

# PC productivity insights

## Bulletin 2023

### Features

Whole economy growth and productivity

Industry-level productivity performance

Australia's recent productivity story

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## Key points

- \* **Data released in June 2023 showed that labour productivity decreased by 4.6% in the 12 months to March 2023. This is most likely due to the unwinding of COVID-19 restrictions and the historically low unemployment rate.**
  - Labour productivity rose during the pandemic as labour shifted to more productive industries, and that appears to be unwinding in 2022-23 with labour productivity falling.
  - Productivity rose in 2021-22. Labour productivity and multifactor productivity (MFP) in the market sector increased by 1.5% and 2.2% respectively. High MFP growth drove increased output in the market sector.
- \* **Growth in labour productivity and MFP varied greatly across industries in 2021-22.**
  - Labour productivity growth ranged from -5.0% to 13.7% across industries; 12 of the 16 market industries reported an increase in labour productivity.
  - MFP growth ranged from -2.8% to 21.2% across industries; 13 of the 16 market industries reported an increase in MFP.
  - The agricultural, forestry and fishing sector demonstrated the largest growth in productivity, while the mining sector struggled with the largest decline in productivity.
- \* **This bulletin provides insights into the 2021-22 productivity story.**
  - The apparent productivity boom in the agricultural, forestry and fishing sector was driven by weather conditions, and not from increased technology or efficiency.
  - Strong growth in commodity prices have led to an uptick in mining investment; this may reverse the weak real output and productivity growth in the mining sector.
  - Falling labour productivity growth may be driven by a stagnation in non-mining investment.

Productivity growth drives long-term economic and income growth and helps improve average living standards. Productivity seeks to quantify how efficiently resources, such as capital and labour,<sup>1</sup> are used to produce output – the goods and services we consume every day. Historically, productivity growth has improved living standards in three main ways.

- **Goods and services became cheaper** – through a fall in the number of hours of labour needed to produce existing goods and services.
- **Goods and services improved in quality** on multiple dimensions.<sup>2</sup>
- **Entirely new goods and services were produced** to satisfy human wants (PC 2022, p. 5).

This Productivity Bulletin analyses the most recent trends in aggregate productivity. A primer on productivity, and how it is measured, is included at the back of the Bulletin. Annual data can be volatile, and subject to revisions and cyclical shocks. Therefore, medium-term and long-term trends are also examined to provide a clearer guide to developments in the economy.

<sup>1</sup> But also other resources such as land, energy, environmental services, and other unpriced public goods.

<sup>2</sup> By an amount worth more than any additional resources required to improve them.

# 1. Whole economy growth and productivity

## Economic growth recovered in aftermath of COVID-19

Australia experienced a rise in productivity in 2021-22. This was in terms of total productivity growth as well as labour and multi-factor productivity (MFP).

Labour productivity increased for the whole economy (1.1%) and the market sector (1.5%). This was, however, below their long-term averages of 1.5% and 1.9% (table 1). The increase in labour productivity could largely be attributed to a labour reallocation effect<sup>3</sup> from the COVID-19 pandemic in 2021-22, which appears to be reversing into 2022-23.

Market sector MFP grew faster in 2021-22 (2.2%) than its long-term average (0.8%) (table 1). MFP growth means that output grew faster than the combined growth rate of capital and labour inputs (2.4%) (ABS 2023e), which is generally taken to reflect innovation or other external factors.<sup>4</sup> Large MFP growth in certain industries – agriculture, forestry and fishing (21.2%); information, media and telecommunications (7.5%); and transport, postal and warehousing (6.3%) – contributed to this aggregate increase (section 2). The upsurge in MFP may not be sustained given there is often short-run variations in long-run trends.

Although Australia saw relatively strong productivity, economic, and income growth in 2021-22, the economy has greatly changed since then (box 1). These changes affected economic and productivity growth in 2022-23, as observed in the quarterly national accounts. Since March 2022, there has been a slump in labour productivity (figure 1). Gross domestic product (GDP) per hour worked has decreased by 4.6% in the year to March 2023.

The decline in labour productivity is likely to be partly structural and could also be due to the unwinding of the COVID-19 pandemic (ABS 2023a), which may have decreased productivity in two ways.

1. **Labour reallocation to low productivity jobs.** The COVID-19 pandemic caused relatively greater disruption to low-productivity firms and low-productivity parts of the service sector. Less productive firms were more likely to pause production, and contact-intensive service sectors were severely affected by COVID-19 restrictions. As a result, labour productivity increased through a productivity-enhancing reallocation of labour. More labour flowed towards high productivity goods sectors, and within the same sector, labour also shifted to high productivity firms (Andrews et al. 2021, p. 16; Black and Chow 2022). As the pandemic subsided and restrictions were lifted, the service sector recovered and firms with low average productivity levels – such as hospitality – returned to production. This partly reversed the reallocation effect, lowering measured labour productivity.
2. **Increased employment among lower-productivity workers.** The COVID-19 pandemic at first caused an increase in under and unemployment. This disproportionately affected low-productivity worker because the pandemic forced firms in lower productivity customer-facing industries to cut costs, reduce production

<sup>3</sup> Evidence suggests the COVID-19 pandemic led to a productivity-enhancing reallocation of labour (Andrews et al. 2021; Birinci et al. 2020). Less productive firms were more likely to pause production and less productive workers were more likely to become unemployed – leading to a temporary increase in labour productivity observed in 2021-22. However, this reallocation effect has likely reversed in 2022-23.

<sup>4</sup> A number of factors could explain high MFP growth in 2021-22. First, it could be output driven due to the rebound in economic growth following the unwinding of COVID-19 restrictions. Second, capital utilisation may have increased in 2021-22, following previous declines during the COVID-19 pandemic. The national accounts assume 100% capital utilisation. Therefore, if capital utilisation rebounded in 2021-22, capital services growth would be underestimated, and therefore, MFP growth would be overestimated. Further, the digitalisation of the economy since COVID-19, and increased investment in other types of capital such as intangible capital (section 3), could have led to an underestimation of capital services growth and an overestimation of MFP growth.

and layoff some of their workers. Consequently, this led to a temporary increase in labour productivity. As the labour market recovered from the COVID-19 pandemic and the unemployment rate fell to historic lows (box 1), lower-productivity workers re-entered the workforce, thereby reducing labour productivity.

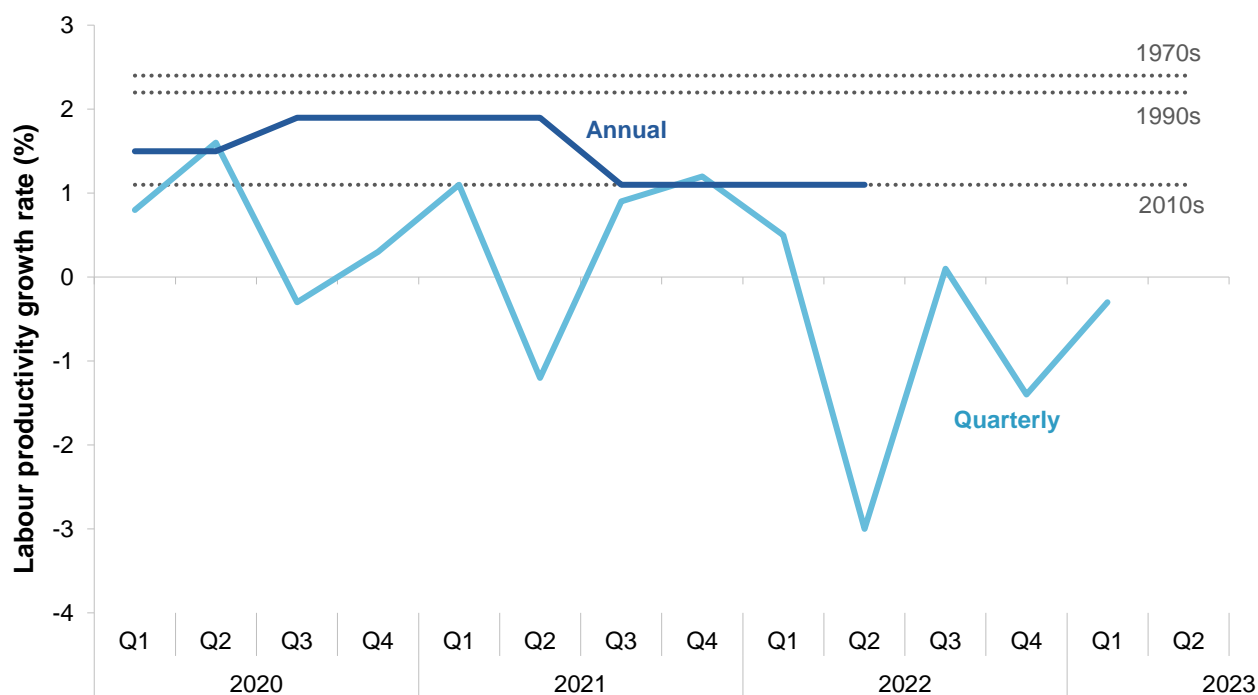
**Table 1 – Aggregate productivity statistics<sup>a,b</sup>**

	Latest years		Most recent five years	Long-term growth rate
	2021-22	2020-21	2017-18 to 2021-22	1994-95 to 2021-22
	%	%	%	%
<b>Whole economy</b>				
Output (real GDP)	3.6	2.2	2.2	3.1
GDP per capita	3.1	1.8	1.1	1.7
Hours worked	2.5	0.3	1.2	1.6
<b>Labour Productivity</b>	<b>1.1</b>	<b>1.9</b>	<b>1.0</b>	<b>1.5</b>
Terms of trade	11.8	10.2	6.1	3.2
Gross national income per capita	3.0	5.2	2.2	2.3
Gross domestic income per capita	5.7	4.0	2.4	2.3
<b>Market sector</b>				
Output (GVA)	4.6	1.4	2.0	3.1
Inputs	2.3	0.4	1.2	2.3
Hours worked	3.1	-0.4	0.9	1.2
Capital services	1.5	1.4	1.5	3.9
<b>Labour productivity</b>	<b>1.5</b>	<b>1.8</b>	<b>1.1</b>	<b>1.9</b>
<b>MFP</b>	<b>2.2</b>	<b>1.0</b>	<b>0.8</b>	<b>0.8</b>

a. Some figures will not appear to add correctly due to rounding to one decimal place. Gross value added (GVA) output is Gross domestic product (GDP) less taxes less subsidies on products and the statistical discrepancy. Labour productivity is the growth in output per unit of labour input. Multifactor productivity growth is the growth in gross value added less the growth of hours worked and capital services, each weighted by their share of total factor income. b. All values are in real, chain weighted, terms.

Sources: Estimates based on: ABS (2022, Australian System of National Accounts, 2021-22, Cat. no. 5204.0, tables 1 and 13).

**Figure 1 – Despite an uptick during COVID-19, labour productivity has steadily declined**  
**Average annual labour productivity growth in the 1970s, 1990s and 2010s; annual and quarterly labour productivity growth in the 2020s**



Sources: estimates based on: ABS (2022, *Australian System of National Accounts, 2021-22*, Cat. no. 5204.0, table 1); ABS (2023, *Australian National Accounts: National Income, Expenditure and Product*, Cat. no. 5206.0, table 1).

### Box 1 – Australia’s economy has changed since 2021-22

As of June 2022, CPI had accelerated to about 6.1% annualised, the cash rate rose by 0.5 percentage points to 0.85%, exports were at a quarterly high, and GDP growth was stable at about 0.9% for the quarter. Since then, Australia’s economy has experienced some notable changes.

#### Consistently high inflation triggered interest rate rises

Inflation surged due to strong consumer demand, global supply chain disruptions, and the carried-on effects of the COVID-19 pandemic. The upward trend continued in the 2022-23, with the annual inflation rising to 7.8% in the December 2022 quarter and remaining at 7.0% in the March 2023 quarter (ABS 2023d). To address high inflation, the Reserve Bank of Australia (RBA) implemented ten consecutive monthly interest rate increases since May 2022. As of June 2023, the interest rate reached 4.10%, representing a 3.25 percentage point increase compared to June 2022 (RBA 2023a).

#### Unemployment stayed low, wages increased but not in real terms

The unemployment rate has remained about 3.6% since June 2022, representing a tight labour market (ABS 2023f). Wage growth responded to a tight labour market and a higher inflation rate; increasing by 2.3% (ABS 2023a).

### Box 1 – Australia’s economy has changed since 2021-22

#### The trade surplus increased as exports strengthened

Exports of goods and services continued to increase for the fourth consecutive quarter in March 2023 – marking a 10.8% increase in exports since March 2022 (ABS 2023c). This was mostly driven by iron ore and traveling services for international students and visitors (ABS 2022c).

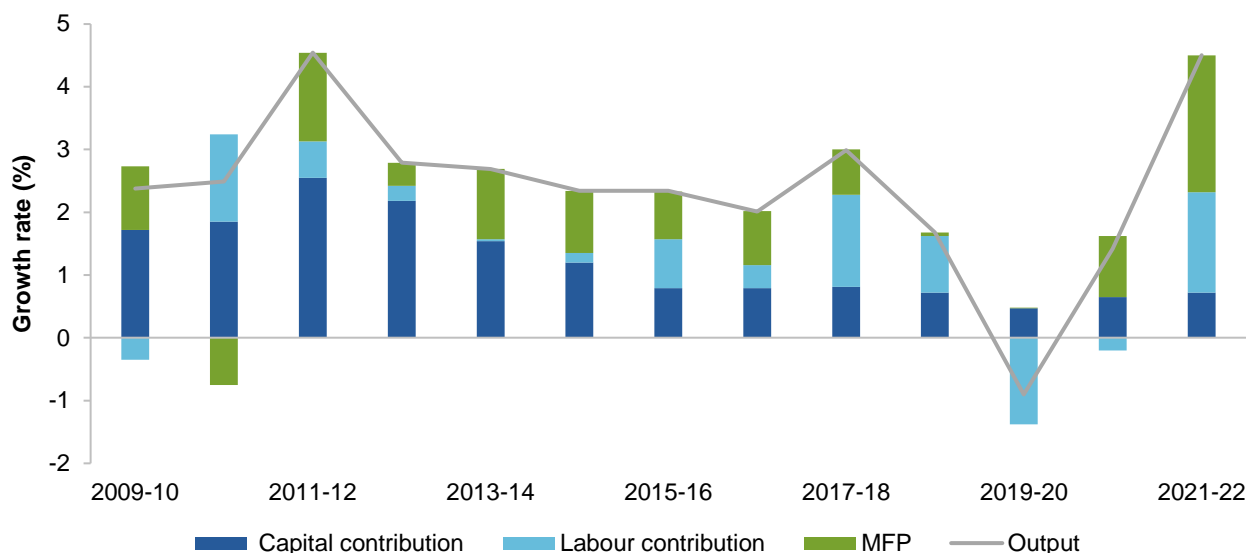
In contrast, imports of goods and services fluctuated. As a result of stronger exports, the trade surplus reached \$40.9 billion in December 2022, the second highest on record, which led to a \$14.1 billion surplus in Australia’s current account (ABS 2023b).

### Market sector output was driven by strong MFP growth

Strong MFP growth was the main driver of market sector output; accounting for nearly half of the 4.6% increase in output in 2021-22 (figure 2). Hours worked contributed to about a third of the increase, while capital services growth only contributed to about a fifth.

**Figure 2 – MFP growth drove market sector output**

**Contributions to market sector value added (output) growth from hours worked (labour), capital services (capital), and MFP between 2009-10 and 2021-22**



Source: ABS (Estimates of Industry Multifactor Productivity, 2021-22, Cat. no. 5260.0.55.002, table 2).

Further, the long-term decline of capital services contribution to output growth continued (figure 3). In 2021-22, the market sector – only for the second time since data was first recorded in 1994-95 – experienced capital shallowing; a decline in the capital-labour- ratio.<sup>5</sup> This might reflect a dampened capital investment environment

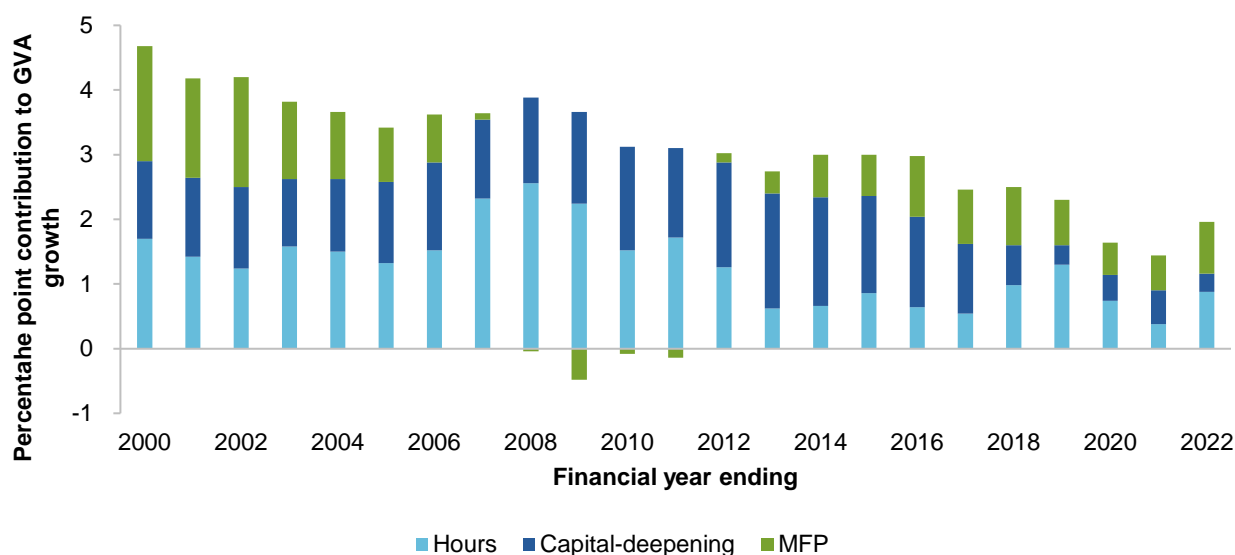
<sup>5</sup> The capital-labour ratio is an indicator of an economy’s ability to augment labour (ABS 2022b). Increases in the capital-labour ratio (capital deepening) means that, on average, each unit of labour has more capital to work with to produce output.



(section 3), or the distortionary effects from COVID-19.<sup>6</sup> Capital shallowing also led to a decline in the contribution of capital deepening to market-sector output growth; continuing a trend since 2013 (figure 3).

### Figure 3 – Capital deepening has continued to stagnate

Five-year rolling average growth of hours worked, MFP and capital deepening and their contribution to market sector GVA<sup>a</sup>



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

Source: ABS (2022, Australian System of National Accounts, 2021-22, Cat. no. 5204.0, table 13).

## Income growth was driven by a stronger terms of trade

Productivity growth is the main driver of long-term income growth.<sup>7</sup> For context, consider figure 4 which shows that income growth in Australia slowed from 2000-01 to 2015-16. It was primarily driven by a decline in labour productivity growth.

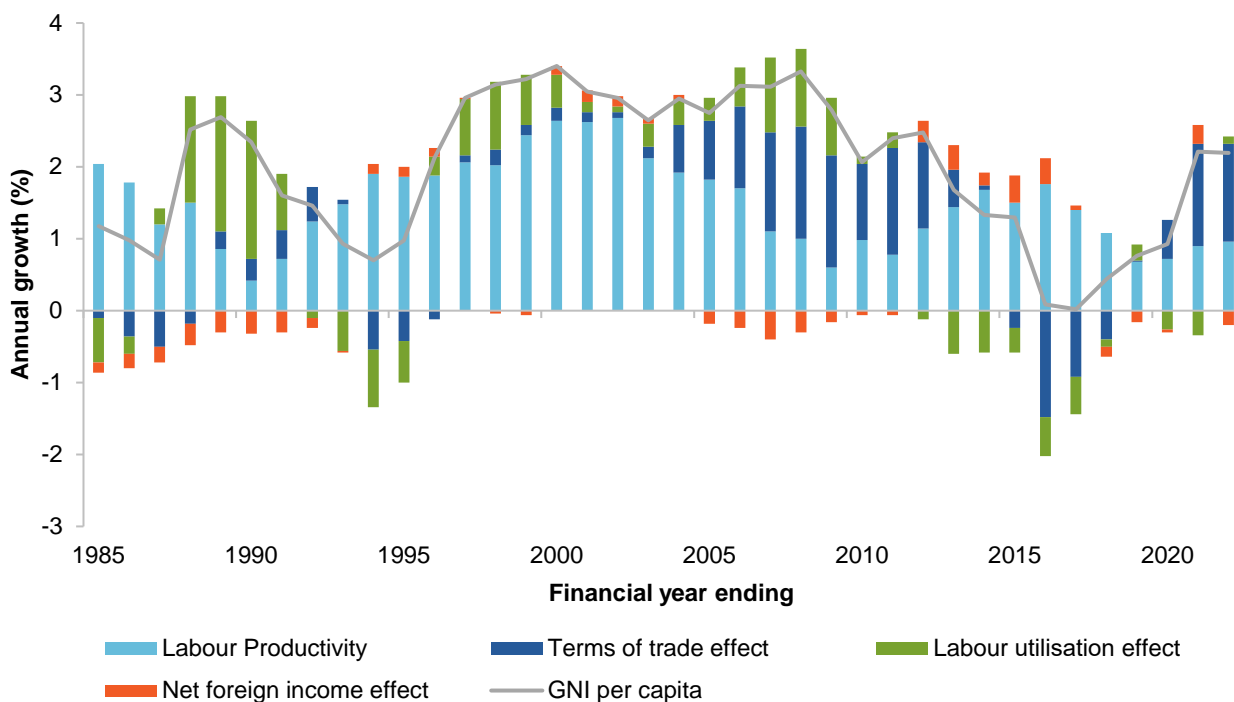
Despite relatively weak labour productivity growth in the past five years, income growth still increased (figure 4); this was due to improvements in the terms of trade over the past three years. While the terms of trade can increase real incomes in the short-term, improvements in labour productivity are important for sustaining any long-term increases in income (box 2).

<sup>6</sup> The capital-labour ratio assumes 100% capital utilisation, however, actual capital utilisation likely decreased during the beginning of the COVID-19 pandemic. In 2021-22 capital utilisation may have increased as the economy recovered, and hence, capital services might have increased at a greater rate than reported by the ABS, causing the appearance of capital shallowing. Further, labour hours increased by a large amount (3.1%), as workers returned to work following the COVID-19 pandemic, which also could have caused the appearance of capital shallowing.

<sup>7</sup> Examining the components of income growth over the past decades highlights the importance of productivity growth for the typical household (figure 4). Growth in incomes (GNI per capita) can be decomposed into the contributions from: labour productivity (production per hour); labour utilisation; the terms of trade (which boost the income from production); and the net flow of foreign income (the income from overseas assets owned by Australians minus the income paid to foreigners from domestic assets).

**Figure 4 – Strong terms of trade growth is driving faster income growth**

**Five year lagged average growth in gross national income and labour productivity, and the contributions from labour utilisation<sup>a</sup>, the terms of trade<sup>b</sup>, and the net inflow of foreign income<sup>c</sup>**



a. The effect of labour utilisation is defined as the difference between GDP per capita growth and labour productivity growth. b. The terms of trade effect is defined as the difference between GDI growth and GDP growth. c. The net foreign income effect is defined as the difference between growth in GNI and growth in GDI.

Source: Commission estimates using ABS (2022, *Australian System of National Accounts*, 2021-22, Cat. no. 5204.0, table 1).

**Box 2 – The terms of trade and income growth**

The terms of trade – the price of exports relative to imports – has increased since 2016-17. The terms of trade grew at 11.8% in 2021-22, which was greater than both the five-year and long-term average (table 1). Increases in the terms of trade have been linked to higher commodity prices – prices of coal were elevated over 2021-22, with annual exports of coal exceeding \$100 billion for the first time (ABS 2022c).

A rising terms of trade generally raises real income. For example, in the most recent mining investment boom (roughly 2001-02 to 2011-12), gross national income per capita increased almost three times as much as labour productivity (PC 2022, p. 14).

But changes in the terms of trade 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 (PC 2022, p. 14).

Thus, in the long term, wage increases are driven almost entirely by productivity growth (PC 2022, pp. 13–14).

## 2. Industry-level productivity performance

### Productivity increased in most industries, but some struggled

Although labour productivity increased across the market sector in 2021-22, outcomes varied by industry (table 2 and figure 5). The largest growth in labour productivity was in the agricultural industry at 13.7%. Four out of the 16 market sector industries decreased their productivity, with the largest decrease in mining (an industry that has performed poorly in terms of productivity growth in recent years).

MFP also varied by industry (table 2 and figure 5). Industries with high labour productivity growth also tended to experience relatively high MFP growth, as exemplified by the particularly strong growth in MFP in the agricultural industry – the largest growth across all industries. Three out of the 16 market sector industries decreased their MFP, with the largest decrease in mining.

### Some industries were outliers

**The agricultural, forestry and fishing** sector experienced the largest growth in productivity and output (table 2), while **the mining** sector recorded a fall in productivity and output for the second consecutive year. These two industries are discussed in section 3.

**The transport, postal and warehousing** sector recorded solid growth in output and productivity, reversing the declining trend from the previous five years.<sup>8</sup> Gross value added (GVA) rose by 9.3%, reflecting a strong recovery from the COVID-19-induced output falls in previous years (table 2); this included increased travel and freight services from strong online sales and a bumper grain harvest (ABS 2022b). GVA growth was driven by both a balanced increase in inputs (hours worked and capital services) and general productivity (labour productivity and MFP).

**The information, media and telecommunication** sector continued to maintain strong productivity growth in 2021-22. The GVA grew by 7.9%, supported by the completion of telecommunications infrastructure, the easing of COVID-19 restrictions, and increased remote working arrangements (ABS 2022b). A rise in GVA was accompanied by minimal growth in inputs – only a 1.8% increase in capital services and a 3.1% decrease in hours worked. This translated to a 7.5% increase in MFP and an 11.3% increase in labour productivity (table 2).

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<sup>8</sup> Flooding in the December 2022 quarter negatively affected transport output due to damaged road closures. This extended the delivery time and increased freight costs for transport (ABS 2023e). Consequently, road transport GVA declined 1.1% over the December 2022 quarter. On the other hand, flooding had limited effect on rails so rail, pipeline and other transport GVA continued to rise by 1.8%.

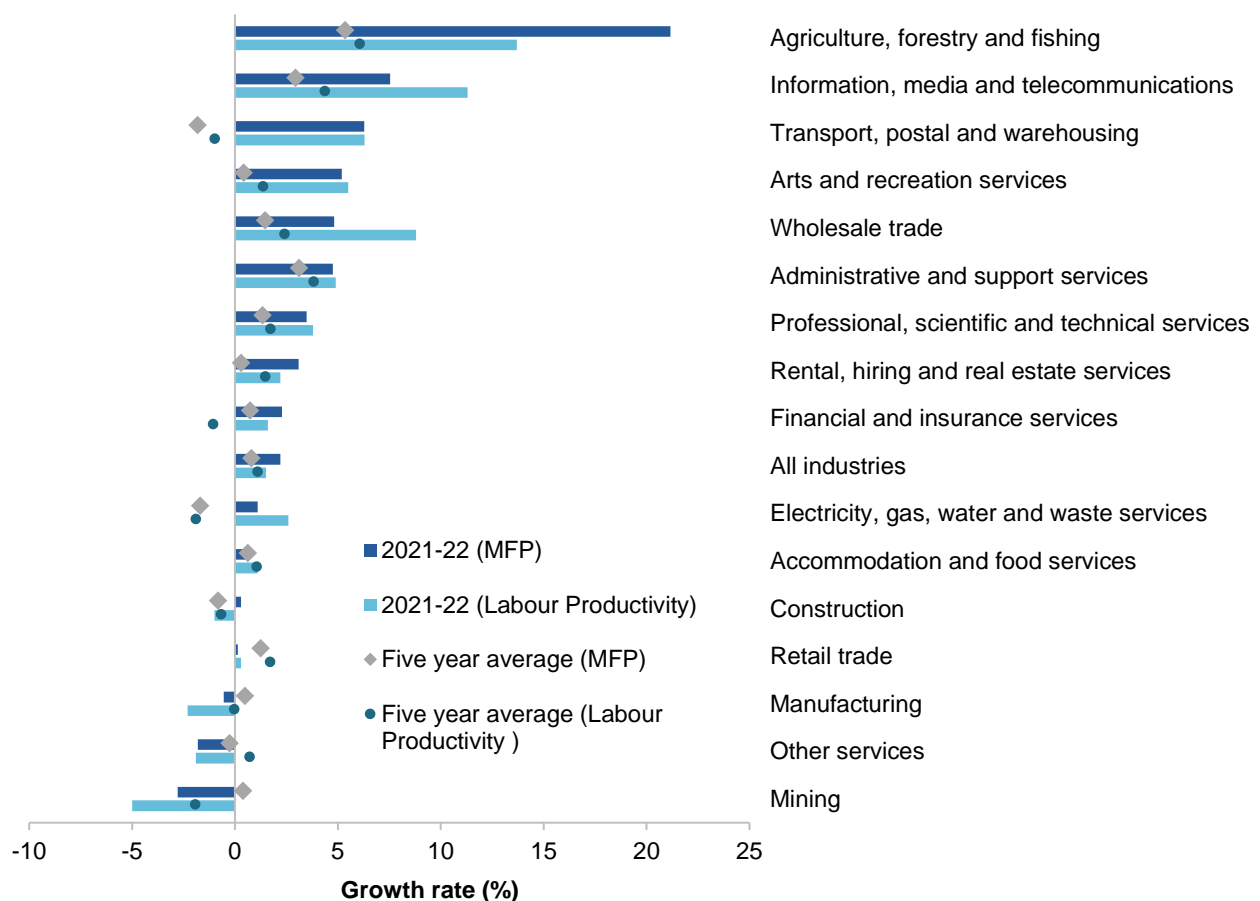
**Table 2 – Industry productivity growth, 2021-22<sup>a</sup>**

	Labour productivity %	MFP %	Hours worked %	Capital Services %	Output (GVA) %
<b>Market sector (16 industries)</b>					
Agriculture, forestry and fishing	13.7	21.2	8.5	-0.3	23.4
Information, media and telecommunications	11.3	7.5	-3.1	1.8	7.9
Wholesale trade	8.6	4.8	-6.8	2.5	1.3
Transport, postal and warehousing	6.3	6.3	2.9	2.9	9.3
Arts and recreation services	5.5	5.2	2.2	3.3	7.9
Administrative and support services	4.9	4.8	7	1.5	12.2
Professional, scientific and technical services	3.8	3.5	3.6	5.9	7.5
Electricity, gas, water and waste services	3.2	1.1	-0.1	2.6	2.5
Rental, hiring and real estate services	2.2	3.1	4.2	2.6	6.5
Financial and insurance services	1.6	2.3	0.8	-0.3	2.4
Accommodation and food services	1.2	0.5	-1.9	0.8	-0.8
Retail trade	0.4	0.1	2.6	3.4	3
Construction	-0.9	0.3	6.3	2.6	5.3
Other services	-1.9	-1.8	6.3	6.1	4.3
Manufacturing	-2.1	-0.5	5	0.4	2.5
Mining	-5	-2.8	3.9	1.2	-1.3
<b>Non-market sector</b>					
Public administration and safety	0.8	NA	0.1	NA	0.9
Education and training	-0.3	NA	1.7	NA	1.4
Health care and social assistance	4.8	NA	0.5	NA	5.4
<b>All industries</b>	<b>1.5</b>	<b>NA</b>	<b>2.5</b>	<b>NA</b>	<b>4.0</b>

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

Sources: estimates based on: ABS (2022, Australian System of National Accounts, 2021-22, Cat. no. 5204.0, tables 1, 5, 15, 46 and 58); ABS (2022, Estimates of Industry Multifactor Productivity, 2019-20, Cat. no. 5260.0.55.002, tables 1, 6 and 14).

**Figure 5 – There was a significant disparity in productivity growth across sectors**  
**MFP and labour productivity growth in market industries, 2021-22 and the five-year average**



Source: ABS (2022, *Australian System of National Accounts, 2021-22*, Cat. no. 5204.0, table 15).

### 3. Australia's recent productivity story

This section provides insights into the 2021-22 productivity story, including: the appearance of a productivity boom in the agricultural sector; the weak productivity performance of the mining sector; and the continued decline in capital deepening.

#### An apparent productivity boom in the agricultural sector

The agricultural sector experienced an output and productivity boom between 2020-21 and 2021-22 – both GVA and MFP increased by more than 20% for two consecutive years (table 2 and figure 6).

#### MFP growth did not represent better technology or efficiency ...

Changes in output growth in the agricultural sector are primarily driven by fluctuations in MFP growth (figure 6).<sup>9</sup> The volatility in MFP growth is unlikely to reflect the changes in technology, as technology improvements

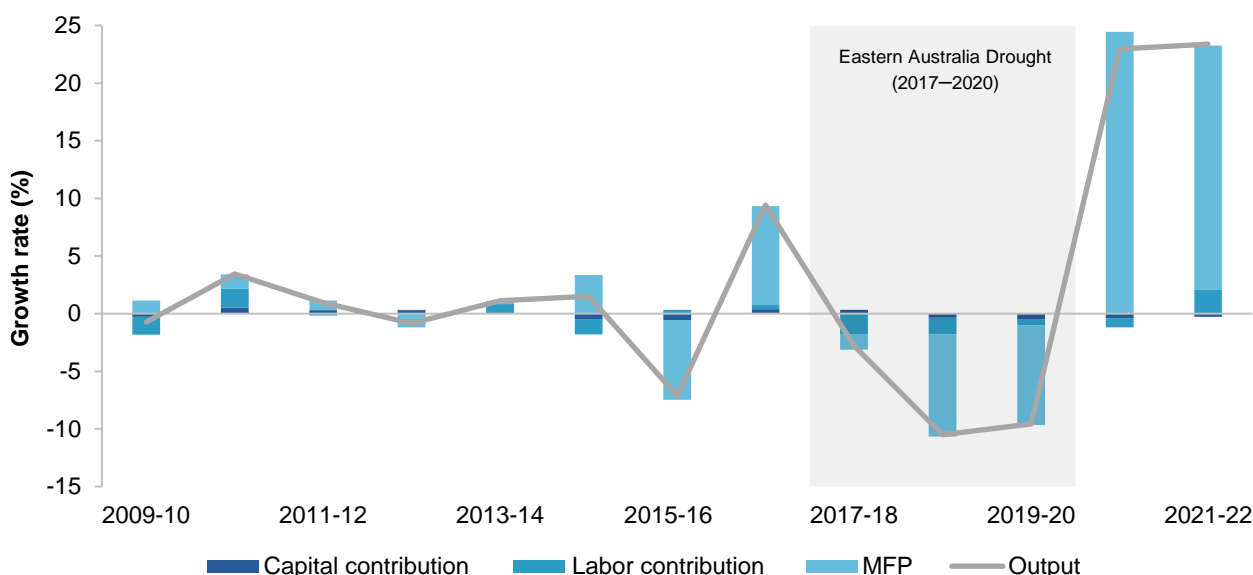
<sup>9</sup> Some of the potential MFP drivers for the agricultural sector are weather conditions, technological progress, government policy, market conditions and infrastructure (DAFF 2023).

tend to drive consistent MFP increases (PC 2021). Instead, external factors are more likely to be responsible for the fluctuations in MFP, and the subsequent changes in output growth.<sup>10</sup>

**... but instead reflected improved weather conditions**

Fluctuations in MFP growth in the agricultural sector primarily reflect weather conditions. Extreme weather conditions directly affect production and subsequently influence MFP measure, as output can vary significantly for a given amount of inputs. For example, the sharp decrease in MFP from 2017 to 2020 was due to the Eastern Australia drought (ABS 2020), while the surge in MFP from 2020 to 2022 were a result of plentiful rainfalls and minimal weather disruptions (ABS 2021, 2022b).

**Figure 6 – Output fluctuations in the agricultural sector are attributed to MFP growth**  
**Contribution to gross value added (output) growth in agricultural, forestry and fishing from hours worked (labour), capital services (capital), and MFP, 2009-10 to 2021-22**



Source: estimates based on ABS (Estimates of Industry Multifactor Productivity, 2021-22, Cat. no. 5260.0.55.002., tables 1-19); ABS (2022, Australian System of National Accounts, 2021-22, Cat. no. 5204.0, tables 64).

The current level of agricultural sector MFP is unlikely to be sustainable in the long term and will change with weather conditions. For instance, strong growth in the sector was disrupted by unfavourable weather conditions in the December 2022 quarter (growth decreased by 2.8%); this was due to severe flooding in regional areas of New South Wales, Victoria, South Australia, and Tasmania (ABS 2023e).<sup>11</sup>

<sup>10</sup> Furthermore, the labour productivity growth also remained weaker than MFP growth in the agricultural sector over 2021-22 (section 2), indicating capital shallowing (decreased quantities of capital per hour worked). Capital shallowing may affect future productivity growth for the sector.

<sup>11</sup> Nevertheless, the negative effects of the flooding are expected to be temporary, as the outlook for the agricultural sector remains positive in 2023 due to anticipated favourable weather conditions.

## Early signs of another mining boom?

The mining sector is a significant contributor to the Australian economy, representing 14.6% of GDP in 2023 (RBA 2023b). Despite the rise in mineral prices and sector profits, growth in real output and productivity has remained stagnant since 2016-17 (figure 7). This is primarily due to lower investment since the mining boom.

Some trends suggest the mining sector may be entering a new investment phase: there are higher commodity prices, low output growth, and increased investment in both capital and exploration. On the other hand, other factors, such as escalating uncertainty and increased competition in the global economy may impede investment growth, potentially hindering productivity and output growth in the coming years.

## Mining output growth before COVID-19 was driven mainly by earlier investment

The mining boom – a period of high mining commodity prices and investment activity – is generally categorised into three phases:

1. **price phase:** late 2004 to mid-2012, as indicated by the contribution of a rapid rise in commodity prices to the value of Australia's resources and energy exports (PC 2020, p. 17)
2. **investment phase:** late 2011 to late 2015, as firms increased capital investment to increase their productive capacity and capitalise on higher commodity prices (PC 2020, p. 17)
3. **production phase:** after the investment phase, firms seek to maintain their productive capacity (Jenner et al. 2018, p. 2); there would be lower output and investment growth.

The mining sector experienced continuous output growth over the last decade (pre-COVID) because of the mining boom (figure 7). This growth can be attributed to significant capital accumulation during the investment phase, where investment (gross capital formation) reached its peak during 2011-12.

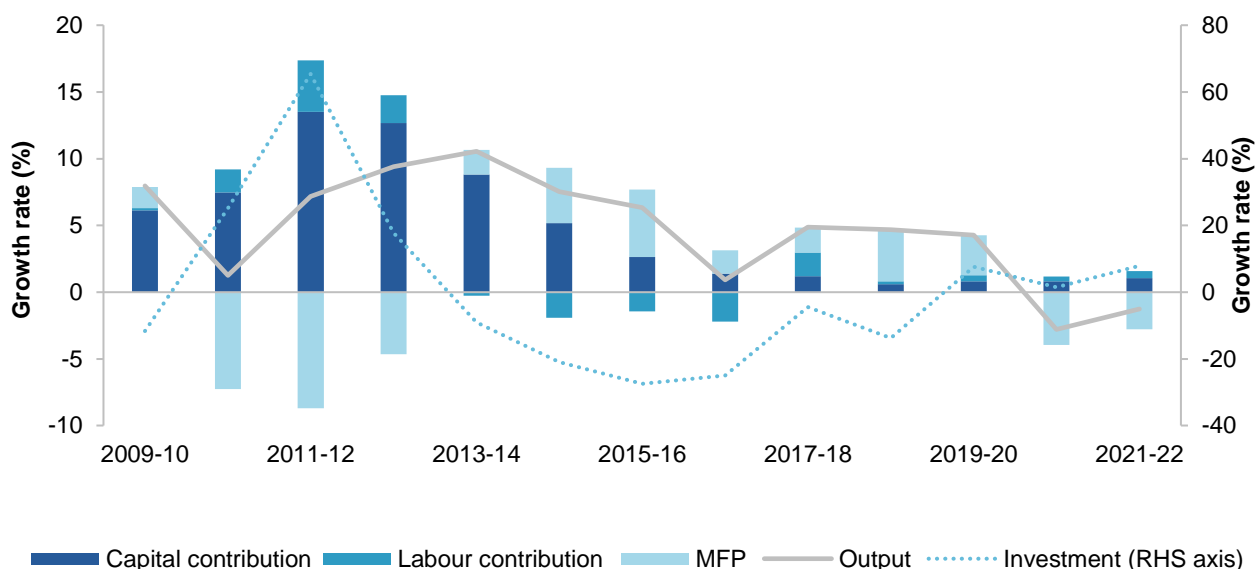
There is a delay between investment and the growth of capital and output, as it takes time to build large mining infrastructure facilities. This lag resulted in negative MFP growth between 2010-11 and 2012-13, during the peak of the investment phase, where output growth was slower than investment and capital input growth (figure 7). Two years after the peak of investment, MFP and output growth grew faster.<sup>12</sup>

## Mining output growth has stagnated since COVID-19

Unfavourable weather conditions and the COVID-19 pandemic caused a fall in output in 2020-21 – the first decline in mining output since 2003-4 (ABS 2022b). Heavy rain and floods disrupted mining operations, and the transportation network for coal movement and mining workers. Similarly, the COVID-19 pandemic also caused disruptions to output growth through increased absenteeism and productivity loss from long-covid (ABS 2022b). Weaker investment growth – relative to the investment peak – over the past decade also may have played a role in stagnating output growth. This resulted in decreased MFP and two consecutive years of output decline in 2020-21 and 2021-22 (figure 7).

<sup>12</sup> As the investment phase ends, commodity prices and mining investment should fall, while capital stock and volume of output increases (Jenner et al. 2018).

**Figure 7 – Stagnated capital growth dragged down output growth in mining sector<sup>a</sup>**  
**Contribution to gross value added (output) growth in the mining sector between 2009-10 and 2021-22**



a. Capital contribution = share of capital in combined input x capital service growth rate. Labour contribution = share of labour in combined index x hours worked growth rate. The share of labour and capital in combined input for each industry each year were derived from simultaneously solving two equations: share of labour in combined input + share of capital in combined input = 1 and share of labour x hours worked growth rate + share of capital x capital service growth rate = combined index growth rate.

Source: Estimates based on ABS (Estimates of Industry Multifactor Productivity, 2021-22, Cat. no. 5260.0.55.002., tables 1-19); ABS (2022, Australian System of National Accounts, 2021-22, Cat. no. 5204.0, tables 64).

### Will the increase in commodity prices drive up investment again?

Global commodity prices increased in 2020-21 and 2021-22. This was driven by the easing of COVID-19 restrictions and global supply constraints, which boosted demand for Australian commodities (ABS 2023b).

Historically, there is a strong positive association between the two-year lagged commodity price and capital investment in the mining sector (figure 8).

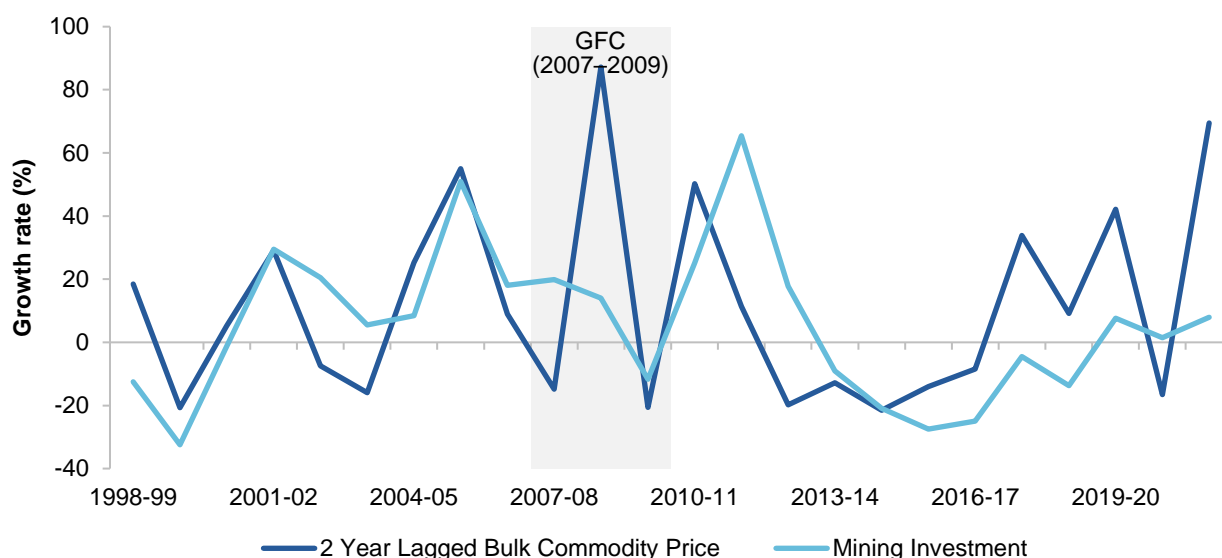
The strong growth in commodity prices in 2020-21 and 2021-22 led to increased investment, reversing the decreasing trend over the past 10 years. Although the increase in investment in 2021-22 (about 8%) was still far below the peak of the mining boom,<sup>13</sup> if commodity prices continue to remain high and stimulate further investment growth, the mining sector may enter a new investment phase and mining boom cycle.

Investment decisions are influenced by factors other than commodity prices. For example, during the Global Financial Crisis (GFC), the sharp rise in commodity prices did not lead to increased capital investment, potentially reflecting a riskier investment environment (figure 8). While the higher commodity prices during 2020-21 and 2021-22 encouraged increased investment in 2021-22, increasing economic pressures in Australia (box 1) may hinder future investment growth in the mining sector. Other factors such as the environmental concerns around fossil fuel investments (Antje 2022), the increased productive capacity globally, as well as an expected slowing in demand for iron ore and coal may also constrain investment (Jenner et al. 2018, pp. 2–3).

<sup>13</sup> Based on ABS data, current investment is still 62% below the investment peak reached during the mining boom.



**Figure 8 – Higher commodity prices drove up mining investment in subsequent years**  
**Growth in mining gross fixed capital formation (chain volume) and bulk commodity price index<sup>a</sup> (lagged by 2 years) between 1998-99 and 2021-22**



a. Bulk commodity here refers to iron ore, metallurgical coal and thermal coal.

Source: ABS (2022, Australian System of National Accounts, 2021-22, Cat. no. 5204.0, tables 64); RBA (2023, Commodity Prices, I2).

## The capital investment puzzle

Labour productivity has slowed over the past decades in Australia and other advanced economies (Hambur and Andrews 2023, p. 1; PC 2023b, p. 1). One explanation – in the Australian context – has been the slowdown in non-mining investment.<sup>14</sup>

### Non-mining capital investment has stagnated ...

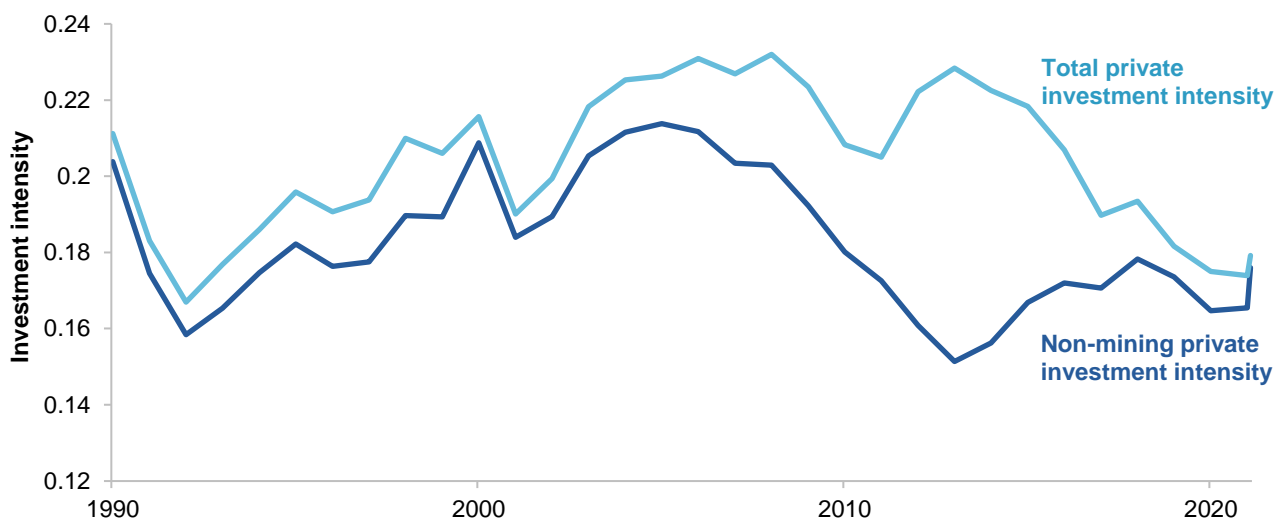
Investment intensity (the ratio of investment spending to GDP) provides a metric for strength of investment. Figure 9 shows that intensity of total private investment and non-mining private investment were aligned until 2004, which was the start of the mining boom. Non-mining investment intensity declined and then stagnated relative to previous decades after the GFC. This led to a fall in the non-mining capital intensity, and slower growth in the capital-labour ratio. Less growth in the capital-labour ratio (less capital deepening) can lead to lower labour productivity growth as workers have less capital to produce output with (Hambur and Andrews 2023, p. 3).<sup>15</sup> There is also some evidence that the investment slowdown was more prominent in more productive firms (Hambur and Andrews 2023, p. 2).

<sup>14</sup> Other explanations included lower job mobility from less to more productive firms (Hambur and Andrews 2023, p. 1).

<sup>15</sup> As suggested by (Hambur and Andrews 2023, p. 3), noting that in many ways, investment is a symptom of productivity growth as much as it is a cause (PC 2023a, p. 40).

**Figure 9 – Non-mining capital investment stagnated after the GFC**

**Total private investment intensity and non-mining investment intensity, current prices, 1990-91 to 2021-22<sup>a</sup>**



a. Total investment intensity = private gross fixed capital formation/GDP. Non-mining private investment intensity = (private gross fixed capital formation – mining gross fixed capital formation)/(GDP – mining gross value added). Capital intensity is the increase non-mining net capital stock divided/(GDP-mining GVA).

Source: Estimates based on ABS (2022, Australian System of National Accounts, 2021-22, Cat. no. 5204.0, tables 1, 5, 52, 56 and 58).

### ... but the stagnation is difficult to explain

Potential explanations for stagnating capital investment have included: structural changes to the economy; cyclical changes that affect investment decisions; and changes in the composition of capital. It is difficult to determine if there was a major driver; they all likely contributed to the decline.

#### Structural changes had a limited effect

Long-term structural changes will affect the nature and level of investment. For example, if an economy shifted away from investment-intensive sectors, such as manufacturing, towards less investment-intensive sectors, such as services, this could decrease capital investment (Hambur and Jenner 2019; PC 2023a, p. 45).

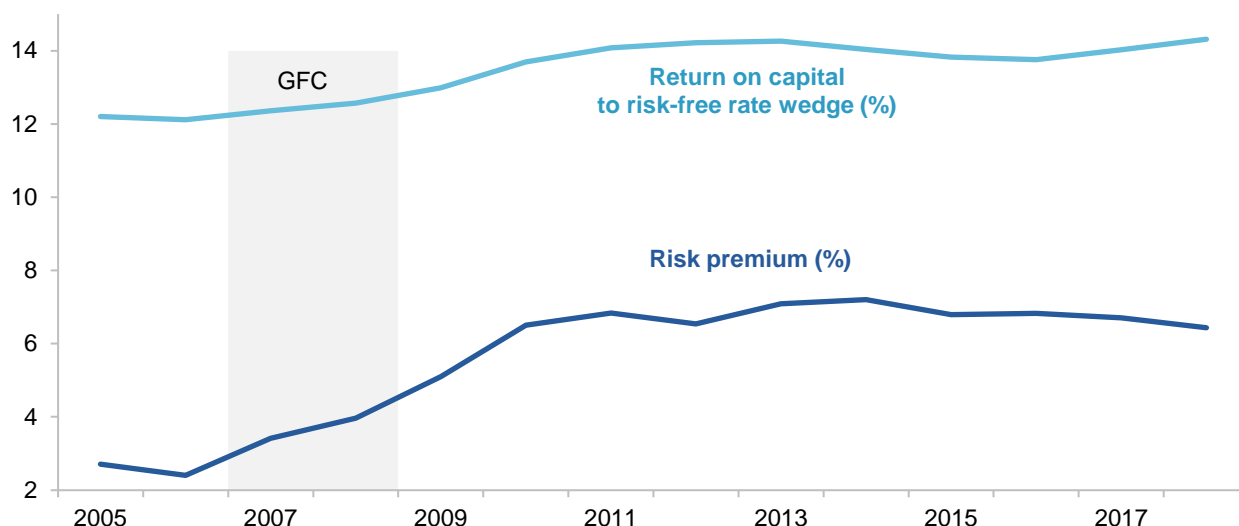
Evidence suggests that within sector rather than between sector changes could have led to the stagnation in investment. Or conversely that whole-economy changes that affected all industries led to the stagnation. This is because investment declined across firms regardless of their industry, age, or time of entry into the market (Hambur and Jenner 2019; van der Merwe et al. 2018, p. 5).

#### Rising risk and uncertainty after the GFC could have played a role

The relative fall in non-mining investment took place after the GFC, which could have affected investment decisions through rising risk and uncertainty.<sup>16</sup> Post-GFC real interest rates declined, which should have led to increased investment and lower returns to private capital; that is, assuming diminishing returns to capital. Instead, investment stagnated and returns to capital remained fairly constant, leading to a growing wedge between the risk-free rate and the return to capital, which increased from about 12% in the 2000s to 14% after 2010 (figure 10).

<sup>16</sup> The GFC could have affected investment decisions in other ways including: weak economic growth, reduced spillovers from the mining sector; or tightened financial conditions (Debelle 2017).

**Figure 10 – The wedge between the return on capital and risk-free rate increased<sup>a</sup>**  
**Five year rolling average**



a. Return on capital to risk-free rate wedge = marginal product of capital – risk-free rate. Marginal product of capital (based on Farhi and Gourio (2018)) =  $(1 - \text{labour share of income}) / (\text{capital stock} / \text{GDP})$ . Real risk free rate = two year bond yields (due to data constraints) – two year inflation expectations. The risk premium is estimated using the model in Farhi and Gourio (2018).

Source: Productivity Commission estimates based on ABS (*Australian National Accounts: National Income, Expenditure and Product, September 2021*, Cat. no. 5206, tables 1 and 56); ABS (*Estimates of Industry Multifactor Productivity, Australia*, 30 November 2020, Cat. no. 5260.0.55.002, table 2); RBA (*Capital Market Yields – Government Bonds, 2021*), RBA (Inflation expectations, 2021).

The larger wedge between the return to capital and the real interest rate could be attributed to factors such as changes in the opportunity cost of capital, increasing market power of firms, or changes to perceptions of risk (PC 2023a, p. 43). The Commission found that increases in the market risk premium (the additional return investors require to be compensated for taking on risk) was the main contributor to the growing wedge (research paper forthcoming). This means that for each dollar invested post-GFC, an investor required a larger rate of return to compensate for additional risk.

The growing risk premium could partly explain firms' higher required rate of return to invest, and therefore, the slowdown in capital investment.<sup>17</sup> There is also anecdotal evidence that firms were less willing to take risks and tightened investment criteria after the GFC (Debelle 2017).

### Changes in the composition of capital

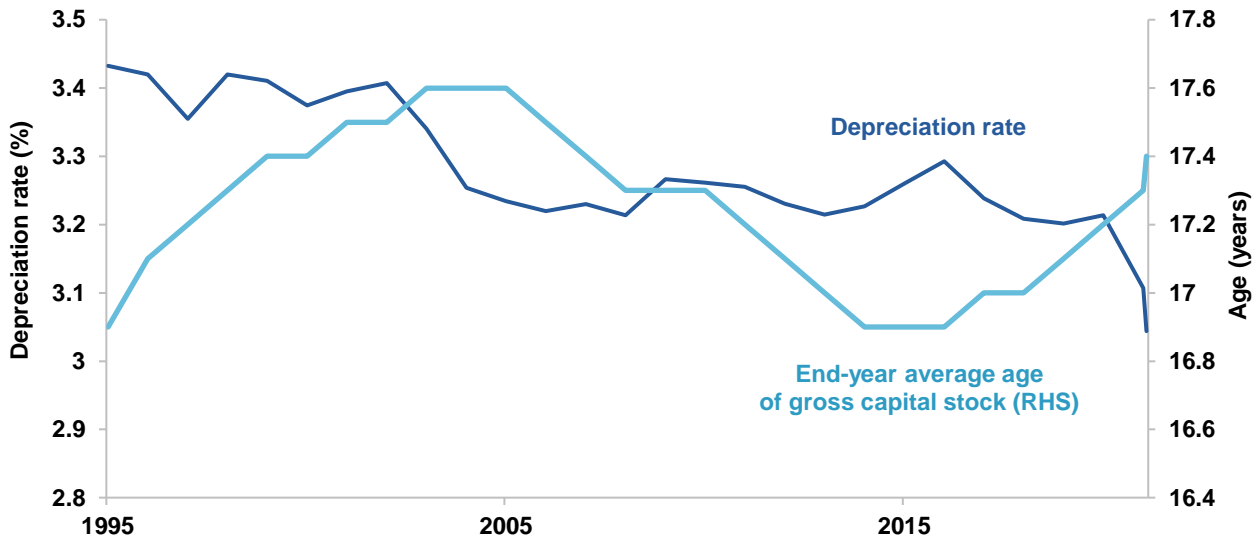
Compositional changes in the capital stock could have led to decreased investment.

Investment may be shifting towards longer lived- assets, such as buildings, which tend to have lower depreciation and replacement rates (Hambur and Jenner 2019). Data show that the age of capital stock has increased while depreciation rates have fallen since 2015 (figure 11); these trends are consistent with investing in longer-lived assets.<sup>18</sup>

<sup>17</sup> However, it is difficult to link a rising risk premium specifically to rising risk aversion from the investor; it may just reflect that economic environment is more uncertain.

<sup>18</sup> Although this could reflect other factors such as declining mining investment.

**Figure 11 – Capital investment could be shifting towards longer-lived assets**  
**Average depreciation rate and age of Australia’s gross capital stock<sup>a</sup>**



a. The depreciation rate was estimated by dividing consumption of fixed capital by the gross capital stock (current prices).  
 Source: Estimates based on ABS (2022, Australian System of National Accounts, 2021-22, Cat. no. 5204.0, table 57).

Other compositional changes, such as increased investment in intangible assets like data, could also be playing a role in slowing investment. Some intangible assets, such as data, are not included in the National Accounts’ measurement of investment, and therefore, could explain some of the decline in investment.

## Supporting material

### A primer on productivity

#### What is productivity?

Productivity measures the rate at which output of goods and services are produced per unit of input. It is calculated as the ratio of the quantity of output produced to some measure of the quantity of inputs used. Many factors can affect productivity growth such as: technological improvements, workforce skills, changes in other inputs (such as capital), competitive pressures and the business cycle.

#### What are the main measures?

Two metrics are commonly used to measure aggregate productivity. **Labour productivity** is the ratio of output to hours worked. Output is typically defined as gross value added (the total value of a firm's production minus intermediate inputs).<sup>19</sup> **Multifactor productivity** (MFP) is the ratio of output to a combined input of labour and capital. It is generally considered to be a better measure of technological change and efficiency improvements than labour productivity.<sup>20</sup>

#### What parts of the economy are we measuring?

The most accurate estimates of productivity are for those industries where prices are set in markets – known as the 'market sector' – and where it is therefore easier to measure output (in terms of real industry gross value added). This Bulletin provides estimates for the 16 market sector industries and the 3 non-market sectors industries. Both labour productivity and MFP measures are available.<sup>21</sup>

<sup>19</sup> Over the long term, wages generally grow in step with labour productivity (paper forthcoming).

<sup>20</sup> Usually, the growth in labour productivity exceeds the growth in multifactor productivity. The difference between the two is the contribution from 'capital deepening'. That is, the accumulation of more and better capital equipment over time helps to make workers more productive.

<sup>21</sup> Labour productivity can also be measured for the whole economy (in terms of real GDP per hour worked). Labour productivity measured in this way contributes to growth in living standards (commonly measured as GDP per capita) but is a poorer indicator of technological change and efficiency improvement because of the difficulty measuring output in health, education and public administration.

## Abbreviations

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<b>ABS</b>	Australian Bureau of Statistics
<b>CPI</b>	Consumer price index
<b>GDI</b>	Gross domestic income
<b>GDP</b>	Gross domestic product
<b>GFC</b>	Global financial crisis
<b>GNI</b>	Gross national income
<b>GVA</b>	Gross value added
<b>MFP</b>	Multifactor productivity
<b>RBA</b>	Reserve Bank of Australia

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