D Further details about subsector productivity

This appendix provides further details about the *contributions* of the subsectors to Manufacturing multifactor productivity (MFP) growth and its *proximate causes* (changes in value added (VA), labour and capital inputs) in cycle 3 (1998-99 to 2003-04), cycle 4 (2003-04 to 2007-08), and in the current incomplete cycle (2007‑08 to 2010-11). (The growth rates over the incomplete cycle that are presented in this appendix should be interpreted with caution because they may be influenced by temporary factors.)

Manufacturing MFP growth went from being positive in cycle 3 to being negative in cycle 4, falling by 2.7 percentage points between the cycles. The decline was driven by a fall in the rate of VA growth and by higher input growth. In cycle 4, capital services growth further increased and there was a transition away from labour shedding in cycle 3, to modest, positive growth in hours worked.

In the incomplete cycle, MFP growth remained negative, although there was some improvement from cycle 4. The decline in VA between cycle 4 and the incomplete cycle was offset by a contraction in labour inputs and lower growth in capital services (figure D.1).

Each of the Manufacturing subsectors makes a different contribution to Manufacturing VA and to its labour and capital inputs. Hence, the subsectors make different contributions to the MFP performance of Manufacturing as a whole (as discussed in chapter 3). The subsectors’ contributions to the change in Manufacturing MFP and to its proximate causes between cycle 3 and cycle 4, and cycle 4 and the incomplete cycle are shown below. This is followed by discussion of the proximate causes of the MFP growth specific to each of the subsectors, in the order of the size of their contribution to the Manufacturing MFP decline between cycle 3 and 4.

Figure D.1 Growth in Manufacturing MFP and its proximate causes by cycle**a**

Average annual growth rate (per cent)

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

a Capital services and hours worked weighted by income shares.

*Data source*: ABS (*Experimental Estimates of Industry Multifactor Productivity, 2010-11,* Cat. no. 5260.0.55.002).

## D.1 Subsector contributions to Manufacturing MFP growth

### Contributions to decline between cycles 3 and 4

As shown in figure D.2, almost all the subsectors contributed to the decline in MFP growth between the last two complete cycles, with Petroleum, coal, chemical and rubber products (PCCR), Food, beverage and tobacco products (FBT) and Metal products (MP) making the larger negative contributions (as discussed in chapter 3). The MFP decline was due in part to a slowdown in VA growth, to which almost all the subsectors made similar-sized contributions. The exceptions were Non-metallic mineral products (NM), which made very little difference between the cycles, and MP, which made a stand-out positive contribution. The other driver of the MFP decline was the acceleration in Manufacturing inputs growth. This was less evenly spread across subsectors. It was driven largely by FBT and MP (for labour inputs) and by MP and PCCR (for capital inputs).

Figure D.2 Subsector contributions to total Manufacturing MFP growth and its proximate causes between cycles 3 and 4**a**

Percentage point change

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

FBT is Food, beverage and tobacco products; ME is Machinery and equipment manufacturing; MP is Metal products; NM is Non-metallic mineral products; PCCR is Petroleum, coal, chemical and rubber products; PRM is Printing and recorded media; TCO is Textile, clothing and other manufacturing; WP is Wood and paper products. a Due to approximation errors, the subsector contributions do not sum to the ABS data shown in figure D.1. See chapter 3 and appendix A for details.

*Data source*: Authors’ estimates.

#### Within and between effects

The contribution of a subsector to the change in aggregate Manufacturing MFP growth is a combination of changes in its MFP growth and changes in its relative size (that is, changes in the subsector composition of the Manufacturing sector). It is possible to decompose the subsector contributions into these two components — referred to as within and between effects, respectively. (This is also called shift-share analysis.) By looking at the between effects, it is possible to determine the importance of compositional change to the change in aggregate Manufacturing MFP (box D.1). Between cycles 3 and 4, change in the composition of Manufacturing between subsectors made little contribution to the change in Manufacturing MFP, accounting for only 1.4 per cent of the total MFP decline in Manufacturing. Change in the composition of the subsectors will be captured in the within effect.

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| Box D.1 Contribution of compositional change to MFP growth |
| MFP growth in aggregate Manufacturing can be broken down into growth due to change in the subsector rates of MFP growth and growth due to change in the subsector composition of the Manufacturing sector. This is done by estimating what aggregate Manufacturing MFP growth would have been as a result only of the subsector rates of growth (that is, if there had been no change in the subsector composition of Manufacturing) (the within effect) and comparing it to the actual change in MFP growth. The difference is the compositional (or between) effect.  The table below shows this decomposition for cycles 3 and 4. Comparing the magnitude of the within and between effects, the within effects were generally far more significant than the between effects for each subsector. The exception is TCO in cycle 4, which would have increased Manufacturing MFP (by 0.08 of a percentage point) if its relative size had not declined.  **Within and between effects for subsector**a **MFP contributions**  Percentage point contributions   |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  | Cycle 3 | | |  | Cycle 4 | | |  | Difference between  cycles 3 and 4 | | | |  | Total | Within | Between |  | Total | Within | Between |  | Total | Within | Between | | FBT | -0.12 | -0.14 | 0.02 |  | -0.85 | -0.84 | -0.02 |  | -0.73 | -0.69 | -0.03 | | TCO | 0.38 | 0.41 | -0.03 |  | -0.02 | 0.08 | -0.10 |  | -0.40 | -0.33 | -0.07 | | WP | -0.11 | -0.08 | -0.03 |  | -0.08 | -0.12 | 0.05 |  | 0.03 | -0.05 | 0.08 | | PRM | 0.25 | 0.23 | 0.02 |  | -0.10 | -0.09 | -0.01 |  | -0.35 | -0.32 | -0.03 | | PCCR | 0.08 | 0.07 | 0.01 |  | -0.73 | -0.71 | -0.02 |  | -0.81 | -0.78 | -0.03 | | NM | 0.31 | 0.32 | -0.01 |  | 0.24 | 0.24 | -0.01 |  | -0.07 | -0.08 | 0.01 | | MP | 0.30 | 0.24 | 0.07 |  | -0.12 | -0.19 | 0.06 |  | -0.42 | -0.42 | 0.00 | | ME | 0.29 | 0.31 | -0.03 |  | -0.04 | -0.05 | 0.01 |  | -0.33 | -0.36 | 0.03 | | **Sum**b | **1.38** | **1.37** | **0.01** |  | **-1.70** | **-1.67** | **-0.03** |  | **-3.08** | **-3.03** | **-0.04** |   a For subsector names see figure D.2. b Based on the sum of subsector contributions (table 3.4).  *Source*: Authors’ estimates based on methodology from Parham (2012).  The last three columns shows the difference between cycles in the within and between effects. The between column shows that compositional change in Manufacturing contributed only 0.04 of a percentage point to the decline in Manufacturing MFP between cycles (this is just over one per cent of the total MFP decline). This means that growth in the relative size of subsectors with relatively lower MFP growth was only a small contributor to the slowdown in MFP growth in aggregate Manufacturing. |
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### Contributions to the decline between cycle 4 and the incomplete cycle

Figure D.3 shows the contribution of the subsectors to the *change* in Manufacturing MFP and in its proximate causes between cycle 4 and the incomplete cycle. Manufacturing experienced a slowing rate of growth in each of the proximate causes: VA, capital and labour. The improvement in Manufacturing MFP was driven by a greater downturn in its capital and labour inputs growth than in its VA growth.

The contribution of the different subsectors to the *change* in MFP growth was mixed. Those subsectors that made positive contributions — FBT, PCCR, Wood and paper products (WP) and Machinery and equipment manufacturing (ME) — were able to offset the negative contributions of the other subsectors — Textile, clothing and other manufacturing (TCO), NM, Printing and recorded media (PRM) and MP.

On the other hand, the subsector contributions to the *change* in the growth in the proximate causes were more uniform in direction, with negative contributions to the change in VA, labour and capital growth being widespread among the subsectors.

* Most subsectors contributed around between 0.2 to 0.5 of a percentage point to the decline in VA growth. MP had a larger contribution of just over 1 percentage point, which accounts for around a third of the VA decline between the cycles.
* There was greater uniformity in the subsectors’ contributions to the hours worked decline between the cycles, with each subsector making negative contributions of between -0.1 to -0.5 of a percentage point. PRM and TCO were the exceptions, each making small positive contributions to the change in hours worked.
* The downturn in capital inputs growth was mainly concentrated in ME, PCCR and MP, which together contributed to almost all of the overall decline. The other subsectors combined had less than 0.2 percentage point decline in capital input growth, which is around 10 per cent of the total decline (after netting out the positive contribution of NM).

Figure D.3 Subsector contributions to total manufacturing MFP growth and its proximate causes between cycle 4 and the incomplete cycle**a**

Percentage point change

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

FBT is Food, beverage and tobacco products; ME is Machinery and equipment manufacturing; MP is Metal products; NM is Non-metallic mineral products; PCCR is Petroleum, coal, chemical and rubber products; PRM is Printing and recorded media; TCO is Textile, clothing and other manufacturing; WP is Wood and paper products. a Due to approximation errors, the subsector contributions do not sum to the ABS data shown in figure D.1. See chapter 3 and appendix A for details.

*Data source*: Authors’ estimates.

## D.2 Subsector MFP growth and its proximate causes

### Petroleum, coal, chemical and rubber products

PCCR had a large decline in MFP between cycles 3 and 4, making the largest contribution to the decline for Manufacturing in total (accounting for around a quarter of the decline). It was also a positive contributor to the improvement in Manufacturing MFP between cycle 4 and the incomplete cycle (figure D.3 above).

Figure D.4 PCCR MFP growth and its proximate causes by cycle**a**

Average annual growth rate (per cent)

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| --- | --- |
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a Capital services and hours worked weighted by income shares.

*Data source*: Authors’ estimates.

Between cycles 3 and 4 (figure D.4), PCCR had a decline in MFP growth to a negative rate. This was associated with:

* a decline in VA growth to a negative rate
* a slowing of labour shedding
* a surge in capital inputs (in cycle 4, PCCR had the second highest capital inputs growth of all the subsectors).

Between cycle 4 and the incomplete cycle there was an improvement in PCCR MFP growth to a less negative rate. This was associated with:

* further decline in VA in PCCR
* intensified labour shedding
* significant slowing in growth in capital inputs.

The factors influencing productivity growth in PCCR are discussed in detail in chapter 4.

### Food, beverage and tobacco products

FBT made the second largest contribution to the decline in MFP growth for Manufacturing in total between the last two complete productivity cycles. FBT was the largest positive contributor to the improvement in Manufacturing MFP between cycle 4 and the incomplete cycle (with less negative MFP growth in the incomplete cycle).

Figure D.5 FBT MFP growth and its proximate causes by cycle**a**

Average annual growth rate (per cent)

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a Capital services and hours worked weighted by income shares.

*Data source*: Authors’ estimates.

Between cycles 3 and 4, the decline in FBT’s MFP growth was driven largely by a surge in hours worked growth with no accompanying surge in VA growth (figure D.5). FBT had:

* positive VA growth in both cycles, but there was a significant fall in its growth between cycles
* a large increase in its hours worked growth between cycles (from labour shedding in cycle 3, to high positive growth in cycle 4)
* a slight fall in capital services growth between cycles.

From the last complete cycle to the current incomplete cycle, FBT’s MFP growth became less negative. This was associated with:

* an increase in VA growth
* a decrease in hours worked growth to near zero.
* a slight decrease in capital services growth.

The factors influencing productivity growth in FBT are discussed in detail in chapter 5.

### Metal products

MP made the third largest contribution to the MFP decline in Manufacturing between cycles 3 and 4. It did not contribute to the improvement in growth in Manufacturing MFP between cycle 4 and the incomplete cycle.[[1]](#footnote-1)

Between cycle 3 and 4, MP had a decline in MFP growth to a negative rate (figure D.6). Unlike most subsectors, this was associated with a surge in VA growth between the cycles, but an even greater surge in inputs.

* VA growth almost quadrupled.
* There was a transition from cutting hours worked in cycle 3 to having modest hours worked growth in cycle 4.
* Capital growth also surged, almost four times higher in cycle 4 than cycle 3 (MP had the highest capital services growth of all subsectors in cycle 4).

Between cycle 4 and the incomplete cycle MP MFP growth returned to a small positive rate. This was associated with a fall in VA growth but an even larger fall in input growth.

* VA growth fell from a very high positive rate to close to zero.
* Labour inputs growth went from being positive to being negative.
* Capital services input growth fell sharply, but remained positive.

The factors influencing productivity growth in MP are discussed in detail in chapter 6.

Figure D.6 MP MFP growth and its proximate causes by cycle**a**

Average annual growth rate (per cent)

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|  | |

a Capital services and hours worked weighted by income shares.

*Data source*: Authors’ estimates.

### Textile, clothing and other manufacturing

TCO made a negative contribution to the change in Manufacturing MFP between cycles 3 and 4 that was in the middle of the range. It made the largest negative contribution to the change in MFP between cycle 4 and the incomplete cycle.

TCO had experienced declining VA and labour shedding in the last two complete cycles (figure D.7). Between cycles 3 and 4, MFP growth in TCO went from positive to negative.

* The rate of its decline in VA more than doubled.
* Labour shedding was substantial in both cycles, but eased slightly between cycles.
* Capital services growth increased slightly.

Between cycle 4 and the current incomplete cycle, TCO experienced very sharp decline in MFP, largely driven by an acceleration of VA decline.

* The decline in VA was much higher than the other subsectors in the incomplete cycle, and it again more than doubled between cycles.
* The rate of labour shedding continued to ease, so that the change in labour input growth was positive.
* Capital services growth fell to near zero.

Figure D.7 TCO MFP growth and its proximate causes by cycle**a**

Average annual growth rate (per cent)

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

a Capital services and hours worked weighted by income shares.

*Data source*: Authors’ estimates.

### Printing and recorded media

PRM made a moderate contribution to the Manufacturing MFP decline between cycle 3 and 4. Between cycle 4 and the incomplete cycle, it also made a moderate, negative contribution to the change in Manufacturing MFP growth.

Between cycle 3 and 4, PRM experienced a very sharp decline in its MFP growth, going from having the highest MFP growth for all the subsectors in cycle 3, to having negative MFP growth in cycle 4 (figure D.8). This was largely driven by VA decline.

* The subsector’s VA growth went from being one of the highest, in cycle 3, to being negative in cycle 4.
* Labour shedding slowed.
* Capital inputs growth increased slightly.

Figure D.8 PRM MFP growth and its proximate causes by cycle**a**

Average annual growth rate (per cent)

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a Capital services and hours worked weighted by income shares.

*Data source*: Authors’ estimates.

Between cycle 4 and the incomplete cycle, there was further decline in MFP growth.

* There was sharp VA decline in the incomplete cycle, with the decline almost quadrupling
* Unlike the other subsectors, PRM went from labour shedding in cycle 4 to hiring more labour in the incomplete cycle
* Capital inputs growth slowed.

### Machinery and equipment manufacturing

ME made a moderate contribution to the MFP decline between cycles 3 and 4, and a small positive contribution to the recovery in MFP growth between cycle 4 and the incomplete cycle.

Between cycle 3 and cycle 4, ME went from having moderate MFP growth to MFP growth just below zero (figure D.9).

* Although ME still had the third highest VA growth in cycle 4, its VA growth rate fell by around half between cycles.
* There was a slight fall in hours worked growth.
* Capital services growth increased slightly.

Figure D.9 ME MFP growth and its proximate causes by cycle**a**

Average annual growth rate (per cent)

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

a Capital services and hours worked weighted by income shares.

*Data source*: Authors’ estimates.

Between cycle 4 and the incomplete cycle, MFP recovered slightly because the fall in VA growth was offset by slowing inputs growth.

* VA growth went from being positive to being negative.
* Labour inputs growth also went from positive to negative.
* The capital inputs growth fell to close to zero in the incomplete cycle.

### Non-metallic mineral products

NM made a very small contribution to the decline in Manufacturing MFP between cycles 3 and 4. It made a more significant negative contribution between cycle 4 and the incomplete cycle.

NM had very high MFP growth in the last two complete cycles (figure D.10). While its MFP growth did fall between the cycles, its MFP growth in cycle 4 was higher than all the other subsectors.

* VA growth was strong in both cycles 3 and 4 and increased slightly between the cycles. NM had the highest VA growth rate in cycle 4.
* The change from labour shedding in cycle 3 to near zero growth in cycle 4 was the main driver for the fall in MFP between the cycles.
* There was a very slight increase in the near-zero rate of capital inputs growth.

Figure D.10 NM MFP growth and its proximate causes by cycle**a**

Average annual growth rate (per cent)

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

a Capital services and hours worked weighted by income shares.

*Data source*: Authors’ estimates.

Between cycle 4 and the incomplete cycle, MFP growth fell sharply to being close to zero in the incomplete cycle.

* Like many other subsectors, NM experienced VA contraction in the incomplete cycle. Because the VA growth was so high in cycle 4, the fall in VA growth was sharp.
* There was also an increase in capital inputs growth which further contributed to the fall in MFP growth.
* On the other hand, NM also experienced labour shedding in the incomplete cycle, and this helped to reduce the fall in MFP between cycles.

### Wood and paper products

WP made a near zero contribution to the change in Manufacturing MFP between cycles 3 and 4.[[2]](#footnote-2) Between cycle 4 and the incomplete cycle, WP made a moderate contribution to the recovery in Manufacturing MFP.

Figure D.11 WP MFP growth and its proximate causes by cycle**a**

Average annual growth rate (per cent)

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a Capital services and hours worked weighted by income shares.

*Data source*: Authors’ estimates.

WP’s MFP growth (which was negative in both cycles 3 and 4) remained little changed between the last two complete cycles. Underlying this were sizable, offsetting movements in the proximate causes (figure D.11).

* WP went from experiencing VA growth in cycle 3 to VA contraction of around the same level in cycle 4.
* Similarly, labour inputs growth went from positive to negative, and was able to offset the decline in VA growth, leaving MFP growth little changed between cycles.
* There was a slight increase in capital inputs growth.

MFP growth recovered between cycle 4 and the incomplete cycle, largely due to further contraction in inputs growth.

* The rate of VA decline remained largely unchanged.
* Labour shedding intensified. Of all the subsectors, WP experienced the steepest decline in hours worked in the incomplete cycle.
* Capital inputs growth fell.

1. It may seem inconsistent that MP experienced stronger MFP growth in the incomplete cycle, relative to cycle 4, yet did not contribute to the improvement in MFP growth for Manufacturing in total over the same period (figure D.3). This outcome occurs as the weights used to calculate MP’s contribution to Manufacturing MFP fell from cycle 4 to the incomplete cycle. [↑](#footnote-ref-1)
2. It may seem inconsistent that WP had slightly lower MFP growth in cycle 4 than cycle 3, yet made a small offsetting positive contribution to the decline in MFP growth for Manufacturing in total over the same period (figure D.2). This outcome occurs as the weights used to calculate WP’s contribution to Manufacturing MFP fell from cycle 3 to cycle 4. [↑](#footnote-ref-2)