South Australian Productivity Commission

Research discussion paper no. 5

South Australia's Productivity Challenge

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Government of South Australia

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1. Introduction

SAPC Research Discussion Paper no. 4 set out the conceptual framework that the South Australian Productivity Commission (the Commission) uses to examine and analyse the factors that drive productivity growth in South Australia.

This is the second paper in a series of three papers that lays the groundwork for the Commission's approach and work program on productivity in South Australia. It analyses South Australia's productivity performance within the context of the conceptual framework and highlights the State's productivity challenge.

This paper is organised as follows. Section 2 examines the performance of South Australia's living standards. Section 3 analyses the performance of labour productivity in South Australia, and its drivers. Section 4 looks at the performance of labour utilisation in South Australia. Section 5 concludes the paper.[1]

The third paper will discuss the distribution of productivity gains.

[1] We would like to thank Paul Bryder, a former staff member at the OSAPC, for assisting with assembling relevant data to prepare the various charts for this paper.

2. South Australia's living standards

Inflation-adjusted Gross State Product (GSP) per person is a commonly used indicator of the material living standards in Australian states. This metric reflects the total value of all final goods and services produced within the state during a specified period, compared to its total population.[2,3]

Material living standards is a key determinant of the quality of life in South Australia. The other elements of the quality of life include access to, and quality of, health care, education, infrastructure services, social services, and amenities, as well as public safety. When South Australia has a higher standard of living, it has a greater ability to provide these other determinants of quality of life to its citizens.

South Australia's real GSP per person in 2022-23 was $73,145, which was well below the national average of $91,439. This gap widened by almost two-fold compared to the disparity in 1990-91 (see Figure 2.1). This was largely a result of the state's dismal average GSP per capita growth rate in the 2010s at 0.1 per cent, well below the national average growth rate of 0.8 per cent over this period, which was also low in historical terms (see Figure 2.2).

The focus in this paper is long run trends in growth. However, as can be seen in Figure 2.2 the past three years coming out of the Covid-19 pandemic have seen GSP growth above both the national average and the recent medium-term trends. Our assessment of the underlying data leads us to the conclusion that this strong growth is largely a result of favourable state and national demand conditions (particularly excellent years for the state's agricultural sector) with only limited evidence for structural improvement in the state's relative competitiveness. As such work remains to be done to address the barriers to securing better living standards for South Australians. Box 1 explores the evidence for the causes of recent growth in more detail.

Population growth in this decade was like that of the previous decade (see Figure 2.3) and so the weak performance in per capita GSP was due to weak growth in GSP.

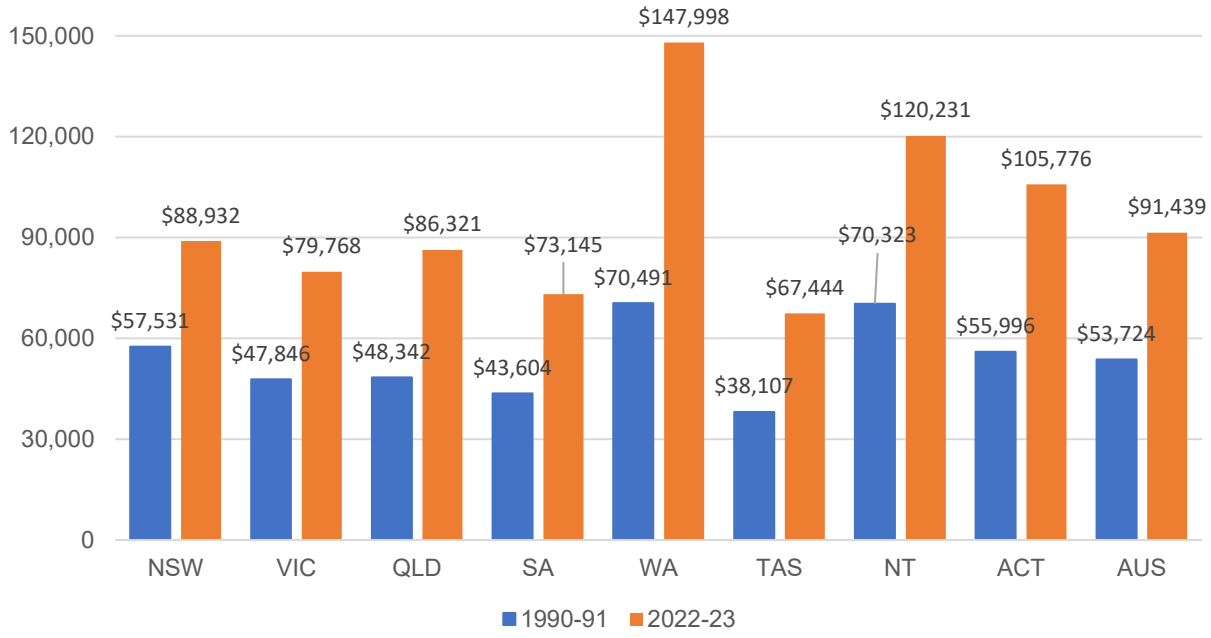
Declining growth of South Australia's living standards is a major concern because it reduces:

- people's ability to purchase goods and services to meet their needs;
- the government's ability to provide public services, fight climate change, and invest in decarbonisation industries;
- business and employment opportunities,
- the scope for increases in real wages,
- the capacity of South Australians to make choices and scope to improve their quality of life, and
- the government's ability to pay off public debt.

[2] More specifically, GSP = Gross Value Added (value of output less value of intermediate goods used) plus Taxes less Subsidies.

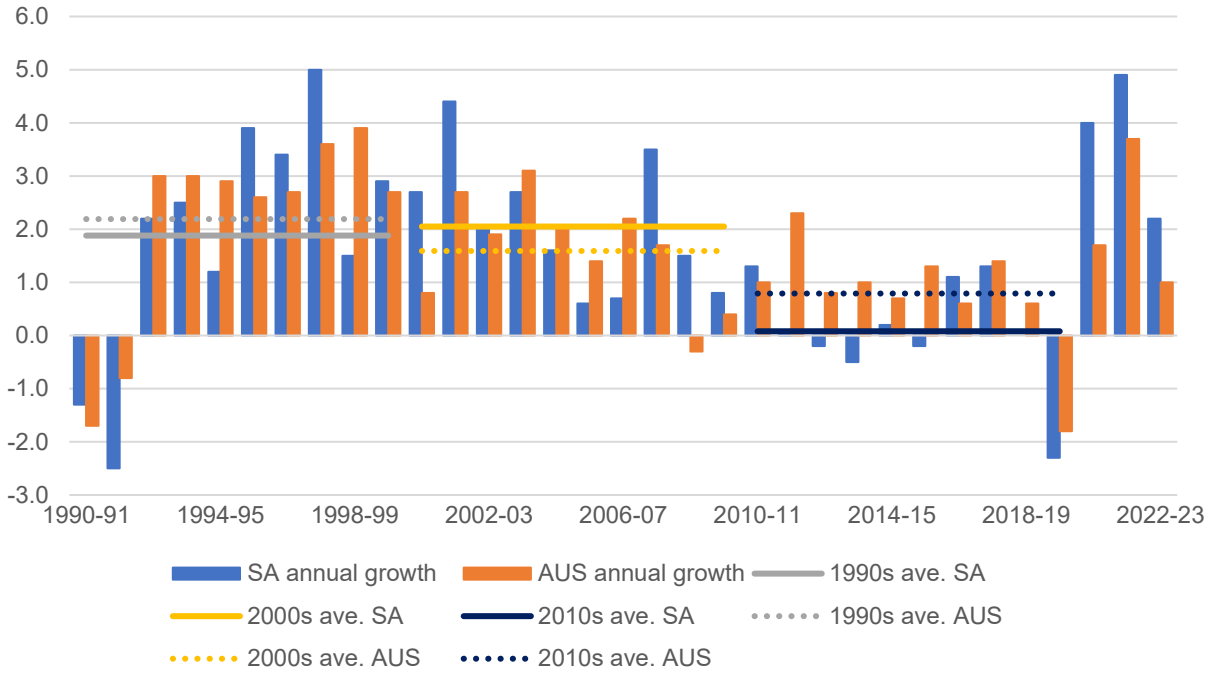
[3] The four often-cited shortcomings of the GSP per capita measure of standard of living are that it does not take into account: (i) unpaid work; (ii) inequality or the distribution of wealth; (iii) non-economic factors (e.g., clean air and water) that also affect people's standard of living; and (iv) the quality improvement in goods and services, OECD (2013), National Accounts at a Glance 2013, OECD Publishing, Paris.

Figure 2.1: Real GSP per capita by jurisdiction, 1990-91 and 2022-23 (2022-23 $)



Source: Australian Bureau of Statistics (2023), 'Australian National Accounts: State Accounts'.
Note: AUS = Australia.

Figure 2.2: Growth in per capita GDP and GSP, South Australia and Australia, annual change and decadal averages, per cent



Source: Australian Bureau of Statistics (2023), Australian National Accounts: State Accounts.

Box 1: What has been driving SA's strong recent economic growth?

Since the end of the initial impact of Covid-19, South Australia has experienced strong growth in employment, economic output, and productivity. Over the three years to June 2023 GSP has increased by 15 per cent compared to national growth of 10 per cent. An important question is whether this means that South Australia's productivity problem is effectively resolved? Or does the recent strength arise from strong demand conditions as was the case during the strong GSP growth South Australia experienced in the three years from 1995-96?

Much of the recent relative strength in the South Australian economy appears to the result of favourable economic conditions, particularly from the significant boost to agriculture, forestry, and fishing after two higher than average growing seasons, together with strong growth in healthcare and social assistance due to the growth of the NDIS.

Neither of these are indicative of an improvement in long-term growth prospects.

However, there was also solid growth in economic output and employment for 'professional, scientific, and technical services' and 'finance and insurance services' which is a potential indication of an improvement in the state's competitiveness.

The loss of young people through net interstate migration has reduced significantly since the mid-2010s, and there has been an increase in the average qualification level of the South Australian workforce, which may have contributed to the growth of these higher skill services sectors. We discuss the role of skilled labour in competitiveness in more detail below.

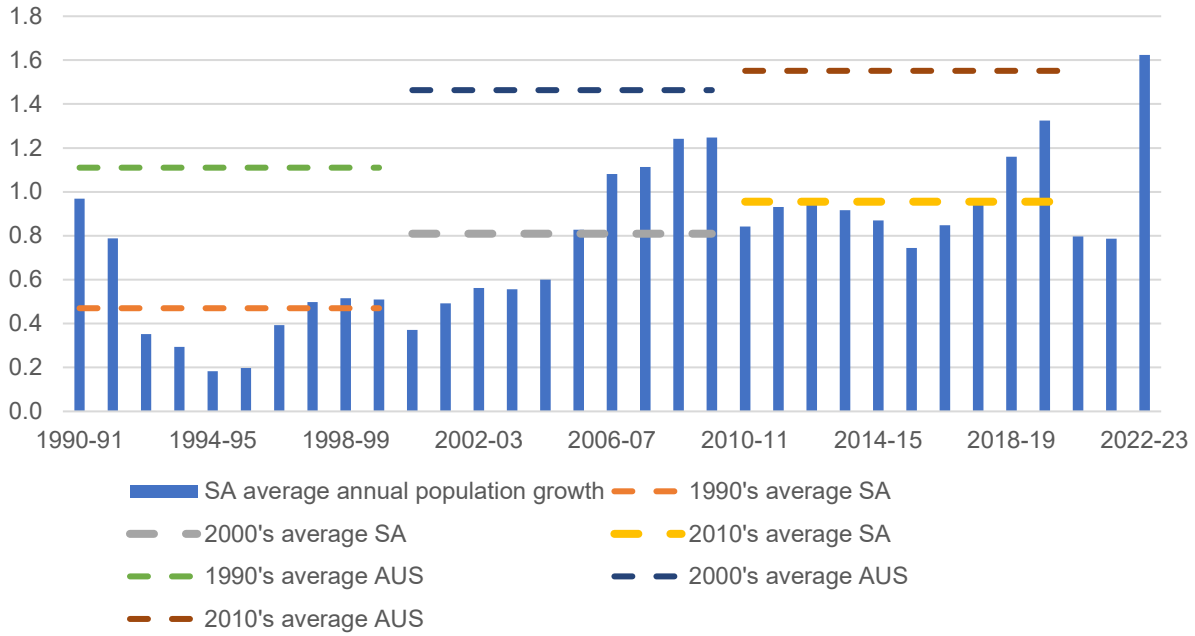
Other indicators suggest any increase in competitiveness may be relatively narrow.

Goods exports have grown strongly; however, this has been commodity exports, particularly agricultural exports. More sophisticated manufacturing exports have fallen slightly in nominal terms (and more significantly in real terms) since Covid.

Innovation data is even more concerning. Business research and development (R&D) in South Australia has fallen as a share of GSP, and this fall seems to be broad based. South Australian business R&D spending in professional, scientific, and technical services (which accounts for one third of national business R&D spending) was only 3.4 per cent of the national R&D total (less than half our population share), and business R&D in the manufacturing sector in South Australia only accounts for 2.5 per cent of the national total.

Our conclusion is that the expected economic growth rate is higher than it was in the 2010s because of the significant fall in net interstate migration of young people. But we would not expect the state's economy to grow at the same rate as the national economy over the medium- to long-term. For that to occur other barriers to productivity growth in the state, which are discussed in this paper, would need to be addressed.

Figure 2.3: Population growth South Australia, annual and decadal averages (SA and Australia), per cent



Source: Australian Bureau of Statistics, (December 2023) National, State and Territory Population.
Note: statistics in this release are impacted by the COVID-19 pandemic and the resulting Australian Government closure of the international border from 20 March 2020.

2.1 Drivers of living standards

To understand why the long-run growth rate of South Australia's living standards has declined and how it can be raised, we need to investigate the main factors that influence GSP per capita growth. As discussed in Research discussion paper no. 4, South Australia's standard of living depends on two factors (see Figure 2.4):

i. ***labour productivity***, i.e., the value of what the South Australian economy produces per hour worked – *how effectively we work*; and

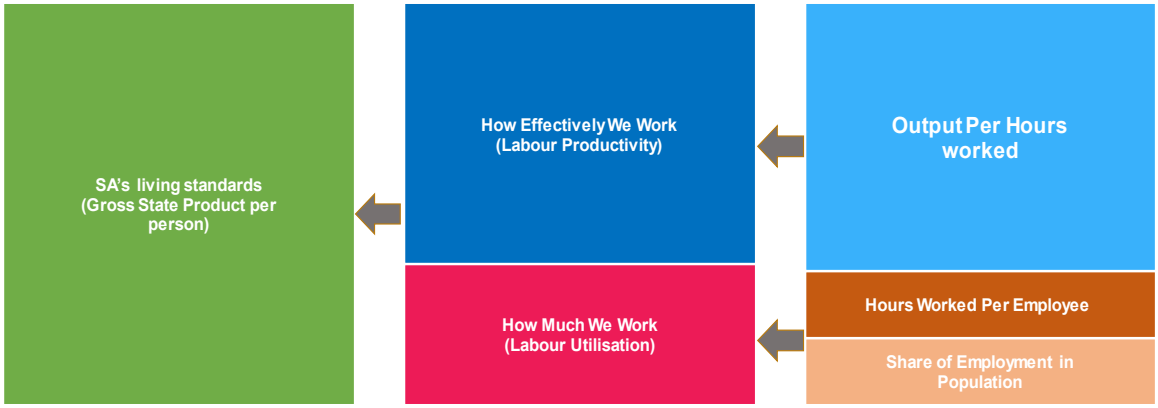
ii. ***labour utilisation***, i.e., the average number of hours worked per person in the population in the South Australian economy – *how much we work*.[4,5]

In other words, the growth rate of South Australia's living standards depends on the growth rates of labour productivity and of labour utilisation. Labour productivity is the only component that drives increases in South Australia's standard of living in the long run because there is an upper limit on increases in labour utilisation. That is, there is a limit on the number of hours that a worker can work in a day, and on the share of workers in the population.

[4] *GSP per person = Labour productivity * labour utilisation; where* $GSP\ per\ person = \frac{GSP}{Population}$; $Labour\ productivity = \frac{GSP}{hours\ worked}$; *and* $Labour\ utilisation = \frac{Hours\ worked}{Workers} * \frac{Workers}{Population}$. Australian Treasury (2007) decomposed real GDP growth into three drivers: population, (labour force) participation and (labour) productivity – known as the "3 Ps". That is, $GDP = population * [1 - unemployment\ rate] * labour\ participation\ rate * averare\ hours\ worked * labour\ productivity$.

[5] Incomes can still rise if the South Australian economy's terms of trade improved, that is, the prices that we receive for goods and services that we export compared those that we import. It is important that resources are shifted to parts of the income where opportunities created by changes in the terms of trade can be captured (Productivity Commission (2013)).

Figure: 2.4: Drivers of South Australia's living standards

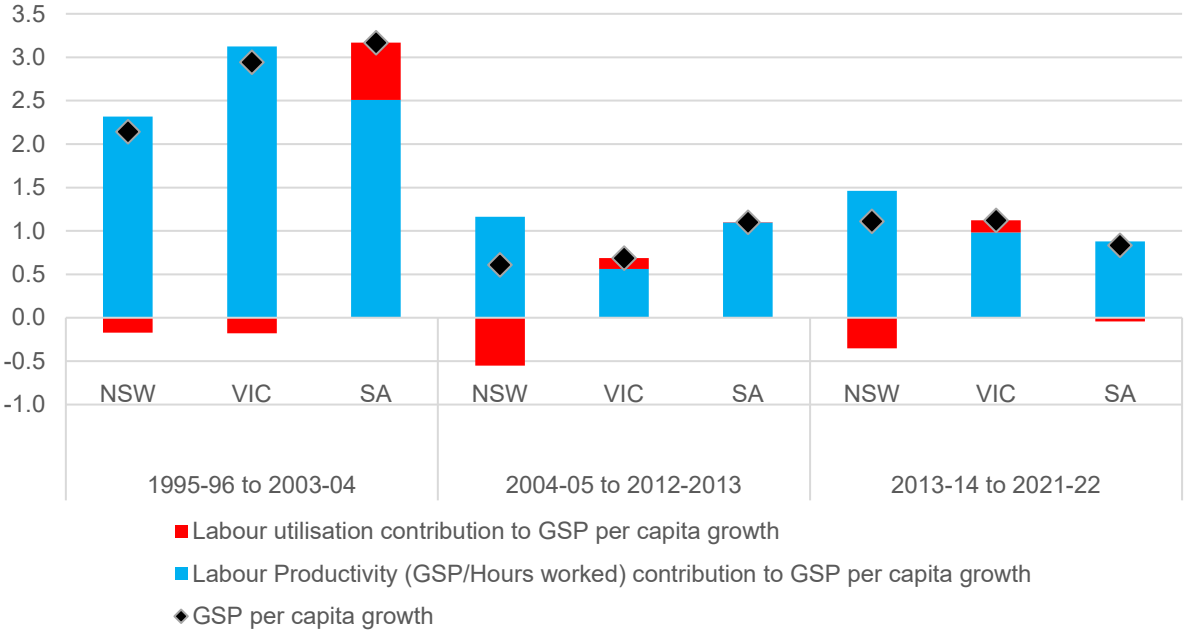


Source: Chang, Findlay and Whetton (2023).

In South Australia, as in other states and territories, GSP per capita growth has been predominantly driven by labour productivity growth. In Figure 2.5, the relative contributions of labour productivity and utilisation are identified. The size of the blue section of the middle column compared to the red (which is also sometimes negative) indicates the greater importance of labour productivity growth for growth of GSP per capita.

Figure 2.5 also illustrates another important trend in performance, which is the decline in the extent of labour productivity growth (the blue component of each column in that figure). In all three states the rate of labour productivity growth falls from the decade of the 1990s to that of the 2010s. The next section will examine the performance of labour productivity in South Australia and its drivers.

Figure: 2.5: Contributors to decadal average annual growth in GSP per capita, South Australia, NSW and Victoria, 1990 – 2020, percentage points



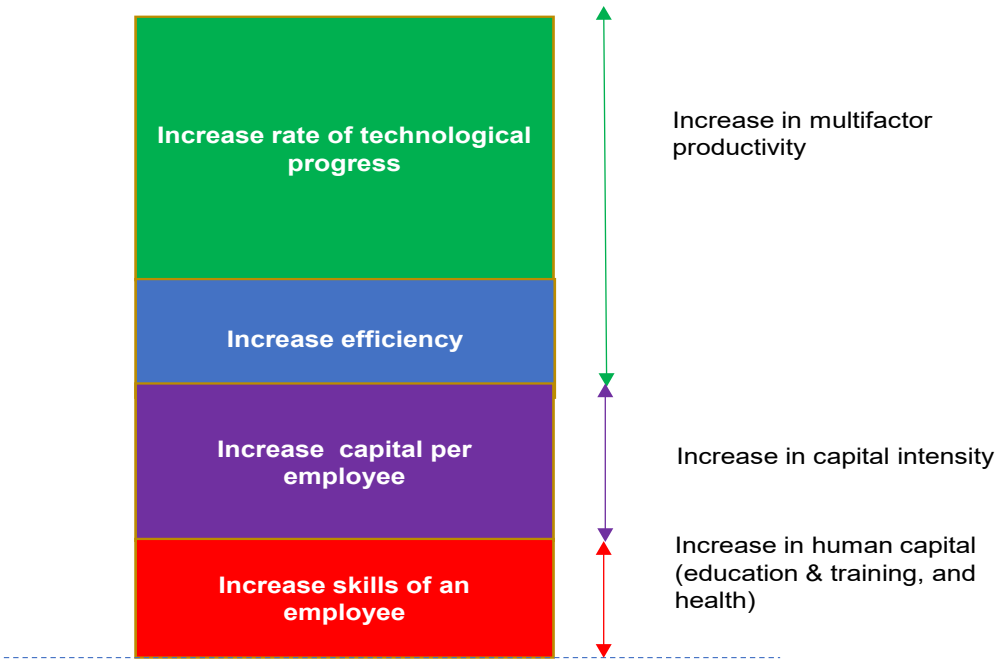
Source: Australian Bureau of Statistics (2020), Australian National Accounts: State Accounts, Australian Bureau of Statistics, (December 2020) *National, State and Territory Population, Australian Bureau of Statistics Labour Force Australia (December 2020), and Australian Bureau of Statistics (2019-20) Experimental Estimates of Industry Multifactor Productivity.*

3. South Australia's labour productivity challenge

3.1 Labour productivity measure

In this section, we use the labour productivity index for the market sector computed by the Australian Bureau of Statistics (ABS). Due to data limitations this index only covers the market sector.[6] The main advantage of this measure over alternatives such as GSP per hour worked is that the ABS also produces linked estimates of multi-factor productivity (MFP – which captures the impact of both technical progress and efficiency changes), labour supply, and capital productivity. This allows the components of productivity changes (Figure 3.1) to be analysed separately.

Figure: 3.1: Four drivers of labour productivity growth



Source: Chang, Findlay and Whetton (2023).

3.2 Labour productivity performance

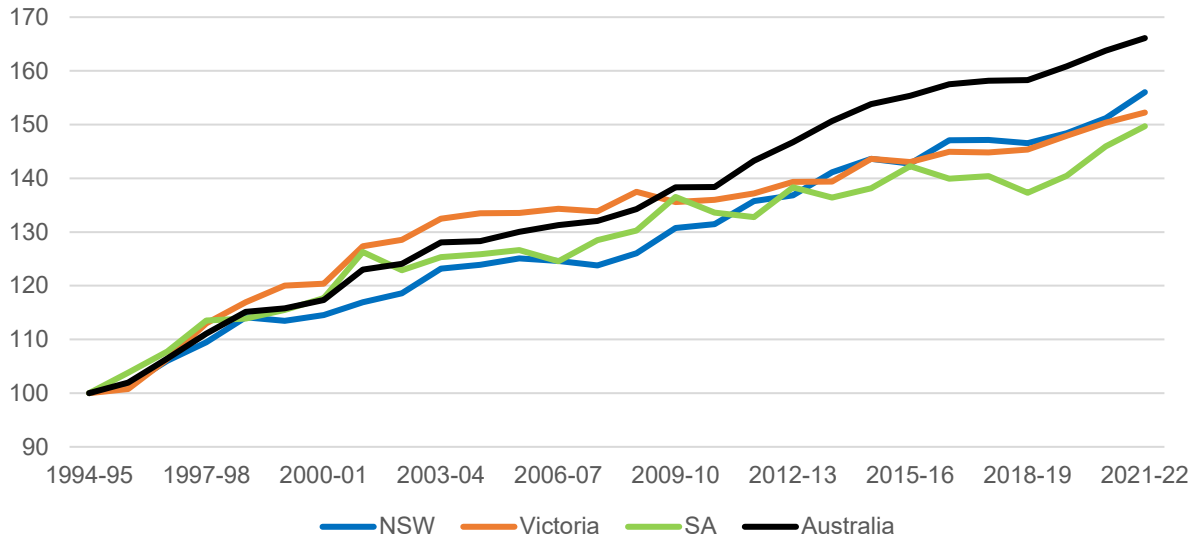
The ABS publishes indices of labour productivity for sixteen industries in the market sector from 1994-95 onwards. According to these data, the rate of growth of labour productivity in South Australia broadly kept pace with the (slowing) growth rates of New South Wales and Victoria up to 2009-10, but it has subsequently fallen behind (Figure 3.2). This overall national decline, and recent South Australian underperformance is even clearer when the data is split into decadal averages (Figure 3.3).

As is the case with GSP, South Australia's relative performance over the three most recent years has been strong, with labour productivity growth faster than the national average. Our

[6] The market sector comprises 16 sectors of the economy, namely: Agriculture, Forestry and Fishing; Mining; Manufacturing; Electricity, Gas, Water and Waste Services; Construction; Wholesale Trade; Retail Trade; Accommodation and Food Services; Transport, Postal and Warehousing; Information, Media and Telecommunications; Financial and Insurance Services; Rental, Hiring and Real Estate Services; Professional, Scientific and Technical Services; Administrative and Support Services; Arts and Recreation; Other Services. ABS (2023), Estimates of Industry Multifactor Productivity methodology.

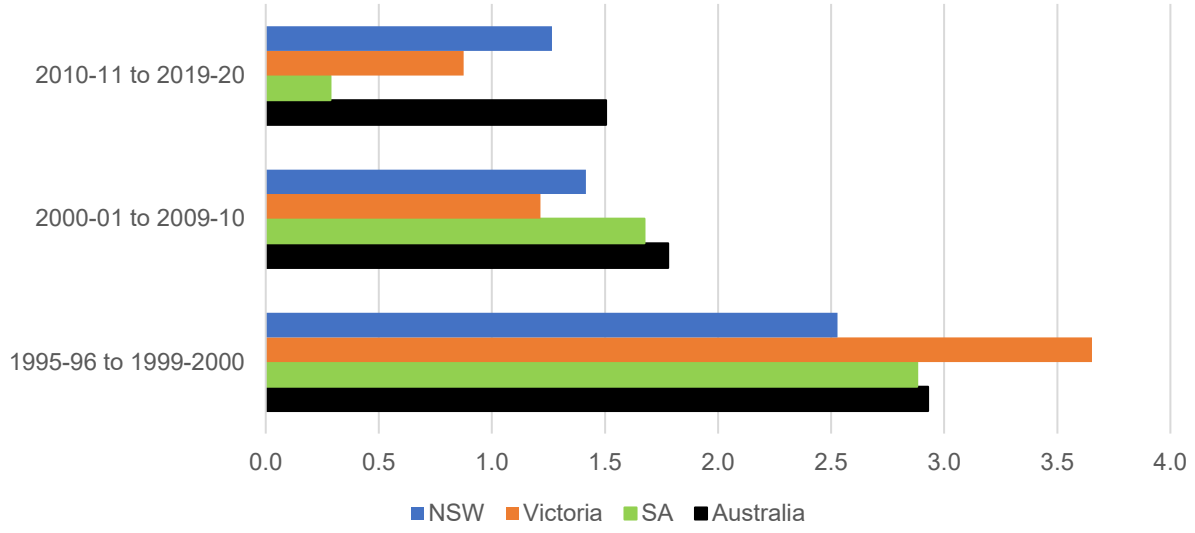
analysis of the factors influencing productivity growth suggests that this recent strength is largely driven by significant reductions in underutilisation of capital and labour as demand conditions recover out of COVID-19 (in other words it is not that the economy's productive capacity has been growing but rather that we have finally emerged from a situation where weak demand was suppressing productivity). The favourable growing conditions in these three years meant that Agriculture had a particularly large drop in underutilisation. Output in the sector grew by 46 per cent over these years, with labour only needing to grow half as much significantly increasing the value produced per unit of labour.

Figure 3.2: Labour productivity index, South Australia, NSW, Victoria and Australia



Source: Australian Bureau of Statistics (2021-22) Experimental Estimates of Industry Multifactor Productivity.
Note: 1994-5 Base year=100.

Figure 3.3: Decadal averages of annual labour productivity growth, South Australia, NSW, Victoria and Australia, per cent



Source: Australian Bureau of Statistics (2019-20) Experimental Estimates of Industry Multifactor Productivity.
Note: 1994-5 Base year=100.

To understand what has been driving this decline in the growth rate of labour productivity, it is necessary to investigate the performance of the four drivers of productivity. However, to do so is difficult. ABS reports a measure of MFP, which aggregates technological progress and efficiency. Similarly, whilst the ABS do have estimates of how the extent of skills in the workforce (also known as human capital) has changed at the national level, these are not available for the individual states due to data limitations. This means that any growth in MFP at the state level is likely to be overstated as nationally the average skill level of the workforce has been increasing consistently, and because of the data limitation increases to the skill level are attributed to MFP.

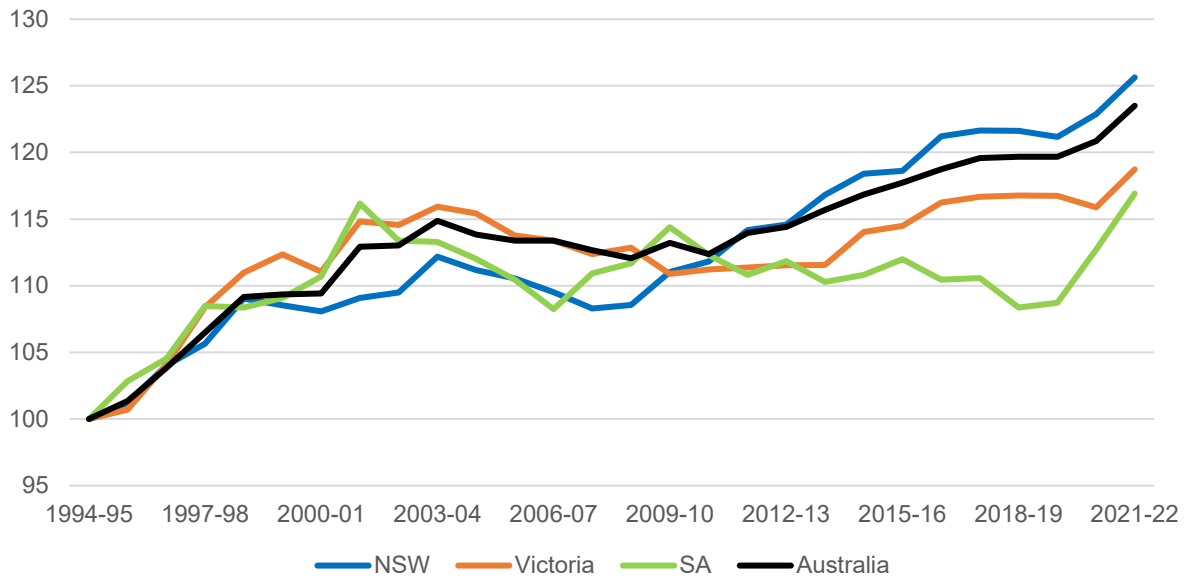
The following sections review the relative contributions of the key drivers of labour productivity using available data.

3.2.1 MFP performance and capital deepening

South Australia's rate of MFP growth was comparable to that of New South Wales and Australia in the 1990s and 2000s, but as was the case with labour productivity it then fell behind the eastern states (Figures 3.4 and 3.5).

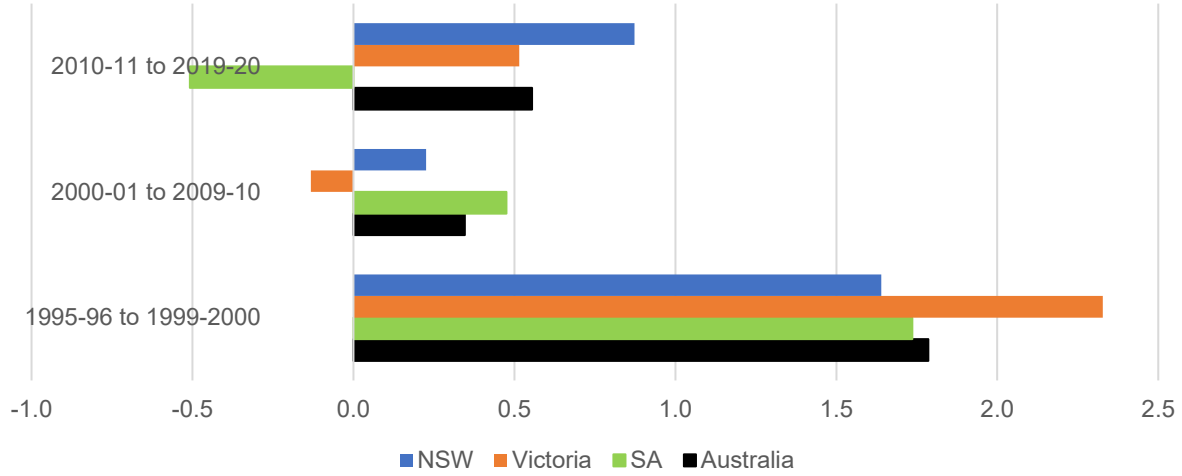
Although MFP growth rates slowed markedly for each of the included states and Australia from 2000 onwards, South Australia's rate became negative, with a decadal average rate of -0.5 per cent in the 2010s. And because labour quality increases could not be measured at the state level it is likely that the actual performance for MFP was even worse as the average qualification level of the workforce improved over this period in every state.

Figure 3.4: Multi-factor Productivity (MFP) indices, South Australia, NSW, Victoria and Australia



Source: Australian Bureau of Statistics (2021-22) Experimental Estimates of Industry Multifactor Productivity.
Note: 1994-5 Base year=100.

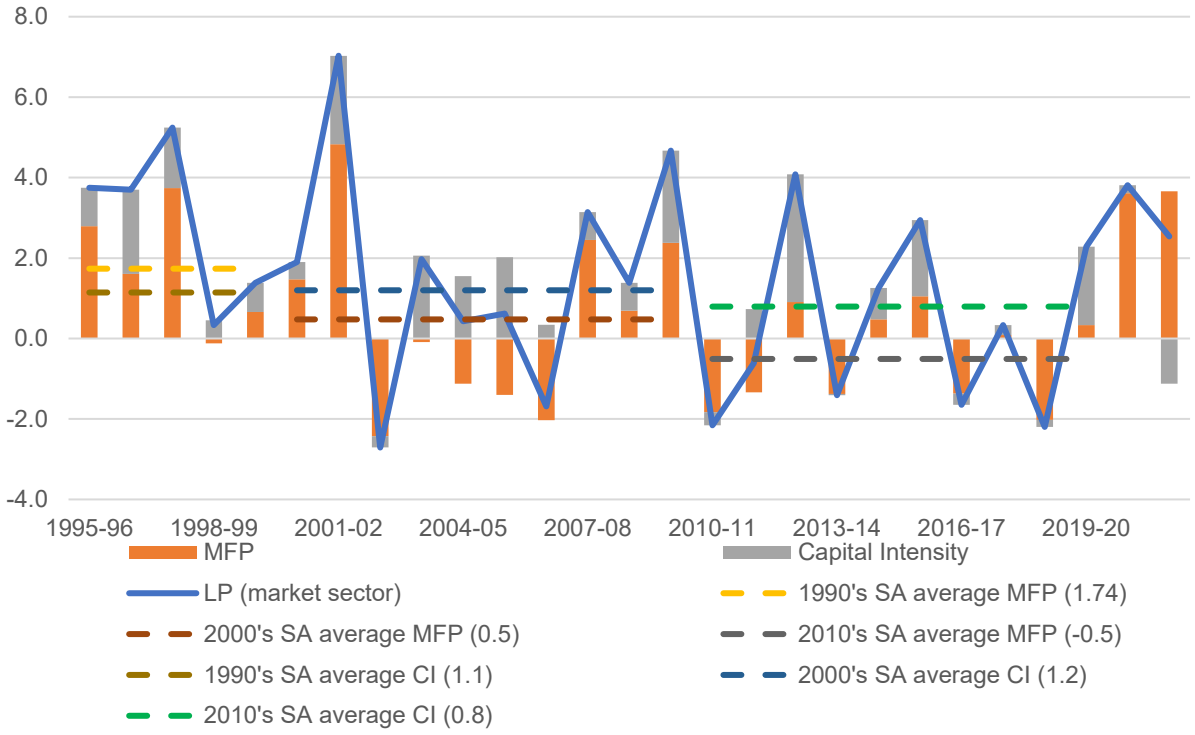
Figure 3.5: Decadal averages of annual MFP growth, South Australia, NSW, Victoria and Australia, per cent



Source: Australian Bureau of Statistics (2019-20) Experimental Estimates of Industry Multifactor Productivity.
Note: 1994-5 Base year=100.

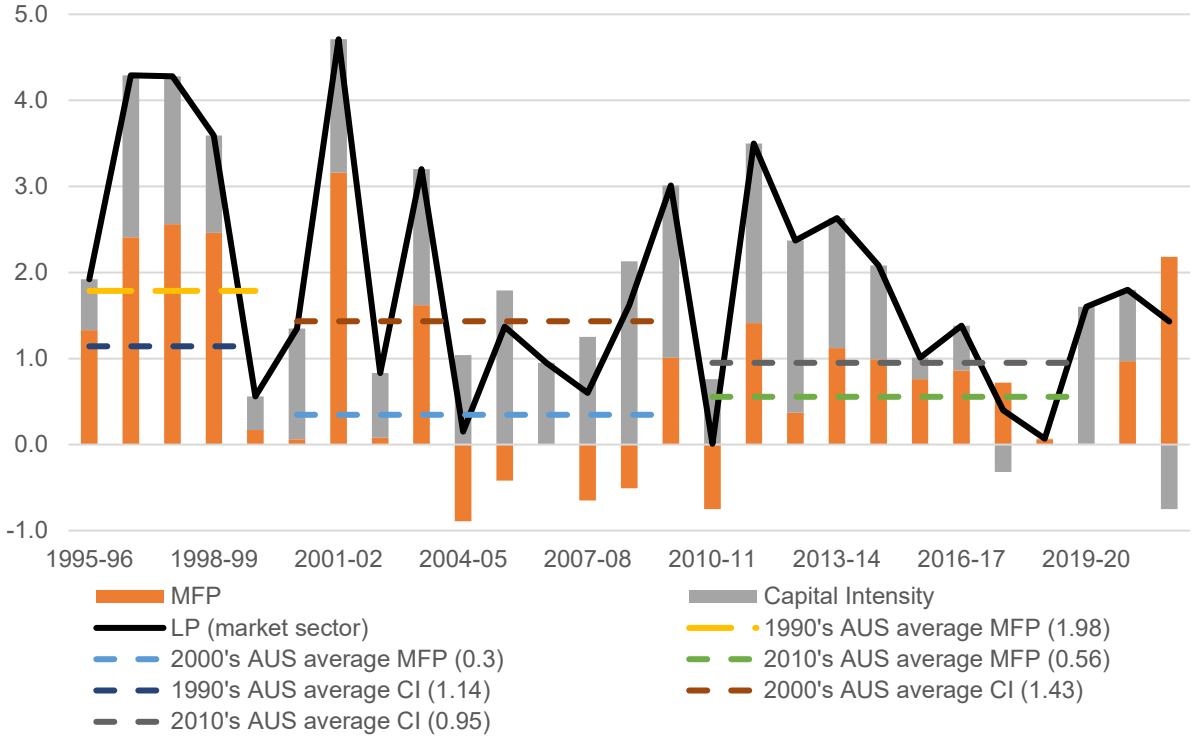
Increases in MFP were the most significant driver of South Australia's labour productivity growth in the 1990s. However, this pattern was reversed over the most recent two decades, with capital deepening became the major driver (Figure 3.6). The Australian data shows a similar pattern (Figure 3.7). The concern is that capital deepening is not a sustainable driver of long-term labour productivity growth. The contributions of extra capital inevitably diminish over time.

Figure 3.6. Contributions to South Australia's labour productivity growth: multifactor productivity (MFP) and capital intensity (CI), percentage points



Source: Australian Bureau of Statistics (2021-22) Experimental Estimates of Industry Multifactor Productivity.
Note: 1994-5 Base year=100.

Figure 3.7. Contributions to Australia's labour productivity growth: multifactor productivity (MFP) and capital intensity (CI), percentage points



Source: Australian Bureau of Statistics (2021-22) Experimental Estimates of Industry Multifactor Productivity.
Note: 1994-5 Base year=100.

3.2.2 Technological progress and efficiency change

To delve into the causes of the decline in MFP growth, we need to examine the performance of the key factors influencing MFP, i.e., technological progress and efficiency change. The ABS does not separately estimate these components of MFP growth.

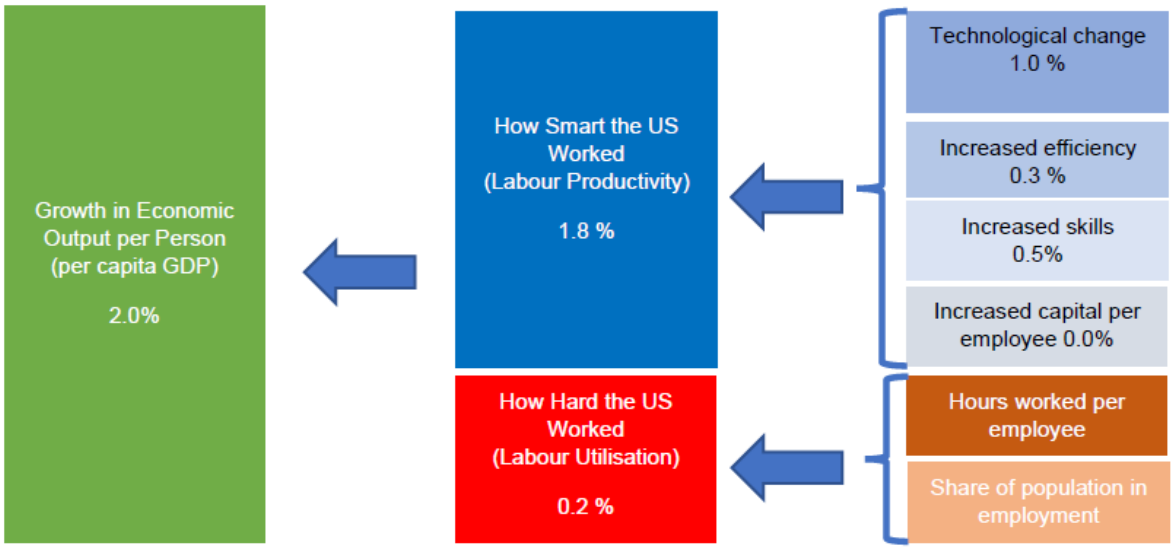
The US experience shows that on average technological progress contributed around half of output growth in the US economy over the past 70 years. Technological progress and efficiency improvements contributed around three-quarters and one-quarter to multifactor productivity growth, respectively, over this period (see Box 2).[7]

More broadly, across a sample of OECD countries (the dataset did not include Australia), it is estimated that technological progress increased at an average annual rate of 1.5 percent over a 15-year period (1990 – 2004), while efficiency declined at an average annual rate of 0.6 per cent. The net effect resulted in MFP growth of 0.9 per cent a year over this period.[8]

As far as we are aware, no studies published in peer reviewed journals have disaggregated the components of MFP growth for South Australia, and only a few have produced national estimates for Australia disaggregating the drivers of MFP growth.[9]

[7] Jones, C.I. (2022), 'The Past and Future of Economic Growth: A semi-endogenous perspective', *Annual Review of Economics*, 14:125–52
[8] Barcenilla-Visus, S., Gomez-Sancho, J-M, Lopez-Pueyo, C., Mancebon, M-J, and Sanau, J., (2013), Technical change, Efficiency Change and Institutions: Empirical Evidence for a Sample of OECD Countries, Economic Record 89(285), pp.207-227.
[9] A good, if now somewhat out of date, example is Wadud, M., and Paul, S., (2006).

Box 2: Components of long-run US growth of GDP per capita



Source: Jones (2022).

Preliminary results from Fox and colleagues[10] at the University of NSW do provide detailed decomposition for the drivers of MFP growth in each Australian state. Their study decomposed MFP for the market sector into three components: technological progress, efficiency change and input mix change[11] at the state and national.[12]

For South Australia, Fox and colleagues' analysis shows that technological progress has stalled since 2001. It appears from the data that on aggregate employers in the state have neither (in net terms) developed their own innovations, nor have they effectively adopted the productivity enhancing technology and innovation developed in the rest of the world. As a consequence, while the global experience has been a growth in technology's contribution to productivity, in South Australia it has been stagnant. And this has been exacerbated by growth in inefficiency over those two decades, leading to the observed falls in MFP over that period.

The US experience illustrates the potential impact on living standards of South Australia's failure to keep pace with technological change and advancement of knowledge. If, over the last two decades, South Australia had kept pace with the average global growth of technology and knowledge and delivered MFP growth of 1 percentage point per year (rather than the actual performance estimated by Fox and colleagues (2022) of no growth in MFP), GSP per person could have grown 1 percentage point faster per year over the last two decades (2000-01 to 2019-20). If this had happened, the Commission calculates that South Australia's GSP per person would be comparable to that of New South Wales' GSP person in 2020, that is, about $13,500 higher than South Australia's actual GSP per person in 2020.

There is further work to be done to identify the factors that are suppressing technological progress and causing inefficiency in the economy. This is a considerable undertaking because

[10] Fox, J. K., (2022), Productivity Inequality: Potential for levelling up by industry and state, A presentation prepared for the CAER-Productivity Commission Workshop on Prospects for a Post-pandemic Productivity Boom, Centre for Applied Economic Research, UNSW Business School, 11 November.
[11] Input mix change measures the extent to which the chosen inputs are appropriate given the observed input prices.
[12] Fox (2022) covered only 12 of the 16 industries in the market sector because data for the other four industries (Rental, Hiring and Real Estate Services, Professional, Scientific and Technical Services, Administrative and Support Services, and Other Services) did not extend back to 1989-90.

of the nature of the task, the knowledge gaps in these areas, and data limitations. Nonetheless, the Commission has taken steps towards this process, particularly, through the conduct of inquiries and reviews on issues relating to technological progress and efficiency improvements (Appendix 1).

3.2.3 Human capital intensity

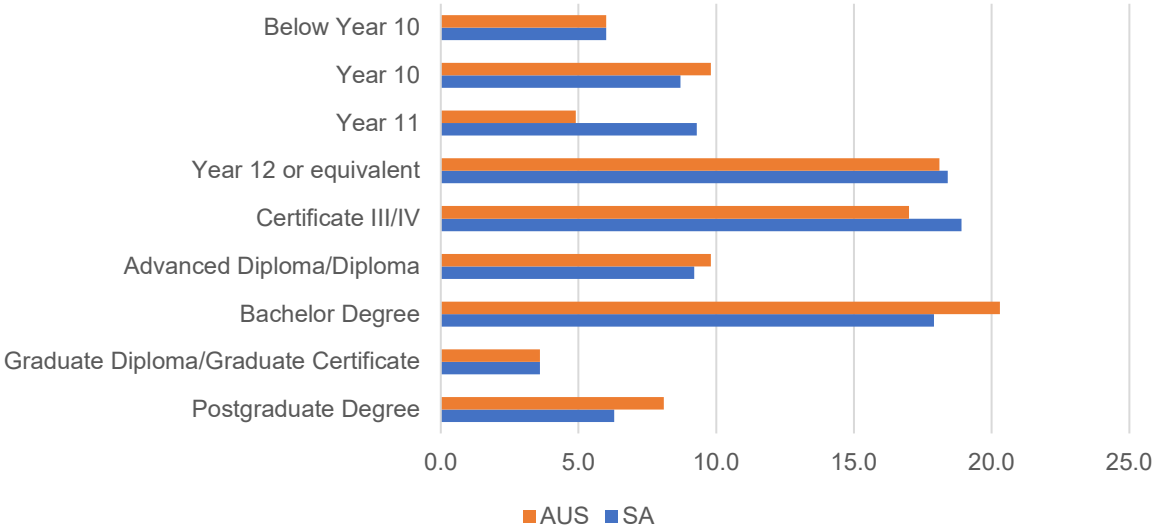
Human capital is another of the four drivers of labour productivity. The OECD defines human capital as "the stock of knowledge, skills and other personal characteristics embodied in people that helps them to be productive".[13] Education & training and health are the key factors that affect the quality of labour and its productivity.[14] However, as far as we are aware there are no indicators for Australian states that capture both the education and health components of human capital.

In this section, we will focus on several key indicators on education and training to inform us about the level and quality of human capital in South Australia.

Educational attainment of the South Australian working age population

Available data cannot measure the skill level of the workforce directly. Instead, the level of educational attainment of the working age population is used as a proxy for the human capital of the workforce. A smaller share of South Australia's working age population have completed the higher levels of educational attainment (Figure 3.8).

Figure 3.8: Highest level of educational attainment, persons aged 15 to 74, Australia and South Australia, per cent of population.



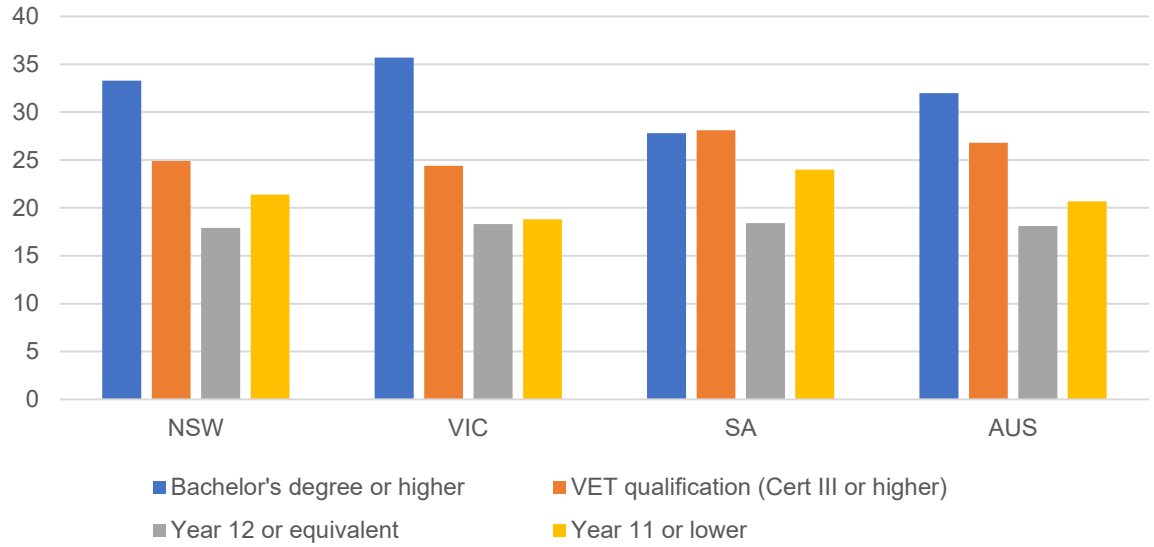
Source: Australian Bureau of Statistics Education and Work, Australia, May 2023.

Amongst the Australian states South Australia had the lowest proportion of the working age population, with a bachelor's degree or higher (22 per cent compared to a national average of 28 per cent, see Figure 3.9). South Australia also has the second highest proportion of its working age population who have not completed high school, with a highest level of education

[13] Botev, J., Égert, B., Smidova, Z. and Turner, D., 2019. A new macroeconomic measure of human capital with strong empirical links to productivity, Paris: OECD, p. 5.
[14] Education includes early childhood, primary and secondary, and post-secondary such as university and vocational training.

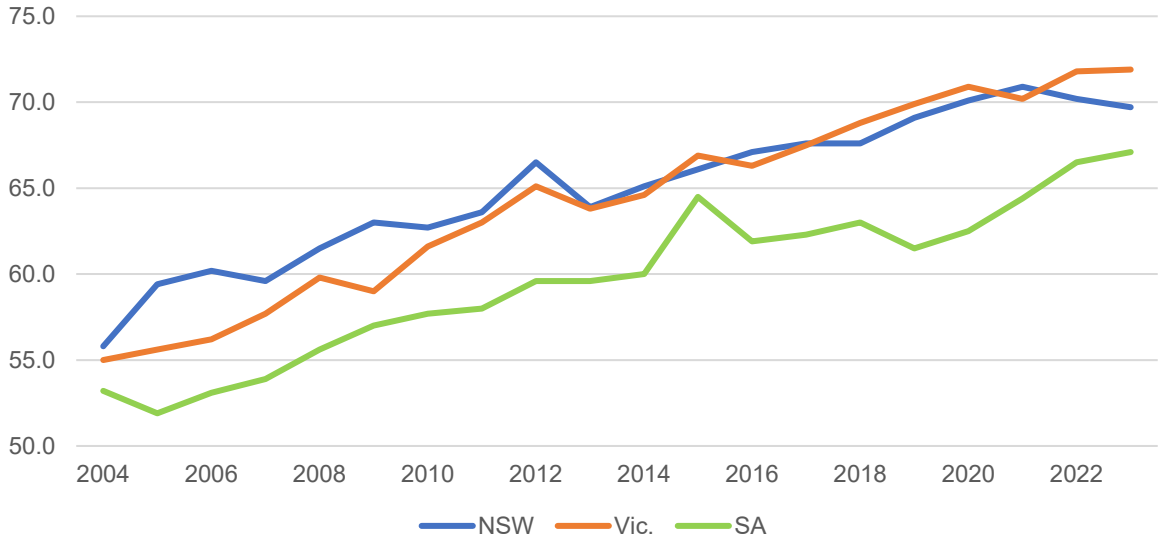
of year 11 or lower (24.0 per cent of South Australia's working age population, lower than only Tasmania on 25.5 per cent).

Figure 3.9: Highest level of qualification, persons aged 15-74 years, by state, per cent of population



Source: Australian Bureau of Statistics Education and Work, Australia, May 2023.

Figure 3.10: Proportion of total population aged 15-74 years with a non-school qualification, South Australia, NSW and Victoria, per cent



Source: Australian Bureau of Statistics Education and Work, Australia, May 2023.

Whilst the share of South Australia's working age population with a post-school qualification has been increasing over the last two decades (and particularly since 2019 with the fall in net interstate migration of young people), it is still well below states such as NSW and Victoria (Figure 3.10).

All these indicators suggest that the stock of human capital in South Australia is less than that in the rest of Australia. Referring to Figure 3.1, this would be expected to lead to lower labour productivity. The extent of this effect, however, is a topic for further work.

4. South Australia's labour utilisation challenge

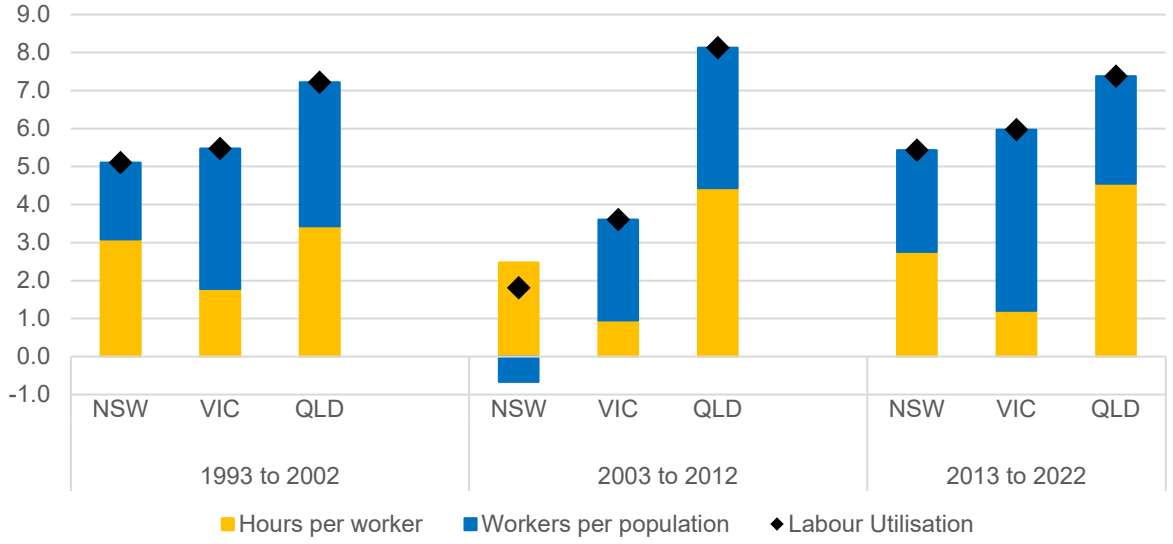
4.1 Labour utilisation performance

As explained in Section 2, higher labour utilisation will raise GSP per capita at a given level of labour productivity. Labour utilisation is higher if there is a larger share of the population in the workforce, or if those in the workforce work more hours on average. In this section, we will examine South Australia's labour utilisation performance.

In comparison to larger states, South Australia had lower labour utilisation over the past three decades (Figure 4.1). These states had a higher share of people in employment relative to the population than in South Australia (blue bar). They work just as hard in Victoria and even harder in NSW (yellow bar).

As a result, GSP per capita is lower in SA than it would be if labour utilisation matched that in NSW and Victoria. For example, if we had matched the labour utilisation in NSW, South Australia's GSP per capita in 2020-21 would have been around $71,000 or 9 per cent higher than the actual level of $65,000.

Figure 4.1: Labour utilisation in NSW, Victoria and Queensland relative to South Australia, percentage difference



Source: Australian Bureau of Statistics (2022), Australian National Accounts: State Accounts, Australian Bureau of Statistics, (December 2022) National, State and Territory Population, and Australian Bureau of Statistics Labour Force Australia (June 2022).

4.1.1 Ageing and labour utilisation

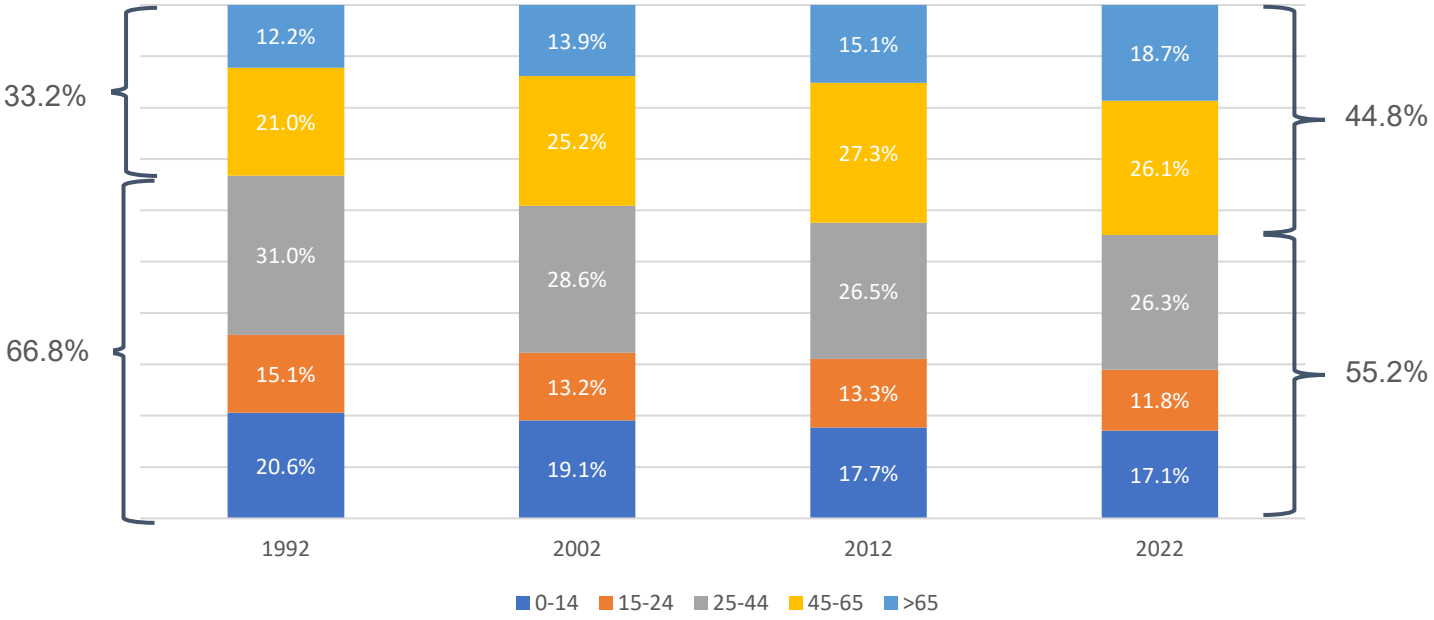
Ageing affects labour utilisation because it changes the share of the population in the workforce and the average number of hours worked by those in the workforce. Furthermore, population ageing may reduce the extent of human capital, for example, when skilled workers retire without replacement, or when the health of workers as declines as they get older. Consequently, population ageing affects living standards through both labour utilisation and labour productivity.

In South Australia, the population is ageing. In 1992, 67 per cent of our population were younger than 45 (Figure 4.2). Now only 55 per cent of our population is in that category.

Meanwhile, only 33 per cent of the state's population were over 45 back then, now its 45 per cent.

Some of this demographic shift reflects national trends. But the South Australian population is ageing faster than the national average because young people, in net terms, are moving interstate. Over the ten years to 2022-23 the state lost an average of 2,434 people aged 20 to 44 years to other states and territories and lost an average of 640 people aged 0 to 19 years. People aged 55 years and older have been moving *into* the state in net terms, at an average of 494 people per year over the same period.

Figure 4.2: Age structure of South Australia's population, per cent of total



Source: Australian Bureau of Statistics (December 2022), Australian Demographic Statistics.

5. Conclusion

Growth in South Australia's living standards declined markedly in the 2010s, from a high of 2.1 per cent in 2000s to a mere 0.1 per cent in the last decade. Rates of growth for both labour productivity and labour utilisation (the two main drivers of living standards) slowed substantially in 2010s.

This means that South Australians earn much less, and have fewer economic opportunities, than they would have done if the state had been able to keep pace with other states such as NSW and Victoria. It has also meant that the South Australian Government has fewer resources to put towards delivering services such as health and education, or to invest in productive infrastructure in the state.

Weak growth in labour productivity was what held back the state's economic performance. Capital intensity increased over the 2010s, however it was offset by a large decline in MFP which fell at an annual average rate of -0.5 per cent over that decade.

Research indicates that stagnation of technological progress and increases in inefficiency both contributed to the fall of MFP in South Australia. This weak performance by South Australian firms in absorbing and implementing technological change is perhaps not surprising given the data identified by the Commission in its recent inquiry 'Turning Research into Economic Competitiveness for South Australia'. South Australian businesses' expenditures on research and development have been falling as a share of GSP, as have key innovation outputs such as patents. South Australian firms are very inward looking in their innovation activities, with a much smaller share drawing on sources of ideas external to the firm such as universities or government, and they are three to five times less likely to participate in joint R&D. Only 3 per cent of South Australian innovation active firms (and therefore only 1.5 per cent of all SA firms) identified universities as a source of ideas for innovation.[15]

There are also gaps in the skills needed for innovation. Our recent inquiry highlighted that not only was the average qualification of the South Australian workforce lower, but that the skills gap was even more significant for research and innovation skills. South Australia does have a strong workforce in key innovation occupations linked to the wine sector, agribusiness and defence, suggesting that those sectors are competitive nationally in innovation. But the state has significantly fewer people employed in innovation jobs in key occupations such as cyber security, software programming, and civil engineering suggesting important gaps in innovation capacity. And it is these ICT skills, and the business skills to turn the technology into more productive firms, that are critical for much of the potential productivity improvements.

The promising recent growth in economic output and employment since the state has come out of the COVID pandemic has been heavily influenced by several very strong years for our agriculture sector, and by strong growth in government spending on the NDIS and on healthcare. Whilst the reduced outflow of young people interstate does give this improved economic performance some structural foundations, it is not in itself sufficient to turn around the longer-term underperformance of the state's economy.

The South Australian Productivity Commission's central purpose is to provide the Premier with independent evidence based economic advice on how to improve our state's economic growth and in turn, South Australian household incomes.

[15] South Australian Productivity Commission (2023), *Turning research into economic competitiveness for South Australia, Final Report*, May 2023.

To support that purpose, we will develop our understanding through our research of what factors have held back South Australia's adoption of economically useful technology, and the efficiency of its economy.

Research into the delivery of education and training to South Australians, and how that interacts with South Australian workplaces, the way in which technology (including management improvements) are identified and implemented in the workplace, the effectiveness of the South Australian Government as a key employer, and the drivers of the apparent decline in efficiency of the state's economy will contribute to this goal.

Appendix 1: The Commission's Inquiries and Reviews

A1.1 The Commission's Inquiry into research and development

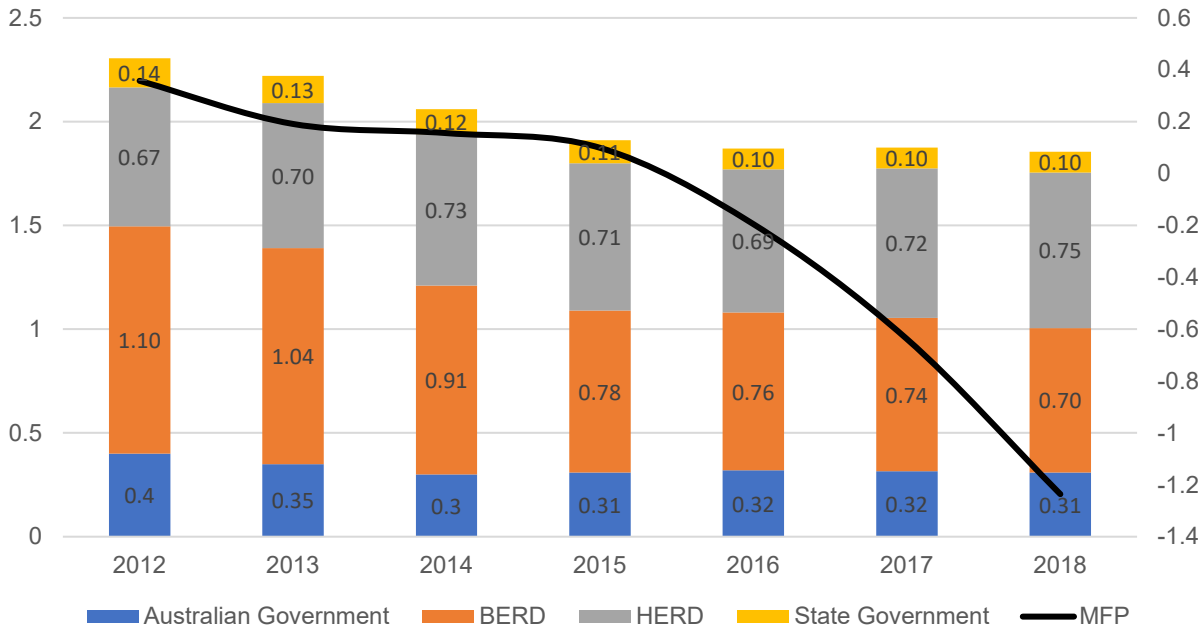
Research and Development (R&D) is a major activity that influences technological progress. In February 2020, the Commission undertook an inquiry into R&D at the request of the South Australian Government. The Inquiry examined the state's R&D activities and the factors that influence the extent to which these activities had translated into productivity gains and enhanced the State's economic performance.

The key findings are summarised into the following three areas.

Impact on productivity growth

South Australia had the second highest R&D intensity (Total R&D expenditure as a share of GSP) among the Australian states over the past decade but its productivity performance had been declining (see Figure A1.1). This outcome suggests that there is a weak link between the translation of R&D effort into application and commercialisation.

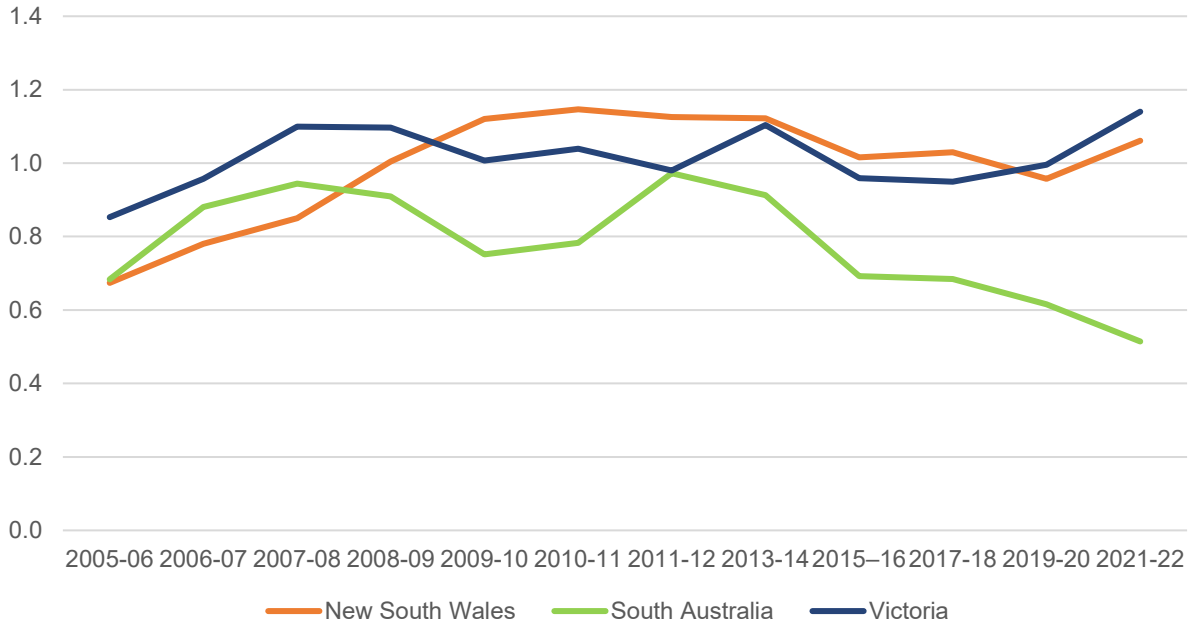
Figure A1.1: South Australian Research and Development Expenditure by sector, and MFP growth trend, per cent



Source: ABS 8109.0, ABS 8111.0, ABS 8104.0.
Note: BERD = business expenditure on R&D; HERD = Higher education R&D.
LHS = share of R&D; RHS = MFP growth.

In part this may be because research and development by South Australian businesses has been declining both as a share of GSP and relative to other states such as NSW and Victoria (Figure A1.2)

Figure A1.2: Business Expenditure on R&D as share of GSP, South Australia, NSW and Victoria, per cent



Source: Australian Bureau of Statistics, Research and Experimental Development, Businesses, Australia, 2021-22.

Performance of R&D indicators

The performance of various R&D indicators in South Australia was mixed (Table A1.1). The indicators that show positive trends are: Australian government expenditure on R&D; higher education spending on R&D; and publications.

The indicators that show negative trends are: academic staff devoted to R&D; university total research workforce; share of Australian Research Council (ARC) and Category 1; Australian Competitive Grants (category 1 income);[16] and number and share of patent applications.

We now examine some of these indicators more closely.

[16] Category 1 – Australian Competitive Grants income is a metric used to inform the allocation of the Australian Government's Research Block Grants to Universities.

Table A1.1: Selected South Australia R&D performance indicators

Indicator	Year	Current	10 years previous	Trend
Academic staff devoted to R&D (PYE)	2018	1,848	1,688	
University total research workforce [a] (PYE)	2018	5,300	4,523	
Australian Government expenditure ($m)	2018-19	340	308	
Business expenditure on R&D ($m)	2017-18	798	948	
No. patent applications	2019	444	605	
SA share of patent applications (%)	2019	5.2	6.2	
Higher education expenditure on R&D ($m)	2018	827	505	
SA Universities income from ARC ($m)	2018	38.2	33.1	
SA Universities category 1 income ($m)	2018	125	99	
SA Universities share of ARC income (%)	2018	6	6.5	
SA Universities share of category 1 income (%)	2018	7.5	8.6	
No. publications in the top 10% of citations	2019	1,047	515	
Publications with an industry co-author (%)	2019	1.9	2.4	
Publications with an international co-author (%)	2019	58.3	41.1	

a: Total research workforce includes academic staff, postgraduate students and other staff

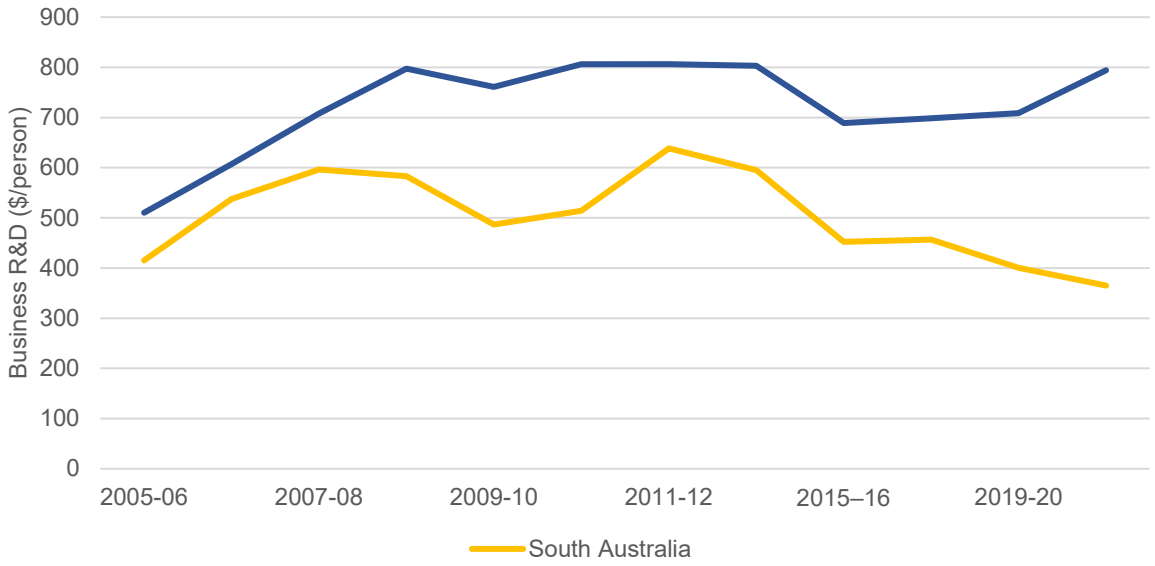
Source: (SAPC 2021).

Business expenditure on R&D

The Commission engaged the ABS to conduct an analysis on the propensity of firms in South Australia to undertake R&D. It found that South Australian firms were more likely to spend on R&D compared to those in other states except in Western Australia. It also found that the propensity for firms to spend on R&D increases with firm size (in terms of employment or income), and younger firms were more likely to spend on R&D than older firms.

In addition, the Inquiry found that South Australia had higher levels of government and higher education expenditure on R&D than other states but lower levels of business expenditure on R&D. A major reason for the lower overall spending on R&D was because South Australia had a smaller share of large and medium-sized firms than in larger states, such as NSW and Victoria. Figure A1.3 shows that business spending on R&D has fallen slightly in South Australia over the last 15 years, whereas national average spending has increased.

Figure A1.3: Expenditure by Business on Research and Development, real dollars per person

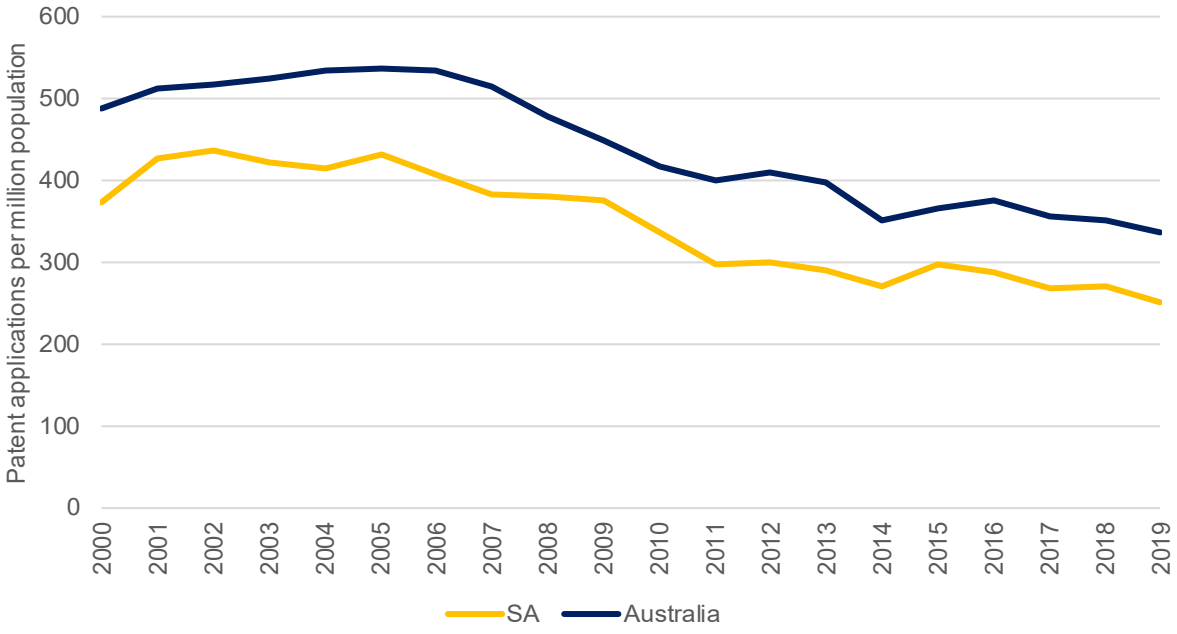


Source: Australian Bureau of Statistics, Research and Experimental Development, Businesses, Australia, 2021-22.

Patent applications

Patents are often used to measure the success of R&D efforts. They are designed to incentivise innovation. However, in practice, not all patents have led to innovations because it is dependent on other factors, such as access to financial capital, practical application, regulations and potential markets amongst others. Nonetheless, a larger pool of patents would increase the likelihood that a patent could lead to an innovation. Patent applications in South Australia have been consistently lower than the national average, suggesting innovation output in the state is below average (Figure A1.4).

Figure A1.4: Patent applications per million persons, South Australia and Australia



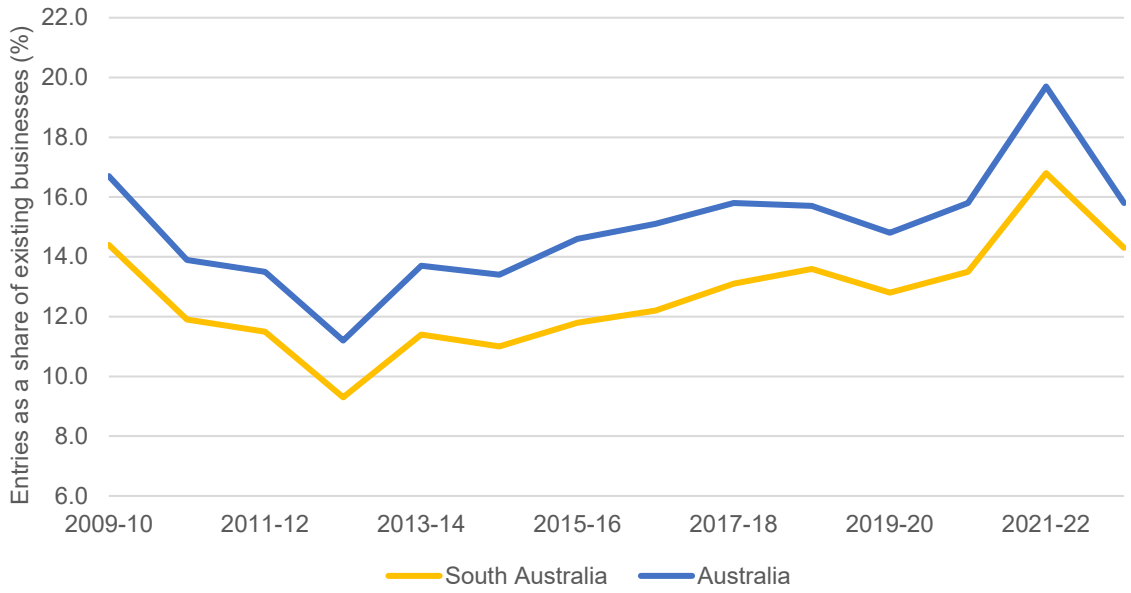
Source: IP Australia.

Note: Data for 2020 and 2021 not included as there is a structural break in the series.

New business formation

The rate of new business formation in South Australia also suggests a less innovative economy, with the rate consistently 15 to 20 per cent below the national average (Figure A1.5).

Figure A1.5: New business entries as a proportion of existing businesses, South Australia and Australia, per cent



Source: Australian Bureau of Statistics (2022), 'Counts of Australian Businesses, including Entries and Exits, June 2018 to June 2022'.

Effectiveness of R&D programs

The Commission Inquiry also reviewed the South Australian Government's R&D activities over the past four decades. It found that the government provided considerable assistance to support R&D activities in selected sectors, including agriculture and health. However, many of these programs were short-lived, and efforts and funds were regularly redirected, which reduced the effectiveness of these programs. The Inquiry also found that little attention was paid to evaluating the effectiveness of government-supported R&D programs.

A1.2 The Commission's work on efficiency improvements

Efficiency refers to how inputs and technology are combined to produce valuable output. In general, there are many factors that can affect the efficiency of an economy, some relating to organisational practices, some relating to government intervention and some relating to social norms. The major factors that impact on efficiency was discussed in Section 4 of Research Discussion Paper no. 4.

As noted earlier, we do not have a lot of data on efficiency, and this is an area that needs more work. Against this backdrop, the Commission has undertaken several inquiries and reviews into several areas to identify the sources of inefficiency and propose reform measures to promote efficiency improvements.

Table A1.2 summarises some key findings of these inquiries and reviews. The final reports containing the findings and recommendations can be accessed via the link https://www.sapc.sa.gov.au/publications.

Table A1.2: The Commission's inquiries to promote efficiency improvements

Inquiry	Some key findings
Inquiry into government procurement – stages 1 and 2	• The SA procurement framework is a combination of several frameworks that operate separately. This fragmentation is a barrier to a whole of government approach, limiting the prospects of simplifying the system for suppliers, improving the value generated by the state's procurement spend and achieving other system wide efficiencies. • The SA procurement system is prescriptive, unnecessarily risk averse, and lacks transparency and guidance in key areas. • There is a need for better engagement with the market to improve the outcome of the procurement process.
Local government cost and efficiency	• An efficiency and productivity analysis (using Data Envelopment Analysis) shows that technical efficiency remained relatively constant over the period 2008-09 to 2017-18; and that total factor productivity fell by an average of 0.8 per cent a year. • The declining trend in measured productivity is most likely to be largely attributable to the unmeasured changes in scope, quality and volume of council services provided.
South Australia's Regulatory Framework	• While there are some shortfalls from OECD best practice, the overall regulatory framework serves the state well. • Areas identified as in greatest need of reform, are ex ante assessment of regulatory proposals and ex post evaluation of regulation which are central to effective and efficient regulation. • Other areas in need of improvement include the coherence, transparency and speed of regulator decision-making, as well as overlap and duplication between regulators, and business access to clear information on regulatory requirements.
South Australia's Renewable Energy Competitiveness	• The main competitive advantage for SA is regions with world-class combined solar and wind resources. • There are a number of barriers that could stop SA from realising its potential economic benefits from renewable energy, i.e., barriers in the electricity market; and recent adverse policy choices which make it more difficult to install renewables in SA. • Green hydrogen is a potentially significant opportunity arising from the global energy transition for Australia and South Australia.
Extractive industry supply chain	• The current regulatory processes pay insufficient regard to the state's ownership of extractives resources and the optimum location of quarries. While other more distant extractives resources may be available, their use incurs higher transport costs and impacts on roads. There is scope to strengthen the operation of the regulatory model applied to this sector in order to reduce costs to industry and the level of uncertainty.
Tourism Regulation Review	• For SA businesses offering nature-based tourism or agritourism, the evidence indicates the main regulatory issues

Inquiry	Some key findings
	mainly relate to either land use and planning, operations or expansion; or access to public infrastructure.

Source: SAPC inquiry and review reports – https://www.sapc.sa.gov.au/publications.

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