C MFP growth cycles for Manufacturing subsectors

Using the method outlined in Barnes (2011), multifactor productivity (MFP) growth cycles were identified for all eight subsectors of Manufacturing examined in this paper. It should be noted that the underlying data were not subjected to the tests (outlined in that paper) for suitability for cycle identification method to be applied.

Subsector MFP growth cycles are periods over which it is best to examine growth *within* a subsector over time. These are cycles that start and end at subsector productivity peaks that are less likely to be affected by temporary influences (see Barnes 2011 for further details). This can be useful in identifying factors that may be specific to utilisation rates in a subsector. While these subsector cycles can differ from those for Manufacturing as a whole, it is appropriate to examine subsector growth over cycles *for Manufacturing* when identifying the contribution of subsectors to changes in total Manufacturing productivity performance over those periods.

Table C.1 presents the peaks identified as the start/end years of MFP growth cycles for the Manufacturing subsectors and total Manufacturing. While there is some variation across subsectors, for three of the five peaks for total Manufacturing at least half of the subsectors have coinciding peaks. There are also several peaks for subsectors in years that are adjacent to the peaks for total Manufacturing.

Table C.2 compares average annual MFP growth for each subsector calculated over subsector-specific MFP growth cycles compared with subsector growth calculated over the MFP growth cycle periods for total Manufacturing. The subsector cycles that are underlined are those that coincide with those for Manufacturing in total — Machinery and equipment has three in common with total Manufacturing, while Metal products, Non-metallic mineral products and Printing and recorded media have one each. The remaining three subsectors have no cycles in common with total Manufacturing.

Table C.1 Peaks identified for use in subsector-specific MFP growth cycles**a**

Shaded rows are total Manufacturing peak years

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Subsectorb | | | | | | | |  |
|  | FBT | TCO | WP | PRM | PCCR | NM | MP | ME | Peaks per year |
| 1985-86 |  |  |  |  |  |  |  |  | c |
| 1986-87 | ✓sw |  |  |  |  |  |  |  | 1 |
| 1987-88 |  | ✓s |  |  | ✓ |  |  |  | 3 |
| 1988-89 |  |  | ✓ |  |  | ✓ |  | ✓ | 3 |
| 1989-90 |  |  |  | ✓s2 |  |  | ✓s |  | 1 |
| 1990-91 | ✓ | ✓s2\* |  |  | ✓ |  |  |  | 3 |
| 1991-92 |  |  |  |  |  |  |  |  | 0 |
| 1992-93 |  |  | ✓s |  |  |  |  |  | 1 |
| 1993-94 | ✓ |  |  | ✓2 |  | ✓ | ✓s | ✓ | 5 |
| 1994-95 |  |  |  |  |  |  |  |  | 0 |
| 1995-96 |  |  | ✓s |  | ✓2 |  |  |  | 2 |
| 1996-97 |  |  |  | ✓sw |  |  |  |  | 1 |
| 1997-98 |  | ✓s |  |  |  |  |  |  | 1 |
| 1998-99 |  |  |  |  |  |  | ✓ | ✓2 | 2 |
| 1999-00 |  |  |  |  |  |  |  |  | 0 |
| 2000-01 | ✓s2 |  |  |  |  |  |  |  | 1 |
| 2001-02 |  |  | ✓2 |  |  | ✓s | ✓ |  | 3 |
| 2002-03 |  |  |  |  | ✓s |  |  |  | 1 |
| 2003-04 | ✓ | ✓2 |  | ✓ |  |  |  | ✓2 | 4 |
| 2004-05 |  |  | ✓s |  |  |  |  |  | 1 |
| 2005-06 |  |  |  |  |  |  |  |  | 0 |
| 2006-07 | ✓ |  |  |  |  | ✓ |  |  | 2 |
| 2007-08 |  | ✓ | ✓sw | ✓ |  |  | ✓ |  | 4 |
| 2008-09 |  |  |  |  |  |  |  |  | 0 |
| 2009-10 | ✓w |  |  |  |  | ✓sw |  | ✓w2\* | 3 |
| 2010-11 |  |  |  |  |  |  |  |  | c |
| Number of peaks | 7 | 5 | 6 | 5 | 4 | 5 | 5 | 5 | **42** |

a Revisions by the ABS to its official industry MFP time series, as well as additional years of data, may also lead to revisions to the industry cycles identified and average annual growth rates over these cycles. b Subsector labels: 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; and ME is Machinery & equipment manufacturing. c Insufficient observations are available to identify peaks in these years. **w** indicates weakly robust. **s** indicates a small deviation. **2** indicates a peak selected from a pair of close together peaks. **\*** judgment exercised to select between consecutive sets of close together peaks — largest H11 peak year selected.

*Source*:Authors’ estimates based on methodology in Barnes (2011).

Table C.2 MFP growth over subsector-specific cycles compared with over total Manufacturing cycles**a**

Average annual growth rate (per cent)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Subsector-specific cycles | |  | Total mfg cycles | |
| Food, beverage & tobacco | 1986-87 to 1990-91 | 1.2 |  | 1988-89 to 1993-94 | 0.6 |
| products (FBT) | 1990-91 to 1993-94 | -0.4 |  |  |  |
|  | 1993-94 to 2000-01 | 0.9 |  | 1993-94 to 1998-99 | 0.7 |
|  | 2000-01 to 2003-04 | -1.8 |  | 1998-99 to 2003-04 | -0.5 |
|  | 2003-04 to 2006-07 | -3.4 |  | 2003-04 to 2007-08 | -4.2 |
|  | 2006-07 to 2009-10 | -2.1 |  |  |  |
|  |  |  |  |  |  |
| Textile, clothing, & other mfg (TCO) | 1987-88 to 1990-91 | -2.1 |  | 1988-89 to 1993-94 | -2.3 |
|  | 1990-91 to 1997-98 | -0.6 |  | 1993-94 to 1998-99 | 0.5 |
|  | 1997-98 to 2003-04 | 1.9 |  | 1998-99 to 2003-04 | 2.5 |
|  | 2003-04 to 2007-08 | -1.6 |  | 2003-04 to 2007-08 | -1.6 |
|  |  |  |  |  |  |
| Wood & paper products (WP) | 1988-89 to 1992-93 | -2.8 |  | 1988-89 to 1993-94 | -2.5 |
|  | 1992-93 to 1995-96 | -1.2 |  | 1993-94 to 1998-99 | -1.0 |
|  | 1995-96 to 2001-02 | -0.9 |  | 1998-99 to 2003-04 | -1.1 |
|  | 2001-02 to 2004-05 | -2.6 |  |  |  |
|  | 2004-05 to 2007-08 | -2.3 |  | 2003-04 to 2007-08 | -1.2 |
|  |  |  |  |  |  |
| Printing & recorded media (PRM) | 1989-90 to 1993-94 | -1.9 |  | 1988-89 to 1993-94 | -1.3 |
|  | 1993-94 to 1996-97 | -3.6 |  | 1993-94 to 1998-99 | -1.8 |
|  | 1996-97 to 2003-04 | 4.8 |  | 1998-99 to 2003-04 | 6.4 |
|  | 2003-04 to 2007-08 | -2.8 |  | 2003-04 to 2007-08 | -2.8 |
|  |  |  |  |  |  |
| Petroleum, coal, chemical & rubber | 1987-88 to 1990-91 | -2.7 |  | 1988-89 to 1993-94 | -2.6 |
| products (PCCR) | 1990-91 to 1995-96 | -0.3 |  | 1993-94 to 1998-99 | 1.1 |
|  | 1995-96 to 2002-03 | 0.5 |  | 1998-99 to 2003-04 | 0.6 |
|  |  |  |  | 2003-04 to 2007-08 | -4.1 |
|  |  |  |  |  |  |
| Non-metallic mineral products (NM) | 1988-89 to 1993-94 | -2.5 |  | 1988-89 to 1993-94 | -2.5 |
|  | 1993-94 to 2001-02 | 3.1 |  | 1993-94 to 1998-99 | 0.3 |
|  | 2001-02 to 2006-07 | 7.4 |  | 1998-99 to 2003-04 | 6.3 |
|  | 2006-07 to 2009-10 | -1.2 |  | 2003-04 to 2007-08 | 4.9 |
|  |  |  |  |  |  |
| Metal products (MP) | 1989-90 to 1993-94 | 0.7 |  | 1988-89 to 1993-94 | 1.0 |
|  | 1993-94 to 1998-99 | 1.1 |  | 1993-94 to 1998-99 | 1.1 |
|  | 1998-99 to 2001-02 | 3.8 |  | 1998-99 to 2003-04 | 1.4 |
|  | 2001-02 to 2007-08 | -1.2 |  | 2003-04 to 2007-08 | -0.9 |
|  |  |  |  |  |  |
| Machinery & equipment mfg (ME) | 1988-99 to 1993-94 | 2.0 |  | 1988-89 to 1993-94 | 2.0 |
|  | 1993-94 to 1998-99 | 2.5 |  | 1993-94 to 1998-99 | 2.5 |
|  | 1998-99 to 2003-04 | 1.6 |  | 1998-99 to 2003-04 | 1.6 |
|  | 2003-04 to 2009-10 | 0.5 |  | 2003-04 to 2007-08 | -0.2 |

a Underlined subsector-specific cycles coincide with Manufacturing cycles.

*Source*: Authors’ estimates.

Figure C.1 illustrates the differences in subsector MFP growth rates when calculated over subsector-specific cycles compared with over total Manufacturing cycles. In general, the pattern of increase/decrease from cycle to cycle is not changed, although the magnitudes vary. The main exception is Petroleum, coal, chemicals and rubber products for which there is a change in the direction of change between the second and third cycles and for which the fourth subsector-specific cycle is yet to be determined. This is discussed further in chapter 4.

Figure C.1 MFP growth by Manufacturing subsector, over subsector-specific cycles compared with over total Manufacturing cycles

Average annual growth rate (per cent)

|  |  |
| --- | --- |
| *Subsector-specific cycles* | *Manufacturing cycles* |
| Food, beverage & tobacco products | |
|  |  |
| Textile, clothing & other manufacturing | |
|  |  |

(continued on next page)

Figure C.1 (continued)

|  |  |
| --- | --- |
| *Subsector-specific cycles* | *Manufacturing cycles* |
| Wood & paper products | |
|  |  |
| Printing & recorded media | |
|  |  |
| Petroleum, coal, chemical & rubber products | |
|  |  |

(continued on next page)

Figure C.1 (continued)

|  |  |
| --- | --- |
| *Subsector-specific cycles* | *Manufacturing cycles* |
| Non-metallic mineral products | |
|  |  |
| Metal products | |
|  |  |
| Machinery & equipment manufacturing | |
|  |  |

*Data source*: Authors’ estimates.

It is possible that the cycles in some Manufacturing subsectors are related to those in the industry sectors that supply inputs to those Manufacturing subsectors or use the output of those Manufacturing subsectors. For example, Food, beverage and tobacco products uses inputs from Agriculture; Construction uses the output of Non-metallic mineral products and Metal products; and parts of Petroleum, coal, chemical and rubber products and Metal products process the output of Mining.

Table C.3 shows that three peaks for Food, beverage and tobacco products coincide with those for Agriculture and another two peaks are lagged one year from Agriculture peaks.

Table C.3 Comparison of Food, beverage and tobacco products cycles and Agriculture cycles**a**

Shaded rows are Agriculture peak years

|  |  |  |
| --- | --- | --- |
|  | Food, beverage & tobacco products | Agriculture, forestry & fishing |
| 1985-86b |  |  |
| 1986-87 | ✓sw |  |
| 1987-88 |  |  |
| 1988-89 |  |  |
| 1989-90 |  |  |
| 1990-91 | ✓ | ✓s |
| 1991-92 |  |  |
| 1992-93 |  |  |
| 1993-94 | ✓ | ✓s |
| 1994-95 |  |  |
| 1995-96 |  |  |
| 1996-97 |  | ✓s2 |
| 1997-98 |  |  |
| 1998-99 |  |  |
| 1999-00 |  |  |
| 2000-01 | ✓s2 | ✓s2 |
| 2001-02 |  |  |
| 2002-03 |  |  |
| 2003-04 | ✓ |  |
| 2004-05 |  |  |
| 2005-06 |  | ✓ |
| 2006-07 | ✓ |  |
| 2007-08 |  |  |
| 2008-09 |  | ✓s |
| 2009-10 | ✓w |  |
| 2010-11b |  |  |
| Number of peaks | 7 | 6 |

a Revisions by the ABS to its official industry MFP time series, as well as additional years of data, may also lead to revisions to the industry cycles identified and average annual growth rates over these cycles. b Insufficient observations are available to identify peaks in these years. **w** indicates weakly robust. **s** indicates a small deviation. **2** indicates a peak selected from a pair of close together peaks.

*Source*:Authors’ estimates based on methodology in Barnes (2011).

Table C.4 shows that only one peak for Non-metallic mineral products coincides with those for Construction. Another two peaks for Non-metallic mineral products are in the year before a Construction peak and one is in the year after. Three peaks for Metal products coincide with those for Construction.

Table C.4 Comparison of Non-metallic mineral products, Metal products and Construction cycles**a**

Shaded rows are Construction peak years

|  |  |  |  |
| --- | --- | --- | --- |
|  | Non-metallic  mineral products | Metal products | Construction |
| 1985-86b |  |  |  |
| 1986-87 |  |  |  |
| 1987-88 |  |  | ✓s |
| 1988-89 | ✓ |  |  |
| 1989-90 |  | ✓s |  |
| 1990-91 |  |  |  |
| 1991-92 |  |  |  |
| 1992-93 |  |  |  |
| 1993-94 | ✓ | ✓s | ✓s |
| 1994-95 |  |  |  |
| 1995-96 |  |  |  |
| 1996-97 |  |  |  |
| 1997-98 |  |  |  |
| 1998-99 |  | ✓ | ✓ |
| 1999-00 |  |  |  |
| 2000-01 |  |  |  |
| 2001-02 | ✓s | ✓ |  |
| 2002-03 |  |  | ✓ |
| 2003-04 |  |  |  |
| 2004-05 |  |  |  |
| 2005-06 |  |  |  |
| 2006-07 | ✓ |  |  |
| 2007-08 |  | ✓ | ✓s2 |
| 2008-09 |  |  |  |
| 2009-10 | ✓sw |  |  |
| 2010-11b |  |  |  |
| Number of peaks | 5 | 5 | 5 |

a Revisions by the ABS to its official industry MFP time series, as well as additional years of data, may also lead to revisions to the industry cycles identified and average annual growth rates over these cycles. b Insufficient observations are available to identify peaks in these years. **w** indicates weakly robust. **s** indicates a small deviation. **2** indicates a peak selected from a pair of close together peaks.

*Source*:Authors’ estimates based on methodology in Barnes (2011).

Table C.5 shows that two peaks for Petroleum, coal, chemical and rubber products coincide with those for Mining and another one is in a year before a Mining peak. For Metal products no peaks coincide with those for Mining, but two peaks are lagged one year from Mining peaks.

Table C.5 Comparison of Petroleum, coal, chemical and rubber products, Metal products and Mining cycles**a**

Shaded rows are Mining peak years

|  |  |  |  |
| --- | --- | --- | --- |
|  | *Petroleum, coal, chemical  & rubber products* | *Metal products* | *Mining* |
| 1985-86b |  |  |  |
| 1986-87 |  |  |  |
| 1987-88 | ✓ |  | ✓s |
| 1988-89 |  |  |  |
| 1989-90 |  | ✓s |  |
| 1990-91 | ✓ |  |  |
| 1991-92 |  |  | ✓ |
| 1992-93 |  |  |  |
| 1993-94 |  | ✓s |  |
| 1994-95 |  |  |  |
| 1995-96 | ✓2 |  | ✓ |
| 1996-97 |  |  |  |
| 1997-98 |  |  |  |
| 1998-99 |  | ✓ |  |
| 1999-00 |  |  |  |
| 2000-01 |  |  | ✓ |
| 2001-02 |  | ✓ |  |
| 2002-03 | ✓s |  |  |
| 2003-04 |  |  |  |
| 2004-05 |  |  |  |
| 2005-06 |  |  |  |
| 2006-07 |  |  | ✓s2 |
| 2007-08 |  | ✓ |  |
| 2008-09 |  |  |  |
| 2009-10 |  |  | ✓w |
| 2010-11b |  |  |  |
| Peaks per industry | 4 | 5 | 6 |

a Revisions by the ABS to its official industry MFP time series, as well as additional years of data, may also lead to revisions to the industry cycles identified and average annual growth rates over these cycles. b Insufficient observations are available to identify peaks in these years. **w** indicates weakly robust. **s** indicates a small deviation. **2** indicates a peak selected from a pair of close together peaks.

*Source*:Authors’ estimates based on methodology in Barnes (2011).

Of these four Manufacturing subsectors, Food, beverage and tobacco products and Metal products appear to have the closest coincidence of subsector-specific cycles with those of the related sector (Agriculture and Construction, respectively).