B Manufacturing's input-output linkages

This appendix provides further background on the linkages between Manufacturing and other sectors of the economy discussed in chapter 2.

## B.1 Using the input-output tables

The ABS publishes input-output (IO) tables as part of the National Accounts (Cat. no. 5209.0.55.001), which can be used to identify up- and downstream relationships between Manufacturing and other sectors, as well as between different Manufacturing subsectors. IO tables break down the value of the total production of ANZSIC-based industry groups[[1]](#footnote-1) into primary inputs and intermediate inputs. The rows in the tables show the value in basic prices of output from each industry or product group being absorbed as intermediate inputs to other industries, as well as the final uses of that industry or product group. The columns show the value of intermediate inputs absorbed by each industry, as well as its primary inputs and the value of its total Australian production.

Analysis of the IO tables in this appendix is based on industry-to-industry tables, rather than product group-to-industry tables, unless otherwise indicated. That is, the cells report the flow of products from supply industries (in the row-headings) to the use industries (in the column-headings). In an industry-to-industry table, the cell entries include not only those products that are mainly produced by, or primary to, the row-heading industry, but also its secondary products, that is, those products that are mainly produced by other industries. Where secondary products make up a significant proportion of the output of an industry, typical IO analysis needs to be interpreted with particular caution. This problem appears not to be substantial in the case of Manufacturing as only a relatively minor proportion of products produced by the industry are not primary to Manufacturing.

The ABS also includes data on imported intermediate goods in the IO tables. The IO tables have either a direct or indirect allocation of imports. Where imports are allocated directly, all the rows which show the intermediate inputs to use industries report the value of domestically produced intermediate inputs only. Where imports are allocated indirectly, each row showing the supply of intermediate inputs to industries comprises the total value of imported and domestically produced intermediate inputs.

Tables with direct allocation of imports give a better indication of how changing supply-use flows affect domestic manufacturers and are therefore useful for studying the reliance of Australian Manufacturing on domestic downstream users. Tables with indirect allocation of imports give a better indication of the technological input structure of an industry, since they show the value of all the intermediate inputs used, regardless of their origin. These are useful for informing how manufacturers may have changed their input structure over time. Unless otherwise indicated, the IO tables used in the analysis in this appendix directly allocate imports (that is, the intermediate flows refer to domestic products only).

The IO tables present static data, based on prices in that reference year only. Stemming from this, the main limitation for observing changing industry-flow relationships over time using the IO tables is that any change in the value of intermediate inputs flowing from a supply to a use industry between any two years captures both price and volume effects. Unless appropriate deflators are used to adjust for price effects, the price and volume effects cannot be separated. Where an input is subject to high price volatility, and use industries are price-takers, the difficulty of interpreting a change in the value of the intermediate use of that input is exacerbated: a price rise (or fall) in an input would change the value of the intermediate flow of that input to a use industry, even where the input structure of the use industry remains unchanged.

The analysis in this appendix is based on reference years 1994-95, 2001-02 and 2008-09 (which is the latest year for which IO data are available). IO tables are based on the edition of ANZSIC current at the time of compilation. To the extent possible, the information presented in this appendix has been adjusted for concordance issues between the 1993 edition (ANZSIC93) and 2006 edition (ANZSIC06). (Box B.1 outlines the major changes to Printing and recorded media. Insufficient data were available to adjust for other changes.)

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| Box B.1 Concordance issues for Printing and recorded media |
| The 2008-09 tables are based on ANZSIC06, whereas the tables from the previous years are based on ANZSIC93. Comparisons of IO tables across these years are based on ANZSIC06. For the 1994-95 and the 2001-02 IO tables, the Input-Output Industry Groups (IOIG) 2401 ‘Printing and services to printing’ and 2402 ‘Publishing, recorded media’ were classified as subdivision 24 Printing, publishing and recorded media and were considered part of Division C Manufacturing in ANZSIC93. These activities have since been reclassified in ANZSIC06 so that they are now mapped to new IOIGs which fall under C Manufacturing, J Information media and telecommunications and N Administrative and support services. However, the mapping from the former IOIGs (IOIG 2005) to the new IOIGs (IOIG 2009) is partial rather than complete (see ABS 2012 for details).  In order to have the earlier IO tables concord with 2008-09, 2401 (IOIG 2005) ‘Printing and services to printing’ is considered to be part of Manufacturing and in this appendix, is compared directly to 1601 (IOIG 2009) ‘Printing (including the reproduction of recorded media)’ (PRM) in the 2008-09 IO tables. But as well as including activities which match PRM, the old 2401 (IOIG 2005) also includes 1502 ‘Paper stationery and other converted paper product manufacturing’ (which belongs to 15 ‘Pulp, paper and converted paper product manufacturing’) as well as activities which are now reclassified outside of Manufacturing into 5401 ‘Publishing (except internet and music publishing) and 7201 ‘Building cleaning, pest control, administrative and other support services’. Because these activities are not separated out, the inclusion of the old 1601 (IOIG 2009) in PRM would overstate input and output flows to and from this subdivision.  On the other hand, 2402 (IOIG 2005) ‘Publishing; recorded media and publishing’ from the earlier tables is, in this appendix, treated as part of Services rather than as Manufacturing because activities in this industry group have mainly been reclassified to division J Information media and telecommunications in ANZSIC 2006.1 This, however, would have the effect of understating the input and output flows from PRM because parts of 1601 (IOIG 2009) ‘Printing (including the reproduction of recorded media)’ were actually formerly included in the old 2402 (IOIG 2005).2 Manufacturing activity (as defined in ANZSIC06) that dropped out would include newspaper printing (which would fall under 1611 Printing) and the Reproduction of recorded media (1620).  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  1 These include 5401 Publishing (except internet and music publishing); 5501 Motion picture and sound recording and 5701 Internet publishing and broadcasting and services providers, websearch portals and data processing services  2 The ANZSIC93 classes which were in 2402 Publishing; recorded media and publishing included: 2421 Newspaper printing or publishing; 2422 Other periodical publishing; 2423 Book and other publishing and 2430 Recorded media manufacturing and publishing. 2430 Recorded media manufacturing and publishing corresponds to these ANZSIC06 classes: 1620 Reproduction of recorded media (which is part of Manufacturing) and partially to 5420 Software publishing and 5521 Music publishing (which are outside of Manufacturing). 2421 Newspaper printing or publishing corresponds partially to these ANZSIC06 classes: 1611 Printing (which is part of Manufacturing) and 5411 Newspaper publishing. |
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## B.2 Manufacturing linkages to other sectors

Manufacturing largely occupies a central position along the supply chain and therefore has a high level of linkages, not only within itself, but also with other sectors of the Australian economy. It is a large downstream user of output from Manufacturing itself, as well as from Agriculture and Mining and a large upstream supplier to Construction and Transport.

Table B.1 shows the IO linkages between Agriculture, Mining, Manufacturing and a selection of service sectors for 2008-09, the latest year for which IO tables have been released by the ABS. This table shows the direct requirement coefficients which are the value of the flows from the supply industry (the row heading), expressed as a percentage of the value of total output produced by the use industry (the column heading). The column for Manufacturing shows the contributions of intermediate inputs from the supply industries to the value of Manufacturing output. Every $100 of Manufacturing output produced required, on average, $55.50 of intermediate inputs ($7.20 from Agriculture, $8.30 from Mining, $19.50 from Manufacturing and the rest from services). Since these data are based on a direct allocation of imports table from the ABS, the intermediate flows between industry refers only to domestic products.

Table B.1 Input-output linkages between sectors,**a** 2008-09

Per cent

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **TO** | | | | | | |
|  |  | Ag. | Mining | Mfg | EGWWSb | Constr. | Transport | Other servicesc |
| |  | | --- | | **FROM** | | | | | | | | | | | Agriculture | 18.4 | 0.1 | **7.2** | 0.0 | 0.1 | 0.2 | 0.5 |
| Mining | 0.1 | 9.2 | **8.3** | 6.8 | 0.3 | 0.2 | 0.2 |
| Manufacturing | **8.3** | **5.1** | **19.5** | **3.4** | **14.4** | **9.1** | **4.8** |
| EGWWSb | 1.4 | 1.2 | **1.5** | 23.4 | 1.0 | 1.1 | 0.7 |
| Construction | 2.1 | 3.5 | **0.8** | 4.5 | 25.9 | 2.2 | 2.3 |
| Transport | 4.4 | 2.3 | **4.6** | 1.2 | 2.1 | 7.9 | 2.7 |
| Other services | 15.8 | 11.8 | **13.6** | 11.0 | 20.8 | 26.9 | 27.5 |
| *Total domestic intermediates* | *50.4* | *33.2* | ***55.5*** | *50.2* | *64.6* | *47.5* | *38.7* |
| Value added | 41.9 | 62.8 | **27.7** | 45.6 | 30.2 | 44.9 | 56.8 |
| Importsd | 7.1 | 4.0 | **16.2** | 3.8 | 4.9 | 6.8 | 3.9 |
|  | **Total**e | 100 | 100 | **100** | 100 | 100 | 100 | 100 |

a Based on direct allocation of imports so that the percentages intermediate inputs refer only to domestically produced inputs. b Electricity, gas, water and waste services. c Includes non-market sector industries. d Imports refer to imported intermediate goods used by column (use) industry and can be products from any industry. e Includes taxes less subsidies on products.

*Source*: ABS (*Australian National Accounts: Input-Output Tables, 2008-09*, Cat. no. 5209.0.55.001, Table 5).

Changes in the coefficients give a broad indication of the changing relationships between Australian manufacturers and their users and suppliers. Table B.1 shows the coefficients at the divisional level and table B.2 shows the coefficients for the subsectors of Manufacturing. Petroleum, coal, chemical and rubber products (PCCR) provides a relatively large share of intermediate inputs to Agriculture and Mining as well as to the Manufacturing subsectors. Of all the Manufacturing subsectors, Metal products (MP) provides the largest share of intermediate inputs used by total Manufacturing. Every $100 of Manufacturing output requires $9.20 of intermediate inputs from MP. Machinery and equipment manufacturing (ME) and Textile, clothing and other manufacturing (TCO) have a high reliance on inputs from MP.

### Suppliers to Manufacturing

A Commission Research Paper in 2003 identified that in the mid-1990s, Manufacturing was a significant user of inputs from the primary industries (Agriculture and Mining), with the resource processing parts of Manufacturing having more linkage with resources than the elaborately transformed manufactures (PC 2003). Since then, the linkages between Manufacturing and the primary industries have strengthened, likely as a result of the mining boom.

While in 1994-95, intermediate inputs from Mining contributed $5.10 per every $100 of Manufacturing output, by 2008-09, it contributed $8.30 (ABS 2012a). Aside from the intra-industry flows within Agriculture and Mining, Manufacturing is the most significant user of inputs from these industries (table B.1).

In the 2003 Research Paper, the Commission also noted that the outsourcing of non‑core service activities (such as accountancy, cleaning, transport and data‑processing) by firms in Manufacturing had contributed to the decline in the sector’s share of gross domestic product. Intermediate inputs from the services sector had been making a significantly higher contribution to Manufacturing in the mid-1990s than in the early 1980s, suggesting that activities that were previously performed by manufacturers themselves were increasingly being supplied from the services sector. The coefficient representing the flow of services into Manufacturing has since stabilised, suggesting that the outsourcing trend may have plateaued. As shown in table B.1, the services industries contributed $20.50 to every $100 of Manufacturing output. This is similar to 1994-95: the IO tables for that year show that the services contribution was $19.80.

Table B.2 Input-output linkages of Manufacturing subsectors,**a** 2008-09

Per cent

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **TO** | | | | | | | | | | | |
|  |  | **Agric.** | **Mining** | FBT | TCO | WP | PRM | PCCR | NM | MP | ME | **Total Mfg** | **Services** |
| ***FROM*** | **Agriculture** | 18.4 | 0.1 | 29.5 | 5.8 | 8.1 | 0.1 | 0.5 | 0.0 | 0.0 | 0.0 | 7.2 | 0.4 |
| **Mining** | 0.1 | 9.2 | 0.5 | 0.1 | 0.6 | 0.2 | 12.1 | 7.8 | 20.6 | 0.1 | 8.3 | 0.4 |
| FBT | 2.2 | 0.2 | 11.6 | 2.8 | 0.2 | 0.2 | 0.8 | 0.2 | 0.1 | 0.2 | 2.9 | 1.2 |
| TCO | 0.2 | 0.1 | 0.2 | 4.1 | 0.2 | 0.4 | 0.2 | 0.2 | 0.2 | 0.4 | 0.4 | 0.2 |
| WP | 0.2 | 0.1 | 1.5 | 2.8 | 7.3 | 4.7 | 0.7 | 0.6 | 0.3 | 0.4 | 1.3 | 0.7 |
| PRM | 0.1 | 0.1 | 0.2 | 0.1 | 0.7 | 1.8 | 0.1 | 0.2 | 0.1 | 0.2 | 0.2 | 0.5 |
| PCCR | 4.1 | 2.1 | 2.1 | 2.2 | 3.2 | 6.6 | 9.5 | 2.7 | 1.1 | 1.9 | 3.4 | 1.3 |
| NM | 0.1 | 0.1 | 0.5 | 0.2 | 0.2 | 0.3 | 0.4 | 11.7 | 0.3 | 0.8 | 0.9 | 0.6 |
| MP | 0.4 | 1.6 | 0.6 | 5.9 | 2.3 | 0.7 | 0.8 | 2.4 | 21.5 | 16.0 | 9.2 | 1.3 |
| ME | 1.0 | 0.8 | 0.3 | 0.5 | 0.6 | 0.7 | 0.3 | 0.4 | 0.3 | 6.0 | 1.3 | 0.9 |
| **Total Mfg** | 8.3 | 5.1 | 17.0 | 18.7 | 14.8 | 15.2 | 12.8 | 18.4 | 23.8 | 25.9 | 19.5 | 6.7 |
| **Services** | 23.7 | 18.9 | 20.4 | 18.3 | 30.6 | 27.1 | 20.8 | 26.9 | 15.0 | 23.9 | 20.5 | 36.6 |
| *Total domestic intermediate inputs* | *50.4* | *33.2* | *67.4* | *43.0* | *54.2* | *42.6* | *46.1* | *53.2* | *59.5* | *49.9* | *55.5* | *44.0* |
|  | Value added | 41.9 | 62.8 | 26.7 | 40.4 | 35.5 | 44.7 | 23.7 | 37.4 | 22.9 | 30.6 | 27.7 | 51.1 |
|  | Importsb | 7.1 | 4.0 | 5.3 | 15.5 | 9.8 | 12.3 | 29.2 | 8.6 | 17.4 | 19.1 | 16.2 | 4.3 |
|  | **Total** | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

FBT is Food, beverage & tobacco products; TCO is Textile, clothing & other manufacturing; WP is Wood & paper products; PRM is Printing & recorded media; PCCR is Petroleum, coal, chemical & rubber products; NM is Non-metallic mineral products; MP is Metal products; ME is Machinery & equipment manufacturing. a Based on direct allocation of imports so that the percentages intermediate inputs refer only to domestically produced inputs. Percentages do not sum to 100 because the row for taxes less subsidies on products is not shown. b Imports refer to imported intermediate goods used by column (use) industry and can be products from any industry.

*Source*: ABS (*Australian National Accounts: Input-Output Tables, 2008-09,* Cat. no. 5209.0.55.001, Table 5).

### Users of Manufacturing

Table B.3 shows the change in the relationships between Manufacturing and its users over time. It shows the direct requirement coefficients for Manufacturing, which is the same information in the row for Manufacturing in table B.1, expressed as the contribution of intermediate inputs from Manufacturing for every $100 of output produced by sectors in the economy for three selected years.

Table B.3 Supply of Manufacturing intermediate inputs to industry sector**a**

Value of Australian Manufacturing intermediate inputs required for every $100 of industry output, basic prices

|  |  |  |  |
| --- | --- | --- | --- |
|  | 1994-95 | 2001-02 | 2008-09 |
|  | $ | $ | $ |
| Agriculture | 12.70 | 8.30 | 8.30 |
| Mining | 7.20 | 7.40 | 5.10 |
| Manufacturing | 23.70 | 20.40 | 20.50 |
| All services | 8.30 | 7.50 | 6.70 |

a Adjustments have been made, to the extent practicable, to broadly match IOIGs for 1994-95 based on the ANZSIC 1993 with the IOIGs for 2001-02 and 2008-09 based on ANZSIC 2006. In 1994-95 and 2001-02 IOIG 2402 Publishing; recorded media and publishing is treated as part of ‘All services’ rather than Manufacturing.

*Source*: ABS (*Australian National Accounts: Input-Output Tables,* 1994-95, 2001-02 and 2008-09 issues*,* Cat. no. 5209.0.55.001, Table 5).

As discussed, movements in the coefficients across different years need to be interpreted with care since the IO tables do not distinguish price and volume effects. The falling coefficients could represent a fall in the relative price of manufactured products used as intermediate goods: for example, price rises in intermediate inputs from other supplying industries, or price rises in the goods produced by the use industries may outpace price rises in the intermediate inputs from Manufacturing.

A change in relative price may in itself produce volume changes by signalling firms and final users to seek cheaper substitutes where these are available. Since table B.3 is based on an IO table with direct allocation of imports, all the coefficients show the amount of domestically produced intermediate goods from Manufacturing used to produce $100 of goods in the row industries.

A decline in the coefficients may also be brought about by the use industries changing their own output mix (in response to changing consumer tastes, or to drought conditions, for instance) in favour of those goods or services which require less intermediate inputs from Manufacturing. It should be noted that coefficients from IO tables do not fully capture the effect of these sources of structural change.

### Intermediate and final usage of Manufacturing

As well as providing information on the intermediate use of goods from supplying industries, the IO tables also provide information on final demand, which includes final consumption by households and government, private and public gross fixed capital formation, change in inventories, and exports.

Table B.4 Breakdown of Manufacturing subsector**a** output into industry and final use categories, 2001-02 and 2008-09

Percentage of total supply

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | FBT | TCO | WP | PRMb | PCCR | NM | MP | ME | Total Mfg |
| ***2001-02*** |  |  |  |  |  |  |  |  |  |
| *Industry use* | *32.7* | *34.3* | *83.1* | *86.8* | *66.9* | *96.7* | *57.5* | *46.4* | *53.1* |
| *Final use* |  |  |  |  |  |  |  |  |  |
| Final consumption | 40.1 | 31.4 | 7.3 | 7.7 | 17.4 | 1.9 | 1.5 | 23.1 | 20.3 |
| Exports | 24.6 | 20.0 | 10.9 | 2.7 | 13.1 | 4.0 | 38.8 | 17.4 | 21.5 |
| GFCFc | 2.6 | 14.3 | -1.4 | 2.7 | 2.7 | -2.6 | 2.3 | 13.2 | 5.1 |
| **Total** | **100** | **100** | **100** | **100** | **100** | **100** | **100** | **100** | **100** |
| ***2008-09*** |  |  |  |  |  |  |  |  |  |
| *Industry use* | *40.5* | *30.3* | *81.2* | *98.3* | *60.1* | *94.7* | *59.2* | *34.9* | *53.6* |
| *Final use* |  |  |  |  |  |  |  |  |  |
| Final consumption | 36.8 | 34.3 | 8.3 | 0.9 | 20.3 | 2.8 | 0.9 | 17.6 | 17.0 |
| Exports | 21.8 | 18.8 | 9.7 | 1.7 | 16.7 | 2.4 | 36.2 | 17.1 | 21.9 |
| GFCFc | 0.9 | 16.6 | 0.7 | -0.9 | 2.9 | 0.2 | 3.7 | 30.4 | 7.5 |
| **Total** | **100** | **100** | **100** | **100** | **100** | **100** | **100** | **100** | **100** |

a For full subsector names see table B.2. b There are some concordance issues between Manufacturing subsectors from ANZSIC93 to ANZSIC 06. For 2001-02, Printing includes IOIG 2401 ‘Printing and services to printing’; so as to best concord with ANZSIC06, IOIG 2402 ‘Publishing; recorded media and publishing’ is not considered as Manufacturing and is therefore not included in either ‘Printing’ or in ‘Total Mfg’. c In this table, change in inventories is included in GFCF so it can therefore be negative.

*Source*: ABS (*Australian National Accounts: Input-Output Tables,* 2001-02 and 2008-09 issues,Cat. no. 5209.0.55.001, Table 5).

Manufacturing is an important supplier of goods for intermediate use both within the Manufacturing sector itself and to other sectors. This can be seen in table B.4 which shows a breakdown of intermediate and final demand for Manufacturing. Well over a half of Australia’s Manufacturing output is supplied for domestic intermediate use and while this has remained largely unchanged over the last one and a half decades[[2]](#footnote-2) at an aggregate level, there are disparate trends across the subsectors.

The majority of the output of Wood and paper products (WP), PRM and NM goes to downstream intermediate users. These subsectors are therefore particularly affected by cyclical or structural fluctuations in their downstream use industries. WP, MP and NM are particularly reliant on domestic downstream intermediate users in Manufacturing (table B.4). Other subsectors have a higher proportion of their output going to final consumption and exports. While in table B.4 PRM has shown an increase in share of total supply going to intermediate use, the concordance problems associated with the introduction of the ANZSIC06 means that no clear conclusions can be drawn about this subsector.

1. The ABS *Australian and New Zealand Standard Industrial Classification* (ABS 2006b). [↑](#footnote-ref-1)
2. This is based on a comparison with 1994-95 IO tables. [↑](#footnote-ref-2)