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CAN AUSTRALIA BE A PRODUCTIVITY LEADER?

Features

Australia's living standards compare well, partly due to high labour utilisation

Can Australia catch up to the US?

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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 second PC *Productivity Insights* of 2020.

Whereas our first edition, published in February, summarised Australia's recent patterns of *growth* in productivity, wages and incomes, this paper presents Australia's relative *levels* of productivity and income compared with other advanced economies.

Australians enjoy a high standard of living. This has been achieved through robust labour markets and decent productivity performance. That said, there is more to be done. In the international league tables — that measure performance narrowly on the basis of average incomes — Australia's labour market participation may warrant a gold medal, but our productivity performance is at best a silver standard. The typical Australian worker can produce in five days what takes their United States counterpart only four days.

Australia will likely retain certain disadvantages relative to the United States. Australia will never have the dense customer base of the United States that makes manufacturing and goods distribution so efficient there. This should not discourage efforts to lift Australia's performance. Australia's economy is predominantly service-based, and here the opportunities are clearer for improvement in our international standings: businesses investing in management capability and organisational capital, regulations supporting flexibility and the adoption of new technologies and work practices, well-functioning cities harnessing the benefits of agglomeration of skills, to name but a few.

In short, while Australia's economic performance is the envy of many other advanced economies, more can be done to sustain high and growing living standards into the future.

Michael Brennan
Chair

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Abbreviations and explanations

Abbreviations

ABS	Australian Bureau of Statistics
CPI	Consumer Price Index
GDP	Gross Domestic Product
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

Explanations

Billion	The convention used for a billion is a thousand million (10^9).
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Can Australia become a productivity leader?

Key points

- Australia is a high income country, with the 12th highest average income in the Organisation for Economic Co-operation and Development (OECD).
 - This is partly due to Australians working *harder*, with the 5th highest hours worked per capita in the OECD. This is driven by high labour force participation rates and hours worked per employee relative to our OECD peers, which in part reflects an absence of recession for 28 consecutive years.
 - When it comes to working *smarter* — measured by our labour productivity level or GDP per hour worked — Australia's productivity is middling, sitting at 16th among the OECD.
- The United States effectively represents the productivity frontier — a large diversified economy with high underlying productivity. It currently takes a typical Australian worker five days to produce what would take their American counterpart four days.
- Catch-up to the productivity level of the United States has proven elusive over the past five decades, partly because our relative remoteness and low population density have been a barrier to achieving efficient scale in manufacturing and goods distribution.
- Australia's remoteness and low population density will continue to limit convergence in manufacturing and goods distribution, but there are substantial opportunities to improve performance in Australia's service industries.
 - Estimates suggest the Australian service industries are between 20 per cent and 60 per cent less productive than the same industries in the United States.
- Australian formal educational attainment is rapidly approaching United States levels. And while the Australian economy is less research and development (R&D) intensive, this largely reflects the different industries in which Australia's comparative advantage lies — more in mining and agriculture, and less in manufacturing.
- Management capability is critical in facilitating innovation but Australian businesses tend to perform poorly in this area, particularly in harnessing the benefits of digital technologies.

As noted in the previous PC *Productivity Insights*, Australia's productivity growth has slowed in recent years, consistent with a global trend. If anything, the fall in Australia's productivity growth rate has been milder than for many other developed economies.

But how does Australia's *level* of productivity compare with that of our Organisation for Economic Co-operation and Development (OECD) — a collection of other advanced economies — peers, given that productivity is a key determinant of relative living standards?

International comparisons of productivity levels are notoriously difficult and should be treated with care for a number of reasons. First, there are differences in the prices of goods and services across both the whole economy and for particular industries that need to be appropriately adjusted for (box 1). Second, differences in productivity at a whole-of-economy level can reflect different industry structures, such as the contribution of oil extraction to the Norwegian economy, or the finance industry to the Luxembourg economy (or for that matter, mining to the Australian economy).

Finally, the specific policy and institutional environment in particular countries can affect productivity measures, often in misleading ways. For example, in France, restrictive labour market regulations lower the average number of hours worked but result in high measured productivity. Hence high productivity might come at the cost of low labour force participation and high unemployment, with an ambiguous result for overall wellbeing. Deep corporate tax concessions in Ireland have fuelled high levels of foreign investment and high measured value add (hence measured productivity) but with smaller implications for actual living standards (Dolman, Parham and Zheng 2007).

These features of other economies may be unattainable or undesirable for Australia to pursue. For these reasons, the United States of America (US) is generally taken to be the best benchmark for global productivity comparisons. It is a large, diversified high productivity economy (notwithstanding that a few European countries now have higher levels of productivity) and so is regarded as the productivity 'frontier' for the purposes of international comparisons.

This paper puts recent Australian output and labour utilisation into an international context by drawing comparisons with the US and with the distribution of outcomes obtained by other advanced economies. It then presents a range of indicators of Australian productivity levels, subject to limitations of the available data. Finally, it assesses the feasibility and likelihood of catch-up to the productivity 'frontier', represented by the US economy.

The earlier observation about France shows that it is important to look at hours worked per capita as well as productivity per se. Australia has relatively high aggregate labour utilisation compared with several OECD economies that have higher output per hour (figure 1). Accordingly, Australia's overall output per *person* is better than might be suggested by focusing on output per *hour worked*.

On face value, the US performs well on all counts from this broader perspective, as it has higher productivity per hour, higher participation rates and lower unemployment rates than

most OECD countries. However, there is significantly more dispersion in wages across workers in the US than Australia — wages for lower skilled workers in the US are generally lower than in Australia. Low paid workers, the unemployed and those unable to work in Australia also have the benefit of a relatively more generous income and social safety net than their counterparts in the US (Whiteford 2010).

Box 1 The difficulty of making international comparisons

To make valid comparisons of productivity across countries requires construction of comparable measures of output, labour input and capital services. Consistency across countries requires a large amount of difficult to obtain data.

Comparisons of output levels across country at an aggregate level need to be adjusted for differences in price levels across countries. These rely on estimates of the purchasing power parity (PPP) of local currencies — constructed by assessing the price levels of a common basket of goods — in every year. That is, comparisons based on market exchange rates are inappropriate as living costs vary across countries and, indeed, can fluctuate from year to year due to financial trading in the currency markets (ONS 2012). In principle, a similar PPP adjustment can be undertaken at an industry level based on comparisons of the prices of a common bundle of that industry's output. In practice, this has rarely occurred and this paper reports only one set of estimates from 2005.

While there is reasonable standardisation of the surveying of hours worked across advanced economies, estimates for capital services (which are required in order to make comparisons of multifactor productivity as distinct from labour productivity – see the first *Productivity Insights* paper (PC 2020) for a description of the difference) can vary substantially. In general, statistical offices do not survey capital stocks but rather accumulate them based on surveys of investment and assumptions about depreciation rates. Capital services are estimated by weighting together capital stocks based on the 'user cost of capital', a measure that takes account of the risk of the investment, tax treatment of capital income, depreciation and capital gains. These calculations require a large number of assumptions that may differ across industries and countries and so multifactor productivity level estimates are rarely published.

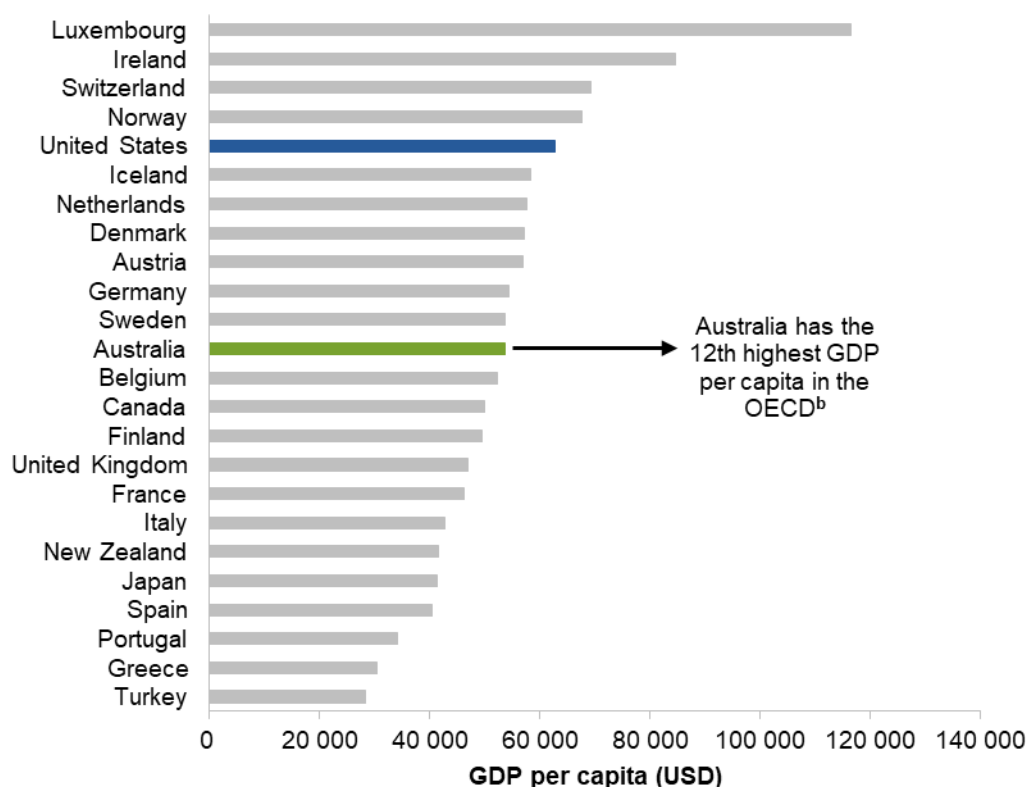
For these reasons, the focus in this paper is on measures of output, hours worked and labour productivity across countries, with most of the analysis undertaken at a whole-of-economy level.

1 Australia's living standards compare well, partly due to high labour utilisation

Compared to other developed nations, Australia's standard of living — as measured by total annual output per person, or gross domestic product (GDP) per capita — is well above average (figure 1). For example, as at 2018, our GDP per capita is 12th among the 24 longest standing OECD member nations (the standard set of countries used throughout this paper) at about 54 000 US dollars (adjusted for purchasing power parity). This places our GDP per capita is about 7 per cent higher than Canada, 14 per cent higher than the United Kingdom, and 29 per cent higher than our neighbour, New Zealand. That said, Australia's GDP per capita is still 13 per cent below the US, and about half that of Luxembourg.

Figure 1 **Australia's living standards are better than many other countries ...**

GDP per capita in 2018 (USD)^a



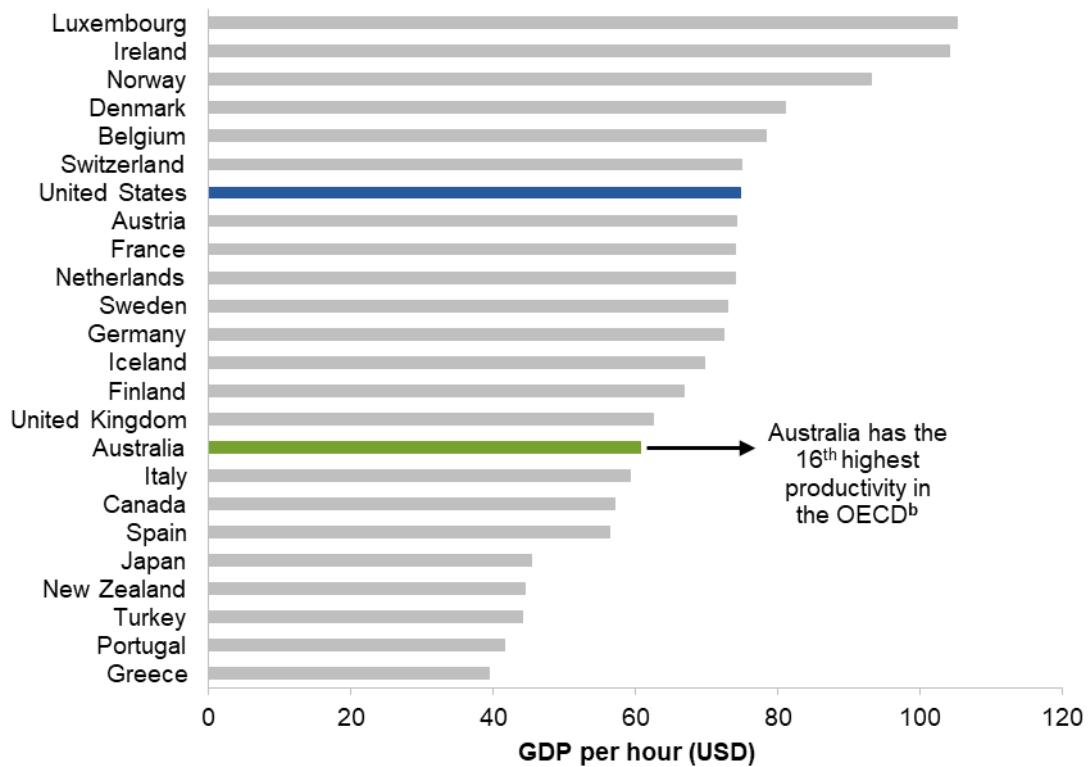
^a Foreign currencies converted to US dollars using current PPPs. ^b Only the 24 longest standing OECD countries were considered.

Source: OECD Stat database.

Our economic success has two components — productivity and the total number of hours worked per person. On the one hand, Australia's labour productivity is middle of the pack compared to our OECD peers (figure 2). For example, the typical Australian worker can only produce about 84 per cent of what the typical German worker can produce in one hour even though the typical German has a lower average income than the typical Australian. Notably, while annual productivity growth rates adjust for the effect of any price changes — including favourable movements in the terms of trade — productivity *levels* can incorporate some impact from changes in a country's terms of trade — hence Australia's GDP per hour worked (in US dollars at purchasing power parity) is boosted to the extent that we receive high prices for our mining and energy exports. A sustained fall in global resource prices might not affect Australia's productivity growth rate, but would likely lower our level of productivity and average income.

Figure 2 ... while labour productivity is only mid-range

Labour productivity in 2018^a



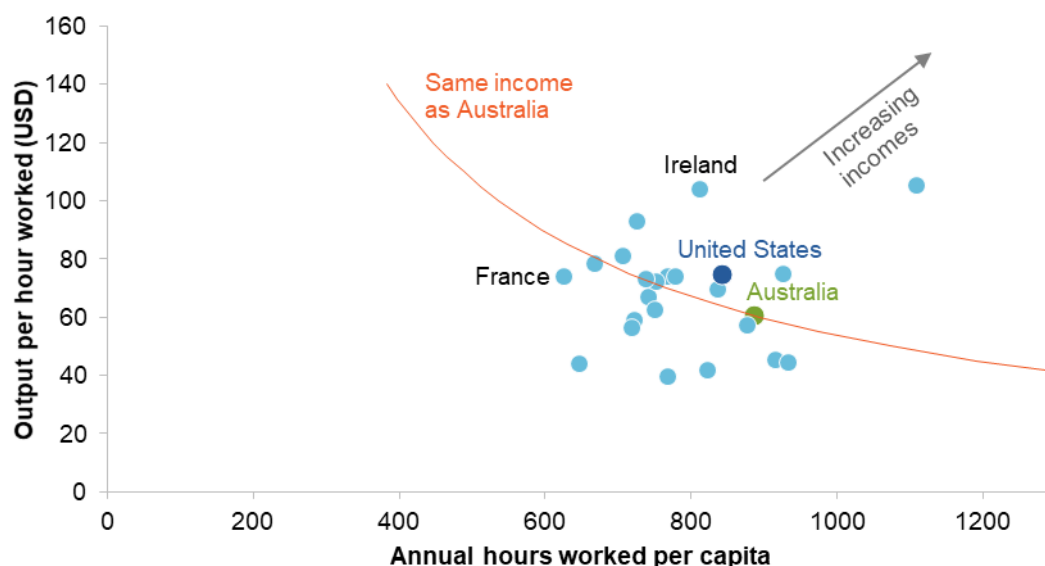
^a Foreign currencies converted to US dollars using current PPPs. ^b Only the 24 longest standing OECD countries were considered. The figure for Turkey is for 2017 as the 2018 figure is not available.

Source: OECD Stat database.

Despite middling productivity levels, Australia has the fifth highest hours worked per person in the OECD (figure 3). For example, on average, Australians work 42 per cent more hours per capita than the French. Working greater hours can have positive and negative aspects. On the one hand, more hours afford Australians a greater income than would otherwise be the case. And where these greater hours are due to lower unemployment and higher labour force participation, they could deliver greater equality of income. On the other hand, higher hours worked per capita can reflect longer average work weeks, which comes at a cost to workers.

Figure 3 **Our high incomes (in part) reflect longer working hours than many other countries^a**

Output per hour worked^b and annual hours worked per capita in OECD^c countries in 2018



^a This chart shows the combinations of productivity and hours worked (green line) that would result in Australia's income per person (GDP per capita); countries that sit about this line have better standards of living while those below have lower. ^b PPP adjusted at current USD. ^c Analysis is restricted to the 24 longest standing OECD members (except for Luxembourg for which data was not available).

Source: OECD Stat database.

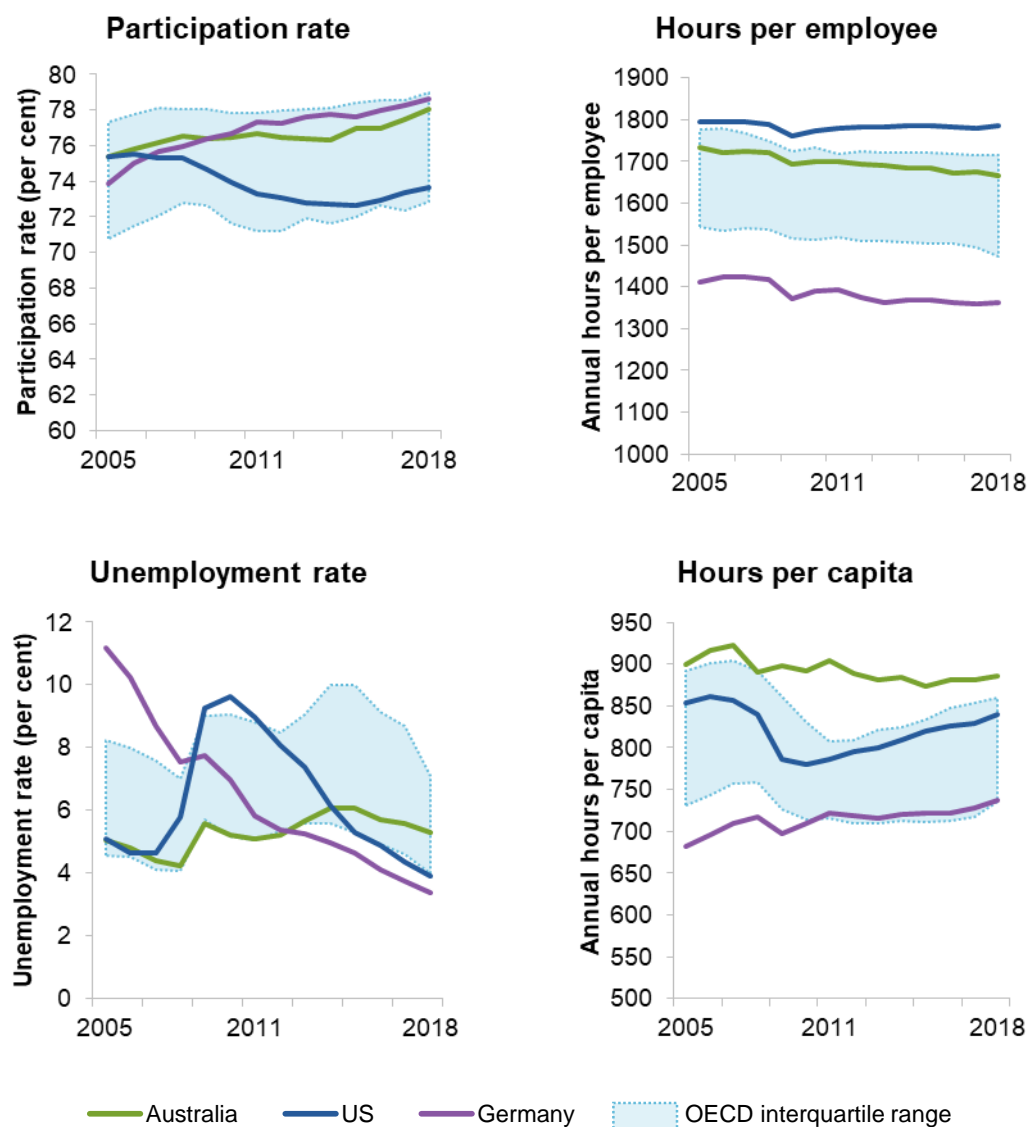
Australia's higher average working hours are driven by three factors: unemployment, participation and average hours worked per worker (figure 4). Australia has unemployment rates roughly equivalent to the OECD median, but has relatively high participation and hours per employee. Considered collectively, these explain Australia's high overall labour input usage.

By way of contrast, Germany has low unemployment (3rd lowest) and high participation (8th highest), but it has the lowest number of hours worked per employee in the OECD. Overall, because it only performs highly on two out of three of these labour market indicators, it has a low number of hours worked per capita (17th highest). In the US, employees work a high number of hours (2nd highest) and unemployment is low (6th lowest), but the participation rate is low (17th highest). Like Germany, the US is only at or above the median OECD levels for two out of three labour force indicators, meaning that although it has higher than average hours per capita, it is still lower than in Australia.

Figure 4

Australia's labour market is an 'all round' performer

Participation rates, hours per employee, unemployment rates and hours per capita in Australia, the US, Germany, and the Interquartile Range^a of OECD countries between 2005 and 2018



^a The interquartile range is the difference between the third quartile and first quartile of the 24 longest standing OECD countries for which these variables are available.

Source: OECD Stat Database.

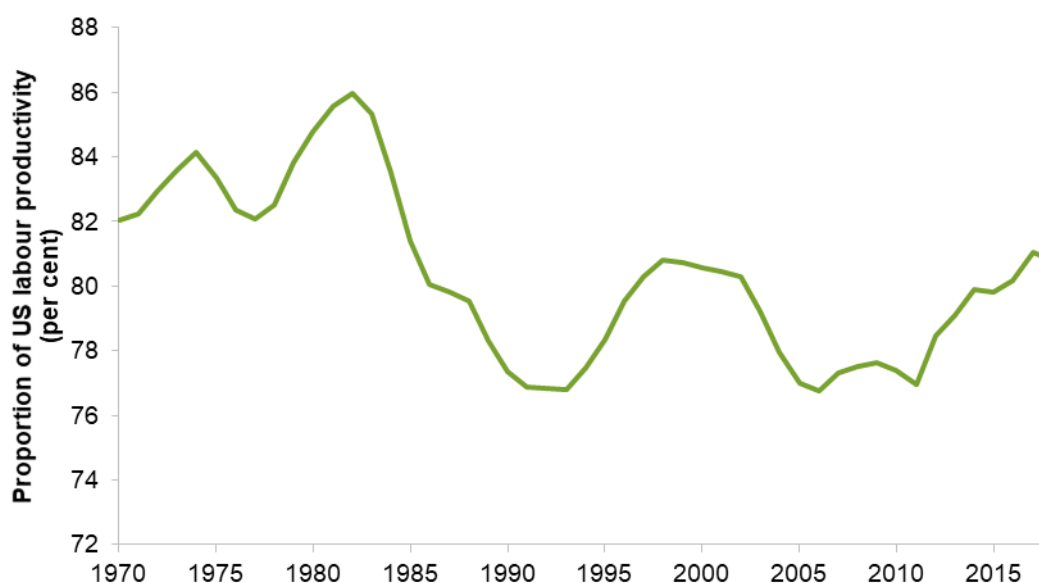
2 Can Australia catch up to the US?

There is a persistent productivity gap between the US and Australian economies in aggregate ...

There remains a sizeable gap between Australian and US productivity levels. As set out above, in 2018 Australian labour productivity was about 20 per cent lower than in the US. Put differently, on average it takes five days for an Australian worker to produce what a US worker can produce in four. This gap has been relatively stable over time — periods of strong relative productivity growth have tended to be followed by periods of weak relative growth and vice versa (figure 5).

Figure 5 **Nearly fifty years of data show few signs of Australia catching up to US productivity**

Three year moving average^a of Australian labour productivity as a proportion of US labour productivity from 1970 to 2018^b



^a Centred three year moving average of the ratio of Australian labour productivity to US labour productivity in current purchasing power parity adjusted USD. ^b Australian data is in financial years while US data runs over calendar years.

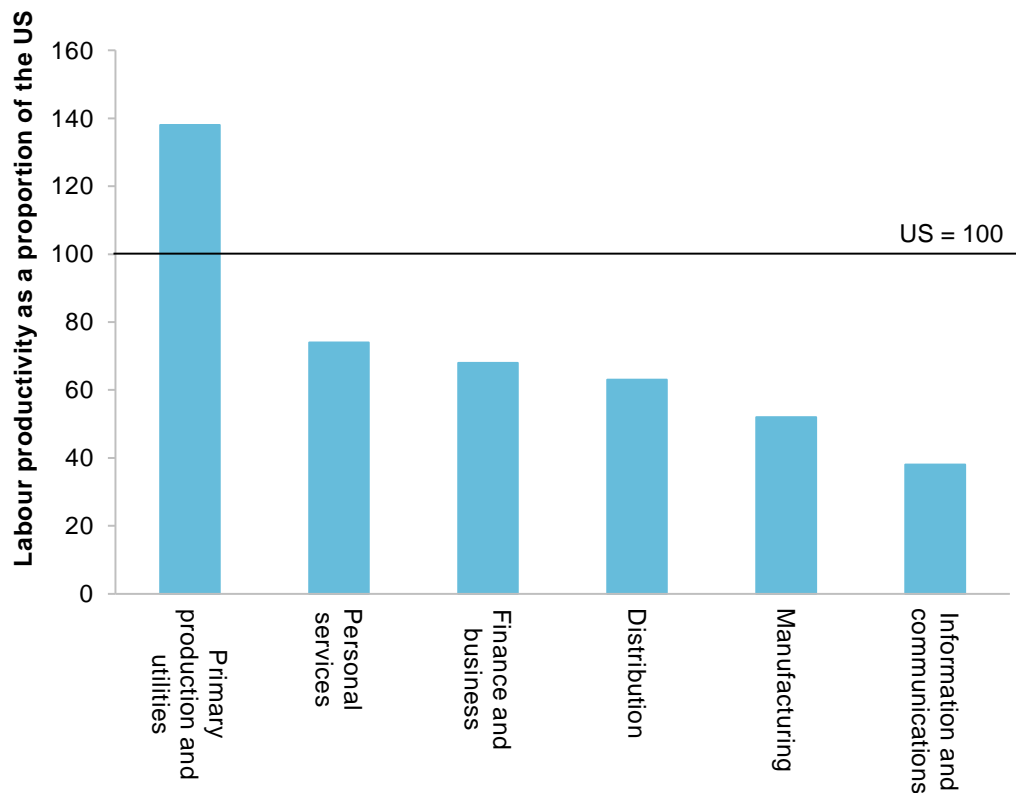
Source: OECD Stat database.

... and this is also the case for most industries

At an industry level, there were numerous sectors that were significantly behind their US peers in labour productivity in 2005, the latest year for which data are available (figure 6). There were large productivity gaps in the manufacturing and goods distribution sectors (including wholesale and retail trade) which have traditionally been characterised by

significant economies of scale. Smaller, but still substantial, gaps were observed in personal and business services. Meanwhile, mining, construction and agriculture (jointly) were significantly more productive than their peers in the US. These observations could reflect the theory of comparative advantage — that nations specialise in areas where they have strong underlying relative advantages (Australia being an exporter of mining and agricultural goods) as well as the possibility that specialisation in and of itself has contributed to improved productivity in relevant sectors over time.

Figure 6 **There are some enduring gaps in productivity**
 Australian levels of labour productivity as a proportion of those in the United States of America^a by industry^b in 2005



^a Purchasing power parity adjustments are made by industry using 2005 prices. Information and communications also includes manufacturing of electrical machinery. ^b Primary production includes agriculture, construction and mining. Finance and business does not include real estate. Manufacturing does not include electrical machinery.

Source: Inklaar and Timmer (2008).

As noted in the first *Productivity Insights* paper (PC 2020), differences in labour productivity can be attributable to differing capital intensity or to differing multifactor productivity (better combining capital and labour inputs to generate higher output). In Australia's case, the overall gap in labour productivity appears to be due mainly to multifactor productivity rather than differences in capital intensity (Schreyer 2009). This implies that Australia's relative

underperformance on labour productivity reflects differences in efficiency, take up of new technologies and economies of scale.

Where has Australia been catching up, or falling behind?

Contemporary data on labour productivity levels by industry in Australia and the US are not available. In this section, two alternative approaches are presented in order to understand how productivity has evolved since the most recent data on productivity levels in 2005. The first approach is to compare productivity growth rates within industries and the second approach is to compare the distribution of industry labour productivity levels within each country.

The idea of the first approach is that you can think about Australian and US productivity levels today as being the levels observed in 2005 plus the growth achieved since that time. This will not be accurate if relative prices in Australia and the US have changed significantly. For example, real productivity *growth* in mining appears to have been slower in Australia than the US (figures 7 and 8). However, if the price of mining output in Australia has risen relative to that of the US (because we mine a different mix of commodities) then this may not mean that the *level* of productivity in mining in Australian is lower relative to the US than it was in 2005.

This analysis indicates that Australia has had faster productivity improvements than the US in some industries and slower productivity in others. On the assumption that relative prices have been fairly steady, this suggests for example that Australian productivity has closed some of the gap with the US productivity level in goods distribution (wholesale, retail and transport and storage) but fallen further behind in information and communications and manufacturing. Australian productivity growth has also been faster in agriculture (note these data pre-date the recent drought).

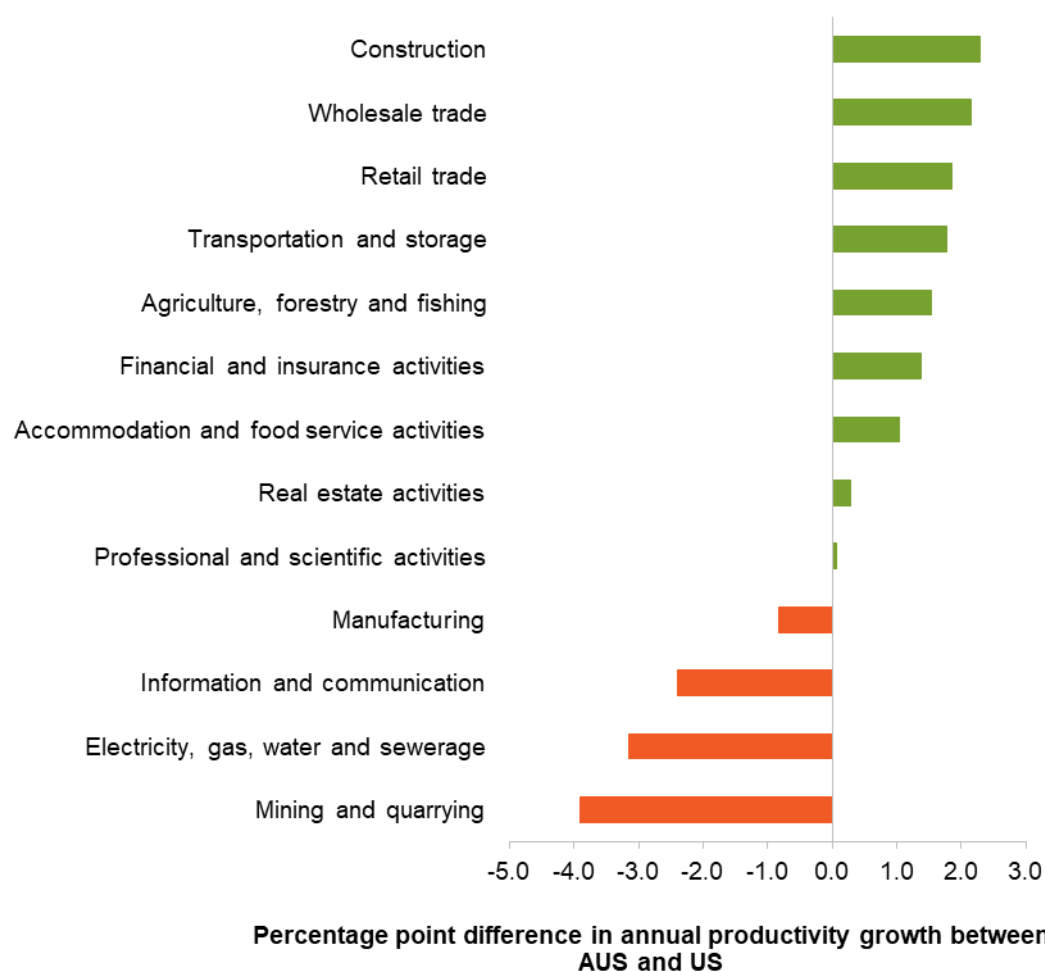
The idea of the second approach — looking at industry productivity levels within countries — is that it allows for changes in relative prices between industries within each country (figure 9). That is, changes in an industry's productivity *level* measured in dollars of value added per hour worked can reflect changes in either physical productivity levels in an industry or the price of its output. An industry that lies on the diagonal line in figure 9 has productivity relative to the economy-wide average that is the same in both countries. An industry above the line is likely an area of particular strength for the US, while an industry below the line is likely an area of particular weakness.

The comparison between 2005 and 2017 suggests industries where Australia may be pulling ahead or falling behind. On the whole, the relative strengths of both the Australian and the US economies have remained fairly stable between 2005 and 2017. However, again, the data suggest that Australia has fallen further behind since 2005 in manufacturing and information and communications (that is, these have moved further above the diagonal line). On the other hand, the analysis suggests that Australian mining productivity has pulled further ahead of the US (it has moved further below the diagonal line), because of the relative improvement

in the price of Australian mineral exports. Again, agriculture also stands out as an area where Australian productivity has outperformed the United States since 2005.

Figure 7 Some Australian industries have improved their productivity more than their US peers

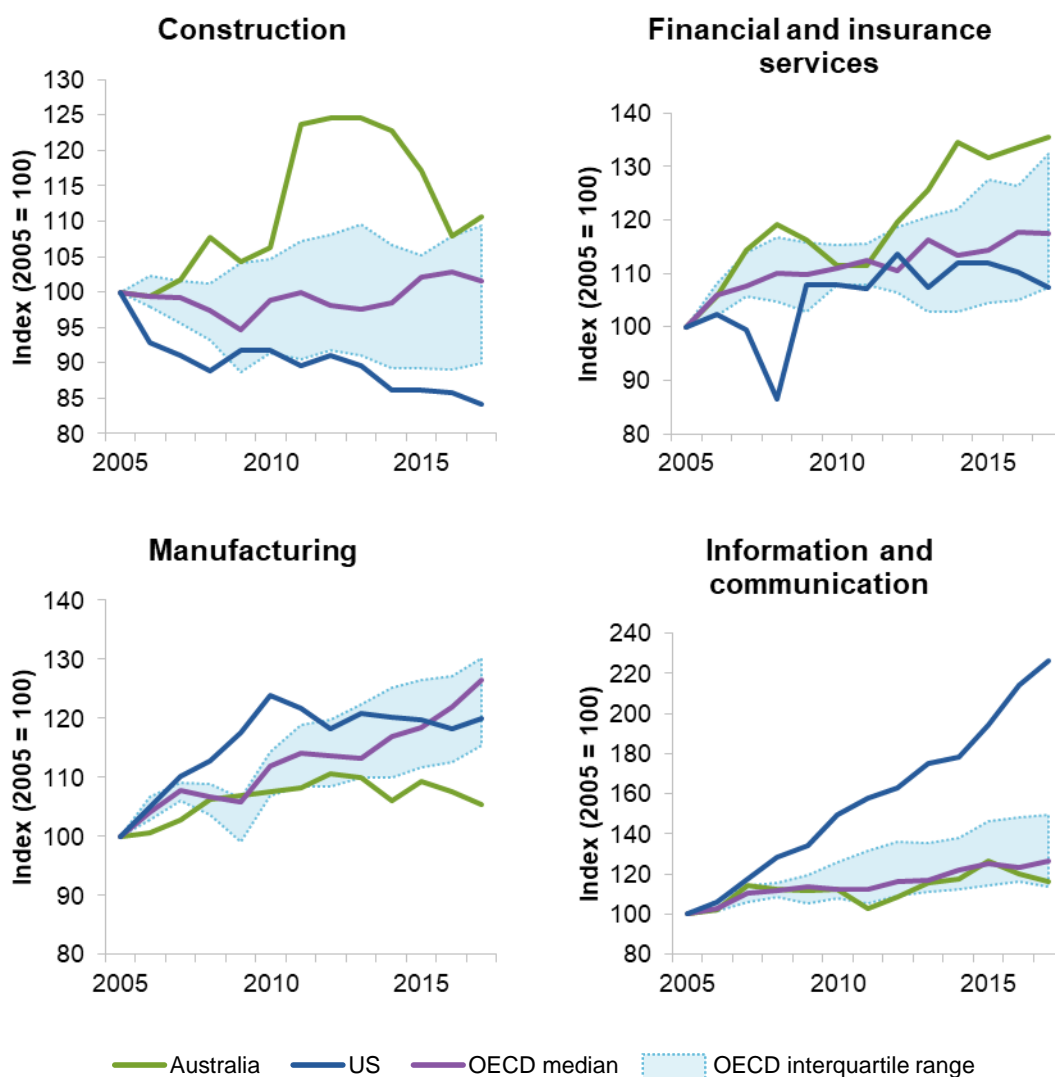
Difference in the average annual labour productivity growth between Australia and the United States of America by industry^a between 2005 and 2017



^a Professional, and scientific services also includes technical, administrative and support services.

Sources: Commission estimates based on ABS (*Estimates of Industry Multifactor Productivity, Australia, 2018-19*, Cat. no. 5260, tables 1 to 19) and the EU KLEMS database.

Figure 8 Finance and construction have performed well, but manufacturing and communications have not
Index of labour productivity by industry in Australia, the US, the OECD^a median, and the OECD interquartile range, 2005 to 2017

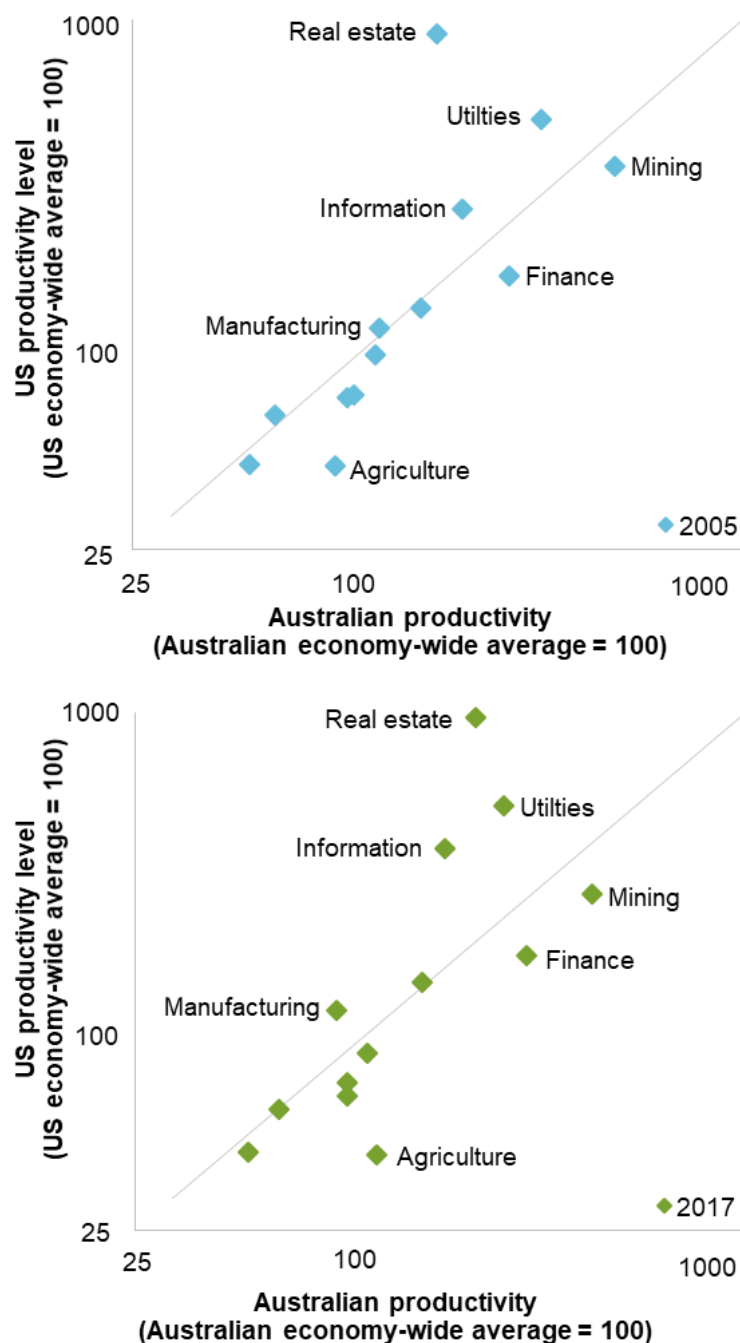


^a Among the 24 longest standing OECD countries, where data was available.

Source: OECD Stat Database and EU KLEMS database.

Figure 9 **Labour productivity levels by industry within Australia and the US^a**

Log scale, economy wide average=100, 2005 (top) and 2017 (bottom)



^a Industries above the line are more productive in the United States (relative to the economy-wide average) than in Australia. Conversely, industries below the line are more productive in Australia.

Sources: Commission estimates drawing on data from the EU KLEMS database and ABS (*Estimates of Industry Multifactor Productivity, Australia, 2018-19*, Cat. no. 5260, tables 1 to 19).

Overall, this analysis suggests that Australia's relative productivity performance has lagged that of the US in manufacturing and in utilities, and also in ICT where the US has enjoyed very rapid productivity growth. On the other hand, in sectors like construction and finance, Australia's relative performance appears to have improved. In mining, it is possible that a relative price effect has contributed to higher relative productivity in Australia.

Can Australia become a productivity leader?

At an aggregate level, there are a range of factors that limit Australia's ability to catch up fully with productivity levels in the US. Geographically, Australia is far from the centres of world economic activity¹ and our population density across the country is less than one-tenth that of the US.² While Australia has a highly urbanised population, it lacks the megacities like New York and Los Angeles (Dolman, Parham and Zheng 2007), and Australian cities sprawl and so have relative low urban densities.³ Moreover, some of the advantages of primacy the US enjoys, as a destination of choice for many of the world's best scientists and engineers for example, will not be easily replicated in Australia. Previous estimates suggest that between 40 and 60 per cent of the gap between Australian and US labour productivity can be explained by geography (Battersby 2006; Boulhol, de Serres and Molnar 2008). Distance and the associated transport costs, limits to economies of scale and barriers to competition may be expected to impact on Australian manufacturing productivity. In addition, the US has significant exposure to the ICT manufacturing sector, which saw very rapid productivity growth over the last two decades.

However, these disadvantages apply differently in different industries. It is less clear that the productivity *potential* in personal and business services need be similarly constrained. Of course, the services sector is large and heterogeneous, but tends to have some key differences with the goods sector.

For example, economies of scale are not the most significant source of differences in labour productivity in services (Lewis et al. 1992). Services tend to be more labour intensive, often with important elements of human interaction driving the value of any transaction. The output of services industries is often more localised, less homogeneous and less amenable to mass production. The scope for automation in some service industries can be more limited or, at any rate, challenging. Spatial transaction costs are high even for inter-city trade in services where personal delivery is necessary, so that remoteness from world markets may

¹ The economic rise of China has been discussed as an opportunity for 'the tyranny of distance [to be] replaced by the prospects of proximity' (Department of the Prime Minister and Cabinet 2012, p. 1). No doubt it has provided market access for bulk commodities transported by ship. For trade in services or high-value goods, air travel is more relevant and, in this regard, it is worth noting that Beijing is closer to London than it is to Brisbane.

² The US population density is 36 people per square kilometre, compared with 3 people per square kilometre in Australia (World Bank 2018).

³ For example, New York has a population density of about 10 400 people per square kilometre (27 012.5 people per square mile) (United States Census Bureau 2018), while Sydney has a population density of about 1237 persons per square kilometre (NSW Government 2019).

no longer be a ‘tyranny’ (Sorbe, Gal and Millot 2018); rather well-functioning cities that facilitate interaction between highly-skilled workers may be key to higher productivity and wages (Glaeser and Resseger 2009).

The nature of knowledge formation is also different in services. R&D leading to new products is less important for some service industries. Rather, adoption and adaptation of process technologies remains important (such as machine-based logistics management) as well as customer service focused technologies (such as online ordering), and organisational capital (how tasks are divided, workplaces are managed, and staff are motivated) and brand capital (connecting the product with needs of consumers) (Corrado, Hulten and Sichel 2006; Lewis et al. 1992). While the overall level of capital stock per hour worked is not lower in market services than in manufacturing, it is skewed towards buildings, ICT and intangible capital.

These distinctions are important. Australia’s economy has, like all other advanced economies, undergone a transition away from goods production towards services production. Today, almost 75 per cent of production (figure 10) and about 80 per cent of employment occurs in the services sector (ABS 2019b). Many economists (van Ark, O’Mahoney and Timmer 2008, p. 37) expect the trend towards services to continue, reflecting rising demand in step with incomes (for example, for health care and education) and, marketisation of previously home-produced services (childcare, food preparation and domestic cleaning). This means that new engines of growth in the services sectors will determine Australia’s future living standards to a greater degree than further progress in Australia’s goods producing sectors.

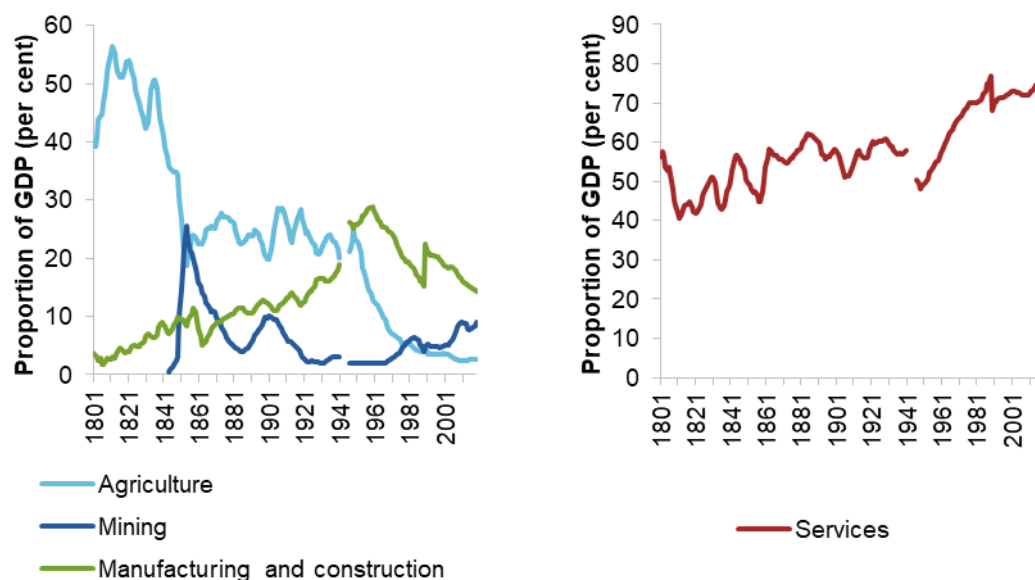
The shift towards services raises important questions about how future productivity growth will be generated, and the sorts of characteristics which might determine future gaps in productivity levels between countries.

It is possible that these characteristics could mitigate some of Australia’s traditional disadvantages (small population and distance leading to a lack of scale economies in local production). But other characteristics could rise in importance.

One characteristic which is likely to remain important is an economy’s underlying innovative capability.

Figure 10 **Australia's is mainly a service economy**

Sectoral shares of GDP for agriculture^a, mining and manufacturing^b (LHS) and services^c (RHS) averaged over five years between 1801 and 2019^d



^a Until 1861, agriculture includes pastoral and non-pastoral primary production. For 1861 onwards, agriculture includes/ pastoral, agriculture and dairying, and forestry and fisheries for the data up to 1989-90. ^b Manufacturing and construction includes private construction only for the data up to 1989-90. ^c Services includes public construction for the data up to 1989-90. ^d Calendar years up to 1900 and then financial years afterwards. Note the discontinuity in both charts at about 1989-90, this is where the ABS data connects with Ville and Withers.

Sources: Commission estimates using Ville and Withers (2015, pp. 555–560) and ABS (2019, *Australian System of National Accounts, 2018-19*, Cat. no. 5204.0, table 5).

Does innovative capability limit Australia's productivity potential?

In the long run, innovation is the main driver of productivity growth (as it feeds directly into multifactor productivity and also creates the scope for capital deepening). Innovation ultimately occurs through people with complex problem solving and critical thinking skills who can develop new and better ways of doing things. This is not just about generating new, ground-breaking discoveries, but also adopting and adapting existing knowledge and technologies. Hence both entrepreneurs and business managers are critical facilitators of innovation, such as through the identification of new products and business models, and in redesigning work practices to harness the benefits of new technologies. The precise ingredients that produce entrepreneurship and innovative capability are hard to strictly codify. In what follows, we identify three (albeit incomplete) indicators which could highlight the innovative capability of an economy. They are levels of formal education, research and development and survey-based measures of management capability.

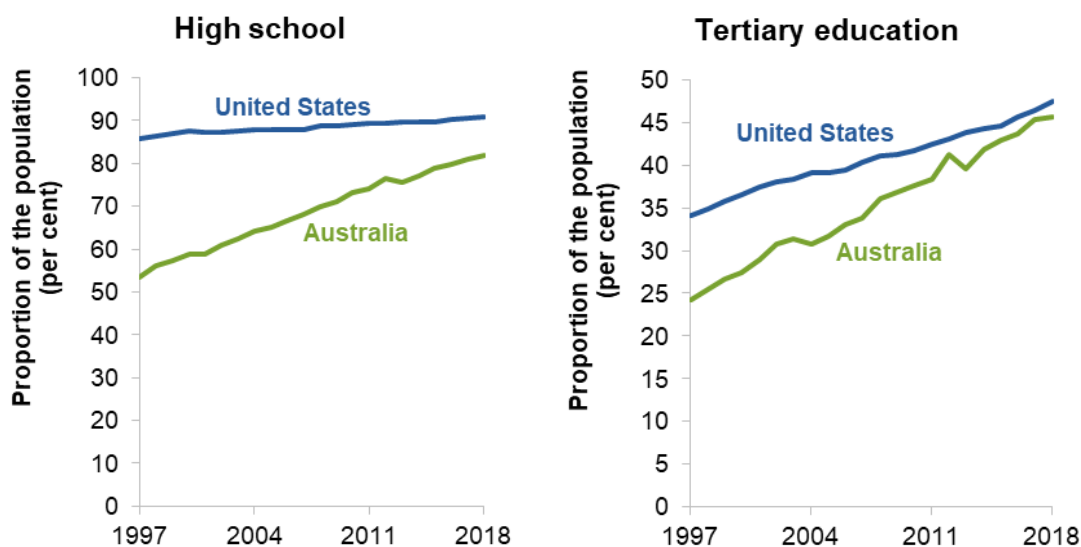
Formal education

Considerable academic literature has pointed to the link between formal education and lifting productivity, both as a driver of future productivity growth and to explain differences in productivity between countries (Dolman, Parham and Zheng 2007). Achieving higher quality outcomes from the education system should be a key goal for policy.

For decades, Australia has had a workforce with a lower average level of formal education compared with that of the US. Higher education and completion of upper secondary education both became widespread much earlier in the US. For example, whereas completion of secondary education became common in Australia through the 1970s and 1980s, as early as 1940 the majority of young Americans were high school graduates (Goldin 1998). Additional years of formal education are generally found to have a positive effect on individual and economy-wide productivity (Benos and Zotou 2014; Leigh 2008), so this gap in education has likely contributed to Australia's historical gap compared with US productivity levels.

More recently, this gap in formal education appears to have almost closed (figures 11).

Figure 11 Australia has almost caught up to the US level of formal education ...
Proportion of the total population (aged 25 to 64 years) that have completed high school (left) and have completed a form of tertiary^a education (right) between 1997 and 2018 in Australia and the United States



^a Tertiary education refers to International Standard Classification of Education (ISCED) codes 4 and above (includes qualifications considered higher than secondary education but lower than bachelor's degrees).

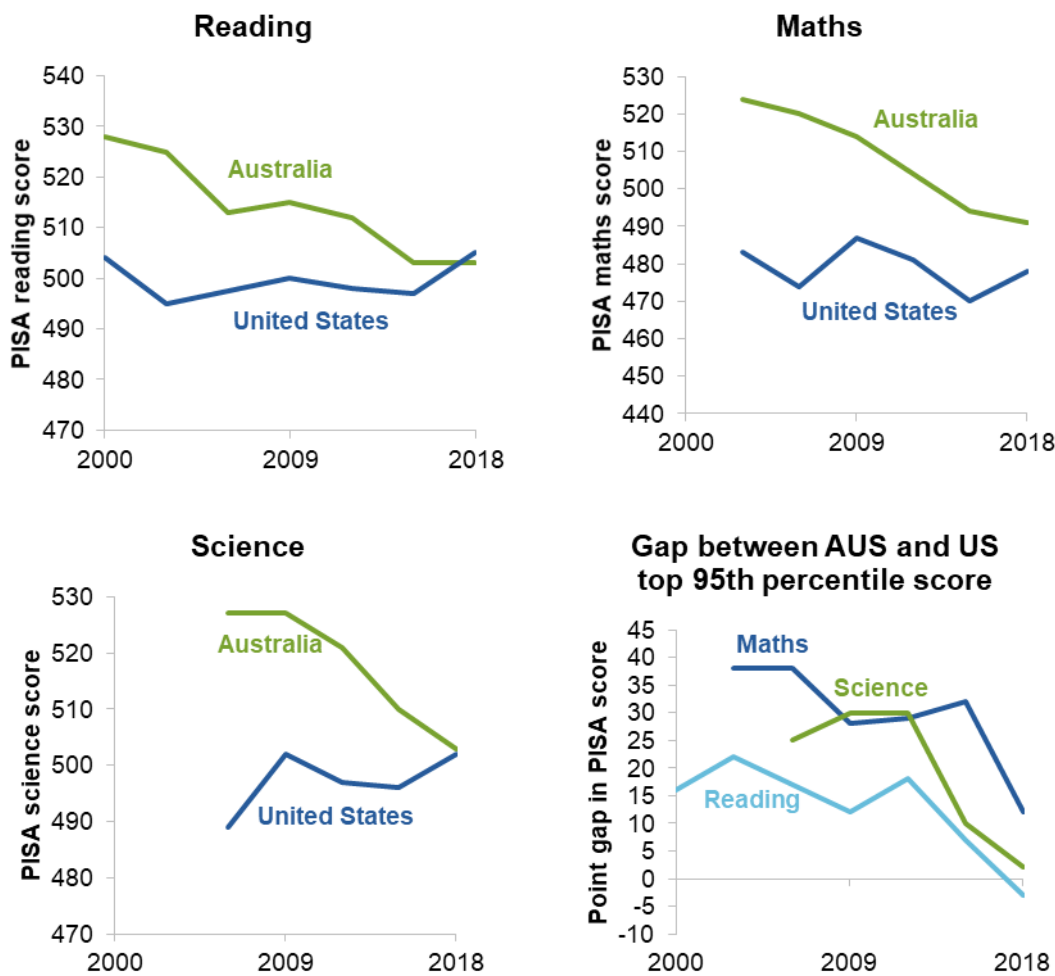
Source: OECD Stat database.

Reasons for closing of the historical education gap include reforms to higher education that have allowed greater enrolment (PC 2019) and the high average levels of education among Australia’s immigrant population (Hatton and Withers 2012, p. 351).

There is also little evidence that Australian educational *quality* is poorer than that in the US, as school achievement levels measured by the Programme for International Student Assessment (PISA) indicate Australian students traditionally perform better than their US peers in reading, maths and science. That said, since 2000, Australia has seen its test scores in all three areas fall relative to the US (figure 12). This has even been the case for the top performing students.

Figure 12 **... and while Australian test scores have fallen sharply, they are no worse than in the United States**

Programme for International Student Assessment (PISA) 2000 and 2018, and the gap between Australia and the US of the top 95th percentile of scores in reading, maths and science (bottom right)



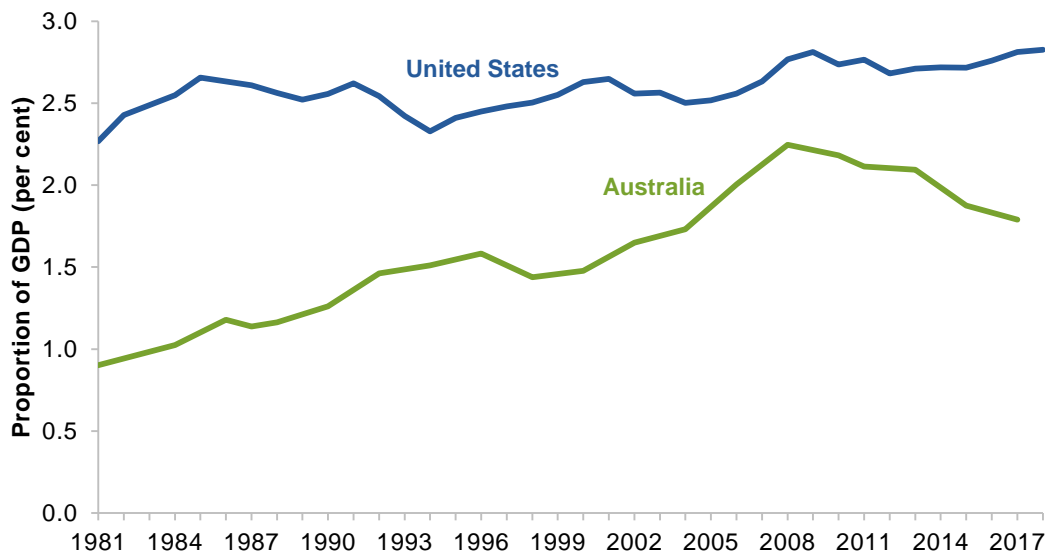
Source: OECD (2018).

Overall, Australia's downward trend in school achievement — including relative to a number of OECD peers — is a cause for concern. It is, and should be, a focus for policy attention. Improving educational attainment is a potential source of long-run productivity growth for Australia. Nonetheless, there is little reason to believe that differing levels of educational attainment are contributing to the present productivity gap with the US.

Research and development

There is a significant gap in research and development (R&D) expenditure between the US and Australia (figure 13). The main reason for the lower R&D intensity of the Australian economy is the differences in industry structure (Davis and Tunny 2005). Australia is a small open economy whose goods sector is mostly primary production- and construction-based,⁴ while the US has a larger manufacturing base.⁵ Within manufacturing, the US has a greater share of activity in ICT-related fields, while Australian manufacturing is more heavily weighted towards food and metals manufacturing (OECD 2020). These differences in structure mean that manufacturing accounts for nearly two thirds of US business expenditure on R&D but only one fifth of Australian expenditure.

Figure 13 The Australian economy is less R&D-intensive than the US, mainly due to lower business expenditure
Australian and United States total research and development expenditure as a proportion of GDP between 1981 and 2018



Source: OECD Stat database.

⁴ Agriculture, mining and construction together account for about 19 per cent of GDP in Australia and about 7 per cent of GDP in the United States (Bureau of Economic Analysis 2019).

⁵ Manufacturing accounts for 11.3 per cent of US GDP (Bureau of Economic Analysis 2019), and 5.6% of Australian GDP (ABS 2019a).

Should this be cause for alarm? While there are pockets of high-tech manufacturing in Australia, the Commission has previously noted other reasons why the potential to expand this sector has been limited. These include that Australia:

- has benefited from primary production (agriculture and mining)
- has a relatively small domestic market and lacks proximity to many larger markets, making it economically appealing for successful innovators to move development and manufacturing phases offshore (PC 2017, p. 24).

That is, inevitably high-tech manufacturing will contribute less to future productivity growth in Australia than it will in the US. On the other hand, in many service industries, R&D is only a small part of firms' innovation effort (Department of Industry, Innovation and Science 2017), and Australia's low overall R&D intensity need not limit our productivity performance in these sectors.

Innovation is a broad concept and encompasses much more than traditional business expenditure on R&D. Increasingly firms are investing in other innovative activities, particularly in 'asset-light, customer focused' service industries ISA (2019, p. 4). These include:

... other intangible asset areas such as staff training, enhanced business models, marketing and branding, productivity-enhancing technologies (including software and systems) and intellectual property acquisition. They are also investing in tangibles such as innovation-related machinery and equipment. (ISA 2019, p. 4)

These 'non-R&D innovation' activities are also associated with higher productivity, revenue and jobs growth for firms that undertake them (ISA 2019, p. 4). As the service sector continues to grow in importance, investment in intangibles may become a larger share of business innovation investment.

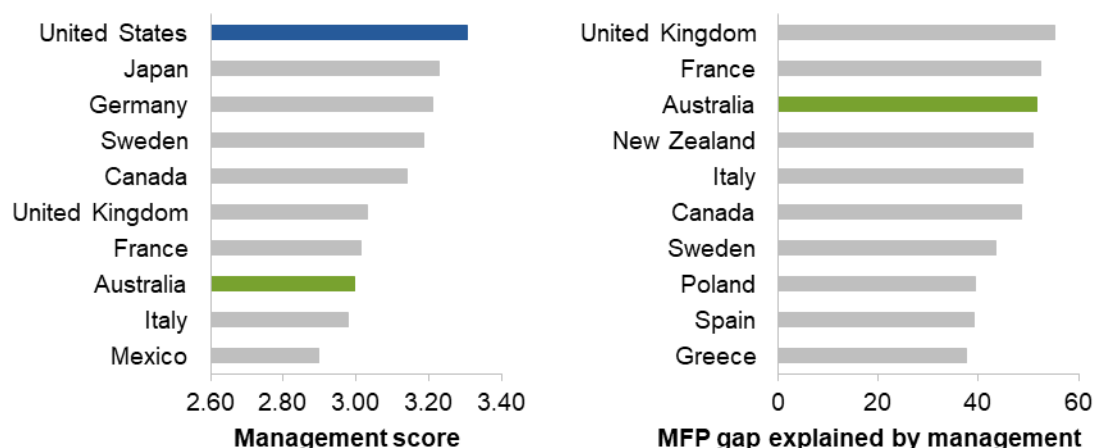
Management capability

Management, like productivity, is about how well resources are used in production, including taking advantage of new technologies. International surveys of management capability show Australian managers scoring lower than peers in the United States and some other advanced economies (Bloom, Sadun and Van Reenen 2017). Econometric evidence suggests that that this difference in management capability may explain up to half of the productivity gap in the manufacturing sector compared with the United States (figure 14).

Australian studies suggest similar management capability across a range of industries. Management performance in manufacturing is not much different than the average across the whole Australian economy (figure 15).

Figure 14 Management capability appears to be lacking, and this may explain some of the productivity gap in manufacturing

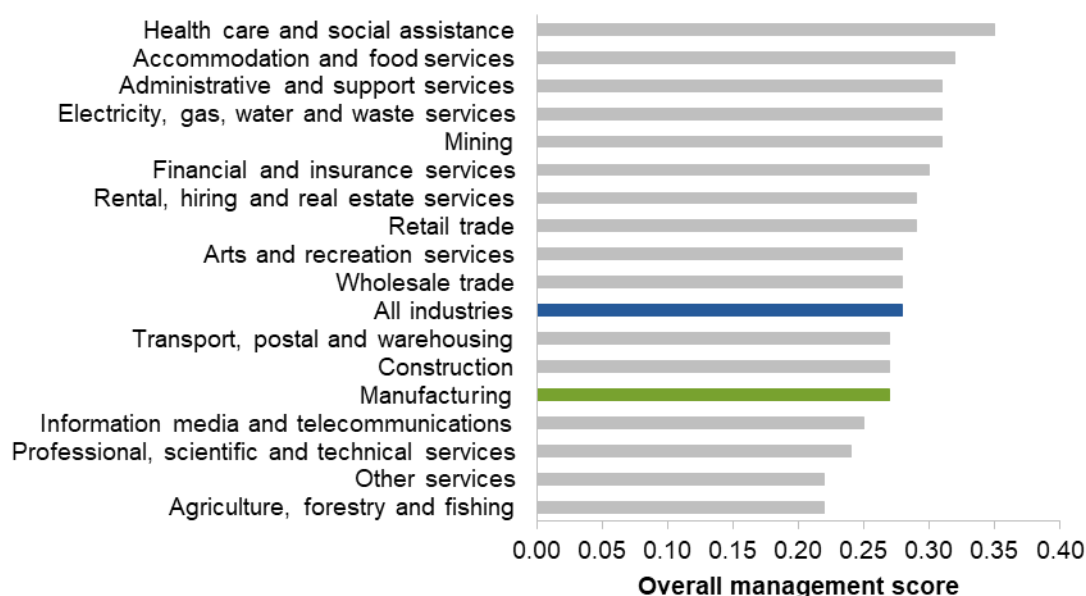
Average management score by country (LHS) and the proportion of the multifactor productivity (MFP) gap with the US that is explained by this score (RHS)



Source: Bloom, Sadun and Van Reenen (2017).

Figure 15 Manufacturing is not the only industry with low management capability

Overall management score by industry in 2016-17



Source: Agarwal et al. (2019).

Within the breadth of management skills, digital management capability appears particularly weak (with a score of about 0.11 compared to the overall management score of 0.28). The poor performance is corroborated by surveys of digital adoption (for example, the World Bank ‘Index of Digital Adoption’ places Australia 33rd in the world for fastest digital adoption (World Bank 2016)). The pervasive importance of digital technology through the economy — across both goods and service sectors — suggests improvement in management capability may yield substantial improvements in productivity over time.

Overall, there is reason to believe that Australia’s underlying innovative capability is strong, but could be improved. Although it is not an obvious source of the gap between Australian and US productivity levels, it might still provide some indication as to where Australia’s focus should be in lifting productivity growth.

3 Summing up

Australia’s average incomes compare very well with most other developed economies. Healthy labour markets and decent productivity levels have allowed Australians to enjoy a standard of living higher than most of the world.

However, Australia’s productivity performance is still well behind the international ‘frontier’, best represented by the economy of the United States. Scope to close the gap with the United States is limited in some areas. Australia’s remoteness and relatively low population density will continue to limit economies of scale, particularly in manufacturing and goods distribution.

On the other hand, there is scope for improvement in many industries. Australia’s productivity levels are lower than those of the US in a range of service industries, in which outputs are customised and economies of scale are less important. Australian businesses in these sectors have opportunities to improve productivity. It is likely that human capital (education quality and lifelong skills formation), firm level innovation (including but broader than R&D), effective use of digital technologies and data and efficient cities that link skilled labour to job opportunities will rise in relative importance in an increasingly service-driven economy.

References

- ABS (Australian Bureau of Statistics) 2019a, *Australian System of National Accounts, 2018-19*, Cat. no. 5204.0, Canberra.
- 2019b, *Labour Force, Australia, Detailed, Quarterly, Aug 2019*, Cat. no. 6291.0.55.003, Canberra.
- Agarwal, R., Bajada, C., Brown, P., Morgan, I. and Balaguer, A. 2019, *Development of Management Capability Scores*, Research Paper, Department of Industry, Innovation and Science.
- van Ark, B., O'Mahoney, M. and Timmer, M.P. 2008, 'The Productivity Gap between Europe and the United States: Trends and Causes', *Journal of Economic Perspectives*, vol. 22, no. 1, pp. 25–44.
- Battersby, B. 2006, *Does distance matter? The effect of geographic isolation on productivity levels*, Treasury Working Paper, The Australian Treasury.
- Benos, N. and Zotou, S. 2014, 'Education and Economic Growth: A Meta-Regression Analysis', *World Development*, vol. 64, pp. 669–689.
- Bloom, N., Sadun, R. and Van Reenen, J. 2017, *Management as technology?*, Working Paper, 22327, National Bureau of Economic Research.
- Boulhol, H., de Serres, A. and Molnar, M. 2008, 'The Contribution of Economic Geography to GDP per Capita', *OECD Economic Studies*.
- Bureau of Economic Analysis 2019, *Interactive Access to Industry Economic Accounts Data: GDP by Industry*, Bureau of Economic Analysis, <https://apps.bea.gov/iTable/iTable.cfm?ReqID=51&step=1> (accessed 19 February 2020).
- Corrado, C.A., Hulten, C.R. and Sichel, D.E. 2006, *Intangible Capital and Economic Growth, 11948*, NBER Working Paper, the National Bureau of Economic Research.
- Davis, G. and Tunny, G. 2005, *International comparisons of research and development*, Economic Roundup, Spring 2005, Treasury.
- Department of the Prime Minister and Cabinet 2012, *Australia in the Asian century: white paper*, White Paper, Commonwealth of Australia, Canberra.
- Dolman, B., Parham, D. and Zheng, S. 2007, *Can Australia Match US Productivity Performance?*, Productivity Commission Staff Working Paper, Canberra.
- Glaeser, E.L. and Resseger, M.G. 2009, *The Complementarity between Cities and Skills, 15103*, NBER Working Paper, the National Bureau of Economic Research.
- Hatton, T. and Withers, G. 2012, 'The labour market', *Cambridge economic history of Australia*, Cambridge University Press, Cambridge, pp. 351–572.
- Inklaar, R. and Timmer, M. 2008, *GGDC Productivity Level Database: International Comparisons of Output, Inputs and Productivity at the Industry Level*, GGDC Working Paper, University of Groningen.
- ISA (Innovation and Science Australia) 2019, *Stimulating Business Investment in Innovation*, Australian Government.

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- Leigh, A. 2008, 'Returns to education in Australia', *Economic Papers: A journal of applied economics and policy*, vol. 27, pp. 233–249.
- Lewis, W.W., Siemen, A., Baley, M. and Sakate, K. 1992, *Service-sector productivity and international competitiveness*, McKinsey Quarterly.
- NSW Government 2019, *Greater Sydney*, City of Sydney, <https://www.cityofsydney.nsw.gov.au/learn/research-and-statistics/the-city-at-a-glance/greater-sydney> (accessed 31 January 2019).
- OECD (Organization for Economic Cooperation and Development) 2018, 2000, 2003, 2006, 2009, 2012, 2015, and 2018 Reading, *Mathematics and Science Assessments*, Program for International Student Assessment.
- 2020, *STAN Structural Analysis Database*, <http://www.oecd.org/sti/ind/stanstructuralanalysisdatabase.htm> (accessed 3 March 2020).
- ONS (Office of National Statistics) 2012, *International comparisons of productivity*, Information Paper, United Kingdom.
- PC (Productivity Commission) 2017, *Shifting the Dial: 5 Year Productivity Review, Supporting Paper No. 12, An Overview of Innovation Policy*.
- 2019, *The Demand Driven University System: A Mixed Report Card*, Commission Research Paper, Canberra.
- 2020, *PC Productivity Insights: Recent Productivity Trends*, Canberra, February.
- Schreyer, P. 2009, 'International Comparisons of Levels of Capital Input and Multi-Factor Productivity', *Productivity Measurement and Analysis*, OECD Publishing, Paris.
- Sorbe, S., Gal, P. and Millot, V. 2018, *Can productivity still grow in service-based economies?: Literature overview and preliminary evidence from OECD countries*, 1531, OECD Economics Department Working Papers, OECD Publishing.
- United States Census Bureau 2018, *Quick facts, New York City*, United States Census Bureau, <https://www.census.gov/quickfacts/fact/table/newyorkcitynewyork,bronxcountybronxboroughnewyork,kingscountybrooklynboroughnewyork,newyorkcountymanhattanboroughnewyork,queenscountyqueensboroughnewyork,richmondcountystatenislandboroughnewyork/PST045219> (accessed 31 January 2020).
- Ville, S. and Withers, G. 2015, *The Cambridge Economic History of Australia*, 1st edn, Cambridge University Press.
- Whiteford, P. 2010, *Transfer Issues and Directions for Reform: Australian Transfer Policy Comparative Perspective*, Conference Paper, Australia's Future Tax and Transfer Policy Conference, University of Melbourne, Melbourne.
- World Bank 2016, *Digital Adoption Index*, The World Bank, <https://www.worldbank.org/en/publication/wdr2016/Digital-Adoption-Index> (accessed 12 November 2019).
- 2018, *Population density*, World Bank Data, https://data.worldbank.org/indicator/EN.POP.DNST?end=2018&name_desc=false&start=1961 (accessed 12 March 2019).