# 3 Productivity growth at the subsector level

The productivity trends evident for Manufacturing as a whole are the net result of a potentially diverse range of trends for the individual industries in the sector. This chapter examines the productivity of Manufacturing at the subsector level and identifies the subsectors that contributed the most to the recent decline in Manufacturing productivity.

## 3.1 Subsectors within Manufacturing

The ABS divides Manufacturing into eight subsectors for the purpose of estimating the volume of output (value added):

* Food, beverage and tobacco products
* Textile, clothing and other manufacturing
* Wood and paper products
* Printing and recorded media
* Petroleum, coal, chemical and rubber products
* Non-metallic mineral products
* Metal products
* Machinery and equipment manufacturing.[[1]](#footnote-1)

Figure 3.1 shows the distribution of value added across Manufacturing subsectors in 2009-10. The larger subsectors are Food, beverage and tobacco products, Metal products, Machinery and equipment manufacturing and Petroleum, coal, chemicals and rubber products, which together make up almost three quarters of Manufacturing value added. The relative size of each of the subsectors has been fairly stable since 1985-86 (figure 3.2). This stability may mask changes in the mix of activities within the subsectors. However, insufficient data for value added volumes are available to be able to estimate productivity at a more disaggregated level in this study.

Figure 3.1 Subsector shares of Manufacturing value added, 2009-10**a**

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a Value added measure is gross value added at current basic prices.

*Data source*: ABS (*Australian System of National Accounts, 2010-11*, Cat. no. 5204.0).

Figure 3.2 Subsector shares of Manufacturing value added, 1985-86 to 2010-11**a**

Percentage shares of total

|  |
| --- |
|  |

a Value added measure is industry value added at current prices from the ABS *Economic Activity Survey*. Data prior to 2006-07 have been converted onto an ANZSIC06 basis using a broad concordance and the series has been benchmarked to value added for 2009-10 from the ABS National Accounts (appendix A).

*Data sources*: Authors’ estimates based on ABS (*Australian Industry,* various issues, Cat. no. 8155.0); ABS (*Manufacturing Industry*, *Australia*, various issues, Cat. no. 8221.0); ABS (*Enterprise Statistics*, various issues, Cat. no. 8103.0); and ABS (*Australian System of National Accounts*, *2010-11*,Cat. no. 5204.0).

## 3.2 Productivity growth in Manufacturing subsectors

The ABS estimates productivity growth for Manufacturing as a whole, but not for subsectors within Manufacturing. This section outlines the approach used in this study to estimate productivity at a more disaggregated level and presents estimates for the eight subsectors within Manufacturing.

### Estimation methodology

As outlined in chapter 2, multifactor productivity (MFP) growth is derived as the difference between growth in value added and growth in combined inputs[[2]](#footnote-2) (the average of growth in capital and in labour, weighted by their respective income shares). And labour productivity (LP) growth is defined as growth in value added per hour worked. Therefore, to construct subsector estimates of LP and MFP, subsector level data for value added, hours worked, capital services and factor income shares (as weights) are required.

Where possible, subsector MFP estimates were based on the same methodology and data sources used by the ABS in its estimates for Manufacturing MFP (in order to be consistent with those ABS estimates). However, data limitations necessitated the use of simplified methodology and different data sources for some variables.

In most cases, the required data were available from the ABS in a single industry classification, *Australian and New Zealand Standard Industrial Classification 2006* (ANZSIC06).[[3]](#footnote-3) In a few cases, data were backcast into ANZSIC06 using a broad concordance between industry classifications.

Full details of the methodology, data sources and assumptions are provided in appendix A. In broad terms, the subsector estimates for value added and hours worked most closely match the ABS total for Manufacturing.

* Value added (volume) for the subsectors was available from the ABS National Accounts — the same source used by the ABS for estimating Manufacturing MFP.
* Hours worked in each of the subsectors was derived from the specific measure of hours worked for Manufacturing in total that the ABS uses in its estimation of Manufacturing MFP. This specific measure is based on published data from the ABS quarterly *Labour Force Survey,* but has been adjusted by the ABS for changes in survey methodology over time and annualised (including adjustment for holidays). Information about the distribution of hours worked, also from the *Labour Force Survey,* was used to allocate this adjusted total across subsectors.

The subsector estimates of capital services and factor income shares required the use of different data sources and additional assumptions.

* Subsector capital services indexes were estimated using a range of data sources and assumptions. Where possible, subsector estimates for investment by asset type were benchmarked to the ABS estimates for Manufacturing in total (box 3.1). But, as a result of data limitations, there is a discrepancy between the sum of the subsector estimates for capital services and the ABS total for Manufacturing.
* Labour income and capital income shares for the subsectors were derived using data from the ABS *Economic Activity Survey*. These data were adjusted for changes in industry classification and survey methodology, to improve consistency over time. This data source is different to that used by the ABS for estimating Manufacturing in total and insufficient data were available to align the subsector shares with those for Manufacturing in total.

Given the data limitations, the subsector estimates presented in this paper are of lesser quality than the ABS estimates for Manufacturing as a whole, and will not necessarily sum to those ABS estimates. Therefore the subsector estimates should be regarded as indicators of differences within the Manufacturing sector, rather than as precise estimates.[[4]](#footnote-4)

|  |
| --- |
| Box 3.1 Estimation of subsector capital services |
| An estimate of the annual flow of capital services is required for the estimation of MFP growth. For each capital asset, the services provided are directly proportional to the asset's productive capital stock. Aggregate capital services indexes are created using the volume index of the productive capital stock of each asset weighted using rental prices.  The *productive capital stock* of an asset is the real stock of capital, adjusted for retirement of capital and efficiency losses related to age. The productive capital stock is estimated using new investment data and an assumed decline in efficiency of previous investment that has aged.  The *rental price* of an asset type can be thought of as an estimate of the rate that the asset type would attract if leased under a commercial agreement. The use of rental prices as weights assumes that the rental price reflects the marginal product of an asset. More productive assets have a higher rental price and, therefore, a higher weight in the aggregate capital services measure.  The rental price of an asset includes: the expected return on the asset; depreciation; the capital gain or loss due to asset price inflation/deflation; and tax adjustments (particularly to correct for distortions in rental prices due to differential tax treatment across capital items). See ABS (2012c) for further details.  Data limitations lead to some differences in methodology and data sources to those used by the ABS for Manufacturing in total.  The main differences are:   * fewer and less detailed asset types were included at the subsector level * some parameters used in rental price estimation were not available on a subsector-specific basis — they were assumed to be the same as for Manufacturing in total * a different primary data source was used for investment by subsector — but these data were benchmarked to ABS estimates for Manufacturing in total, by applying the subsector shares to that total.   The resulting discrepancy between the ABS Manufacturing estimates and the aggregate of the subsector estimates for capital services varies over time. But it is relatively small over the cycles that are the main focus in this study (cycles 3 and 4). Appendix A provides full details of the method and compares subsector estimates with the ABS Manufacturing estimates. |
|  |
|  |

#### Consistency with ABS Manufacturing estimates.

The most significant of the discrepancies between the ABS estimates for Manufacturing in total and the aggregate of the subsector estimates is in capital services and this flows through to the MFP estimates (figure 3.3).

Figure 3.3 Discrepancies in capital services and MFP

Index 2009-10 = 100

|  |  |
| --- | --- |
| *Capital services* | *MFP* |
|  |  |
|  | |

*Data sources*: Authors’ estimates; ABS (*Experimental Estimates of Industry Multifactor Productivity, 2010-11,* Cat. no. 5260.0.55.002).

Nonetheless, the discrepancies are relatively small over the last two complete productivity cycles (appendix A), which are the focus of this paper. And the broad pattern of subsector MFP growth across cycles does not change substantially with the use of alternative capital data or alternative assumptions regarding R&D capital. The magnitude of the changes in inputs and outputs underlying the subsector productivity estimates makes it unlikely that the declines in subsector productivity are the result of statistical error in the data (appendix E).

In the remainder of the chapter, all tables include both the aggregate of the subsectors estimates and the ABS estimates for Manufacturing in total. But, for clarity, charts include only the ABS estimates for Manufacturing (unless otherwise specified).

### Subsector-specific estimates

From 1985-86 to 2010-11, the MFP trend for Manufacturing as a whole was relatively flat (with average annual growth of around 0.3 per cent). However, this aggregate disguises considerable variation among the subsectors, with some subsectors experiencing positive growth and others experiencing negative growth in MFP, on average (figure 3.4). Over the period, Non-metallic mineral products had the highest average annual MFP growth at 1.4 per cent and Textile, clothing and other manufacturing the lowest at -1.4 per cent.

Three subsectors had MFP growth above the average for Manufacturing as a whole (figure 3.4, top panel) and five subsectors had below average growth (bottom panel). All the subsectors in the bottom panel experienced *negative* MFP growth on average over the full period. However, in most subsectors, the rate of MFP growth varied considerably over time.

Figure 3.4 MFP by Manufacturing subsector**a**

Index 2009-10 = 100

|  |
| --- |
| *Subsectors with above average MFP growth*b |
|  |
| *Subsectors with below average MFP growth*b |
|  |

a 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. b As 2009-10 is the base year of the indexes, those subsectors with an index value below that for total Manufacturing in 1985-86 have higher average MFP growth than Manufacturing over the period 1985‑86 to 2009-10 (and vice versa).

*Data sources*: Authors’ estimates; ABS (*Experimental Estimates of Industry Multifactor Productivity, 2010-11,* Cat. no. 5260.0.55.002).

#### MFP growth over productivity cycles

As noted in chapter 2, examining average productivity growth over cycles gives a better indication of underlying productivity performance.[[5]](#footnote-5) Table 3.1 shows average annual MFP growth for the subsectors over the last four complete productivity cycles and the current incomplete cycle. (The growth rates over the incomplete cycle that are presented in this chapter should be interpreted with caution because they may be influenced by temporary factors.)

Table 3.1 Manufacturing subsector MFP growth by cycle

Average annual growth rate (per cent)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Subsectors | Cycle 1:  1988-89 to 1993-94 | Cycle 2:  1993-94 to 1998-99 | Cycle 3:  1998-99 to 2003-04 | Cycle 4:  2003-04 to 2007-08 | Incomplete cycle:  2007-08 to 2010-11 |
| Food, beverage & tob. products | 0.55 | 0.66 | -0.53 | -4.23 | -1.12 |
| Textile, clothing & other mfg | -2.27 | 0.53 | 2.53 | -1.62 | -9.28 |
| Wood & paper products | -2.52 | -1.00 | -1.13 | -1.19 | 1.91 |
| Printing & recorded media | -1.28 | -1.83 | 6.45 | -2.84 | -9.15 |
| Petrol., coal, chem. & rubber | -2.64 | 1.13 | 0.57 | -4.09 | -1.15 |
| Non-metallic mineral products | -2.54 | 0.32 | 6.33 | 4.89 | -0.33 |
| Metal products | 0.97 | 1.05 | 1.44 | -0.85 | 0.11 |
| Machinery & equipment mfg | 1.98 | 2.53 | 1.62 | -0.21 | 0.29 |
| *Aggregate of subsectors* | *-0.40* | *0.87* | *1.37* | *-1.52* | *-1.29* |
| **Total Manufacturing (ABS)** | **-0.02** | **0.59** | **1.34** | **-1.38** | **-0.79** |

*Sources*: Authors’ estimates; ABS (*Experimental Estimates of Industry Multifactor Productivity, 2010-11,* Cat. no. 5260.0.55.002).

In most cycles, MFP growth has been quite variable across subsectors, with both positive and negative rates of growth coexisting in every cycle. In cycle 1, most of the subsectors had negative MFP growth, but three had positive MFP growth. In cycles 2 and 3, there was an improvement in MFP growth rates in most subsectors, with only two subsectors recording negative rates of MFP growth. (In each cycle, Wood and paper products had negative growth.)

In cycle 4, however, there was negative MFP growth in almost all the subsectors (the sole exception being Non-metallic mineral products, which was also strongly positive in cycle 3). And the rate of decline in some of the subsectors was particularly sharp. Food, beverage and tobacco products and Petroleum, coal, chemical and rubber products had MFP growth rates of around -4 per cent a year — higher rates of decline than in any of the subsectors in the previous three cycles.

In the incomplete cycle, the smaller subsectors of Textile, clothing and other manufacturing and Printing and recorded media had even sharper declines in MFP, with growth rates of around -9 per cent a year. By contrast, the larger subsectors improved their MFP growth rates, with some (such as Metal products and Machinery and equipment manufacturing) experiencing positive growth once again. For Manufacturing as a whole, the decline in MFP also became less severe.

Focusing on the most recent complete cycles, figure 3.5 shows that *between* cycles 3 and 4, MFP growth fell in all subsectors as well as for Manufacturing in total. In most subsectors, this was a fall from an average rate of MFP growth that was positive in cycle 3 to one that was negative in cycle 4.

Figure 3.5 Change in subsector MFP growth rates between cycles 3 and 4**a**

Percentage points

|  |
| --- |
|  |

*Data sources*: Authors’ estimates; ABS (*Experimental Estimates of Industry Multifactor Productivity, 2010-11,* Cat. no. 5260.0.55.002).

#### LP growth over cycles

LP growth has also been quite variable across subsectors in each cycle (table 3.2). However, unlike MFP growth, LP growth remained positive in most subsectors in each cycle, supported by consistently positive capital deepening. (As noted in chapter 2, LP growth can be broken down into capital deepening and MFP growth. Capital deepening is an increase in the capital intensity of the production process.)

Table 3.2 Manufacturing subsector LP growth by cycle

Average annual growth rate (per cent)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Subsectors | Cycle 1:  1988-89 to 1993-94 | Cycle 2:  1993-94 to 1998-99 | Cycle 3:  1998-99 to 2003-04 | Cycle 4:  2003-04 to 2007-08 | Incomplete cycle:  2007-08 to 2010-11 |
| Food, beverage & tob. products | 1.97 | 2.11 | 2.12 | -4.00 | 0.61 |
| Textile, clothing & other mfg | -1.43 | 0.81 | 3.76 | 0.28 | -7.82 |
| Wood & paper products | -1.28 | 1.96 | -1.68 | 2.60 | 5.31 |
| Printing & recorded media | 1.07 | -0.83 | 8.26 | -0.75 | -9.09 |
| Petrol., coal, chem. & rubber | 0.13 | 2.79 | 2.91 | -0.64 | 3.17 |
| Non-metallic mineral products | 0.08 | 2.16 | 7.39 | 5.12 | 4.31 |
| Metal products | 3.01 | 1.31 | 3.95 | 2.96 | 3.12 |
| Machinery & equipment mfg | 3.76 | 3.57 | 2.51 | 0.96 | 0.95 |
| **Total Manufacturing (ABS)**a | **1.72** | **2.10** | **3.29** | **0.84** | **0.88** |

a The sum of the subsector estimates is not shown as it is the same as the ABS Manufacturing estimates for LP at one decimal place.

*Sources*:Authors’ estimates; ABS (*Experimental Estimates of Industry Multifactor Productivity, 2010-11,* Cat. no. 5260.0.55.002).

Figure 3.6 shows the breakdown of subsector LP growth (denoted by the diamond) into its additive component parts — MFP (pale column) and capital deepening (dark column). There were only a few cases where LP growth was negative, and this was because capital deepening was insufficient to offset negative MFP growth.

Focusing on recent cycles, Manufacturing and most subsectors experienced a decline in LP growth between cycles 3 and 4 (as was the case for MFP growth). In most subsectors, capital deepening intensified but this was more than offset by a decline in MFP growth. The exceptions were: Food, beverage and tobacco products and Non-metallic mineral products (for which the rate of capital deepening decreased rather than increased); and Wood and paper products (for which LP growth increased because capital deepening increased and MFP growth did not decline further). The relationship between growth in value added, inputs and productivity is discussed further in section 3.3.

Figure 3.6 Breakdown of subsector**a** LP growth**b** by cycle

Average annual growth rate (per cent)

|  |  |
| --- | --- |
|  |  |
|  |  |
|  | |

a 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. b LP growth equals the sum of MFP growth and capital deepening. Components do not sum exactly due to approximation errors arising from estimating an annualised growth rate from the start to the end year of productivity cycles and from the use of averaged weights across the cycles.

*Data source*: Authors’ estimates.

### Subsector contributions

Information on MFP growth for each of the subsectors does not indicate the contribution each subsector makes to the decline in MFP for the whole of Manufacturing. Two subsectors with the same subsector-specific MFP growth can make different percentage point contributions to Manufacturing MFP growth depending on their relative size. Table 3.3 presents estimates of the contribution made by each subsector, taking their relative size into account.

Table 3.3 Subsector contributions to Manufacturing MFP growth by cycle

Percentage points

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Subsectors | Cycle 1:  1988-89 to 1993-94 | Cycle 2:  1993-94 to 1998-99 | Cycle 3:  1998-99 to 2003-04 | Cycle 4:  2003-04 to 2007-08 | Incomplete cycle:  2007-08 to 2010-11 |
| Food, beverage & tob. products | 0.08 | 0.16 | -0.12 | -0.85 | -0.25 |
| Textile, clothing & other mfg | -0.14 | 0.06 | 0.38 | -0.02 | -0.52 |
| Wood & paper products | -0.21 | -0.09 | -0.11 | -0.08 | 0.11 |
| Printing & recorded media | -0.04 | -0.10 | 0.25 | -0.10 | -0.37 |
| Petrol., coal, chem. & rubber | -0.41 | 0.18 | 0.08 | -0.73 | -0.37 |
| Non-metallic mineral products | -0.14 | 0.01 | 0.31 | 0.24 | -0.04 |
| Metal products | 0.22 | 0.19 | 0.30 | -0.12 | -0.13 |
| Machinery & equipment mfg | 0.32 | 0.45 | 0.29 | -0.04 | 0.08 |
| Sum of the contributionsa | -0.32 | 0.86 | 1.38 | -1.70 | -1.49 |
| *Aggregate of subsectors* | *-0.40* | *0.87* | *1.37* | *-1.52* | *-1.29* |
| **Total Manufacturing (ABS)** | **-0.02** | **0.59** | **1.34** | **-1.38** | **-0.79** |

a Using a methodology based on Parham (2012), the contribution of each subsector to Manufacturing MFP is derived by first estimating its contributions to the proximate causes (value added, capital inputs and labour inputs), and then by taking its contribution to Manufacturing value added less its contribution to total inputs (the sum of its contribution to capital and labour inputs). Due to approximation errors, there is discrepancy between the sum of the subsector MFP contributions and the aggregate of the subsector estimates of the MFP growth.

*Source*: Authors’ estimates.

In cycle 3 (1998‑99 to 2003-04) two of the smaller subsectors, Textile, clothing and other manufacturing and Non-metallic mineral products, made the largest contributions to the positive growth in Manufacturing MFP, followed by Metal products and Machinery and equipment manufacturing.

In cycle 4, where average MFP growth for Manufacturing was negative, Non-metallic mineral products was the only subsector to make a positive contribution. All other subsectors made negative MFP contributions, with Food, beverage and tobacco products, Petroleum, coal, chemical and rubber products and Metal products making the larger contributions to the decline.

Focusing on the change between cycles 3 and 4, all but one of the subsectors made a negative contribution to the decline in MFP for Manufacturing as a whole (figure 3.7). Petroleum, coal, chemical and rubber products, Food, beverage and tobacco products and Metal products were the most significant contributors to the MFP decline in cycle 4. Collectively, they accounted for almost two thirds of the decline in Manufacturing MFP between the last two complete cycles.[[6]](#footnote-6)

Petroleum, coal, chemical and rubber products and Food, beverage and tobacco products made large contributions principally because of poor performance in cycle 4, rather than falling from a strong performance in cycle 3. This is in contrast to the third largest contributor, Metal products, which had strong productivity performance in cycle 3, followed by a sharp decline in cycle 4.

Figure 3.7 Subsector contributions to the change in Manufacturing MFP growth between cycles 3 and 4

Percentage points

|  |
| --- |
|  |

*Data source*: Authors’ estimates.

The contribution of a subsector to the change in Manufacturing MFP growth is a combination of the change in its MFP growth and the change in its relative size (the latter reflecting changes in the subsector composition of the Manufacturing sector). Between cycles 3 and 4, however, change in the composition of Manufacturing between subsectors[[7]](#footnote-7) made little contribution to the change in Manufacturing MFP, accounting for only 0.04 of a percentage point of the decline in total Manufacturing MFP (box D.1).

## 3.3 Proximate causes of subsector MFP growth

The Manufacturing subsectors have had different sources of positive and negative MFP growth over time. Table 3.4 shows growth in each of the proximate causes and MFP by subsector in cycles 3 and 4 and in the incomplete cycle.

In cycle 3, most subsectors had positive MFP growth through positive value added growth and labour shedding that offset positive growth in capital inputs. In cycle 4, the negative MFP growth in most subsectors was associated with low or negative value added growth in the face of strong growth in capital inputs, and, for some subsectors, positive growth in labour inputs. Some subsectors did experience a contraction in labour inputs, but this was generally to a lesser extent than in cycle 3.

In the incomplete cycle, there were mixed results for subsector MFP. Value added contracted in even more subsectors and capital continued to grow in all subsectors. But there was an offsetting fall in labour inputs in some subsectors. While some of the smaller subsectors experienced a sharp MFP decline, in other subsectors the MFP decline slowed or there was a return to positive rates of growth.

To relate these subsector-specific trends in proximate causes back to the whole of Manufacturing, figure 3.8 shows the *contributions* of each of the subsectors to the change in value added, labour and capital inputs for Manufacturing in total between the last two complete cycles.[[8]](#footnote-8) While most subsectors contributed to the Manufacturing MFP decline through declines in value added growth, their contributions to the increase in capital and labour inputs were more concentrated.

* Most subsectors contributed between 0.2 to 0.4 of a percentage point to the decline in value added growth. These negative contributions were offset, to some extent, by a large positive contribution from Metal products (0.7 of a percentage point).
* Metal products and Petroleum, coal, chemical and rubber products made by far the largest contributions to the capital input surge between cycles 3 and 4. Food, beverage and tobacco products made a small negative contribution, but this largely offset the small positive contributions of the remaining subsectors.
* In terms of labour inputs growth, the spread of the subsector contributions was slightly wider, but still dominated by the larger positive contributions (from Food, beverage and tobacco products and Metal products), and a sizable, offsetting negative contribution from Wood and paper products.

Table 3.4 Proximate causes of subsector MFP growth by cycle

Average annual growth rate (per cent)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Subsectors | Value  added | Capital servicesa | Hours  workeda | MFPb |
| *Cycle 3 (1998-99 to 2003-04)* | | | | |
| Food, beverage & tob. products | 1.25 | 2.33 | -0.53 | -0.53 |
| Textile, clothing & other mfg | -1.87 | 0.07 | -4.35 | 2.53 |
| Wood & paper products | 2.27 | 1.28 | 2.14 | -1.13 |
| Printing & recorded media | 6.25 | 1.18 | -1.36 | 6.45 |
| Petrol., coal, chem. & rubber | 1.79 | 1.75 | -0.52 | 0.57 |
| Non-metallic mineral products | 5.19 | 0.05 | -1.12 | 6.33 |
| Metal products | 1.25 | 1.30 | -1.47 | 1.44 |
| Machinery & equipment mfg | 3.58 | 1.14 | 0.79 | 1.62 |
| *Aggregate of subsectors* | *2.02* | *1.41* | *-0.76* | *1.37* |
| **Total Manufacturing (ABS)** | **2.03** | **1.41** | **-0.72** | **1.34** |
| *Cycle 4 (2003-04 to 2007-08)* | | | | |
| Food, beverage & tob. products | 0.25 | 2.05 | 2.57 | -4.23 |
| Textile, clothing & other mfg | -4.61 | 0.54 | -3.56 | -1.62 |
| Wood & paper products | -2.41 | 1.71 | -2.89 | -1.19 |
| Printing & recorded media | -1.87 | 1.76 | -0.75 | -2.84 |
| Petrol., coal, chem. & rubber | -0.63 | 3.65 | -0.04 | -4.09 |
| Non-metallic mineral products | 5.65 | 0.42 | 0.30 | 4.89 |
| Metal products | 4.50 | 4.61 | 0.76 | -0.85 |
| Machinery & equipment mfg | 1.72 | 1.39 | 0.53 | -0.21 |
| *Aggregate of subsectors* | *1.07* | *2.50* | *0.13* | *-1.52* |
| **Total Manufacturing (ABS)** | **1.08** | **2.38** | **0.15** | **-1.38** |
| *Incomplete cycle (2007-08 to 2010-11)* | | | | |
| Food, beverage & tob. products | 0.68 | 1.79 | 0.04 | -1.12 |
| Textile, clothing & other mfg | -11.86 | 0.12 | -2.95 | -9.28 |
| Wood & paper products | -2.13 | 0.45 | -4.39 | 1.91 |
| Printing & recorded media | -7.48 | 0.67 | 1.16 | -9.15 |
| Petrol., coal, chem. & rubber | -2.25 | 1.63 | -2.71 | -1.15 |
| Non-metallic mineral products | -1.83 | 1.93 | -3.37 | -0.33 |
| Metal products | 0.33 | 1.64 | -1.39 | 0.11 |
| Machinery & equipment mfg | -0.60 | 0.17 | -1.05 | 0.29 |
| *Aggregate of subsectors* | *-1.56* | *1.18* | *-1.44* | *-1.29* |
| **Total Manufacturing (ABS)** | **-1.58** | **0.70** | **-1.47** | **-0.79** |

a Capital services and hours worked weighted by income shares. b Growth in value added less growth in hours worked and capital services do not add exactly to MFP growth due to approximation errors.

*Sources*: Authors’ estimates; ABS (*Experimental Estimates of Industry Multifactor Productivity, 2010-11,* Cat. no. 5260.0.55.002).

Figure 3.8 Subsector**a** contributions to the change in Manufacturing MFP growth and its proximate causes between cycles 3 and 4

Percentage points

|  |  |
| --- | --- |
| *MFP* | *Value added* |
|  |  |
| *Hours worked* | *Capital services* |
|  |  |

a FBT is Food, beverage & tobacco products; ME is Machinery & equipment manufacturing; MP is Metal products; NM is Non-metallic mineral products; PCCR is Petroleum, coal, chemical and rubber products; PRM is Printing & recorded media; TCO is Textile, clothing & other manufacturing; WP is Wood & paper products.

*Data source*: Authors’ estimates.

## 3.4 Selection of subsectors for detailed analysis

Based on the above MFP estimates, the subsectors selected for detailed analysis in the remainder of the paper (chapters 4–6) are: Petroleum, coal, chemical and rubber products; Food, beverage and tobacco products and Metal products. (A brief discussion of the other subsectors is provided in appendix D.)

These three subsectors have been selected because they made the largest contributions to the decline in MFP for Manufacturing in total between the last two complete productivity cycles. Together, they accounted for almost two-thirds of the decline of 2.7 percentage points in Manufacturing MFP between cycles.[[9]](#footnote-9)

Also, these subsectors contributed the majority of value added, hours worked and investment in Manufacturing. In 2009-10, Food, beverage and tobacco products, Petroleum, coal, chemical and rubber products and Metal products together accounted for around 60 per cent of value added, half of hours worked and two-thirds of investment for Manufacturing as a whole. The quality of the estimates for these subsectors is also likely to be better than for some of the other subsectors, because they are relatively unaffected by industry classification changes and related data issues.[[10]](#footnote-10)

The above analysis shows that there is a range of different proximate causes for the contribution of these three subsectors to the aggregate MFP decline.

* The decline in the contribution of Food, beverage and tobacco products was related to some slowing in value added growth, much higher labour growth and fairly static capital growth.
* Petroleum, coal, chemical and rubber products had a large decline in value added growth (with an absolute decline in value added in the last complete cycle), along with moderate growth in capital and slight growth in labour.
* Metal products was quite different with very high value added growth, even larger capital growth (which accounted for the majority of capital growth for the entire Manufacturing sector), and an increase in labour growth.

This is summarised in figure 3.9, which shows the percentage point contributions of these three subsectors to the change in total Manufacturing value added, inputs and MFP between cycles 3 and 4. The figure also shows that the rest of Manufacturing in aggregate contributed to the MFP decline through a slowdown in value added growth.

Figure 3.9 Main subsectors contributing to change in the proximate causes of Manufacturing MFP growth between cycles 3 and 4

Percentage points

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*Data source*: Authors’ estimates.

There is also a wide range of possible influences on productivity in these three subsectors. Some of these influences are explored for each of these subsectors in the following chapters.

1. Includes Motor vehicle and motor vehicle part manufacturing. See appendix A for further details on ABS industry classifications and the industries included each subsector. [↑](#footnote-ref-1)
2. As noted in chapter 2, all outputs and inputs are measured in volume (real) terms. [↑](#footnote-ref-2)
3. Despite this approach, some subsectors are still less well estimated than others because of industry classification changes and practical limitations in backcasting. Textile, clothing and other manufacturing and Printing and recorded media have been particularly affected by the change from the 1993 edition to the 2006 edition of ANZSIC — MFP estimates for these subsectors are therefore likely to be of lower quality. [↑](#footnote-ref-3)
4. Attempting consistency with the ABS total for Manufacturing has meant using subsector data for each variable from the survey used for that ABS total (or the closest available survey) rather than taking data for all variables from a single survey. Any errors in the allocation of outputs and inputs to individual Manufacturing subsectors are likely to be offsetting when aggregated to the sector level. But these errors may be more apparent at the subsector level and may vary across surveys, thus introducing some inconsistency between data taken from different surveys.

   However, the most comprehensive ABS industry survey, the *Economic Activity Survey* (which underlies ABS publication *Australian Industry*, Cat. no. 8155.0) has insufficient data to calculate capital services indexes and includes only employment, not hours worked. Also, there are a number of breaks in series that hamper data comparability over time. [↑](#footnote-ref-4)
5. The cycles used in this chapter are for Manufacturing in total (and are particularly relevant to identifying contributions of subsectors to changes in total Manufacturing over those periods). Subsector-specific cycles are examined in appendix C. These subsector-specific cycles may be a better basis on which to examine MFP growth *within* a subsector over time. However, in general, the pattern of increase/decrease in average MFP growth from cycle to cycle is not changed if subsector-specific cycles are used instead of total Manufacturing cycles (although the magnitudes of the average growth rates vary). Therefore, for simplicity, the total Manufacturing cycles are used throughout the main body of this paper. Nonetheless, there are particular implications of using industry-specific cycles for Petroleum, coal, chemical and rubber products as discussed in chapter 4. [↑](#footnote-ref-5)
6. This is based on the contribution of the three subsectors, as a share of the sum of the estimated contributions for all eight subsectors, not of the ABS estimate for Manufacturing in total. [↑](#footnote-ref-6)
7. This does not indicate whether or not change in the composition of manufacturing activities *within* individual subsectors contributed to the change in MFP for Manufacturing in total. The effect of change in the composition of a subsector is captured in the measure of MFP growth for that subsector. [↑](#footnote-ref-7)
8. The change between cycle 4 and the incomplete cycle is discussed in appendix D. [↑](#footnote-ref-8)
9. Calculated as the share of the sum of the subsector MFP contributions, which due to approximation error will differ from the aggregate of the subsector estimates of the MFP growth (table 3.3). [↑](#footnote-ref-9)
10. For example, Textile, clothing and other manufacturing and Printing and recorded media are more affected by industry classification changes and the grouping of industry subdivisions. [↑](#footnote-ref-10)