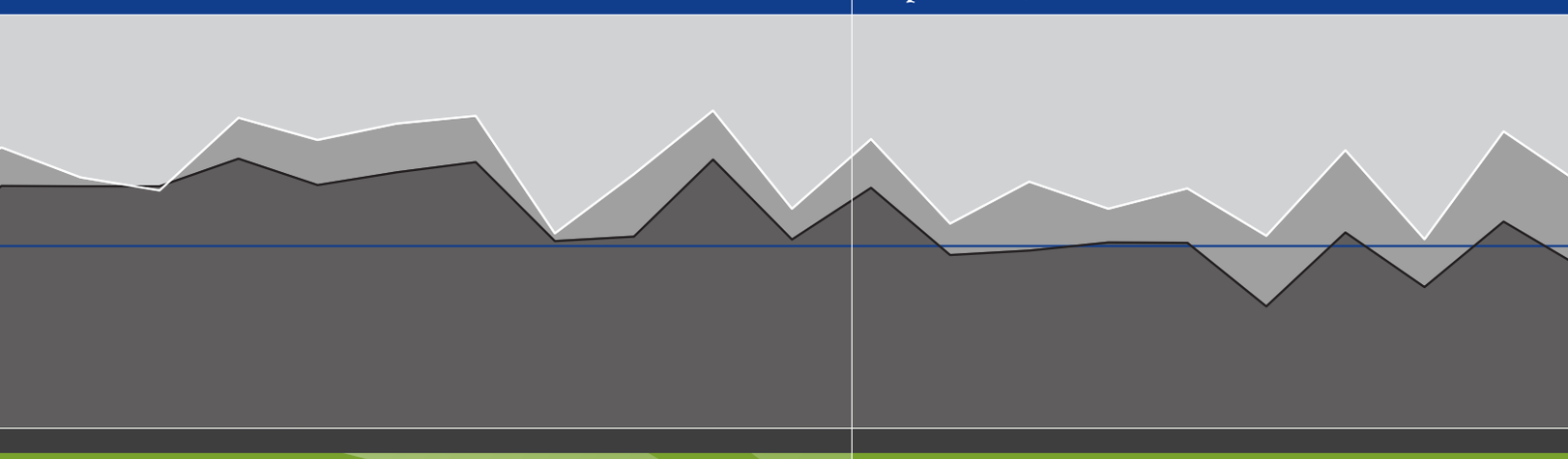
Australian Government
Productivity Commission

PC Productivity Update

April 2014



Features

- 2013 Australian productivity
- The effect of price on productivity
- Insights from recent productivity research — Productivity in Manufacturing

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Australian Government
Productivity Commission

The Productivity Commission is the Australian Government's independent research and advisory body on a range of economic, social and environmental issues affecting the welfare of Australians. Its role, expressed most simply, is to help governments make better policies, in the long term interest of the Australian community.

The Commission's independence is underpinned by an Act of Parliament. Its processes and outputs are open to public scrutiny and are driven by concern for the wellbeing of the community as a whole.

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Foreword

Welcome to the second edition of the **PC Productivity Update**.

In this edition we analyse the latest ABS productivity statistics and comment on new developments underlying Australia's recent productivity performance.

One of the roles of the Commission is to promote the public understanding of productivity issues, as well as contribute to the public debate and encourage informed policy discussion. In this edition of the **Update** our feature issue is the effect of price distortions on productivity.

As part of our industry analysis, we focus on the Australian Manufacturing industry, drawing on recently released research undertaken by the Commission.

As highlighted in a recent Commission research report, productivity growth will be critical for meeting the challenges posed by Australia's ageing population, while achieving improvements in living standards. Productivity growth enhances the nation's capacity to address future challenges arising from an ageing population, as well as from the changing natural environment, the changing structure of Australian industry, terms of trade and other external economic shocks.

Finally, I was particularly attracted to the message evident in Figure 1.15. It compares Australian productivity performance with a wide range of other countries. While we share some similarities with Canada, the figure demonstrates that our performance has been significantly worse than that of most other developed economies for more than a decade. Food for policy thought!

As always, we welcome your feedback on this edition of the **Update**.

Peter Harris
Chairman

Productivity at a glance

Australia's labour productivity growth for the Total economy

Annual change, 2011-12 to 2012-13, GDP per hour worked

Labour productivity	**+2.2%**

Australia's productivity growth for the Market sector (12 industries)

Annual change, 2011-12 to 2012-13

Multifactor productivity	**-0.8%**
Labour productivity	+2.0%
Output	+2.2%
Labour input	+0.2%
Capital input	+6.1%

Long-term, average annual growth rate, 1973-74 to 2012-13

Multifactor productivity	**+0.7%**
Labour productivity	+2.2%
Output	+3.0%
Labour input	+0.8%
Capital input	+4.4%

Data sources: ABS (*Australian System of National Accounts, 2012-13*, Cat. no. 5204.0, November 2013); ABS (*Estimates of Industry Multifactor Productivity, 2012-13*, Cat. no. 5260.0.55.002, December 2013).

For more detailed productivity statistics and commentary see Chapter 1.

1 2013 Australian productivity

1.1 Introduction

This overview of Australia's productivity performance in 2012-13 is based on the latest Australian Bureau of Statistics (ABS) annual estimates of multifactor productivity (MFP) and labour productivity (LP) growth for both the 12 industry market sector as a whole, and for each of its 12 individual industries.

Productivity performance is a key source of long-term economic growth, business competitiveness and real per capita income growth. Hence, it is an important determinant of a country's living standards and wellbeing. Productivity is defined in box 1.1.

Section 1.2 provides an update of 2012-13 productivity growth and the proximate causes (relative changes in output, labour and capital) in the (12 industry) market sector. Four industries — Mining; Electricity, gas, water and waste services; Financial and insurance services; Agriculture, forestry and fishing — have been relatively more influential on aggregate productivity in recent years. Additional analysis is provided in section 1.3 for these industries. In the final section, Australia's productivity performance is compared with a selected number of other countries.

Box 1.1 What is productivity?

Productivity (the ratio of output produced to inputs used) measures how efficiently inputs, such as capital and labour, are used to produce outputs in the economy. It is sometimes referred to as productive efficiency. Productivity increases if output grows faster than inputs (or shrinks more slowly).

Multifactor productivity (output produced per unit of combined inputs of labour and capital) is the measure that comes closest to the underlying concept of productivity — efficiency of producers in producing output using both labour and capital. Labour productivity (output produced per unit of labour input) measures efficiency in the use of labour but it also captures the value added from growth in capital that supports increased output without increasing labour.

PC Productivity Update 2013 provides a more detailed discussion of the measurement issues associated with multifactor productivity and labour productivity.

1.2 2012-13 market sector update

In 2012-13, the 12 industry market sector represented 64.6 per cent of total industry gross value added (IGVA) (a reduction from 65.4 per cent in 2011-12). The non-market sector totalled 19.1 per cent in 2012-13, including Health care and social assistance (7.5 per cent), Public administration and safety (6.1 per cent) and Education and training (5.4 per cent). The remaining four industries[1] accounted for 16.4 per cent of gross value added.

In terms of output, the four largest market sector industries in 2012-13 were Financial and insurance services (9.5 per cent), Mining (9.4 per cent), Construction (9.1 per cent) and Manufacturing (7.8 per cent) (box 1.2).

Market sector MFP recorded negative growth in 2012-13

Australia's market sector MFP declined by 0.8 per cent in 2012-13,[2] offsetting an increase of the same magnitude in the previous year.[3] From a historical perspective, the negative productivity growth over the last decade stands in contrast to the long-term growth of 0.7 per cent per year for the period 1973-74 to 2012-13 (figure 1.1).

Output growth in 2012-13 was 2.2 per cent, down from 4.3 per cent in the previous year (table 1.1).

Box 1.2 Output (IGVA) shares of the 12 industries in the market sector, 2012-13

- Financial and insurance services (9.5 per cent)
- Mining (9.4 per cent)
- Construction (9.1 per cent)
- Manufacturing (7.8 per cent)
- Transport, postal and warehousing (5.7 per cent)
- Retail trade (5.3 per cent)
- Wholesale trade (4.8 per cent)
- Electricity, gas, water and waste services (3.4 per cent)
- Information, media and telecommunications (3.3 per cent)
- Accommodation and food services (2.7 per cent)
- Agriculture, forestry and fishing (2.6 per cent)
- Arts and recreation services (0.9 per cent)

Source: ABS (*Australian System of National Accounts, 2012-13*, Cat. no. 5204.0, November 2013).

1 These industries are Rental, hiring and real estate services, Professional scientific and technical services, Administrative support services and Other services. They are included in what is known as the 16 industries market sector but are not covered in this analysis.

2 The growth rates used in the latest ABS productivity estimates publication (ABS, *Estimates of Industry Multifactor Productivity, 2012-13*, Cat. no. 5260.0.55.002) are expressed as natural logarithms multiplied by 100. For consistency this paper has also applied this method to productivity data sourced from this ABS publication.

3 Annual rates of MFP and LP growth are affected by the utilisation rate of inputs (notably capital) as well as other factors. Hence some of this annual change can be due to the effect of the business cycle. For this reason the ABS reports estimates over the productivity cycle which matches peaks in the business cycle. This concept was explained in the PC Productivity Update 2013 (PC 2013, p. 13).

Table 1.1
Summary productivity statistics, market sector (12)[a]

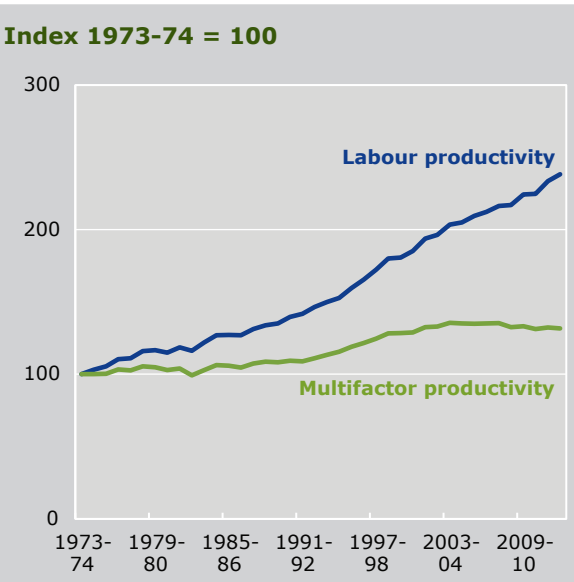
Per cent

	Long term growth rate	Last complete cycle	Period since the last cycle	Latest years	
	1973-74 to 2012-13	2003-04 to 2007-08	2007-08 to 2012-13	2011-12	2012-13
Output (GVA)	3.0	4.0	2.2	4.3	2.2
Total inputs	2.3	4.1	2.8	3.5	3.0
Labour input	0.8	2.5	0.3	0.4	0.2
Capital input	4.4	5.9	5.5	6.8	6.1
MFP	**0.7**	**-0.1**	**-0.6**	**0.8**	**-0.8**
Capital deepening[b]	1.5	1.6	2.5	3.0	2.8
Labour productivity	**2.2**	**1.5**	**1.9**	**3.9**	**2.0**
Capital labour ratio	3.6	3.4	5.3	6.3	5.9

[a] Annual growth rates or average annual growth rates in designated periods. [b] Capital deepening is the change in the ratio of capital to labour, weighted by the capital share of market sector income.

Source: Commission estimates based on ABS (*Estimates of Industry Multifactor Productivity, 2012-13*, Cat. no. 5260.0.55.002, December 2013).

Figure 1.1
Market sector (12) productivity, 1973–74 to 2012–13



Data source: ABS *(Estimates of Industry Multifactor Productivity, 2012-13,* Cat. no. 5260.0.55.002, December 2013).

On the input side, capital growth of 6.1 per cent, though down from 6.8 per cent in the previous year, continued its strong decade-long growth trend. Labour input growth has remained subdued, rising by only 0.2 per cent in 2012-13. Overall, total input growth was 3.0 per cent in 2012-13, which more than offset output growth and resulted in MFP growth being a negative 0.8 per cent.

2012-13 was the ninth consecutive year of negative or very weak MFP growth in the market sector. This pattern over the last decade is atypical in the longer-term history of Australia's productivity performance. In the current (incomplete) productivity cycle from 2007-08 to 2012-13, negative 0.6 per cent growth of MFP was the result of:

- relatively weak output growth (2.2 per cent per year), which is below the long-term average of 3.0 per cent per year (between 1973-74 and 2012-13)
- strong growth in capital input (5.5 per cent per year), which was significantly higher than the long-term average (4.4 per cent per year)
- marginal growth of labour input (0.3 per cent per year), which was below the historical average (0.8 per cent per year).

LP growth, which is determined by MFP growth and capital deepening, was 2.0 per cent in 2012-13. This was close to its long-term average, though down from 3.9 per cent in the previous year. The reduced rate of increase of LP in the latest year was largely due to the reversal of MFP growth from 0.8 per cent to -0.8 per cent. Growth in capital deepening, at 2.8 per cent in 2012-13, was similar to the 3.0 per cent recorded in the previous year and was well above the long-term average of 1.5 per cent per year.

Most industries recorded negative MFP growth in 2012-13

In total, 8 of the 12 industries recorded negative MFP growth in 2012-13. The greatest proportional declines were in Information, media and telecommunications (-7.2 per cent), Agriculture, forestry and fishing (-5.8 per cent) and Mining (-4.9 per cent) (table 1.2).

For Information, media and telecommunications and Agriculture, forestry and fishing, output growth was strongly negative (-2.6 and -5.7 per cent respectively), despite inputs either increasing substantially (4.6 per cent for the former) or marginally (0.1 per cent for the latter).

The Mining industry recorded very high output growth (8.8 per cent), resulting from the resources boom, but it was dwarfed by the growth of total inputs (13.6 per cent), especially very high capital growth (16.0 per cent).

Only four industries displayed positive MFP growth: Financial and insurance services (3.6 per cent); Retail trade (1.4 per cent); Wholesale trade (0.5 per cent); and Transport, postal and warehousing (0.5 per cent).

For Financial and insurance services, output growth decreased from 3.9 per cent in 2011-12, but still remained strongly positive at 3.3 per cent. On the input side, although capital services growth remained strong (2.2 per cent), it was more than offset by the decline in labour input (-4.1 per cent), resulting in an overall input decline of 0.3 per cent.

Output growth of Retail trade, Wholesale trade, and Transport, postal and warehousing was strong (2.4, 4.4 and 2.5 per cent, respectively), outpacing the growth of inputs (1.0, 3.8 and 2.1 per cent, respectively).

Labour productivity growth was strong for four of the market sector industries — Financial and insurance services (7.4 per cent), Electricity, gas, water and waste services (6.3 per cent), Mining (3.2 per cent) and Retail trade (2.2 per cent). For Financial and insurance services, this was lifted by relatively strong growth in MFP (3.6 per cent). For the other three industries, LP growth was more influenced by growth in capital inputs (Mining at 16 per cent, Electricity, gas, water and waste services at 5.0 per cent and Retail trade at 2.9 per cent).

As observed in previous years, specific factors were behind the variability among the 12 industries. Four industries are examined more closely in the following section.

Table 1.2
Industry productivity growth 2012-13

Per cent

	Output (GVA)	Total inputs	Labour input	Capital input	Labour productivity	MFP
Agriculture, forestry and fishing	-5.7	0.1	-4.4	2.1	-1.3	-5.8
Mining	8.8	13.6	5.6	16.0	3.2	-4.9
Manufacturing	-1.2	-0.7	-1.2	0.0	-0.1	-0.5
Electricity, gas, water and waste services	-1.0	0.8	-7.3	5.0	6.3	-1.8
Construction	0.5	0.9	-0.2	3.6	0.8	-0.3
Wholesale trade	4.4	3.8	4.9	1.4	-0.5	0.5
Retail trade	2.4	1.0	0.2	2.9	2.2	1.4
Accommodation and food services	-0.1	1.8	2.1	0.9	-2.2	-2.0
Transport, postal and warehousing	2.5	2.1	1.3	3.2	1.2	0.5
Information, media and telecommunications	-2.6	4.6	1.9	6.3	-4.5	-7.2
Financial and insurance services	3.3	-0.3	-4.1	2.2	7.4	3.6
Arts and recreation services	1.7	2.3	1.7	3.4	0.0	-0.6
Market sector (12)	**2.2**	**3.0**	**0.2**	**6.1**	**2.0**	**-0.8**

Source: Commission estimates based on ABS (*Estimates of Industry Multifactor Productivity, 2012-13*, Cat. no. 5260.0.55.002, December 2013).

1.3 Industry developments

This section provides a closer examination of the causes of productivity growth for Mining, Electricity, gas, water and waste services, Financial and insurance services and Agriculture, forestry and fishing.

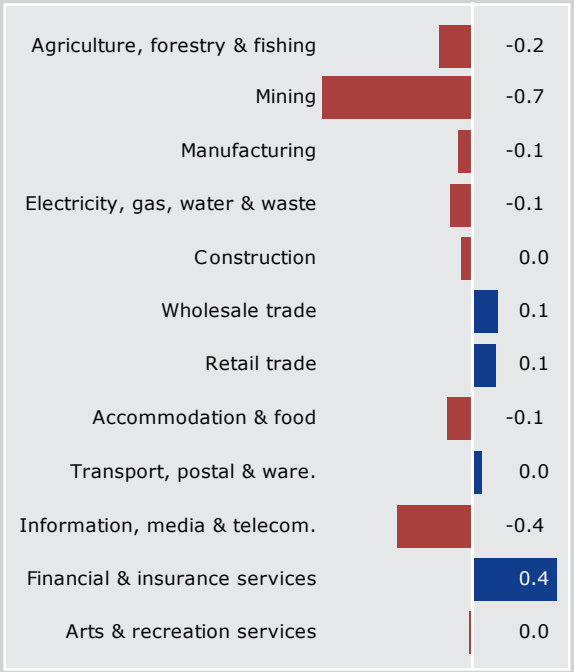
These industries have been singled out because Mining and Financial and insurance services are large (and hence more influential on the market sector aggregate — see figure 1.2), and the other two industries were major causes of negative MFP growth in the market sector in the last decade.

The Commission examined productivity trends in Mining to 2006-07 (Topp et al. 2008), Electricity, gas, water and waste services to 2009-10 (Topp and Kulys 2012), and Manufacturing to 2010-11 (Barnes et al. 2013). A summary of the manufacturing paper is provided in chapter 3. (The Financial and insurance services industry has been identified for closer analysis.)

The Information, media and telecommunications industry recorded a sizable decline in MFP (-3.8 per cent) in 2011-12 and an even greater decline (-7.2 per cent) in 2012-13, making a significant negative contribution to market sector MFP growth (table 1.2 and figure 1.2). If this trend continues, then further research into the industry will be warranted.

Figure 1.2
Industry contributions to market sector (12) MFP growth for 2012-13[a]

Percentage points



[a] For more information on the methodology used to calculate industry contributions see Parham (2012).

Data sources: Commission estimates based on ABS (*Estimates of Industry Multifactor Productivity, 2012-13*, Cat. no. 5260.0.55.002, December 2013); unpublished ABS estimates.

The Mining industry

MFP continued to deteriorate

The Mining industry saw substantial profit growth in the last decade, following a surge in commodity prices. This led to a strong acceleration in the growth of investment in the industry, as highlighted by Debelle (2013), with company profits being extensively redeployed in this expansion (Arsov et al. 2013).

The strong rise in industry inputs, without a simultaneous rise in production, has meant that measured MFP growth in the Mining industry has steadily declined in recent years, recording a negative 4.9 per cent in 2012-13 (figures 1.3 and 1.4).

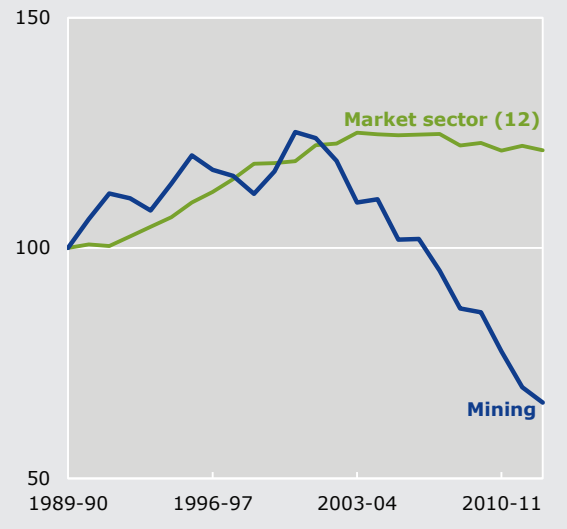
The higher commodity prices during much of the past decade were reflected in the heightened terms of trade (the price of exports relative to imports) (figure 1.5). However, a more recent decline in mineral prices has led to a drop of 9.7 per cent in the terms of trade in 2012-13.

In 2012-13, the proximate causes of negative MFP growth in Mining (-4.9 per cent) have been:

- strong input growth of 13.6 per cent, above the long-term average (5.7 per cent)
  - especially strong capital input growth of 16.0 per cent
- output growth of 8.8 per cent, also above the long-term average (3.9 per cent).

Figure 1.3
MFP in Mining, 1989-90 to 2012-13

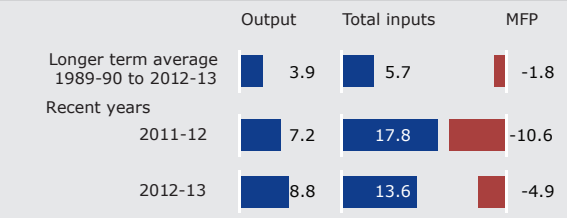
Index 1989-90 = 100



Data source: ABS (*Estimates of Industry Multifactor Productivity, 2012-13*, Cat. no. 5260.0.55.002, December 2013).

Figure 1.4
MFP growth in Mining[a]

Per cent

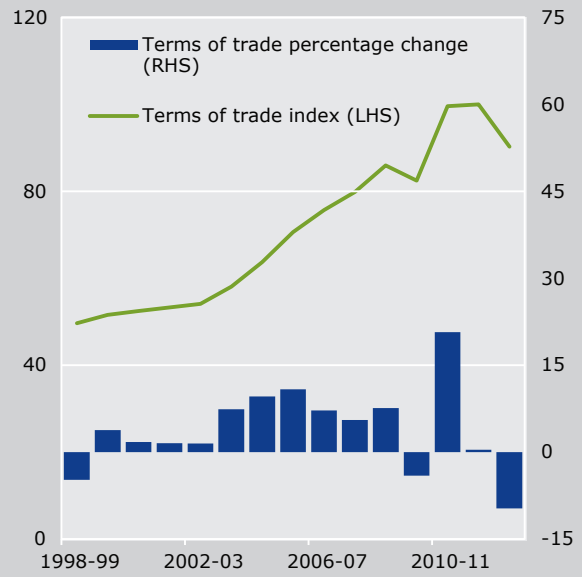


[a] Average annual growth rates and annual growth rates in designated periods.

Data source: Commission estimates based on ABS (*Estimates of Industry Multifactor Productivity, 2012-13*, Cat. no. 5260.0.55.002, December 2013).

Figure 1.5
Terms of trade, 1998-99 to 2012-13

Index 2011-12 = 100 and annual growth rates, per cent



Data source: ABS (*Australian System of National Accounts, 2012-13*, Cat. no. 5204.0, November 2013).

Capital investment growth remains strong

Topp et al. (2008) identified capital lags combined with acceleration in the growth in capital investment and resource depletion, as the underlying sources of poor measured productivity performance in Mining. Estimates by Syed et al. (2013) concluded that, without these influences, the average annual growth rate in MFP would have been 2.5 per cent between 1985-86 and 2009-10 instead of -0.65 per cent.

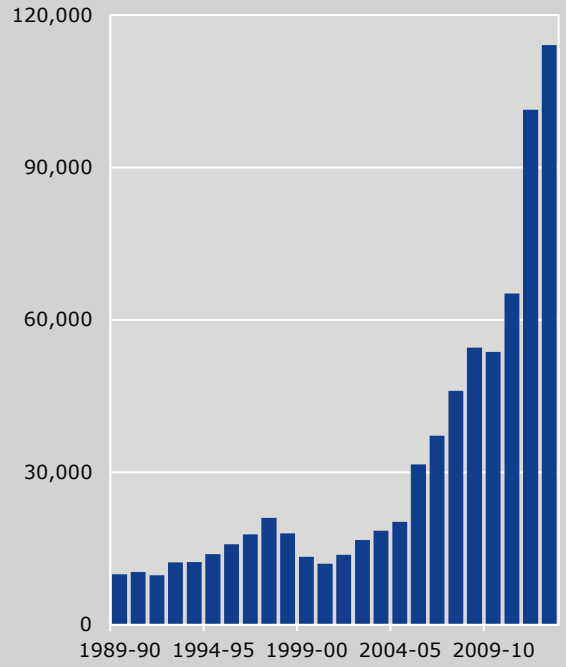
On the investment side, real capital expenditure in Mining increased to a record $114 billion in 2012-13, which was 12.5 per cent above that in 2011-12 (figure 1.6). This is despite the softening of commodity prices, and reflects the time taken to develop mining projects.

Higher prices have made it financially viable to mine marginal resources that have had a higher per unit production cost, such as the extraction of deeper ores and lower yielding resources. As a result, measured average productivity declined. If prices continue to fall, mining companies are likely to cease production at the most marginal sites. However, to the extent that fewer high value deposits are discovered to replace those that become depleted, this downward pressure on productivity growth may continue into the future years.

Analysis by Barber et al. (2013) suggests that the influence of capital lags on MFP may be beginning to subside. Forecasts of the mining investment pipeline indicate that capital investment will begin to stabilise in 2013, before decreasing in 2014. From 2017 onwards, capital investment is expected revert to levels comparable to those in 2007.

Figure 1.6
Real capital expenditure in Mining,[a] 1989-90 to 2012-13

$ million, 2011-12 constant prices



[a] Gross fixed capital formation.

Data source: ABS (*Australian System of National Accounts, 2012-13*, Cat. no. 5204.0, November 2013) on dXtime database.

The Mining industry will shift from an investment phase to one of increased production volumes over the next few years (Stevens 2013). Sheehan and Gregory (2013) have estimated that the volume of Australian resources exports will at least double in the decade from 2010-11.

The slowing of labour input growth reflects this shift toward a production phase. A number of Mining companies, particularly in the coal sector, have reduced staff levels, as the mining construction boom subsides and production rises (Stringer 2013). BHP Billiton (2013) has suggested that declining commodity prices are leading to an increased focus on productivity by Australian miners.

If the forecasts by Barber et al. (2013) and Sheehan and Gregory (2013) are realised, higher Mining output will be a positive influence on measured MFP growth in the future. This would see the already measured capital investment become productive, providing a productivity 'dividend' for the Mining industry which will contribute to the productivity growth of the market sector as a whole.

The Electricity, gas, water and waste services (Utilities) industry

MFP growth in Utilities remains negative

In recent years, the Utilities industry has recorded negative productivity growth. Developments in 2012-13 represent a slowing of the negative trend (figures 1.7 and 1.8).

For 2012-13, the slowdown in the negative Utilities MFP growth (to -1.8 per cent compared with -3.8 per cent in the previous year) was driven by:

- a significant slowing of input growth (0.8 per cent relative to 3.9 per cent in the previous year), despite
- negative output growth (-1.0 per cent compared with 0.1 per cent in the previous year).

Recent productivity drivers

The PC Productivity Update 2013 described five factors that have contributed to negative MFP growth in the Utilities industry since 1998-99. The effect of three was likely to diminish over time:

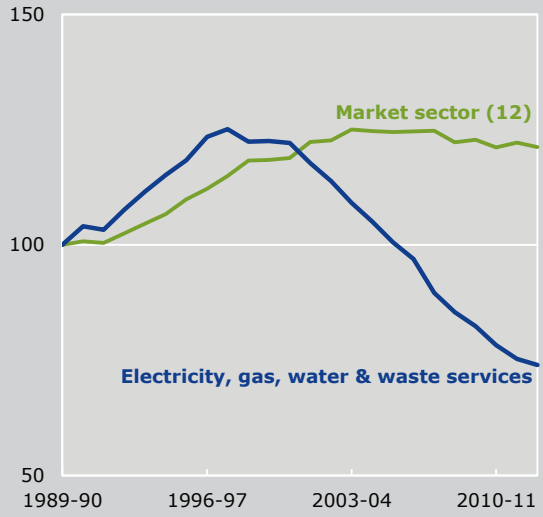
- a surge in investment in large and lumpy infrastructure projects
- rising peak relative to average demand for electricity, lowering the average utilisation rate of transmission capacity
- the effect of drought on output growth in the water supply sector.

Additionally, two structural and more permanent influences were acknowledged. There was a move to higher cost production technologies across many utility services in order to:

- provide better environmental outcomes
- meet increased reliability standards.

Figure 1.7
MFP in Utilities, 1989-90 to 2012-13

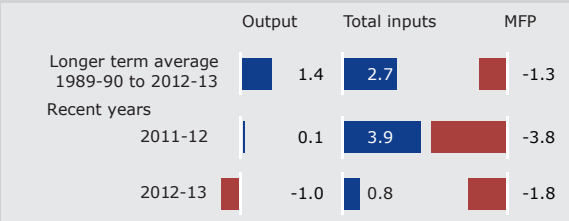
Index 1989-90 = 100



Data source: ABS (*Estimates of Industry Multifactor Productivity, 2012-13*, Cat. no. 5260.0.55.002, December 2013).

Figure 1.8
MFP growth in Utilities[a]

Per cent



[a] Average annual growth rates and annual growth rates in designated periods.

Data source: Commission estimates based on ABS (*Estimates of Industry Multifactor Productivity, 2012-13*, Cat. no. 5260.0.55.002, December 2013).

Detailed investment information would be needed to shed light on current developments with regard to permanent influences but that data are not currently available. It is possible, however, to provide some insights into the non-permanent influences.

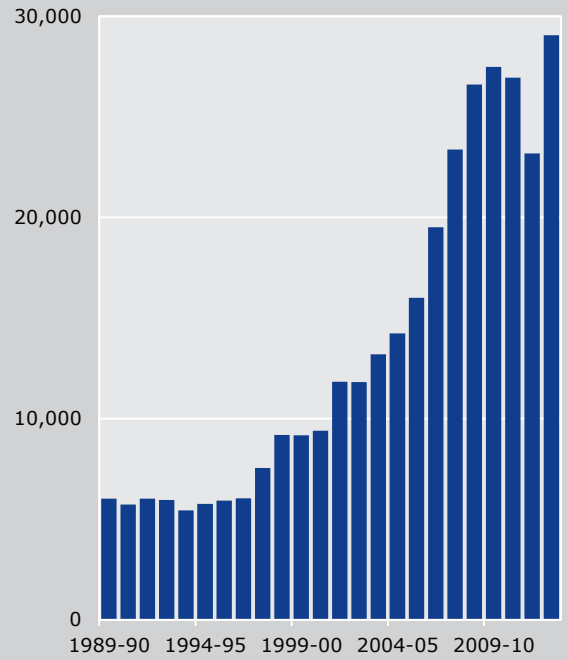
In recent years, investment in large and lumpy assets, such as power stations and high-voltage transmission lines, has played a role in the negative rates of Utilities MFP growth (Topp and Kulys 2012). Part of this reflects the cyclical nature of utilities investment, due to the large fixed capital costs combined with the need to replace ageing assets periodically. With much of the industry heavily regulated, and some utilities still state owned, investment can respond to regulatory incentives or reflect policy decisions of governments.

In 2012-13 capital investment reached new highs, following a slight decline in the previous year (figure 1.9). Continued capital investment in the Utilities industry is likely to exert an ongoing downward influence on MFP growth. Even if capital investment stabilised, an improvement in productivity is likely to be slow, reflecting the time taken for the infrastructure to approach full utilisation.

A related factor is the decline in electricity demand. From 2008-09 to 2012-13, annual total energy demand decreased on average by 1.1 per cent per year (AEMO 2013). The continued uptake of rooftop solar systems and energy efficiency savings has reduced the pressure on the overall electricity network. The closure of the Kurri Kurri aluminium smelter has also contributed to the lower rate of growth in electricity consumption and the deferral of the Olympic Dam mine expansion will dampen future demand growth (AEMO 2013).

Figure 1.9
Real capital expenditure in Utilities,[a] 1989-90 to 2012-13

$ million, 2011-12 constant prices



[a] Gross fixed capital formation.

Data source: ABS (*Australian System of National Accounts, 2012-13,* Cat. no. 5204.0, November 2013) on dXtime database.

Electricity demand is forecast by AEMO (2013) to grow by 0.5 per cent in 2013-14, with the expected completion of three large Queensland LNG projects (for export) cited as the main drivers of this growth. However, the closure of the Point Henry aluminium smelter in August 2014 will put downward pressure on long term electricity demand. In the decade to 2022-23 the average annual growth rate in electricity demand is forecast to be 1.3 per cent. To the extent that demand growth can be met without the need for major new investments in capacity, this should provide positive impetus for measured MFP growth in the electricity sector.

The second influence has been the rising peak use of electricity relative to average demand. According to Australian Energy Regulator (AER 2013), peak demand rose steadily up until 2008-09 and usually at a faster rate than average demand. The increasing use of household air conditioners was considered to be the main driver of this trend. However, AER analysis shows that, between 2008-09 and 2010-11, peak demand flattened and, since then, there has been a significant drop. Some reasons suggested for this decline include:

- changes in customer behaviour in response to higher electricity costs
- adoption of energy efficiency measures
- slowing economic growth
- the rise in the use of rooftop solar photovoltaic generation systems.

An analysis reported by Saddler (2013) appears to support the AER view. It suggests that the fall in peak demand was caused by factors other than an absence of very hot days during the recent summers.

The third influence has been the major drought of the 2000s. This saw a dramatic reduction in water availability and the introduction of water consumption restrictions. As a result, measured output in the water sector declined.

The latest ABS figures show that household water consumption grew by 1 per cent to 1715GL in 2011-12. However, this is still 5.7 per cent less than the 2008-09 consumption levels (1818GL). This decline is likely to be in response to increasing water prices as well as the enduring nature of water efficient appliances installed during the drought (Water Services Association of Australia 2013; ABS 2013c).

The slow growth of household water consumption remains an influence on Utilities MFP growth. As the water supply industry is characterised by a relatively fixed capital cost structure (including a number of recently installed, and underutilised, desalination plants), the lower level of measured output relative to previous years directly results in lower measured productivity growth rates.

As outlined, the effects of infrastructure investment, drought and slow growth in consumer demand have persisted in 2012-13. Given this, the Utilities industry is unlikely to see marked short-term MFP growth improvements. Over time, and provided investment decisions are soundly based, increasing levels of consumer demand may see a reversal of the persistent long-term decline in measured MFP growth. Any more permanent downward shift in consumer demand raises the opportunity for asset rationalisations.

The Financial and insurance services (FIS) industry

MFP growth becomes positive

Financial and insurance services is the largest industry within the market sector and therefore developments in this industry have a considerable impact on market sector MFP growth (PC 2013).

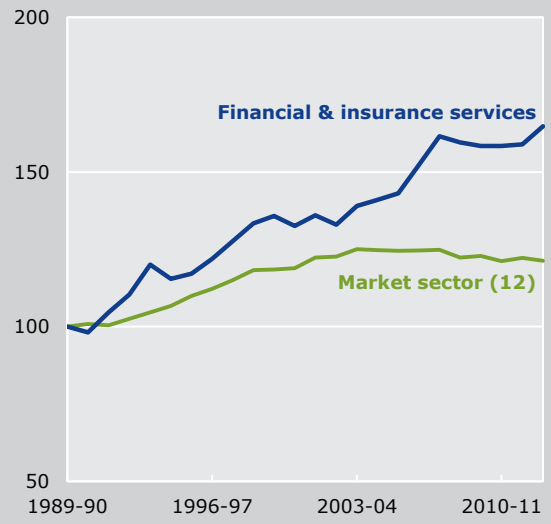
Financial and insurance services MFP growth declined from 2007-2008 to 2011-12, after sustained positive growth. However, in 2012-13 the industry again recorded positive MFP growth of 3.6 per cent (figures 1.10 and 1.11).

In 2012-13 the proximate causes of Financial and insurance services MFP growth (3.6 per cent compared with 0.3 per cent in the previous year) were:

- negative input growth (-0.3 per cent compared with 3.6 per cent in the previous year)
  - in particular, negative growth of labour input (-4.1 per cent compared with 6.1 per cent in the previous year)
- strong output growth despite declining slightly (3.3 per cent compared with 3.9 per cent in the previous year).

Figure 1.10
MFP in FIS, 1989-90 to 2012-13

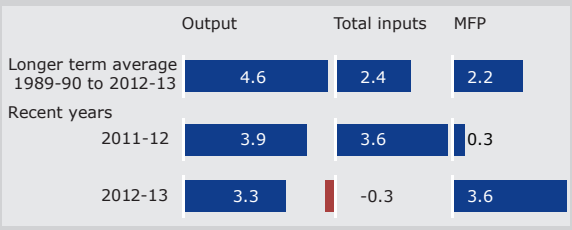
Index 1989-90 = 100



Data source: ABS (*Estimates of Industry Multifactor Productivity, 2012-13*, Cat. no. 5260.0.55.002, December 2013).

Figure 1.11
MFP growth in FIS[a]

Per cent



[a] Average annual growth rates and annual growth rates in designated periods.

Data source: Commission estimates based on ABS (*Estimates of Industry Multifactor Productivity, 2012-13*, Cat. no. 5260.0.55.002, December 2013).

Interpretation of FIS productivity needs caution

Between 2007-08 and 2011-12, average MFP growth in the Financial and insurance services industry turned slightly negative (-0.4 per cent per year) after sustained growth over more than two decades.

In addition to one-off events (such as floods and bushfires that raised insurance costs), the global financial crisis and a more cautious household sector were considered likely influences.

The PC Productivity Update 2013 cautioned on the interpretation of the recent slowdown in MFP growth in the Financial and insurance services industry — noting that it could be either a temporary phenomenon or the beginning of a sustained period of negative or low MFP growth.

It is worth noting the rebound to 3.6 per cent MFP growth in 2012-13 was significantly higher than the averages of both the last complete productivity cycle (2003-04 to 2007-08) and the whole period between 1989-90 and 2011-12.

The Commission has embarked on a research project into the drivers of MFP growth in Financial and insurance services, which is expected to provide greater insight into the productivity performance of this industry.

The Agriculture, forestry and fishing (AFF) industry

Agriculture returns to negative MFP growth

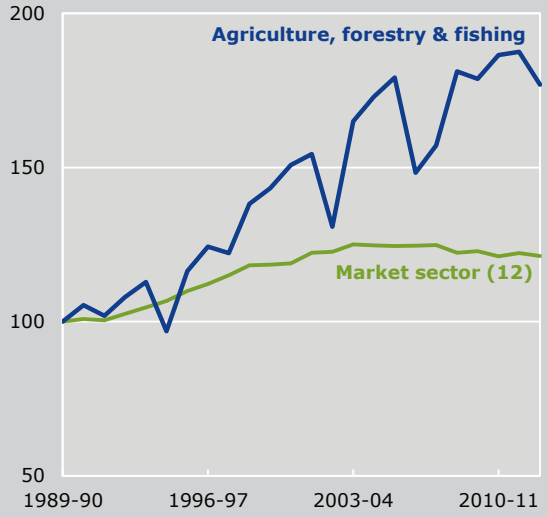
Since 2007-08, following a major drought, the industry had sustained positive MFP growth until 2012-13 when MFP growth turned negative again (figures 1.12 and 1.13).

The proximate causes of the strong negative MFP growth in Agriculture, forestry and fishing in 2012-13 (-5.8 per cent relative to 0.6 per cent in the previous year) are:

- strongly negative output growth (-5.7 per cent compared with 1.0 per cent in the previous year)
- marginally positive input growth (0.1 per cent compared with 0.4 per cent in the previous year).

Figure 1.12
MFP in AFF, 1989-90 to 2012-13

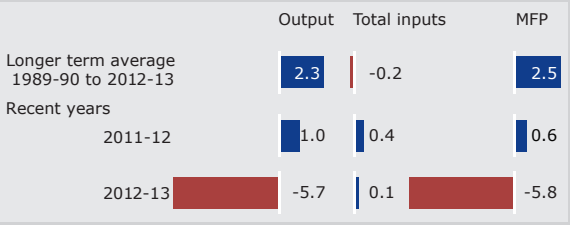
Index 1989-90 = 100



Data source: ABS (*Estimates of Industry Multifactor Productivity, 2012-13*, Cat. no. 5260.0.55.002, December 2013).

Figure 1.13
MFP growth in AFF[a]

Per cent



[a] Average annual growth rates and annual growth rates in designated periods.

Data source: Commission estimates based on ABS (*Estimates of Industry Multifactor Productivity, 2012-13*, Cat. no. 5260.0.55.002, December 2013).

Weather and natural disasters affected agricultural MFP

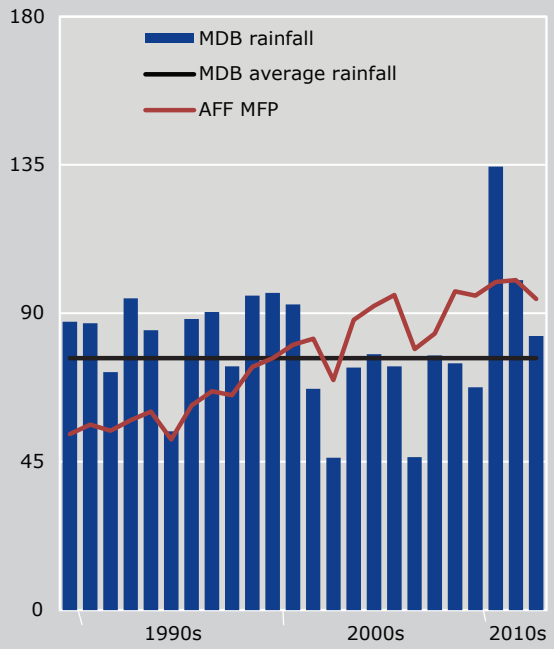
Agricultural MFP tends to follow output changes as capital and labour input growth are usually relatively low and stable. Persistent and widespread drought conditions were the main cause of negative MFP growth between 2003-04 and 2007-08 (for example, figure 1.14 shows rainfall in the Murray-Darling Basin). Since then, MFP growth has remained positive as a result of improved weather conditions.

2012-13 saw a year of unfavourable weather conditions for a substantial share of Australia's agricultural production, with natural disasters in early 2013 being the main cause of this output decline. The floods following tropical cyclone Oswald in January 2013 saw 72 Queensland and New South Wales local government areas eligible for Natural Disaster Relief assistance. Overall the eligible councils and shires represented 21 per cent of Australia's agricultural production value (ABARES 2013a).

Looking forward, ABARES (2013b) expects output to rise in 2013-14. Specifically, farm production is forecast to increase by 2.9 per cent, with crop output improving by 3.9 per cent. However, continuing and potentially worsening drought conditions in NSW and Queensland (McVeigh 2013; Stoner and Hodgkinson 2013) may prove to be a downward influence on output and consequently on MFP growth.

Figure 1.14
Rainfall in the Murray-Darling Basin (MDB) and MFP in AFF, 1989-90 to 2012-13[a]

Index 2011-12 = 100



[a] The MFP index is measured on a fiscal year basis (1 July to 30 June), while the rainfall index is measured on a calendar year basis.

Data sources: Commission estimates based on ABS (*Estimates of Industry Multifactor Productivity, 2012-13*, Cat. no. 5260.0.55.002, December 2013); Bureau of Meteorology, http://www.bom.gov.au/cgi-bin/climate/change/timeseries.cgi?graph=rain&area=mdb&season=0112&ave_yr=0.

1.4 Comparing Australian productivity performance

International data from the Conference Board Total Economy Database show that its measure of MFP in Australia fell by 1.3 per cent in 2013 (same magnitude of the decline in 2012).[4] This productivity performance was comparable with that of Canada (-1.1 per cent) and New Zealand (-1.2 per cent) but significantly worse than most other developed economies (figure 1.15).

Between 2007 and 2011, average MFP growth in nearly all major developed economies was negative. Australia's MFP growth (-1.2 per cent per year) was comparable with other resource rich countries, such as Norway (-2.6 per cent per year) and Canada (-0.9 per cent per year).

In 2013, global MFP growth was marginally negative (down by 0.1 per cent on average). For Europe, MFP growth remained negative (-0.5 per cent). However, the United States and Japan recorded positive growth. Giles (2014) observed that this decline in global MFP growth in 2013 continues a trend of recent years in which the remarkable rise in the productive efficiency of emerging economies has slowed and in developed economies it has declined.

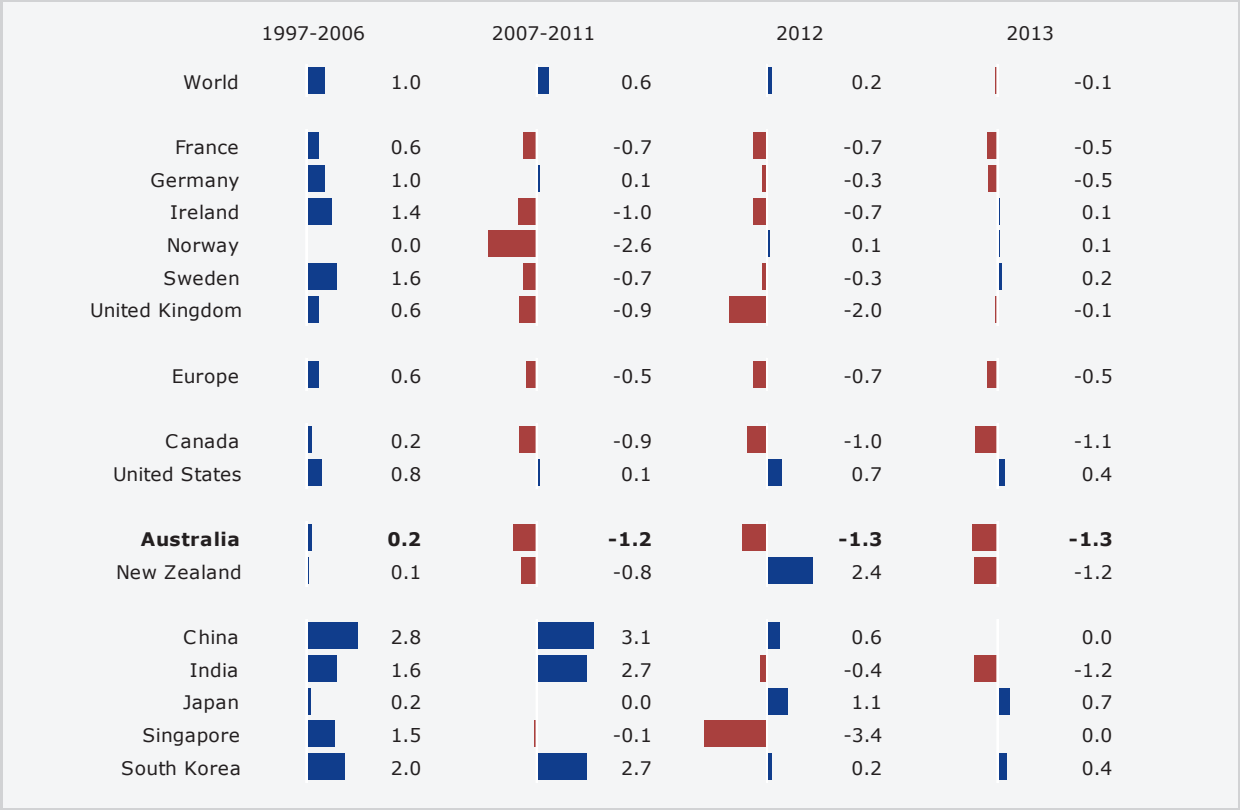
According to the Conference Board (2014b), the poor productivity appears to be the result of slowing in demand which has reduced output of the global economy. But the Conference Board was uncertain whether it was also due to the lack of implementation of new technologies and innovation. In Europe, slow productivity growth was possibly related to 'structural rigidities' in the labour market where people found it difficult to move from one company to another and where innovative firms could not take on these people without overcoming substantive constraints and unnecessary risks.

However, the Conference Board believes that overall productivity growth may pick up (but remain weak) in 2014 because demand conditions are expected to improve, which should boost output growth relative to input growth.

4 The productivity estimates for Australia in this section differ from ABS estimates due to methodological differences.

Figure 1.15
Multifactor productivity growth in selected countries and regions

Averages of yearly growth rates and annual growth rates, per cent



Data source: The Conference Board Total Economy Database™, January 2014, http://www.conference-board.org/data/economydatabase/.

References

ABARES (Australian Bureau of Agricultural and Resource Economics and Sciences) 2013a, *Agricultural Commodities: March Quarter*, ABARES, Canberra.

ABARES (Australian Bureau of Agricultural and Resource Economics and Sciences) 2013b, *Agricultural Commodities: December Quarter*, ABARES, Canberra.

ABS (Australian Bureau of Statistics) 2013a, *Australian System of National Accounts, 2012-13*, Cat. no. 5264.0, November, ABS, Canberra.

ABS (Australian Bureau of Statistics) 2013b, *Estimates of Industry Multifactor Productivity, 2012-13,* Cat. no. 5260.0.55.002, December, ABS, Canberra.

ABS (Australian Bureau of Statistics) 2013c, *Water Account Australia, 2011-12,* Cat. no. 4610.0, ABS, Canberra.

AEMO (Australian Energy Market Operator) 2013, *National Electricity Forecasting Report 2013, A*EMO, Sydney.

AER (Australian Energy Regulator) 2013, *State of the Energy Market 2013*, Australian Competition and Consumer Commission, Melbourne. http://www.aer.gov.au/sites/default/files/746_SOEM_Chapters_Singles_3.pdf. (accessed January 2014).

Arsov, I., Shanahan, B. and Williams, T. 2013, 'Funding the Australian Resources Investment Boom', *RBA Bulletin*, March, Sydney.

Barber, J., Shael, T., Cowling, S., Bialowas, A. and Hough, O. 2013, *Resources and Energy Major Projects April 2013*, Bureau of Resources and Energy Economics (BREE), Canberra.

BHP Billiton Limited 2013, *Annual Report 2013*, BHP Billiton Limited, Melbourne.

The Conference Board 2014a, *Total Economy Database*™, January, http://www.conferenceboard.org/data/economydatabase/.

The Conference Board, 2014b, *2014 Productivity Brief – Key Findings, Global Productivity Slowdown Moderated in 2013 — 2014 May See Better Performance*, http://www.conferenceboard.org/data/economydatabase/.

Debelle, G. 2013, *Funding the Resources Investment Boom*, Address to the Melbourne Institute Public Economic Forum, Canberra, 16 April, RBA, Sydney.

Giles, C. 2014 'Productivity crisis haunts global economy', *Financial Times*, 14 January, London.

McVeigh, J. 2013, 'More support is on the way for droughtstricken farmers', *Media Statements, (Queensland) Minister for Agriculture, Fisheries and Forestry*, 14 October, http://statements.qld.gov.au/Statement/2013/10/14/more-support-is-on-the-way-for-droughtstricken-farmers (accessed November 2013).

Parham, D. 2012, *Australia's Productivity Growth Slump: Signs of Crisis, Adjustment or Both?,* Visiting Research Paper, Productivity Commission, Canberra.

PC (Productivity Commission), 2013, *PC Productivity Update*, Canberra.

Saddler, H. 2013, 'Electricity demand's in free-fall, but what happened to the peak?' *Business Spectator*, 8 August, http://www.businessspectator.com.au/article/2013/8/8/energy-markets/electricity-demands-free-fall-what-happened-peak. (accessed January 2014).

Sheehan, P. and Gregory, R. 2013, 'The Resources Boom and Economic Policy in the Long Run', *Australian Economic Review*, Vol. 46, no. 3, pp. 121–139.

Stevens, G. 2013, *Economic Policy After the Booms*, Address to The Anika Foundation Luncheon, Sydney, 30 July, RBA, Sydney.

Stoner, A. and Hodgkinson, K. 2013, 'Additional in-drought support package for north west NSW', *Media Release*, 20 November, http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0003/489450/media_release_131120_additional_in-drought_support_package_north_west_nsw.pdf (accessed November 2013).

Stringer, D. 2013, 'Anglo's Cutifani Sees Grim Outlook for Mine Sector', *Bloomberg*, 28 June, http://www.bloomberg.com/news/2013-06-25/anglo-american-ceo-says-outlook-grim-for-mining-sector.html (accessed December 2013).

Syed, A., Grafton, Q. and Kalirajan, K. 2013, *Productivity in the Australian Mining Sector*, Bureau of Resources and Energy Economics (BREE) Discussion Paper Series, 13.01, March, BREE, Canberra, http://www.bree.gov.au/documents/discussion-papers/australian-mining-productivity-paper.pdf (accessed October 2013).

Topp, V., Soames, L., Parham, D. and Bloch, H. 2008, *Productivity in the Mining Industry: Measurement and Interpretation*, Productivity Commission Staff Working Paper, Canberra.

Topp, V. and Kulys, T. 2012, *Productivity in Electricity, Gas and Water: Measurement and Interpretation*, Productivity Commission Staff Working Paper, Canberra.

Water Services Association of Australia 2013, *Using Water Wisely*, Position paper 005, March 2013, https://www.wsaa.asn.au/Resources/Positions/Using%20Water%2Wisely.pdf.

2 The effect of price on productivity

Much of the Commission's work focuses on remedying price distortions in the economy that give rise to wasteful resource misallocation and reduce community welfare. Such distortions arise in myriad ways, including from restrictions on competition which limit supply and raise prices, price-based industry assistance (for example tariffs) which can expand some sectors at the expense of more efficient ones, and poorly designed regulations that unnecessarily distort choices by producers and consumers. Distortions also arise from market failures that are not adequately addressed. This chapter looks at how price distortions can affect efficiency and productivity, drawing on Commission inquiries into the electricity and urban water sectors.

2.1 Policy induced price distortions

Some government interventions intentionally alter prices to address market failures and/or modify behaviour — taxing pollution; deterring consumption of harmful products such as tobacco; or conversely, subsidising the cost of vaccines that have wide public benefits. Other measures, such as stamp duties, distort market prices to achieve revenue objectives but may have other negative economic impacts. Regulatory interventions such as quotas and price caps also alter the prices that would otherwise prevail:

- in the 1980s, import quotas on motor vehicles and textile, clothing and footwear products enabled domestic firms to raise prices and gain market share — when quotas were in place, 80 per cent of new car consumers were limited to purchasing a locally produced vehicle at a highly inflated price (PC 2002)
- urban water authorities are constrained from raising prices to respond to higher supply costs or rising demand — the resultant excess demand has to be managed through rationing or through new (potentially inefficient) investment (PC 2011a)
- for privatised airports, initial price cap regulation was found to deter much needed investment — the removal of price caps in 2002 instigated an appreciable increase in aeronautical investment (PC 2011b).

The distortion of market prices generally has consequential impacts on economic efficiency. When, for instance, the relative price of a good rises owing to say a tax, consumers reduce their consumption of the affected good or consume the same amount but reduce expenditures elsewhere, depending on their relative preference for the goods (their elasticity of demand). This occurs even though there has been no fundamental change in their preferences or in production costs. Hence, the opportunity for society to produce and consume the most desired mix of products and attain the greatest return, or utility, from its scarce resources is reduced. Such distortions can also alter investment decisions and change producers' choices of inputs and technology, affecting how efficiently they can deploy their factors of production.

2.2 Electricity: price distortions, investment decisions and productivity

Distortions that prevent efficient pricing in output markets can affect producers' investment decisions.[1] In these cases, distortions cause more than just a reduction of allocative efficiency, they may also prompt inefficient (excessive) investment in the production of certain goods and services.

'Peak' electricity demand requires additional investment

Overinvestment relative to willingness to pay for the full cost of that investment leads to the underutilisation of capital in a sector and adversely affects the measured productivity performance of the economy.

The absence of peak pricing for electricity, as examined in the Commission's recent inquiry into Electricity Network Regulation Framework (PC 2013), is a particular example of how a distortion arising from the use of an average price can affect investment and lead to poorer productivity performance.

While there are regular fluctuations in electricity use associated with the time of day or the season, there are also irregular fluctuations — or spikes — related to extreme hot or cold weather. These spikes represent periods of peak demand, such as when a large number of users respond to an unseasonably hot day by turning on their air conditioners at approximately the same time.

But while the amount of electricity demanded by households can fluctuate significantly, the total amount of electricity which can be supplied is fixed by the availability of operating capacity at that time. Unless there is sufficient capacity to handle a spike, there will be blackouts or brown outs. This can lead to equipment failure and process shut-downs as well as inconvenience to household users.

Since electricity cannot be easily stored, networks have been built to accommodate the peak demand of electricity consumers at any instant, even if they are brief and infrequent, to avoid such failures. For example, electricity distribution business ENERGEX claims that 13 per cent of their network capacity is only used for a few hours a few times a year (Topp and Kulys 2012).

One price for two services

Peak demand has implications for the cost of supplying electricity. The cost of supplying an extra unit of electricity includes investment costs associated with guaranteeing the reliability of the network at its most congested times. By way of contrast, off-peak electricity is consumed when the network is not congested. Since no additional network investment is required, the marginal cost of delivering off-peak electricity is lower compared to peak electricity.

Since they have very different cost structures, the supply of peak and off-peak electricity are effectively two distinct services which, in a competitive market, would be priced differently.

But current charging arrangements do not always reflect this difference. Most consumers are charged a single price for every unit of electricity consumed, without regard for the time-of-use. Consumers receive a single price signal for what are two different services with two distinct cost structures.

1 Distortions in input markets may also affect investment decisions. However, this chapter focuses on the impact of price distortions in the output markets.

An 'inefficient' price has consequences

An average price for the two types of electricity has the effect of making peak electricity appear cheap and off-peak electricity appear expensive. Consumers react by using too much peak and too little non-peak electricity, compared to a situation in which these services were separately priced. The average price effectively sends a wrong signal to the consumers, which encourages more consumption of the product that requires a higher cost to produce than many consumers would be willing to pay. The additional cost is induced by the 'distorted' price. In other words, if consumers faced a price that reflected this higher cost then demand for peak electricity would be lower.

The impact of the price distortion is not limited to an inefficient allocation of resources to cater for the peak demand. It also affects productivity. Since consumers choose to use more peak electricity, electricity companies guard against system outages by investing in the network. This results in the expansion of the network ahead of when it would have been required under marginal cost pricing. As the additional capacity to meet peak hour demand is not used most of the time, the increase in total inputs (primarily capital) is not matched by proportionately greater total outputs (the total amount of electricity generated). The productivity of the electricity network is, accordingly, lower than it would be if peak demand were managed through cost reflective pricing.

Poor multifactor productivity performance

A Commission inquiry (PC 2013) found that the use of a single price was a significant influence on capital investment growth in the electricity industry between 1997-98 and 2009-10.[2] Over this period, overall capital utilisation was low and productivity declined in this industry (Topp and Kulys 2012).

Since around 2003-04, average demand has been flat or falling but peak demand has been trending upwards. Thus, the gap between peak and average demand is widening, with some exceptions observed during a run of mild summers since 2010-11 (figure 2.1).

Similarly, between 2003-04 and 2009-10, there was a rapid acceleration in the growth of inputs, while output has continued to increase at about trend levels. This has led to falls in measured multifactor productivity in the sector (figure 2.2).

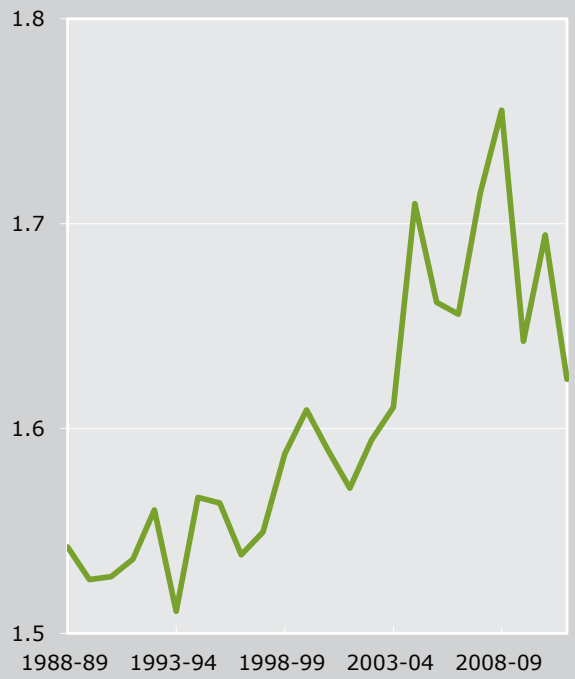
Efficient pricing can deliver savings

One policy option which would at least partially ameliorate the problems of overinvestment in the network would be to ensure an 'efficient' price. The implementation of cost-based, time of use pricing, would let the price of electricity vary to better reflect the cost of supply under different network demand loads. In particular it gives the consumer a price signal to reduce their consumption of peak electricity.

The Commission recommended that the introduction of cost-reflective prices, which vary with the time of use, would reduce the required capacity of the network and lower the operating costs of managing the network (PC 2013). As a consequence, measured productivity would also be expected to improve.

2 Other potential drivers of poor productivity performance were also identified by Topp and Kulys (2012). These included tightened reliability standards, increased undergrounding of the network and unmeasured changes in the quality of outputs.

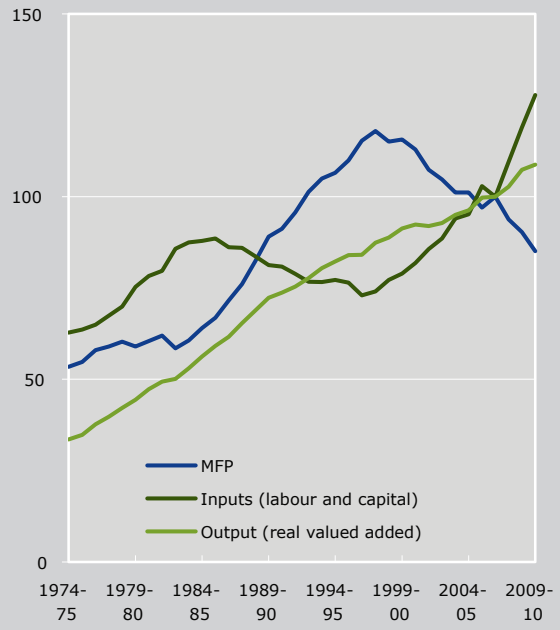
Figure 2.1
Ratio of peak to average load in the National Electricity Market (NEM)



Data source: PC (2013).

Figure 2.2
Electricity supply: inputs, output and multifactor productivity, 1974-75 to 2009-10

Index 2006-07 = 100



Data source: Topp and Kulys (2012).

2.3 Urban water: price distortions, technology choice and productivity

Australia's urban water sector bears little resemblance to competitive markets for goods and services. The supply chain from water storage through to delivery to users and waste removal is the province of government monopolies. Charges are determined administratively and vary little with supply availability. During the last drought, urban water authorities across Australia's cities responded with water use restrictions. Scarcity-based pricing was not pursued.

Prices versus restrictions

If water is under-priced then demand will exceed supply. Indeed, water restrictions are proof of the absence of an efficient market. Rationing water use ensures there is little likelihood that supply will be directed to the highest value uses.

If flexible pricing, based on the opportunity cost of supply, had a role, households could be offered a range of service tariff offerings (rather than a prescribed single two-part tariff) to cater for differences in consumer preferences. Households choosing a tariff which increased the volumetric price of water during a period of water scarcity would have the option of, for example, ceasing to water the garden or alternatively, paying more for their water and retaining the value of their garden. The household on a default 'vanilla' tariff (a single volumetric price and a fixed service charge) receives security of supply and price regardless of overall water availability.

In terms of production, market intelligence about the values that consumers place on water would better equip utilities to make decisions about when new investment should proceed. Pricing also provides scope to defer such investments or even obviate the need for them. Assessing the relative costs and benefits of augmentation options without this information is daunting. While a high-cost desalination plant would provide water independent of rainfall, this should be weighed against the higher cost of supply including the prospect of all users having to pay for excess capacity in normal times.

The Commission's review of the urban water sector (PC 2011a) concluded that the prolonged period of water use restrictions and subsequent investments in desalination capacity had imposed substantial costs on the community. It found:

- nationally, water restrictions are likely to have cost in excess of a billion dollars per year from the lost value of consumption alone
- inefficient supply augmentation in Melbourne and Perth could cost consumers and communities up to $4.2 billion over 20 years.

The effect of restrictions on productivity

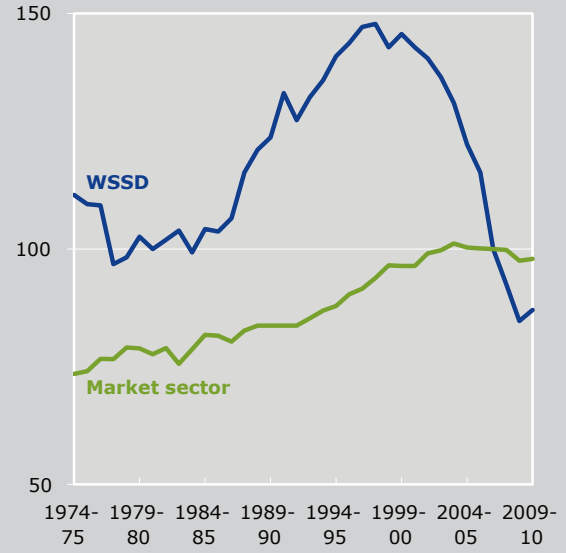
The absence of a market signal in the urban water market has affected productivity in two ways. The first is through the investment channel — because demand exceeds supply, decisions are taken to increase supply — and the second is through the choice of production technology.

Different production technologies have implications for productivity. Because each technology varies in its use of inputs to produce outputs, an industry-wide shift towards or away from a certain technology will result in different measured industry productivity. For example, if desalination plants use more inputs to produce a given amount of output, then their increased use will have adverse effects on productivity. Further, the construction of these plants adds to the capital inputs, but it takes time for production to reach its full capacity.

The multifactor productivity of the urban and rural water sectors declined over the past decade after strong growth from the mid-1980s to the mid-1990s (figure 2.3). The decline is likely due to a number of factors, including:

- investments in non-traditional sources of supply such as desalination and recycling that are more expensive than traditional sources such as dams, increasing the long-run marginal cost of supply. Moreover, because large supply augmentation projects take time to build there is a lag between the increase in inputs and the corresponding increase in output
- rationing during the drought reduced the 'output' of the water sectors
- treatment standards for water and wastewater have risen (a quality improvement), which has likely resulted in increased labour and capital inputs, without an increase in measured output (the quantity, but not the quality) of the water.

Figure 2.3
Multifactor productivity in the Water supply, sewerage and drainage (WSSD) services subdivision and the market sector,1974-75 to 2009-10



Data source: Topp and Kulys (2012).

How else to allocate water?

The Commission recommended a range of reforms. While competitive procurement of supply was a key to reducing costs, adopting flexible pricing was also important to improve efficiency.

The Commission considered that flexible (scarcity-based) retail pricing, based on the opportunity cost of supply, had the potential to allocate water more efficiently in the short run to reduce the cost of supply in the long run (PC 2011a). However, it contended that providing a range of service offerings (tariffs) to cater for differences in consumer preferences would provide greater net benefits than simply prescribing a single two-part tariff for all consumers.

Specifically, this involves freeing up the pricing of water by retailers by encouraging them to have multiple tariffs, subject to providing a default 'vanilla' two-part tariff, with a single volumetric price and fixed service charge set for three to five years, and with guaranteed supply. That default tariff would cater for consumers who prefer secure supply and stable prices.

Subject to government guidelines, multiple tariffs would allow consumers to choose between paying a higher price for access to additional supply and being undersupplied in circumstances of low water availability.

All such service offerings would take into account the opportunity cost of supplying each service. Multiple service offerings would:

- give consumers choice, instead of having an 'essential' level of demand prescribed for them
- provide an opportunity for retailers to more efficiently manage demand as supply changes over time.

Most importantly, the Commission recommended institutional and structural reforms aimed at strengthening the pressures for efficient water resource allocation and productivity by progressively introducing more contestability into elements of the integrated water cycle.

References

AEMC (Australian Energy Market Commission) 2013, *Electricity price trends final report,* Possible future retail electricity price movements: 1 July 2012 to 30 June 3015, 22 March.

BITRE (Bureau of Infrastructure, Transport and Regional Economics) 2006, *Freight Measurement and Modelling in Australia*, Report 112, Canberra, March.

ESAA (Energy Supply Association of Australia) 2012, *Electricity Gas Australia 2012*.

PC (Productivity Commission) 2002, *Review of Automotive Assistance*, Report No. 25, Canberra.

PC (Productivity Commission) 2011a, *Australia's Urban Water Sector*, Report No. 55, Final Inquiry Report, Canberra.

PC (Productivity Commission) 2011b, *Economic Regulation of Airport Services*, Inquiry Report No. 57, Canberra.

PC (Productivity Commission) 2013, *Electricity Network Regulatory Framework,* Report No. 62, Canberra.

Topp, V. and Kulys, T. 2012, *Productivity in Electricity, Gas and Water: Measurement and Interpretation*, Productivity Commission Staff Working Paper, Canberra.

3 Insights from recent productivity research — Productivity in Manufacturing

There was a marked slowdown in productivity growth in Australia between 2003-04 and 2007-08. The Commission has undertaken extensive research into why this slowdown occurred, and found that four industries were primarily responsible. The Commission has previously examined three of these industries — Mining, Agriculture and Utilities. This article provides an outline of the findings of the Commission's recent Staff Working Paper on productivity in the fourth industry — Manufacturing (Barnes, Soames, Li and Munoz 2013).

Manufacturing's multifactor productivity (MFP) declined considerably between 2003-04 and 2007-08. As one of the larger industries in the market sector, Manufacturing's productivity decline was a major driver of the overall slowdown.

Manufacturing includes a very diverse range of activities, from bread making to alumina refining, and the influences on the different types of manufacturers vary widely. While there are significant differences at the subsector level, more disaggregated official measures of productivity are not available.[1] Recent Commission research fills this gap by providing estimates of MFP for different parts of Manufacturing. These estimates show that the bulk of Manufacturing's MFP decline was attributable to three subsectors — Petroleum, coal, chemical and rubber products, Food, beverage and tobacco products, and Metal products. The productivity performance of each of these subsectors was influenced by numerous factors, some very specific to individual manufacturing activities.

Manufacturing MFP declined faster than the market sector

The slowdown in MFP growth between 2003-04 and 2007-08 was more pronounced for Manufacturing than for the market sector as a whole (figure 3.1). A period of relatively strong growth for Manufacturing between 1998-99 and 2003-04 (cycle 3) was reversed between 2003-04 and 2007-08 (cycle 4). This steep decline was not typical of Manufacturing's performance over the longer term.[2]

Manufacturing MFP declined while value added continued to grow

MFP can decline even when industry value added (gross output less intermediate inputs such as energy, raw materials and services) is increasing. A starting point for understanding the influences on productivity is to look at changes in the growth in value added and inputs (capital and labour) — referred to as the 'proximate causes' of MFP growth.

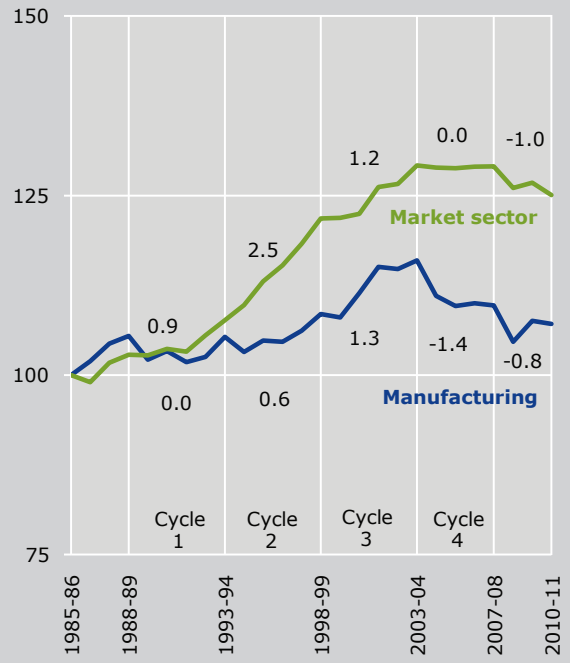
Between 1998-99 and 2003-04 (cycle 3), Manufacturing value added increased as did inputs, but inputs increased at a slower rate, so there was positive MFP growth of 1.3 per cent per year (figure 3.2). Value added continued to grow between 2003-04 and 2007-08 (cycle 4), but the rate of input growth was higher, resulting in a decline in MFP growth of -1.4 per cent per year.

1 The eight subsectors within Manufacturing are: 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; and Machinery and equipment manufacturing.

2 The estimates for Manufacturing and the market sector in this chapter are based on ABS (*Experimental Estimates of Industry Multifactor Productivity*, *2010-11*, Cat. no. 5260.0.55.002), the data set used in Barnes, Soames, Li and Munoz (2013). These estimates differ slightly from the estimates in Chapter 1, which are based on a later data set.

Figure 3.1
MFP in Manufacturing and the market sector, by cycle

Index 1985-86 = 100, average annual growth rate, per cent



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

Comparing cycles 3 and 4 (figure 3.2), the rate of MFP growth fell by 2.7 percentage points (from 1.3 per cent to -1.4 per cent per year).

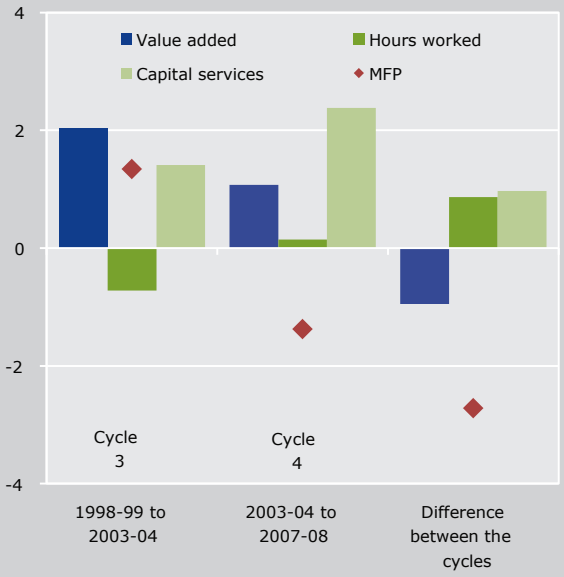
- While value added continued to grow, it did so at half the rate.
- There was a turnaround in hours worked, from a fall to slight growth.
- The rate of growth in capital increased strongly.

The aggregate picture for Manufacturing as a whole fails to explain why strong input growth was not matched by value added growth.

The measurements that underpin the official MFP statistics reflect the impacts of technological progress as well as other factors that influence the growth of output and inputs. These factors include scale economies, the effect of firm entry and exit when productivity levels differ across firms, the rates of input utilisation, changes in unmeasured inputs, and unmeasured changes in output (usually changes in quality). Negative MFP growth is rarely interpreted as a regression of technology. A change in MFP can be negative simply due to composition effects if, for example, the subsectors that are expanding in response to positive relative price changes started with a lower level of productivity relative to other subsectors. The estimates can also be subject to measurement error, especially when there are changes in output quality.

Figure 3.2
Growth in Manufacturing MFP and its proximate causes in cycles 3 and 4[a]

Average annual growth rate, per cent



[a] Capital services and hours worked weighted by income shares. This means that the sum of these growth rates is equal to the growth in combined inputs (effectively a weighted average of the growth rates in the two inputs).

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

MFP growth varied across subsectors

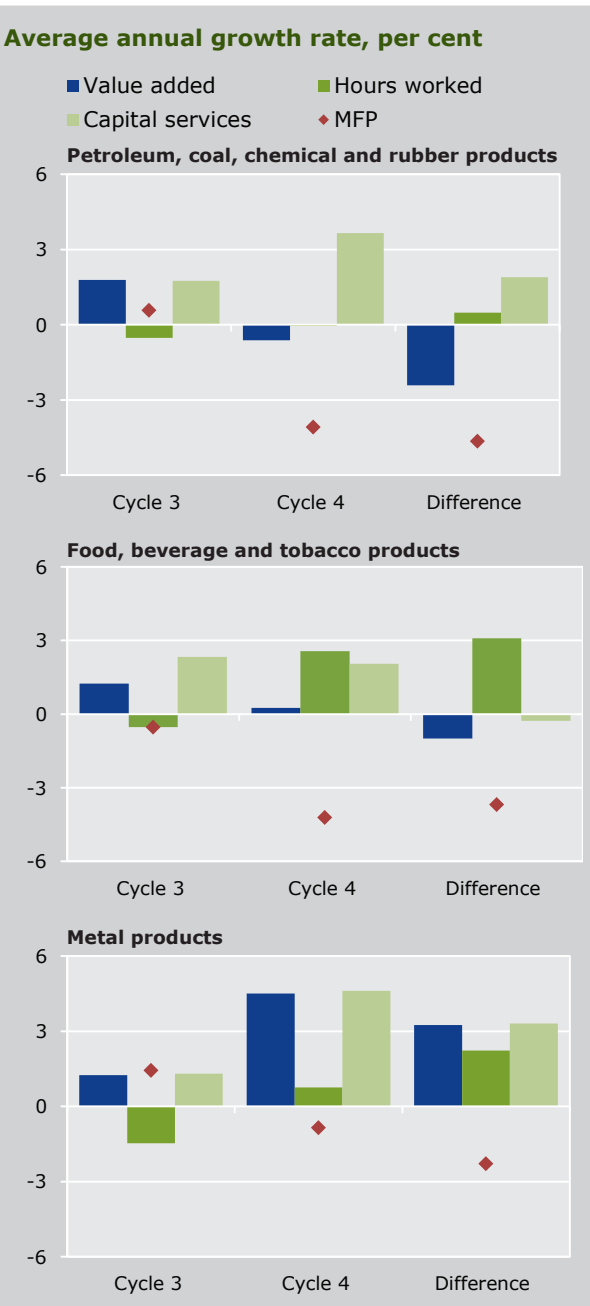
The eight subsectors within Manufacturing represent a diverse range of activities, with different production processes, technologies and users of their output, and different rates of MFP growth. While every subsector experienced a decline in the rate of MFP growth between cycles 3 and 4, Petroleum, coal, chemical and rubber products and Food, beverage and tobacco products contributed almost half of the overall decline. Metal products made the third largest negative contribution. These three subsectors collectively accounted for around two-thirds of the MFP decline in Manufacturing.

Different drivers led to the MFP declines in the three main subsectors

The proximate causes of the MFP decline between cycles 3 and 4 were different in the three subsectors (figure 3.3).

- The level of value added fell in Petroleum, coal, chemical and rubber products. At the same time, the rate of input growth increased, particularly for capital.
- Value added growth continued in Food, beverage and tobacco products, but at a slower rate. However, hours worked growth accelerated.
- Value added growth accelerated in Metal products, but was outpaced by exceptionally strong input growth, particularly capital.

Figure 3.3
Proximate causes of the MFP decline between cycles 3 and 4 in three subsectors



[a] Capital services and hours worked weighted by income shares.

Data source: Barnes, Soames, Li and Munoz (2013).

Petroleum, coal, chemical and rubber products

The Petroleum, coal, chemical and rubber products subsector includes industries such as petroleum refining, and the manufacturing of fertilisers, pharmaceuticals, paints, and plastic products to name just a few. Some of these played a much greater role in the subsector's MFP decline than others.

Value added declined in several parts of the subsector, including petroleum refining, tyres, and plastics. The growth in capital inputs was more concentrated and included investment to increase the capacity to produce fertilisers and explosives and to upgrade petroleum refineries to make cleaner fuels.

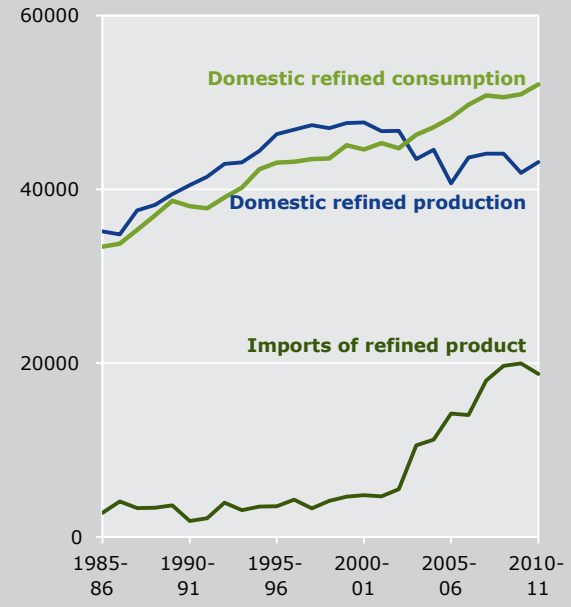
Declining value adding and rapid investment in Petroleum refining

The amount of crude oil available from Australian oilfields for refining into petroleum products has been declining. Petroleum refiners have had to import crude oil and refined fuel to maintain supply. This means that while the gross output from the petroleum refining industry has remained relatively steady, the amount of value added per unit of gross output has fallen.

The greatest value adding in Australia comes from refining domestic crude oil. Less value adding occurs when refined fuel is imported because the imports are already processed and only require domestic refineries to add value by blending it to meet Australian standards. A lot more refined fuel was imported over cycle 4 (figure 3.4).

It is not just the declining output from Australian oilfields that led to greater imports of refined fuel — there has also been a change in the mix of fuel products consumed in Australia. Growth in the mining industry and an increase in the sales of vehicles fitted with diesel engines have led to greater demand for diesel, a fuel that most Australian refineries were not designed to produce.

Figure 3.4
Production, consumption and imports of refined fuel



Data source: BREE (2012).

Petroleum refining firms invested heavily over the last decade (and particularly over cycle 4) to upgrade their Australian refineries to produce petroleum products that meet higher fuel standards. Essentially, this means that there have been greater capital inputs to improve the *quality* (such as fewer harmful pollutants) rather than increase the *volume* of petrol products. This acted as a brake on measured productivity growth as the increased level of (mainly capital) inputs to improve fuel quality was counted, but the change in quality was not fully reflected in the volume measure of value added.

Substantial investment in fertilisers and explosives production

Fertilisers and explosives manufacturing also contributed to the measured productivity decline. There was increased demand for fertilisers from Agriculture following the drought years during cycle 4, and the mining boom generated greater demand for explosives. Accordingly, firms made substantial investments in cycle 4 to expand production capacity, which accounted for around 30 per cent of the investment growth in Petroleum, coal, chemical and rubber products for the cycle. However, much of the output associated with those investments did not occur until after the end of the cycle. This meant there was growth in inputs, but no associated growth in value added — and this capital lag effect contributed to the measured decline in the subsector's MFP.

Import competition in tyres and plastics

Tyre manufacturing was affected by rising competition from lower priced imports over the 2000s, and especially over cycle 4. As a consequence, capital in the industry was underutilised. (The manufacturing of new tyres has since ceased.)

Strong import competition also affected manufacturers of some finished plastic products, such as plastic containers and dinnerware, as overseas firms with lower input costs expanded their production capacity. While this did not directly affect the productive efficiency of domestic firms, a shrinking market share led to reduced output by some firms, leaving some capital underutilised.

Greater competition creates an incentive for firms to improve their productivity, and raises industry productivity through the process of competitive dynamics (less productive firms exit the industry). However, in the adjustment period, declining output can leave capital underutilised (but it is still counted as an input by the ABS). In total, it is likely that, over cycle 4, plastics manufacturers reduced output without a matching reduction in inputs, contributing to the negative MFP growth in Petroleum, coal, chemical and rubber products.

Food, beverage and tobacco products

Food, beverage and tobacco product manufacturing includes a wide range of activities, each with different production processes. For example, large breweries use relatively more capital and less labour in their production process than do artisan brewers, and the same applies to bakeries.

The proximate causes of the decline in MFP growth for this subsector between cycles 3 and 4 were an increase in the rate of growth of hours worked and a slowdown in the rate of value added growth. Change in the composition of output was one of the factors behind this decline.

- There was an increase in the output of some types of food and beverage manufacturing that have lower levels of measured productivity, which lowered the *average* productivity of the subsector.
- There was a reduction in the output of some food and beverages products, but without a matching reduction in inputs. Underutilised inputs depressed the level of measured productivity for these manufacturing activities.

The underlying drivers of these changes in the composition of output were:

- change in the preferences of consumers for particular product features such as premium quality (eg artisan bread); and convenience (eg pre-prepared meals)
- reduced demand for some products, both in domestic and export markets, as the appreciation of the dollar and other factors reduced their relative competitiveness
- a decline in the output of some products because drought reduced the availability of the agricultural inputs.

The decline in MFP may also have been accentuated by measurement challenges — improvements in output quality can be difficult to quantify but the additional inputs required to achieve them are measured.

Examples from Wine and Bakery products illustrate how some of these factors interacted to put downward pressure on measured productivity for Food, beverage and tobacco product manufacturing.[3]

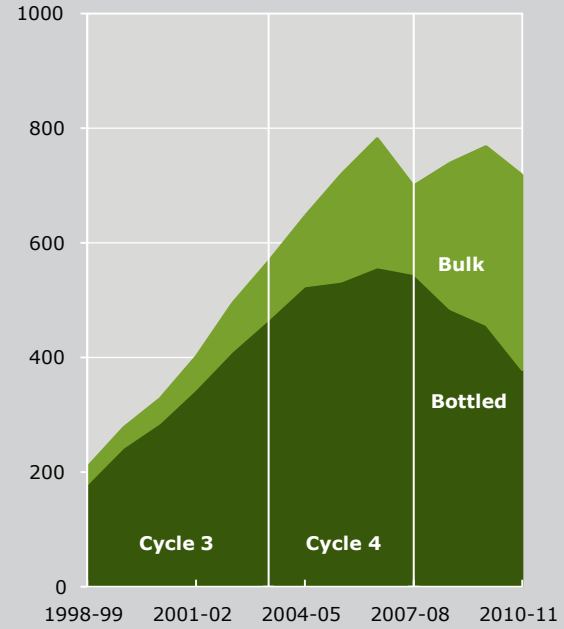
Declining value added in wine manufacturing

Output had grown strongly in Australian wine manufacturing during cycle 3. Previous investment in vineyards and winemaking capacity led to peak wine production early in cycle 4. But by the end of cycle 4 wine output had fallen from this peak, in part because drought reduced the supply of wine grapes.

By the middle of cycle 4 global markets had an excess supply of wine relative to demand. In response, some domestic winemakers shifted the composition of wine produced towards 'bulk wine' rather than bottled for final consumption (as reflected in the composition of exports in figure 3.5). This meant that less value was added during the production process (for example, less bottling and packaging activity), so value added declined more than gross (or the volume of) output.

In response to these changed market conditions, it appears that initially wine manufacturers were slower to adjust their labour and capital inputs than output and value added. One reason why firms may have been reluctant to reduce their inputs was an expectation of greater demand in the future from emerging markets, such as China. There was some consolidation of winemaking operations, but at the same time the number of smaller winemakers increased. Lifestyle considerations, tax arrangements, and alternative sources of income may have reduced the incentive for smaller winemakers to leave the industry. Overall, these factors may have left some winemaking capacity underutilised. This depresses measured MFP since it is still counted as an input but is not producing as much output as previously.

Figure 3.5
Wine manufacturing export of bulk and bottled wines

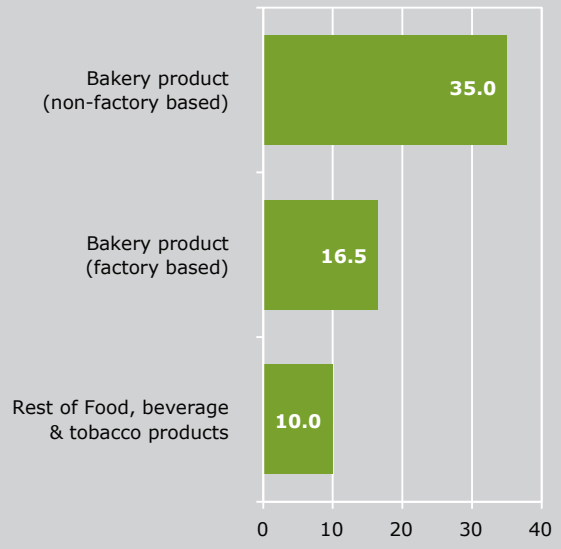


Data source: Wine Australia (unpublished data).

3 MFP cannot be estimated for Wine and Bakery because of data limitations, but measures of changes in inputs and production provide some indication of the drivers of MFP.

Figure 3.6
Labour intensity of bakery production in 2006-07

Employed persons per $ million of nominal value added



Data sources: Authors' estimates based on ABS (*Manufacturing Industry, Australia*, Cat. no. 8221.0).

Different bakery products made in a different way

Bakery product manufacturers have responded to consumers' demand for a wider variety of products — including premium artisan products and specialised products like international-style breads and breads with healthy additives such as whole grains. At the same time, there has been change in the share of bakery products produced by different types of manufacturers — with stronger growth in shop-based bakeries than in centralised factories.

Both factory and non-factory baking are more labour intensive than the rest of Food, beverage and tobacco product manufacturing on average (figure 3.6). However, shop-based bakeries, which are usually small scale and less automated, do not achieve the economies of scale of large factories. For example, more labour is used per dollar of value added produced in shop-based bakeries (in part also because they sell their products directly to the consumer) than in factory manufacture.

This shift in the mix of bakery products and bakery manufacturers has contributed to the strong growth in hours worked in Food, beverage and tobacco products over cycle 4. However, the higher quality of some of the output produced with these additional inputs may not be fully reflected in the measures of real value added growth for the subsector, given the challenges of measuring changes in quality. For these reasons, bakery product manufacturing is likely to have contributed to lower measured MFP for the subsector as a whole.

Metal Products

Metal products is a subsector that has two distinct parts. *Primary metals* includes industries that refine metal ores into basic metal products, such as steelmaking. *Fabricated metals* includes industries that produce more complex metal products, such as transforming steel into building materials.

MFP in Metal products declined between cycles 3 and 4 as very strong value added growth was outpaced by even stronger growth in inputs, particularly capital. But most of the value added growth occurred in Fabricated metals, while nearly all the capital growth occurred in Primary metals.

Strong output growth for Fabricated metals

Most of the output growth in Metal products occurred in Fabricated metals, particularly those fabricators that supply materials to the Construction and Mining industries. Stronger demand from these industries saw Fabricated metal manufacturers expand output and supply a greater share of their output to these industries. At the same time, there was a decline in the downstream use of steel within Manufacturing for things like whitegoods, hardware, packaging and other appliances (figure 3.7).

While there was some increase in employment in Fabricated metals between cycles, the growth in value added was far greater. Thus it is likely that Fabricated metals had positive MFP growth, but that the very large investments in Primary metals to expand future production capacity, as explained below, more than offset this effect.

Figure 3.7
The changing share of Fabricated metal products use

2001-02 and 2008-09, per cent

Data Source: Barnes, Soames, Li and Munoz (2013).

Capital growth in Primary metals

Growth in capital inputs accounted for around two-thirds of total input growth in overall Metal products between cycles 3 and 4. Practically all of the investment growth was associated with building and upgrading refineries to expand the production capacity of Primary metals. This expansion was in response to the higher prices received for primary metals during cycle 4, and in anticipation of strong demand in the future. The bulk of this investment was undertaken by alumina refiners. Where investment has accelerated, and the new investment takes some years to come fully online, the capital lag effect will tend to dampen MFP growth in the short term. The effects tend to be reversed if investment growth slows and the new capital becomes more fully utilised.

Manufacturing productivity more recently

Since the end of cycle 4, the decline in Manufacturing MFP has slowed. At the same time, the decline in MFP for the broader market sector has accelerated.[4]

The three Manufacturing subsectors discussed above all had better productivity growth in the three years since 2007-08, compared with over cycle 4. This suggests that the particularly poor growth in cycle 4 was exceptional — which is understandable given some of the 'one-off' events that have occurred.

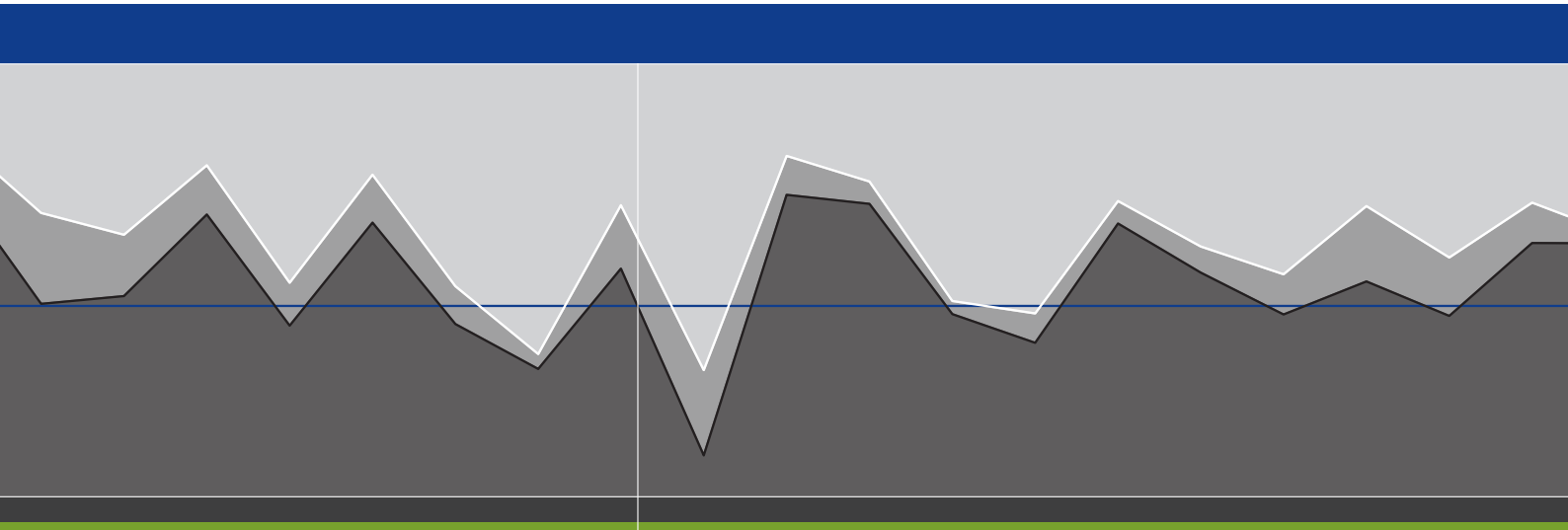
This research highlights the benefits of examining productivity at a more disaggregated level. There is not a single, overarching reason for the productivity decline in Manufacturing. The MFP slowdown is more accurately described as the result of a range of different events and changes in business conditions, many of which affected quite specific parts of Manufacturing. This is not surprising for an industry as diverse as Manufacturing, and should be kept in mind when interpreting movements in aggregate productivity measures.

4 See Chapter 1 for an in-depth look at the industries contributing to the decline since the end of cycle 4.

References

Barnes, P., Soames, L., Li, C. and Munoz, M. 2013, *Productivity in Manufacturing: Measurement and Interpretation,* Productivity Commission Staff Working Paper, Canberra.

BREE (Bureau of Resources and Energy Economics) 2012, *Resources and Energy Statistics, Annual 2012,* BREE, Canberra.



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