Information Paper Australian National Accounts Introduction to Input-Output Multipliers

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INFORMATION PAPER:
AUSTRALIAN NATIONAL ACCOUNTS: INTRODUCTION TO INPUT-OUTPUT MULTIPLIERS

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FOREWORD

Input-Output tables are part of the Australian national accounts, complementing the quarterly and annual series of national income, expenditure and product aggregates. They provide detailed information about the supply and disposition of commodities in the Australian economy and about the structure of, and inter-relationships between, Australian industries.

Detailed data on supply and use of commodities, inter-industry flows and a range of derived data, such as input-output multipliers, 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.

This publication is intended to serve three main purposes. First, it provides a guide to the construction and interpretation of input-output multipliers. Second, it provides details of the way in which the input-output multiplier tables can be used. Third, it provides a means of answering some of the questions often asked by input-output practitioners. These queries tend to arise because of the types of "what if?" analysis for which input-output tables can be used (for example, what would be the impact on employment of an x% change in output by the chemical industry). This type of analysis is really dependent on a knowledge of input-output multipliers and their shortcomings. Using input-output tables, multipliers can be calculated to provide a simple means of working out the flow on effects of a change in output in an industry on one or more of imports, income, employment or output in individual industries or in total. The multipliers can show just the 'first-round' effects, or the aggregated effects once all secondary effects have flowed through the system.

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INTRODUCTION TO INPUT-OUTPUT MULTIPLIERS

INPUT-OUTPUT TABLES

Introduction

1. Input-output tables provide a detailed dissection of intermediate transactions in an economy, and are thereby a means of describing the supply and use of the products of an entire economic system. They provide detailed statistics underlying the national accounts for a specified economy and period and so enable more comprehensive analysis of the productive system than do standard national income and expenditure accounts, which are concerned only with the end result of production rather than the intermediate flows.

Structure

2. To simplify the initial presentation, suppose that we have a closed economy with no imports or exports. Its input-output table would look like Figure 1. The table is constructed as a matrix, itself consisting of four sub-matrices. The four sub-matrices, as shown in Figure 1 are: intermediate usage; final demand; primary inputs to production; and primary inputs to final demand.

3. The intermediate usage sub-matrix, or quadrant 1, measures the flows between industries. The columns in quadrant 1 depict all intermediate inputs into an industry's output in the form of goods and services. The rows show those parts of an industry's output that are absorbed as an intermediate input into other industries.

4. The disposition of output into categories of final demand is given in the final demand sub-matrix, or quadrant 2. Together, quadrants 1 and 2 show the total usage of goods and services supplied by each industry.

5. The primary inputs to production sub-matrix, or quadrant 3, shows all primary inputs into production. Such inputs include wages, salaries and supplements, gross operating surplus, and the various forms of indirect taxes. These inputs differ from the intermediate inputs since they are not part of the current output process. Quadrants 1 and 3 together show the total inputs used in the production process in each industry.

6. Finally, the primary inputs to final demand submatrix, or quadrant 4, shows all primary inputs into final demand.

7. To be more realistic, we need to allow trade with other countries, so we must add imports and exports to the model. Part of the output of the economy is now exported, with details being shown by adding an exports column to the input-output table. The imports are more complicated to present because there are two different ways of treating imports in input-output tables. If we wish to regard imports as being induced by final demand, then we must show the imports as an import row, with the imports shown as direct inputs to the industries that use them. The resulting table is said to have *direct allocation* of imports, as shown in Figure 2.

8. For some analytical purposes, however, it is more appropriate to regard (negative) imports as part of final demand, by netting them off the exports. In this case, the imports are shown as being produced by the industry that would have produced them if they had been domestically produced. This table is referred to as having *indirect allocation* of imports (see Figure 3). Note that the total supply remains unchanged.

9. An advantage of using indirect allocation of imports is that the technical coefficients (calculated by dividing each industry's column of inputs by its Australian production) remain the same whatever changes may occur in the relative proportions of domestically produced and imported inputs. However, if we are trying to estimate, say, the employment that might be induced by a proposed increase in an industry's output, the indirect allocation input-output model will always give a higher result than the corresponding direct allocation model. The reason is that it will include the extra employment required to produce those goods and services that would have been regarded as induced imports in the direct allocation model.

Interpreting input-output tables

10. A 7 industry input-output table for the Australian economy is presented in Table 1. This table refers to the financial year 1989-90, and is constructed using the 28 industry input-output tables as published in 1989-90 *Australian National Accounts: Input-Output Tables* (ABS Cat. No. 5209.0).

11. Given the information presented above, we can obtain structural information about the Australian economy. As an example 'Construction' activity is considered further. Looking firstly at the usage of goods and services supplied by 'Construction', Table 1 shows the industry's total supply was $56,328 million. Final demand absorbed $53,516 million of total supply, while the remaining $2,812 million of supply was absorbed as intermediate inputs to production. Of all the industries, the 'Services Industries' used the greatest proportion of the 'Construction' supply absorbed as an intermediate input ($1,504 million).

FIGURE 1. STRUCTURE OF AUSTRALIAN INPUT-OUTPUT TABLES

	To / *From*	*Row prefix*	*Intermediate Demand*					*Intermediate usage (sub-total)*	*Final Demand*						*Final Demand (sub-total)*	*Total supply (grand total)*
			Agriculture, etc	*Mining*	*Manufacturing, etc*	*Construction*	*Services*		*Final consumption expenditure —private*	*Final consumption expenditure —government*	*Gross fixed capital expenditure —private*	*Gross fixed capital expenditure —public enterprises*	*Gross fixed capital expenditure —general government*	*Increase in stocks*		
	Column prefix		01.01-04.00	11.01-16.00	21.01-37.01	41.01-41.02	47.01-93.01		Q1	Q2	Q3	Q4	Q5	Q 6		
Intermediate inputs	Agriculture	01.01-04.00	QUADRANT 1 INTERMEDIATE USAGE						QUADRANT 2 FINAL DEMAND							
	Mining	11.01-16.00														
	Manufacturing, etc.	21.01-37.01														
	Construction	41.01-41.02														
	Services	47.01-93.01														
	Intermediate inputs (sub-total)															
Primary inputs	Wages, salaries and supplements	P1	QUADRANT 3 PRIMARY INPUTS TO PRODUCTION						QUADRANT 4 PRIMARY INPUTS TO FINAL DEMAND							
	Gross operating surplus	P2														
	Commodity taxes (net)	P3														
	Indirect taxes n.e.c. (net)	P4														
	Sales by final buyers	P5														
	Australian production															

The shaded areas correspond to aggregates shown in the National production account.

corresponds to aggregates shown as the components of 'gross domestic product' at market prices.

corresponds to aggregates shown as the components of 'expenditure on gross domestic product'.

FIGURE 2. STRUCTURE OF AUSTRALIAN INPUT-OUTPUT TABLES
Direct allocation of imports, Basic values, Recording of intra-industry flows

	To / *From*	*Row prefix*	*Intermediate Demand*					*Intermediate usage (sub-total)*	*Final Demand*							*Final Demand (sub-total)*	*Total supply (grand total)*
			Agriculture, etc	*Mining*	*Manufacturing, etc*	*Construction*	*Services*		*Final consumption expenditure —private*	*Final consumption expenditure —government*	*Gross fixed capital expenditure —private*	*Gross fixed capital expenditure —public enterprises*	*Gross fixed capital expenditure —general government*	*Increase in stocks*	*Exports of goods and services*		
	Column prefix		01.01-04.00	11.01-16.00	21.01-37.01	41.01-41.02	47.01-93.01		Q1	Q2	Q3	Q4	Q5	Q 6	Q 7		
Intermediate inputs	Agriculture	01.01-04.00	QUADRANT 1 INTERMEDIATE USAGE						QUADRANT 2 FINAL DEMAND								
	Mining	11.01-16.00															
	Manufacturing, etc.	21.01-37.01															
	Construction	41.01-41.02															
	Services	47.01-93.01															
	Intermediate inputs (sub-total)																
Primary inputs	Wages, salaries and supplements	P1	QUADRANT 3 PRIMARY INPUTS TO PRODUCTION						QUADRANT 4 PRIMARY INPUTS TO FINAL DEMAND								
	Gross operating surplus	P2															
	Commodity taxes (net)	P3															
	Indirect taxes n.e.c. (net)	P4															
	Sales by final buyers	P5															
	Imports	P6															
	Australian production																

The shaded areas correspond to aggregates shown in the National production account.

corresponds to aggregates shown as the components of 'gross domestic product' at market prices.

corresponds to aggregates shown as the components of 'expenditure on gross domestic product'.

FIGURE 3. STRUCTURE OF AUSTRALIAN INPUT-OUTPUT TABLES
Indirect allocation of imports, Basic values, Recording of intra-industry flows

	To / *From*	*Row prefix*	*Intermediate Demand*					*Intermediate usage (sub-total)*	*Final Demand*							*Final Demand (sub-total)*	*Total supply (grand total)*
			Agriculture, etc	*Mining*	*Manufacturing, etc*	*Construction*	*Services*		*Final consumption expenditure —private*	*Final consumption expenditure —government*	*Gross fixed capital expenditure —private*	*Gross fixed capital expenditure —public enterprises*	*Gross fixed capital expenditure —general government*	*Increase in stocks*	***Net** exports of goods and services*		
	Column prefix		01.01-04.00	11.01-16.00	21.01-37.01	41.01-41.02	47.01-93.01		Q1	Q2	Q3	Q4	Q5	Q 6	Q 7		
Intermediate inputs	Agriculture	01.01-04.00	QUADRANT 1 INTERMEDIATE USAGE						QUADRANT 2 FINAL DEMAND								
	Mining	11.01-16.00															
	Manufacturing, etc.	21.01-37.01															
	Construction	41.01-41.02															
	Services	47.01-93.01															
	Intermediate inputs (sub-total)																
Primary inputs	Wages, salaries and supplements	P1	QUADRANT 3 PRIMARY INPUTS TO PRODUCTION						QUADRANT 4 PRIMARY INPUTS TO FINAL DEMAND								
	Gross operating surplus	P2															
	Commodity taxes (net)	P3															
	Indirect taxes n.e.c. (net)	P4															
	Sales by final buyers	P5															
	Australian production																

The shaded areas correspond to aggregates shown in the National production account.

corresponds to aggregates shown as the components of 'gross domestic product' at market prices.

corresponds to aggregates shown as the components of 'expenditure on gross domestic product'.

TABLE 1. AUSTRALIA: INDUSTRY BY INDUSTRY FLOW MATRIX, 1989-90
DIRECT ALLOCATION OF COMPETING IMPORTS, BASIC VALUES, 7 INDUSTRIES
($ million)

USING INDUSTRY / *SUPPLYING INDUSTRY*	*Agriculture* (1)	*Mining* (2)	*Manu-facturing* (3)	*Construction* (4)	*Trade and transport* (5)	*Service industries* (6)	*Public admin. & defence* (7)
Agriculture	2,399	58	11,336	48	48	757	55
Mining	4	2,108	8,212	447	52	2,733	42
Manufacturing	3,362	2,267	40,944	15,902	11,673	10,518	3,533
Construction	17	181	106	68	623	1,504	314
Trade and transportation	1,937	2,038	15,824	5,217	12,965	10,669	2,791
Service industries	1,957	2,217	11,158	3,604	19,076	38,117	5,044
Public admin. and defence	86	40	874	546	628	955	5,612
Intermediate usage	**9,762**	**8,909**	**88,454**	**25,832**	**45,065**	**65,253**	**17,391**
Wages, salaries, supplements	3,268	4,104	27,835	12,276	39,950	73,076	12,020
Gross operating surplus	11,025	12,152	27,831	13,074	31,400	61,782	1,287
Commodity taxes (net)	627	307	2,759	637	3,031	1,767	-
Indirect taxes nec (net)	654	242	1,101	715	4,097	7,493	60
Sales by final buyers	-	5	800	1	-	27	-
Competing imports cif	882	1,445	17,046	3,459	4,425	4,842	1,906
Duty on competing imports	30	58	817	245	142	154	-
Complementary imports cif	2	20	425	89	178	174	565
Duty on complementary imports	-	-	-	-	-	-	-
Australian production	**26,250**	**27,242**	**167,068**	**56,328**	**128,288**	**214,568**	**33,229**

USE / *SUPPLYING INDUSTRY*	*Intermediate usage* (8) =Sum(1)-(7)	*Final consumption expenditure* (9)	*Gross fixed capital expenditure* (10)	*Increase in stocks* (11)	*Exports* (12)	*Final demand* (13) =Sum(9)-(12)	*Total supply* (14) =(8)+(13)
Agriculture	14,701	3,224	155	2,540	5,632	11,551	26,252
Mining	13,598	81	313	531	12,718	13,643	27,241
Manufacturing	88,199	39,893	15,611	1,354	22,012	78,870	167,069
Construction	2,813	3,884	49,549	2	81	53,516	56,329
Trade and transportation	51,441	57,342	7,738	244	11,523	76,847	128,288
Service industries	81,173	127,076	4,082	2	2,232	133,392	214,565
Public admin. and defence	8,741	24,329	-	-	159	24,488	33,229
Intermediate usage	**260,666**	**255,829**	**77,448**	**4,673**	**54,357**	**392,307**	**652,973**
Wages, salaries, supplements	172,529	-	-	-	-	-	172,529
Gross operating surplus	158,551	-	-	-	-	-	158,551
Commodity taxes (net)	9,128	12,670	1,766	88	358	14,882	24,010
Indirect taxes nec (net)	14,362	-	2,617	-	-	2,617	16,979
Sales by final buyers	833	3,188	-4,222	13	188	-833	-
Competing imports cif	34,005	12,308	13,048	345	5,954	31,655	65,660
Duty on competing imports	1,446	1,241	746	9	-	1,996	3,442
Complementary imports cif	1,453	705	37	-20	-	722	2,175
Duty on complementary imports	-	-	-	-	-	-	-
Australian production	**652,973**	**285,941**	**91,440**	**5,108**	**60,857**	**443,346**	**1,096,319**

12. Looking at the inputs into 'Construction' production, Table 1 shows that Australian production equals $56,328 million. Note that each industry's production equals its supply. 'Construction' production used $25,832 million in intermediate inputs. Most of these intermediate inputs came from 'Manufacturing', which supplied $15,902 million.

Exercises

With regards to 'Service industries', how much intermediate production did it absorb in its own production? How much of its supply was absorbed as intermediate inputs?

How much of 'Agriculture' supply was absorbed as an input into 'Manufacturing'? How much output of 'Service industries' did 'Agriculture' use?

How much 'Final demand' was there for 'Manufacturing' output? How much of this went to 'Exports'?

MULTIPLIERS

Introduction

13. Input-output multipliers are summary measures used for predicting the total impact on all industries in an economy of changes in the demand for the output of any one industry. They describe average effects, not marginal effects, and thus do not take account of economies of scale, unused capacity or technological change.

14. The multipliers are derived from the input-output tables. It takes two or three years after the reference period for most countries to compile a set of input-output tables, because of the large amount of data required and the complexity of the tasks involved. Technological change does not occur very rapidly in most industries, so that it is possible to obtain reasonable results for the latest year even though the latest input-output tables may be a few years old. The various multipliers generally remain fairly stable over time. The exceptions would be those industries producing commodities that are susceptible to wide fluctuations in price on the world market, such as petroleum products, and those agricultural industries most affected by adverse climatic conditions, namely sheep and wheat.

15. The standard input-output model used to calculate multipliers is the demand-side input-output model, in which the model is driven by demand for its outputs. The model assumes that, in a particular year, fixed amounts of given inputs are required to produce a given output.

Calculating the standard input-output multipliers

16. The following paragraphs show how to calculate the standard input-output multipliers using seven-industry input-output tables as shown in Table 1 above. As an exercise, it is suggested that the reader should work through the steps as outlined below. It is assumed that the reader has access to a spreadsheet package that can perform the usual matrix functions. Previous knowledge of matrix algebra is desirable but not essential.

17. Using the demand-side model, we can generate different kinds of input-output multipliers, which are summary measures used to estimate the likely effects of economic change.

Output multipliers

18. The output multiplier for an industry, say Construction, is defined as the total value of production by all industries of the economy required to satisfy one extra dollar's worth of final demand for that industry's output.

19. The initial requirement for an extra dollar's worth of output of a given industry is called the *initial output effect*. By definition it is equal to one in total for all industries, since an additional dollar's worth of output from any industry will require the initial one dollar's worth of output from that industry plus any induced extra output. The *first round effect* is the amount of output required from all industries of the economy to produce the initial output effect. Suppose that the output of the Construction industry is increased by one dollar. Then inputs from other industries, such as Manufacturing and Mining, will be required, as well as inputs from the Construction industry itself. The demand for the extra dollar's worth of Construction output is regarded as having caused the production of these outputs. The Construction industry is said to have "backwards linkages" to the industries supplying its inputs.

20. The first round effect can be measured quite simply by deriving another table from the flow table, Table 1 above, by dividing each of its columns by the Australian production of that industry (the column total) to produce a table of coefficients (which measure the strength of the backwards linkages). The result is the *Direct requirements matrix*, Table 2 below.

TABLE 2. AUSTRALIA: DIRECT REQUIREMENTS COEFFICIENTS, 1989-90
DIRECT ALLOCATION OF COMPETING IMPORTS, BASIC VALUES, 7 INDUSTRIES

USING INDUSTRY / *SUPPLYING INDUSTRY*	*Agriculture*	*Mining*	*Manu-facturing*	*Construction*	*Trade and transport*	*Service industries*	*Public admin. & defence*
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*
Agriculture	9.14	0.21	6.79	0.09	0.04	0.35	0.17
Mining	0.02	7.74	4.92	0.79	0.04	1.27	0.13
Manufacturing	12.81	8.32	24.51	28.23	9.10	4.90	10.63
Construction	0.06	0.66	0.06	0.12	0.49	0.70	0.94
Trade and transportation	7.38	7.48	9.47	9.26	10.11	4.97	8.40
Service industries	7.46	8.14	6.68	6.40	14.87	17.76	15.18
Public admin. and defence	0.33	0.15	0.52	0.97	0.49	0.44	16.89
Intermediate usage	**37.19**	**32.70**	**52.94**	**45.86**	**35.13**	**30.41**	**52.34**
Wages, salaries, supplements	12.45	15.06	16.66	21.79	31.14	34.06	36.17
Gross operating surplus	42.00	44.61	16.66	23.21	24.48	28.79	3.87
Commodity taxes (net)	2.39	1.13	1.65	1.13	2.36	0.82	—
Indirect taxes nec (net)	2.49	0.89	0.66	1.27	3.19	3.49	0.18
Sales by final buyers	—	—	0.48	—	—	—	—
Complementary imports cif	—	0.07	0.25	0.16	0.14	0.08	1.70
Duty on complementary imports	—	—	—	—	—	—	—
Competing imports cif	3.36	5.30	10.20	6.14	3.45	2.26	5.73
Duty on competing imports	0.11	0.21	0.49	0.43	0.11	0.07	—
Australian production	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

USE / *SUPPLYING INDUSTRY*	*Intermediate usage*	*Final consumption expenditure*	*Gross fixed capital expenditure*	*Increase in stocks*	*Exports*	*Final demand*	*Total supply*
	(8) =Sum(1)-(7)	*(9)*	*(10)*	*(11)*	*(12)*	*(13) =Sum(9)-(12)*	*(14) =(8)+(13)*
Agriculture	2.25	1.13	0.17	49.72	9.25	2.61	2.39
Mining	2.08	0.03	0.34	10.40	20.90	3.08	2.48
Manufacturing	13.51	13.95	17.07	26.51	36.17	17.79	15.24
Construction	0.43	1.36	54.19	0.04	0.13	12.07	5.14
Trade and transportation	7.88	20.05	8.46	4.79	18.93	17.33	11.70
Service industries	12.43	44.44	4.46	0.04	3.67	30.09	19.57
Public admin. and defence	1.34	8.51	—	—	0.26	5.52	3.03
Intermediate usage	**39.92**	**89.47**	**84.70**	**91.49**	**89.32**	**88.49**	**59.56**
Wages, salaries, supplements	26.42	—	—	—	—	—	15.74
Gross operating surplus	24.28	—	—	—	—	—	14.46
Commodity taxes nec (net)	1.40	4.43	1.93	1.73	0.59	3.36	2.19
Indirect taxes nec (net)	2.20	—	2.86	—	—	0.59	1.55
Sales by final buyers	0.13	1.12	-4.62	0.26	0.31	-0.19	—
Complementary imports cif	0.22	0.25	—	-0.39	—	0.16	0.20
Duty on complementary imports	—	—	—	—	—	—	—
Competing imports cif	5.21	4.30	14.27	6.75	9.78	7.14	5.99
Duty on competing imports	0.22	0.43	0.82	0.18	—	0.45	0.31
Australian production	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

21. The coefficients in a given industry's column of this table show the amount of extra output required from each industry to produce an extra dollar's worth of output from that industry. For example, to produce an extra dollar's worth of output from the Construction industry, the Manufacturing industry must have produced an extra $0.28 worth of output, the Trade and transportation industry must have produced an extra $0.09 worth, and so on.

22. Similarly, the extra output from the Manufacturing industry will induce extra output from all industries of the economy and, in turn, these will induce extra output, and so on. The combined effects of the initial effects plus all of the production induced rounds of extra output are called the *simple multipliers.*

23. To calculate the simple multipliers, we take the first seven rows and columns of the Direct Requirements Table and form the **A** matrix (also referred to as the intermediate usage matrix or the first quadrant of the Direct Requirements matrix). We set up a 7x7 matrix **I** with all its diagonal elements equal to 1 and all its other elements equal to zero and calculate a new matrix **(I - A)**. Then we call the matrix inversion function (available on spreadsheets programs) to calculate the Leontief inverse $\mathbf{(I - A)}^{-1}$. We then form the column totals. These are the required simple multipliers. Appendix A provides more detail about this process.

24. Example: All output multipliers are presented in Table 5 in this paper. The simple multiplier for Mining shows that $1.53 of extra output from the Australian economy is induced by an additional output of $1.00 in the Mining industry. In other words, to produce an additional unit of output in 'Mining', aside from Mining's additional unit of output, the economy's output must increase by an additional $0.33 in order to provide inputs to 'Mining', and in turn to increase by $0.21 to provide inputs to the suppliers to 'Mining'. The effects encompassed by the simple multiplier are the initial effects ($1.00), the first round effects ($0.33) and the industrial support effects ($0.21).

25. It can be shown that this procedure is mathematically equivalent to calculating the effects of all of the rounds of induced production and adding them to the initial effects. Since we already know the initial effects and the first round effects, we can now calculate the *industrial-support* effects, the effects of the second and subsequent rounds of induced production, as follows:

industrial support effects = simple multiplier
- initial effects
- first round effects.

We can also calculate the *production induced* effects:

production induced effects = first round effects
+ industrial support effects.

26. The household sector receives wages for work done in the production process and spends some or all of this wage income on goods and services. The wages are shown in the Wages, salaries and supplements row and consumption by households is shown in the Private final consumption expenditure column of the flow matrix. The Private final consumption expenditure can be regarded as generating the production of goods and services by the industries of the economy. This induced production of extra goods and services is referred to as the *consumption-induced* effects. A new set of multipliers can be calculated taking into account the initial effects, the production induced effects and the consumption induced effects. These are called the *total multipliers*.

27. The total multipliers are calculated by defining an 8x8 matrix (the **B** matrix), which is formed by adding to the previously defined **A** matrix the Wages, salaries and supplements row and the Private final consumption expenditure column of the Direct Requirements Coefficients matrix (Table 2). In effect, we are adding a "household" industry to the economy.

28. In calculating the simple multipliers, we effectively assume that the spending of households takes place outside the model and there is no feedback between the household sector and the other sectors. We are said to be using an open model. However, in calculating the total multipliers, we do allow feedback to occur, and the model is said to be closed with respect to households. The open and closed models are shown in Figure 4.

29. The total multipliers are calculated by taking the Leontief inverse of the **B** matrix, $\mathbf{(I - B)}^{-1}$ (note that this time we require an 8x8 **I** matrix). Then we form a new matrix, **B***, from the first seven rows and columns of the Leontief inverse of the **B** matrix and add up the column totals. These are the total multipliers. The consumption induced effects can then be calculated:

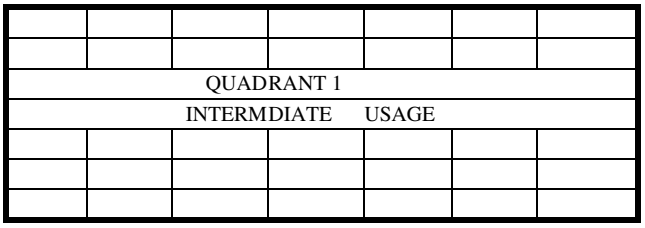
consumption induced effects = total multiplier
- simple multiplier.

30. Example: The total output multiplier for 'Construction' was calculated to be $2.73. This implies that $2.73 in additional output is required from all industries to satisfy an increased demand of $1.00 in the construction sector, as well as to satisfy the additional demand generated by the increased wages, salaries and supplements resulting from all increased output. This multiplier incorporates all the effects of the simple multiplier, plus the consumption effects.

FIGURE 4. OPEN AND CLOSED MODELS

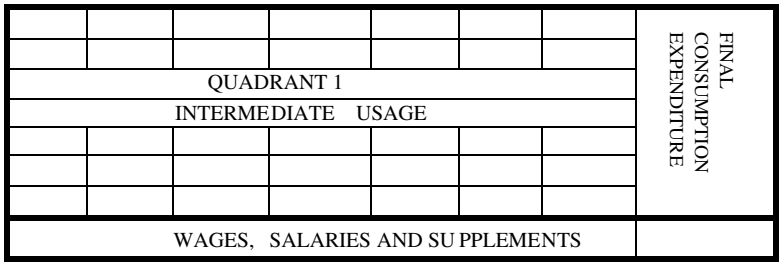
MATRIX USED TO CONSTRUCT THE OPEN MODEL DIRECT ALLOCATION MATRIX

(7 x 7)



MATRIX USED TO CONSTRUCT THE CLOSED MODEL DIRECT ALLOCATION MATRIX

(8 x 8)



Income multipliers

31. The income multiplier for a given industry is defined as the total value of income from wages, salaries and supplements required to satisfy a dollar's worth of final demand for the output of that industry. We have already calculated the household coefficients in the Wages, salaries and supplements row of the Direct Requirements matrix (Table 2), and these are the initial household income effects. For simplicity, we can refer to them as the vector **h**.

32. The remaining income multipliers can be calculated using the matrix multiplication function of a spreadsheet package as follows:

first round income effects = **h * A**
simple income multipliers = **h * (I - A)**$^{-1}$
total income multipliers = **h * B***.

Note that * denotes matrix multiplication (which is not the same as ordinary multiplication).

The remaining income multipliers can then be calculated in the same way as the corresponding output multipliers.

Employment multipliers

33. Employment multipliers can be obtained by using the row vector of employment coefficients, **e**, instead of **h**. The employment coefficients are calculated by dividing the number of employed persons in a given industry by the level of production generated by that industry. This calculation, as well as the raw data involved in this step, is included in Table 3. In this table, the employment multipliers relate to an extra $1 million of output. To incorporate

the employment coefficient into the matrix calculations, the column of employment coefficients is transposed to give a vector.

TABLE 3. AUSTRALIA: EMPLOYMENT COEFFICIENTS, 1989-90

Industry	*Employed persons (a) (persons) (1)*	*Australian production ($ million) (2)*	*Employment coefficient (1) / (2)*
Agriculture	381,926	26,250	14.5496
Mining	102,693	27,242	3.7697
Manufacturing	1,165,208	167,068	6.9745
Construction	563,785	56,328	10.0090
Trade and transportation	1,907,882	128,288	14.8719
Service industries	2,552,600	214,568	11.8965
Public admin. and defence	395,782	33,229	11.9107
Total	**7,069,876**	**652,973**	

(a) Source. Australian National Accounts, Input-Output Tables, 1989-90 (Cat. No. 5209.0), Table 22. Full-time equivalent = full-time plus 50 per cent of part-time employed persons.

Summary

34. The results of output, income and employment multiplier calculations are presented in Table 5, while examples of intermediate matrices used in the calculation of these multipliers are presented in Table 4 for reference. The matrices included in Table 4 are **A**, $\mathbf{(I - A)}^{-1}$ and **B***.

35. Other multipliers (e.g. import multipliers) can be calculated by using the first seven elements of the appropriate row of the Direct Requirements matrix to replace **h**.

36. All of these multipliers (except the import multipliers) can also be calculated using a model with indirect allocation of imports. Note that import multipliers can only be calculated when there is direct allocation of competing imports. When there is indirect allocation of imports, there is no imports row; increased demand does not induce more imports, but increases net exports (which can happen by increasing exports and/or decreasing imports).

Exercises

There is enough information in the paper to allow replication of the multipliers. This is a useful exercise, and can be achieved using conventional spreadsheet software with matrix functions.

If the output of 'Trade and Transportation' were to increase by $121 million, what do the I-O multipliers suggest will happen to (a) output, (b) income, and (c) employment, using the simple multipliers.

Paragraph 35 demonstrates how import multipliers can be calculated. Calculate the import multipliers, and show how a $121 million change in 'Trade and Transportation' output affects the economy after all effects have been accounted for. To act as a guide, three intermediate matrices used in calculations have been included in Table 4 below.

Related Publications

37. Other ABS publications that relate to input-output multipliers include:

Australian National Accounts: Concepts, Sources and Methods (5216.0)
Australian National Accounts: Input-Output Tables (5209.0)
Australian National Accounts: Input-Output Multipliers (5237.0)

Multiplier tables special data service

38. Multiplier tables are available on hard copy and floppy disk. Tables on floppy disk are spreadsheets suitable for most popular micro computer software packages. An order form is provided at the back of this publication. When ordering a floppy disk please specify your software package, disk size and density.

TABLE 4. SELECTED MATRICES USED IN 1989-90 MULTIPLIER CONSTRUCTION

(1) MATRIX: A

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) Agriculture	0.0914	0.0021	0.0679	0.0009	0.0004	0.0035	0.0017
(2) Mining	0.0001	0.0774	0.0492	0.0079	0.0004	0.0127	0.0013
(3) Manufacturing	0.1281	0.0832	0.2451	0.2823	0.0910	0.0490	0.1063
(4) Construction	0.0006	0.0066	0.0006	0.0012	0.0049	0.0070	0.0094
(5) Trade and transportation	0.0738	0.0748	0.0947	0.0926	0.1011	0.0497	0.0840
(6) Service industries	0.0746	0.0814	0.0668	0.0640	0.1487	0.1776	0.1518
(7) Public admin. and defence	0.0033	0.0015	0.0052	0.0097	0.0049	0.0044	0.1689
First round effects	**0.3719**	**0.3270**	**0.5294**	**0.4586**	**0.3513**	**0.3041**	**0.5234**

(2) MATRIX: $(I-A)^{-1}$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) Agriculture	1.1175	0.0144	0.1043	0.0328	0.0134	0.0124	0.0196
(2) Mining	0.0139	1.0940	0.0762	0.0330	0.0122	0.0227	0.0172
(3) Manufacturing	0.2175	0.1506	1.3848	0.4162	0.1603	0.1002	0.2171
(4) Construction	0.0026	0.0090	0.0035	1.0037	0.0074	0.0094	0.0143
(5) Trade and transportation	0.1248	0.1175	0.1712	0.1625	1.1455	0.0840	0.1553
(6) Service industries	0.1445	0.1446	0.1628	0.1505	0.2248	1.2449	0.2732
(7) Public admin. and defence	0.0073	0.0045	0.0112	0.0163	0.0091	0.0080	1.2072
Simple multipliers	**1.6281**	**1.5346**	**1.9140**	**1.8150**	**1.5728**	**1.4817**	**1.9039**

Note This B* matrix is wrong.see below and CHECK. xls for correct data.

(3) MATRIX: B*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) Agriculture	1.1359	0.0337	0.1297	0.0606	0.0456	0.0452	0.0624
(2) Mining	0.0255	1.1062	0.0922	0.0506	0.0326	0.0434	0.0442
(3) Manufacturing	0.3639	0.3037	1.5857	0.6368	0.4155	0.3600	0.5562
(4) Construction	0.0056	0.0121	0.0075	1.0081	0.0125	0.0146	0.0211
(5) Trade and transportation	0.2823	0.2822	0.3874	0.3999	1.4201	0.3635	0.5201
(6) Service industries	0.4114	0.4238	0.5291	0.5528	0.6902	1.7186	0.8915
(7) Public admin. and defence	0.0122	0.0096	0.0178	0.0236	0.0175	0.0166	1.2184
Total multipliers	**2.2369**	**2.1714**	**2.7494**	**2.7323**	**2.6340**	**2.5618**	**3.3139**

TABLE 5. MULTIPLIERS

OUTPUT MULTIPLIERS, DIRECT ALLOCATION OF COMPETING IMPORTS, 1989-90

	Initial effects	*First round effects*	*Industrial support effects*	*Production induced effects*	*Consumption induced effects*	*Simple multipliers*	*Total multipliers*
(1) Agriculture	1.0000	0.3719	0.2562	0.6281	0.6088	1.6281	2.2369
(2) Mining	1.0000	0.3270	0.2076	0.5346	0.6368	1.5346	2.1714
(3) Manufacturing	1.0000	0.5294	0.3845	0.9140	0.8354	1.9140	2.7494
(4) Construction	1.0000	0.4586	0.3564	0.8150	0.9173	1.8150	2.7323
(5) Trade and transportation	1.0000	0.3513	0.2215	0.5728	1.0612	1.5728	2.6340
(6) Service industries	1.0000	0.3041	0.1776	0.4817	1.0801	1.4817	2.5618
(7) Public admin. and defence	1.0000	0.5234	0.3805	0.9039	1.4100	1.9039	3.3139

INCOME MULTIPLIERS, DIRECT ALLOCATION OF COMPETING IMPORTS, 1989-90

	Initial effects	*First round effects*	*Industrial support effects*	*Production induced effects*	*Consumption induced effects*	*Simple multipliers*	*Total multipliers*
(1) Agriculture	0.1245	0.0824	0.0618	0.1442	0.1708	0.2687	0.4395
(2) Mining	0.1506	0.0788	0.0517	0.1305	0.1787	0.2811	0.4598
(3) Manufacturing	0.1666	0.1110	0.0912	0.2021	0.2344	0.3687	0.6031
(4) Construction	0.2179	0.1027	0.0842	0.1870	0.2574	0.4049	0.6623
(5) Trade and transportation	0.3114	0.1002	0.0568	0.1570	0.2977	0.4684	0.7662
(6) Service industries	0.3406	0.0896	0.0466	0.1362	0.3030	0.4768	0.7798
(7) Public admin. and defence	0.3617	0.1591	0.1016	0.2607	0.3956	0.6224	1.0180

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

	Initial effects	*First round effects*	*Industrial support effects*	*Production induced effects*	*Consumption induced effects*	*Simple multipliers*	*Total multipliers*
(1) Agriculture	15	4	3	7	7	22	28
(2) Mining	4	3	2	5	7	9	16
(3) Manufacturing	7	5	4	9	10	16	26
(4) Construction	10	4	4	8	10	18	28
(5) Trade and transportation	15	4	2	6	12	21	33
(6) Service industries	12	3	2	5	12	17	30
(7) Public admin. and defence	12	6	4	10	16	22	38

GLOSSARY OF TERMS

Terms	*Simple definition*	*Practical definition*
Intermediate inputs (or usage)	Commodities that are used in the process of production.	Consists of non-durable goods and services used up in the process of production. Non-durable goods are those having an expected life time use of less than one year.
Primary inputs	The inputs into production other than goods and services.	Inputs into the production process that are not goods and services. Primary inputs include items such as wages, salaries and supplements (or return to labour) and gross operating surplus (or return to capital) and the various forms of indirect taxes.
Wages, salaries and supplements	Payments by producers to their employees.	Payments made by producers to their employees for services rendered. They cover income received in cash and kind as well as supplementary benefits.
Gross operating surplus	The excess of gross output over the costs incurred in production.	The excess of gross output of enterprises operating in Australia over costs incurred in producing that output, but before deducting consumption of fixed capital, dividends, interest, royalties and land rent payments and direct taxes payable.
Commodity taxes (net)	Indirect taxes on certain commodities less subsidies.	Indirect commodity specific taxes that are levied on some commodities. Commodity specific subsidies are treated as negative commodity taxes. Commodity taxes are shown as being paid by the users of the commodity on which the tax is levied.
Indirect taxes nec (net)	Other indirect taxes less subsidies.	Taxes assessed on producers, on the production, sale, purchase or use of goods and services, less subsidies. Commodity specific indirect taxes are shown separately as commodity taxes (net).
Sales by final buyers	Records the sales of 'second-hand' capital assets and consumer goods.	In input-output tables this item is necessary to record the sales of capital assets for scrap and the use of scrap as a raw material in production. It also is used to record net sales of used motor vehicles.
Competing imports (cif)	Commodities purchased from non-residents which can be substituted for a locally produced commodity.	Competing imports are those imported commodities which can be substituted for domestically produced commodities.
Complementary imports (cif)	Imported commodities for which there are no locally produced substitutes.	Complementary imports are those imported commodities for which there is no domestically produced substitute (e.g. natural rubber).
Australian production	The total of intermediate usage and primary inputs.	The value of goods and services produced by the Australian economy.
Final demand	Demand for goods and services not used up in the production process.	Final demand is the sum of Final consumption expenditure-private & government; Gross fixed capital expenditure-private & government; Increase in stocks and Exports of goods and services.

GLOSSARY OF TERMS

Terms	*Simple definition*	*Practical definition*
Final consumption expenditure	Current expenditure by households, producers of private non-profit services to households, and general government bodies.	Current expenditure by households and producers of private non-profit services to households, and by general government bodies on services to the community such as defence, education, and public order and safety. It includes purchases of durable as well as non-durable goods. However, it excludes expenditure by persons on the purchase of dwellings and expenditure of a capital nature by unincorporated enterprises.
Gross fixed capital expenditure	Expenditure on assets.	Expenditure on additions to durable goods (purchases and own-account production) both new and second-hand, less sales of similar second-hand goods. Although the acquisition of non-reproducible tangible assets such as land is not included with gross fixed capital expenditure, capital costs associated with the extension or development of such projects are included, as are outlays on land reclamation and improvement.
Increase in stocks	The value of the change in stocks of goods.	The physical changes in stocks valued at prices current at the time the changes take place. Stocks are defined to include finished goods, partly finished goods and other work in progress (except construction and other major capital goods such as ships), materials, fuels and other miscellaneous stores.
Exports	Commodities sold to non-residents of Australia.	The values of goods exported to overseas and amounts receivable from non-residents for the provision of services by residents.
Total supply	Total supply of goods and services in the economy.	The total supply of goods and services in the economy.

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 inter-industry sales from sector i to sector j, we may write:

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

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:

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

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

$$X = AX + Y \qquad \text{(A.3)}$$

From (A.3) we obtain

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

where:

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

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
- the vector V_1' gives the first round effect $\begin{bmatrix} 1 \\ 1 \\ . \\ . \\ 1 \end{bmatrix}$
- 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 = $\dfrac{\text{total multiplier − initial}}{\text{initial}}$

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 multipliers by a similar procedure as for output multipliers, which will be required to obtain, let's say, 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', $V_1^{*\prime}$, $V_2^{*\prime}$ and $V_3^{*\prime}$ be the transposes of h, V_1^*, V_2^*, V_3^*, then:

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

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 in a similar way to the 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 in a similar way to the 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, similar to 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 cannot 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 4 on pages 22 and 23, which are extracts from the 1989-90 edition of the ABS publication, *Australian National Accounts: Input-Output Multipliers* (5237.0).

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*
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 person employed by the chemicals industry.

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

6. COMPETING IMPORTS MULTIPLIERS (Table 4)

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 $1.274 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 $6.666 (i.e. 1/0.150) of additional output. For each one dollar increase of competing imports used in that industry, an extra $1.436 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 $1.656 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*

Type 2B equals Type 2A less the original one dollar increase in competing imports used by the chemicals industry.

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. Appendix C provides some guidance in the underlying assumptions and interpretation of input-output multipliers.

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

	Indusrty	*Initial Effects*	*First Round Effects*	*Indust-rial Support Effects*	*Prod-uction Induced Effects*	*Con-sumption Induced Effects*	*Simple Multi-pliers*	*Total Multi-pliers*	*Type 1A Multi-pliers*	*Type 1B Multi-pliers*	*Type 2A Multi-pliers*	*Type 2B Multi-pliers*
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	1.459	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*	*Indust-rial Support Effects*	*Prod-uction Induced Effects*	*Con-sumption Induced Effects*	*Simple Multi-pliers*	*Total Multi-pliers*	*Type 1A Multi-pliers*	*Type 1B Multi-pliers*	*Type 2A Multi-pliers*	*Type 2B Multi-pliers*
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	1.878	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. 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	1.657	2.135	2.862	1.862
2	Forestry, fishing, hunting	0.048	0.023	0.015	0.038	0.039	0.086	0.125	1.480	1.787	2.622	1.622
3	Mining	0.053	0.020	0.012	0.032	0.026	0.085	0.111	1.368	1.604	2.102	1.102
4	Meat and milk products	0.008	0.024	0.029	0.053	0.032	0.061	0.093	4.030	7.677	11.648	10.648
5	Food products nec	0.039	0.026	0.026	0.052	0.036	0.091	0.127	1.680	2.353	3.294	2.294
6	Beverages, tobacco products	0.044	0.029	0.024	0.053	0.031	0.097	0.128	1.664	2.193	2.885	1.885
7	Textiles	0.134	0.039	0.025	0.064	0.036	0.198	0.234	1.291	1.477	1.746	0.746
8	Clothing and footwear	0.169	0.042	0.022	0.064	0.043	0.233	0.276	1.248	1.378	1.630	0.630
9	Wood, wood products etc	0.094	0.036	0.024	0.060	0.044	0.154	0.198	1.388	1.649	2.114	1.114
10	Paper, printing etc	0.131	0.033	0.017	0.050	0.040	0.181	0.221	1.249	1.381	1.686	0.686
11	Chemicals	0.144	0.040	0.023	0.063	0.032	0.207	0.239	1.274	1.436	1.656	0.656
12	Petroleum and coal products	0.155	0.036	0.022	0.058	0.021	0.213	0.234	1.234	1.374	1.509	0.509
13	Non-metallic min. products	0.059	0.027	0.019	0.046	0.035	0.105	0.140	1.454	1.787	2.377	1.377
14	Basic metals and products	0.065	0.032	0.024	0.056	0.028	0.121	0.149	1.484	1.852	2.290	1.290
15	Fabricated metal products	0.082	0.035	0.028	0.063	0.039	0.145	0.184	1.427	1.758	2.237	1.237
16	Transport equipment	0.168	0.037	0.021	0.058	0.034	0.226	0.260	1.220	1.346	1.549	0.549
17	Machinery etc nec	0.154	0.033	0.021	0.054	0.039	0.208	0.247	1.216	1.347	1.601	0.601
18	Miscell. manufacturing	0.130	0.040	0.021	0.061	0.038	0.191	0.229	1.305	1.475	1.761	0.761
19	Electricity, gas, water	0.015	0.016	0.016	0.032	0.028	0.047	0.075	2.066	3.033	4.882	3.882
20	Construction	0.061	0.032	0.022	0.054	0.039	0.115	0.154	1.523	1.866	2.502	1.502
21	Wholesale, retail trade	0.022	0.018	0.012	0.030	0.048	0.052	0.100	1.830	2.384	4.578	3.578
22	Repairs	0.075	0.027	0.013	0.040	0.046	0.115	0.161	1.361	1.531	2.157	1.157
23	Transport, communication	0.047	0.024	0.014	0.038	0.040	0.085	0.125	1.502	1.795	2.626	1.626
24	Finance, property etc	0.019	0.012	0.010	0.022	0.049	0.041	0.090	1.669	2.200	4.813	3.813
25	Ownership of dwellings	0.008	0.008	0.007	0.015	0.009	0.023	0.032	1.930	2.825	3.876	2.876
26	Public admin., defence	0.057	0.032	0.023	0.055	0.058	0.112	0.170	1.552	1.945	2.970	1.970
27	Community Services	0.028	0.012	0.008	0.020	0.071	0.048	0.119	1.413	1.703	4.257	3.257
28	Recreational etc services	0.047	0.019	0.015	0.034	0.046	0.081	0.127	1.399	1.727	2.709	1.709

APPENDIX C

UNDERLYING ASSUMPTIONS AND INTERPRETATION OF INPUT-OUTPUT MULTIPLIERS

The *basic assumptions* in input-output analysis include the following:

- there is a fixed input structure in each industry, described by fixed technological coefficients (evidence from comparisons between input-output tables for the same country over time have indicated that material input requirements tend to be stable and change but slowly; however, requirements for primary factors of production, that is labour and capital, are probably less constant);

- all products of an industry are identical or are made in fixed proportions to each other;

- each industry exhibits constant returns to scale in production;

- unlimited labour and capital are available at fixed prices; that is, any change in the demand for productive factors will not induce any change in their cost (in reality, constraints such as limited skilled labour or investment funds lead to competition for resources among industries, which in turn raises the prices of these scarce factors of production and of industry output generally in the face of strong demand); and

- there are no other constraints, such as the balance of payments or the actions of government, on the response of each industry to a stimulus.

2. The multipliers therefore describe *average effects, not marginal effects*, and thus do not take account of economies of scale, unused capacity or technological change. Generally, average effects are expected to be higher than the marginal effects.

3. The input-output tables underlying multiplier analysis only take account of one form of *interdependence,* namely the sales and purchase links between industries. Other interdependence such as collective competition for factors of production, changes in commodity prices which induce producers and consumers to alter the mix of their purchases and other constraints which operate on the economy as a whole are not generally taken into account.

4. The combination of the assumptions used and the excluded interdependence means that input-output multipliers are higher than would realistically be the case. In other words, they tend to *overstate* the potential impact of final demand stimulus. The overstatement is potentially more serious when large changes in demand and production are considered.

5. The multipliers also do not account for some important pre-existing conditions. This is especially true of Type 2 multipliers, in which employment generated and income earned induce further increases in demand. The implicit assumption is that those taken into employment were previously unemployed and were previously consuming nothing. In reality, however, not all 'new' employment would be drawn from the ranks of the unemployed; and to the extent that it was, those previously unemployed would presumably have consumed out of income support measures and personal savings. Employment, output and income responses are therefore overstated by the multipliers for these additional reasons.

6. The most *appropriate interpretation* of multipliers is that they provide a relative measure (to be compared with other industries) of the interdependence between one industry and the rest of the economy which arises solely from purchases and sales of industry output based on estimates of transactions occurring over a (recent) historical period. Progressive departure from these conditions would progressively reduce the precision of multipliers as predictive devices.

ANSWERS TO EXERCISE QUESTIONS

INPUT-OUTPUT TABLES

Service industries absorbed $65,252 million of intermediate production in its own production. $81,174 million of Service industries supply was absorbed as intermediate inputs.

$11,336 million of Agriculture supply was absorbed as input into Manufacturing. Agriculture used $1,957 million of output of Service industries.

There was $78,870 million of Final demand for Manufacturing output. $22,012 million of this went to Exports.

MULTIPLIERS

A $121 million increase in the output of Trade and transportation would induce an additional $190 million (121 x 1.5728) of output, $57 million (121 x 0.4684) of income, and 2,541 (121 x 21) of employment, using the simple multipliers (that is, from the initial and production induced effects).

Competing imports plus duty multipliers are:

	Initial effects	*First round effects*	*Industrial support effects*	*Production induced effects*	*Consumption induced effects*	*Simple multipliers*	*Total multipliers*
(1) Agriculture	0.0347	0.0215	0.0150	0.0365	0.0293	0.0712	0.1005
(2) Mining	0.0552	0.0183	0.0119	0.0302	0.0305	0.0854	0.1159
(3) Manufacturing	0.1069	0.0365	0.0232	0.0597	0.0402	0.1666	0.2068
(4) Construction	0.0658	0.0361	0.0218	0.0579	0.0440	0.1237	0.1677
(5) Trade and transportation	0.0356	0.0174	0.0123	0.0297	0.0510	0.0653	0.1163
(6) Service indust.	0.0233	0.0127	0.0095	0.0222	0.0518	0.0455	0.0973
(7) Public admin. and defence	0.0574	0.0283	0.0212	0.0495	0.0677	0.1069	0.1746

These indicate that a $121 million increase in Trade and transportation output would induce an additional $14 million (121 x 0.1163) of competing imports plus duty after taking account of all effects.