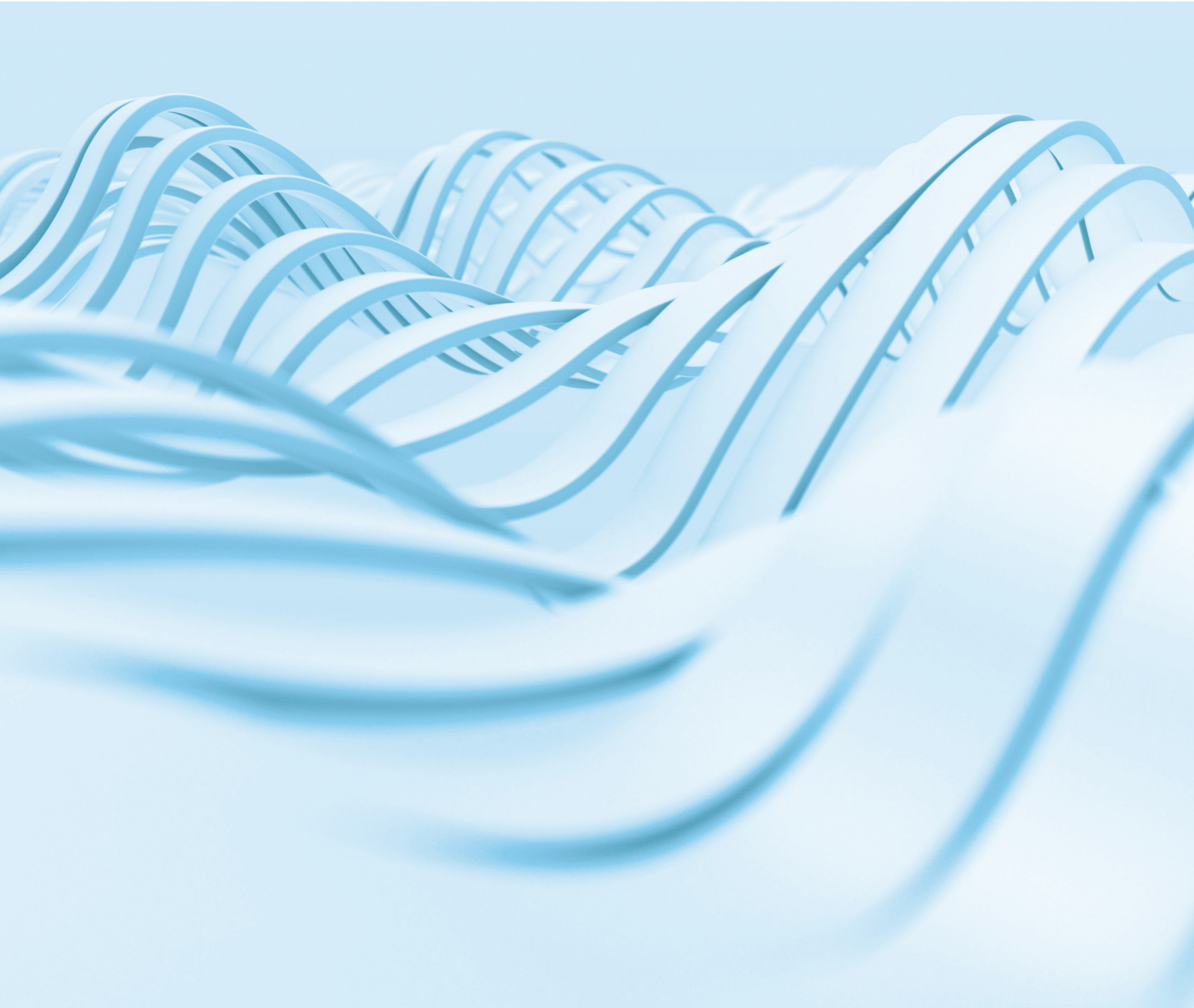
Australian Government
Productivity Commission

Interim report no. 1 – July 2022

5-year Productivity Inquiry: The Key to Prosperity

Interim report



The Productivity Commission acknowledges the Traditional Owners of Country throughout Australia and their continuing connection to land, waters and community. We pay our respects to their Cultures, Country and Elders past and present.

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).

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Publication enquiries:
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Opportunity for comment

The Commission thanks all participants for their contribution to the inquiry and now seeks additional input for the final report.

You are invited to examine this interim report — and forthcoming focus area interim reports for this inquiry — and comment by written submission to the Productivity Commission, preferably in electronic format, by 7 October 2022.

Further information on how to provide a submission is included on the inquiry website: www.pc.gov.au/inquiries/current/productivity

The Commission will shortly release a number of focus area interim reports, hold further discussions with participants (including public hearings), and review additional submissions received before preparing the inquiry final report. The final report will be forwarded to the Government in February 2023.

Public hearing dates and venues

Dates and venues will be listed on the inquiry website once confirmed.

Commissioners

For the purposes of this inquiry and interim report, in accordance with section 40 of the *Productivity Commission Act 1998* the powers of the Productivity Commission have been exercised by:

Michael Brennan	Chair
Alex Robson	Commissioner
Stephen King	Commissioner
Lisa Gropp	Commissioner

Terms of reference

I, Josh Frydenberg, Treasurer, pursuant to parts 2 and 3 of the *Productivity Commission Act 1998*, hereby request that the Productivity Commission undertake an inquiry into the Australia's productivity performance and provide recommendations on productivity-enhancing reform. This inquiry is the second of a regular series, undertaken at five-yearly intervals, to provide an overarching analysis of where Australia stands in terms of its productivity performance. The first report, Shifting the Dial was completed in 2017.

Background

Australia's economy has performed strongly in recent decades enjoying robust growth in incomes and living standards following 28 years of consecutive economic growth interrupted by the COVID-19 pandemic. Australia's economic recovery from the pandemic has been world leading however to ensure Australians continue to enjoy higher living standards, we need to continue to focus on the task of lifting productivity.

Productivity growth is vital for Australia's future, particularly as the Australian and global economies emerge and begin to recover from the economic impacts of COVID-19. The 2021 Intergenerational Report makes it clear that future growth in income and living standards will be driven from productivity growth as the participation effects of young migration are offset by an ageing population. Global and domestic productivity growth in recent decades however has slowed. Changes brought about by the COVID-19 pandemic and the global and domestic policy responses will also provide a unique historical context for this Review.

Given the scale and nature of the economic shock caused by the COVID-19 pandemic, it is expected to have an enduring impact on Australia's productivity challenge. The acceleration in the uptake of technology by business and individuals has stimulated growth in remote work, online commerce, businesses' digital presence and innovative delivery of public services like health and education. The pandemic has affected business models in some key sectors and underscored the need for labour mobility across the economy.

In this environment, Australia needs policy settings that foster a flexible and dynamic economy, that is able to adapt in the face of economic challenges and opportunities. Policy settings should encourage the economy to adapt to the growing importance of digital technologies, including through developing a skilled labour force. They must also be forward looking and support an environment that promotes economic dynamism, entrepreneurship and appropriate risk-taking, and innovation and technological adoption.

Against this background, the Review can play a critical role in making high-value and implementable recommendations to support Australia's productivity growth. Lifting Australia's productivity growth will involve a combination of economy-wide and structural reforms, in addition to targeted policies in particular sectors to push Australian industries closer to the global frontier.

Scope of the inquiry

The Commission is to review Australia's productivity performance and recommend an actionable roadmap to assist governments to make productivity-enhancing reforms. Each recommendation should qualitatively and quantitatively estimate the benefit of making the reform and identify an owner for the action and a timeframe in which it might occur.

Without limiting related matters on which the Commission may report, its report to the Government should:

1. Analyse Australia's productivity performance in both the market and non-market sectors, including an assessment of the settings for productive investment in human and physical capital and how they can be improved to lift productivity.
2. Identify forces shaping Australia's productivity challenge as a result of the COVID-19 pandemic and policy response.
3. Consider the opportunities created for improvements in productivity as a result of Australia's COVID-19 experience, especially through changes in Australia's labour markets, delivery of services (including retail, health and education) and digital adoption.
4. Identify priority sectors for reform (including but not limited to data and digital innovation and workforce skills) and benchmark Australian priority sectors against international comparators to quantify the required improvement.
5. Examine the factors that may have affected productivity growth, including domestic and global factors and an assessment of the impact of major policy changes, if relevant.
6. Prioritise and quantify the benefit of potential policy changes to improve Australian economic performance and the wellbeing of Australians by supporting greater productivity growth to set out a roadmap for reform.
7. Revisit key recommendations and themes from the previous five yearly review in light of the above, where relevant.

The Commission should have regard to other current or recent reviews commissioned by Australian governments relating to Australia's productivity performance and include comparisons of Australia's productivity performance with other comparable countries. The Commission should support analysis with modelling where possible and qualitative analysis where data is not available, and this is appropriate.

Process

The Commission should consult widely and undertake appropriate public consultation processes, inviting public submissions. The Commission should actively engage with Commonwealth, and state and territory governments. The final report should be provided to the Government within 12 months of receipt of these terms of reference.

The Hon Josh Frydenberg MP
Treasurer

[Received 7 February 2022]

Acknowledgements

The Commission acknowledges and thanks Jared Dent, Colin Burns and Rosalyn Bell for their work on this interim report and its underlying analysis.

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Foreword

Productivity is the key to prosperity.

It is the process by which we learn how to get more from less: more and better products — new solutions to meet human needs, produced with less hours of work, fewer resources and a lighter environmental impact.

In essence, productivity growth is about working smarter. The extraordinary rise in average living standards over the last 200 years has come about through the ongoing discovery and spread of new, useful ideas. Some took the form of new technology — like electricity or antibiotics. Others were new business models like mass production or ride sharing. Still others were institutional innovations like accounting standards, capital markets or free trade. Australia has not had to generate all these new ideas, but has benefited from its own ingenuity in raising productivity across the economy, and from diffusing, using and building on others' inventiveness.

What will come next? What should we do to speed the pace of growth, or at least clear a path?

The current 5 year Productivity Inquiry tackles these questions. It builds on the work of the last review, *Shifting the Dial*, released in 2017. It starts with this document, which lays out the context of our productivity challenge: what we have learned from history, what we think is most salient about the present and where we might therefore focus our policy effort.

A key message is that the path and pace of growth is necessarily uneven. Countless innovations have burst onto the scene, radically transformed an industry or aspect of life, and then plateaued towards a new normal. They have varied in their effect: some innovations made a product dramatically cheaper. Others improved the quality of a good or service. Others came up with a good or service that was entirely new. And some did a combination of all three. This unevenness extends to parts of the economy. Agriculture was completely transformed in the twentieth century. Some service industries, by contrast, have seen less change. No transformative change of the past was foreseeable ahead of time.

Productivity policy is about *positioning* rather than prediction. It involves a set of institutions and policy settings that can foster innovation and can efficiently test, select and spread the best new ideas across the economy. By this, the benefits of (uneven) progress can be widely shared.

Our current state

The unevenness of productivity growth — both in its causes and effects (cost, quality and novelty) — makes it is hard to measure. But the evidence suggests that like its global peers, Australia's productivity growth has slowed in the last two decades.

Recapturing the productivity growth rates of the past could yield large benefits in extra income alongside a reduced working week.

But productivity faces some headwinds. One is the gradual but dramatic rise of a predominantly services based economy. Ironically, productivity growth in the production of goods has seen a shift of labour and other resources into services, which have risen to make up 80 per cent of the economy. Many services are delivered in person. Many are government funded and/or delivered. Often it has proven hard to automate aspects of the service, or otherwise economise on the labour input. Hence productivity growth in most services has been slower than traditional sectors like agriculture, manufacturing and mining, where capital has replaced much labour and new technology has driven large gains in overall productivity. Moreover, globally, Australia ranks lower in service sector productivity than we do in the goods sector.

Slower productivity growth in services is a historical pattern. It need not be our future. New approaches, such as digital technologies and the better use of data (through artificial intelligence, for example) hold great promise for broadly based productivity gains, including in services.

This does not mean that we will ignore productivity enablers in traditional industries. Rather, the point is to broaden the policy conversation about productivity to encompass the services sectors that now employ the bulk of the workforce.

The COVID-19 pandemic has forced the take up of technology, including online retail, telehealth and remote work. It forced new realities on the producers and consumers of services — the sector hardest hit by pandemic restrictions. The adaptations forced by the pandemic (including of government regulators) are now opening new possibilities for future productivity growth, if we can grasp them.

But the pattern of productivity growth could look different in services. Perhaps quality improvements will be more salient than cost reductions, making it even harder to accurately measure the gains. Service innovation could be focused less on the invention of new technology and more on its use, particularly for a small open economy like Australia. Getting value from university expertise could be as much about person-to-person connections as commercialising academic IP. A focus on service sector productivity forces a rethink and subtle adjustment of many traditional policy tools.

Global forces are creating their own productivity headwinds. The need to decarbonise the economy is one. Decarbonising represents an effort to reduce costs — specifically the cost of carbon emissions not hitherto counted in firm profits or GDP. It will require global and local innovation, strong partnerships between the public and private sector and significant new investment — partly to replace rather than add to the existing capital stock. Australia's success in meeting this challenge efficiently will be a key determinant of our overall productivity performance in coming decades.

Heightened geopolitical tensions and supply chain disruptions also pose a challenge. Global trade and investment have been a great benefit to Australia as a small open economy. Building supply chain resilience (and redundancy) might be attractive to some firms, but will almost certainly increase costs, and prices faced by consumers. Any fragmentation of the multilateral rules based order could crimp the benefits to Australia from trade and investment flows.

Where to next?

This document sets out areas of policy focus which, in our judgment, best reflect the balance of challenges and opportunities that Australia faces. They are broad enablers, rather than targeted predictions. They do not identify 'sunrise' industries or the next big technological wave. But they are selected partly for their relevance to our current context: including the rising service sector, the challenge of decarbonisation and continued openness to the best the world can offer.

In some cases, they reflect the need to advance traditional policy goals, like labour market flexibility or innovation policy, in light of new circumstances. Some reflect areas discussed 5 years ago in *Shifting the Dial*, which have taken on new importance, but where implementation has been limited to date.

Priority areas are identified in this document and will be followed up with interim papers to further discuss the issues, set out the Commission's early thinking and elicit feedback from the community.

These areas of policy focus are:

- Innovation policy and diffusion of new processes and ideas: Policies that foster a business environment that encourages efficiency, innovation and diffusion.

- Data policy, digital technology and cyber security: The economy-wide importance of data and the digital technologies that generate and use data, as general purpose technologies that could boost productivity in many areas of the economy, including services.
- A productivity-friendly business environment: Limiting impediments to business investment, a flexible workforce, sound regulation and an efficient approach to decarbonising the economy.
- A skilled and educated workforce: The importance of education in driving productivity growth through increasing human capital and creating settings conducive to technological breakthroughs and adoption.

We welcome feedback on this document and look forward to the consultation subsequent to these other interim reports.

Together these areas of policy focus reflect our best judgment about where we can achieve the biggest return on our reform effort. They are not specific bets on the future sources of growth, so much as broad settings that stack the odds in Australia's favour.

1. Productivity growth and prosperity

Key points

- **Productivity growth — producing more outputs, with the same or fewer inputs — is the only sustainable driver of increasing living standards over the long term. While economic growth based solely on physical inputs cannot go on forever, human ingenuity is inexhaustible.**
- **Sustained productivity growth is a relatively recent historical phenomenon. It has ensured that modern life is richer in potentially every sense compared to any time in the past.**
  - Over the past 200 years, productivity growth has lifted hundreds of millions of people out of poverty and has led to a dramatic increase in living standards for the vast majority of the world's population.
  - Technological developments and inventions — including vaccines, antibiotics and statins — have driven huge increases in the quality and length of life over the past century.
- **The benefits of productivity growth come in the form of:**
  - goods and services that cost less, in terms of number of hours employees need to work to afford them
  - goods and services whose quality improves over time
  - completely new goods and services invented to improve everyday lives.

  In practice, novel products, improved quality and reduced cost often blend together.
- **As goods and services become more affordable, people can work fewer hours and consume more; over the past 120 years, the economic output of the average Australian is up 7-fold, while hours worked have consistently fallen.**
- **While productivity growth is an imperfect measure of rising wellbeing, lifting the rate of productivity growth is an essential element of any policy strategy aimed at increasing the collective welfare of the Australian community. Productivity growth relaxes the constraints of scarcity and opens up opportunities — for individuals, businesses and the general community.**

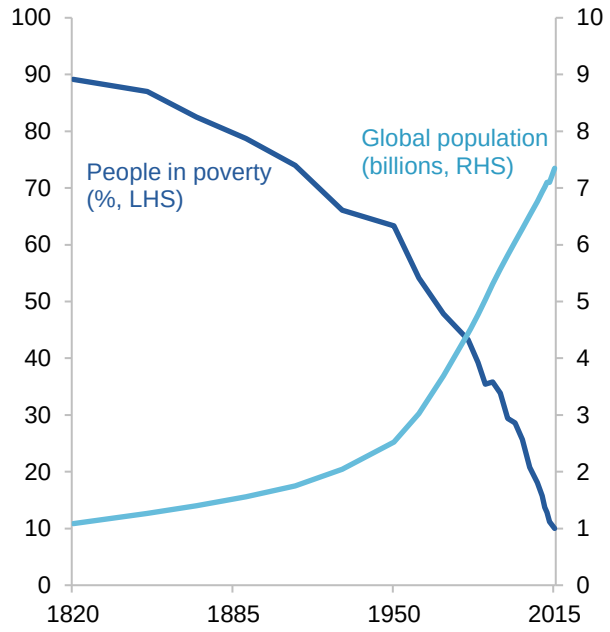
1.1 Productivity and prosperity go hand in hand

One of the most startling facts in human history is the dramatic rise in living standards over the past two centuries. This is despite the global population increasing almost 7-fold over that period. Just 200 years ago, 90 per cent of the world's population lived in a state of extreme poverty, compared to less than 10 per cent today (figure 1.1 panel a). In Australia, economic output per person — a general measure of prosperity — is

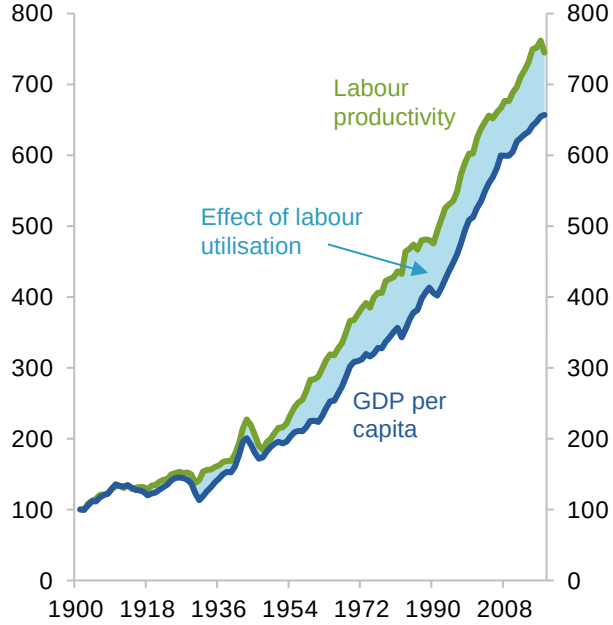
around 7 times higher than at Federation (121 years ago).[1] This transformation is ultimately a function of human ingenuity: of being more productive — working smarter not harder (figure 1.1 panel b).

Figure 1.1 – Productivity makes people better off

a. Extreme poverty has plummeted while population's soared[a]



b. Australians are better off due to rising productivity[b] (index = 100 in 1901)



a. Extreme poverty is defined as an income lower than 2.15 USD (2017 prices, the equivalent of 1 USD in 1985 prices) (World Bank 2022a). b. The effect of labour utilisation is the difference in growth between GDP per capita and labour productivity. Here this effect has been negative (decreased growth in GDP per capita) because the ratio of total hours worked in the economy to total population has fallen due to with falling average hours worked.

Source: Productivity Commission estimates using Bergeaud, Cette and Lecat (2016); Roser, Ortiz-Ospina and Giattino (2019).

But what has this meant in practice? It means that people alive today have the opportunity to access an array of goods and services that were unimaginable in the past. And access to these goods and services can transform people's quality of life.

At the turn of the twentieth century, life was materially worse for the average Australian than it is today on many dimensions:

- For every 10 000 newborn babies, more than 1000 died before they reached their first birthday, compared to just 3 in 10 000 today (ABS 2002; AIHW 2022).
- For those that survived childbirth, life expectancy was about 60 years, compared to more than 80 years today. The invention of antibiotics, which largely eradicated infectious diseases such as cholera, diphtheria, pneumonia, typhoid fever, plague, tuberculosis, typhus and syphilis, was decades away, and only became a mainstream medicine from the 1950s (Adedeji 2016).
- During their 60 years of life, the average Australian worked much longer hours than today (the 48 hour week was legislated in 1916); with little access to paid leave (paid annual leave was first introduced into

[1] The picture is similar in other countries. In the United States, 95 per cent of the increase in living standards over the past 70 years is attributable to growth in productivity. In China, 92 per cent of the increase in living standards over the past 30 years was attributable to productivity growth (Feenstra, Inklaar and Timmer 2015).

industry awards beginning in 1935 (Fair Work Ombudsman 2022)); and they worked in a more dangerous workplace (Jansz and Gilbert 2017).

- The average Australian would also die before accessing the age pension, which was introduced in 1909 for men aged 65 years and over (ABS 1988). The average person could afford far fewer goods and services for the wages earned (a steak would have cost the equivalent of 5 per cent of a week's wages (see table 1 sources).
- Home life was more crowded (about 5 people per household in 1910 to less than 3 today in much larger housing (AIFS 2017)) and much dirtier: automatic dishwashers and washing machines did not become commonplace in Australian households until at least the 1970s, and toilets were often located outside the house until as recently as the 1950s.

In many cases productivity growth by itself did not directly cause shorter working weeks, more holidays, and longer, healthier lives — some of the beneficial changes that make life generally better today than in the past. But productivity growth did enable those changes, by consistently freeing up small amounts of time and resources year after year, which could subsequently be reallocated to more valuable pursuits. Small changes add up: steady productivity growth has underpinned massive increases in living standards over the longer run (box 1.1). Although in the short-term, people can increase their incomes by working more hours (to increase production now) or consuming less and saving more (to produce more tomorrow), neither option can increase living standards indefinitely.[2] There are only so many hours in the day to work, and only so much that can be saved from a given income.

Despite its pivotal role in driving prosperity, the precise causes of productivity growth are not universally agreed or well understood (Appendix A.2). Some combination of flexible and dynamic markets (where prices determine the allocation of resources), institutional settings (including relatively stable government), transparent property rights, access to resources (including finance), and the application of science and ingenuity to production processes are likely key ingredients. What we are sure about is that productivity growth is about learning to do more with the resources we already have — working smarter, not longer — investing in the latest technology and the best ideas (from domestic and international sources), which become embodied in the things that we build and the ways that we organise and approach tasks.

Productivity growth is generally described in terms of a single, economy-wide aggregate — the percentage change in GDP per hour worked. This measure is invaluable for understanding the rate at which productivity changes, and for making comparisons over time and across different countries. But it can also obscure the reality that underpins the aggregate: the disparate, uneven and unpredictable short term movements — both up and down over time and at different rates across the economy, reflecting actions taken by individual firms across different industries — that ultimately lead to improvements in the production of individual goods and services.

A more 'micro' lens is a useful starting point for understanding Australia's current productivity challenges and identifying policy responses.

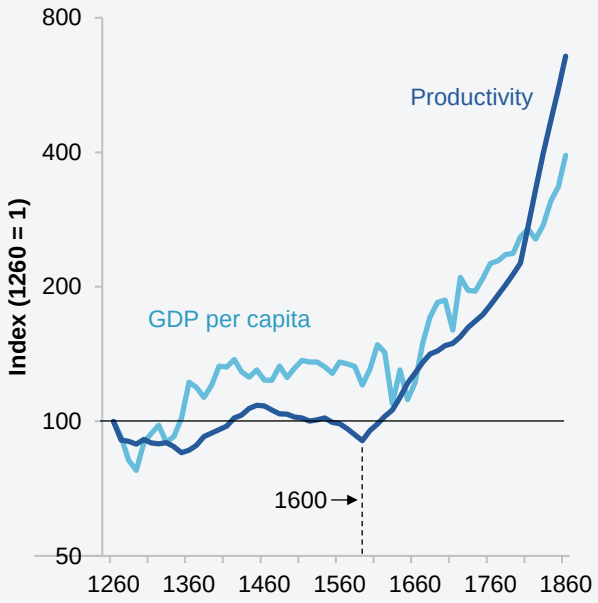
[2] Technically, both options are, absent productivity growth, subject to diminishing marginal returns on additional capital and labour inputs.

Box 1.1 – Consistent productivity growth is vital for prosperity

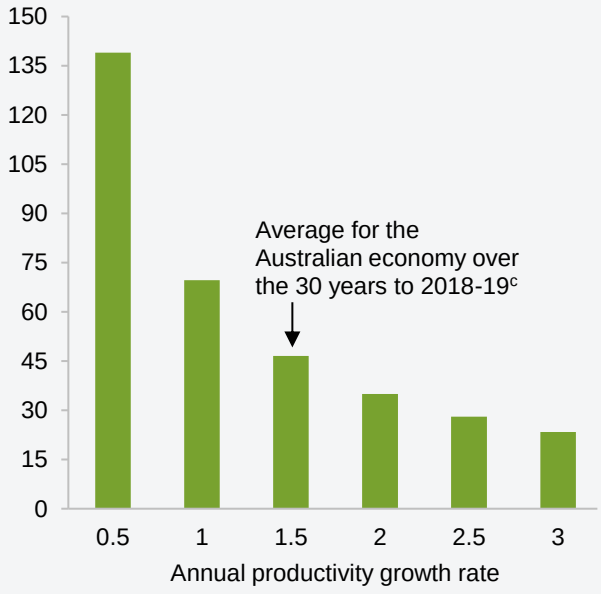
The dramatic rise in living standards over the past 200 years is not the historical norm. For most of human history, the average person experienced virtually no growth in material prosperity. This is illustrated for the United Kingdom — one of the only countries where long term economic data is available — in the figure below (panel a), which illustrates the relationship between GDP per capita and productivity. For many hundreds of years growth in per capita GDP was stagnant, consistent with non-existent productivity growth.[1] Starting in the early 1600s, productivity growth began and rapidly accelerated, as the industrial revolution gathered pace and scope (Bouscasse, Nakamura and Steinsson 2021). Growth in per capita GDP, and increasing economic prosperity, followed.

Compounding of this growth is important: seemingly small productivity growth leads to large changes in economic output over longer periods of time (panel b) — so policy changes that secure even small increases in productivity growth matter. For example, in any economy, if productivity growth averages 2 per cent per year, other things equal, economic output per person will double in 35 years, triple in 55 years and increase by more than 5 fold over 85 years — the life expectancy of an Australian born today. Conversely, if productivity grows at a slower rate of 1 per cent per year, economic output will take 70 years to double.

a. Productivity and GDP per capita in the United Kingdom



b. Years to double per capita economic output[b]



a. Based on estimates of total factor productivity from Bouscasse et al. (2021). **b.** This chart shows for a hypothetical country how long it would take for per capita economic output to double for various rates of productivity growth. It assumes no change in labour utilisation rates (i.e. holding participation and hours worked constant), hence the rate of productivity growth is the sole determinant of the rate of economic growth. **c.** As reported in the 2021 Intergenerational Report (2021a).

Source: Broadberry et al (2012).

[1.] Prior to the 1600s, productivity increases tended to lead to increases in the population and hence there was no change in real living standards. This is known as the Malthusian trap.

Insight 1.1 – Productivity growth is a recent historical phenomenon and over the past 200 years has led to massive growth in living standards around the world.

1.2 A micro lens on productivity growth

At the most elementary level, productivity describes the quantity of products that can be generated (output) from the resources (inputs) used in the production processes.[3]

In reality, the change in productivity — productivity growth — reflects not only the *quantity* of goods and services produced but also changes in their *quality* over time. It also reflects the invention and introduction of entirely new products.

Hence, the growth in living standards experienced over the last 200 years can be seen as manifesting in three main ways.

1. Goods and services that became ***cheaper*** — through a fall in the *number of hours* ('labour cost') of workers' time needed to produce existing goods and services
2. Goods and services that got ***better*** — through improvements in *quality* on multiple dimensions (by an amount worth more than any additional resources required to improve them)
3. ***Entirely new*** goods and services — as new ways were found to satisfy human wants (or new wants were discovered and developed) either through wholly novel products or new varieties of existing ones

Different goods and services, and different parts of the economy, have experienced different combinations of these three effects. Some everyday items have become materially cheaper; others have become much better; and many have done both. All the while, the introduction of new goods and services has fundamentally re-shaped the economy.

> … growth as we have known it has centrally involved the birth of new products and industries and the decline and death of others, a perspective incompatible with thinking about and measuring growth simply as an aggregate phenomenon. (Nelson et al. 2018, p. 153)

In each of these three ways, productivity growth has increased the typical worker's purchasing power — a smaller number of hours of work is required to achieve any particular level of material living standards (which encompasses the quality, quantity and variety of goods and services).

[3] More formally, productivity is defined as the ratio of some measure of output (goods and services after accounting for goods supplied by others) to some measure of inputs (typically labour, machines, equipment, or the combination of these) for some unit of analysis (be it a single company, an industry within an economy, or an entire country).

Insight 1.2 – Productivity growth benefits the average Australian by increasing their purchasing power. The average worker can consume more, better quality, and novel goods and services, while working fewer hours.

Things that get cheaper: lowering the labour cost of goods and services

Productivity growth often involves finding ways to produce goods and services with fewer inputs. This in turn means that the goods and services become cheaper over time to purchase. One way to measure this is by the number of hours the typical employee (receiving the average wage) needs to work in order to buy particular goods and services. In fact, on this measure, the 'labour cost' of many everyday items has indeed fallen consistently over time as productivity has improved (table 1.1).

For example, a double bed with a mattress, a blanket and pillows in Australia in 1901 cost the equivalent of 3 weeks of work at the average weekly wage, compared with 1 week in 1980, and just 2 days in 2021. Even housing rental costs, which have risen in inflation-adjusted terms over the past 40 years, have fallen (on average, across the country) in terms of their labour time cost — the average person needed to work about 20 hours to rent a three bedroom house in 1901, while in 2021 the same person would only need to work for about 9 hours. A more dramatic example is the bicycle, which, in 1901 would require several months of work to afford, but now requires less than a day of work.

Table 1.1 – Australians need to work fewer hours to afford most goods and services[a,b]

Hours of work to pay for goods and services

	1901	1990	2000	2010	2019
Good or service	Hours	Hours	Hours	Hours	Hours
Double bed, mattress, blanket and pillows	185	41	37	24	18
Bicycle	473	-	14	8	6
Rent	20	12	11	10	9
Theatre (minutes)	321	81	84	69	62
Loaf of bread (minutes)	18	5	6	6	4
Smartphone	-	-	-	60	16
Cars (new, months)	-	17	13	7	5

a. Number of hours required to purchase good calculated by dividing the nominal price of each good/service by the average nominal wage (inclusive of tax, bonuses and superannuation benefits). Nominal prices for all products (except smartphones and cars) is known for 1901 and 2000 and for other years the price was extrapolated using the consumer price index series corresponding most closely with that product. Wages were calculated as labour compensation from the national accounts divided by aggregate hours worked in the economy. For pre-1960 wages, the wage estimates for 1960 were backcasted using a variety of data sources including the Long term productivity database and Butlin. Nominal prices for smartphones and cars come from 2021 and were extrapolated backwards using the consumer price index. **b.** For figures quoted in months, one month is taken to be 20 work days of 8 hours each.

Source: Productivity Commission estimates using ABS (*Australian System of National Accounts, 2020-21 financial year*, Cat. no. 5204.0. table 1; *Consumer Price Index, Australia, March 2022*, Cat. no. 6401.0., table 7); Bradstock (2021); Birot (2021); Butlin, Dixon and Lloyd (2015); Feenstra, Inklaar and Timmer (2015).

Even from this small sample, it is notable that different goods and services have fallen in cost by varying amounts. The path of real cost reduction is neither smooth nor consistent, as might be implied by looking only at aggregate percentage changes in labour productivity across the economy.

The loaf of bread became cheaper in part because of the complementary effects of innovation and capital investments in agriculture. Innovations — such as the development of synthetic fertilisers, pesticides and new strains of wheat — improved crop yields. These went hand-in-hand with complementary investments in more and better capital that allowed machinery (such as tractors and harvesters) to replace manual and animal labour.[4]

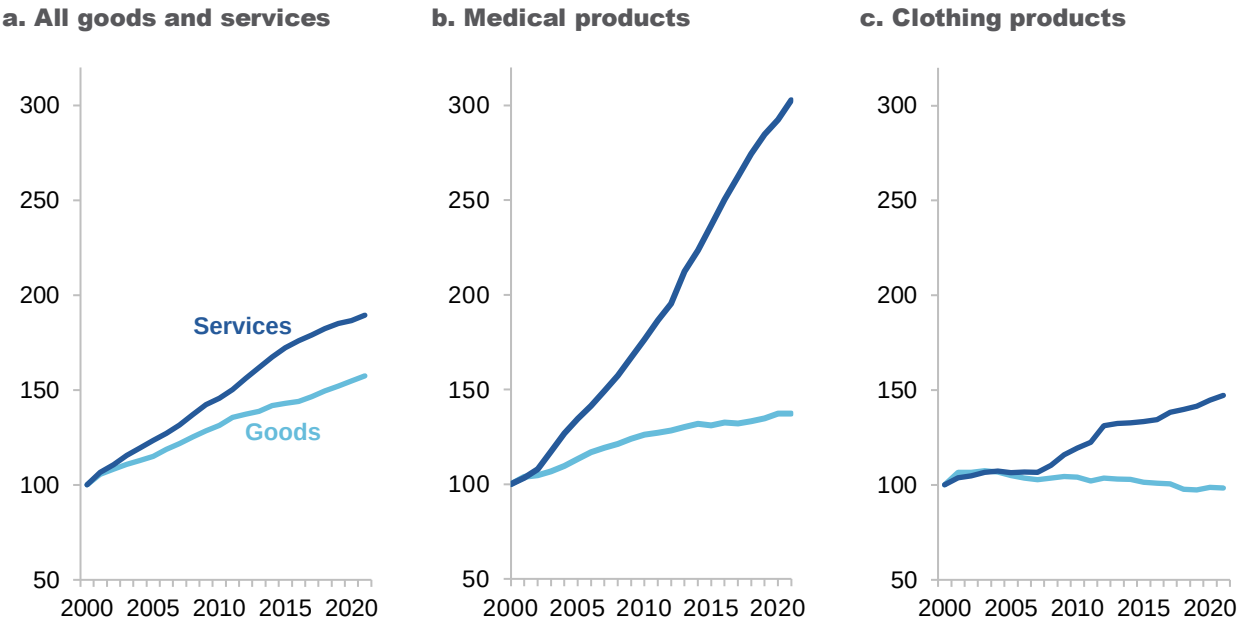
The bicycle became cheaper through improved manufacturing efficiency — cheaper energy, better materials and mass production. The rise of global trade also made the bicycle cheaper to Australian consumers by allowing access to products that are more efficiently produced overseas. In contrast, the cost of housing — measured by rent — has seen a much less spectacular fall, because it has proven more difficult to adopt technological innovations (as well as institutional and governance innovations) which would reduce the real cost of housing, including by getting the most out of available land.

Whether a product is a good or a service can influence how much cost reduction occurs. This can be illustrated by considering pairs of products — one a good and the other a service — that are used in similar contexts (figure 1.2). Almost without exception, the prices of the good, from medical equipment to clothing have risen more slowly (or declined) relative to the price of the similar service (this phenomenon is related to ‘cost disease’ which will be discussed further in chapter 2).

[4] Mechanically interpreting contributions to productivity growth in terms of innovation (or multifactor productivity, MFP) on the one hand — versus capital investment on the other — can potentially be misleading. This is because improvements in MFP raise the productivity (and profitability) of capital, which in turn encourages further investment in capital such that the capital to labour ratio increases. In addition, investment in new capital typically embodies the latest innovation. See Appendix A.1 for a more detailed discussion.

Figure 1.2 – Price growth in services has outstripped goods

CPI index for various pairs of related services and goods (2000 = 100)



Source: ABS (Consumer Price Index Australia, December 2021; Cat. No. 6401.0.; tables 7-8).

Countries with higher productivity typically have a lower cost of living

A similar pattern can be observed across countries. Compared with people in countries that have lower aggregate productivity, the average Australian works fewer hours to purchase the same goods, and vice versa (table 1.2). For example, in Mexico, where labour productivity is 66 per cent lower than in Australia, the average worker would need to work about 4 times as long (420 per cent longer) to afford food, compared to an Australian earning the average wage. Indeed, among the items listed in table 1.2, not a single one is more affordable for the average Mexican (in terms of hours worked) compared to the average Australian.

There are exceptions to this general finding. Compared to the United States, where labour productivity is about 20 per cent higher than in Australia, some goods and services, such as pharmaceuticals and medical services are *more expensive* (90 per cent and 19 per cent respectively) in terms of average hours worked. These outcomes can often be a function of specific government policy designed to alter the consumer prices of certain goods and services. For example, Australia's Pharmaceuticals Benefit Scheme subsidises the cost of selected drugs making them cheaper for consumers.

Table 1.2 – Relative labour cost of goods and services in different countries[a]

Labour costs relative to Australia (percentage difference) by country in 2017

Good/service	Mexico	New Zealand	United States
Food (all)	419	42	-17
Bread	425	6	-30
Clothing and footwear	511	29	6
Actual rents for housing	173	21	-29
Electricity, gas and other fuels	224	29	-38
Pharmaceutical products	1331	90	90
Medical Services	178	-11	19
Motor cars	662	62	15
Education	1	-21	37
Catering services	319	17	-16

a. Labour cost is the price of a good/service divided by the average wage (average annual employee earnings divided by average annual hours worked per employee). That is, the number of hours required to buy that particular good or service.

Source: Productivity Commission estimates using OECD (2022b) and unpublished data from the World Bank International Comparisons program (2017 release).

Things that get better: improving the quality of goods and services

Many of the benefits accruing from productivity growth come in the form of improved quality of existing products (figure 1.3). Postal services are faster today, as are almost all communication mediums, including mobile phone networks and the internet, and the quality of the services (e.g. in terms of network reliability) is much higher. Entertainment, such as music and television, is available on a wide variety of mediums, making it more accessible to more people. And health services are available to treat a wider variety of ailments and illnesses with much higher diagnostic precision (more on this below). Goods, such as cars (safer, more powerful, more fuel efficient, more automated); computers (faster and smaller); and homes are all now built with better quality materials with greater functionality and more features than they had in the past.

Figure 1.3 – Then and now

Ford Model T (1908)	**VS**	**Tesla Model 3** (2022)
20hp crank started Internal combustion	**Engine**	283hp electric
~70km/h	**Top speed**	>250km/h
34-64 km	**Range**	600km
no seat belts	**Safety**	seat belts, air bags, automatic braking and computer aided collision avoidance systems
Paper maps	**Navigation**	GPS navigation on an internal touch screen
Sprung Leather seats stuffed with horsehair and cotton	**Comfort**	Heated seats and steering wheel and 13 speaker audio system
Apple PowerBook 100 (1991)	**VS**	**Apple MacBook Air** (2022)
9 inch monochrome (1 colour) 640 x 400 pixels	**Screen**	13.3 inch touch screen, millions of colours, 2560 x 1600 pixels
Lead acid battery with <4 hours	**Battery**	Lithium polymer up to 18 hours
2.3kg	**Weight**	1.3kg
up to 40 megabytes	**Storage**	1TB (25,000 times larger)
Plastic	**Material**	Aluminium
serial modem	**Communication**	WiFI, Bluetooth and built in high definition camera
Single speaker	**Sound**	Stereo speakers & headphone jack

Source: Information on Apple Powerbook 100 and Macbook Air: Apple (2022) and Wikipedia (2022); Information on Ford Model T and Tesla: anon (2017), Alvarez (2007) and Tesla (2022).

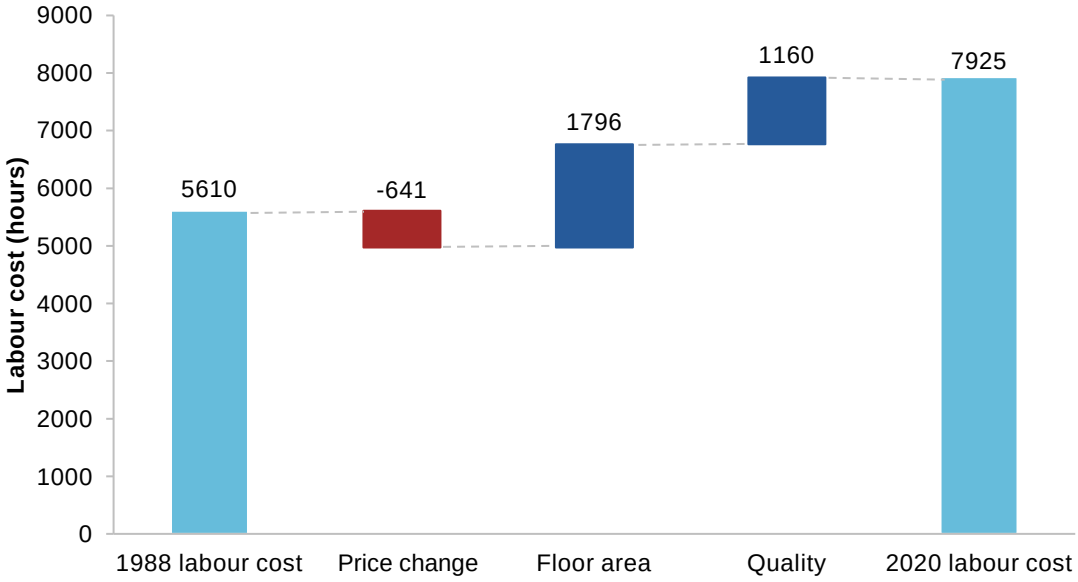
Each of the quality factors discussed above are ultimately reflected in the prices of each product. But because the price of a product is not typically broken down to reveal the contribution of quality and other changes in attributes, this makes it difficult to directly assess the benefits of productivity growth. The benefits of productivity growth for improved quality can, however, be determined by comparing the quality-adjusted and non-adjusted change in the price of a product over time.

The cost of constructing a house (excluding the land) is illustrative (figure 1.4). Between 1988 and 2020, the labour cost of constructing a new house increased from 5610 hours of work for the average worker to 7925 hours. That is, housing became more expensive. But this was entirely driven by the increasing size (floor area, 1796 hours) and quality (1160 hours) of the average detached house. In fact, the labour cost of building a house in 2020 of identical size and quality to a 1988 house actually fell by 641 hours — or around

11 per cent. Put differently, the typical worker in 2020 wanting to construct a house of the same size and quality typical in 1988 would find it more affordable (641 fewer hours of work time). And most houses now cost more than they did in 1988 because modern detached houses are typically larger and of higher quality.

Figure 1.4 – Houses are costlier to build today because they are bigger and better[a]

Price, size and quality contributions to the labour cost of constructing a new house in 1988 compared to 2020



a. The quality effect is the difference in the growth of the average cost of constructing a new house and the implicit price deflator used by the ABS to derive chain volume estimates of construction activity.

Source: Productivity Commission estimates using ABS (*Building Activity, Australia, various releases*, Cat. no. 8752.0.); Feenstra, Inklaar and Timmer (2015).

Entirely new things: increasing the variety of goods and services

Productivity improvements also come in the form of novel products, which contribute to an increase in product variety. A notable example is the introduction of electric sources of light. When this service was first introduced, the market price of electric lighting was similar to gas. But the light produced was brighter, creating substantial additional benefits (e.g. fewer accidents in factories) without requiring additional resources.

A more recent example is the rapid improvement in communication technology: between 1983, when mobile phones were first introduced, to 2007, when the first 'smartphone' (the iPhone) was introduced, mobile phones evolved from being brick-like devices that could be used for making wireless phone calls (itself a significant breakthrough), to small hand held computers with complete access to the internet, bundling a broad range of functions including telephony and photography.

Smartphones are now ubiquitous around the world — there are more people with a smartphone than with a flushing toilet.[5] This ubiquity tends to understate the immense economic value of the novelty (including its mobility and versatility) of the smartphone. It has been estimated that to create the equivalent computing

[5] In 2018, about 67 per cent of the global population (5.095 billion out of 7.602 billion) own a smartphone while in 2018 about 60 per cent of global population did not have a toilet to safely manage human waste at home (Statistica 2022; UNICEF 2018; World Bank 2022b).

power contained in an iPhone X in 1957 (using vacuum tubes) would have cost roughly one and a half times 2017's global GDP (or 14 times the global GDP in 1957), required 100 billion square metres of floor space (a factory 50 per cent larger than Tasmania) and consumed about 30 times the global electricity generation capacity at the time (Delong (2017)).

The smartphone showcases how novel products, improved quality and reduced cost often occur simultaneously. In addition to the novelty of the smartphone, it also indirectly reduces cost by replacing a range of other items for many people: cameras, torches, stereos, telephone books and calculators.

Overall, the volume of new and improved goods (and increases in their variety) introduced into the market each year is enormous. For example, more than 50 per cent of online transactions between 2014 and 2017 were purchases of products that did not exist in the previous year (Goolsbee and Klenow (2018)).

The benefits of new and better products are larger than we might think

The size and nature of the benefits of novel and improved quality products are difficult to measure and are typically underestimated (box 1.2 and appendix A.3 and A.4). Whilst these measurement problems have always been present, it is unclear whether they have worsened or improved in recent decades and hence it is also unclear whether the consumer welfare gain associated with recent innovations (often involving ICT products and the internet) has been larger or smaller than other past breakthroughs (such as electricity or refrigerators) (Gordon 2018; Mokyr 2018).

Box 1.2 – Examples of mismeasuring the benefits of new products: statins and free digital goods

To measure the benefit of new products accurately, we would need to know how much people would have hypothetically paid for the new product before it existed. Similarly, for products whose quality (or variety) has improved, we would need to know how much a consumer would have been willing to pay for the quality improvement, or for greater variety of choice.

These measurement issues can be illustrated with reference to the productivity benefits associated with the ICT revolution such as smartphones, discussed above, and 'free online goods and services' such as social media and map apps. The benefits of free goods and services are likely undermeasured because while they create significant value for consumers, there is no price with which to weight them and the advertising revenue they generate likely also understates their value. Brynjolfsson et al. (2019) recently developed a method to estimate the value created by these services and found that the existence of Facebook alone would, if properly incorporated into GDP measurement, add about 0.05-0.11 percentage points to annual GDP growth. Including the gains to consumer welfare from cameras on smartphones adds another 0.62 percentage points to annual growth in GDP (between 2008 and 2017). Even if these estimates are optimistic, they do point to the real consumer benefits that have accrued from the ICT revolution that are often undermeasured in productivity statistics.

Medical improvements over the past century provide some notable examples of novel products that have provided large benefits to society (Feldstein 2017). One contemporary instance is statins (others are vaccines and antibiotics), which were trialled in 1994 as a cholesterol reducing medication, and are today the most prescribed medication among Australians aged 65 and over to treat cardiovascular disease (in 2016 44 per cent of this age group were prescribed statins, (Ofori-Asenso et al. 2018)). The benefits of statin use

to individuals and society are large. They accrue in the form of, for example, additional years of life and earnings by lowering morbidity rates, heart attacks, strokes and related hospitalisations.

More generally, mismeasurement of the benefits of novel and improved quality products may mean that real wages growth has actually been higher than its measured rate.

Advantages of the micro lens

Seeing productivity growth through a micro lens — as existing goods and services that get cheaper and better through time and new products that come into being — has several advantages.

First, a micro lens demonstrates that productivity growth *manifests* differently in different parts of the economy. Some goods and services (including many manufactured products) have become dramatically cheaper over time (such as through productivity improvements in their source country). Others (such as health care) have primarily improved in quality rather than cost. Other things have not improved as much along either dimension.

Second (and relatedly), a micro lens reminds us that the *proximate causes* of productivity growth, such as specific innovations and technological discoveries, operate in uneven and unpredictable ways — both across the economy and through time. There are observed waves of technological progress in enabling areas such as energy, transport or communications, with rapid take-up often followed by a levelling off at high rates of adoption. Some innovations have broad application (so-called 'general purpose technologies'), such as the take up of electricity, computers or the internet; others have more specific application to an individual industry. The implications for rates of productivity growth across and within different sectors of the economy vary considerably.

Third, a micro lens demonstrates that the benefit of productivity growth is not merely about having more 'stuff' — that is, cheaper and more plentiful supplies of the existing suite of goods and services. Much of the dividend from productivity growth comes in the form of better or entirely new goods and services, often satisfying new or previously unaddressed human needs.

Fourth, a micro lens illustrates that the analysis of productivity growth need not be confined to that which is measurable or included in an aggregate such as GDP. Productivity growth can improve lives on multiple dimensions wherever innovation can reduce the inputs required to achieve a desired outcome. The right policies and institutions can encourage productivity growth in non-market sectors (where it may not be reflected in GDP statistics), for example.

Nonetheless, there are important insights to be gained from taking all these disparate instances of productivity growth and combining them into a statistical aggregate, such as GDP per hour worked. For all their imperfections, these aggregate measures do tell us something about relative progress through time and across countries.

1.3 The aggregate picture

Despite the uneven *sources* of productivity growth, the benefits tend to be widely distributed across the economy in the long term, flowing to business owners, workers and ultimately, consumers.

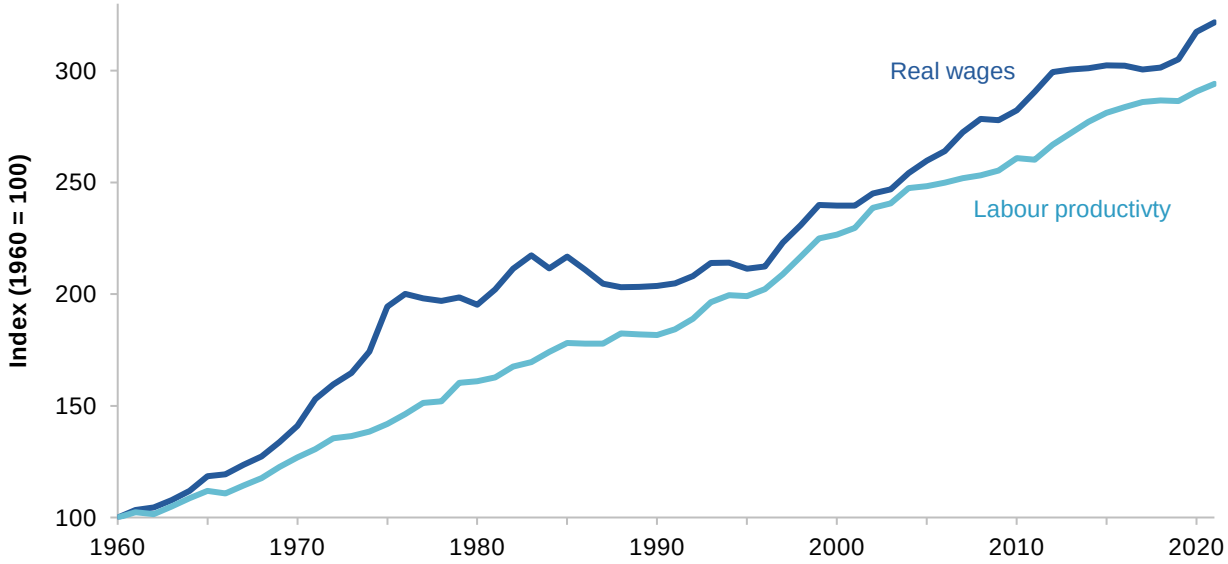
Being more productive enables increases in real wages

In terms of wages, growth in labour productivity — the broadest measure of productivity, which measures the number of hours required to produce a unit of economic output (GDP) — is very strongly correlated with the long-term growth in real wages received by the average worker (figure 1.5). In the short to medium term, factors such as relative bargaining power and economic shocks (such as large movements in the terms of

trade) can lead to deviations in the relationship between real wages and productivity (in both directions) (box 1.3). But in the long run, almost all increases in real wages are due to labour productivity improvements.

Figure 1.5 – In the long run, wage increases are driven almost entirely by productivity growth[a,b]

Australian wages and labour productivity, 1960-2021 (indices, 1960 = 100)



a. Wages only include total labour compensation per hour rather than the labour income from owner operators. Hours data (used to calculate both labour productivity and wages) prior to 1975 have been sourced from the Penn World Tables. **b.** Wages are deflated by the consumer price index while labour productivity is deflated by the GDP deflator.

Source: Productivity Commission estimates using ABS (*Australian System of National Accounts, 2020-21 financial year*, Cat. No. 5204.0., tables 1,16, 46; *Consumer Price Index, Australia, December 2021*, table 1, Cat. No. 6401.0.); Feenstra, Inklaar and Timmer (2015).

Box 1.3 – When real wages and productivity growth diverge

The dominant role of productivity in driving Australia's growth in real wages is perhaps surprising given our historical reliance on the export of commodities, with movements in global prices having a significant bearing on real income.

When global demand is particularly strong for commodities, export prices tend to rise. A rising terms of trade generally causes measures of real income to rise with them. Indeed, in the most recent mining investment boom (roughly 2001-02 to 2011-12), real wages in Australia increased at about twice the rate of labour productivity and gross national income (GNI) per capita increased almost three times as much as labour productivity.

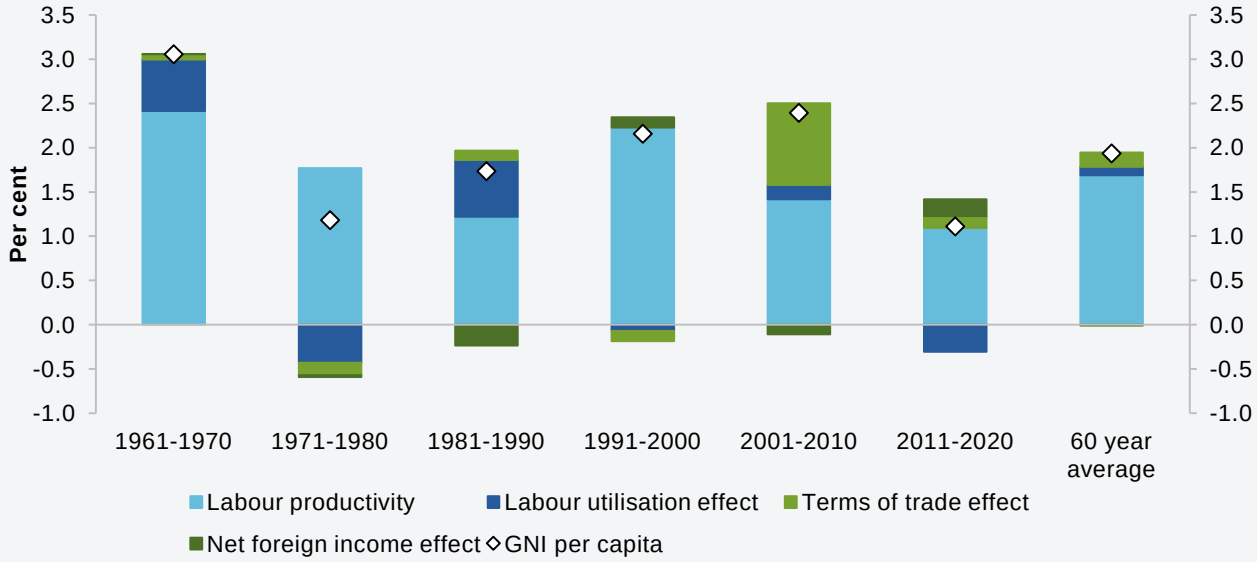
But terms of trade changes tend to cause only short term deviations between measures of real income growth and productivity growth. As markets respond to supply or demand shocks, there is a strong tendency for the path of real income growth to revert to the longer-term relationship with labour productivity growth. For example, on average, during the mining boom the increasing terms of trade

Box 1.3 – When real wages and productivity growth diverge

added nearly 1 percentage point to annual growth in GNI per capita in the decade to 2009-10, but just a little over a tenth of a percentage point (0.1) to the same measure in the following decade, to 2019-20.

Likewise, changes in labour utilisation (which measures the effect of labour force participation, unemployment and average working hours) have contributed to increases in real incomes during certain periods. Structural changes in the Australian economy beginning in the 1960s led to rising labour force utilisation as the share of women (and later, also the average number of hours they worked) in the labour force increased. On average, this contributed about 0.5 percentage points to annual growth in GNI per capita over the decade. However, across the past 60 years, increasing labour utilisation has contributed less than 0.1 percentage points to annual growth in the same measure (figure).

Terms of trade booms and increasing participation drive only temporary changes to real growth in average national incomes[a,b]



a. Real wages are defined as labour compensation per hour (using Penn World Tables for hours pre-1980) but excludes the income of the self-employed. **b.** Real wages have been deflated by CPI while GNI per capita and labour productivity were deflated by the implicit GDP deflator.

Source: Commission estimates using ABS (*Australian System of National Accounts, 2020-21*, Cat. no. 5204.0., table 1); Feenstra, Inklaar and Timmer (2015).

What determines who — business owners, workers or consumers — get the benefits from productivity growth over time is complex, particularly in a modern economy where the distinction between these groups can be somewhat artificial (e.g. a worker can be an employer and a shareholder in a business, as well as a consumer). With respect to wages, at least in the near term, factors such as the relative bargaining power between business owners and employees, and the institutional and regulatory settings that govern these interactions, are important.

The extent to which the gains from productivity growth are passed on to consumers (through lower prices) is a function of market structures, both in input and output markets. This includes the extent of barriers to market entry and the degree of competition, which determines the markup that businesses can charge for their products. Again, the distribution of gains can also be affected by institutional settings — such as legislation affecting how businesses compete (competition policy) and how much of the profits from

innovation they can capture (this includes intellectual property rights legislation, and subsides or taxes designed to alter relative prices, and therefore consumption).

Insight 1.3 – Almost all sustained increases in real wages are underpinned by improvements in labour productivity growth.

Being more productive enables greater consumption

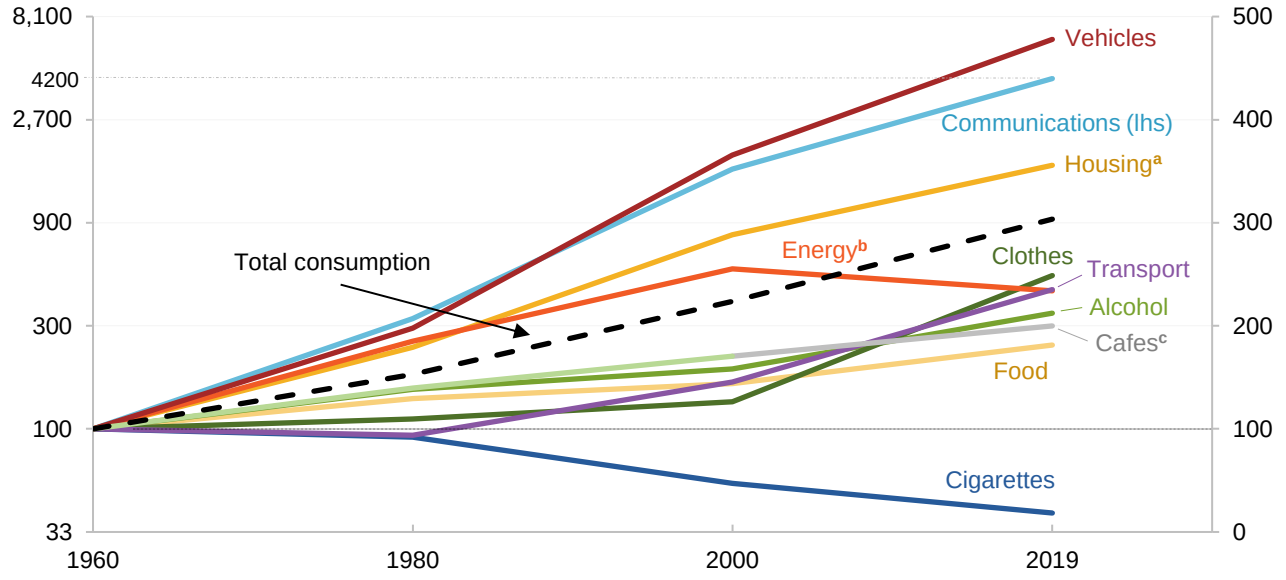
A consequence of productivity growth lowering the labour cost of most goods and services is the potential for higher consumption of almost everything. The average Australian now consumes about 3 times more than they did in 1960, across almost every category of goods and services (figure 1.6).

Much of these increases in consumption have come through *quality* improvements rather than *quantity*.[6] As illustrated above for cars and laptop computers, typically consumer products have significantly improved in quality and variety. These quality improvements — because they provide substantial benefits to consumers — are measured as higher levels of consumption, even where the physical number of products consumed is the same.

But again, there are exceptions to this finding, which can be the outcome from government policy. For example, the falls per person in consumption of cigarettes likely reflect attempts at both moral suasion (e.g. negative advertising campaigns) and the use of 'sin taxes' (which, by pushing up consumer prices of cigarettes, puts downward pressure on their consumption) by governments seeking to reduce the incidence of smoking.

Figure 1.6 – Australian household consumption has increased for almost everything

Real household consumption per person (1960 = 100, right hand axis unless noted)



a. Housing consists of actual rents and imputed rents for owner occupiers and maintenance of dwellings. **b.** Includes electricity, gas and other fuel. **c.** Includes hotels and restaurants.

Source: Productivity Commission estimates using ABS (Australian System of National Accounts, 2020-21, Cat. no. 5204.0., tables 1 and 42).

[6] The net change in consumption is the result of changes in three factors: the quantity of a product consumed, changes in the mix of products consumed (buying more high value products) and changes in the quality of products consumed.

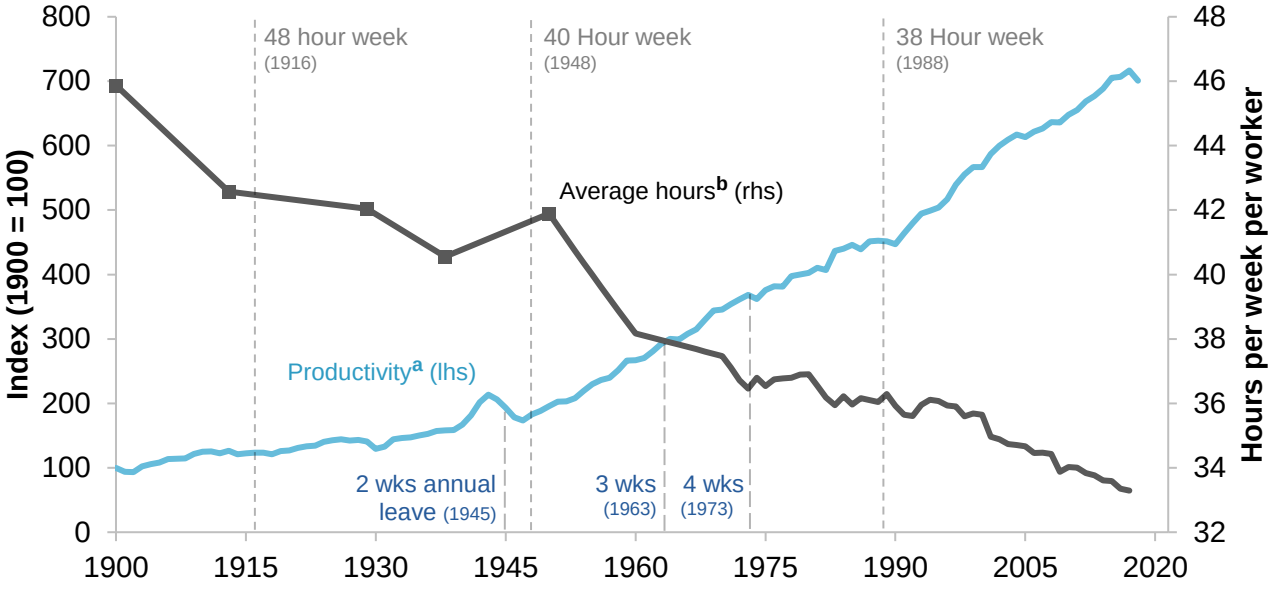
Insight 1.4 – Being more productive means that the average Australian can consume more higher quality and completely new goods and services.

Being more productive enables more leisure

Productivity growth can also enable Australians to reduce their hours spent working (at least in a paid capacity). And most importantly — because of increased purchasing power (the amount of goods and services that can be purchased from income earned) — Australians can actually work fewer hours and still be at least as well off in terms of how much they can consume. While not all reductions in hours are due to productivity growth (the tax system also effects hours worked, for example), it enables people to work less and consume more (box 1.4). This has been the lived experience of the average Australian (and much of the world) over the past 120 years (figure 1.7).

Since 1900, aggregate labour productivity has increased by more than 700 per cent, underpinning a similarly large increase in economic output per person (650 per cent between 1901 and 2018, see figure 1.1 panel b) and facilitating a significant reduction in average hours in paid work, which fell by about 30 per cent or 13 hours in line with legislated reductions in the length of the working week and annual leave provisions (figure 1.7).[7]

Figure 1.7 – Productivity growth supports higher economic output with less work



a. GDP per capita is expressed in $US2011. **b.** Prior to 1950 the data is reported on an intermittent basis and shows full time hours for production workers only. From 1950 the data is reported annually, for all workers.

Source: Bergeaud, Cette and Lecat (2017); Denniss (2003); Irvine (2021); National Museum of Australia (2022); Roser, Ortiz-Ospina and Giattino (2020).

Insight 1.5 – Being more productive means that the average Australian can spend fewer hours at work to achieve a given level of consumption if they choose to.

[7] More recently average working hours have fallen due to a combination of increases in part-time work — primarily women entering paid work on part time hours — and a decrease in full-time work — principally men who were working full-time leaving the labour force (Lattimore 2007) (ABS 2022c).

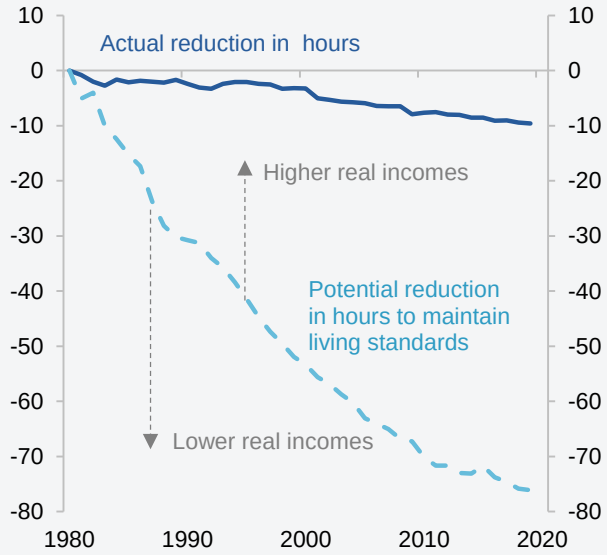
Box 1.4 – Productivity growth makes it possible to consume more and work less

The decreased hours of work and increased income that result from productivity growth can be thought as a 'productivity dividend'. One way to illustrate these benefits of productivity growth is to think about the trade-off that it implies for the average worker between hours spent working on the one hand, and consumption possibilities, on the other. As discussed, productivity growth leads to higher real wages and lower real prices, which means that the average worker can choose to:

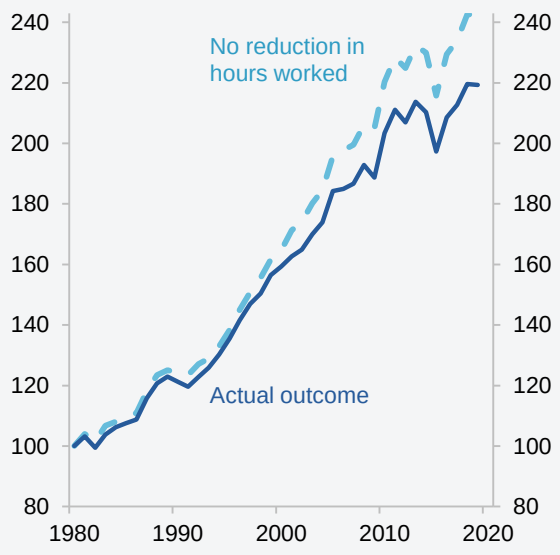
1. work the same and consume more (the whole dividend is used to increase consumption)
2. work less and consume the same (the whole dividend is used to reduce work)
3. some combination of the above including working *less*, and consuming *more* (the dividend is divided between less work and more consumption).

In practice, Australians have (looking collectively) implicitly 'chosen' the third option. The outcome of this choice, in terms of work and income, is illustrated in the figures below. The solid line in panel a shows that since 1980, Australians have used their productivity dividend to reduce their average hours worked by about 10 per cent. Over the same period, real incomes (as proxied by growth in real GDP per capita) more than doubled (green line in panel b). The dashed line in panel a illustrates option 2. If Australians had been content with a 1980s standard of living they could have reduced their average hours by 76 per cent (28 hours) and real incomes would have stayed the same. In other words, Australians used about 13 per cent of the productivity dividend to 'purchase' leisure. The dashed line in panel b illustrates option 1 and shows that if there had been no reduction in hours worked (assuming that actual labour productivity outcomes prevailed) incomes would have increased by an additional 22 percentage points since 1980.

a. Actual vs potential change in hours worked per week to maintain GDP per capita at 1980[a]



b. Actual vs potential Income (GDP per capita) growth since 1980[a] (index 1980=100)



a. GDP measured at chained PPPs in million 2017US$ using data from 2019.

Source: Productivity Commission estimates using the Penn World Tables (eleventh edition).

1.4 Productivity: what lies beyond the aggregates?

Aggregate measures of productivity growth provide a useful approximation of the rate of economic progress, including the trade off between consumption and work. But the micro lens illustrates the richness and variety in the way economic progress unfolds in the real world. And there are other aspects of community wellbeing that the macro aggregates can miss (although in many cases these tend to be positively correlated with productivity growth).

In practice, community wellbeing can be imperfectly represented by aggregate measures such as income per capita or GDP per hour worked. Three commonly cited areas in which these economic aggregates fall short are:

- Equity: are the fruits of rising productivity being evenly shared across all groups and individuals?
- The natural environment: are we adequately counting the impact of environmental degradation, carbon emissions or the depletion of natural resources?
- Life satisfaction: do higher incomes necessarily make us happier?

How well does Australia spread the gains of productivity growth?

Historically, consumers have received outsized benefits from productivity growth. For example, analysis of the US market (Nordhaus 2004) showed that about 98 per cent of the value generated by the production of novel goods and services between 1948 and 2001 accrued to consumers, as opposed to entrepreneurs and business owners.[8]

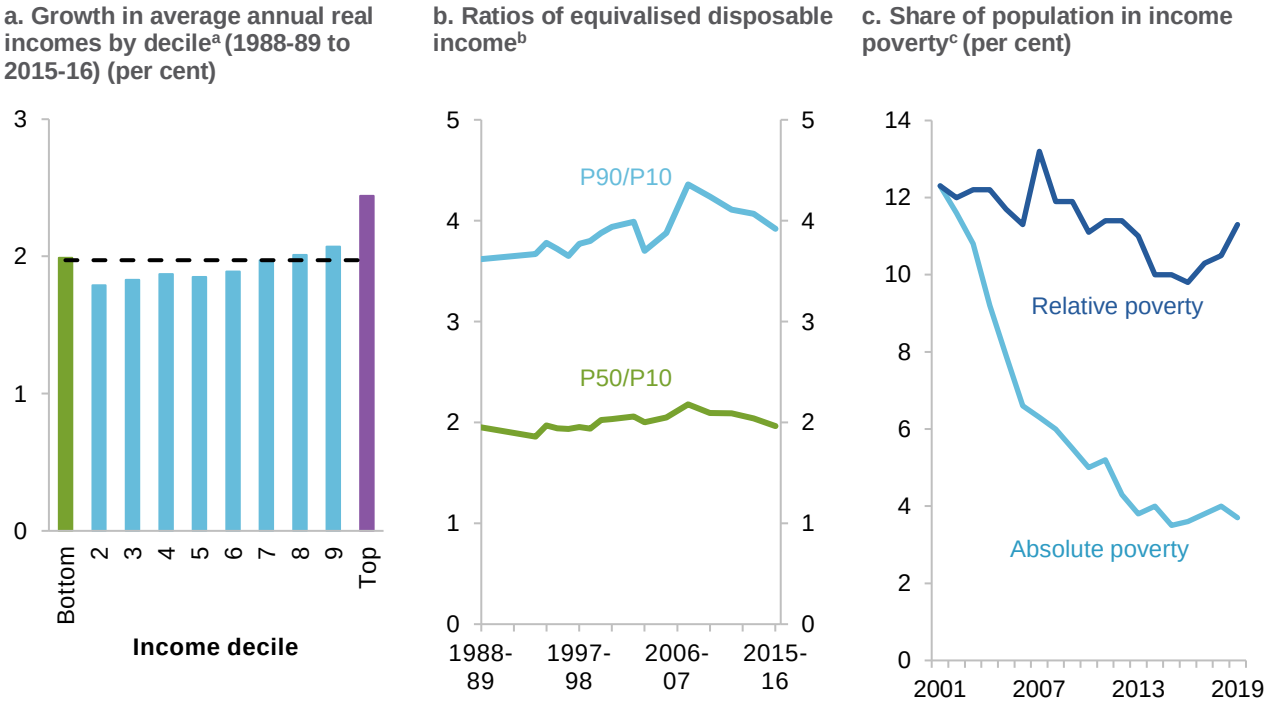
In many other respects, the fruits of productivity growth (such as quality improvements and lower prices) inherently benefit everyone regardless of income (as discussed, technological advances tend to become embedded in new and existing goods and services, improvements in medical services — which benefit all Australians in the form of subsidised access to medical care — is one such example).[9] That said, a focus on average outcomes can mask the actual lived experience of some Australians. In this case, redistributive policies, including provision of a robust safety net, play a role in ensuring that the benefits of productivity growth are widely distributed. And productivity growth, by growing the pie, allows governments, via the tax and transfer system, to reinforce that safety net (box 1.5). Indeed, over the longer term, providing a more generous social safety net and delivering the government services that many Australians rely upon would not be possible without robust productivity growth.

Over the past three decades, real income growth of the lowest income groups has been only slightly below the average (figure 1.8 panel a). Inequality in income (and consumption) has increased only modestly in Australia since the late-1980s and measures of income poverty have tended to fall, significantly so in the case of absolute poverty over the past two decades (figure 1.8 panel b and c).

[8] Nordhaus (2004)estimated the social value of technological advances and the amount that was captured by producers and consumers. The typical rate of return on capital in the United States between 1948 and 2001 was about 5.9 per cent, which is very close to the cost of capital (Nordhaus 2004, p. 35), indicating that most firms typically do not capture profits above the cost of capital.

[9] In absolute terms, even if the *nominal* income of Australians does not change, real incomes will likely rise due to lower prices, higher quality and the invention of new products — in this way the benefits are broadly distributed. In a relative sense, low income Australians may have benefited by proportionately more than the average to the extent that they spend a higher share of their incomes on non-discretionary items, such as food, whose price has fallen dramatically in line with agricultural productivity improvements, amongst other things.

Figure 1.8 – Productivity growth has not exacerbated inequality – rather, it has been associated with rapidly declining absolute poverty rates



a. Income is deflated by CPI. **b.** Equivalised measures of income adjust for household size and composition. **c.** Relative poverty is defined as household equivalised income that is less than 50% of the median household equivalised income. Absolute poverty is based on an income poverty threshold whose real value is held constant over time. In this case, equivalent to the relative poverty threshold in 2001.

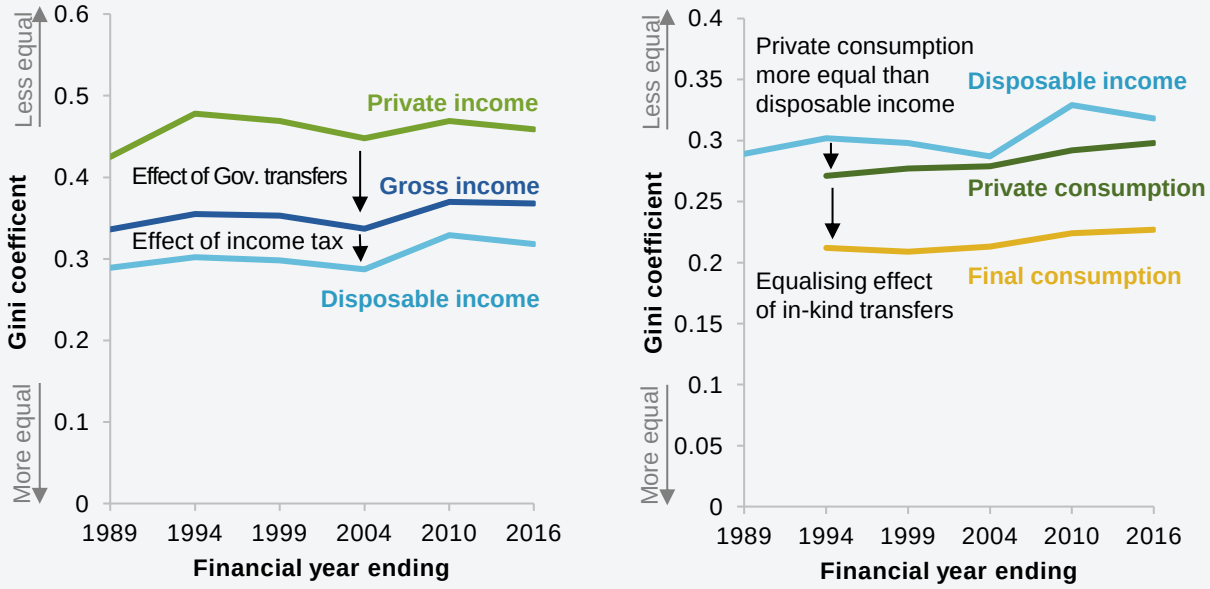
Source: Panel a & b: Productivity Commission estimates using ABS (Microdata: Household Expenditure, Income and Housing, 2015-16, Cat. no. 6540.0, released 25/10/17) and ABS HES Basic confidentialised unit record file for 1988-89 as available at 25/10/17. Panel c: Wilkins et al. (2020).

Box 1.5 – Well targeted redistribution by governments significantly reduces inequality in Australia

While income inequality has remained steady over the past few decades, Australia's progressive tax and highly targeted transfer systems substantially reduce the level of inequality at a given point in time. For example, an often used measure of income inequality, known as the Gini index (which rises as income inequality increases) reduces consistently as government transfers (such as unemployment benefits and rent assistance) and income taxes are applied to private incomes. Similarly, the Gini index for final consumption, which includes in-kind government transfers such as health, education and social housing, is lower than both final consumption, which in turn is lower than for disposable income (which likely reflects access to finance and savings behaviour). In effect, government policy has meant that while an individual's (or a household's) income from work and investments can be volatile over time, their actual spending on goods and services is usually much more stable. This indicates that redistribution, while imperfect, does act as a form of insurance against income shocks.

Box 1.5 – Well targeted redistribution by governments significantly reduces inequality in Australia

The impact of redistribution on measures of inequality[a,b]



a. The Gini index is a measure of inequality ranging from 0 (completely unequal) to 1 (perfectly equal) that is calculated by comparing the actual cumulative proportional distribution of income to the counterfactual cumulative distribution if the society was completely equal. **b.** Private income refers to income before tax and transfers, disposable income is income after taxes and transfers and final consumption is private consumption plus in-kind service received for health and education

Source: Productivity Commission (2018, pp. 54, 65).

Insight 1.6 – Consumers have received large benefits from productivity growth, including the capacity to benefit from a broad government social safety net.

Accounting for environmental impacts

As with any manifestation of progress in the economy, productivity growth can give rise to either negative or positive environmental outcomes associated with the destruction, or preservation (respectively), of natural land and water resources.

Achieving more and higher quality goods and services from the use of fewer inputs can lessen the use of scarce natural resources and reduce adverse environmental impacts, as well as returning more leisure time to people to enjoy environmental assets.

If there are no markets to provide an indication of how different environmental outcomes are valued, or regulations to influence behaviour to achieve environmental outcomes valued by the community, then this can mean there are environmental consequences of productivity growth that detract from people's wellbeing.

Input and output prices are the fundamental market signals that help businesses allocate resources to the production of goods and services, and (in the case of output prices) provide information to consumers to make consumption choices.

When prices are incomplete (because the prices for certain inputs and outputs are themselves missing, typically because of an absence of property rights, markets, regulation or information), market participants will tend to over or under produce certain outputs, relative to levels which maximise the community's well-being.[10] Missing prices tend to plague the use of 'common-property' natural resources, such as the Earth's atmosphere:

- In the 1980s the production of chlorofluorocarbons (CFCs) — a chemical used in fridges, air conditioners and aerosols — was found to be destroying a part of the Earth's stratosphere known as the ozone layer. A depleted ozone layer leads to an increase in ultraviolet light reaching the earth from the sun, which tends to increase the rate of skin cancers and cataracts in humans, as well as being deleterious to marine and terrestrial ecosystems. This damage was not reflected in the price of products (nor initially in non-price regulations) that contained CFCs.
- A scientific consensus was reached in the 1990s that greenhouse gas emissions associated with the production of fossil fuel based energy (burning coal or gas in power plants and petrol in cars) were influencing the climate, leading to, amongst other things, more frequent and more destructive weather events. This damage was also not reflected in the price of products that directly or indirectly used fossil fuels.

In both of these cases, damage is caused, which detracts from income growth, but the lack of an explicit market price (associated with CFC and carbon emissions) means that economic harm is poorly measured, or not measured at all (box 1.6).

Box 1.6 – Accounting for the environmental impact of carbon emissions

Some economists have experimented with applying a hypothetical market price to certain environmental outcomes to investigate the potential impact on economic outcomes. An example of this for Australia is putting a hypothetical price on carbon dioxide emissions (a price or cost per tonne of emissions) with an eye to estimating an 'emissions cost', which could then be deducted from real GDP per capita (figure).

Imputing a price to carbon emissions has the effect of reducing the estimate of past GDP but increasing the estimate of recent GDP growth. In other words, the failure to count carbon emissions as a cost has led in the past to an over-estimate of GDP levels and an underestimate of GDP growth, as carbon emissions fell between 2000 and 2020. For modest carbon price assumptions, these differences are relatively small.

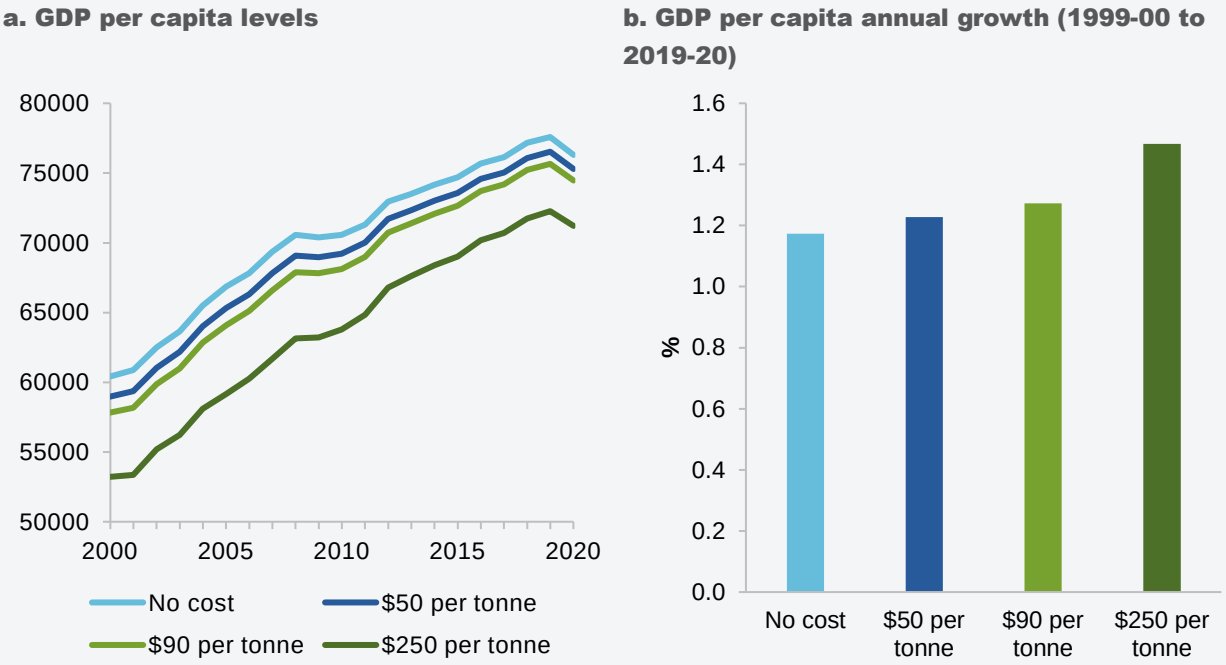
This hypothetical example is an accounting exercise, and does not purport to measure the economic impacts of an actual carbon price. It does not necessarily imply that if an actual carbon price had been imposed on the Australian economy in 2000 that incomes — and wellbeing — would have been lower. Rather the examples serves to demonstrate the benefits of having a more complete view of the environmental impact of growth, either incorporated in or as a supplement to, measures of average income. The example also assumes that Australia can wholly capture the benefits (and costs) of any

[10] This can be problematic when outputs, either directly (cigarettes and alcohol) or indirectly (pollution), detract from income and harm wellbeing. Similarly, regulations that, for example, lock up natural environments in the absence of a market price carries an opportunity cost that may, to the extent that it bans productive uses, also detract from wellbeing.

Box 1.6 – Accounting for the environmental impact of carbon emissions

emissions reductions undertaken here. But 'carbon leakage' and offsetting actions by other countries means this is unlikely the case. Moreover because we do not know the cost of reducing emissions in the past we do not know whether we could have been better off bybo not cutting emissions as much as we have. In other words, we do not know the net benefits of cutting emissions.

Accounting for carbon emissions decreases the measured level of incomes but increases measured growth rates[a]



a. The value of a tonne of carbon dioxide emissions is assumed to be constant over time.

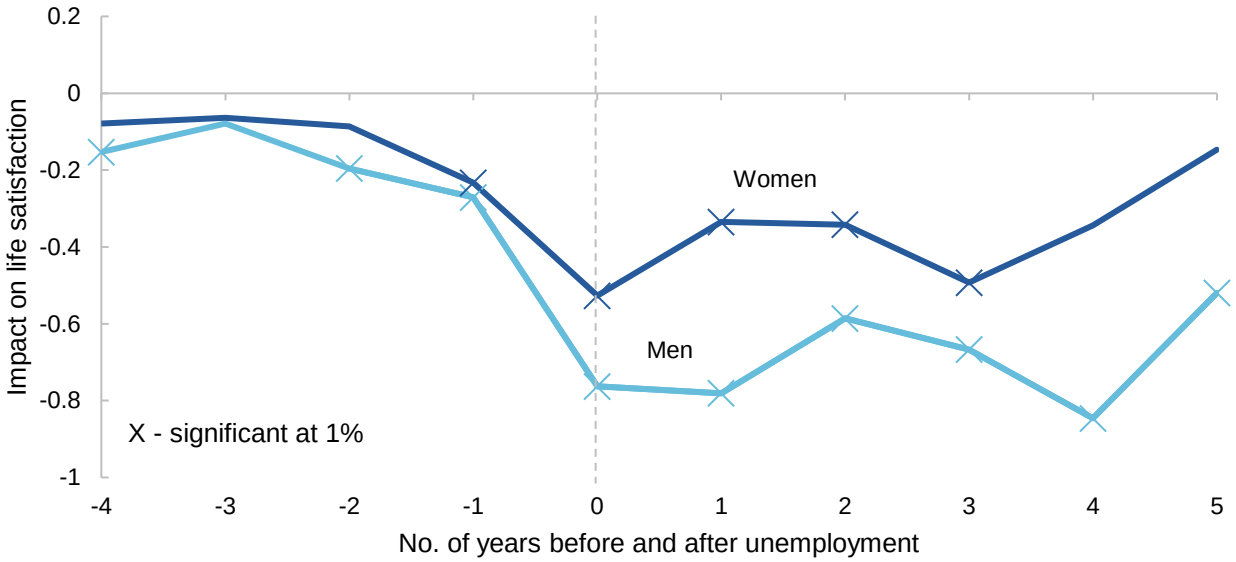
Source: Productivity Commission estimates using ABS (*Australian System of National Accounts, 2019-20 financial year*, Cat. no. 5204.0, table 1); DISER (2021).

Productivity can be an imperfect reflection of wellbeing

Productivity statistics are not designed to explicitly measure wellbeing. While productivity growth equates to higher real wages and higher consumption on average, most people consider their wellbeing with reference to more than just the volume of goods and services that they can purchase.

Quality of personal relationships, a sense of fulfilment in life, mental health status, all play a role in how individuals rate their subjective wellbeing. The wellbeing of individuals is a function of their *own* economic outcomes (figure 1.9), but can also be related to their perception of the economic outcomes experienced by other people — for example, whether or not they perceive equality or fairness in the distribution of economic resources throughout society.

Figure 1.9 – The effect of unemployment on life satisfaction[a]



a. Reproduced from analysis of data from the German Socio-Economic Panel Study between 1984 and 2003. Life satisfaction is m easured on a 10 point scale.

Source: Clark et al (2008).

While productivity is not a direct measure of wellbeing, in practice it is a key input and often a correlate. The level of productivity across countries correlates with numerous measures of wellbeing and environmental outcomes (figure 1.10). Countries with higher productivity tend to have longer life expectancies, rate their life satisfaction higher and have lower levels of income and wealth inequality.[11]

The positive cross-country correlation between productivity and various measures of wellbeing likely reflects that many measures are in fact highly correlated with material wealth and relative abundance. That is, productivity improvements explicitly (for example, health related innovations that prolong life) and implicitly improve wellbeing by creating additional income for given amounts of effort.

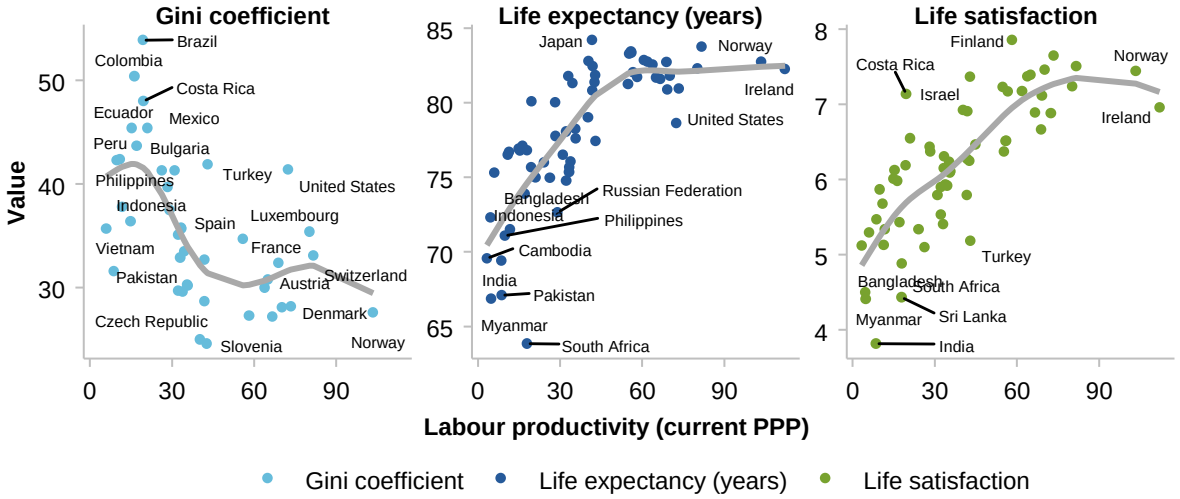
This means the productivity dividend has potential to 'lift all boats'. It can be redirected by individuals into consumption of goods and services that directly improve their own subjective wellbeing, and by businesses and entrepreneurs into innovation and further investment. But governments can also redirect the dividend on behalf of the community into areas that improve wellbeing for those who for whatever reason, may not directly benefit from productivity growth (unemployment benefits, publicly funded education and health care). In this way, productivity growth is a positive policy objective.

To a certain degree, welfare improvement may be better assessed not by jettisoning traditional productivity estimates but by considering a broad suite of welfare indicators in addition to productivity and income, such as measures of inequality or disadvantage for particular groups.

[11] For some measures of wellbeing, such as subjective happiness, the story is less conclusive, with some arguing that the correlation can be negative across time within the same country (see for example Easterlin et al. 2010; Easterlin and O'Connor 2020; Stevenson and Wolfers 2008).

Figure 1.10 – Productivity correlates with many other policy objectives[a,b]

Cross country comparison of labour productivity (current PPP) against various measures of policy objectives for 2019



a. Gini index ranges from 0 to 100 (higher is more unequal) and life satisfaction ranges from 0 to 10. **b.** Solid line is line of best fit using a natural spline.

Source: Productivity Commission estimates using Feenstra, Inklaar and Timmer (2015).

Insight 1.7 – Productivity growth is an imperfect measure of wellbeing, but higher productivity growth means more opportunities for individuals, businesses and government to devote resources to directly improving wellbeing.

2. Forces shaping Australia's productivity challenge

Key points

- **Australian productivity growth is at its lowest rate in 60 years. This broad-based slowdown has been observed across advanced economies.**
  - Australia's productivity performance in the goods sector, including mining and agriculture, is consistently strong when compared to global peers. Australia's services — which employs almost 90 per cent of Australian workers and accounts for about 80 per cent of economic activity — are comparatively less productive.
  - Australia has slipped down the productivity rankings recently and has instead maintained its rich country status largely through increasing the share of people in the workforce.

- **The Australian economy faces challenges bouncing back from its recent poor productivity performance. These include:**
  - Continuing increase in the size of the services sector, where productivity growth has historically been more difficult to achieve than in the traditional goods sectors (e.g. mining, manufacturing and agriculture).
  - A fast growing, government funded and regulated, non-market services sector (e.g. aged care, schools, childcare and disability services), where a lack of competition and contestability can mask underperformance and the freedom to innovate and the sharing of new approaches can be limited.
  - Impacts of climate change and the task of decarbonising the Australian economy in line with international commitments.
  - Threats to open and flexible international markets for trade, capital and labour — which has benefited Australia enormously in the past — as some countries turn inwards in the face of increasing global tensions.

- **COVID-19 prompted an acceleration in the uptake of digital technologies across the Australian economy and showed that when governments, businesses and households worked together they could adapt quickly, including to remove long standing productivity bottlenecks.**

- **As the economy evolves in the wake of COVID-19, increased digital capacity could lead to a productivity dividend, particular in the services sector. Taking advantage of the opportunities afforded by digital technology — such as online service delivery, artificial intelligence and data analytics — will require:**
  - governments and businesses continuing to adopt and adapt innovative business models.
  - a suitably skilled workforce (and training infrastructure) adept in non-routine tasks.
  - access to data, much of which is collected through businesses reliant on funding or regulation of governments, is not unduly locked down.

Australia has maintained its position as a relatively high income, high living standard economy for the past 200 years thanks to consistent, long-term growth in productivity. However, over the past decade, in line with most advanced economies, Australia's rate of productivity growth has slowed significantly.

Several contemporary forces will likely shape productivity growth in the future — as well as influencing whether, and to what extent, the economy can bounce back from this slowdown.

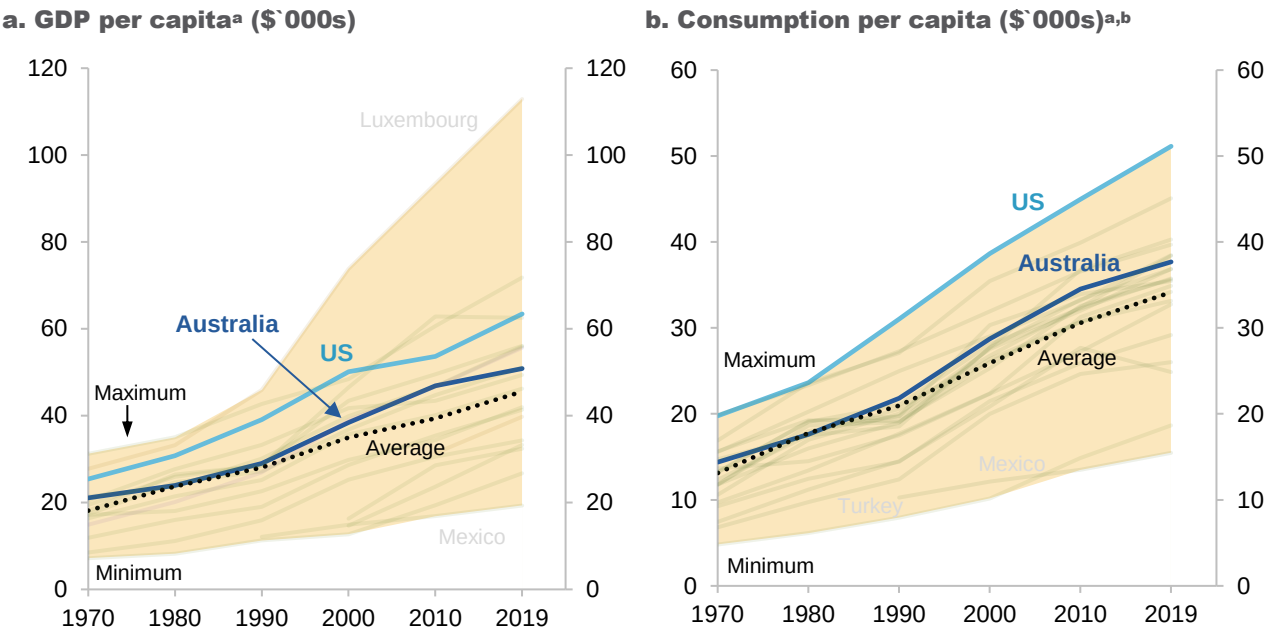
- A growing services sector: The Australian economy, like most other advanced economies, is now dominated by services, which account for about 80 per cent of production and 90 per cent of employment. Historically at least, achieving productivity growth has been relatively difficult in services, particularly when compared to the rapid gains seen in the more traditional goods industries, such as agriculture, manufacturing and mining. Some of the most significant areas of services delivery are those — such as healthcare, aged care, disability support and education — that have a substantial reliance on government funding and regulation.
- The recovery from COVID-19: The pandemic has highlighted deficiencies in digital infrastructure and how a lack of effective cooperation between governments, businesses and households in Australia can hobble the economy during a crisis. Changing priorities during the pandemic highlighted the need for consistent institutional structures and an adaptable workforce, while the labour shortages in the wake of the pandemic bring a greater focus on investment in labour-saving technology.
- Decarbonisation: Australia is richly endowed with fossil fuel-based resources, but the economy — and the country more broadly — is highly exposed to downside risks associated with climate change. Decarbonising the economy in line with international commitments over the next thirty years will have a non-trivial bearing on productivity outcomes.

2.1 Australia's recent productivity performance

Consistent, but overall, not world leading …

The Australian economy has maintained a relatively high standard of living throughout the past hundred or so years. More recently, over the past five decades Australia has experienced healthy growth in real incomes — up 250 per cent between 1970 and 2019 (figure 2.1) — and today, Australia remains a relatively rich economy with consumption levels well above average.

Figure 2.1 – Income and consumption amongst OECD economies



a. OECD membership has changed over time. To reflect this, the group of countries included in the 'OECD' calculations here changes based on the nearest decade at which the country ratified membership. Measured at chained PPPs in million 2017US$ using data from 2019. OECD average is weighted by country population. **b.** Consumption is real consumption of households and government, at current PPPs (in mil. 2017US$).

Source: Feenstra, Inklaar and Timmer (2015).

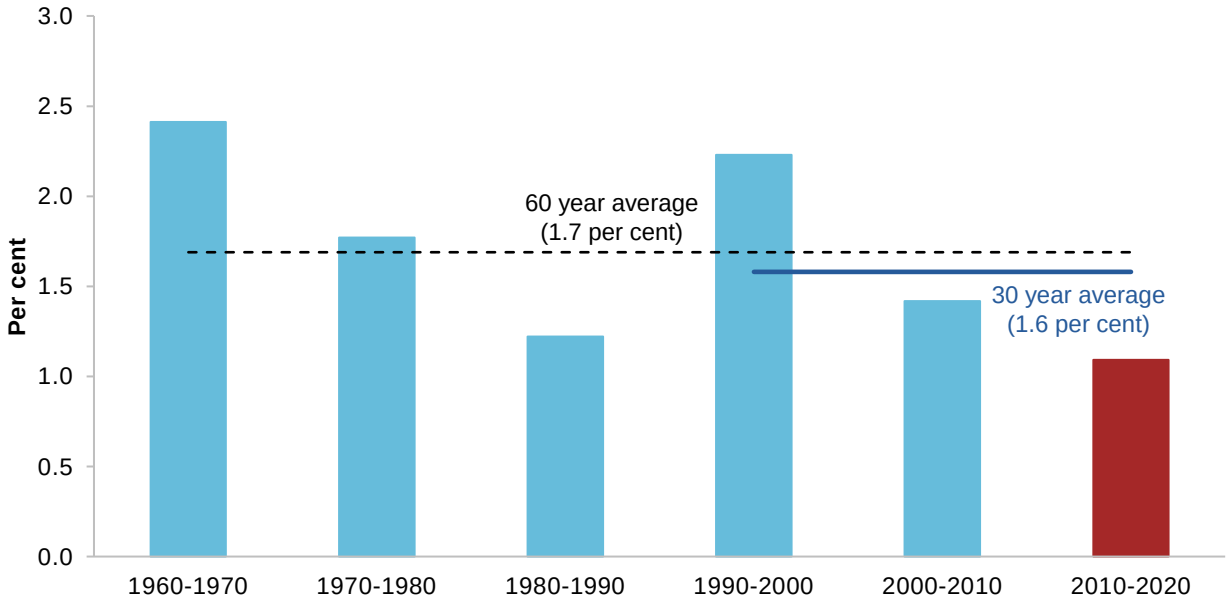
Despite its strong income and consumption performance, Australia's productivity growth has slowed significantly in the past decade, falling to its lowest rate since the 1970s (figure 2.2). To put this in perspective, if, over the decade, productivity had instead grown at an annual rate consistent with the average over the past 60 years (1.7 per cent compared to 1.1 per cent), gross national income per person would have been around $4 600 higher (6 per cent) in 2020 (ABS 2021a).

Australia's performance should be placed in a global context. There has been a widespread and sizable slowdown in productivity growth across most advanced economies recently.[12] For example, average productivity growth among OECD economies since 2005 was about one percentage point per annum below the historical average (figure 2.3).[13]

[12] Exactly why productivity growth has slowed is contested, as are the implications for future growth. The economics literature identifies a number of potential culprits, which range from measurement error to fundamental changes in the structure of the economy. Key sources include Gordon (2018), Mokyr (2018) and Syverson (2017).

[13] From a global perspective, the slowdown is particularly evident in advanced economies; developing countries are growing faster than ever before. In fact, global income growth is currently the fastest it has ever been, with the living standards of some of the world's poorest countries improving at the fastest rate on record (Bolt and van Zanden 2020).

Figure 2.2 – Australia's labour productivity growth in the past decade has been the slowest in 60 years[a,b,c]

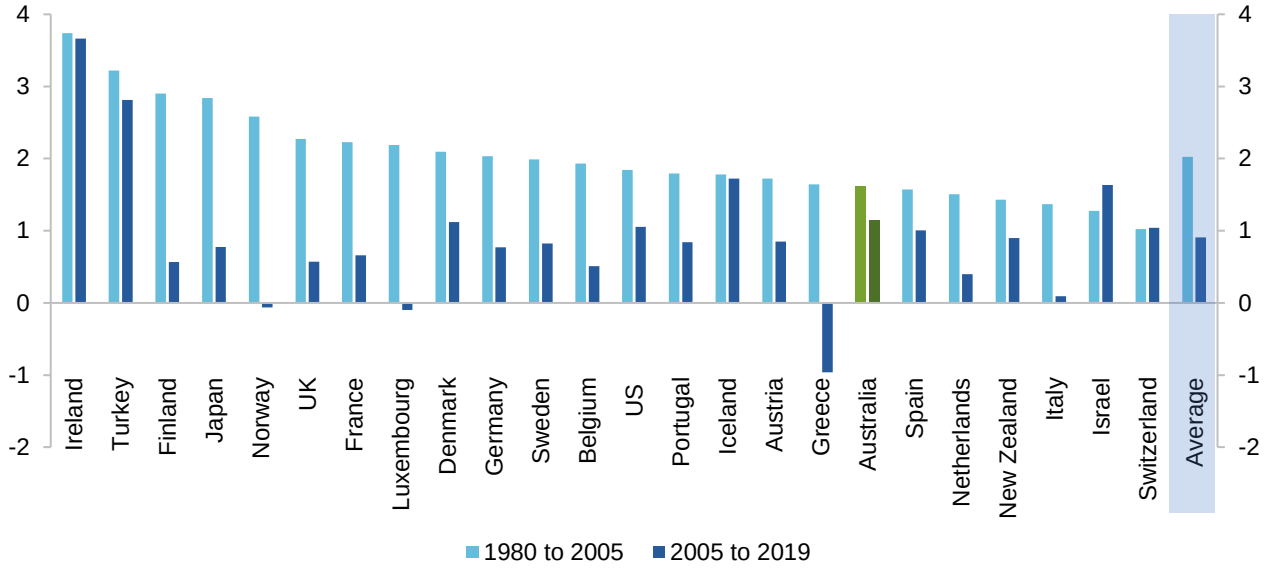


a. Labour hours from 1960 to 1980 come from the Penn World Tables. **b.** All years are the financial year ending in that year. So the range 1960-1970 is actually 1959-60 to 1969-70 but has been shortened for readability. **c.** The period averages are based on the 2021 ABS Annual National Accounts. The average annual productivity growth rate over 30 years to June 2020 is 1.6 per cent, compared to 1.5 per cent reported in the 2021 Intergenerational report (The Commonwealth of Australia 2021b) for the 30 years to June 2019.

Source: Productivity Commission estimates using ABS (Australian System of National Accounts, 2020-21, Cat. no. 5204.0., table 1); Feenstra, Inklaar and Timmer (2015).

Figure 2.3 – Most OECD countries have experienced a productivity slowdown[a]

Labour productivity growth in OECD countries (%)



a. Includes only the 24 longest standing OECD countries. For some countries, the average growth rate between 1980 and 2005 could not be calculated due to missing data for the 1980s. Countries where the average growth rate was calculated for a narrow window were: Austria (1995 to 2005), Greece (1983 to 2005) and Israel (1981 to 2005).

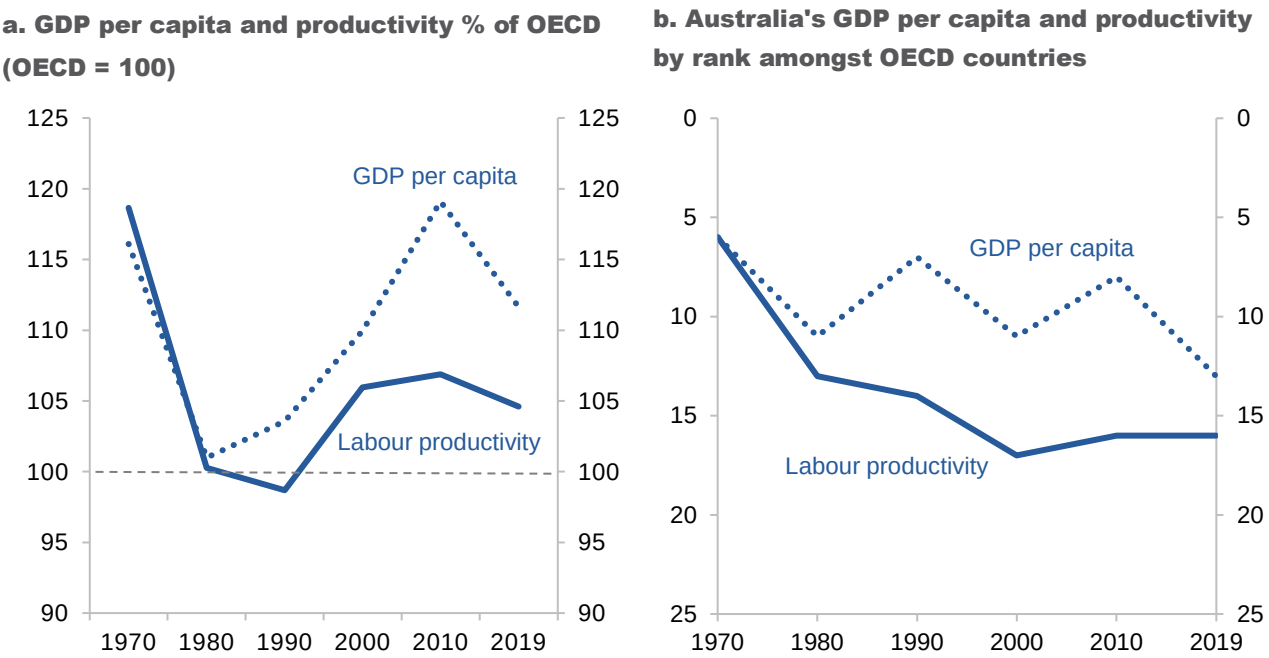
Source: OECD (2022b).

Insight 2.1 – Australia's productivity is growing at its lowest rate in 60 years, consistent with a broad-based slowdown in productivity growth among advanced economies.

Despite maintaining a high income ranking since the 1970s, there has been a long term decline in Australia's relative labour productivity growth performance; labour productivity has not recovered after falling behind in the three decades to 2000. Between 1970 and 2020, Australia's labour productivity ranking fell ten places from sixth in the OECD, to sixteenth (figure 2.4).

Australia's productivity is now about 22 per cent lower than that of the US — a country typically acknowledged as the 'global frontier' economy.

Figure 2.4 – Australia's income position belies its middling productivity performance[a]

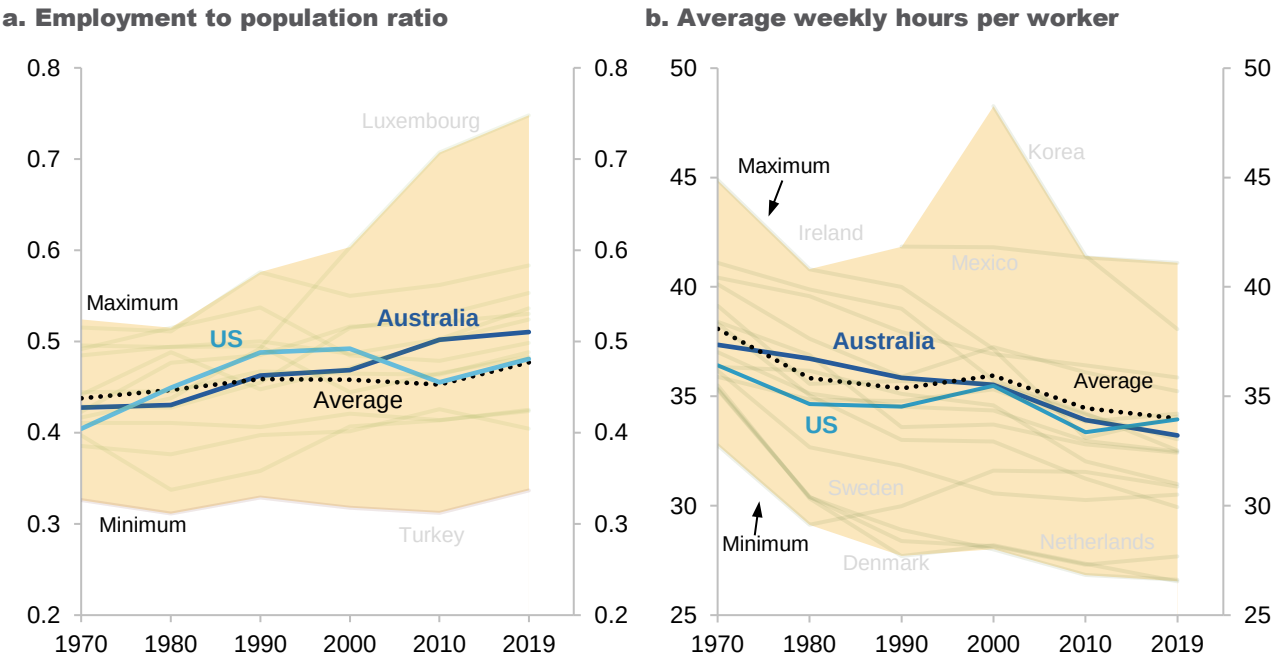


a. OECD membership has changed over time. To reflect this, the group of countries included in the 'OECD' calculations here changes based on the nearest decade at which the country ratified membership. Measured at chained PPPs in million 2017US$ using data from 2019. OECD average is weighted by total hours.

Source: Productivity Commission estimates using the Penn World Tables (eleventh edition).

An important reason that the living standards of Australians have remained among the top tier advanced economies despite our middling productivity growth, is that a higher-than-average proportion of Australians work, and they work relatively long hours (figure 2.5).

Figure 2.5 – More Australians work, and they work longer hours[a]



a. OECD membership has changed over time. To reflect this, the group of countries included in the 'OECD' calculations here changes based on the nearest decade at which the country ratified membership.

Source: Productivity Commission estimates using the Penn World Tables (eleventh edition).

Insight 2.2 – The increasing share of people in the workforce has shielded Australia from some of the effects of slowing productivity growth, but sustaining an ever-increasing share of people in the workforce (and maintaining their income levels), is neither possible nor desirable.

Australia's employment to population ratio has increased since 1970, from around 42 per cent to 51 per cent, moving from below the average to above the average in the OECD. (This is primarily due to a substantial increase in Australia's female participation rate over the past 40 years, and a slight fall in the male participation rate (ABS 2022d)). Although average working hours in Australia fell by around 10 per cent, or about 4 hours in the 5 decades to 2019, average hours amongst OECD peers fell more. In some European countries, such as Norway, Belgium and Denmark, average working hours fell by as much as 25 per cent or more, or the equivalent of an entire standard working day for a full-time worker in Australia today (figure 2.6).[14]

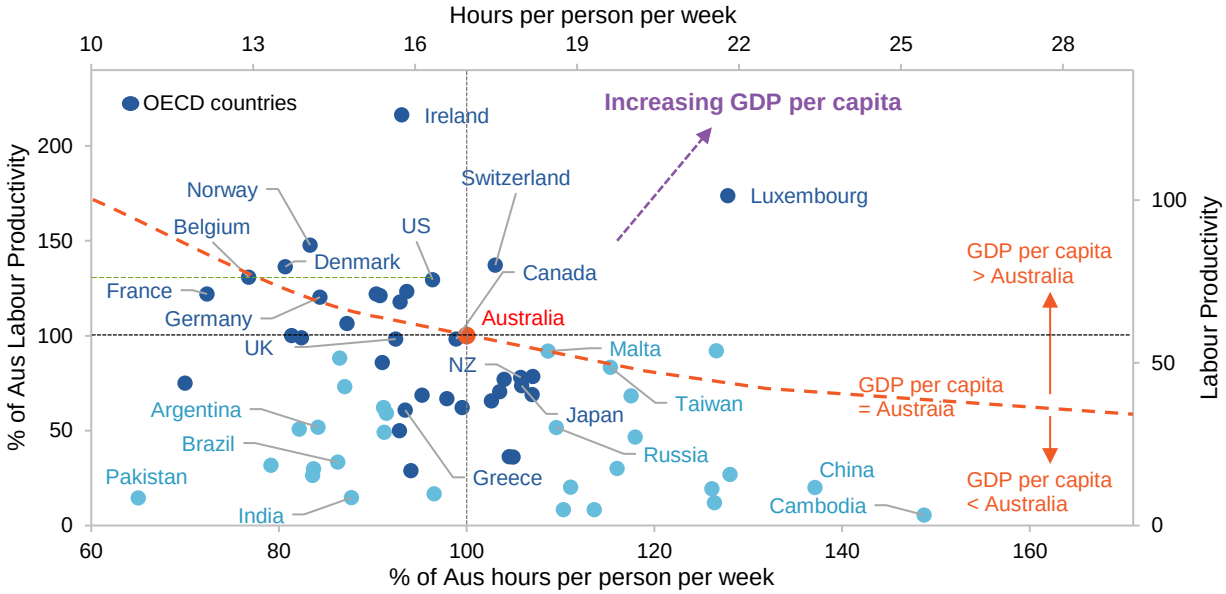
On a per capita basis, Australians work longer hours than about 60 per cent of their OECD peers. This maintains a relatively high level of GDP per capita (figure 2.6).

[14] When making comparisons (and finding 'learnings') between Australia and other countries it is important to take into account the effect of labour utilisation. For example, some countries (e.g. France) with higher levels of labour productivity than Australia appear to have labour markets that exclude marginal members of the workforce (lower participation and higher unemployment) and prevent workers from working longer hours where they might be less productive (by restricting the length of the working week). Tax and other policy settings also affect labour utilisation and participation. In some countries, higher measured productivity levels could be the result of policy settings which prevent less productive workers from participating in the labour market.

In principle, if Australia could close the relative productivity gap it would bring significant benefits for the average Australian in line with the productivity dividend described in chapter 1 (box 1.4). For example:

- If Australia's labour productivity were at the same level as Belgium — a country with a very similar GDP per capita to Australia (the dashed line in figure 2.6) — Australian's per capita hours worked could be around 4 hours fewer per week without any reduction in income. This would translate to about one fewer day per week for each working Australian, other things equal — a leisure dividend.
- Alternatively, with a shift in productivity such that it was in line with Belgium, but with a more modest reduction in hours worked — around 0.5 hours fewer per capita, or just over an hour per week for the average Australian worker — Australia's GDP per capita would increase by about 25 per cent, in line with the average American — a consumption dividend (figure 2.6).

Figure 2.6 – Labour productivity and hours worked per head of population[a]



a. Labour productivity is GDP per hour worked measured at chained PPPs in 2017US$.

Source: Productivity Commission estimates using the Feenstra, Inklaar and Timmer (2015).

Insight 2.3 – Closing the productivity gap to our OECD peers requires working smarter so that Australia can have higher GDP per capita without having to work longer.

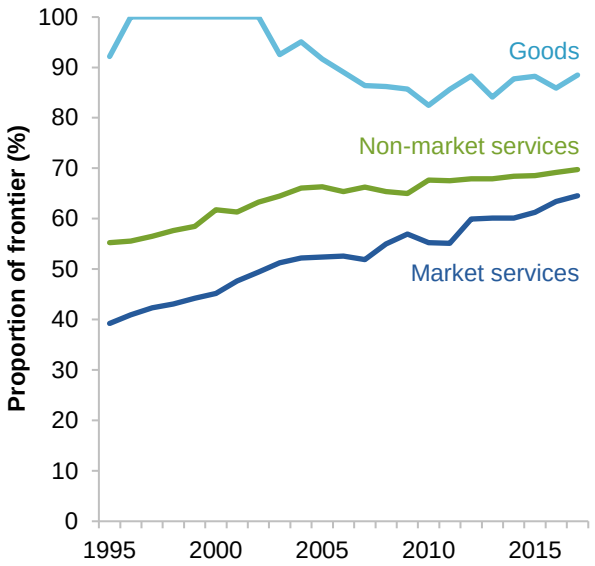
Goods sector productivity is strong, but services continue to lag

Australia's goods sector has performed relatively well over the past two decades when compared to European countries, the United States and Japan (figure 2.7).[15] The relative performance of the services sector is less impressive, but both sub-sectors (non-market and market) are steadily improving.

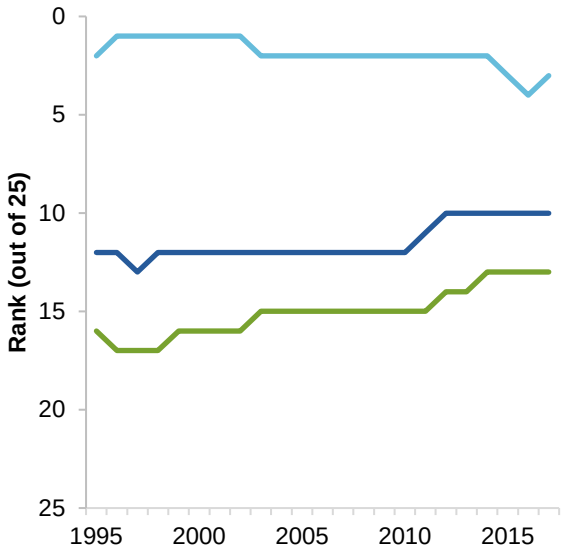
[15] Cross-country, industry-level, labour productivity statistics are constructed by estimating industry-level purchasing power parity (PPP) adjustments using the most recent internationally available estimates from 2014. These estimates should be interpreted cautiously. Aggregated results (whole economy or sector level) are more reliable than

Figure 2.7 – Australia's labour productivity performance is strong for goods, but much weaker — although improving — for services[a,b,c,d]

a. Labour productivity (% of frontier)



b. Labour Productivity rank (of 25 countries)



a. 'Frontier country' refers to the country with the highest labour productivity in a particular industry or sector in a particular year. Using the frontier country as a benchmark leads to more stable results than a constant benchmark country (e.g. the United States). **b.** Goods encompass manufacturing, mining and agriculture; market services includes all services other than non-market services and non-market services are education, health care and public administration and defence. **c.** The comparator set includes 25 countries, 21 of which are in the OECD (Australia, Austria, Belgium, Bulgaria, Cyprus, Germany, Denmark, Spain, Finland, France, United Kingdom, Greece, Croatia, Hungary, Ireland, Italy, Japan, Lithuania, Luxembourg, Latvia, Malta, Poland, Slovenia, Sweden and the United States) plus Bulgaria, Cyprus, Croatia and Malta. Data limitations make comparisons to a broader array of countries difficult. **d.** The PPP benchmark year is 2014, these level estimates were then extrapolated using estimates of labour productivity growth. This means results closer to the 2014 benchmark year are more reliable than those well before or well after this date.

Source: Productivity Commission estimates using the World Input Output Tables, UN Comtrade data and unpublished data from the World Bank International Comparisons Program.

Breaking each sector into its component parts shows that in the goods sector, agriculture and mining consistently perform at, or within, the top 5 countries. The ranking for the manufacturing sector — which accounts for around 5 per cent of the Australian economy — has continued to slide after the peak of the mining investment boom in the early 2010s.[16]

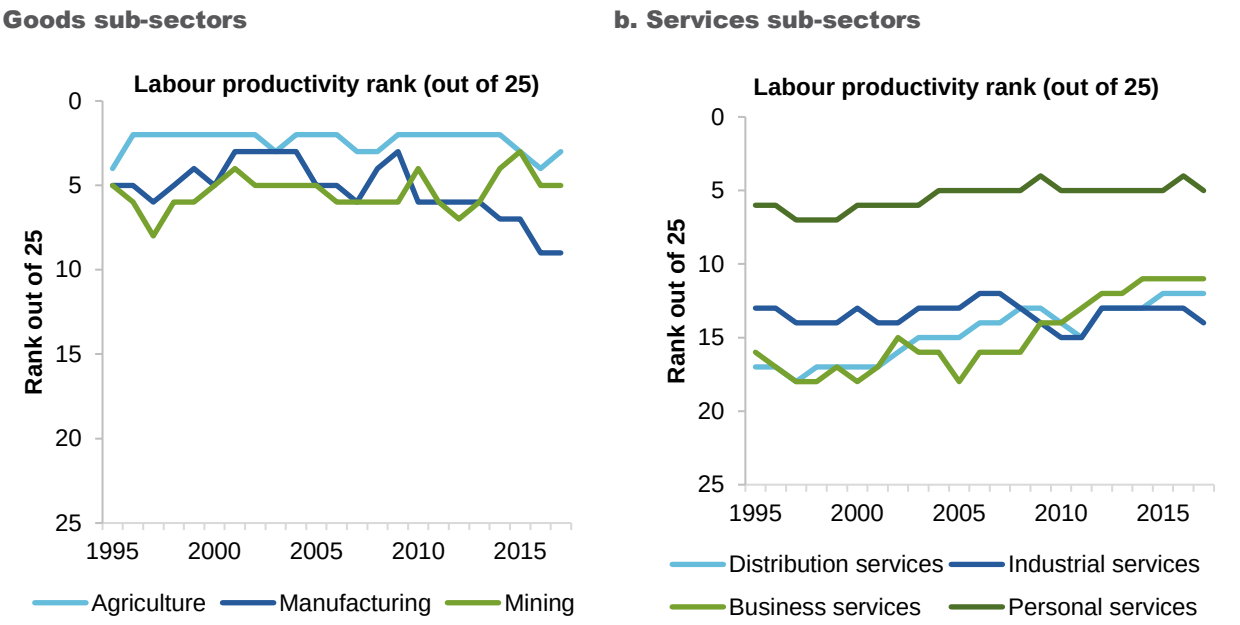
Services are characterised by a clear separation in relative performance between *personal services* (such as hotels, cafes and gyms), which ranks consistently in the top 5 countries, and the *professional, non-market*

industry-level results due to the uncertainty regarding the pricing differences across countries for particular products and industries. Further, the relative ranking of countries is more robust than the particular estimates themselves. This has been confirmed in comparisons of multi-country productivity datasets which vary significantly in their absolute (and growth) estimates but vary little in their rankings of different countries

[16] The cause of this decline may be related to 'Dutch Disease', associated with the mining investment boom whereby the strong resources sector raises the value of the Australian dollar and reduces the relative competitiveness of the manufacturing sector.

and distribution services, where performance is improving (in the face of the broader advanced economy productivity slowdown) but remains outside the top 10 (figure 2.8).

Figure 2.8 – Manufacturing and industrial services are Australia's productivity laggards



a. Distribution services are transport and postal, IT and telecommunications and retail and whole trade; industrial services are construction and utilities; personal services are food and accommodation and arts and recreation; and professional services are professional, scientific and technical services, real estate, finance and administration and support services. **b.** See notes c and d in figure 2.7.

Source: Productivity Commission estimates using the World Input Output Tables, UN Comtrade data and unpublished data from the World Bank International Comparisons Program.

Insight 2.4 – Australia's relative global productivity performance is strong in the goods sector, which includes mining and agriculture. Services are comparatively less productive on average, but our rankings are improving.

2.2 Forces shaping future productivity growth

As Australia continues to become a more service-centric economy, real wages and national welfare will be increasingly dependent on service-sector productivity. But driving productivity growth in (at least parts of) the services sector has, on average, been more difficult compared to the goods sector, which includes agriculture, manufacturing and mining.

In addition to the ongoing challenges presented by climate change and transitioning to a lower carbon economy, the global pandemic has disrupted production processes and service delivery in many industries. In some cases this has led to productivity gains, but maintaining this momentum as Australia recovers from COVID-19, and embedding innovation over the long term, represent further productivity challenges.

The dominance of services

The services sector defies definition as it covers such a broad array of products from brick laying to neurosurgery. *The Economist* quipped that services are 'products of economic activity that you can't drop on your foot' (The Economist nd). The services sector is by far the largest part of the economy — almost 90 per cent of Australian workers are employed in the services sector and it accounts for a little more than 80 per cent of economic activity.[17] Both of these figures have grown significantly over the past 70 years — from around 50 per cent in 1950 (PC 2021b, p. 6).

The general increase in the overall size of the services sector, while the goods sector (agriculture, mining and manufacturing) has contracted, is a typical characteristic of the course of economic development in countries (PC 2021b, pp. 5, 7).

Over the past 35 years in Australia, the expansion of employment in the services sector has been mainly in government subsidised and regulated 'non-market' services — in particular, health care and social assistance — but also business services. Employment in distribution services (retail and wholesale trade, transportation and warehousing) has contracted. The pattern is slightly different when viewed as a share of the economy: the economic contribution of the difficult-to-measure non-market services has plateaued while the contribution of business services has increased in line with their share of employment (figure 2.9).[18]

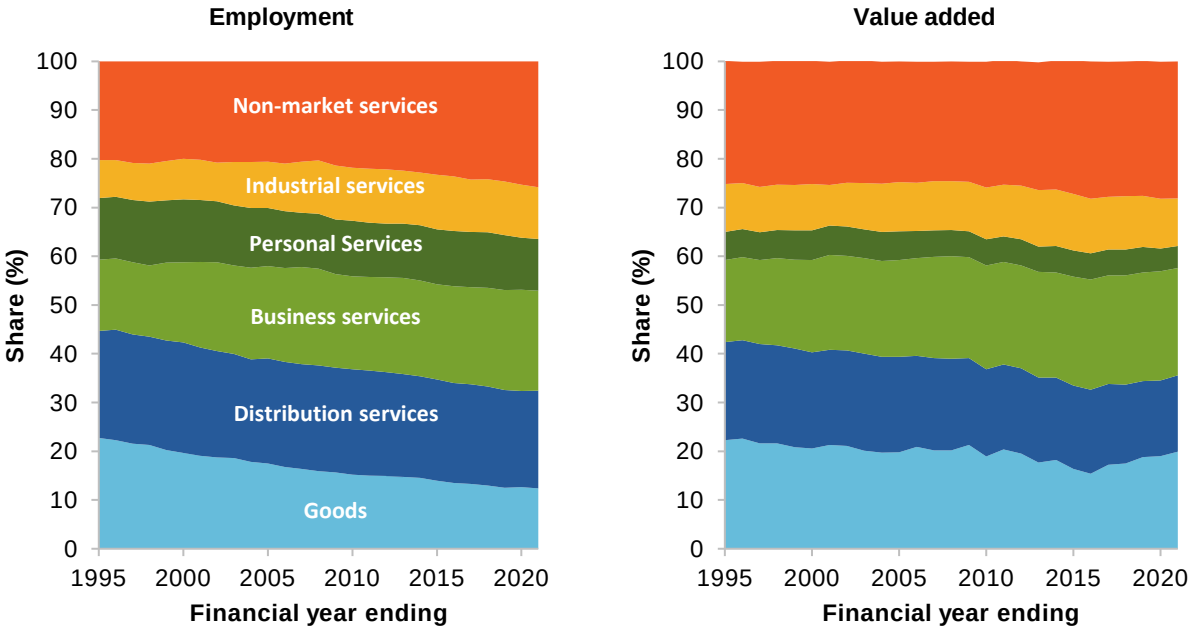
[17] The ABS (2013b, 2019b) defines services as all products in the following divisions of the Australian and New Zealand Standard Industry Classification 2006: The Electricity, Gas, Water And Waste Services (Division D), Construction (Division E), Wholesale Trade (Division F), Retail Trade (Division G), Accommodation And Food Services (Division H), Transport, Postal And Warehousing (Division I), Information Media And Telecommunications (Division J), Financial And Insurance Services (Division K), Rental, Hiring And Real Estate Services (Division L), Professional, Scientific And Technical Services (Division M), Administrative And Support Services (Division N), Public Administration And Safety (Division O), Education And Training (Division P), Health Care And Social Assistance (Division Q), Arts And Recreation Services (Division R), and Other Services (Division S). Services also include Agriculture, Forestry and Fishing Support Services (otherwise part of Agriculture (Division A)); and Exploration and Mining Support Services (otherwise part of Mining (Division B)). The goods sector includes Agriculture, Mining and Manufacturing (Division C) except for Forestry and Fishing Support Services, and Exploration and Mining Support Services.

In this report, each services division is subsequently aggregated into five categories (a slight modification to the categorisation used in Connolly and Lewis (2010)): 1. Business, (Division K-N); 2. Industrial (Divisions D & E); 3. Personal (Divisions H, R & S); 4. Non-market (Divisions O-Q); 5. Distribution (Divisions F, G, I & J).

[18] The productivity of the non-market sector is not regularly reported as part of the national accounts process because there are no market prices — a key building block in measuring productivity. Some irregular experimental measures of multifactor productivity are available for the hospital, higher education and schools sectors, and are very limited in their usefulness, not least because they are largely based on output measures — for example, in the hospital sector, number of diseases treated (PC 2017b).

Figure 2.9 – The increase in the share of the service sector is largely attributable to non-market and business services[a,b]

Goods sector and services subsector shares of total employment and total gross value added



a. Employment is weighted by hours worked rather than a simple headcount of employees. **b.** See footnote 5 for a description of the categories.

Source: (PC 2021b).

The services sector rise reflects our growing prosperity

The rise of the services sector is symptomatic of rising prosperity and productivity growth more broadly.

First, as economy-wide productivity has increased, higher incomes have led to more consumption of services compared with goods (that is, services demand is relatively responsive to income changes). Consumption of holidays, house-cleaning, afterschool care, gyms and home delivered food has grown faster than that of TVs, clothing and sports equipment (Beech et al. 2014).

Second, as productivity growth in goods sectors (such as manufacturing) outstripped the services sector average, the relative price of services rose. This phenomenon is often referred to as 'cost disease', or less pejoratively, 'the Penn effect' (Baumol 1967; Vollrath 2017). Because demand for many services has proven to be relatively unresponsive to price increases, overall spending on services has grown relative to spending on goods. On the supply side, the resources freed up by higher goods sector productivity, flowed into the services sector, where productivity growth has been harder to achieve.[19] That is, high productivity growth in 'progressive' sectors has led to a shift of labour and other resources to the less progressive sectors (i.e. those sectors with low productivity growth), which grow as a share of the economy overall. This in turn slows the overall rate of productivity growth across the economy. As economist Charles Jones (2021, p. 31) put it, 'Economic growth is determined not by what we are good at but rather by what is essential and yet hard to improve.'

[19] Given the enormous diversity in services, cost disease does not affect all of them. Some services have not seen significant growth in consumption or prices as the economy has grown either because these services have productivity growth similar to the goods sector (such as distribution services or business services, discussed below) or because demand for these services is not closely tied to income growth, or rather it is responsive to price increases.

Hence, in many respects, the rise of the service sector is really the story of the decline in the relative share of the goods sector as the good sector has become more productive. A stark example of this is the agriculture sector, which has seen large increases in productivity while its share of the labour force has declined (box 2.1).

While the term 'cost disease' has negative connotations, it is arguably just a product of rising prosperity and productivity growth in some sectors of the economy.[20] So long as other parts of the economy demonstrate the twin properties of demand growing with income and productivity being slower than the economy-wide average, that part of the economy will tend towards some degree of cost disease.

But this does not make slow future productivity growth inevitable. It is simply the context for the productivity challenge. As long as the economy can continually evolve, finding new ways to innovate and raise productivity in those lagging (but growing) sectors, ongoing productivity and income growth is possible.

Box 2.1 – Will services productivity follow the path of agriculture?

At the beginning of the twentieth century, about 25 per cent of all Australian employees — 371 000 people — worked in the agriculture sector. Collectively, this workforce produced just over 1 million tonnes of wheat, 239 million kg of wool and included about 9.4 million head of cattle. Flash forward to the end of the century and about 5 per cent of Australian employees — 348 000 people — worked in the agriculture sector. But this workforce (and a lot of machines) now managed to produce almost 25 times more wheat (25 million tonnes) and over two and half times as much wool and head of cattle (642 million kg and 28 million head respectively). This smaller agricultural workforce is also both working more land and making the land they use more productive. In 1900, two hectares of land was required to produce about one tonne wheat, while in 2000 producing a tonne of wheat required about half a hectare of land — that is, the yield quadrupled.

A contracting agricultural workforce is not unique to Australia. In 1500, about 60 per cent of workers in (what is now) the United Kingdom were devoted to agricultural production compared to about 1 per cent in 2019. But how has productivity in the agricultural sector led to such large shifts in the structure of the workforce in Australia and elsewhere?

The main reason agriculture has seen a falling share of employment and output while its productivity has increased is a manifestation of Baumol's cost disease — a combination of relatively rapid productivity growth within agriculture compared to the rest of the economy combined with consumer preferences. As productivity growth in agriculture increased it became more profitable to replace people with machines — threshers, reapers and tractors do the work of dozens of people (and animals). The other reason is that as agricultural and economy-wide productivity improved, there was increased demand for non-agricultural goods and services which led to higher wages in these sectors, and so attracted the surplus labour from agriculture.

By reducing the amount of labour required in agricultural production, Australia has been able to effectively redeploy additional workers to meet demands for other important needs and wants — doctors, nurses, teachers and even baristas — which were largely unmet in a predominately agricultural economy.

[20] A point forcefully made in Dietrich Vollrath's 'Fully Grown' (Vollrath 2019).

Box 2.1 – Will services productivity follow the path of agriculture?

Will services repeat the same trend?

As the services sector grows in importance, the question arises as to whether it (or at least parts of it) will repeat the pattern observed in agriculture. That is, will some part of services have rapidly expanding output while its workforce contracts?

We have already seen the agriculture story play out in parts of the service sector. In 2004, the largest US video rental store, Blockbuster, had about 84 000 employees globally while in 2021 the largest streaming service Netflix, which along with similar companies largely replaced video rental, had only 11 600 employees. At the same time, while official numbers are unavailable, the number of views of video content on Netflix in 2021 was almost certainly higher than the number views of rental videos back in 2004 (with a larger variety and easier access). A similar story has played out in offices with the uptake of computer word processing power — fewer people are employed as typists or secretaries, but far more pages of documents are produced.

It remains to be seen how widespread the achievement of productivity improvements through similar such labour saving approaches will be. But it is not obvious that these trends in labour use would necessarily be replicated in all parts of the services sector — particularly in services that involve non-routine tasks or non-cognitive experience — at least in the short term.

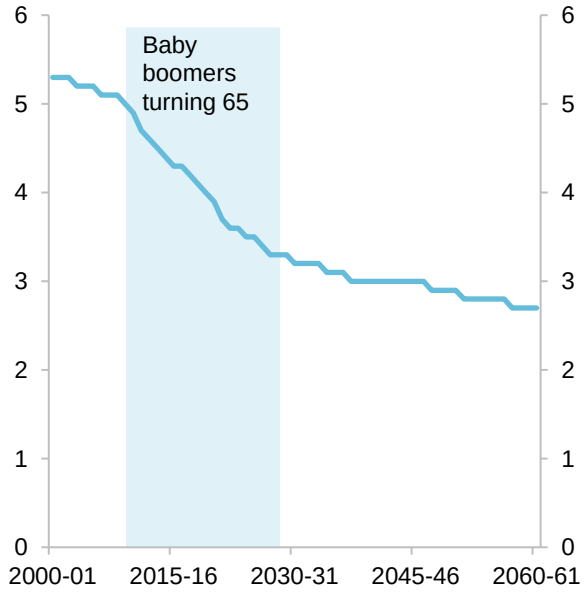
Source: ABS (ABS 2013a); Blockbuster Inc. (2004); Butlin (1969); Butlin, Dixon and Lloyd (Butlin, Dixon and Lloyd 2015); Netflix Inc. (2021); Roser (2013).

There are several other contributors to the increase in the share of the services sector. Global economic factors include the shift of the manufacturing base into East and South East Asia in the late twentieth century, which was driven by access to a large pool of relatively cheap labour. This shift was facilitated in Australia when domestic manufacturing was increasingly exposed to international trade via the removal of tariffs beginning in the 1960s. In some industries, outsourcing meant that a services component (such as sales or marketing) of what was a manufacturing operation, was outsourced and remained in Australia even after the manufacturing moved offshore.

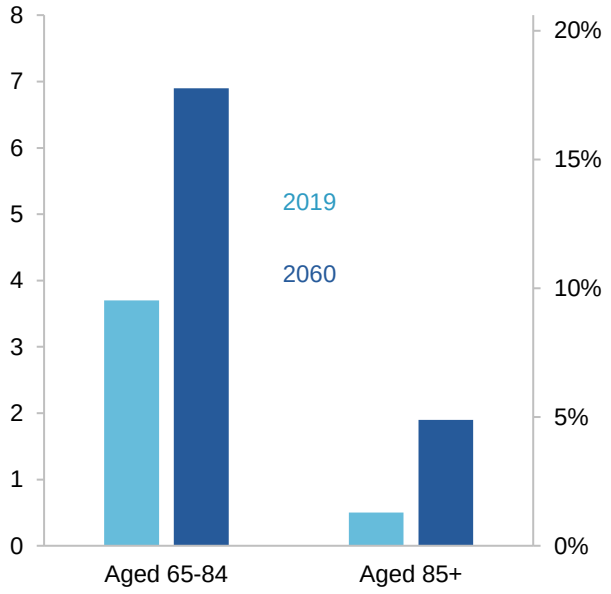
Australia's aging population and shifts in other demographic factors contribute to an expanding services sector, especially the government-run and regulated non-market services. As our population ages, demand for health and aged care services increases, which is likely to weigh on productivity growth. The most recent Intergenerational Report projected that over the next 40 years the share of the population aged over 65 will increase to nearly 23 per cent as the baby boomer generation ages (panel b figure 2.10). This will drive the dependency ratio — the ratio of working age people to non-working age people — down by almost a third, from 4 people today to around 2.7 in 2060 (panel a figure 2.10). And consistent with the higher labour force participation of women, demand for childcare services is likely to at least keep pace with working age population growth.

Figure 2.10 – The aging population will further increase Australia's services sector

a. Old age dependency ratio[a]



b. Older Australians by level (millions) (LHS) and share (RHS)



a. Number of people of traditional working-age (15-64) for every person aged 65 and over.

Source: The Commonwealth of Australia (2021b).

Insight 2.5 – Similar to other advanced economies, the services sector dominates the Australian economy. This reflects both the impact of higher incomes on consumer preferences, and the fact that productivity gains have been harder to secure in many service industries — making services relatively more expensive. Australia's industry structure also reflects our areas of comparative advantage (which for example, leads to a reliance on imported manufactured goods) and demographic factors such as an ageing population.

Productivity growth in services tends to lag the goods sector — though there is great variation

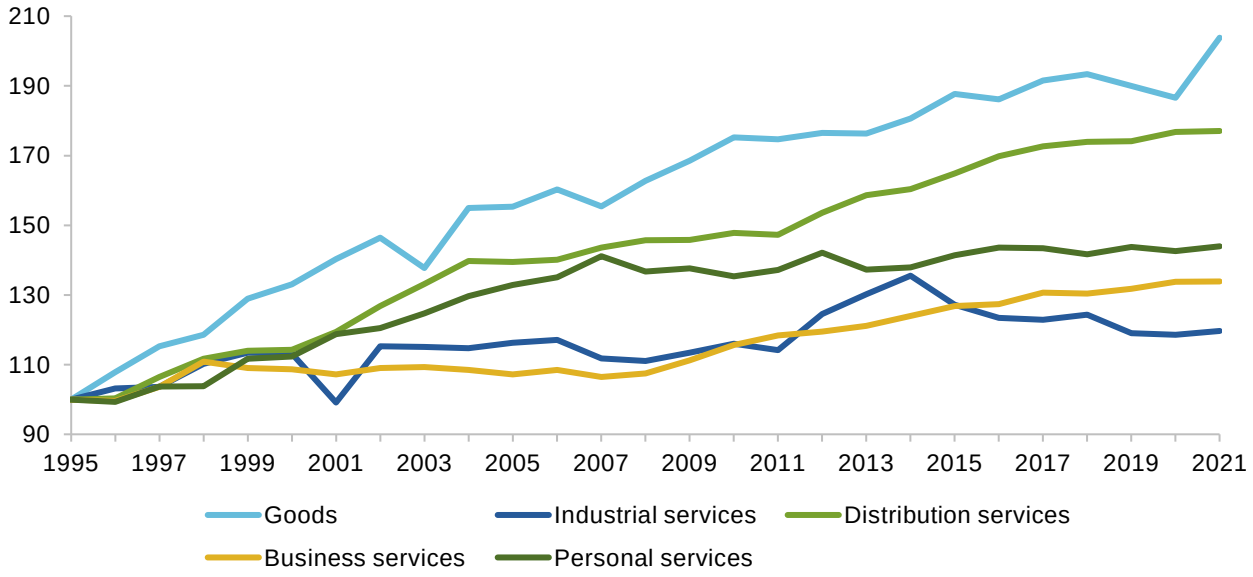
On average over the past 35 years, market-based measures of labour productivity have been higher in the goods sector than any subsector within the services sector (figure 2.11).[21] But as discussed, services are highly diverse, including with respect to productivity growth.

Since 1995, the services sub-sector with the fastest productivity growth was distribution services (which includes retail and wholesale trade, transportation and warehousing, and information media and telecommunications). Growth in distribution services was about 7 times faster than in industrial services, the slowest growing sub-sector, but still around 15 per cent slower than productivity growth in the goods sector.

[21] The figures in this section for the services subsector productivity performance differ from those presented in the 'Things you can't drop on your feet' Productivity Insight report (2021b) due to data revisions by the ABS. These reflect, among other issues, the ABS' move from the use of the labour account (from the labour survey) and revisions to several industries' historical GVA estimates (ABS 2021b).

Figure 2.11 – Labour productivity growth in Australia by subsector[a,b]

Index (1995 = 100) between 1994-95 and 2020-21



a. Industries at the ANZSIC 1 digit level were aggregated into sectors by weighting the growth in labour productivity by the hours share of that industry (in the previous year). **b.** See box 2.1 for definition of services aggregation.

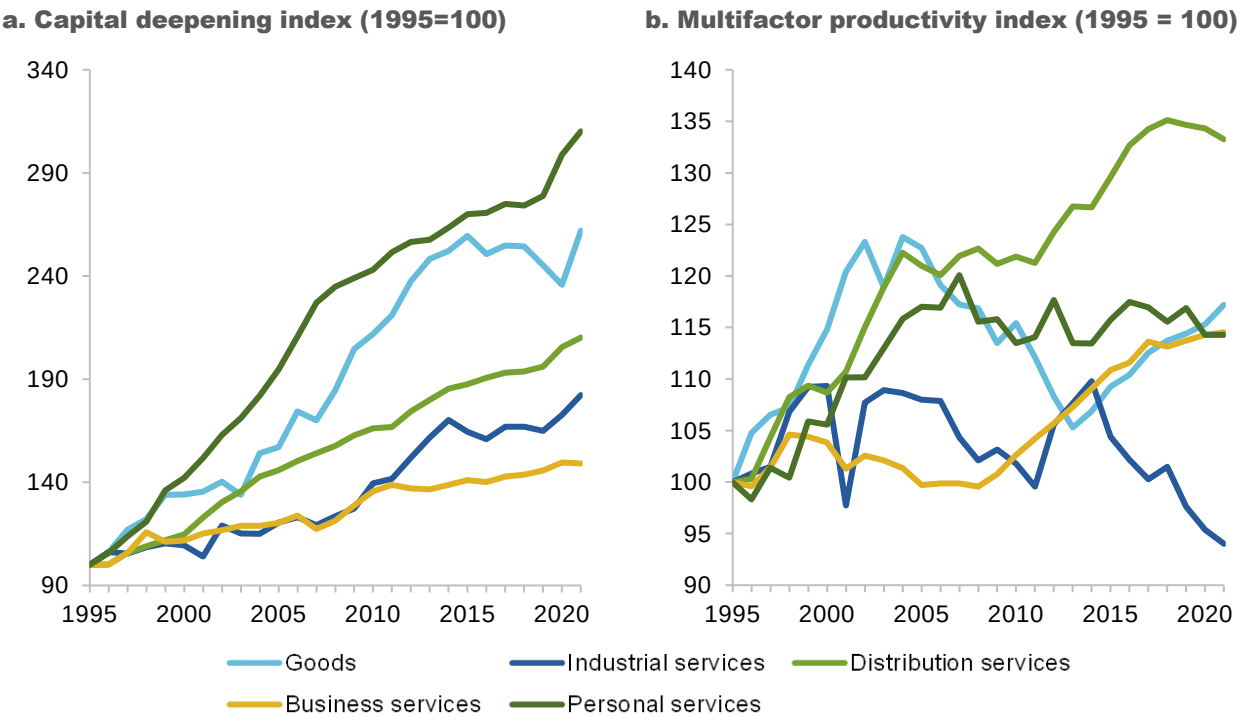
Source: Commission estimates using ABS (*Estimates of Industry Multifactor Productivity, 2020-21 financial year*, Cat. no. 5260.0.55.002., tables 1-19; *Labour Account Australia, March 2022*, Cat. no. 6150.0.55.003., Industry summary table).

The variation across sources of labour productivity growth — multifactor productivity (MFP) and capital deepening (Appendix A.1) — for Australia's goods and services industries is significant (figure 2.12).

Since the mid-2000s, the goods sector's MFP growth has been broadly in line with most of the services sub-sectors but significantly slower than for distribution services — where average annual MFP growth was fastest. Ironically, given the broader upside benefits to Australia, a significant driver of the relatively slow goods sector MFP growth was the mining sector. The price shock that caused a terms of trade boom in the 2000s (see box 1.3) made extraction of resources from low productivity mines profitable and led to a massive capacity expansion characterised by investment in infrastructure with long, unproductive lead times.

Apart from personal services, which has seen the fastest capital deepening of any subsector of the economy over the past 25 years (possibly reflecting the fact that repair services, a subsector within personal services, has become increasingly capital intensive and computerised), the rate of growth of capital deepening in the services sector has been consistently lower than in the goods sector since at least the mid-2000s. This is particularly true for the business and industrial services sub-sectors, which have also seen large increases in employment in recent decades.

Figure 2.12 – Components of productivity by subsector between 1994-95 and 2020-21[a,b]



a. MFP growth at the ANZSIC 1 digit level was aggregated into sectors by weighting the growth in MFP by the gross value added share of that industry (two year weighted average). The capital deepening contribution for each sector was estimated by differencing sector growth in labour productivity from sector growth in MFP. Capital deepening itself was then estimated by dividing the capital deepening contribution by industry by its estimated sector labour income share. Sector labour income shares were estimated by multiplying the factor income shares in the ABS MFP statistics by the total factor income for that industry in the national accounts and then adding up the capital and labour incomes. **b.** Subsectors are — *Goods*: Mining, Manufacturing, Agriculture, forestry and fishing; *Industrial services*: Electricity, gas, water and waste services, Construction; *Distribution services*: Transport, postal and warehousing, Information media and telecommunications, Retail trade, and Wholesale trade; *Business services*: Professional, scientific and technical services, Financial and insurance services, Rental, hiring and real estate services, and Administrative and support services; *Personal services*: Accommodation and food services, Arts and recreation services, and Other services.

Source: Productivity Commission 2021.

Insight 2.6 – Productivity growth in the goods sector is faster than in services. However, reflecting their diversity, the variation in growth rates across the services subsectors is substantial.

Maintaining momentum in the use of data and digital technologies

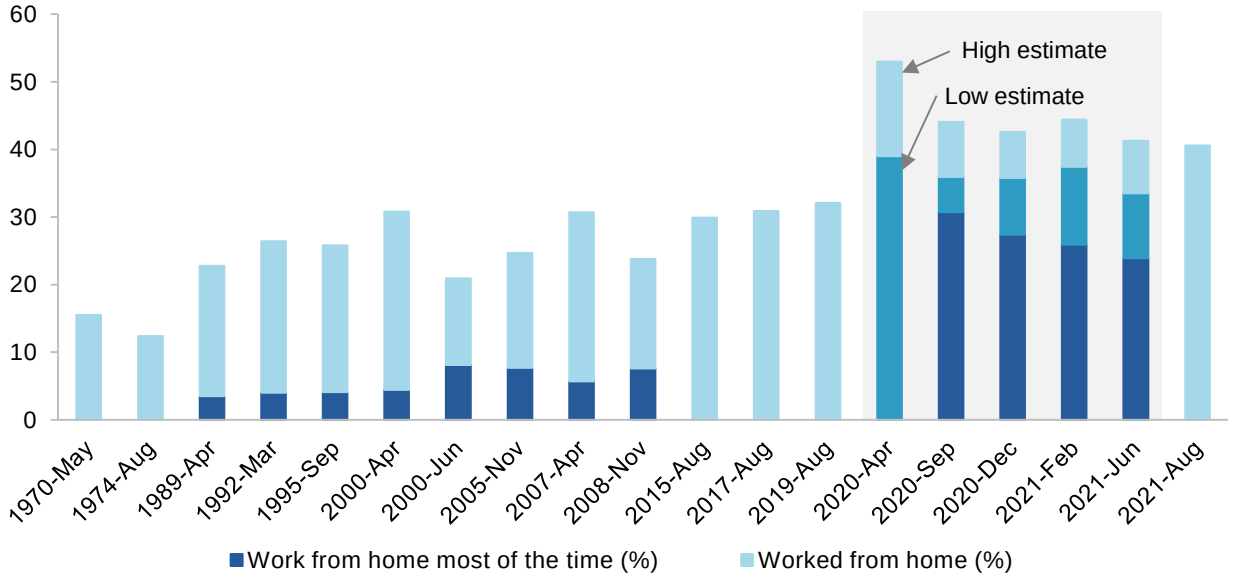
A defining characteristic of our COVID-19 times, from March 2020 to the lifting of the last significant restrictions in early 2022, was the hastened adoption of digital technologies to help the economy continue to function. This has been exemplified by governments, businesses and employees alike embracing the move to regular working from home (PC 2021c). The adoption of digital technologies constituted a massive productivity boost, relative to a counterfactual scenario in which such technologies did not exist or were not adopted en masse.

At the height of the outbreak, as many as two out of three people may have been working from home (Baxter and Warren 2021). COVID-19 accelerated the trend of more people working from home, more often. The share of people 'regularly working from home' in late 2021 was 40 per cent, about 8 percentage points higher than in 2019, prior to the onset of the pandemic, and about twice what it was a decade prior (figure 2.13). The share of

people working 'most of their hours' from home was as high as 30 per cent in 2020 (although this has moderated somewhat since then), more than 4 times higher than when it was last measured in 2008.

If, and how far, the proportion of people working from home moderates as the pandemic and economic recovery from it progress, is uncertain. However, the uplift in online capacity (among both businesses and households) combined with a broader embrace of the innovative potential of digital technology, can transform the way the economy operates — services in particular — with significant productivity benefits. The challenge will be to ensure that policy settings are sufficiently flexible and incentives are appropriately calibrated to support continued uplift as the COVID-19 recovery continues.

Figure 2.13 – COVID-19 accelerated a trend to increasing working from home



Source: ABS (2021c).

Sustaining uptake of online service delivery

COVID-19 highlighted pre-existing productivity bottlenecks in both the private and public sector, and in some cases underlined how quickly and easily some of these (arbitrary) bottlenecks could be removed by embracing online service delivery. As the Australian economy becomes increasingly dominated by services, embedding these changes into businesses' and governments' operations will consolidate longer-term productivity dividends from online activity and services.

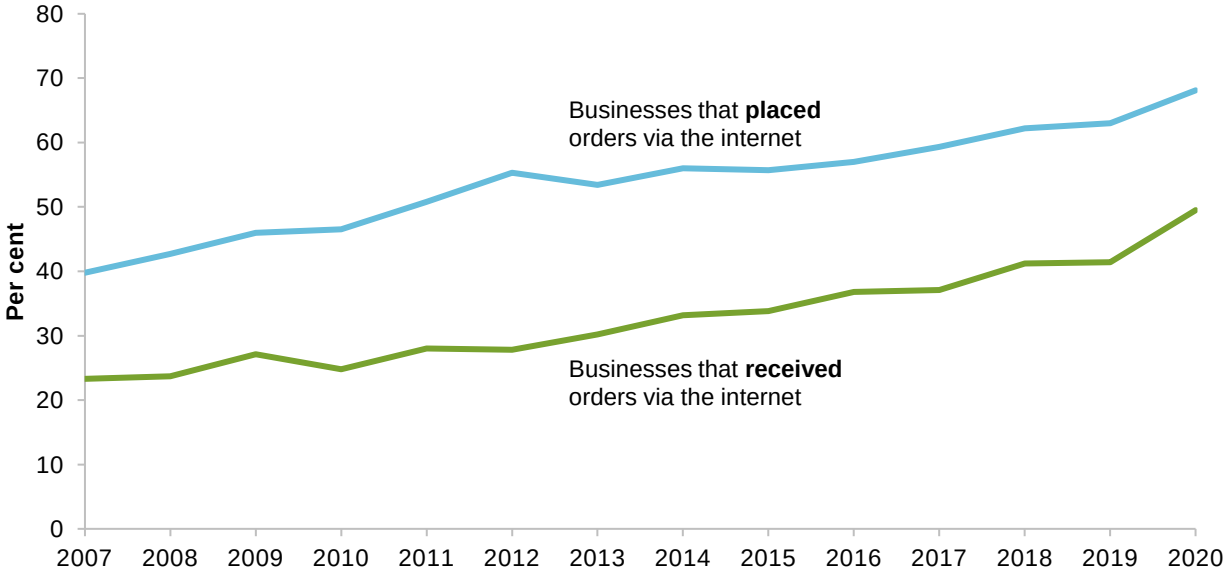
Virtual interactions via online platforms provided a crucial substitute to physical face-to-face interactions, which effectively ceased during phases of the pandemic. Across a range of sectors, businesses that had previously only operated from a 'bricks and mortar' location invested in online capacity to take orders and payments from customers while also discovering entirely new customer groups, including in overseas markets (figure 2.14). Use of digital documentation and signatures for transactions by legal and financial services that were previously reliant on in-person verification, became more widely accepted.

In the government subsidised health care sector, the pandemic highlighted the lack of flexibility around the delivery of some services. The widespread take up of 'Telehealth' consultations, access to which had been heavily restricted under the Medicare Benefits Schedule funding guidelines prior to March 2020, showed a willingness amongst consumers to engage with telehealth across a variety of services.

From near zero uptake in late 2019, General Practitioner (GP) telehealth consults jumped to over 12 million in mid-2020 — close to a third of total GP consultations (figure 2.15 panel a) (Snoswell et al. 2022). There was a similarly large impact on mental health consults, including via video conferencing (figure 2.15 panel b). The effect on quality of outcomes for telephone and video consults compared to traditional face-to-face service delivery is, at this point, unclear, although the potential benefits are widely documented (PC 2021a).

Figure 2.14 – Businesses are increasing their digital presence

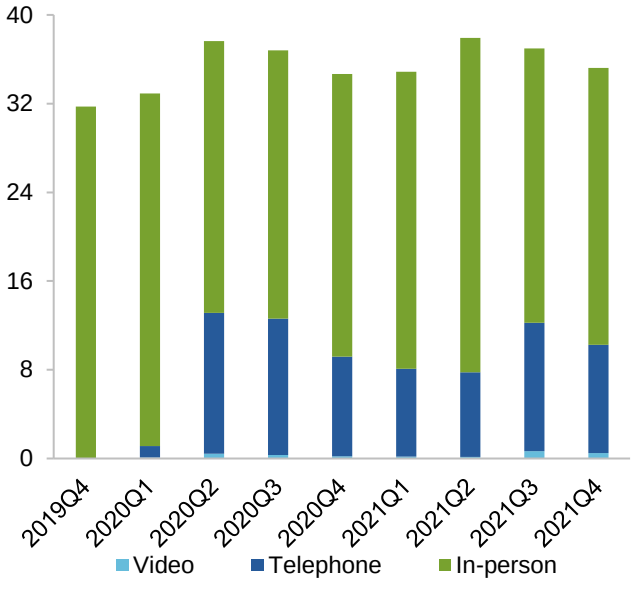
Proportion of businesses that have placed and received orders on the internet



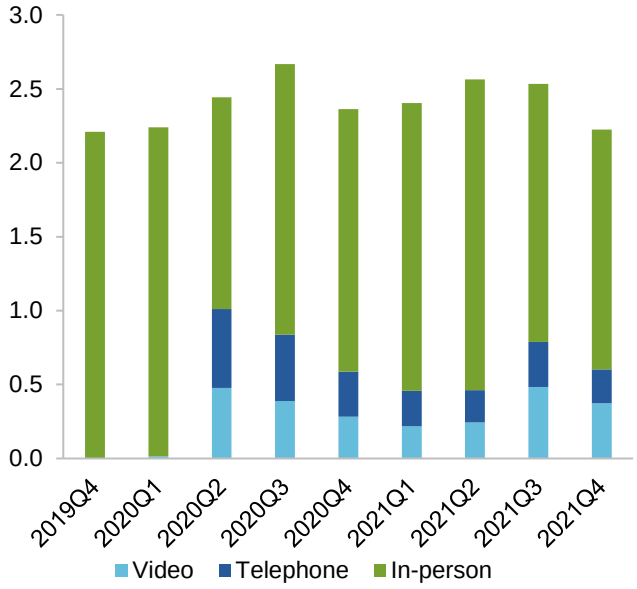
Source: ABS (*Characteristics of Australian Businesses, various editions*, Cat. no. 8167.0)

Figure 2.15 – Funding changes and lockdowns led to a large jump in the number of telephone and video consultations during COVID-19[a]

a. General Practitioner consults (millions)



b. Mental health consults (millions)



a. Includes services provided by a GP, clinical psychologist, psychologist, occupational therapist or social worker.

Source: (Snoswell et al. 2022).

Insight 2.7 – COVID-19 prompted an acceleration in the general uptake of digital technologies and showed that in a crisis, governments, businesses and households can adapt quickly. The challenge is for Australia to achieve a sustained productivity dividend following the pandemic by embedding the efficiency gains from online activity and services.

The nature of innovation is changing in a services-dominated economy

Innovation is about more than just high-tech research and development (R&D) laboratories generating new 'things'. And in an economy increasingly dominated by services, there is another, more immediately practical, side to innovation — the process of changing the way a business operates. The former might require specific, advanced technical skills (such as STEM), but the latter requires a combination of strategic understanding, creativity, drive, risk appetite, emotional intelligence and adaptability. Both forms of innovation are fundamental to productivity growth in a modern economy.

The challenge for Australia is that, historically, innovation in goods-producing industries such as agriculture, mining and manufacturing has usually meant changes to production processes that are far removed from direct consumer interactions. But services sector innovation can be altogether different; for example, by changing a user interface to improve customer experience and service quality.

While scientific breakthroughs feed into such innovations, they are only part of the story. The other part consists of the diffusion, adaption and implementation of such breakthroughs to the needs of consumers and businesses. To achieve this, the exchange of ideas, some scientific, some business and most a hybrid of the two, may be much more important than a focus on the generation and commercialisation of research.

Pivoting the policy thinking on innovation as the economy becomes more dominated by services could be challenging, but the past decade has brought a range of illustrative examples. Vehicle ride sharing apps, online banking and telehealth are all examples of digital technologies being used to disrupt the way consumers access some services. Returning to the Netflix example (box 2.1), online streaming services completely replaced brick and mortar video rental stores. And in doing so, produced a much better product: greater variety that can be accessed from their living room (or anywhere, via their mobile phone), at any time and with no late fees and no waiting (for a DVD to be returned by another customer).

In addition, COVID-19 brought both business adaptation and widespread technology diffusion. Further to the increase in online service delivery discussed above, there were notable examples of businesses rapidly switching the nature of their production during COVID-19, including by changing both business models and business activities simultaneously. Such changes were made in order to continue using capital equipment, keep workers employed and provide an ongoing income stream. From distilleries that switched to making alcohol-based hand sanitisers, to stage production companies that switched to construction of home office equipment, the adaptability and resilience of private businesses was potently demonstrated.

Despite these past successes, Andrews et al. (2016) noted there is an increasingly large gap between firms at the top and bottom of the productivity distributions, which the authors interpreted as being a defect within the process of diffusing new innovative ideas. And some parts of the services sector face particular headwinds; for instance, while government-funded services — such as health care and aged care — supported the diffusion of technology during COVID-19, their longer-term capacity to adapt their business models is fundamentally limited by their regulation and funding. Finding ways to enable these firms and services to embrace innovations will be important for their future contribution to productivity.

Insight 2.8 – Innovation in services industries is less about inventing 'things' and relies more heavily on diffusing ideas and adapting business models. But this can be difficult for businesses operating away from the productivity frontier, and in sectors where government funding and regulation have a heavy influence.

Data must be used, not just produced

Data has increasingly been used in recent decades to fine-tune and customise production and maintenance processes, and enable the creation of new models for business operation (box 2.1). Data use can improve productivity by enabling more competition (as consumers make more informed purchase decisions) and increasing allocative efficiency (as businesses and governments better direct resources to higher-value uses).

Deriving productivity dividends from the increasing data volumes produced in today's economy and society requires individuals, businesses and governments to use data to improve decision-making. Effective use of data to improve productivity goes hand-in-hand with widespread adoption of the digital technologies that draw upon and ensure the safe use of data. But while Australia compares well internationally as a data producer and consumer (Chakravorti, Bhalla and Chaturvedi 2019), it performs poorly in its use of data-driven technologies, such as artificial intelligence and data analytics (OECD 2022a, 2022b).

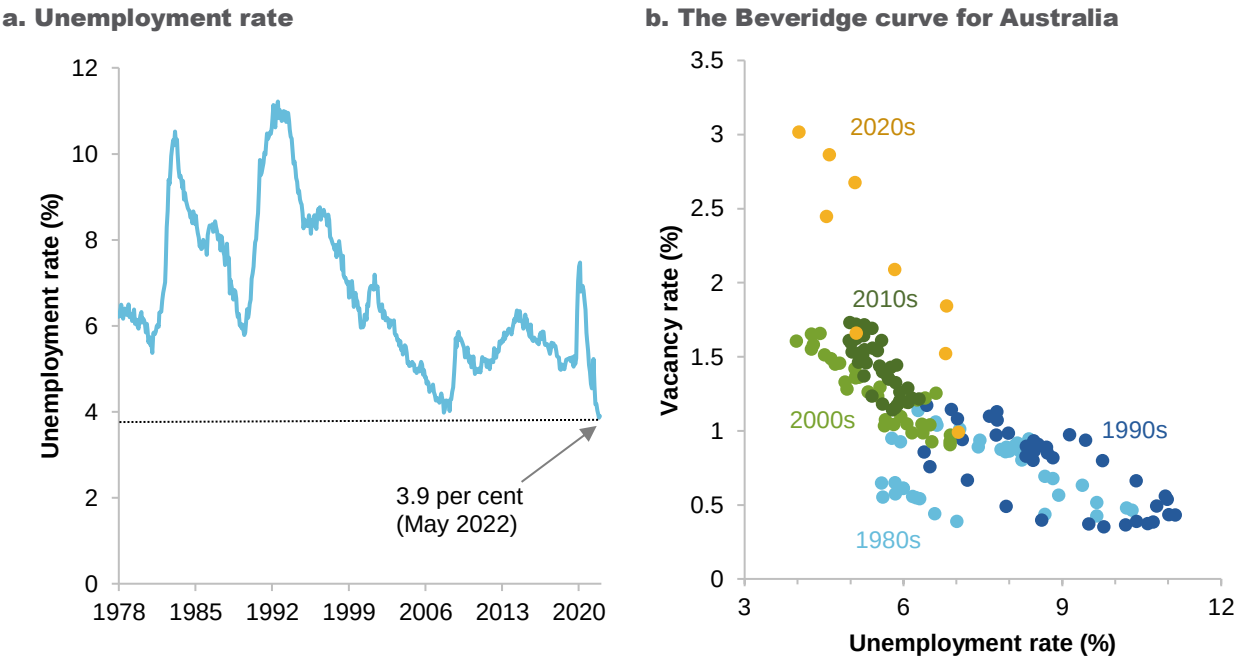
The COVID-19 policy response provided several good examples where data was effectively used to improve health and economic outcomes. There was a great need for consistent quality near-real time data to inform rapid decision making in a range of public services (such as health, public safety and employee financial support) and commercial services (including logistics and supply chain management). The challenge for Australia will be to build on this momentum and accelerate data use in other sectors and contexts, so that we can maximise the value gained from data produced in our increasingly digitised and services-oriented economy.

Insight 2.9 – The large volumes of data produced by our increasingly digitised and services-oriented economy can be used to improve productivity. While there were good examples of effective data use during the COVID-19 response, Australia compares poorly internationally on use of data-driven technologies.

Access to skilled labour

The economic recovery from COVID-19 has been rapid, and this is evident in the current tightness of the labour market. The unemployment rate has reached its lowest level in almost 50 years (panel a figure 2.16) and the relationship between job vacancies and the unemployment rate is at an unprecedented point, suggesting a very tight labour market (panel b figure 2.16). The fact that the employment to population ratio is also at its highest level in 70 years — more than a percentage point higher than at the start of the COVID-19 pandemic in early 2020 — suggests that the tightness may remain for some time.

Figure 2.16 – The Australian labour market is particularly tight



Source: ABS 2022.

The scarcity of workers can be a spur to productivity improvement, creating strong incentives to invest in new capital and innovate to make better use of labour. In this environment (and with inflationary pressures evident) ensuring labour and other resources flow to their highest value use remains of critical importance.

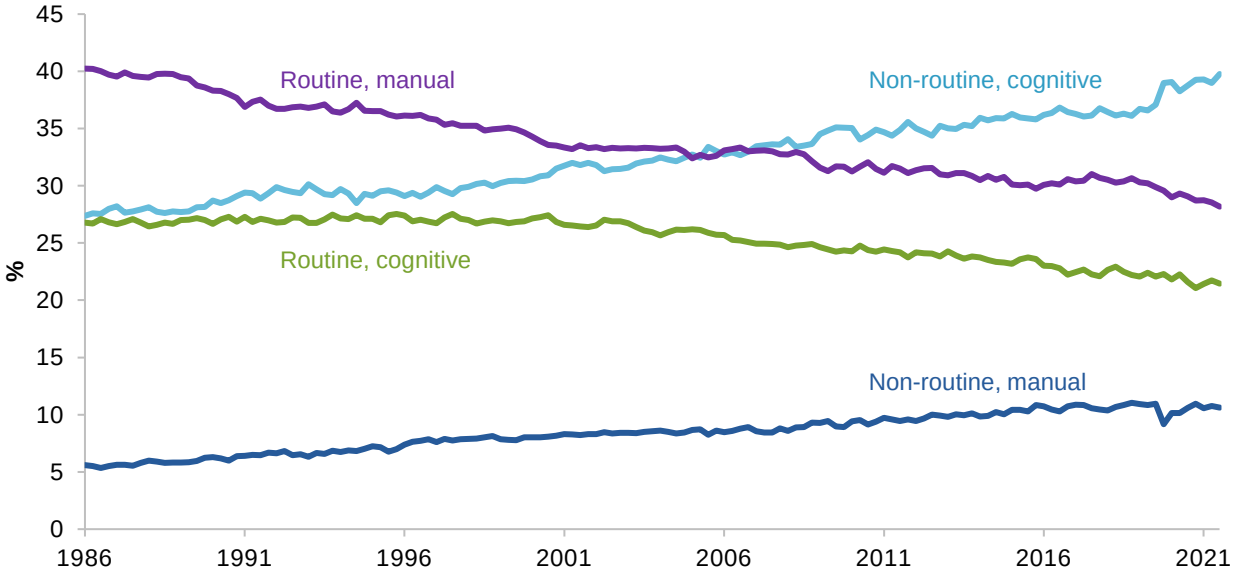
A highly skilled workforce, proficient in non-routine cognitive tasks is even more valuable in a rapidly changing service economy

The Australian economy of a few generations ago — where manufacturing and agriculture accounted for nearly half of aggregate production (Butlin, Dixon and Lloyd 2015) — had different skills and educational needs. Those sectors provided relatively high average incomes with a workforce that was largely trained on the job, with fewer requirements for formal education. As services (including high tech and human services) continue to expand as a share of economic activity (and goods production increasingly requires highly skilled labour), jobs in the Australian economy increasingly involve non-routine tasks (figure 2.17). The diffusion of technology has supported these trends. AlphaBeta (2017, p. 13) estimated that about 70 per cent of the 'automation' expected over the next 15 years will involve automating tasks within jobs (rather than replacing entire jobs). The capacity of professionals and other vocations to perform tasks will be enhanced by in-time delivery of analytical insights and information.

While these non-routine services jobs often require more formal education in the first instance, the evolving nature of the modern economy also means that the workforce needs to be able to easily upskill and reskill as job roles change including because of the introduction of new technologies. Meeting this challenge requires academic and vocational education systems that can provide the workforce with both solid foundational skills — such as the ability to problem solve and to think critically — as well as equipping workers with the specialist (or vocational) knowledge required for specific roles.

Figure 2.17 – Non-routine roles are on the rise

Job types in the labour force (share of total)[a]



a. Based on a mapping from ABS labour force to Australian and New Zealand Standard Classification of Occupations job classifications. Non-routine, cognitive: Managers, Professionals; Non-routine, manual: Community and Personal Service Workers; Routine, cognitive: Clerical and Administrative Workers, Sales Workers; Routine, manual: Technicians and Trades Workers, Machine Operators and Drivers, Labourers.

Source: ABS (2022d): Table 7. Leal, Lai and Rosewall (2019).

Insight 2.10 – A high skilled workforce is more important in an economy where jobs increasingly involve non-routine tasks, and use of digital technologies and data manipulation.

Skilled overseas workers can support productivity

The Australian border has now reopened to migration after being closed for almost two years, which could help satisfy the current unmet demand in the domestic labour market. However, tightness in the labour market is not unique to Australia. Labour markets in most advanced economies are at, or above, full employment. This suggests that Australia may face greater competition in attracting skilled labour post COVID-19.

Migration has long been a defining characteristic of Australian cultural and economic life. The benefits of migration in a productivity context are numerous.

- Migration complements the education sector to supply skills to the Australian labour market. This allows Australian firms to become more productive, by hiring the best available workers, but also increases competition amongst employees, which can provide incentives for workers to improve their skills.
- Migration can help to provide a diversity of skills and facilitate the diffusion of innovation, particularly where foreign work experience helps Australian firms adopt global best practices, or where foreign workers may be necessary to implement technology that is new to Australia.
- Migration can also play a role in filling skill gaps in occupations with standardised (competency-based) licensing, or in regional areas that rely on either international or interstate migrants.

At the same time, migration can have unintended effects on productivity. Some businesses may face reduced incentives to provide on-the-job training, while others may only seek migrant workers who will

accept lower wages (rather than improve the quality of output). And unexpectedly rapid population growth that is concentrated in particular areas can create congestion in the provision of some services, as well as pressure on infrastructure. Immigration should not be seen as the solution to every case where an employer cannot find an employee at the prevailing wage.

Attracting the best and brightest migrants may be more difficult post COVID-19. Global migration patterns have not returned to those observed prior to the pandemic and it is not guaranteed that Australia will remain as attractive to working migrants as it was previously (CEDA 2015). Recent evidence suggests that enrolment levels for international students in Australian universities (previously a source of considerable low skilled labour in the food services and hospitality sectors) may remain subdued in the near term (DESE 2022).

The number of skilled employees who are working overseas while undertaking tasks online for businesses based in Australia may have increased during COVID-19 in line with the increased uptake of working from home. In the short term, this is an avenue to alleviate some existing labour market pressures, and in the longer term — if its use by employers increases — it could lower the reliance on the formal skilled migration system and have potentially significant implications for the way in which businesses access skilled labour.

Insight 2.11 – Tight labour market conditions in Australia strengthens the need for workers to be allocated to their highest valued use. It also highlights the importance of access to skilled labour from other countries, which can help alleviate demand pressures and enhance productivity by improving the quality and diversity of skills in the labour market.

The challenges of climate change and decarbonising the economy

Climate change and the associated need for decarbonisation of the Australian economy could dampen future productivity growth, particularly if the transition is not appropriately managed.

Climate change itself poses a threat to the Australian economy through various channels, and by some measures this threat may be larger than for other major economies (figure 2.18). These risks are most pronounced for industries that depend directly upon the natural environment as a key input, such as agriculture, tourism and construction. The ways in which these industries adapt to the effects of climate change will influence their potential for productivity growth — a challenge compounded by the continued effects of past carbon emissions.

The need to decarbonise the economy over a relatively short time frame has implications for productivity. On the one hand, it reduces a production cost (carbon emissions) but could also reduce measured productivity growth due to:

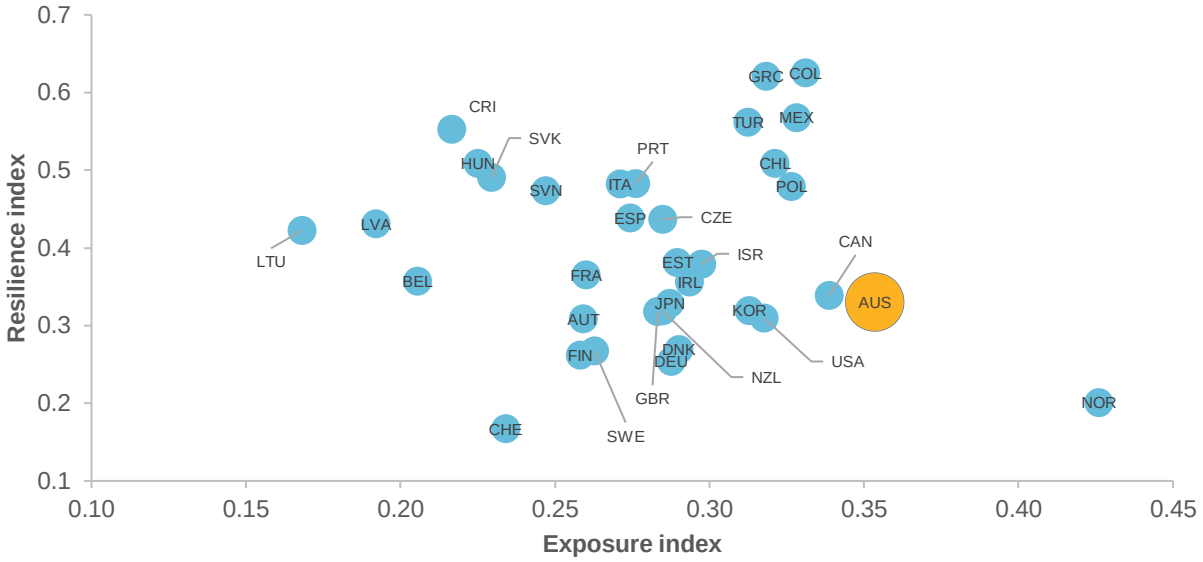
- the costs associated with developing and implementing new technologies to achieve decarbonisation (for example, replacing fossil fuel based energy generation with alternative sources — effectively investment to replace, rather than increase, the economy's existing capital stock)
- the move away from some existing low cost production methods (for example, switching away from using coal to produce steel)
- reducing production of goods that do not have carbon-free production methods (for example, if no carbon-free fuel sources are found for commercial flights).

These costs need to be balanced against the benefits of decarbonising the economy in line with Australia's commitment to net zero emissions by 2050. The policy challenge is to ensure that the process of decarbonisation is undertaken in the most cost effective way.

This task is made more difficult by the considerable uncertainty about the cost of reducing emissions (or failing to reduce emissions enough), the desirable pace of decarbonisation and the lowest cost method of achieving it. Technologies and methods of decarbonisation will need to be developed and selected in an environment where full knowledge of the associated costs and benefits will only be apparent in the future.

Figure 2.18 – Australia's comparative preparedness for a low-carbon transition

Economic exposure and resilience to transitional risk in Australia and OECD countries



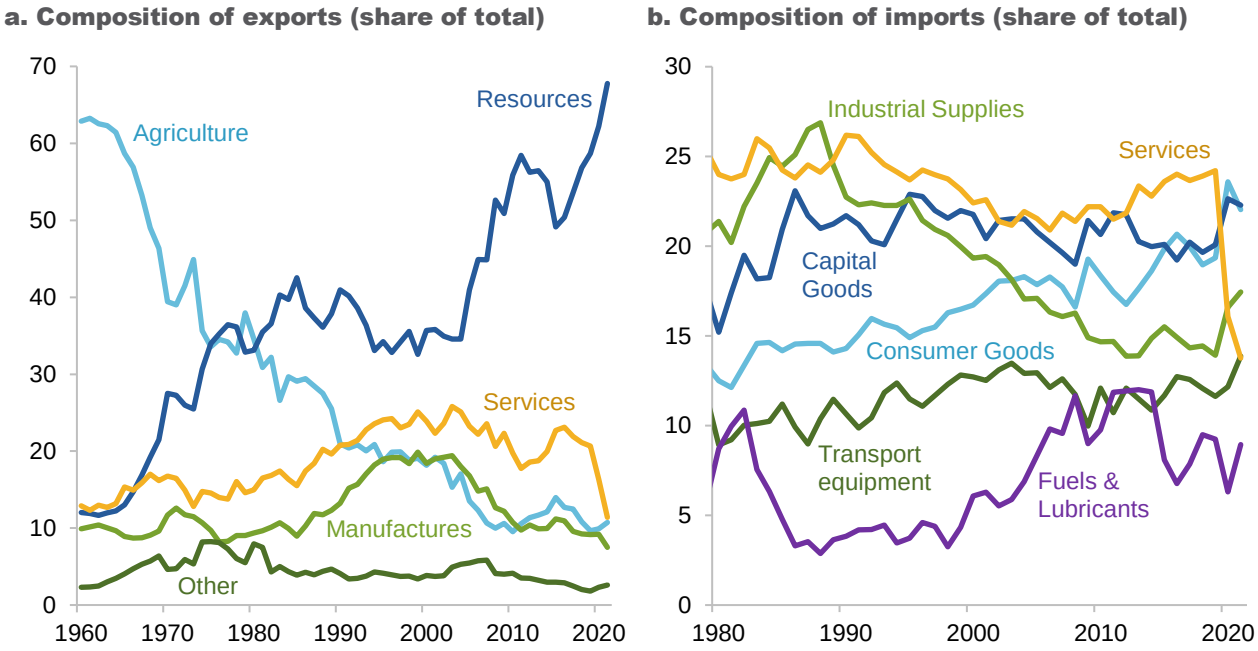
Source: Peszko et al. (2020).

Insight 2.12 — Climate change presents risks to the Australian economy, especially for industries that utilise the environment as a key input. Selecting forms of abatement and mitigation to cost effectively achieve Australia's net zero by 2050 commitment will be challenging given the inherent uncertainty about future technological breakthroughs.

Vulnerability to international headwinds

As a small economy, Australian businesses and consumers are heavily reliant on, and have benefited enormously in the past from, foreign investment and trade. Much of our agricultural production (beef, wool, wheat, forestry and fishery products) and resource and energy outputs (such as iron ore and coal) have been sold on global markets. Many of our consumer goods (from televisions to toasters to smartphones to overseas holidays and clothing and footwear) and production inputs (including those in the form of the latest technologies embodied in capital) have been brought in from overseas (figure 2.19).

Figure 2.19 – Australia is heavily reliant on resource exports, but imports are balanced across a range of consumer and business goods and services



Source: RBA based on ABS (2022b): Table 1, 5, 6 and 10.

Historically, Australia's domestic savings have been insufficient to fund the numerous investment opportunities available, and we have typically run a current account deficit. For this reason, Australia has relied on foreign investment to fund infrastructure and other capital, which has allowed the economy to grow faster than our relatively small pool of domestic savings would otherwise have allowed. Even to the extent Australia is able to meet its overall capital needs[22] using domestic savings, foreign investment is still desirable because it brings new expertise, innovations and novel types of capital to Australian firms. Investment, domestic and foreign, will continue to be critical enablers of growth in Australian living standards into the future.

Recent global developments could add to the productivity growth challenge. The reappraisal of supply chain risks could see firms incur costs to achieve greater certainty. Global tensions have disrupted trade flows, added complexity to foreign investment policy and led to a degree of technological decoupling. All these effects could add costs and impede productivity growth to some extent. They could be compounded by policy responses that further move away from openness and multilateralism. Australia hasn't always been as open as it is today. Following Federation, the newly created Australian Government embraced protectionist policies: erecting tariffs, protecting manufacturing, centralising wage arbitration and adopting the White Australia policy. The latter two had the effect of reducing labour market flexibility and the size of the potential pool of foreign labour that could

[22] Australia has run a current account surplus since September 2019 — the first surplus since 1975 — on the back of an elevated terms of trade.

be accessed, while tariffs had the effect of 'taxing' both domestic consumers and other Australian exporters[23] while also reducing the incentives for productivity improvement in trade-exposed industries.[24]

For a while, any negative effect of 'Fortress Australia' on living standards was not obvious in the aggregate statistics. Strong global demand for Australian resources meant that prosperity could be found via a 'ride on the sheep's back'. But from the 1950s onward, Australia's productivity performance consistently lagged the OECD, and Australian living standards began to fall relative to our peers: in 1950 Australia was ranked 5th in the world in terms of GDP per person, but it was 9th by 1973 and 15th by the late-1980s (Banks 2005). Such movements in relative rank reflect domestic policies — a number of studies have argued that the fast productivity growth experienced by Australia in the 1990s can be linked with the preceding microeconomic reforms (including significant trade liberalisation) (Parham 2004; PC 1999) — as well as a host of factors unrelated to domestic policy (not least of which is catch up from a number of other economies).

'Fortress Australia' was born of a time of increased global instability and deep scepticism of reliance on international trade and capital flows for economic development. It provides an important lesson in the economic (and cultural) costs of turning inwards, which is relevant in a world where external threats — threats to national and cyber security, critical supply chains to name a few — seem to abound. Chief among these costs are that it can create powerful, often mutually reinforcing, avenues for rent seeking that are difficult to unwind once created.[25]

This policy episode has clear parallels with the contemporary international trade environment. Disadvantage in areas affected by trade liberalisation, increasing political tensions between major global powers and a series of supply-side disruptions resulting from the COVID-19 pandemic appear to have cooled enthusiasm for multilateralism. The challenge for Australia moving forward will be to maintain the stance of unilateral free trade that has been demonstrated as the best policy response even when other countries increase their trade barriers (PC 2017a, p. 79).

Insight 2.13 - As an increasingly services-based economy, Australia can benefit from greater global trade and integration in many service industries.

[23] Tariffs have the effect of decreasing demand for foreign imports, which reduces the demand for foreign exchange and appreciates the domestic currency. This makes Australian exports less competitive, effectively placing a 'tax' on them (Dornbusch 1974; Furceri et al. 2018).

[24] Trade openness improves productivity growth through a number of channels: i) increased competition leading to resource allocation away from unproductive firms and towards productive ones; ii) increased market size for exporting firms raises the return on both developing and adopting new innovation; and iii) increased economic integration creates more opportunities for knowledge flows, leading to faster diffusion of innovation (Acemoglu and Linn 2004; Crespi, Criscuolo and Haskel 2008; Melitz and Trefler 2012).

[25] For example, early in the Fortress Australia period, there were instances where an industrial court (one of the key components in centralised wage arbitration) would increase minimum wage requirements for import-competing firms, who would then lobby for governments to increase tariffs to preserve their profitability. However, higher protectionism itself was then often used as an argument to increase minimum wages by industrial courts, leading to a spiral of ever greater protectionism (Wilson 2014).

3. Enabling future productivity growth

Key points

- **Productivity growth relies on the generation and spread of ideas that enable businesses and other product and service providers to deliver more (in quantity, quality or variety), from less. Institutional and policy settings play a key role in providing the frameworks and capabilities that enable and support this process.**
- **Considering the current context and headwinds to productivity growth, this review will focus on the broad cross-sectoral enablers to productivity growth — what we must have in place to enable businesses to adapt efficiently in a rapidly changing environment. The policy areas of focus are:**
  - Innovation and diffusion of new technologies, processes and ideas: including openness to foreign direct investment, ideas and skills; collaborations between businesses and universities and other channels for knowledge transfer; removing unnecessary regulations that discourage the diffusion of new ideas from the global frontier; and aligning incentives for innovation and information sharing in government services.
  - Data, digital technology and cyber security: The economy-wide importance of data and the digital technologies that generate and use data, as general purpose technologies that could boost productivity in many areas of the economy, including services.
  - A productivity-friendly business environment: Limiting impediments to employment and investment, including through openness to trade and foreign investment, which is critical for Australia's relatively small economy; providing policy settings that facilitate efficient emissions reductions and energy security and reliability; sound macroeconomic policy frameworks and competitive and contestable markets
  - A skilled and educated workforce: The importance of education in driving productivity growth through increasing human capital and creating settings conducive to technological breakthroughs and adoption.
- **The inaugural 5-Year Productivity Inquiry released in 2017 — *Shifting the Dial* — provides a basis for productivity-enhancing reforms that the current Inquiry can build on. *Shifting the Dial* detailed a blueprint — much of which is still very relevant today — to achieve productivity growth in several sectors of the economy, including within government itself. It focussed on delivering benefits for Australian consumers.**

As noted in chapter 1, the growth process is not always smooth and is rarely predictable.

No one knows exactly where the next big productivity-enhancing, life-changing technological breakthrough will come from. But experience has shown that a range of underlying factors are important, such as the ability of, and incentives for, individuals and organisations to take risks to pursue growth; the capability of firms and individuals to absorb new ideas and approaches; the stability and fairness of underlying social institutions; and the structure, efficiency and stability of regulations.

In addition, the forces discussed in chapter 2 — the dominance of services; maintaining momentum in use of data and digital technologies; access to skilled labour; the need to decarbonise the economy; and vulnerability to international headwinds — provide some guide as to where the policy response should focus.

3.1 The Commission's approach to the current productivity inquiry

A focus on broad enablers and areas of highest return

The terms of reference for this inquiry give the Commission considerable scope to identify areas to investigate for productivity-enhancing reforms.[26]

The starting point for the inquiry is a consideration of the current economic, social and environmental context from which productivity growth is needed.

The inquiry 'deep dives' into selected areas where other reviews and our own research suggest that recommendations for reform would have the greatest impact. Important as they are for economic growth, some areas and sectors of focus suggested by inquiry participants such as the regulation of a specific industry could be touched upon, but are unlikely to be able to be explored in depth in this inquiry. The likely relevance of some topics as the structure of the economy evolves over the longer term is considered, as is the question of whether there is a role for government in addressing each particular challenge. On other issues, the inquiry refers to detailed work which has been done through other processes (including in the previous 5 year productivity inquiry, *Shifting the Dial)*.

The Commission has assessed that a focus on the following areas for reform is necessary in this inquiry, to supplement existing knowledge of productivity-enhancing reforms: innovation and its diffusion; the use of data and digital technologies, and enabling safeguards; the openness, dynamism and transformation of the business environment; and education and skills.

Each of these areas contribute to productivity growth by reducing costs, increasing product variety and improving product quality, with some examples summarised in figure 3.1.

Innovation and diffusion. A substantial literature links productivity growth to innovation and research. This is the basis for a number of policies and programs to fund public research — and increasingly, its commercialisation — and encourage research and development (R&D) by private firms. These are important elements of innovation policy.

[26] The terms of reference also identifies 7 specific issues of inquiry: 1) Analyse Australia's productivity performance in both the market and non-market sectors, including an assessment of the settings for productive investment in human and physical capital and how they can be improved to lift productivity; 2) Identify forces shaping Australia's productivity challenge as a result of the COVID-19 pandemic and policy response; 3) Consider the opportunities created for improvements in productivity as a result of Australia's COVID-19 experience, especially through changes in Australia's labour markets, delivery of services (including retail, health and education) and digital adoption; 4) Identify priority sectors for reform (including but not limited to data and digital innovation and workforce skills) and benchmark Australian priority sectors against international comparators to quantify the required improvement; 5) Examine the factors that may have affected productivity growth, including domestic and global factors and an assessment of the impact of major policy changes, if relevant; 6) Prioritise and quantify the benefit of potential policy changes to improve Australian economic performance and the wellbeing of Australians by supporting greater productivity growth to set out a roadmap for reform; 7) Revisit key recommendations and themes from the previous five yearly review in light of the above, where relevant.

A key question is whether these settings suit all parts of the modern economy. Innovation occurs in different ways in different sectors — some with a heavy emphasis on private R&D, others based on the commercialisation of research done in universities and public institutions, and still others through an 'eco-system' of small, young firms trying out new ideas. If the pattern of innovation differs substantially in some sectors — the services sector compared with manufacturing, mining or agriculture for example — then it may have implications for how we encourage innovation through traditional innovation policies, university research collaboration or broader policy settings.

But invention is only a small part of the innovation process. Considerable innovation in the economy can appear prosaic: less the big new invention and more the streamlined process or enhanced customer offering. The diffusion and adaptation of established ideas and technologies is likely to be of at least equal importance to productivity, and how most Australian firms innovate in practice. For Australia, the speedy adoption and adaptation of breakthroughs from overseas has always been a key driver of productivity growth. Often this has occurred through foreign direct investment, enabled by skilled migration. Future trade in services could also be a channel.

Hence an important policy question is how well we facilitate and encourage the spread and uptake of proven ideas and technologies. Are there barriers to this process, or a lack of capability among firms that give rise to a role for government policy? How can we better leverage existing channels for knowledge and innovation diffusion to firms?

Data, digital and cyber security. The use of digital technology and data have the potential to improve productivity. This can occur through reduced costs (such as lowering search costs, transportation costs or transaction costs) or boosting quality and choice. Data use can improve efficiency, such as by helping firms to better target customer offers, and can also be an enabler of machine learning, artificial intelligence and other tools to supplement and economise on human decision making. A number of studies have found a positive relationship between technology adoption and GDP growth.

COVID-19 led to an acceleration in technology uptake and data use, including through online commerce, remote working and new approaches to service delivery (chapter 2).

Australia has high levels of technology and data uptake, but lower levels of more advanced uses such as artificial intelligence. Generally, businesses will adopt technology as and where it makes commercial sense. But there are some roles for government in areas including infrastructure, digital skills, data sharing frameworks and potentially regulating high-risk scenarios, such as in respect of cyber security. Public agencies like regulators can encourage digital uptake by businesses, including leading by example through their own adoption of technology and data.

Hence this is a key area of focus for policy — how Government can build on this momentum by ensuring that Australia's digital and data infrastructure and policy frameworks are fit for purpose.

The broader business environment. The adoption and spread of new ideas is facilitated by flexible market settings — so that ideas are tested, labour and capital can shift to new opportunities, and successful firms can grow as their innovations bear fruit.

The flexibility of labour is a key part of this process. The ability of skilled workers to move between jobs matters, as does the ability of firms and workers to agree arrangements that lift firm productivity while protecting minimum standards. A key policy question will be how to maintain and enhance labour market flexibility without undermining minimum standards, including in light of new business models that use platforms to contract workers.

Australia has successfully attracted skilled migrants to help fill workforce needs and skill shortages. However, numbers of international students (and migration broadly) have not recovered to pre-COVID-19

levels. Skilled migration is effectively a finite resource — one which should be allocated efficiently and with maximum transparency.

In light of the increase in government funded and delivered services, a key question arises as to how new innovations can be encouraged and then diffused in a non-market setting. Without some risk appetite and the ability to spread good practice, public services can become productivity laggards — stuck in legacy models of service delivery.

Geopolitical tensions and increased concerns over the security of supply chains are an emerging reality. A policy challenge for Australia is maintaining the benefits of openness — to trade, investment and technology — in this environment. A rigorous and least-cost approach to any government involvement in supply chain resilience will be critical. On the other hand, there are potentially new opportunities in global services trade, particularly via digital technology. This could have far reaching effects to the extent it exposes new parts of the economy to global competition, just as parts of the manufacturing, agriculture and financial sectors were in earlier decades. Australia's regulatory settings — including across different states and territories — could have a bearing on our ability to take advantage of this opportunity.

The path of decarbonisation will be one of the most significant structural changes in Australian economic history. How we handle the twin challenges of efficient, low cost abatement at the same time as fostering and adopting emerging (and rapidly evolving) technologies will have major implications for productivity growth and living standards.

School and tertiary education systems equip Australian workers with foundational and job-specific skills that can contribute to productivity growth. This is often referred to as 'human capital' — a complement to physical and financial capital in creating value.

The educational and skills needs of the economy continue to evolve. A higher proportion of jobs require post school qualifications like a bachelor's degree or Certificate III qualification. Non-routine jobs are increasing while routine jobs shrink as a share of total employment. This reflects a growing demand and premium for those distinctly human skills that are hard to automate — such as judgment, critical thinking, synthesis, or empathy. Considerable automation of tasks *within* jobs is occurring over time, and could be a larger force than the automation of complete jobs.

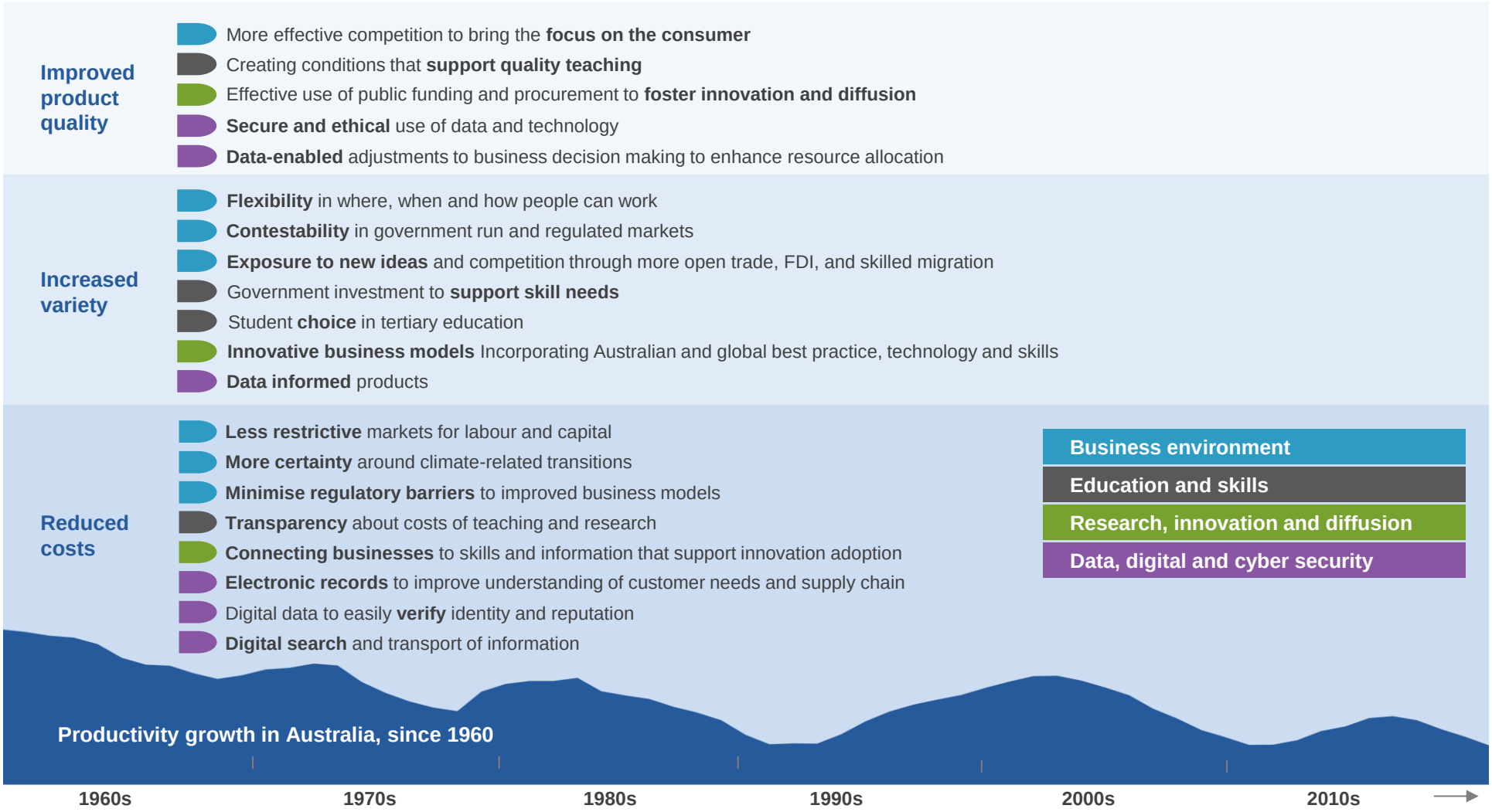
These trends could have implications for the respective roles of school, vocational, university and lifelong education. The rise in educational requirements of the modern economy underscore the importance of lifting the quality of teaching and learning in each part of the system. The economic gains from additional years of schooling across the community (a significant driver of growth in the 20th century) have largely been achieved. A key question for the future is how to lift the productivity of the education sector itself: higher levels of attainment for the time and resources devoted to formal learning.

This could have implications for the allocation of resources.

Quality teaching across all sectors is likely to be an important contributor. Attracting high performing candidates into primary and secondary teaching is an important lever, but a bigger question could be whether school systems are well configured to support existing teachers to deliver their best. A strong focus on quality teaching in universities could also yield significant future productivity gains.

Technology is likely to offer considerable opportunities for augmenting high quality instruction, assisting and guiding assessment and allowing students to undertake tasks previously not thought possible. This would be consistent with the past path of productivity growth in other sectors, with capital and new technology augmenting labour input. (The dividend is more likely to be a higher quality outcome, rather than more output).

Figure 3.1 – Enablers for productivity growth



3.2 The recommendations from *Shifting the Dial* continue to be relevant

The first five yearly productivity review — *Shifting the Dial* — released in 2017 sought to refocus the 'reform conversation', highlighting areas for policy focus including: cities, data policy, the working of the Federation and the growing non-market sector of the economy. Consistent with this report, it highlighted that not all productivity improvements increase measured GDP per hour worked — some improve unmeasured quality and many important ones are in the non-market sector — and the importance of services, particularly the government funded ones.

Shifting the Dial anticipated some of the issues that have become more prominent as a result of COVID-19. They include the use of digital technology, the need for more coordinated health care and ways to strengthen the efficiency and resilience of our cities.

On health care …

Shifting the Dial noted the rigidities of existing healthcare service models: the lack of integration between parts of the system, inadequate use of data, and poor diffusion of best practice. It used the example of the 'waiting room' to symbolise the lack of innovation and patient focus in the system noting that 'waiting times in doctors' offices [are] likely to impose costs on Australians of approximately one billion dollars annually' (PC 2017b, p. 64).

As discussed in chapter 2, COVID-19 prompted the uptake of telehealth to ensure that medical services could continue to be delivered during lockdowns. It remains to be seen whether this represents the beginning of a more enduring move to remote, tech-enabled delivery of healthcare services. *Shifting the Dial* and other subsequent work have demonstrated the way technology — including the sharing of data but also relatively simple communications — can be a catalyst for a more integrated and patient-centred approach to health.

Consistent with the theme of chapter 1 in this report, this can improve the *quality* and responsiveness of the system, but also reduce *costs*, by economising on the valuable time of clinicians and augmenting their labour with technology. But as noted above, the challenge is not just the addition of technology but the reimagining of a service model based on what technology makes possible.

Other work by the Commission highlights the inflexibility of service models, based on established practice and incumbent funding models. The *Mental Health Inquiry*, released in 2020, and the *Innovations in Care for Chronic Health Conditions* study, released in 2021, showed the benefits to patients from service models based even on relatively simple digital channels, data analytics and data linkages. The Australian Government's Primary Health Care 10 Year Plan, parts of the National Health Reform Agreement (signed by all Australian governments), and the recent work of Heads of Treasuries reflect a degree of momentum. But this is a long and painstaking reform process rather than a single 'big bang'.

On cities …

Shifting the Dial noted the importance of urban agglomeration for productivity and innovation. It called for: flexibility through lighter zoning controls and responsive housing supply; mobility through replacement of stamp duty; better infrastructure choices through robust project selection and more cost-reflective pricing.

These issues have become more salient in the wake of COVID-19, which has meant firms and workers now have to think harder about the value of agglomeration benefits (vs. the commute) and how to maximise them. With more economic activity (work, retail, health, education) happening 'anywhere' via digital channels, the direction of land use policy should be towards greater flexibility — effectively, greater

agnosticism about what forms of economic activity occur where, and with less rigid separation of economic activity via strict adherence to traditional 'in or out' approaches to zoning.

A significant infrastructure build is ramping up across States and Territories, bringing price and wage pressures. Delivering this program at acceptable cost and value for taxpayers will be a big challenge. But increasingly, focus will shift to the efficient use of infrastructure, where technology is once again a significant enabler.

In transport for example, governments and businesses are less technologically hostage to some of the relatively crude pricing and cost recovery mechanisms of the past, such as fuel excise, paper tickets or first-generation card technology in public transport. More sophisticated approaches make it possible to get closer to marginal cost pricing (including in close to real time) where that is appropriate and efficient with the added flexibility of remote work as a viable alternative for many workers, at least part of the time. A more sophisticated pricing approach to rationing demand and gauging the willingness to pay for costly transport infrastructure has the potential to be the twenty first century transport transformation.

On education ...

Shifting the Dial discussed the changing skill needs of the modern economy and the continuum from early learning to lifelong education. It called for a better evidence base to inform classroom practice; changes to workforce structure and a greater focus on teaching in universities compared with research.

Experiences during COVID-19 with remote learning has highlighted the potential for use of digital technology in learning environments, as well as some of the challenges that need to be addressed in order for technological and other innovations in education to robustly enhance development of Australia's future workforce and contribute to future productivity growth.

On markets ...

Shifting the Dial noted the importance to productivity of improving resource allocation and the efficiency with which markets operate. It observed that market rules should not be a case of 'set and forget' (with energy market operations used as a particular example of where there is scope for improvement), and that having the right institutional structures, and regulation that is technology neutral (with an eye to the unpredictability of future developments) are important.

The past five years has brought some progress on regulatory reform — the progression of recognition of occupational licensing across state and territory boundaries and the increased focus on regulatory technology. The pressure for reform in energy markets has been given renewed urgency by the broadening acceptance in Australia of the need to decarbonise our economy. And the unprecedented disruptions to markets and business models more generally in the economy throughout COVID-19 have laid bare the opportunities and possibilities for doing things differently.

What's left to do?

Although the past five years have been an eventful period for the Australian economy, the themes from *Shifting the Dial*, and the 28 recommendations from that report are, if anything, increasingly relevant following the significant COVID-19 disruptions of the past 2 years. However, overall, the dial has yet to be shifted by government.

As noted by a number of submissions to this inquiry, although some progress has been made in terms of implementation, many recommendations, including those with potentially *large* economic implications, are yet to be implemented, and none have been fully implemented.

> limited progress has been made in implementing the recommendations from the first of the Productivity Commission's five-year productivity inquiries in 2017 (Shifting the Dial) and … there remains significant opportunity for policy reform to drive productivity gains in these areas (sub 44, p. 2).

Some experiments in integrated health have been occurring, but their implementation is far from system wide (recommendation 2.3 in *Shifting the Dial*). There is minimal evidence of improved educational outcomes for school student coming from reforms over the past five years (recommendation 3.1). Pharmacies are still granted what are effectively monopolies on the sale of drugs, with strong restrictions on the opening of adjacent new pharmacies (recommendations 2.5 and 4.5). Apart from the ACT (where reform predated *Shifting the* Dial), no additional jurisdictions have abolished stamp duty on residential property, although New South Wales will now allow first home buyers purchasing properties below a threshold price to choose to pay an annual property tax instead of stamp duty.

More broadly, *Shifting the Dial* noted the importance of credible governance, and credible governments, as a foundation of reform.

> cooperation is itself a key theme of this Report … a commitment that restores credibility in government leadership on issues where shared responsibilities are common. We were told by countless participants that governments themselves — their structures, relationships, incentives and capabilities — are today the key impediment to (but could be the crucial catalyst for) essential reform.

3.3 What comes next in the inquiry?

The Commission is preparing a series of interim reports that will examine productivity enhancing reforms within the four focus areas outlined above. These reports will be released over the coming months and provide further opportunity for individuals and organisations to have a say in shaping the reforms critical for Australia's future. The Commission wants to ensure that policy reforms can be implemented cost effectively and in ways that enable the benefits of productivity growth to be widespread.

Feedback on the interim reports will be drawn on to develop recommendations for change . The final report for the inquiry will quantify the impacts of reform options where possible, and set out a reform roadmap that helps secure a higher productivity future.

Appendix

A. Productivity and how it is measured

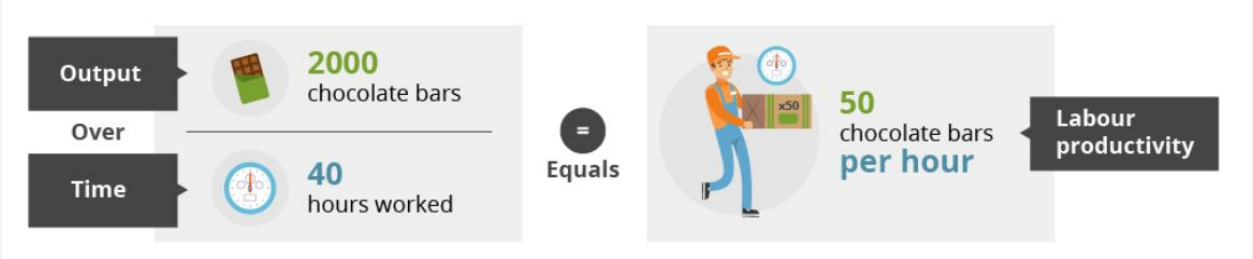
A.1 What is productivity?

Recall the definition of productivity given at the start of section 1.2 in chapter 1:

This raises the question: what should be treated as inputs and what should be treated as outputs? How this question is answered creates different methods of measuring productivity. The most commonly reported measures of productivity are 'labour productivity' (the ratio of output to the number of work hours used in production) and 'multifactor productivity' (the ratio of output to a combination of both hours worked and capital). The difference between the two is the definition of 'inputs'. Output always refers to the production of goods and services minus the value of goods and services purchased from other firms, or 'gross value added'. At the whole economy level, 'output' is gross domestic product (GDP). Box A.1 contains a stylised example of labour productivity.

Box A.1 – Jared and the chocolate factory: a stylised example of labour productivity

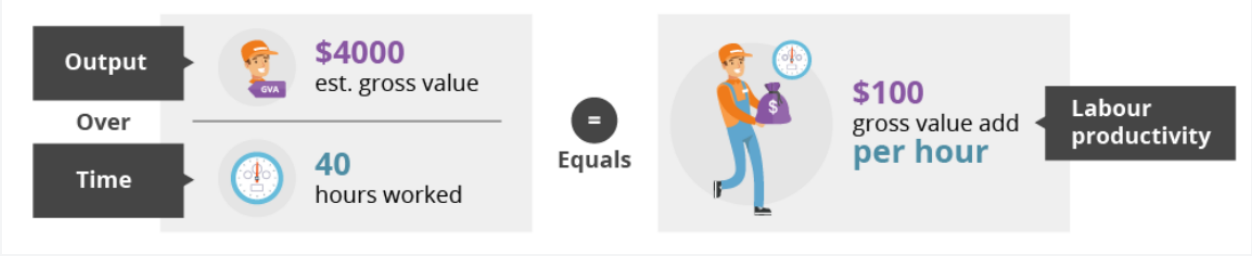
Jared works in a chocolate factory. Jared's boss, Colin, wants to measure the labour productivity of his workforce to make operational improvements at the factory. Colin estimates that during a 40 hour work week, Jared produces 2000 chocolate bars. Colin calculates Jared's labour productivity as:



While this allows Jared's performance to be compared to other employees in the chocolate bar branch, Colin cannot compare Jared to employees in the chocolate biscuit division. To allow for comparison, Colin notes that chocolate bars each sell for $2 and Jared produces 2000 of them, so the total value of

Box A.1 – Jared and the chocolate factory: a stylised example of labour productivity

Jared's production is $4000. Using this instead of just the number of chocolate bars, Colin calculates Jared's labour productivity as:



In this report we are interested in the enablers of productivity growth, which cover a broad range of actions by firms and individuals, as well as policy and institutional settings. For statistical purposes, we often divide productivity growth into two (slightly stylised) categories: capital deepening and multifactor productivity (MFP).

- Capital deepening is the process of investing to increase the stock of buildings, machines and intellectual property relative to labour. Capital deepening accounts for about 45 per cent of labour productivity growth since 1901 (figure A.1).[27]
- Multifactor productivity describes how productively firms combine both capital and labour and accounts for about 55 per cent of labour productivity growth since 1901.

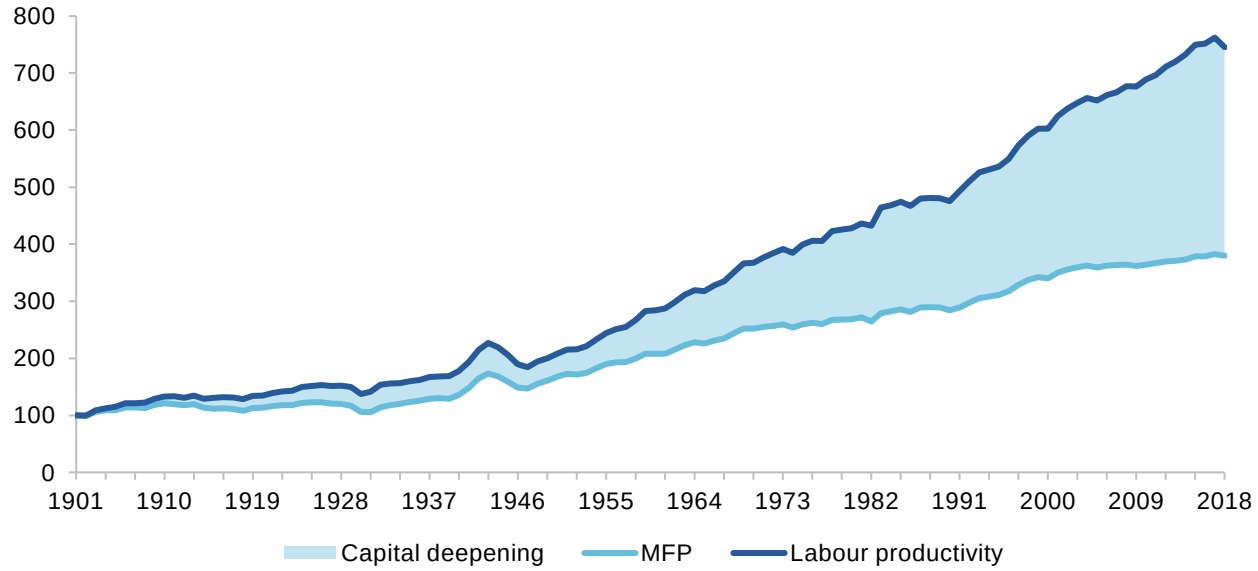
The distinction between these two sources of growth is clearer when considered from the perspective of a company and the business manager. A business manager has a choice in how much 'capital' (machinery, equipment and buildings) to allocate to each employee. For example, the manager of a retail store must decide how many automated checkouts to install for each checkout employee. As the number of automated checkouts increases, each employee is more productive (the number of customers served, and the value of output generated per day, rises) as they no longer have to scan and bag grocery items, but can instead concentrate on troubleshooting when the automated checkouts make mistakes. So, each additional automated checkout machine raises the labour productivity of each existing checkout worker.

This process of increasing the ratio of capital (in this case automatic checkout machines) to labour (checkout staff) is called 'capital deepening'. Eventually, as the number of machines per employee increases beyond a certain point, the additional profit created by each machine will fall. This could be because staff cannot, in a timely manner, supervise an ever increasing number of machines when mistakes occur, giving rise to 'diminishing returns'.

[27] Based on estimates of labour productivity, GDP per capita and MFP in the *Long Term Productivity Database*. Note that this dataset uses capital services that impose a constant (exogenous) rate of return on different kinds of capital, which differs from capital services measures used by modern statistical agencies.

Figure A.1 – Australian labour productivity growth due to capital deepening and MFP[a]

Index (1901=100)



a. Capital deepening is the difference between growth in labour productivity and growth in MFP.

Source: Bergeaud, Cette and Lecat (2017).

If the retail manager rearranged the machines, or perhaps added signals that quickly alerted staff about malfunctioning machines, this would make the staff *and* the machines more productive. This is an example of an MFP improvement. Once this is done, it then becomes profitable to add even more automatic checkout machines per staff member. That is, as the MFP of the store increases, the more profitable capital deepening becomes.

In many ways, the distinction between capital deepening and MFP is stylistic — a simplification of a highly complex real world process. It is but one lens through which to view the path of productivity growth. But it can shed some light on sources of past productivity growth in the Australian economy.

MFP growth can come from a number of sources, including the introduction of new technology in the production process, and redesigns of the systems of production (for example, changing the physical orientation of factories or the structure of supply chains). If there is an increase in MFP, then this means the profitability of *new* capital (machines, equipment etc) increases and so businesses invest more, leading to an increase in the amount of capital per employee in the economy (the capital to labour ratio). In this way, an increase in MFP encourages more capital deepening, making MFP growth a necessary condition for continued labour productivity growth as it pushes out the point of diminishing returns on new capital.

The various measures of productivity are summarised in box A.2.

Box A.2 – How do we measure productivity?

What do all measures have in common?

There are many ways to measure productivity, but they all compare the ratio of output produced by firms to the inputs used. Where they differ is in the particular inputs and outputs that are examined and whether market prices or other methods are used to weight particular products and inputs.

Labour productivity and quality adjusted labour productivity

Labour productivity is a commonly produced, intuitive measure of productivity. It is the ratio of output (usually measured as gross value added derived in respective countries' system of national accounts) to the number of hours worked (labour) to produce this output. A complementary capital productivity measure is more difficult to produce, because capital services data is often harder to collect (and harder to compare across time and across countries). Labour productivity is often used for cross-country and cross-industry comparison, and is more easily available than multifactor productivity measures.

In addition to calculating labour productivity using labour hours, some statistical agencies also calculate quality adjusted labour hours by weighting the growth in labour hours in different occupation-skill combinations by their different wages. This has the effect of giving higher weight to growth in hours worked in occupation-skill combinations that demand higher wages.

Multifactor productivity

Multifactor productivity (MFP) measures the ratio of output to a combination of labour and capital services. Generally, MFP is calculated as a growth rate and the growth in combined inputs is the weighted average of labour hours and capital services growth with the labour and capital shares of income being used as the weights respectively.

Capital services are typically calculated as a weighted average of growth in different capital assets with different asset types in different industries given different weights based on market profits, depreciation rates and several other factors. Because these weights are different for different countries in different years, it makes levels comparisons of MFP across countries (or industries) difficult.

KLEMS productivity

When calculating labour productivity or multifactor productivity, the measure of 'output' is typically the value of goods and services produced by a firm ('gross output') minus the goods and services they bought from other firms ('intermediate inputs'), which is referred to as 'gross value added'. An alternative is to use gross output as the measure of output and add intermediate inputs as an additional input along with capital and labour. KLEMS productivity measures take this a step further and split out the intermediate inputs into services, materials and energy. The advantage of this approach is that it gives insight into how a particular industry uses the energy, materials and services of other firms to produce its output. A major disadvantage is that KLEMS analysis only makes sense at an industry or firm level because at the whole economy level there are no 'intermediate' inputs only capital and labour.

Non-index methods

The above measures of productivity are referred to as 'index methods' and are the approaches used by national accounts agencies. While these methods are well suited to the measurement of aggregate progress, they have the shortcoming that they require market prices to weight different goods and services. Certain 'non-market' services such as public services, health care and education are often

Box A.2 – How do we measure productivity?

provided at free or discounted cost due to extensive government subsidies and so using national accounts methods is not appropriate.

For these services, economists often use alternative methods to measure productivity such as Data Envelopment Analysis, Stochastic Frontier Analysis and several others. These methods compare productivity of firms by focusing on a narrowly defined industry and rather than using prices and cost shares to weight different outputs and inputs, they make assumptions about the way different inputs and outputs can be combined by firms (as well as about how random noise and productivity improvements can be separately identified). For example, an economist might create a stochastic frontier model by assuming firms have constant returns to scale and use a Cobb-Douglas production function with the relative efficiency of firms being half-normally distributed. These assumptions may be strong but they remove the need to have market prices to compare firms within narrowly defined industries.

Source: Sickles and Zelenyuk (2019).

A.2 The elusive quest for the causes of growth

The last 70 years have seen the development of numerous 'growth' models that attempt to explain the underlying drivers of economic growth (and hence, productivity) at the aggregate level.

The task has several challenges. First, it is an attempt to explain what (many) economists regard as an 'unexplained residual' — that is, the observed tendency for output to grow by more than can be accounted for by the growth in capital and labour inputs. Second, it is an attempt to sum up in a single variable (or very few) the underlying cause or driver of growth, whereas in reality growth comes from multiple, disparate, uneven processes.

Candidate variables have included capital accumulation, an externally determined rate of technological advance, improvements in human capital, and the generation and sharing of ideas that add cumulatively to the stock of knowledge across the economy.

While such models have been used to explain some of the massive divergence in economic growth experienced across countries and time, none of them completely succeeds in predicting or, even ex-post explaining, the rates of growth of most countries. And in most cases they are of limited use as a guide for comparing specific policies. In particular, they are not a substitute for rigorous project evaluation and cost benefit analysis of government programs. But the aspects of economic growth they do manage to explain and — often more importantly — the aspects they *do not* manage to explain reveal much about both the nature of economic growth itself and the strengths and limits of formal models in identifying the underlying drivers of the growth process.

Some key takeaways from these models are:

- Once a country achieves high income status, all further economic growth will tend to be driven by a 'residual' term — multifactor productivity — which includes the effects of innovation (technological progress) and better resource allocation (Aghion and Howitt 1998, p. 16, 2009, p. 39). However, explaining the *source* of innovation was the main gap in older economic models.

- The MFP residual is partially due to the steady acquisition of skills and experience by the workforce. Known as 'human capital', this also captures the direct effect of formal education (Lucas 1993; Mankiw, Romer and Weil 1992).
- Some early models emphasized the role of a common stock of scientific knowledge, produced through public funding of research, as underpinning, or enabling, private innovation (Arrow 1962a; Nelson 1959).
- Other models of growth emphasise the role of ideas more broadly in explaining residual MFP growth. Because one's use of an idea does not prevent others from also using it (ideas are 'non-rivalrous') the stock of ideas can grow exponentially (Arrow 1962b; Romer 1986). Some of these ideas are generated via a process of 'learning by doing' and are often embedded in new capital (Arrow 1962b), but markets may undervalue the provision of this learning and so less is achieved than socially desirable.
- More recent growth models emphasise the process by which knowledge is shared across an economy, highlighting that the transfer of knowledge is not an automatic process (Lucas 1993).
- Another class of models emphasise 'creative destruction', an ongoing process characterised by new innovations leading to the replacement of older products and production techniques (Aghion and Howitt 1992). These models implicitly embrace the unevenness and unpredictability of productivity growth, highlighted in chapter 1 as a central driver of MFP growth, and as an explanatory factor for differences in income levels between economies. Summarised below are various explanations for how creative destruction occurs and its nature:
  - Markets provide price signals about the value of innovation and the design of market structures can moderate the strength of this signal (Aghion and Howitt 1998, pp. 205–225)
  - Education plays an indirect role in lowering the cost of undertaking or engaging with innovation (better educated workers can more easily adopt and improve on new scientific concepts in an applied setting) (Aghion and Howitt 1998, pp. 327–356)
  - The closer an economy comes to the technological 'frontier', innovation efforts should focus less on 'catching up' and more on novel breakthroughs to drive continued growth (Aghion and Howitt 1998, pp. 67–69).
- Some newer models also emphasise the role of general purpose technologies (GPTs, such as steam power or electricity) to drive rapid, prolonged periods of productivity growth (Bresnahan 2010; Bresnahan and Trajtenberg 1995; Bryjolfsson, Rock and Syverson 2018).
  - The information and communications technology (ICT) revolution was the most recent example of a GPT. Some suggest that newer digital technologies (such as artificial intelligence) will be the next GPT (Brynjolfsson, Rock and Syverson 2017).
- Institutional settings that underpin markets are an important ingredient that influence the pace of economic and productivity growth by encouraging and rewarding risk-taking and providing a test bed for ideas via price signals and the free flow of resources across the economy (North, Wallia and Weingast 2006).

A.3 Changing prices make productivity measurement challenging

Measurement of real productivity (and GDP) growth is complicated by changing prices. More straightforward is the measurement of nominal productivity growth, which only requires adding up the total dollar value of goods and services produced in the economy and dividing by some measure of inputs (usually number of hours worked).

Constantly changing prices creates problems for productivity measurement because prices are used to weight the importance, or value, given to a particular good or service. If a product has a high price, then it receives a high weight under the assumption that this product is valued highly by consumers. But what if a product has a high price in one year and a low one in the next? Which set of prices should be used? The first or the second year's prices?

A simple solution is to use the prices from the first year to weight goods produced in the first year and prices from the second year to weight goods produced in the second year. But this approach has two issues. First, it ignores 'inflation', the general increase in the price level of goods and services. To see why this is problem, imagine all goods and services uniformly increased in price by 2 per cent between the first and second year. If the prices for the first year are used to weight goods in the first year and prices in the second for products in the second year, then this will lead to productivity measures also increasing by 2 per cent even if actual production remained unchanged. This is because all of the prices will increase by 2 per cent even if the quantity does not. The second issue is that this approach does not deal with the issue of products that are lacking prices either in the first period (because the product was invented in the second period) or in the second period (because the product became obsolete in the second period after being replaced by a new product).

The various measurement challenges for productivity created by changing prices can be grouped into a few distinct types:

- *Substitution bias* — when the price of a good changes, should we use the old price or the new price? As discussed below, the answer turns out to be somewhere in the middle.
- *Outlet bias* — the emergence of discount outlets create issues as to which price (the common retail price or the discount price) should be used to weight a particular good.
- *Quality and new product bias* — new products or products whose quality has improved have the challenge of not having past prices. Likewise, products that are no longer sold had prices in the past but no longer have them.

Each of these challenges and their consequences (and potential solutions) for productivity measurement will be discussed below.

Substitution and outlet bias

Substitution bias is the potential to over or underestimate inflation (and hence productivity) because of changing relative prices. To understand substitution bias, consider a simple example involving apples and oranges: both apples and oranges were $2 last year but now apples have risen in price (perhaps because of a flood) to $4 while oranges are still $2. If we use the first year's prices in both years, this will tend to under weight apple production in the second period and if we use the second year's prices, this will tend to over weight apple production in the first year. In either case, productivity and inflation will be mismeasured.

A good way to solve this issue is to take the geometric average of the two prices.[28] Such a measure of prices is called 'superlative', meaning it is symmetrical between prices of the two periods (Hausman 2003, pp. 33–35). Another approach to mitigate substitution bias is to have more frequent collection of data on prices and quantities.

Outlet bias refers to the potential bias caused by the existence of discount outlets that offer almost identical products at lower prices. Unlike substitution bias, this issue cannot be resolved using a different formula to

[28] The approach of using the first year's prices as weights is called a 'Laspeyres' index while using the second year's prices is called a 'Paasche' index while using the geometric average of the two is called a 'Fisher' index.

calculate the weights given to particular goods. Instead, more frequent and detailed collection of price and quantity data for both outlet and non-outlet stores is necessary (Hausman 2003, pp. 32–33).

Quality improvements and new products

The consumer benefits of both quality improvements and new products were discussed previously (chapter 1). The reason these two kinds of improvement are often underestimated in productivity statistics is that both require statistical agencies to know the size of the consumer welfare gain (or 'consumer surplus) due to either the quality improvement or the introduction of a new product/variety. However, these welfare gains cannot be inferred from the changes in prices alone, information is needed about how much consumers would have been willing to pay for either the quality improvement or the new product (which is typically *more than* the current market price) (Hausman 2003, pp. 25–32).

Box A.3 gives an example of the issues created by the introduction of new products.

Box A.3 – Why do new products present problems to GDP measurement?

Quality improvements and the introduction of new products present no problems to the measurement of *nominal* output and productivity but can distort measures of *real* (inflation adjusted) output. In order to understand how, consider how chain-weighted GDP growth (the most common method) of GDP is calculated:

$$real\ GDP\ growth\ = \frac{\sum p_j^0 q_j^1}{\sum p_j^0 q_j^0} * 100 - 100$$

Where p are prices of a product, q are the quantities of products, j is the subscript for a particular product and superscript 0 and 1 refer to periods 0 (yesterday) and 1 (today).

In order to calculate the growth in production between two periods of time, the price of all j products needs to be known for the first period. But for goods that did not exist in the previous period either because they are new products that were introduced in the current period or because their quality changed enough that the prices at their previous levels of quality are not appropriate, this creates the problem of what price to apply.

A case where a whole new product is introduced is shown in the table below. Here only apples and widgets were ever produced, with widgets being invented in the second period and not existing in the first period. This means we do not have a market price for widgets for period zero and it is unclear how to calculate real GDP. Improvements in quality which make it so the previous price would not accurately reflect the true price of an improved product had it been sold in period 0 create a similar issue.

Example of introduction of new products

	Widgets		Apples		Nominal GDP
	Price ($)	Quantity	Price ($)	Quantity	
Period 0	?	0	1	10	10
Period 1	2	2	1	5	9
Growth	-	-	-	-	-10%

Looking at nominal GDP growth, it would look like GDP *fell* but how do we know if this is also true of real GDP? One approach, is to determine what the price of widgets would need to have been in period 0 in

Box A.3 – Why do new products present problems to GDP measurement?

order for the quantity consumed to be zero. Under this approach, say we determined that based on observed demand this price would have to be $10 per widget. In this case, we can calculate real GDP as:

$$real\ GDP\ growth\ =\ (10*2+1*5)/(10*0+1*10)*100-100\ =\ 150\%$$

So once the price of the new good is properly accounted for, real GDP actually increased substantially due to the introduction of the new product.

What is the net effect of these price-related measurement challenges on wages growth?

Beginning with the Boskin Commission, a range of papers and public inquiries have examined the effect of various measurement issues on estimates of consumer prices (table A.2). With the exception of substitution bias, most of these issues in the measurement of consumer prices pass onto issues in the measurement of productivity (box A.4); however, all of the studies considered here are for estimates in the United States (US) economy. It is unlikely that Australian estimates differ significantly for consumer prices but they may with respect to productivity (consumer product sales tend to be more similar across advanced economies than production patterns due to international trade of consumer goods). The only Australian estimate of consumer price index bias that can be directly compared to the United States estimates are those of 'upper level' substitution bias. According to the ABS, this was about 0.22 percentage points annually between 1995-96 and 2015-16, which is broadly similar to the range of 0.15-0.3 percentage points estimated for the US (ABS 2017; Moulton 2018, p. 31).[29]

Assuming estimates of the bias in the consumer price index for the US due to quality improvements and the introduction of new products are applicable to Australia (say at the lower end of the range, about 0.37 percentage points per year), then this implies that Australian wage growth over the past twenty years (June 2001 to June 2021) was about double its measured amount — measured real wages (the wage price index deflated by the consumer price index) rose about 20 per cent, while mismeasured quality means real wages may have grown by about 38 per cent.[30]

Assuming that all the sources of bias listed in table A.2 are applicable to the Australian consumer price index over the past twenty years (June 2001 to June 2021), then real wage growth may have been about 52 per cent over this period, or about one and a half times as much as the published estimates.

These kinds of direct calculation cannot be performed for productivity due to differences in the way that the GDP deflator and consumer price index are calculated. Nonetheless, it is likely that if these estimates of the mismeasurement of consumer price index inflation due to quality improvement/new products are accurate, then productivity is likely underestimated by a similar margin to real wage growth.

[29] 'Upper level' substitution bias refers to substitution bias between broad classes of products, say apples and oranges. While 'lower level' substitution bias refers to substitution bias between more granular classes of products say between different types of apple.

[30] Calculations using ABS (2022a, 2022e).

Table A.2 – Estimates of the degree of overestimation of the consumer price index due to quality mismeasurement and other sources[a,b]

Bias in the CPI due to quality/new products, outlet bias, substitution bias and total bias (percentage points)

Paper	Quality and new products	Outlet bias	Substitution bias	Total CPI bias
	Percentage points	Percentage points	Percentage points	Percentage points
Boskin Commission (1996)	0.6	0.1	0.45	1.1
Lebow and Rudd (2003)	0.37	0.05	0.35	0.85
Gordon (2006)	0.4	0.1	0.4	1.0
Moulton (2018)	0.37	0.08	0.3	0.87
Total range	**0.37-0.6**	**0.05-0.1**	**0.3-0.45**	**0.85-1.1**

a. Substitution bias adds the estimated effects of both 'upper' and 'lower' level substitution bias.

Source: Boskin Commission (Boskin Commission 1996); Gordon (2006); Lebow and Rudd (2003); Moulon (2018).

Box A.4 – CPI vs the GDP deflator: why mismeasured consumer prices do not always lead to mismeasured productivity

Why is there more than one measure of aggregate price changes?

Above it was discussed why estimates of productivity growth and economic growth more broadly need to be adjusted for changes in prices. Loosely speaking, the changes in prices of goods and services over time can be aggregated into a single measure that tries to capture the average change in prices across the economy, which is referred to as a measure of 'inflation' (price growth).

There are two main kinds of 'inflation' that are of most interest: changes in the prices of goods produced in Australia and changes in the prices of goods most commonly consumed by Australians. Generally, the former is measured using the 'implicit GDP deflator' while the latter is measured using the 'consumer price index' (CPI).

How does this affect productivity growth?

The GDP deflator is used to convert nominal (not adjusted for price changes) measures of productivity into 'real' (price change adjusted) measures of productivity while the latter is used to (among many other things) convert nominal measure of wages into real measures of wages. So while the flaws in the measure of CPI discussed in this section have a one-to-one effect on the measurement of consumer prices they do not always affect measured productivity. There are two reasons for this. Firstly, the GDP deflator has a different basket of goods to the CPI; the GDP deflator contains all the goods and services produced in the Australian economy while the CPI has only the prices of the most commonly consumer goods and services. Secondly, the methods use different formulas to assign weights to different goods and services and update those weights at different intervals.

Box A.4 – CPI vs the GDP deflator: why mismeasured consumer prices do not always lead to mismeasured productivity

The overall effect of these differences on the mismeasurement of productivity compared to the measurement of consumer prices is difficult to determine and no systematic attempts have been made to estimate this difference.

Source: ABS (2015, 2019a).

A.4 The impact of measurement error

Productivity growth not coinciding with increased individual wellbeing can result from flaws in the way productivity is measured. These measurement issues include:

- Non-market production — home cooked meals, looking after one's own children, cleaning one's house and undertaking own repairs of property all produce goods and services valued by individuals but they are not recorded in GDP or productivity statistics. This can become an issue where government policy reduces non-market production and increases market production but with a potentially ambiguous effect on wellbeing.
- Marginal verses average — productivity growth cannot always distinguish between the marginal and the average. For example, if a barrier to labour force participation is reduced and the result is that a previously marginalised group of people join the labour force this might reduce average measured productivity if the productivity of this new group of workers is lower than the economy average. However, if this group of people had previously wished to work but were prevented from doing so due to discrimination, then this likely enhances welfare and the economy itself while reducing measured productivity.
- Stocks verses flows — productivity and GDP measure the flow of new goods and services being produced but they do not account for the destruction of existing assets. So for example, in some circumstances, a natural disaster, or wars, can (assuming it does not severely damage the productive capital stock) actually lead to an increase in measured GDP and productivity growth but are clearly hugely destructive to individual and economic wellbeing.
- Utilisation of inputs — while capital stocks can be measured with a reasonable degree of accuracy, measuring the degree to which this stock is being productively utilised is very difficult. As a result, statistical agencies typically assume the capital stock is being fully utilised, which tends to result in productivity being underestimated during recessions (when capital utilisation is falling) and overestimated in economic recoveries (when utilisation is rising). A similar issue arises in measuring mining productivity where measured capital services increase steadily as a mine is being built rather than when the mine is made operational, leading to underestimation of productivity in periods of heavy mining investment and overestimation in subsequent periods of heavy extraction.
- Sensitivity to environmental factors — agricultural, mining and transport productivity are all affected by the state of the natural environment. For example, whether there is heavy rainfall or drought in a particular year will have a strong effect on agricultural productivity. Likewise, the productivity of mining can depend on how 'marginal' (difficult to extract) particular deposits are.
- Quality changes and new goods — the bias created by new goods and quality improvements to productivity measurement were discussed in chapter 1.

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