



Australian Government
Productivity Commission

PC PRODUCTIVITY INSIGHTS

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RECENT PRODUCTIVITY TRENDS

Features

Recent productivity trends

A strong labour market
has supported continued
economic growth

The productivity slowdown

Strong terms of trade have
allowed incomes to outgrow
productivity over the past
20 years

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The 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.

Further information on the Productivity Commission can be obtained from the Commission's website (www.pc.gov.au).

Foreword

Welcome to the first *PC Productivity Insights* of 2020.

Each year, we provide an analysis of Australia's recent productivity performance, recognising that it is a key determinant of our long-run prosperity. This year, rather than providing a single document, the Commission will be publishing a series of research papers on different aspects of Australia's productivity performance. The first in the series focuses on Australia's recent productivity trends.

Ongoing output growth has pushed Australia's recession-free hot streak out to 28 consecutive years, a record that is the envy of policymakers the world over. That said, this year, Australia's productivity has slid backwards for the first time since the mining boom. Output growth has been driven by strong growth in employment, rather than 'doing things better'. The result is that the labour and multifactor productivity performance of the market sector, where measurement of performance is most accurate, has continued to deteriorate. Economy-wide generalisations do not capture the fact that some industries have experienced strong productivity growth — a story that we emphasise in this paper.

Subsequent papers in the *PC Productivity Insights* series will explore in more detail some of the issues raised in this document, such as Australia's performance in an international context and the role of productivity as a long-run driver of growth in living standards. The aim of these papers is to make a contribution to public discussion and debate about productivity, which in turn can guide policy to lift Australia's future productivity performance.

Michael Brennan
Chair

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Abbreviations

| | |
|------|--|
| ABS | Australian Bureau of Statistics |
| CPI | Consumer Price Index |
| GDP | Gross Domestic Product |
| GFC | Global Financial Crisis |
| GVA | Gross Value Added |
| MFP | Multifactor Productivity |
| OECD | Organisation for Economic Co-operation and Development |
| PC | Productivity Commission |
| PPP | Purchasing power parity |
| R&D | Research and Development |
| TED | Total Economy Database |
| UK | United Kingdom |
| US | United States of America |

Recent productivity trends

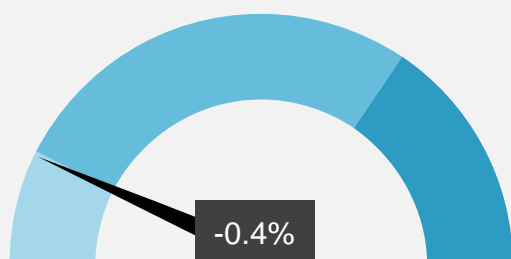
Key points

- Labour productivity and multifactor productivity in the market sector both fell in 2018-19, the first fall since the peak of the mining boom, by 0.2 per cent and 0.4 per cent respectively.
 - This continues a spell of weak productivity growth since the peak of the investment phase of the mining boom in 2012-13.
- Advanced economies the world over have experienced a productivity growth slowdown since about 2005. The Australian slowdown was somewhat smaller, partly because of the expansion of the mining sector during this period.
- Wages growth, measured against consumer prices, has been weak since about 2012-13 for three reasons:
 - labour productivity growth has slowed (accounting for about half of the slowdown in wages)
 - consumer price inflation has outpaced producer price inflation due mainly to the shifting terms of trade (about a quarter of the slowdown)
 - the labour share of income has continued its pattern of decline since 2000 (accounting for about a fifth of the slowdown in wages).
- The fall in the labour share of income was due to labour reallocation towards the mining sector and increased profitability in the finance sector.

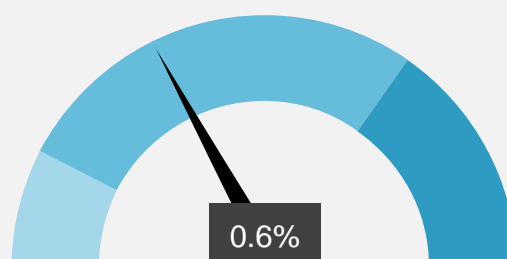
Productivity at a glance

Multifactor productivity performance

Multifactor productivity 2018-19



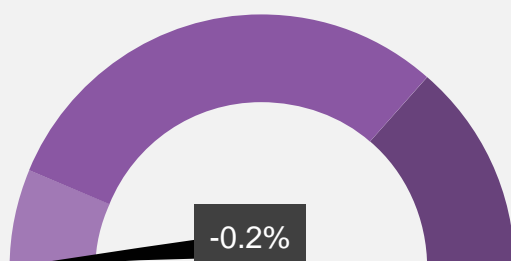
Five year average



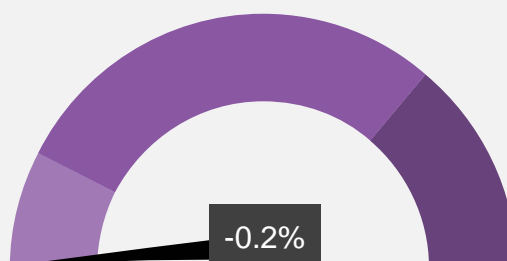
Below average Typical Above average

Labour productivity performance

Economy wide 2018-19



Market sector 2018-19



Below average Typical Above average

Table 1 Aggregate productivity statistics^a
Per cent^b

| | Long-term growth rate | Most recent five years | Latest years | |
|----------------------------------|--------------------------|---------------------------|--------------|---------|
| | 1974-75 to 2018-19 | 2013-14 to 2018-19 | 2017-18 | 2018-19 |
| Whole Economy | | | | |
| Output (real GDP) | 3.1 | 2.5 | 2.9 | 1.9 |
| GDP per capita | 1.7 | 0.9 | 1.3 | 0.3 |
| Hours worked ^c | 1.6 | 1.8 | 2.7 | 2.0 |
| Labour productivity | 1.5 | 0.7 | 0.3 | -0.2 |
| Terms of trade | 0.8 | -0.1 | 1.9 | 6.0 |
| Gross national income per capita | 1.8 | 0.8 | 1.3 | 1.6 |
| Market sector | | | | |
| Output (GVA) | 3.2 | 2.3 | 3.1 | 1.3 |
| Inputs | 2.4 | 1.7 | 2.2 | 1.6 |
| Hours worked | 1.2 | 1.4 | 2.4 | 1.6 |
| Capital services | 4.2 | 2.1 | 1.9 | 1.8 |
| Labour productivity | 2.0 | 0.9 | 0.7 | -0.2 |
| MFP | 0.8 | 0.6 | 0.9 | -0.4 |

^a Some figures will not appear to add correctly due to rounding to one decimal place, for example labour productivity growth and hours growth not appearing to add to GVA. Appendix A provides the details on the data and methodology for estimating output, input and productivity at the 16-industry market sector level. Gross value added (GVA) output is Gross domestic product (GDP) less taxes less subsidies on products and the statistical discrepancy. Labour productivity is the growth in output per unit of labour input. Multifactor productivity growth is the growth in gross value added less the growth of hours worked and capital services, each weighted by their share of total factor income. ^b All values are in real, chain weighted, terms. ^c Hours worked and labour productivity for the whole economy are only available back to 1978-79.

Sources: Estimates based on: ABS (2018, *Australian System of National Accounts*, 2017-18, Cat. no. 5204.0, tables 1, 5, 15, 46 and 58); ABS (2018, *Estimates of Industry Multifactor Productivity*, 2017-18, Cat. no. 5260.0.55.002, tables 1, 6 and 14); ABS (*Labour Force, Australia, Detailed, Quarterly*, Cat. no. 6291.0.55.003, Aug 2018, table 11); and ABS (unpublished data).

Table 2 Industry productivity growth, 2018-19^a
Per cent

| | Output (GVA) | Hours worked | Capital services | Labour productivity | MFP |
|---|-----------------|-----------------|---------------------|------------------------|-----------|
| Market sector (16 industries) | | | | | |
| Agriculture, forestry and fishing | -10.4 | -0.4 | -0.8 | -10.1 | -9.8 |
| Mining | 6.1 | 8.2 | 1.0 | -2.0 | 3.8 |
| Manufacturing | -1.5 | -0.5 | -0.7 | -1.0 | -0.9 |
| Electricity, gas, water and waste services | 0.3 | 3.0 | 2.7 | -2.6 | -2.4 |
| Construction | -3.4 | -0.9 | 3.6 | -2.6 | -4.0 |
| Wholesale trade | 1.1 | 5.5 | 1.1 | -4.1 | -2.7 |
| Retail trade | 1.0 | -2.0 | 3.5 | 3.1 | 1.6 |
| Accommodation and food services | 0.6 | 1.9 | 1.3 | -1.3 | -1.2 |
| Transport, postal and warehousing | 0.1 | 0.0 | 3.0 | 0.1 | -1.2 |
| Information media and telecommunications | 2.6 | -1.6 | 5.0 | 4.3 | 0.6 |
| Financial and insurance services | 2.0 | 2.3 | 1.2 | -0.3 | 0.5 |
| Rental, hiring and real estate services | 2.1 | 0.1 | 2.9 | 2.0 | 0.3 |
| Professional, scientific and technical services | 3.6 | 7.4 | 4.8 | -3.5 | -3.2 |
| Administrative and support services | 5.5 | 4.3 | 1.4 | 1.1 | 1.3 |
| Arts and recreation services | 5.2 | 0.2 | 4.5 | 4.9 | 3.5 |
| Other services | 4.8 | 0.8 | 6.5 | 3.9 | 3.2 |
| Non-market sector (3 industries) | | | | | |
| Public administration and safety | 2.4 | 11.6 | NA | -8.3 | NA |
| Education and training | 2.3 | 2 | NA | 0.3 | NA |
| Health care and social assistance | 7.4 | 0.8 | NA | 6.6 | NA |
| All industries | 2.3 | 1.7 | NA | -0.2 | NA |

^a Some figures will not appear to add correctly due to rounding to one decimal place, for example labour productivity growth and hours growth not appearing to add to GVA.

Sources: Estimates based on: ABS (2019, *Australian System of National Accounts*, 2017-18, Cat. no. 5204.0, tables 1, 5, 15, 46 and 58); ABS (2019, *Estimates of Industry Multifactor Productivity*, 2017-18, Cat. no. 5260.0.55.002, tables 1, 6 and 14); ABS (*Labour Force, Australia, Detailed, Quarterly*, Cat no. 6291.0.55.003, Aug 2019, table 11); and ABS (unpublished data).

Productivity growth is a key source of long-term economic and income growth, and as such, is an important determinant of a country's average living standards (box 1). Conceptually, it seeks to quantify how efficiently resources, such as capital and labour, but also land, energy, environmental services, and other unpriced public goods, are used to produce output — the goods and services we consume every day.

This *PC Productivity Insights* paper analyses the most recent productivity trends at a highly-aggregated level, comprising labour productivity for the whole economy and both labour productivity and multifactor productivity for the market sector and its component industries (box 2). Annual data can be volatile, and subject to revisions and cyclical shocks. Medium-term trends over the past five years or longer periods generally provide a clearer guide to developments in the economy.

Overall, this year's data present a continuation of a pattern of weaker productivity outcomes evident in Australia since about 2005, in step with a slowing in productivity growth globally. Such high-level productivity measures rarely provide guidance to policy makers about specific problems to target, but the sustained weakness in productivity data is rightly cause for concern.

Box 1 Productivity gains drive down the cost of goods and services

Quoting just the increase in GDP per capita fails to capture the enormous change in lifestyle of everyday Australians, including the most disadvantaged members of society, since Federation. For example, the price of individual goods, in terms of hours a person needs to work in order to buy them, has fallen dramatically (table 3). Even housing rental costs, which have risen in real dollar terms, have fallen in labour time cost terms (on average, across the country) — the average person needed to work about 22 hours to rent a three bedroom house in 1901, while in 2019 the same person would need only need to have work for about 12 hours. A more dramatic example is the bicycle, which in 1901 would require several months of work to afford, now requires less than a day of work. These falling costs also likely understate the increased quality of most goods available now compared to what was available at Federation. For example, even the lowest quality new bicycles produced now are now much safer and easier to use than those produced at Federation.

More significant in the lives of many people, are the goods which are cheaply available now that had not been invented at Federation. Antibiotics, for example, have played a substantial role in lowering the mortality from infectious disease from about 301 per 100 000 people in 1907 to per 100 000 people in 2017 (AIHW 2019), and are available for about 9 minutes of work.

Since the turn of the millennium, the effect of productivity on the labour cost of goods has been mixed (figure below). The costs of many goods, have fallen dramatically — for example, the cost of clothing and footwear has decreased about 60 per cent. On the other hand, the labour cost of many products (mostly services and utilities) have increased substantially. It is notable that most of the increase in the labour cost of these goods occurred since 2012-13, coinciding with the recent wage stagnation and the peak of the mining boom.

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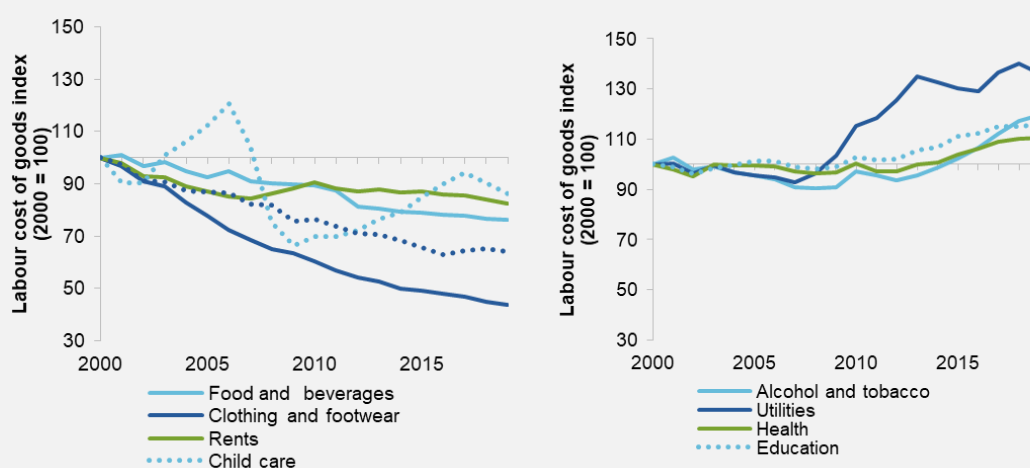
Box 1 (continued)

Hours of work needed to purchase particular goods in 1901, 2000 and 2019

| | 1901 | 2000 | 2019 |
|------------------------|---------|---------|---------|
| | Hours | Hours | Hours |
| Rent (3 bedroom house) | 22.1 | 13.9 | 11.8 |
| Bicycle | 527.4 | 17.8 | 7.5 |
| Game of football | 1.7 | 1.2 | 1.2 |
| | Minutes | Minutes | Minutes |
| Rump steak (1 kg) | 142.9 | 41.8 | 38.0 |
| Cigarettes (1 packet) | 51.0 | 37.4 | 92.5 |
| Antibiotics | na | 18.0 | 8.6 |
| Bread (a loaf) | 20.4 | 7.7 | 5.5 |
| Milk (1 litre) | 30.6 | 4.7 | 2.2 |

^a Calculated as the ratio of the average price of a good as a proportion of the average weekly earnings (before tax and including superannuation) multiplied by the average working week length. For 2000, the price of most goods is the unweighted average across the eight capital.

But more recently, only some products have fallen in labour time cost



The above figures show the effect of policy as well as broader economic trends on the living standards of Australians. Tax policy has been the primary contributor to the rising cost of alcohol and tobacco (PBO 2015; Scollo and Bayly 2019). In terms of economic trends, goods such as clothing and footwear, and food and beverages, have fallen in price more than labour-intensive service industries such as health care and higher education. This arguably reflects Baumol's 'cost disease', which describes the challenge of reducing relative cost in service sectors, compared with the 'goods' sector of the economy which is often more amenable to automation and capital deepening (Baumol 2013).

Sources: Commission estimates using ABS (2019, *Consumer Price Index, Australia, Sep 2019*, Cat. no. 6401.0; 2001, *Year Book Australia, 2001*, Cat. no. 1301.0) for prices of goods in 1901 and 2019, and for earnings in 2019, and Ville and Withers (2015, pp. 561–569) for earnings and a combination of Bergeaud et al. (2016), Ville and Withers (2015, pp. 561–569) and the Conference Board (2018) for hours worked in 1901, and for wage growth since 2000, ABS (2019, *Australian System of National Accounts, 2018-19*, Cat. no. 5204.0, table 1; 2019, *Estimates of Industry Multifactor Productivity, 2018-19*, Cat. no. 5260.0.55.002, tables 1–19).

Box 2 **Productivity: A primer**

What is productivity?

Productivity is a measure of the rate at which output of goods and services are produced per unit of input (labour, capital, raw materials, etc.). It is calculated as the ratio of the quantity of output produced to some measure of the quantity of inputs used.

Many factors can affect productivity growth. These include technological improvements, economies of scale and scope, workforce skills, management practices, changes in other inputs (such as capital), competitive pressures and the stage of the business cycle.

What are the main measures?

Labour productivity is the ratio of output to hours worked. Over the long term, wages generally grow in step with labour productivity and as such it is a key determinant of income growth.

Multifactor productivity (MFP) is the ratio of output to combined input of labour and capital. It is generally considered to be a better measure of technological change and efficiency improvements than labour productivity.

Usually, the growth in labour productivity exceeds the growth in multifactor productivity. The difference between the two is the contribution from 'capital deepening'. That is, the accumulation of more and better capital equipment over time helps to make workers more productive.

What parts of the economy are we measuring?

The most accurate estimates of productivity are for those industries where prices are set in markets — known as the 'market sector' — and where it is therefore easier to measure output (in terms of real industry gross value added). This publication provides estimates for the two market sectors used by the Australian Bureau of Statistics (ABS) — the 12 and 16 industry sectors — the latter distinguished by the fact that less historical data are available. Both labour productivity and multifactor productivity measures are available.

Labour productivity can also be measured for the whole economy (in terms of real GDP per hour worked). Labour productivity measured in this way contributes to growth in living standards (commonly measured as GDP per capita), but is a poorer indicator of technological change and efficiency improvement because of the difficulty measuring output in health, education and public administration.

How can productivity be compared across countries?

While productivity growth rates can be compared readily across countries, productivity level comparisons require estimates of relative price levels across countries. International comparisons of labour productivity levels in this *Insights Paper* reflect conversion to US dollars per hour worked based on current year purchasing power parity. International comparisons of multifactor productivity levels require further assumptions about fair rates of return to capital and are not widely published.

1 A strong labour market has supported continued economic growth

Output growth, while weak, continues Australia's recession-free streak

The Australian economy slowed in 2018-19. Economy-wide growth in output of goods and services, measured as real gross domestic product (GDP), was 2 per cent, its slowest pace in a decade. Output per person, measured as real GDP per capita, a commonly used measure of living standards, grew by only 0.4 per cent. Market sector output growth, measured as real gross valued-added (GVA), was 1.3 per cent, the slowest pace since records began in 1994-95 (ABS 2019b).

A number of industries detracted from overall growth in output this year. Drought conditions and rainfall deficiencies through much of New South Wales, South Australia and southern Queensland saw agricultural output contract for the second consecutive year. Construction and manufacturing also experienced decreases in GVA of 3.4 and 1.5 per cent respectively. These figures hide significant heterogeneity within industries — for example, heavy and civil engineering construction experienced an 8.8 per cent fall in GVA, while building construction increased 0.4 per cent (ABS 2019c).

On the other hand, some industries continued to grow strongly. Mining GVA grew 6.1 per cent due to an increase in gas extraction and export as liquefied natural gas, with output ramping up at the Wheatstone and Ichthys projects off the Western Australian coast (Office of the Chief Economist 2019, p. 61). Outside the market sector, the health, aged care and social assistance industry's GVA grew by 7.4 per cent due to strong growth in public expenditure.

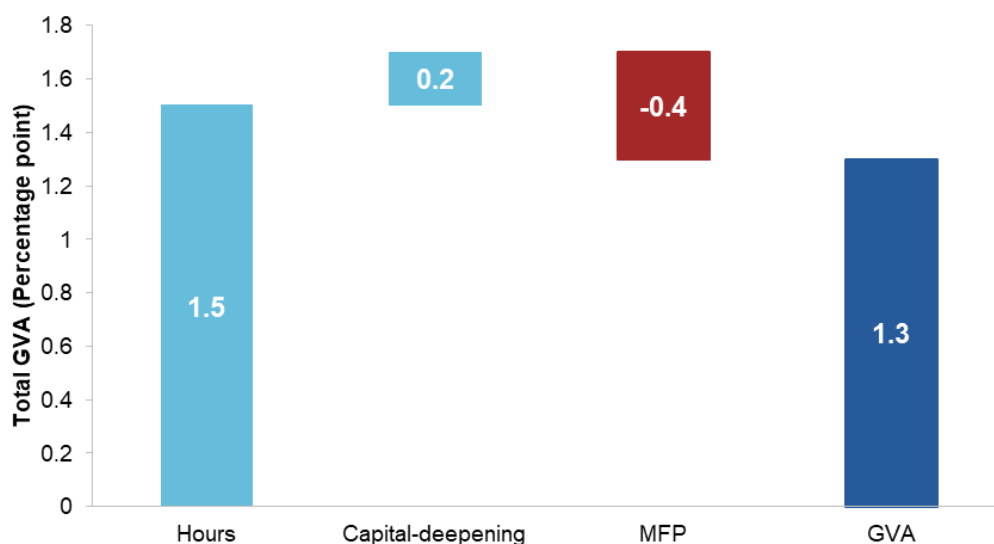
Overall, Australia has now extended its uninterrupted period of GDP growth to 28 consecutive financial years — with Australians not experiencing a recession since the 1990-91 financial year, before almost 40 per cent of the population were born.¹

¹ The *Australian Demographic Statistics* estimate there are 9 423 995 persons aged 28 years or younger, or about 38 per cent of the estimated 24 981 326 resident population (ABS 2019a).

Output growth has been driven by a strong labour market ...

The main driver of output growth was that more Australians were working. Total hours worked in the market sector grew by 1.5 per cent (figure 1), in line with population growth. This reflected an increase in the participation rate² of 0.2 percentage points to 65.7 per cent and a decline in the unemployment rate by 0.4 percentage points to 5.1 per cent, offset by a small decline in average hours worked (ABS 2019f).

Figure 1 **Output continued to grow due to growth in inputs ...**
Hours worked^a, GVA^b and contributions to labour productivity from capital-deepening and MFP in the market sector, 2018-19



^a The ABS published data is rounded to only one decimal place, which would make hours, capital-deepening and MFP not add to GVA. To avoid this issue, for visual purposes in this graphic, the Commission chose to round hours worked down to 1.5 rather than use the 1.6 published figure. ^b GVA = gross value added. The contribution from capital-deepening is calculated as the difference between labour productivity growth and multifactor productivity growth. MFP = multifactor productivity growth.

Source: ABS (2019, *Australian System of National Accounts, 2018-19*, Cat. no. 5204.0, table 13).

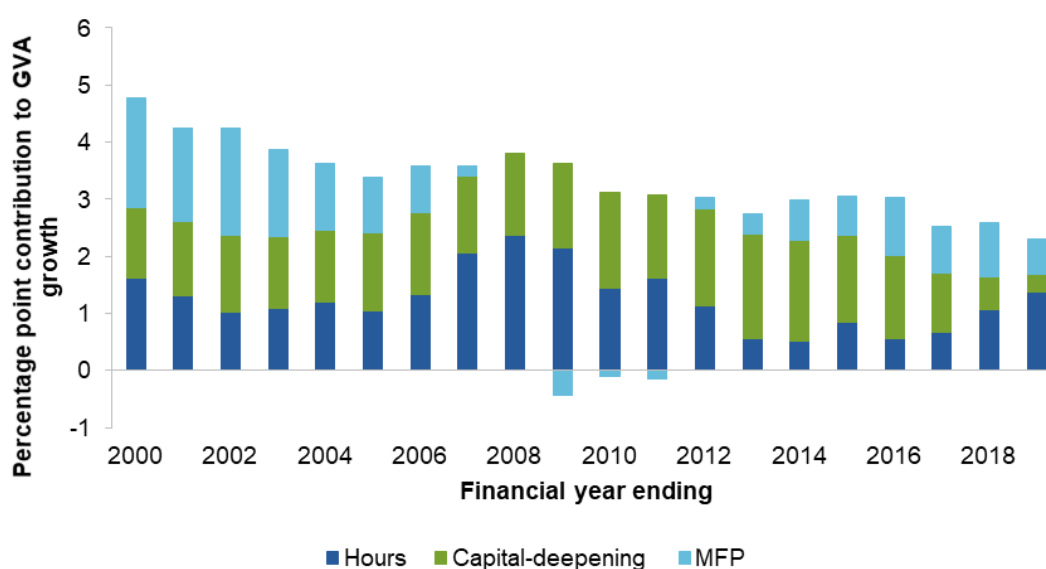
... while investment remains subdued

Capital services grew only slightly faster than hours worked in 2018-19. That is, the amount of capital available per worker increased and the effect of this capital deepening was to contribute about 0.2 percentage points to market sector output (figure 1). This only partly unwound the unusual ‘capital-shallowing’ observed in the previous year (PC 2019), with the level of capital per hour worked remaining lower than in 2016-17.

² The labour force participation rate is the percentage of people aged 15 years and over that are employed or unemployed.

Investment remains relatively weak by historical standards, which partly reflects the end of the mining investment boom (figure 2). The mining boom saw a massive investment in expansion of iron ore and coal facilities as well as the development of liquefied natural gas facilities and new natural gas fields on both the east and west coasts. Overall, real mining investment grew from about 2 per cent of GDP in 2003-04 to a peak of 9 per cent of GDP in 2012-13, but has since fallen to 3 per cent of GDP (figure 3). A high exchange rate during this period acted to ‘crowd out’ investment in other trade-exposed sectors, such as manufacturing (Tulip 2014).

Figure 2 ... led by strong labour markets ...
Five-year rolling average of growth in hours worked and MFP and the contribution from capital-deepening^a



^a GVA = Gross-value added. MFP = multifactor productivity. Capital-deepening is calculated as the difference between labour productivity growth and multifactor productivity growth. Average growth is the geometric average.

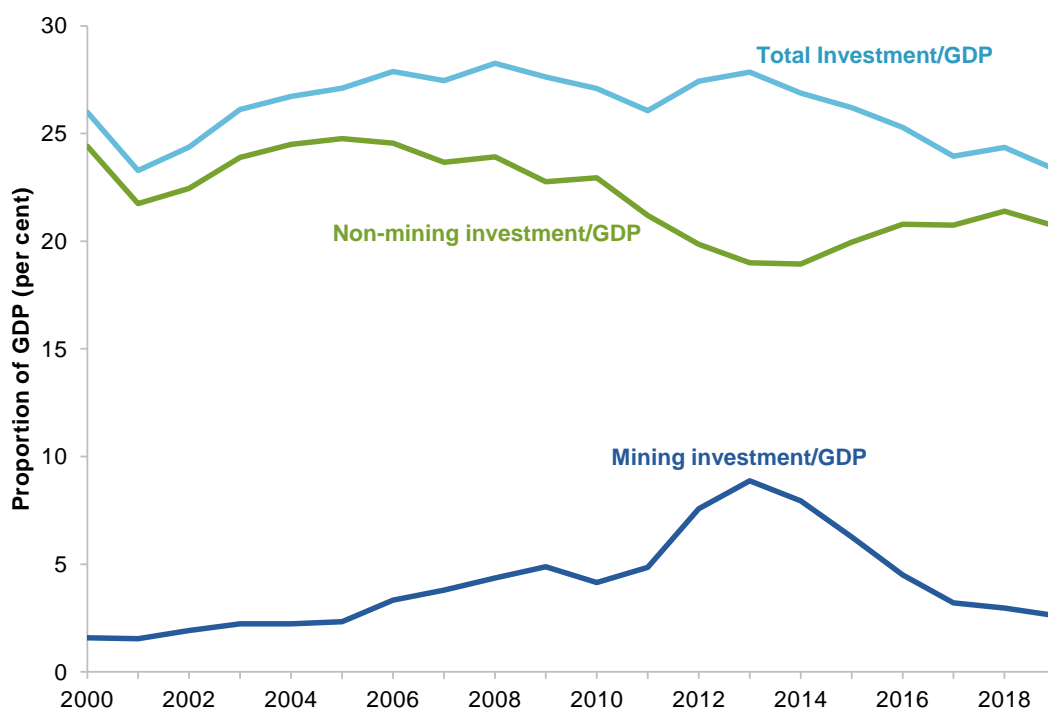
Source: ABS (2019, *Australian System of National Accounts, 2018-19*, Cat. no. 5204.0, table 13).

Outside the mining industry, however, investment has been trending lower as a share of GDP over the past two decades (figure 3). This underlying pattern of declining investment as a share of GDP is in step with patterns evident in advanced economies generally (Lowe 2013). Weakness in business confidence following the global financial crisis may have contributed, but structural forces are also at play.

The secular shift to a service-driven economy means a lower rate of investment in physical capital may be necessary in future. Instead, intangible investment — which is only partially

measured in the national accounts — is likely to play a stronger role.³ Outside the mining sector there has been little growth in real investment in machinery and equipment or buildings and structures, but measured investment in intellectual property has grown by about 5 per cent per year — led by strong growth in computer software (Lowe 2018b). The accompanying need for complementary investments such as reorganising work practices and retraining staff, are almost certainly large, but are not measured (OECD 2013). Best estimates for the United States and United Kingdom are intangible investment is now larger than tangible investment (Corrado, Hulten and Sichel 2009).⁴

Figure 3 ... while investment has remained weak since the mining boom
Ratios of total investment, mining investment and non-mining investment to GDP^a



^a Gross fixed capital formation in mining and all industries in each financial year in current prices as a proportion of GDP in current prices.

Source: ABS (2019, *Australian System of National Accounts, 2018-19*, Cat. no. 5204.0, tables 1 and 64).

³ In line with the UN System of National Accounts 2008, the ABS capitalises investment in R&D, software, artistic originals and mineral exploration, while other forms of intangible investment including brand equity, firm-specific human capital and organisational capital are treated as expenses and so not included in estimates of the capital stock (ABS 2018a).

⁴ The most recent comprehensive estimates for Australia (Barnes and McClure 2009) suggest intangible investment was around half the level of tangible investment in 2005-06.

Labour productivity declined this year, with poor outcomes across a range of industries

Slower growth in output this year was driven by falling productivity. Labour productivity — the amount of output produced with one hour of labour — in the market sector declined 0.2 per cent. Further, multifactor productivity — the amount of output for a given amount of labour and capital — in the market sector fell for the first time since 2011, declining by 0.4 per cent (figure 1 above).

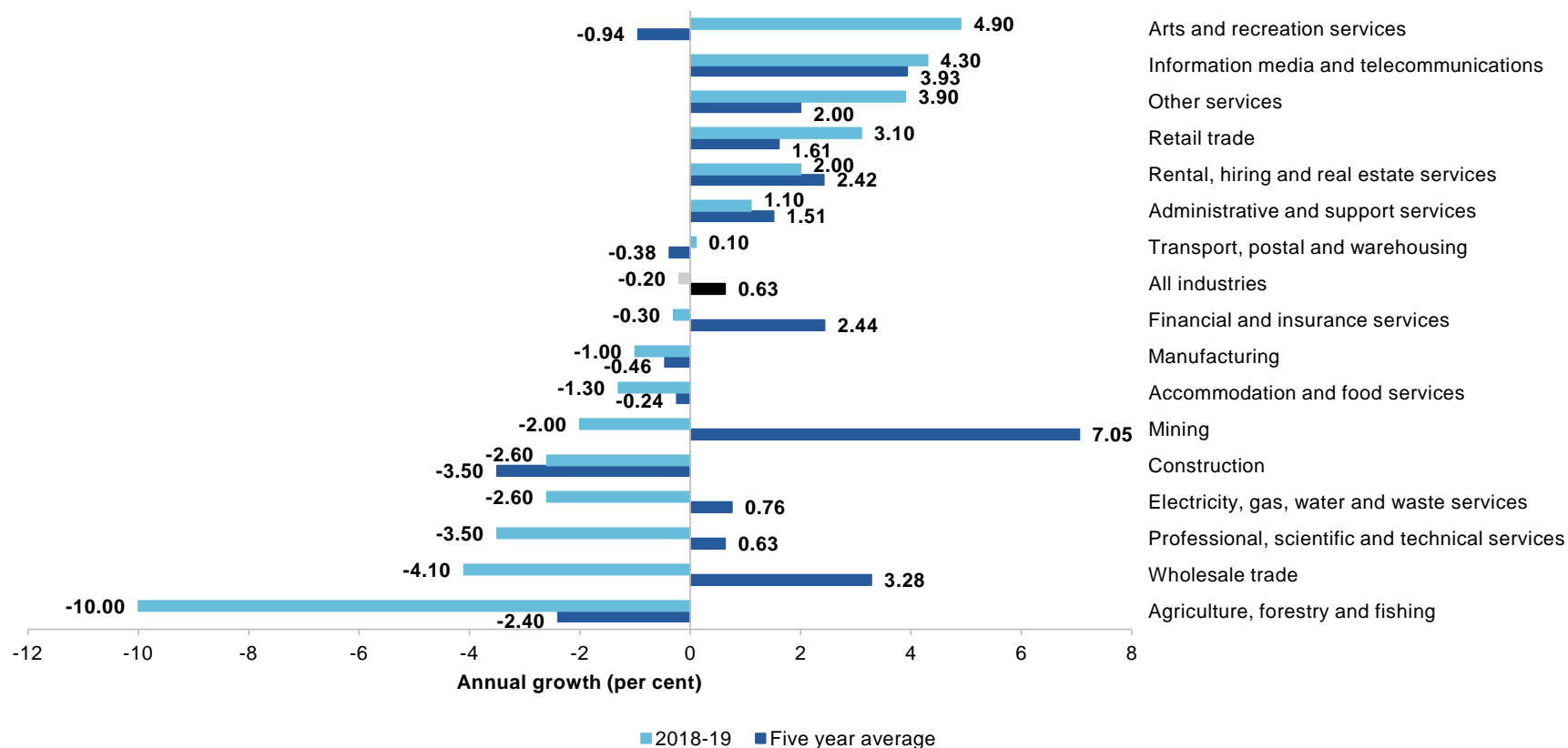
Although labour productivity fell across the market sector as a whole, outcomes varied by industry (figure 4). The largest fall in productivity occurred in the drought-affected agricultural sector. Six out of the 16 market sector industries increased their productivity, with the largest increase in arts and recreation (an industry that usually underperforms).

Mining productivity fell 2.0 per cent in 2018-19. This breaks a trend of impressive productivity growth over the past five years as output capacity came on stream following the recent period of heavy investment.⁵

Outcomes in multifactor productivity were also highly dispersed across industries (figure 5). The most noticeable difference between the labour productivity and multifactor productivity statistics was that while mining labour productivity fell, it had the strongest multifactor productivity growth of any industry in 2018-19. This reflects the strong growth in hours worked in the mining industry (about 8.2 per cent), which led to a slight capital shallowing despite the use of capital services actually increasing (about 1 per cent) (ABS 2019d).

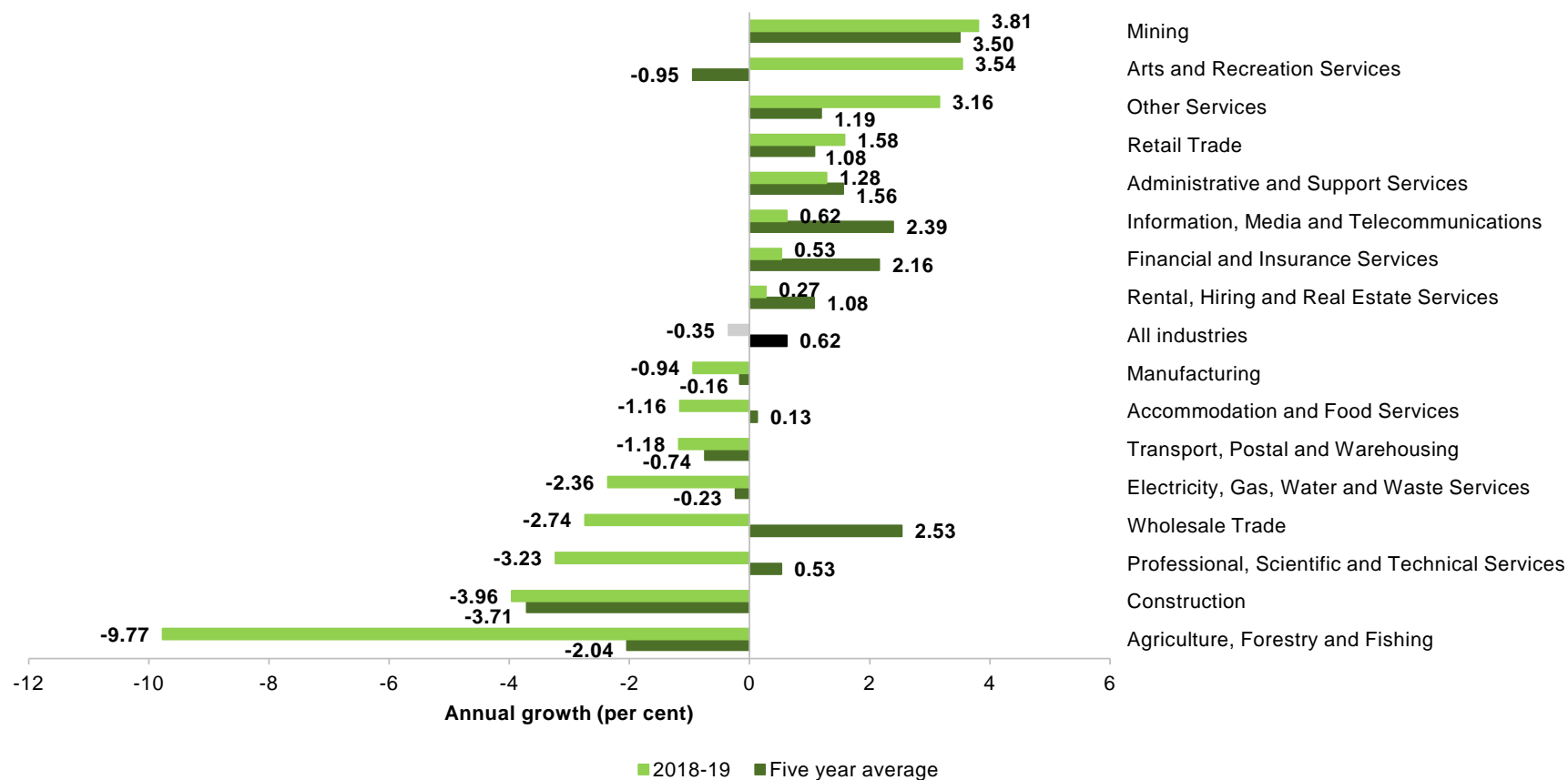
⁵ Mining productivity growth had been temporarily very weak at the height of the mining boom, as the time needed to build new projects is significant, so high commodity prices encouraged exploitation of more marginal, less productive, reserves using less efficient capital equipment in the interim (Topp, *et al.* 2008).

Figure 4 A highly uneven labour productivity performance ...
Labour productivity growth in market industries in 2018-19 and the past five years



Source: ABS (2019, *Australian System of National Accounts, 2018-19*, Cat. no. 5204.0, table 15).

Figure 5 **... and a similar unevenness in multifactor productivity**
Multifactor productivity growth in market industries in 2018-19 and the past five years



Source: ABS (2019, *Estimates of Industry Multifactor Productivity, 2018-19*, Cat. no. 5260.0.55.002, tables 1–19).

2 The productivity slowdown

Australia's recent weak productivity performance is part of a widespread slowdown since about 2005 seen across most of the developed world (figure 6).⁶ That said, although Australia's productivity growth has slowed, the slowdown has been less severe than in many other nations. In Australia's case, the slowdown in labour productivity is mainly due to slowing multifactor productivity growth (table 3).

Although there are many theories for why productivity growth has slowed, there is little consensus in the economics profession (box 3).

Table 3 The productivity decline is mostly due to a slowdown in multifactor productivity

Average growth rates and contributions^a of labour productivity, multifactor productivity and capital-deepening in the market sector

| | <i>1994-95 to 2004-05</i> | <i>2004-05 to 2018-19</i> | <i>Difference</i> |
|-------------------------------------|---------------------------|---------------------------|-------------------|
| | % | % | % |
| Labour productivity | 2.7 | 1.6 | -1.2 |
| Multifactor productivity | 1.4 | 0.4 | -1.1 |
| Contribution from capital-deepening | 1.3 | 1.2 | -0.1 |

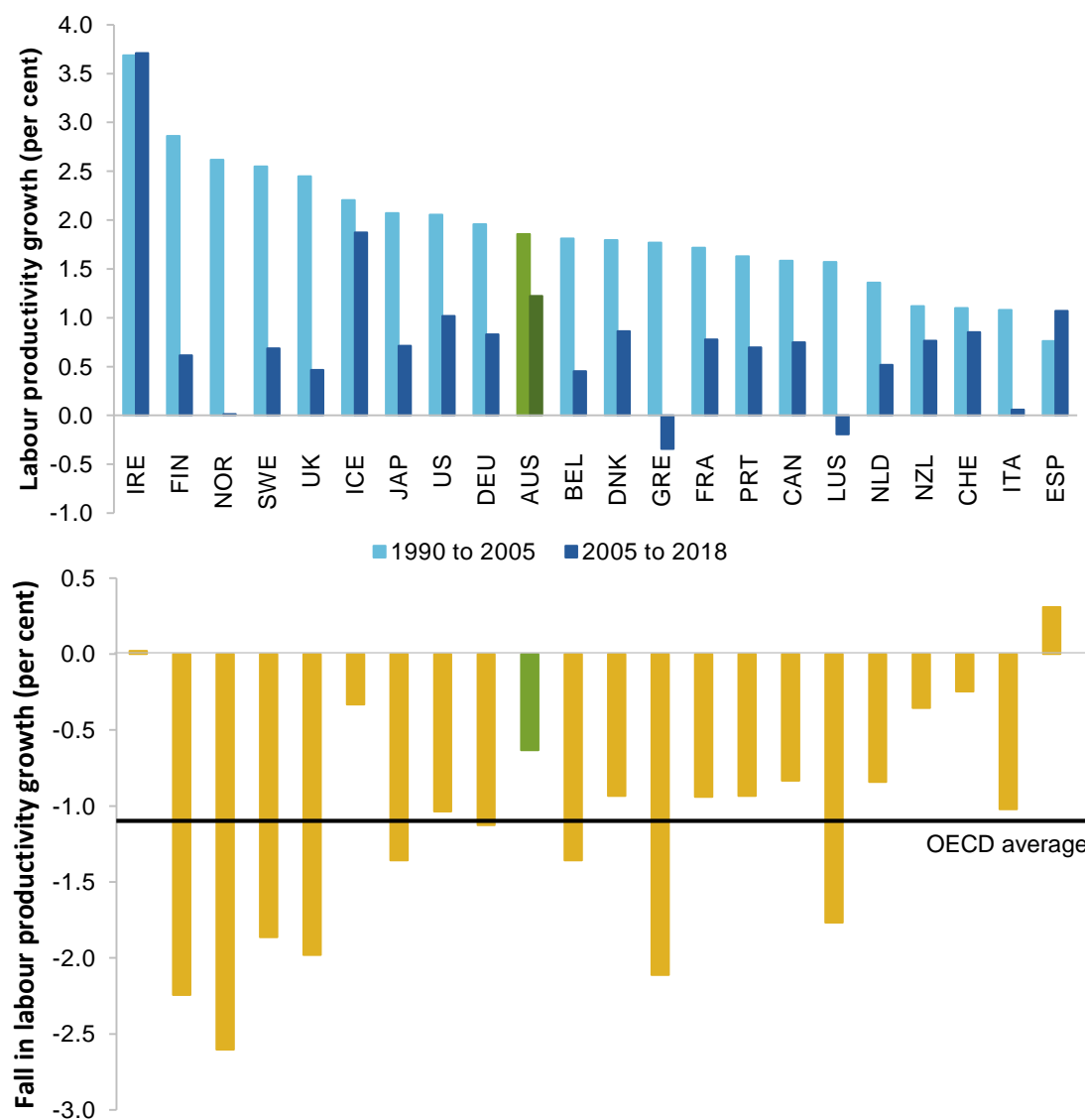
^a The contribution from capital-deepening was calculated as the difference between labour productivity and multifactor productivity growth. This approach makes the numbers align as closely as possible with headline ABS figures on productivity growth (though the contribution numbers may be different).

Source: ABS (2019, *Australian System of National Accounts, 2018-19*, Cat. no. 5204.0, table 13).

⁶ Labour productivity was chosen because it makes for easier cross-country comparisons than multifactor productivity, though the results are much the same when multifactor productivity growth is used instead.

Figure 6 The productivity slowdown was less severe in Australia

Labour productivity growth in OECD countries^a (top panel) and the fall in annual productivity growth after 2005 (bottom panel)



^a Includes only the 24 longest standing OECD countries, except for Turkey and Austria due to data availability. FIN = Finland, NOR = Norway, SWE = Sweden, ISL = Israel, JPN = Japan, USA = United States of America, DEU = Germany, AUS = Australia, BEL = Belgium, DNK = Denmark, GRC = Greece, FRA = France, PRT = Portugal, CAN = Canada, LUX = Luxembourg, NLD = The Netherlands, NZL = New Zealand, CHE = Chile, ITA = Italy, ESP = Spain.

Source: Commission estimates based on OECD Stat database.

Box 3 **Explanations for the global productivity slowdown**

In a supporting paper of *Shifting the Dial: 5 year productivity review*, the Commission outlined numerous potential explanations for the global fall in productivity growth:

- *Measurement issues* — many information technology services have value over and above what is captured in their prices, and have had quality improvements that are also not captured in their prices (Productivity Commission 2017, pp. 29–30). However, it is unclear whether these are issues would explain the patterns of the slowdown, as productivity growth has slowed across a number of industries, not just information technology.
- *Slower diffusion of technology* — some studies have suggested that the gap between the most productive and least productive firms in the economy has increased over time (Andrews, Criscuolo and Gal 2015). However, there are differences in these patterns across countries and limitations with available data sets.⁷
- *The effects of globalisation on industry composition* — increasing openness, ease of trade and trade intensity have, among other factors, generally led to a reduction in the size of the tradable sector in developed nations and this sector generally has higher productivity than the non-tradeable sector. However, some studies cast doubt on this — for example, Goodridge et al. (2018) found that labour reallocation had contributed positively towards productivity in the United Kingdom, rather than reducing it. Further, the evidence presented in this *Insights Paper* is similar, with reallocation towards mining raising productivity (below).
- *Investment in knowledge-based capital* — technical progress is driven by innovation, which requires investment in different forms of knowledge-based capital (including R&D, intellectual property etc.). Hence, the observed lower rate of knowledge-based capital accumulation may be a contributing factor (Productivity Commission 2017, p. 36).
- *Changes in the nature of technology progress* — this encompasses many different theories whose common thread is that new technological breakthroughs are either less likely to occur (due to higher cost or fewer opportunities for improvement) or less likely to yield the benefits that previous discoveries did (Productivity Commission 2017, p. 37).
- *Macroeconomic environment* — the slowdown in productivity growth has coincided with the Global Financial Crisis and its associated macroeconomic effects including a build-up of debt in developed countries (and a ‘savings glut’ in developing countries), a ‘liquidity trap’ as interest rates hit the zero lower bound, and ‘secular stagnation’ (Productivity Commission 2017, pp. 38–39).

Sectoral aspects of the productivity slowdown

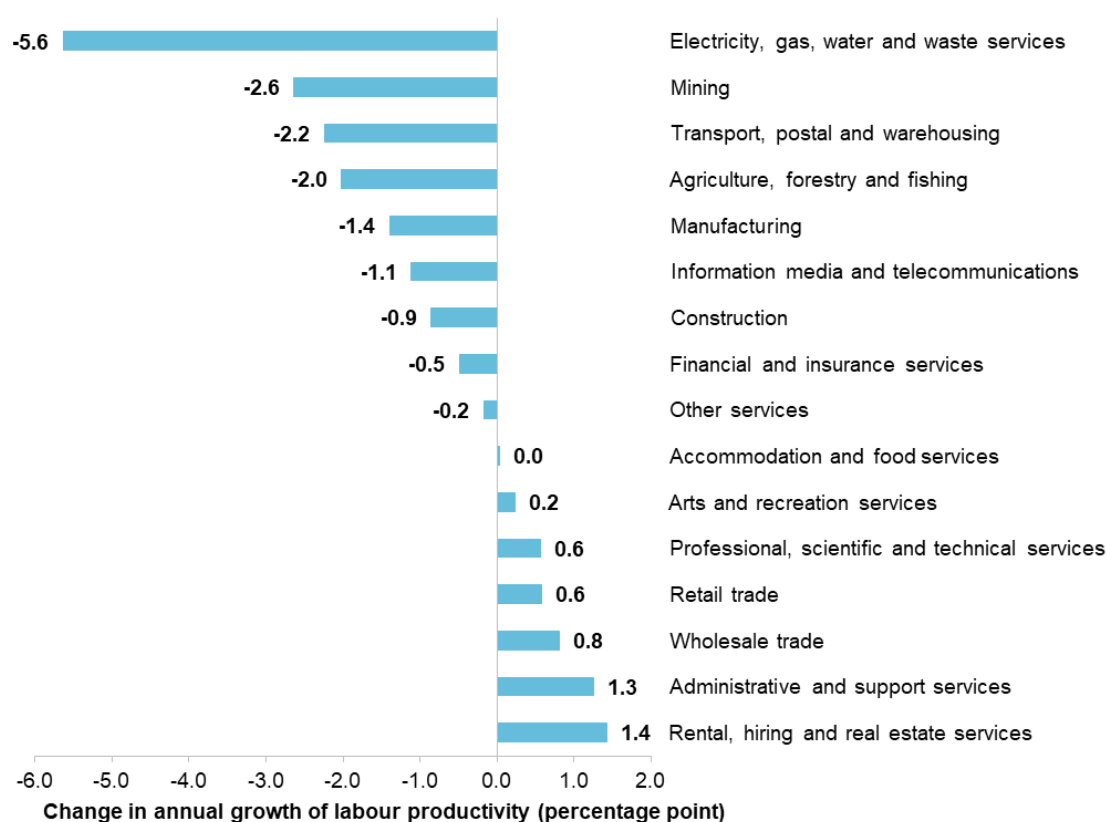
Investigation of the contributions of particular industries to overall productivity growth over time can reveal insights but until now has received little attention.

⁷ These papers typically take firm-level sales and deflate them by industry-level prices. This means that firms with higher than average prices have their production overestimated and vice versa for low price firms. Several papers (Foster, Haltiwanger and Syverson 2005; Klette and Griliches 1996) have shown that this approach can lead to biased estimates of productivity and the production function. The effect in studies of firm-level productivity dispersion is unclear.

Overall, there are a few notable sectorial trends. First, the slowdown in productivity growth that has occurred since 2005 varies significantly across industries (figure 7). Utilities had annual labour productivity growth that was 5.6 percentage points lower after 2005 compared to before 2005, while labour productivity actually grew faster after 2005 in seven out of the sixteen market sector industries.

Figure 7 Most industries saw a productivity slowdown after 2005 ...

Difference in labour productivity growth rates, by industry, for 2004-05 to 2018-19 compared to 1974-75 to 2004-05



Source: Commission estimates using data from ABS (2019, *Estimates of Industry Multifactor Productivity, 2018-19*, Cat. no. 5260.0.55.002, tables 1-19) and unpublished ABS data.

Second, reallocation of labour between industries has become an increasingly important source of growth since 2005 due to the mining boom. While labour productivity fell slightly *within* the mining industry after 2005 and this subtracted from labour productivity growth, the movement of labour *between* industries (into the mining industry, allowing the sector to grow rapidly) added to labour productivity growth, as mining has a very high level of labour productivity compared with other industries. So for the mining sector, the beneficial effect of this labour reallocation was larger, resulting in an additional 0.4 percentage points of growth in market sector labour productivity since 2005 (table 4). However, across all

industries, within-industry productivity growth was still the more important factor in determining aggregate productivity growth.

This finding can be interpreted in either a positive or negative light. The positive perspective is that the Australian economy has shown remarkable flexibility in seizing the opportunities presented by the largest terms of trade boom since Federation. This experience contrasts sharply with that during the earlier, much smaller terms of trade boom of the early 1970s, when adjustment between industries proved more difficult and ultimately fuelled a ‘wage-price spiral’ across the whole economy (Gruen 2011).

More negatively, the implication is that the slowdown in labour productivity within industries has been even sharper than the market sector aggregates may suggest. The addition to labour productivity growth provided by movement of workers into the mining sector is an unusual, perhaps once-off, benefit. All else held equal, without the benefits from movement of workers between industries, labour productivity growth in the market sector would have fallen from 2.4 per cent per year over the three decades to 2005 to just 1.3 per cent in the subsequent period.⁸ This slowdown within industries is broadly in line with the average slowdown across OECD countries. That is, the opportunity the mining boom presented to move workers into highly productivity activities explains in part why the labour productivity slowdown in Australia has appeared less severe than in other countries.

Table 4 ... but labour reallocation between industries offset some of the slowdown

Average annual growth in aggregate labour productivity, and the percentage point contribution of within and between industry effects to this growth

| <i>Period of time</i> | <i>Average growth</i> | <i>Within effects</i> | <i>Between effects</i> |
|-----------------------|-----------------------|-----------------------|------------------------|
| Financial years | per cent | percentage points | percentage points |
| 1975 to 2005 | 2.5 | 2.4 | 0.1 |
| 2005 to 2018 | 1.7 | 1.3 | 0.4 |
| Difference | 0.8 | 1.1 | -0.3 |

Sources: Commission estimates using data from ABS (2018, *Estimates of Industry Multifactor Productivity, 2017-18*, Cat. no. 5260.0.55.002, tables 1–19) and unpublished ABS data.

Third, slower labour productivity growth in three particular industries explains about 90 per cent of the overall productivity slowdown (figure 8).

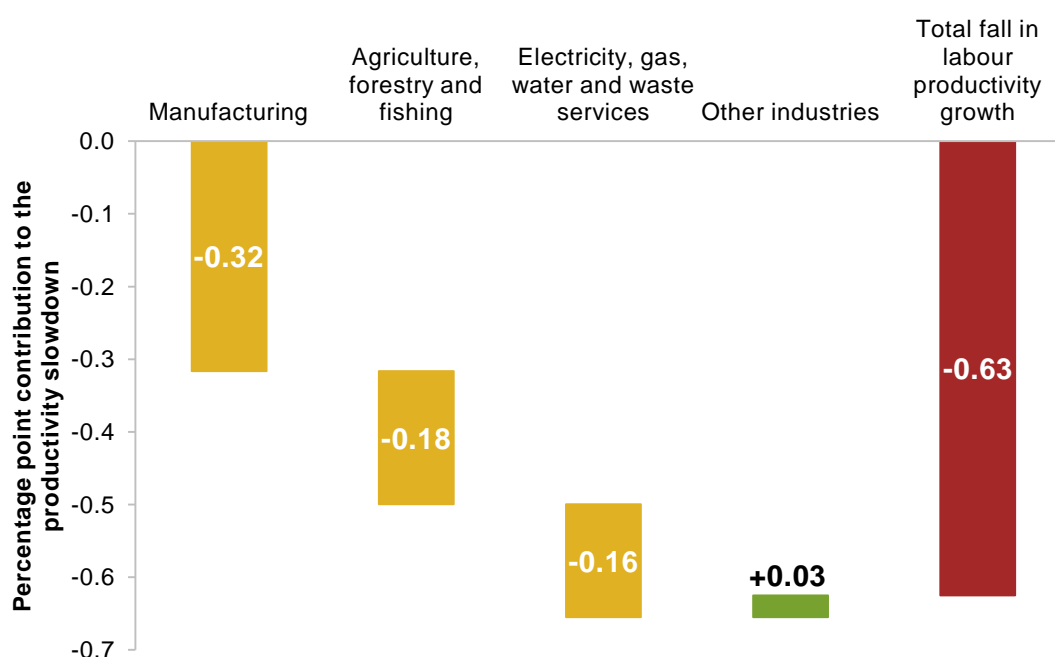
- Both the manufacturing industry, which is responsible for nearly half of the slowdown, and agriculture, which is responsible for almost a quarter, had much weaker productivity growth relative to earlier decades, as well as a falling share of the economy. This may

⁸ Such a counterfactual is impossible to know with any certainty because the mining boom likely affected gross domestic income in other unmeasurable ways. For example, mining productivity may have increased there had been no resources boom, as high prices during the boom encouraged investment in very more marginal extraction. Further, without the crowding out of non-mining investment by the high exchange rate, capital deepening might have contributed more to productivity growth in other industries.

simply reflect the one off benefits of the increased competition that both industries were exposed to as Australia dismantled its trade barriers over the past 40 years. Alternatively, it could represent fewer recent technical discoveries that are applicable to these industries (box 3 above).

- Similarly, the electricity, gas, water and waste services industry, which was a target of microeconomic reforms through the 1980s and 1990s and made a strong contribution to labour productivity at that time, has since given up those gains and overall detracted from productivity growth during the period after 2005. The negative contribution of this industry, however, was partially offset by its increasing share of the workforce (even though this industry had mediocre *growth* in productivity, it has a high *level* of productivity relative to other industries).

Figure 8 Three industries explain most of the slowdown
Percentage point contribution of select industries to the labour productivity slowdown



Sources: Commission estimates using data from ABS (2019, *Estimates of Industry Multifactor Productivity, 2018-19*, Cat. no. 5260.0.55.002, tables 1–19) and unpublished ABS data.

3 Strong terms of trade have allowed incomes to outgrow productivity over the past 20 years

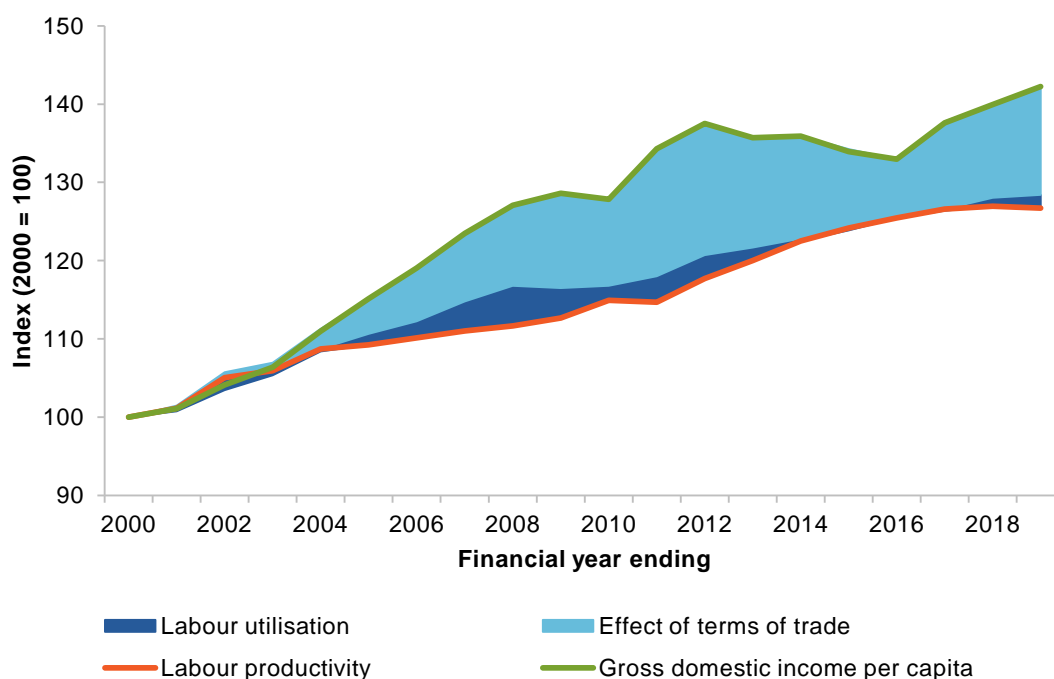
While labour productivity is the dominant long-term driver of incomes, the past two decades have seen favourable changes in the world price of Australian exports compared with the price of Australian imports (the ratio of the two is referred to as the ‘terms of trade’). This has allowed Australia to sustain strong growth in incomes despite weak productivity.

The *direct* effect of the terms of trade on incomes is to increase the volume of goods Australians can consume (including imports) by selling what they produce. This is measured in the national accounts as ‘gross domestic income’ (GDI). However, Australia sourced significant amounts of capital from overseas to fund the enormous investment in the mining sector, so interest payments will flow overseas for some time. Similarly, Australia’s largest mining companies are about 80 per cent foreign owned⁹ and, as such, most of the mining company profits made during the commodity price boom accrued to foreign shareholders. Now that many of these mines have become productive, it is likely more dividends will be paid and a larger portion of the terms of trade benefits will flow overseas (Gregory 2012, p. 192).

The income of Australians (adjusted for foreign income outflows) is recorded in the national accounts as gross national income (GNI). So far, the direct benefits of the terms of trade boom to Australian incomes have been much larger than the indirect costs of foreign income outflows. While GDP per capita has grown 28 per cent since 2000, the terms of trade has caused GDI per capita to increase 42 per cent (figure 9), while GNI per capita has grown by almost the same amount (the difference from GDI is so small it was omitted from the figure), after adjusting for negligible foreign income outflows to date.

⁹ Foreign ownership is very difficult to measure accurately, given the global nature of capital markets. Older estimates by Connolly and Orsmond (2011, p. 38) which focused on iron ore, coal and LNG producers put the figure at about 80 per cent. More recent estimates which focused on the locality of stock owners estimated about 90 per cent foreign ownership for BHP and 85 per cent for Rio Tinto (Fernades 2019).

Figure 9 Strong terms of trade have increased the income from production^{a,b,c}
 The effects of the terms of trade, labour utilisation and labour productivity on gross domestic income per capita



^a The effect of the terms of trade is approximated as the difference between growth in gross domestic product per capita and gross domestic income per capita. ^b The effect of labour utilisation is approximated by the difference between the growth in GDP per capita and labour productivity. ^c The effect of net foreign income flows is approximated by the difference between the growth rate of gross national income per capita and gross domestic income per capita.

Source: ABS (2019, *Australian System of National Accounts, 2018-19*, Cat. no. 5204.0).

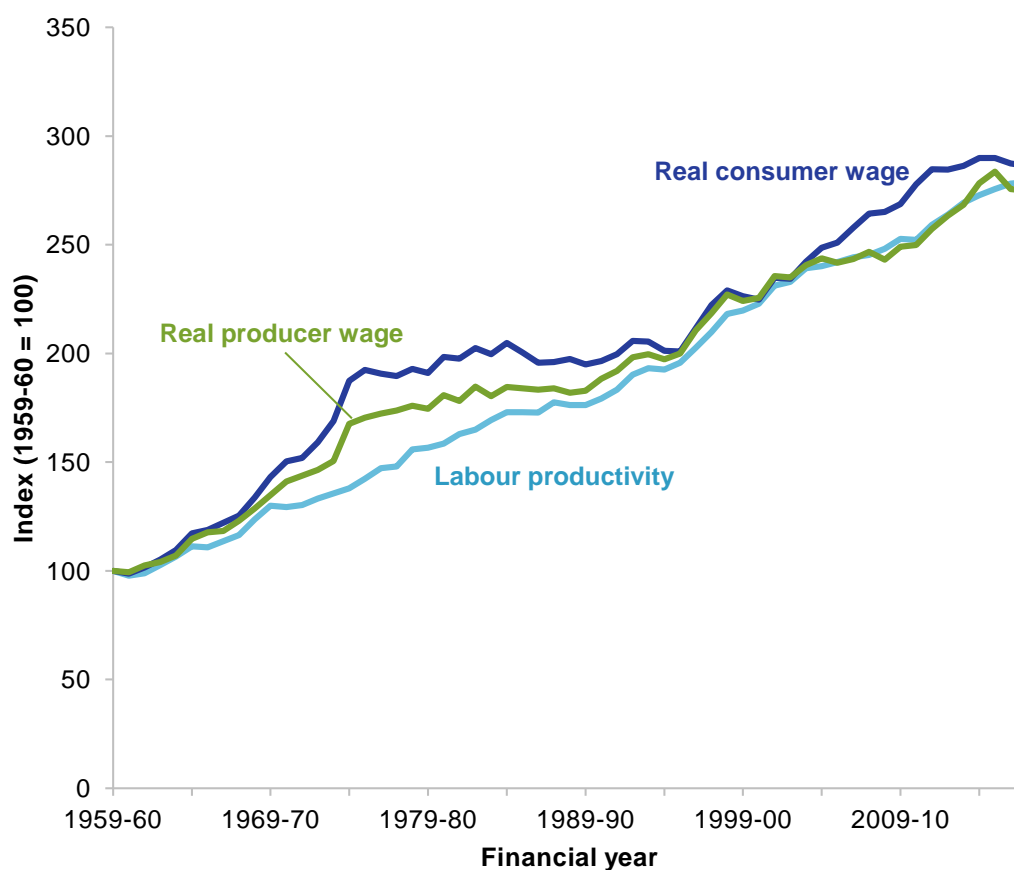
Wage growth has stagnated since 2012-13 ...

During the mining boom, wage growth outpaced labour productivity by a significant margin until about 2012-13. Since this time, wage growth has stagnated, despite labour productivity continuing to grow (figures 10). Numerous explanations have emerged for this ‘wage growth puzzle’, with answers ranging from too little labour market dynamism to too much casualisation, part-time work and job insecurity (box 4).

The Commission has previously noted (PC 2019) that part of the problem is one of framing — from the employer’s perspective, the wage cost of employees has continued to grow broadly in line with labour productivity throughout the period. During the mining boom, much of the benefit of a higher exchange rate was, desirably, passed through to workers as higher purchasing power. But as the commodity price boom has dissipated and the exchange

rate has fallen, much of the effect has similarly passed through to consumers as slower growth in the purchasing power of their wages.

Figure 10 The degree of stagnation depends on how you measure wages
Labour productivity, consumer and producer wages^a from 1959-60 to 2017-18



^a Consumer wages are wage deflated by the Consumer Price Index, while Producer wages are wages deflated by the GDP Deflator (as a proxy for the Producer Price Index). Both wages comprise compensation of employees from the National Accounts, plus imputed labour income of the self-employed, calculated using the approach described in the data annex.

Sources: Commission estimates using data from ABS (2019, *Estimates of Industry Multifactor Productivity, 2018-19*, Cat. no. 5260.0.55.002, tables 1-19) and unpublished ABS data.

Box 4 **Other explanations for the recent wage stagnation**

Last year's *PC Productivity Bulletin* presented an overview of the Australian literature on the wage slowdown. That overview is reiterated here with some updates:

- Spare capacity in the labour market (Heath 2018; Jacobs and Rush 2015; Lowe 2018a; Treasury 2017), particularly given that the gap between the unemployment and underemployment rate (which used to be positive) has become negative since 2002 and has widened in the more recent period from November 2013 (ABS 2019f). However, overall underutilisation rates have kept steady since 2013, while labour force participation rates have been rising, suggestive of less discouraged workers and a tighter labour market. Total vacancies peaked at the end of 2018 (and were higher than any time over the last decade), before falling slightly in 2019 (ABS 2019e). Nevertheless, it may be that the level of labour utilisation that creates wage pressures has shifted upwards, which would imply that increased aggregate demand could lift wage growth without raising inflation. The Reserve Bank of Australia has overestimated wages since 2011 because the historically stable relationships used for forecasts have broken down (Cassidy 2019).
- Declining inflationary expectations, although this seems unlikely to explain the full observed magnitude of real wage growth stagnation (Jacobs and Rush 2015; Treasury 2017).
- Globalisation, increased import competition, outsourcing and a lower terms of trade putting pressure on firms to constrain costs, with the need for the real exchange rate to adjust to improve international competitiveness of Australian firms (Weir 2018). However, these factors would need to be reconciled with stable or increasing business profitability.
- Structural change and increased employment in lower productivity activities. While this may be an explanation for longer-term slower wage growth, the recent decline in wage growth appears to be more a within-industry than between-industry outcome (Weir 2018), which is not consistent with a standard structural change argument (Coelli and Borland 2016).
- The large expansion in the number of immigrant workers, especially temporary migrants (including working students). The evidence to date does not suggest that this has played a major role (Brell and Dustmann 2019; Breunig, Deutscher and To 2017).
- Increasing casualisation of the workforce, part-time employment and job insecurity (whether actual or perceived) (Lowe 2018a; Treasury 2017; Weir 2018). In fact, part-time employment trends aside, labour job tenure has increased, casualization and self-employment rates are stable and perceptions of insecurity have fallen (Borland 2017; PC 2018, p. 91). The trend in part-time work, while still broadly upwards, has slowed noticeably for the period from mid-2003 to February 2019. Econometric analysis does not find any impacts (Lass and Wooden 2019).
- Weaker labour market dynamism as measured by slowing rates of job-to-job transition. Such transitions often reflect employee job changes to better use their skills (or acquire new ones) or the shift from lower to higher productivity firms, with associated wage increases. There is good evidence of wage pressures through this mechanism for the United States (Danninger 2016; Moscarini and Postel-Vinay 2017) and some OECD countries (Engbom 2017). However, ABS data suggest small changes in the share of people with less than 5 years tenure with businesses from 1972 to 2018, and no change since 1994 (ABS 2018b). That said, the employer-to-employer transition rate did fall during the recent period of wage stagnation, while the frequency of wage changes in the economy has fallen, also consistent with the impact of lower transition rates (Cassidy 2019).

(continued next page)

Box 4 (continued)

- Changes to workplace relations laws that weaken employee bargaining and declining union membership (Weir 2018). However, the union wage growth premium — an indication of union bargaining power — has not declined (Bishop and Chan 2019). That finding would not rule out weaker bargaining power by workers generally — whether represented by unions or not.
- Changes in the quality and composition of labour services, suggested by the fact that the stagnation evident from the wage price index (which controls for these changes) is less than for other wage measures that do not.
- Falling usage of collective bargaining beginning about the same time as falling wage growth — the number of current federal enterprise agreements fell by 54 per cent between June 2012 and December 2018 (Gilfillan 2019), although this is only a correlation, with the ultimate causes being unclear.

Other economies have also experienced an appreciable slowing in real wages growth over recent years (OECD 2018), though a (partly) shared pattern across countries does not imply a shared explanation. Nor should there be an expectation that one factor lies behind wage stagnation. For instance, adaptation of prices to the resources boom may be a partial explanation in the Australian context, but the boom may have masked other longer-run trends. As yet there is no consensus about the causes of the stagnation or its likely persistence.

While aggregate data of the kind described in this Insights Paper provides some insights, data obtained from longitudinal firm and employee-based surveys will ultimately shed most light on the sources of wage stagnation and its incidence among different types of employees and firms. In Australia, the most promising insights will likely arise from analysis of the Linked Employer-Employee Database (LEED), and the Business Longitudinal Analysis Data Environment (BLADE). Using these datasets, Treasury has recently found evidence of:

- a breaking of the link between productivity improvements and wages growth at the firm level after 2012-13 (Andrews et al. 2019).
- weaker job switching at a firm level (falling from about 11 per cent to 8 per cent) being associated with slower wage growth, even for those who do not switch jobs (Quinn 2019).

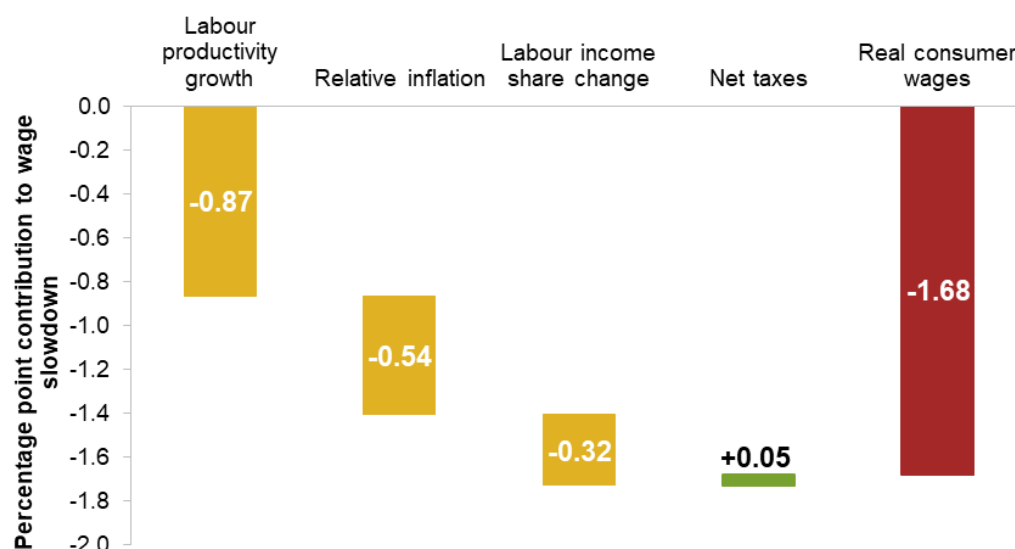
... and productivity appears to be the biggest contributor ...

Using some simple accounting identities, the Commission has decomposed the drivers of wages growth (in consumer wages in the market sector) in the periods 1994-95 to 2012-2013 and 2012-13 to 2017-18, and identified the key, proximate causes of the recent wage slowdown (figure 11, full methodological details are in appendix A). Overall, slower labour productivity growth explains over half of the fall in consumer wages growth, with relative consumer inflation (consumer prices growing more quickly than producer prices) and the fall in the labour share of income explaining about a quarter and a fifth respectively.

As discussed in last year's *PC Productivity Bulletin*, the rise in consumer price inflation relative to producer price inflation is mostly due to a fall in the terms of trade, so it is unlikely to be an ongoing cause of wage stagnation. However, it is possible that labour productivity

will continue growing at historically slower rates indefinitely and that the labour share of income may fall again in the future.

Figure 11 Slower labour productivity growth and higher consumer inflation are the main causes of the slow wage growth
Key contributors to the post 2012-13 slowdown in consumer wages growth in the market sector^a



^a The effect of the relative rise in consumer prices was calculated as the difference in growth between consumer inflation and producer price inflation. The contribution of the labour productivity slowdown was the difference between the growth in total factor income (per hour worked) and growth in producer wages, and the fall in the labour share of income was the proportional fall in the labour share of income. Other factors are the changes in taxes and subsidies that meant that growth in labour productivity was not quite equal to growth in total factor income per hour.

Sources: Commission estimates using data from ABS (2019, *Australian National Accounts: National Income, Expenditure and Product, Jun 2019*, Cat. no. 5206.0, table 34; 2019, *Consumer Price Index, Australia, Sep 2019*, Cat. no. 6401.0, tables 1 and 2; 2019, *Estimates of Industry Multifactor Productivity, 2018-19*, Cat. no. 5260.0.55.002, tables 1-19.

... and the falling labour share of income played a role

As discussed, a key contributor to the recent wage slowdown is the falling labour share of income, which measures total compensation of employees including wages, superannuation and allowances¹⁰ as a share of total factor income.

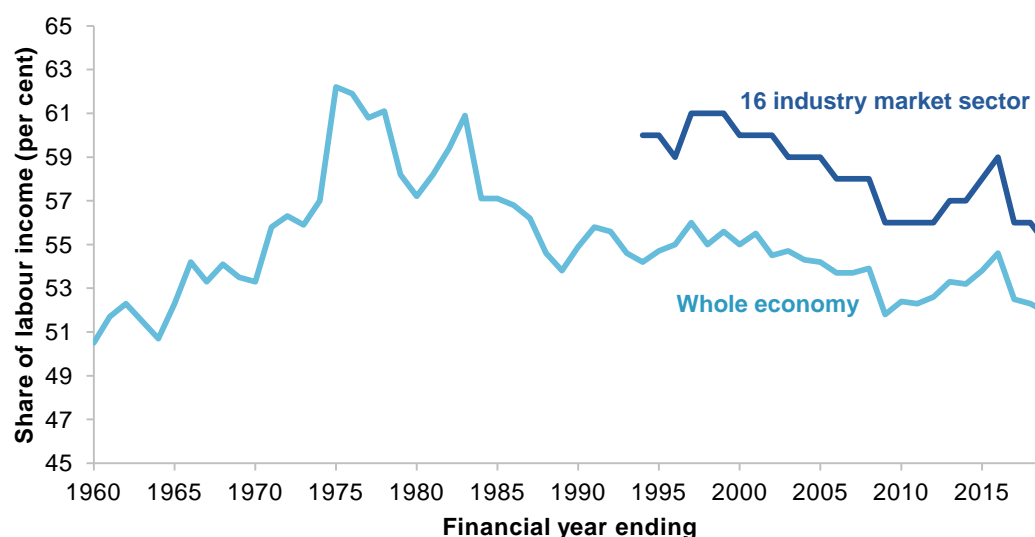
In Australia, as in many other advanced economies (Dao et al. 2017), the labour share of income has been drifting lower over time. Although wages have only been stagnant since 2012-13, the labour share of income has been declining over a longer period, falling by about

¹⁰ ABS estimates include adjustments for the implicit labour income of proprietors of unincorporated businesses as part of their industry productivity database.

4.4 percentage points since the turn of the century (figure 12). The labour income share also fell between the 1970s and the early 2000s, following a sharp rise in the late 1960s and early 1970s. This decline reflects the unwinding of a wage-price spike in the 1970s that resulted in heightened unemployment and ultimately led to workplace relations reforms through the Prices and Wages Accords and eventually enterprise bargaining in order to restore labour market equilibrium. That is, movements in earlier periods had very different causes and should not be confounded with more recent developments. Overall, the labour share of income has actually risen slightly compared to its value in 1960 (excluding gross mixed income, figure 12).

Figure 12 The labour share of income has fallen since 2000 ...

Labour share of income^a in the whole economy^b since 1959-60 and the 16 industry market sector since 1993-94



^a Labour share of income is calculated as compensation of employees plus the income of self-employed business owners. ^b The whole economy figures exclude gross mixed income and so there is a level difference between this series and the series for the market sector (which does include gross mixed income).

Sources: Commission estimates using data from ABS (2019, *Australian System of National Accounts, 2018-19*, Cat. no. 5204.0; 2019, *Estimates of Industry Multifactor Productivity, 2018-19*, Cat. no. 5260.0.55.002, tables 1-19).

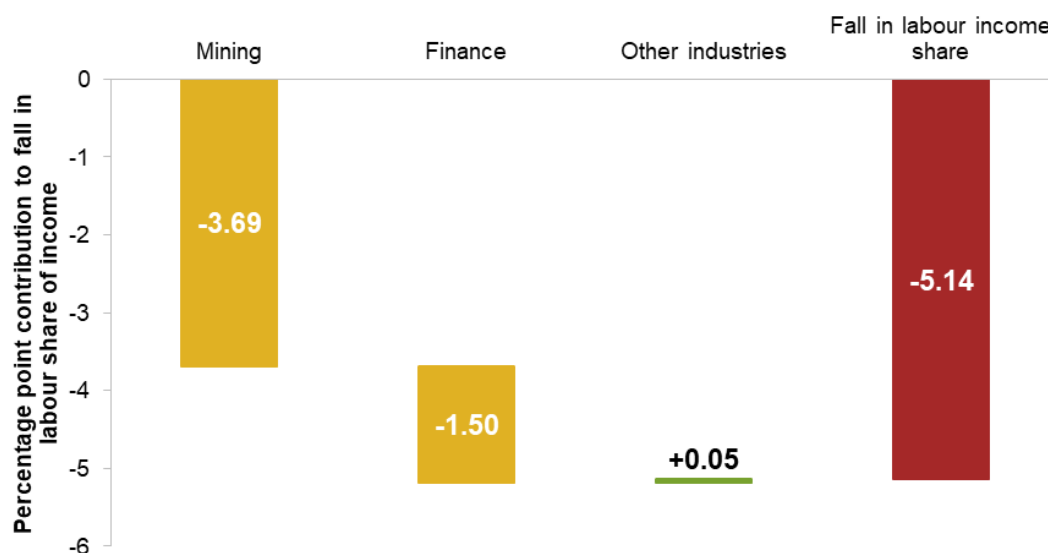
However, as with the slowdown in labour productivity, movements in the labour share of income need to be considered in the context of substantial structural change in the economy (including the mining boom). Two main explanations for the decline in the labour share stand out from the detailed analysis in appendix A.

- First, the labour share of income has fallen because of growth in the size of the mining sector (explaining about 80 per cent of the fall), which is naturally a highly capital-intensive industry.

- Second, the labour income share has fallen because the finance and insurance sector has become more profitable. Together, these two changes account for almost all of the overall decline (figure 13).

Australia's experience of labour reallocation (mainly to mining) explaining a significant proportion of the fall in the labour share of income is unusual among developed nations, where fall in the labour share of income are mostly driven by within-industry changes (Dao et al. 2017, p. 39). Australia's uniqueness may be due to the small size and specialisation of its economy and the scale and unrepresented nature of the recent terms of trade boom.

Figure 13 ... due to growth in the mining sector and the increasing profitability of financial services
Percentage point contribution of each industry to the fall in the labour share of income from 1999-00 to 2018-19



Sources: Commission estimates based on figures in ABS (2019, *Australian System of National Accounts, 2018-19*, Cat. no. 5204.0, table 5; 2019, *Estimates of Industry Multifactor Productivity, 2018-19*, Cat. no. 5260.0.55.002, table 14).

Hence, although Australia's recent productivity performance reflects trends seen in other developed nations (including slowing productivity and wages growth, and a declining labour income share), it also has elements which are specific to Australia. The Commission will further explore international comparisons and longer term historical trends in future papers in the *Productivity Insights* series.

A Technical appendix

A.1 Industry decomposition of labour productivity

Starting with the definition of the change in market sector labour productivity as the sum of each of the industries' gross value added divided by the sum of the total industries' hours worked, it is easy to show that:

$$\begin{aligned}\Delta LP_m &= \frac{\sum GVA_{i,t+n}}{\sum Hours_{i,t+n}} - \frac{\sum GVA_{i,t}}{\sum Hours_{i,t}} \\ \Delta LP_m &= \sum LP_{i,t+n} s_{i,t+n} - \sum LP_{i,t} s_{i,t} \\ \Delta LP_m &= \sum \Delta LP_i \bar{s}_i + \sum \bar{LP}_i \Delta s_i\end{aligned}$$

Where: LP is labour productivity, s is the share of a particular industry of total hours worked, Δ is the arithmetic change in a variable, a bar denotes the average of a variable across both time periods, subscript i refers to industry i , and subscript m refers to the market sector as a whole.

Here the first term on the LHS gives the *within effect* of an industry to the change in market sector labour productivity, and the second term the *between effect* of an industry. However, a decomposition of this type would show a positive between effect for any industry that increased its share of total hours. The following tweak solves this issue:

$$\begin{aligned}\Delta LP_m &= \sum \Delta LP_i \bar{s}_i + \sum \bar{LP}_i \Delta s_i - \bar{LP}_m \sum \Delta s_i + \bar{LP}_m \sum \Delta s_i \\ \Delta LP_m &= \sum \Delta LP_i \bar{s}_i + \sum (\bar{LP}_i - \bar{LP}_m) \Delta s_i + \bar{LP}_m \sum s_{i,t+n} - \bar{LP}_m \sum s_{i,t}\end{aligned}$$

However, $\sum s_{i,t} = 1$ for any t , so this simplifies to:

$$\Delta LP_m = \sum \Delta LP_i \bar{s}_i + \sum (\bar{LP}_i - \bar{LP}_m) \Delta s_i$$

Once again, the first term is the within effect but now the second term, the between effect, is only positive when an industry with *higher than average* labour productivity increases its share of total hours worked. Finally, to convert the arithmetic change in labour productivity to a percentage growth formula, simply divide both sides by market sector labour productivity in the first period:

$$g_{m,LP} = \frac{1}{LP_{m,1}} \sum \Delta LP_i \bar{s}_i + \frac{1}{LP_{m,1}} \sum (\bar{LP}_i - \bar{LP}_m) \Delta s_i$$

Annualising and then differencing these gives the effect of particular industries (and the split of within and between effects) on the overall productivity slowdown can be determined (table A.1).

Table A.1 Industry contribution to the labour productivity slowdown

| | <i>1974-75 to 2004-05</i> | | | <i>2004-05 to 2018-19</i> | | | <i>Difference</i> | | | |
|---|---------------------------|-----------------------|---------------------|---------------------------|-----------------------|---------------------|----------------------|-----------------------|---------------------|-------------------------------|
| | <i>Within effect</i> | <i>Between effect</i> | <i>Total effect</i> | <i>Within effect</i> | <i>Between effect</i> | <i>Total effect</i> | <i>Within effect</i> | <i>Between effect</i> | <i>Total effect</i> | <i>Proportion of slowdown</i> |
| | percentage point | | | percentage point | | | percentage point | | | per cent |
| Agriculture, forestry and fishing | 0.20 | 0.04 | 0.24 | 0.04 | 0.02 | 0.05 | -0.16 | -0.02 | -0.18 | 29 |
| Mining | 0.19 | 0.02 | 0.21 | -0.04 | 0.40 | 0.37 | -0.23 | 0.39 | 0.16 | -25 |
| Manufacturing | 0.41 | 0.04 | 0.44 | 0.08 | 0.05 | 0.13 | -0.33 | 0.01 | -0.32 | 51 |
| Electricity, gas, water and waste services | 0.17 | -0.06 | 0.12 | -0.10 | 0.06 | -0.04 | -0.28 | 0.12 | -0.16 | 25 |
| Construction | 0.16 | 0.00 | 0.16 | 0.04 | -0.02 | 0.02 | -0.12 | -0.02 | -0.15 | 23 |
| Wholesale trade | 0.14 | -0.01 | 0.14 | 0.15 | -0.01 | 0.14 | 0.01 | -0.01 | 0.00 | 0 |
| Retail trade | 0.11 | -0.02 | 0.09 | 0.15 | 0.05 | 0.20 | 0.05 | 0.07 | 0.11 | -18 |
| Accommodation and food services | 0.02 | -0.03 | -0.01 | 0.01 | 0.00 | 0.01 | -0.01 | 0.03 | 0.02 | -2 |
| Transport, postal and warehousing | 0.19 | 0.00 | 0.19 | 0.05 | 0.00 | 0.05 | -0.13 | 0.00 | -0.13 | 21 |
| Information media and telecommunications | 0.12 | 0.00 | 0.12 | 0.16 | -0.02 | 0.15 | 0.04 | -0.02 | 0.02 | -4 |
| Financial and insurance services | 0.27 | 0.06 | 0.33 | 0.27 | 0.02 | 0.29 | 0.00 | -0.04 | -0.04 | 7 |
| Rental, hiring and real estate services | 0.02 | 0.05 | 0.07 | 0.07 | 0.00 | 0.07 | 0.05 | -0.05 | 0.00 | 0 |
| Professional, scientific and technical services | 0.04 | 0.03 | 0.07 | 0.09 | -0.03 | 0.06 | 0.05 | -0.05 | -0.01 | 1 |
| Administrative and support services | 0.01 | 0.05 | 0.07 | 0.09 | 0.00 | 0.08 | 0.07 | -0.06 | 0.02 | -3 |
| Arts and recreation services | -0.14 | 0.14 | -0.01 | -0.04 | 0.00 | -0.04 | 0.10 | -0.13 | -0.03 | 4 |
| Other services | 0.03 | -0.04 | -0.02 | 0.02 | 0.02 | 0.04 | 0.00 | 0.06 | 0.06 | -9 |
| Total market sector | 1.94 | 0.27 | 2.21 | 1.05 | 0.53 | 1.58 | -0.89 | 0.26 | -0.63 | 100 |

Source: Commission estimates using ABS (2018, *Estimates of Industry Multifactor Productivity, 2018-19*, Cat. no. 5260.0.55.002, Tables 1–19) and unpublished ABS data.

A.2 Decomposing the wage slowdown

This wage decomposition makes use of the following identity for consumer wages:

$$w = LIS \times \frac{TFI_{CW}}{H} \times \frac{P_{GVA}}{P_{CPI}}$$

Where: LIS is the labour income share, TFI_{CW} is the total factor income (chain weighted volume measure), H is hours, P_{CPI} is the price level for the CPI, P_{GVA} is the price level for the implicit price deflator for market sector gross value added.

Then the growth in wages should be:

$$w_g = LIS_g + (TFI_g - H_g) + (\pi_{GVA} - \pi_{CPI})$$

Where: π_{GVA} is inflation in the implicit price deflator for market sector gross value added, π_{CPI} is CPI inflation, and subscript g refers to the growth rates of a variable.

It can be seen then that there are three contributors to consumer wage growth: growth in the labour share of income, growth in total factor income per hour, and producer price inflation (measured as the implicit market sector GVA deflator) outpacing consumer price inflation. The remaining task is then to replace total factor income per hour with some function of labour productivity. Starting with the definition of total factor income (nominal):

$$Total\ factor\ income + Taxes - Subsidies = Gross\ value\ added$$

Where the taxes and subsidies on factor income. In growth terms this becomes:

$$TFI_g - H_g + NT_g \approx LP_g$$

Where: NT_g is the growth in net taxes on the factors of production. It is calculated as the difference in labour productivity growth and growth in real total factor income per hour.

Putting these together we have:

$$w_g = LIS_g + LP_g - NT_g + (\pi_{GVA} - \pi_{CPI})$$

Table A.2 Contributors to the wage slowdown

| <i>Contributions from:</i> | <i>1994-95 to 2012-13</i> | <i>2012-13 to 2018-19</i> | <i>Difference</i> | <i>Proportion of difference</i> |
|-----------------------------------|-------------------------------|-------------------------------|-------------------|-------------------------------------|
| | Percentage point | | | Per cent |
| Slower labour productivity growth | 2.19 | 1.32 | -0.87 | 52 |
| Relative inflation | 0.32 | -0.22 | -0.54 | 32 |
| Labour income share change | -0.21 | -0.54 | -0.32 | 19 |
| Net taxes | -0.13 | -0.08 | 0.05 | -3 |
| Total | 2.17 | 0.49 | -1.68 | |

Source: Commission estimates based on ABS (2019, *Australian System of National Accounts, 2018 19*, Cat. no. 5204.0, tables 1 and 5; 2019, *Estimates of Industry Multifactor Productivity, 2018 19*, Cat. no. 5260.0.55.002, tables 1–19).

A.3 Industry contributions to the fall in the labour share of income

A similar decomposition to the one used for decomposing the change in productivity. The formula is:

$$\Delta LIC_m = \sum \Delta LIC_i \bar{s}_i + \sum (\bar{LIC}_i - \bar{LIC}_m) \Delta s_i$$

Where: LIC is the labour income share, s is the share of a particular industry of total gross value added, Δ is the arithmetic change in a variable, a bar denotes the average of a variable across both time periods, subscript i refers to industry i , and subscript m refers to the market sector as a whole.

This decomposition was done for the financial years 1999-00 and 2018-19, with the results shown below (table A.3).

Table A.3 Industry contributions to the change in the labour income share

1999-00 to 2018-19

| | <i>Within effect</i> | <i>Between effect</i> | <i>Total contribution</i> | <i>Proportion of the change</i> |
|---|----------------------|-----------------------|---------------------------|---------------------------------|
| | Percentage point | Percentage point | Percentage point | Per cent |
| Agriculture, forestry and fishing | -0.38 | 0.33 | -0.05 | 1 |
| Mining | -0.80 | -2.88 | -3.69 | 72 |
| Manufacturing | 1.00 | -0.50 | 0.50 | -10 |
| Electricity, gas, water and waste services | -0.04 | -0.02 | -0.05 | 1 |
| Construction | -0.30 | 0.18 | -0.12 | 2 |
| Wholesale trade | -0.12 | -0.18 | -0.30 | 6 |
| Retail trade | -0.20 | -0.22 | -0.41 | 8 |
| Accommodation and food services | -0.18 | -0.10 | -0.28 | 5 |
| Transport, postal and warehousing | -0.41 | 0.00 | -0.41 | 8 |
| Information media and telecommunications | 0.30 | 0.31 | 0.62 | -12 |
| Financial and insurance services | -1.20 | -0.29 | -1.50 | 29 |
| Rental, hiring and real estate services | -0.12 | -0.18 | -0.30 | 6 |
| Professional, scientific and technical services | -0.58 | 0.87 | 0.29 | -6 |
| Administrative and support services | 0.00 | 0.61 | 0.61 | -12 |
| Arts and recreation services | -0.01 | -0.04 | -0.05 | 1 |
| Other services | 0.08 | -0.09 | -0.01 | 0 |
| Market sector total | -2.95 | -2.19 | -5.14 | 100 |

Source(s): Commission estimates using ABS (2019, *Estimates of Industry Multifactor Productivity, 2018-19*, Cat. no. 5260.0.55.002, Tables 1–19)

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