change of one dollar in final demand. Associated with this change, there will also be initial effects on household income, employment and imports. These are determined by the industry's *income, employment* and *imports coefficients* (see Appendix A). Note that the

initial effects and the following effects on imports are only applicable in the case of direct allocation.

(b) *First round and industrial support effects:*
To produce an extra unit of output to meet a one dollar increase in final demand, an industry must increase its purchases from other industries and from itself. These additional *intermediate inputs* sum to the *first round effect*. Other industries in turn will need to increase their purchases to expand their output in order to meet the first round requirement. Following this will be second, third, and subsequent round requirements of indirect purchases. These indirect purchases sum to the *industrial support effect* which equals the simple multiplier less the initial and first round effects. The first round effect can be combined with the industrial support effect to produce the *production-induced effect*. The production-induced effect on industry output will have corresponding effects on household income, employment and imports.

(c) *Consumption-induced effects:*
The *consumption-induced effect* for an industry is equal to its total multiplier less its simple multiplier.

Type 1 and Type 2 multipliers

9 The preceding paragraphs define simple multipliers (para 6), total multipliers (para 7) and the component effects of these multipliers (para 8). Eight tables of input-output multipliers for output, household income, employment and imports, derived from the 1989-90 input-output tables, are included in this publication. Each table has 11 columns. The first seven columns show each of the effects identified in paragraph 8 as well as the simple and total multipliers for each of the 28 industry groups. The last four columns of each table are the *Type 1A, Type 1B, Type 2A* and *Type 2B multipliers*. The Type 1A and 1B multipliers express the **simple multiplier** (or components of the simple multiplier) as a multiple of the initial effect. The Type 2A and Type 2B multipliers express the **total multiplier** (or part of the total multiplier) as a multiple of the initial effect. The formulae for deriving these multipliers are shown in Appendix A.

10 The Type 1 and Type 2 output multipliers published in Tables 1 and 4 do not provide any more information than the simple or total output multipliers. The reason is that the initial effect for all industries is identical. Recall that the starting point for the derivation of all these multipliers is to assume an exogenous change in final demand of $1 for each industry. This $1 change is the *initial effect* used in the derivation of output multipliers.

11 The Type 1 and Type 2 household income multipliers published in Tables 2 and 5 do add to the information contained in the simple or total household income multipliers. The starting point for deriving household income multipliers, as with the output multipliers, is to assume a $1 change in final demand. The first impact of a $1 change in final demand on the household income (wages, salaries and supplements) for an industry is the amount of wages that the industry pays in producing an extra $1 worth of output. This proportion (wages to output), which can be different for each industry, is the *initial effect* which is used in deriving the simple and total household income multipliers. The Type 1 and Type 2 household income multipliers are informative in this case, because they show the total change in household income resulting from the initial unit change in household income rather than the change in household income resulting from a unit change in final demand.

12 The initial effect of a change in employment is defined as the change in employment necessary to satisfy a $1 million change in final demand for the output of an industry. This relationship between output and employment varies markedly between industries. Therefore, as with the household income multipliers, the simple and total employment multipliers are calculated using different initial effects for each industry. It will often be desirable to look at the total change in employment resulting from an initial unit change in employment rather than that resulting from an initial change in final demand. Again the Type 1 and Type 2 employment multipliers add to the information provided by the simple or total employment multipliers because they express the simple or total change as a multiple of the initial impact.

13 In the case of import multipliers, the initial effect is the value of imports consumed in producing an extra $1 of domestically produced goods. There are two tables of import multipliers, Table 7 for all imports and Table 8 for competing imports only. The multipliers for all imports (competing imports plus complementary imports) are bigger than those for competing imports. The largest difference is for the industry *Public administration and defence*, because some defence imports are classified as complementary. For further details of complementary imports, see Appendix D of *Australian National Accounts, Input-Output Tables 1989-90* (5209.0).

14 An illustration of the differences between the total household income multiplier and the Type 1 and Type 2 household income multipliers is seen in Table 2 for the industry *Petroleum and coal products*. The total multiplier for this industry is 0.339, which means that a $1 change in final demand for the output of this industry requires 33.9c in wages to be paid by all industries in the economy. The Type 2A multiplier has a value of 13.049 which means that a $1 change in the household income generated by this industry produces a change of $13.05 in wages throughout the whole economy. The relatively high value for the Type 2A multiplier occurs because of the relatively low value of wages as a proportion of output. An initial effects value of 0.026 means that a $38.46 change in final demand for the output of this industry is required to generate an initial $1 change in wages paid by this industry. This $38.46 change in final demand means that the industry will require increased production by all industries in order to satisfy its input requirements. The consequential production by all industries requires an extra $12.05 to be paid as wages. Therefore, the total

wages bill for the whole economy will be increased by $13.05, which is the initial $1 plus the consequential $12.05.

Data sources

15 The main sources used to derive the input-output multipliers are *Table 12, Direct requirements coefficients (28 industries, direct allocation of competing imports)* and *Table 15, Direct requirements coefficients (28 industries, indirect allocation of competing imports)*, from *Australian National Accounts, Input-Output Tables 1989-90* (5209.0). Employment estimates used are full-time equivalent, that is, the number of full-time workers plus 50 per cent of the number of part-time workers. Employment estimates used in Tables 3 and 6 are obtained from the ABS Labour Force Survey and are published in Table 22 of 5209.0. Table 22 also shows employment estimates derived from the 1991 Population Census. Other multipliers are available as priced products on request.

Related publications

Australian Standard Industrial Classification, 1983 edition (1201.0)

Australian National Accounts: Input-Output Tables 1989-90 (5209.0)

The Labour Force, Australia, July to June 1989-90 (6203.0)

16 Current publications produced by the ABS are listed in the *Catalogue of Publications and Products, Australia* (1101.0). The ABS also issues, on Tuesdays and Fridays, a *Publications Advice* (1105.0) which lists publications to be released in the next few days. The Catalogue and Publications Advice are available from any ABS office.

Further reading

Barbetti, A.J., Bobbin, I., de Zilva, D. and Ho, T.V. [1992]: Input-Output: Derived Tables for Australia Based on a Japanese Input-Output Model; paper presented at RSA Conference, Ballarat.

Centre for South Australian Economic Studies, 1986: Input-Output Tables for the State and Regions of South Australia 1980-81; report to the South Australian Department of State Development.

Centre for South Australian Economic Studies, 1988: Input-Output Tables for the State and Regions of South Australia 1985-86; report to the South Australian Government.

Danmarks Statistik, 1989: Input-Output tabeller og analyser 1985.

Government Statisticians Office, 1990: Experimental Input-Output Tables Queensland 1985-86, Queensland.

Jensen, R.C. and West, G.R. [1986]: Input-Output for Practitioners, Theory and Applications; Australian Government Publishing Service, Canberra.

Laplagne, P. [1988]: Comparative Multiplier Analysis of the Tourism and Nickel sectors in New Caledonia; University of New England, Armidale.

Miller, R.E. and Blair, P.D. [1985]: Input-Output Analysis, Foundations and Extensions; Prentice-Hall, Englewood Cliffs.

Morrison, J.B. and West G.R. [1988]: An Input-Output Table for the Canberra economy; report prepared for the National Capital Development Commission.

Symbols and other usages

17 The following general abbreviations are used in this publication:

ABS	Australian Bureau of Statistics
nec	Not elsewhere classified
—	Nil or rounded to zero.

APPENDIX A
TECHNICAL NOTE

Assume an economy is divided into n sectors. If we denote by X_i the total output of sector i, Y_i the total final demand for sector i's product, and Z_{ij} the interindustry sales from sector i to sector j, we may write:

$$
\begin{aligned}
X_1 &= Z_{11} + Z_{12} + \ldots + Z_{1j} + \ldots + Z_{1n} + Y_1 \\
X_2 &= Z_{21} + Z_{22} + \ldots + Z_{2j} + \ldots + Z_{2n} + Y_2 \\
&\;\;\vdots \\
X_i &= Z_{i1} + Z_{i2} + \ldots + Z_{ij} + \ldots + Z_{in} + Y_i \\
&\;\;\vdots \\
X_n &= Z_{n1} + Z_{n2} + \ldots + Z_{nj} + \ldots + Z_{nn} + Y_n
\end{aligned}
\tag{A.1}
$$

Consider the information in the second row and second column on the right-hand side. The row represents the sales by sector 2, to all the sectors and to final demand; and the column is the sales to sector 2. Thus, the column represents the sources and magnitudes of sector 2's *input* and the row represents the distribution of sector 2's *output*. The Z terms on the right-hand side therefore represent the inter-industry flows of input and output, which can be recorded in a table called an *input-output* table. These figures (the Z terms) are the core of input-output analysis.

The ratio of input to output, denoted by a_{ij} (which equals Z_{ij}, the flow of input from i to j, divided by X_j, the total output of j), is termed a technical coefficient. In input-output analysis, a fundamental assumption is that the technical coefficients are assumed to be fixed. That is, inputs are employed in fixed proportions. Hence, (A.1) can be rewritten as:

$$
\begin{aligned}
X_1 &= a_{11}X_1 + a_{12}X_2 + \ldots + a_{1j}X_j + \ldots + a_{1n}X_n + Y_1 \\
X_2 &= a_{21}X_1 + a_{22}X_2 + \ldots + a_{2j}X_j + \ldots + a_{2n}X_n + Y_2 \\
&\;\;\vdots \\
X_i &= a_{i1}X_1 + a_{i2}X_2 + \ldots + a_{ij}X_j + \ldots + a_{in}X_n + Y_i \\
&\;\;\vdots \\
X_n &= a_{n1}X_1 + a_{n2}X_2 + \ldots + a_{nj}X_j + \ldots + a_{nn}X_n + Y_n
\end{aligned}
\tag{A.2}
$$

In matrix notation, (A.2) is expressed as

$$X = AX + Y \tag{A.3}$$

From (A.3) we obtain

$$X = (I - A)^{-1} * Y \tag{A.4}$$

where:

$$A = \begin{bmatrix} a_{11} & a_{12} & \cdot\cdot & a_{1n} \\ a_{21} & a_{22} & \cdot\cdot & a_{2n} \\ \cdot & \cdot & & \cdot \\ \cdot & \cdot & & \cdot \\ a_{n1} & a_{n2} & \cdot\cdot & a_{nn} \end{bmatrix}, \quad X = \begin{bmatrix} X_1 \\ X_2 \\ \cdot \\ \cdot \\ X_n \end{bmatrix}, \quad Y = \begin{bmatrix} Y_1 \\ Y_2 \\ \cdot \\ \cdot \\ Y_n \end{bmatrix} \quad \text{and } I = \begin{bmatrix} 1 & 0 & \cdot & \cdot & 0 \\ 0 & 1 & & & 0 \\ \cdot & & \cdot & & \cdot \\ \cdot & & & \cdot & \cdot \\ 0 & 0 & \cdot & \cdot & 1 \end{bmatrix}$$

If the inverse $(I - A)^{-1}$ exists then (A.4) has a unique solution. The matrix A is known as the *direct requirements coefficients matrix* and $(I - A)^{-1}$ is the open Leontief inverse which is frequently referred to as the *total requirements coefficients matrix*. In an 'open' input-output model where only the productive sectors of the economy are assumed to be *endogenous* (determined by factors inside the productive system), all final demands (private final consumption expenditure, government final consumption expenditure, public gross fixed capital expenditure, increase in stocks, exports) are assumed to be determined by factors outside the productive system. The model, however, can be closed with respect to households by including in the matrix A one more column and row, for household consumption and income, respectively. This will form a new matrix denoted by B and $(I - B)^{-1}$ is termed the *closed inverse matrix*. The closed inverse has one more column and row than the open inverse $(I - A)^{-1}$. In input-output analysis, the last

column of the closed inverse is interpreted as the *consumption multiplier* (the effect on the output of each sector of an additional dollar of consumption) and the last row as the *household income multiplier* (income created by each dollar of sales of each sector). The remaining rows and columns of the closed inverse (denoted by B^*), which correspond to rows and columns of the open inverse, represent the productive sectors. They contain elements which are larger than those of the open inverse, because they include extra output required to meet consumption induced output effects, as a result of closing the model with respect to households. The matrices B^*, A and $(I - A)^{-1}$ are used to derive input-output multipliers.

Derivation of Input-Output Multipliers

Output multipliers

Adding up each column vector of the A matrix will form a new row vector denoted by V_1. Similarly, by adding up each column vector of $(I - A)^{-1}$ and B^*, we obtain V_2 and V_3 respectively. Let V_1', V_2' and V_3' be the transposes of V_1, V_2 and V_3. The derivation of the output multipliers and their various multiplier effects is then as follows:

- the initial effect is given by $\begin{bmatrix} 1 \\ 1 \\ . \\ . \\ 1 \end{bmatrix}$
- the vector V_1' gives the first round effect
- the vector V_2' gives the simple multiplier
- the industrial-support effect = simple multiplier – initial effect – first round effect $= V_2' - \begin{bmatrix} 1 \\ 1 \\ . \\ 1 \end{bmatrix} - V_1'$
- production-induced effect = first round effect + industrial-support effect
- the vector V_3' gives the total multiplier
- consumption-induced effect = total multiplier – simple multiplier = $V_3' - V_2'$
- Type 1A $= \dfrac{\text{initial + first round}}{\text{initial}}$
- Type 1B $= \dfrac{\text{initial + production-induced}}{\text{initial}}$
- Type 2A $= \dfrac{\text{total multiplier}}{\text{initial}}$
- Type 2B $= \dfrac{\text{total multiplier} - \text{initial}}{\text{initial}}$

Income multipliers

Denote by **h** the vector of household coefficients, which is obtained by dividing the household income generated by each sector by the corresponding sector's output. Multiplying the elements of the matrices A, $(I - A)^{-1}$ and B^* by the corresponding household coefficients, we obtain the *income direct coefficients matrix*, the *income open inverse* and the

sub-matrix of the *income closed inverse*, respectively. These income matrices are used to derive income multiplier vectors V_1^*, V_2^*, and V_3^*.

By matrix multiplication, the vectors are given as:

$$V_1^* = h * A$$

$$V_2^* = h * (I - A)^{-1}$$

$$V_3^* = h * B^*$$

Let h', $V_1^{*'}$, $V_2^{*'}$ and $V_3^{*'}$ be the transposes of h, V_1^*, V_2^*, V_3^*, then:

- the vector h' gives the initial effect
- the $V_1^{*'}$ gives the first round effect
- the $V_2^{*'}$ gives the simple income multiplier
- industrial-support effect = $V_2^{*'} - h' - V_1^{*'}$
- production-induced effect = first round effect + industrial-support effect
- $V_3^{*'}$ gives the total income multiplier
- consumption-induced effect = total income multiplier – simple income multiplier
  $= V_3^{*'} - V_2^{*'}$

Employment multipliers
Denote by e the vector of employment coefficients which is obtained by dividing sector employment by corresponding sector output. Then the employment multipliers are derived similarly to the derivation of income multipliers:

$$V_1^{**} = e * A$$

$$V_2^{**} = e * (I - A)^{-1}$$

$$V_3^{**} = e * B^*$$

Import multipliers
Denote by i the vector of import coefficients which is obtained by dividing sector total imports (competing + complementary) by corresponding sector output. Then the import multipliers are also derived similarly to the derivation of income and employment multipliers:

$$V_1^{***} = i * A$$

$$V_2^{***} = i * (I - A)^{-1}$$

$$V_3^{***} = i * B^*$$

The above procedures to derive output, income and employment multipliers apply for both direct and indirect allocation of competing imports. Derivation of import multipliers is only applicable in the case of direct allocation where imports are treated as a direct cost to the industry using them, like the cost of the wages and salaries that the industry has to pay for employing labour. Import multipliers can be defined as the total change in imports (endogenous variable) when the final demand (exogenous variable) changes by one unit. Import multipliers can not be obtained when using indirect allocation since imports are then exogenous (they could be regarded as a negative component of final demand).

APPENDIX B
ILLUSTRATIVE EXAMPLES

This Appendix provides a brief explanation of each type of multiplier together with examples (using industry 11 - Chemicals) from Tables 1, 2, 3 and 8 in this publication.

1. OUTPUT MULTIPLIERS (Table 1)

1.1 Initial effects

The initial requirement for an extra dollar's worth of output of a given industry.

For an extra dollar of output of the chemicals industry, $1.00 of output is initially required from the chemicals industry itself.

1.2 First round effects

The amount of output required from all industries of the economy to produce the initial one dollar of extra output from an industry.

For an extra dollar of output of the chemicals industry, 50.1c of output is required from all industries (including chemicals) of the economy.

1.3 Industrial support effects

The first round output from all industries will induce extra output from all industries, and in turn, these will induce extra output, and so on. The induced output from the first round output (but excluding the first round output) is the industrial support output.

To produce 50.1c of first round output by all industries in the economy, 38.2c of output will be required from all industries eventually (after many rounds equilibrium is reached).

1.4 Production induced effects (1.2 plus 1.3 above)

The amount of output required from all industries of the economy to produce the initial one dollar of extra output and all the subsequent induced output.

To produce an extra dollar of output from the chemicals industry, 50.1c of first round output by all industries in the economy and an additional 38.2c of output by all industries eventually (after many rounds equilibrium is reached), that is, a total of 88.3c, is required from all industries (after many rounds of induced production).

1.5 Consumption induced effects

To produce the initial and the production induced output, wage and salary earners will earn extra income which they will spend on commodities produced by all industries in the economy. This spending will induce further production by all industries. The output resulting from this further induced production is the consumption induced output.

An extra dollar of initial output required from the chemicals industry will eventually lead to 71.4c of output induced by the spending on all commodities by wage and salary earners.

1.6 Simple multipliers (1.1 plus 1.4 above)

The total amount of output induced by the requirement from all industries to produce output to satisfy the demand for an extra dollar of output from an industry.

To satisfy the demand for an extra dollar of output from the chemicals industry, the initial output of $1.00 is required from that industry, and, as well, the production induced output of 50.1c + 38.2c is ultimately required (at an equilibrium point in time).

1.7 Total multipliers (1.5 plus 1.6 above)

The total amount of output induced by the requirement from all industries to produce output to satisfy the demand for an extra dollar of output from an industry, and by the spending of the extra wages and salaries earned (from producing the additional output) by householders (consumers).

To satisfy the demand for an extra dollar of chemicals output, the production induced output of $1.883 is

required from all industries in the economy, and 71.4c consumption induced output is required from all industries, that is, a total of $2.597 output is induced ultimately (at an equilibrium point in time).

1.8 Type 1A (1.1 plus 1.2 above)
Type 1B (1.1 plus 1.4 above)
Type 2A (1.7 above)
Type 2B (1.4 plus 1.5 above)

For output multipliers, these four types are self-explanatory but do not provide information additional to that from the first seven types. For income, employment etc multipliers, these four types do provide extra information (see below).

2 INCOME MULTIPLIERS (Table 2)

2.1 Each of the seven types of income multipliers (initial, first round, industrial support, production induced, consumption induced, simple and total) corresponds to the additional wages, salaries and supplements earned from working on producing the extra output induced by each of the first seven output effects in 1 above.

Wage and salary earners in the chemicals industry earned an extra 13.4c from working to produce the extra $1.00 of initial output. Wage and salary earners in all industries in the economy earned an extra 11.0c from working to produce the 50.1c of first round output. And so on.

2.2 Type 1A

For a one dollar increase in the wages and salaries earned by income earners in the industry being studied, the amount of additional wages, salaries and supplements earned by income earners in all industries in the economy, after the initial and first round of induced output.

Income earners in the chemicals industry earned an extra one dollar for every $7.463 (i.e. 1/0.134) of additional output. For each one dollar increase in these workers' income, an extra $1.823 is earned by workers in all industries in the economy, after the initial and first round of induced output.

2.3 Type 1B

For a one dollar increase in the wages and salaries earned by income earners in the industry being studied, the amount of additional wages, salaries and supplements earned by income earners in all industries in the economy, after the initial, first round and industrial support of induced output.

Income earners in the chemicals industry earned an extra one dollar for every $7.463 (i.e. 1/0.134) of additional output. For each one dollar increase in these workers' income, an extra $2.498 is earned by workers in all industries in the economy, after the initial, first round and industrial support induced output.

2.4 Type 2A

The amount of total additional wages and salaries earned by income earners in all industries in the economy due to a one dollar increase in the wages and salaries earned by income earners in the industry being studied. The amount includes the original one dollar increase in wages, salaries and supplements.

Income earners in the chemicals industry earn an extra one dollar for every $7.463 (i.e. 1/0.134) of additional output. For each one dollar increase in these workers' income, an extra $3.836 is earned by workers in all industries in the economy. The amount includes the original one dollar increase in wages and salaries.

2.5 Type 2B equals Type 2A less the original one dollar increase in wages and salaries.

3 GROSS OPERATING SURPLUS (GOS) MULTIPLIERS

These can be interpreted in the same way as the income multipliers except that 'income' refers to wages, salaries and supplements earned by householders; here GOS is earned by businesses.

4. VALUE ADDED AT FACTOR COST MULTIPLIERS

These can be interpreted in the same way as the income multipliers - value added at factor cost being (wages, salaries and supplements plus GOS).

5. EMPLOYMENT MULTIPLIERS (Table 3)

5.1 Each of the seven types of employment multipliers (initial, first round, industrial support, production induced, consumption induced, simple and total) corresponds to the additional employment (number of persons employed) generated by producing the extra output induced by each of the first seven output effects in 1 above.

In the tables, the employment multipliers relate to an extra $1 million of output. So for example, for an extra $1 million of output from the chemicals industry, initially an extra 5 persons are employed by that industry. Or one extra worker is employed by the chemicals industry for an extra $200,000 (i.e. 1,000,000/5) of output from that industry.

5.2 Type 1A

For one extra person employed in the industry being studied, the extra number of persons employed in all industries in the economy, after the initial and first round of induced output.

An additional person is employed in the chemicals industry for every $200,000 (i.e. 1,000,000/5) of chemicals output. For each extra person employed in the chemicals industry, an extra 1.968 persons are employed, after the initial and first round induced output.

5.3 Type 1B

For one extra person employed in the industry being studied, the extra number of persons employed in all industries in the economy, after the initial, first round and industrial support induced output.

An additional person is employed in the chemicals industry for every $200,000 (i.e. 1,000,000/5) of chemicals output. For each extra person employed in the chemicals industry an extra 2.761 persons are employed, after the initial, first round and industrial support induced output.

5.4 Type 2A

For one extra person employed in the industry being studied, the total number of extra persons employed in all industries in the economy. The number includes the original increase of one person employed in the industry being studied.

An additional person is employed in the chemicals industry for every $200,000 (i.e. 1,000,000/5) of chemicals output. For each extra person employed in the chemicals industry, an extra 4.441 persons are employed by all industries in the economy. The number includes the original increase of one full-time person employed by the chemicals industry.

5.5 Type 2B equals Type 2A less the original increase of one full-time person employed by the chemicals industry.

6 COMPETING IMPORT MULTIPLIERS (Table 8)

6.1 Each of the seven types of competing imports multipliers (initial, first round, industrial support, production induced, consumption induced, simple and total) corresponds to the additional imports required to produce the extra output induced by each of the first seven output effects in 1 above.

To produce an extra dollar of output of the chemicals industry, an extra 14.4c of competing imports of commodities used by that industry is required. To produce 50.1c of first round output by all industries in the economy, 4.0c of competing imports of commodities used by all industries in the economy is required. And so on.

6.2 Type 1A

For a one dollar increase in competing imports used by the industry being studied, the amount of additional competing imports required by all industries in the economy, after the initial and first round induced output.

The chemicals industry uses an extra one dollar of competing imports for every $6.944 (i.e. 1/0.144) of additional output. For each one dollar increase of competing imports used by the chemicals industry, an extra $1.291 is used by all industries in the economy, after the initial and first round induced output.

6.3 Type 1B

For a one dollar increase in competing imports used by the industry being studied, the amount of additional

competing imports required by all industries in the economy, after the initial, first round and industrial support induced output.

The chemicals industry uses an extra one dollar of competing imports for every $6.944 (i.e. 1/0.144) of additional output. For each one dollar increase of competing imports used in that industry, an extra $1.475 is used by all industries in the economy, after the initial, first round and industrial support induced output.

6.4 Type 2A

For a one dollar increase in competing imports used by the industry being studied, the total amount of additional competing imports required by all industries in the economy. This total includes the original extra one dollar of increase in competing imports required by the industry being studied.

The chemicals industry uses an extra one dollar of competing imports for every $6.944 (i.e. 1/0.144) of additional output. For each one dollar increase of competing imports used in the chemicals industry, a total of an extra $1.739 of competing imports is used by all industries in the economy. This total includes the original extra one dollar of increase in competing imports required by the chemicals industry.

6.5 Type 2B equals Type 2A less the original one dollar increase in competing imports used by the industry being studied)

There are other multipliers, for example commodity taxes (net) multipliers, and they can be interpreted similarly to the six types mentioned above. Caution should be exercised in the use of these multipliers. They apply to 'average' circumstances and their use depends on certain assumptions (for example constant inter-industry linkages) which may or may not hold over time, or in particular circumstances. Reference to publications on multipliers should clarify the pitfalls, etc in their use.

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