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RESEARCH PAPER

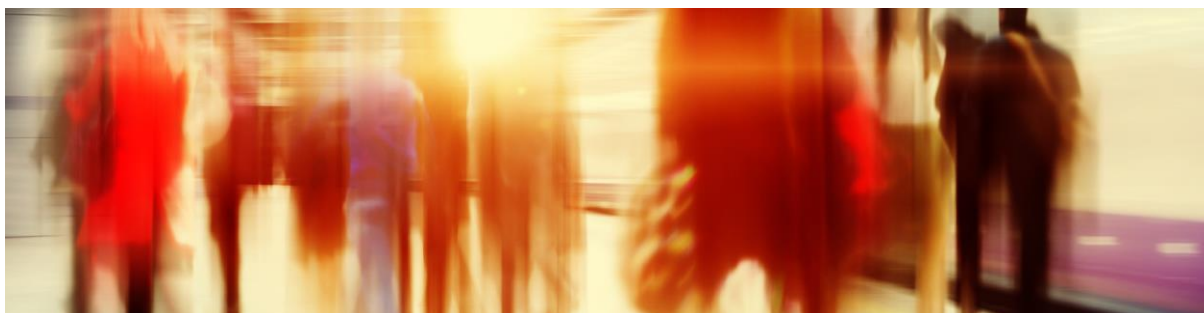
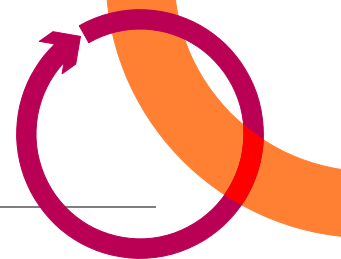
Productivity: Concepts, Measurement & Performance

December 2016

Table of Contents

FOREWORD	IV
PRODUCTIVITY: CONCEPTS, MEASUREMENT AND PERFORMANCE	V
1 PRODUCTIVITY CONCEPTS	1
1.1 What is productivity?	1
1.2 Why does productivity matter?	1
1.3 Determinants of productivity growth	3
2 MEASUREMENT OF PRODUCTIVITY	4
2.1 Indicators	4
2.2 Coverage and units of measurement	6
2.3 Limitations of measurement	6
3 QUEENSLAND PRODUCTIVITY PERFORMANCE	8
3.1 MFP and labour productivity	8
3.2 A global productivity challenge	11
3.3 Industry labour productivity growth	14
3.4 Productivity and growth in incomes	16
3.5 Productivity gaps and convergence	18
4 POLICY AND PRODUCTIVITY	24
4.1 Policy framework	24
APPENDIX A : GROWTH ACCOUNTING	26
APPENDIX B : PRODUCTIVITY AND COMPONENT INDICES	28
REFERENCES	29

The Role of the QPC



The Queensland Productivity Commission provides independent advice on complex economic and regulatory issues, and proposes policy reforms, with the goal of increasing productivity, driving economic growth and improving living standards in Queensland. Wide-ranging, open and transparent public consultation underpin these functions.

The Commission is an independent statutory body established under the *Queensland Productivity Commission Act 2015*.

The Commission's work encompasses four key streams:

- public inquiries into matters relating to productivity, economic development and industry in Queensland, as directed by the Treasurer
- advice and research on matters beyond a formal inquiry function
- advice and guidance to departments, including providing independent support and information on the quality of regulatory proposals
- investigation of competitive neutrality complaints about state and local government business activities.

The Commission operates on the principles of independence, rigour, responsiveness, transparency, equity, efficiency and effectiveness.

The Commission operates independently from the Queensland Government — its views, findings and recommendations are based on its own analyses and judgments.

The Commission has an advisory role. This means that it provides independent advice to the government that contributes to the policy development process — but any policy action will ultimately be a matter for the government.

Foreword

Welcome to the first paper prepared as part of the Commission's research program.

One of the Commission's functions is to undertake research on matters that support the goal of increasing productivity, driving economic growth and improving living standards in Queensland. As the key driver of long-term growth in real per capita incomes, productivity growth is vital to improve our living standards.

Given the importance of productivity growth and that we are named the Queensland Productivity Commission, it seems natural that our first research paper discusses productivity.

This paper is a 'primer' or introduction to measuring and interpreting productivity, and to some of the issues investigated in productivity studies. It summarises Queensland's productivity performance and places that performance in a national and international context.

There are many areas for further investigation including:

- industry productivity analysis and drivers of performance
- productivity gaps, convergence and implications for Queensland businesses
- capital measurement
- output measurement in those industries with a high proportion of government service provision, such as education and health
- policy drivers of improved productivity performance.

Future research papers will look at these and similar issues. The Commission's inquiries also provide an opportunity to examine Queensland's productivity performance in detail with, for example, the Commission's current inquiry into manufacturing in Queensland taking a closer look at manufacturing productivity performance and its drivers.

The core data used to construct state-level productivity estimates is released by the Australian Bureau of Statistics at the end of each year. The 2016 release will include experimental estimates of Net Capital Stocks by industry, by state, which should further our understanding of industry productivity performance in Queensland. Our intention is to publish an annual update discussing Queensland's productivity performance.

We would welcome your feedback on this publication.

Kim Wood
Principal Commissioner

Productivity: Concepts, measurement and performance

Key Points

- Productivity is, put simply, how efficiently inputs are used to produce outputs in the economy.
- Productivity growth is important as it is a major determinant of the growth in living standards.
- Between 1985–86 and 2014–15, Queensland’s multifactor productivity (MFP) grew annually by 1.0 per cent on average, compared with 0.6 per cent in the rest of Australia.
- From a peak in 2007–08, MFP in Queensland declined until 2010–11, with some subsequent recovery. For the rest of Australia, after a significant period of declining to stagnant growth, from 2010–11 improved MFP performance has returned MFP to the 2003–04 level.
- Internationally, many countries have recorded poor productivity performance over the last decade.
- The decline in MFP in Queensland over the last decade can, in large part, be explained by extended periods of drought, large investments in water and electricity infrastructure, large investments in mining, and in particular, the unprecedented level of capital investment associated with the LNG industry, and a decline in the quality of mining resources.
- Ultimately, productivity improvements at the economy-wide level will depend upon the actions of individual enterprises. The government can best support productivity growth by ensuring the overall policy framework:
 - promotes competition
 - enables firms to respond quickly to market forces
 - facilitates research and development
 - enhances human capital
 - ensures the availability of key economic infrastructure
 - maintains stable institutions.

1 Productivity Concepts

1.1 What is productivity?

Productivity is a commonly used term, but is often not well understood. It can mean different things to different people — for example, financial professionals may view productivity through a prism of revenue, costs and profit, whereas engineers consider productivity from a technical perspective, such as in terms of the operational capacity of plant and equipment.

In economics, productivity relates to the transformation of inputs into outputs. It is a measure of how efficiently resources are used in that transformation process, and is expressed in terms of the amount of output produced per unit of input consumed. Productivity is sometimes referred to as productive efficiency (Box 1).¹

In this context, productivity can be defined as:

the efficiency with which an entity such as a firm or industry, or at the aggregate level an economy, is using its resources (labour, materials and capital) in the production process to generate output in the form of goods and services.

Productivity is a relative concept and should not be confused with production. Productivity growth, or an improvement in productivity, implies that either:

- more output is produced with the same amount of inputs, or
- less inputs are required to produce the same level of output.

Accordingly, increased production does not necessarily result in productivity growth:

Productivity is about “working smarter”, rather than “working harder”.²

1.2 Why does productivity matter?

Productivity growth is the major determinant of long-term growth in living standards. As Paul Krugman famously noted:

Productivity isn’t everything, but in the long run, it is almost everything. A country’s ability to improve its standard of living over time depends almost entirely on its ability to raise output per worker.³

At an economy-wide level, productivity growth generates greater returns on total inputs and provides more income that can be made available for distribution to owners of those inputs.

For businesses, productivity growth improves profitability and enhances a firm’s competitive position in the market. It also potentially allows the firm to:

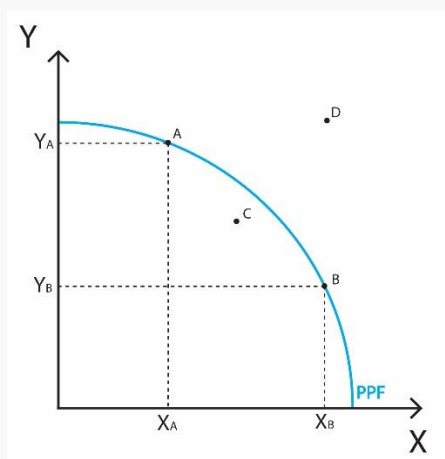
- offer higher wages and provide better working conditions for its employees
- increase its returns to shareholders
- fund investment in new capital
- reduce prices for customers of its goods and services.

Box 1: What is productive efficiency?

Productive efficiency is often measured with reference to a production possibilities frontier.

The production possibilities frontier identifies the potential output of a hypothetical firm, or group of firms within an economy (illustrated in Figure 1). This frontier represents the maximum amount of output that can be produced over a period of time, given a level of technology and available inputs. In this simple example, there are only two outputs — good X and good Y.

Figure 1 Production Possibilities Frontier



Points outside the frontier, such as D, represent combinations of output that are unobtainable, given technology and input limitations.

At points along the frontier, such as at A or B, the firm or economy is productively efficient. It is using an optimal combination of labour and capital to maximise output at least cost, given available technologies. At these points, it is not possible to produce more of one good without producing less of another.

Within the frontier, such as at point C, the firm or economy is not productively efficient. Excessive inputs are being used to produce output. By reallocating resources and making use of existing technologies in a more efficient manner, more could be produced overall, and the firm or economy could move towards the frontier.

Productivity growth arises from:

- the movement of the firm or economy towards its potential
- growth in the productive potential of the firm or economy, resulting in an outward shift of the production possibilities frontier, and allowing more output to be produced from a given amount of inputs.

The closer a firm or economy is to its potential, the greater will be its reliance on technological progress to improve its productivity.

For households, higher incomes allow individuals to increase their consumption of goods and services, and improves social outcomes.

In addition, greater income accruing to owners of capital, labour and other inputs generates additional tax revenue for governments, which allows them to provide additional services, build new infrastructure and fund new social and environmental programs.⁴

1.3 Determinants of productivity growth

The primary driver of productivity growth is technological progress, arising from technical and organisational innovation. This innovation is the product of new ideas and knowledge, which are often generated by research and development. Market-leading organisations are distinguished by their ability to acquire knowledge and apply it to their own circumstances.⁵

At the level of the firm, technological progress comprises:

- investment in new capital and equipment that incorporate advances in design and quality, such as faster computers or more powerful machinery. This is referred to as *embodied* technological progress, and
- changes in the organisation of inputs, such as new processes, management practices, organisational structures and work practices. These factors improve productivity independently of capital accumulation, and are referred to as *disembodied* technological progress.

The information and communication technology (ICT) revolution of recent decades has been the principal source of productivity growth for firms, as more powerful computer-based hardware and other digital technology has been integrated into new streamlined production processes.

Individual businesses can also improve their productivity and profitability by making use of scale economies. As the firm expands in size, it can adopt a different technology or organisational arrangement to lower its unit production costs.

At the national level, productivity growth is driven by the diffusion of knowledge as rival firms copy the innovations of efficient market leaders, in seeking to preserve their market share. These knowledge spillovers can occur through:

- firms adopting innovations in the production of goods and services
- workers moving from one firm or industry to another.⁶

National productivity growth is further enhanced by competitive forces that reallocate resources from less productive to more productive organisations and industries. As new more innovative businesses enter the market, less efficient firms that rely on legacy technology must either innovate, cede market share, or close down.

2 Measurement of productivity

2.1 Indicators

There are different measures of productivity and the choice among them generally depends upon the purpose of use, and the availability of data. Productivity measures can be single-factor (or partial) indicators, which quantify the relationship between output and one particular input (such as labour, capital or energy) or multi-factor indicators, which account for multiple inputs.

The two most common productivity measures are:

- labour productivity, measured as output per unit of labour input (hours worked)
- multifactor productivity, measured as output per unit of combined inputs of capital and labour

Total factor productivity (TFP) is a comprehensive measure that takes collective account of the contribution of all inputs used in the production process. It identifies the growth in output relative to the combined growth in all inputs. The use of TFP is limited in practice because of the difficulties in effectively measuring all input categories, in particular intermediate inputs.

2.1.1 Labour productivity

Labour productivity is calculated as:

$$\frac{\text{units of output produced}}{\text{units of labour employed}} = \text{real gross domestic product (GDP) per hour worked.}$$

It is usually expressed as a growth rate.

Labour productivity measures efficiency in the use of labour. To the extent that output increases through the addition of labour in production, this statistic identifies the increase in output that is not attributable to that additional labour input.

An increase in labour productivity implies that an hour of work produces more output than it did previously, or that the same amount of output is obtained from fewer hours of work.

The widespread use of labour productivity is largely due to the importance of labour in the production process, and the statistic's simplicity and ease of measurement — with labour force data being readily available at the national and state levels.

As labour productivity growth has a close relationship with wages growth, it is considered to be an indicator of an overall improvement in the standard of living.

Even so, labour productivity measures may be misleading.⁷ Rather than quantifying the specific contribution of labour to output growth, the statistic attributes changes in efficiency to all factors of production. In this context, labour productivity is not a pure measure of input efficiency. For example, labour productivity is affected by:

- changes in the efficiency with which labour and capital are combined
- changes in the amount of available capital per worker (referred to as capital deepening).

Accordingly, labour can become more productive due to a greater use of capital in production, in addition to a greater intensity of work effort.

2.1.2 Multifactor productivity

Multifactor productivity (MFP), which accounts for the contributions of a subset of inputs (capital and labour), reflects the general efficiency with which capital and labour are used together to produce outputs.

Estimates of MFP are not impacted by the amount of labour and capital used in production. Rather, MFP reflects the influence of all other factors that determine how efficiently capital and labour are combined. It is a measure of disembodied technological progress.

MFP is generally estimated as a growth rate using a 'growth accounting' framework.¹ This framework recognises that economic growth, in terms of higher output, arises from:

- greater utilisation of labour and capital in the production process, and/or
- greater efficiency in how these inputs are combined, and
- splits output growth into contributions from these sources.

MFP is measured as the growth of output over and above the growth of inputs. An increase in MFP implies that new technology or work practices, for example, have resulted in greater output being produced from the same level of capital and labour inputs.

Importantly, while growth accounting identifies relevant sources for productivity growth, the framework does not provide an explanation for underlying growth in the employment of capital or labour, or in the level of technology.

2.1.3 Relationship between MFP and labour productivity

As noted, labour productivity should not be considered an indicator of the capacity of labour or the intensity of work effort, as its name implies. Rather, it measures the joint effect of influences which impact upon the use of labour, and is the sum of:

- innovation and technology-related factors which contribute to MFP growth
- capital deepening.

In this context, labour productivity and MFP are closely linked.

MFP is generally considered to be a superior measure of productivity because it is not distorted by substitutions between capital and labour inputs. In this context, MFP is more consistent with the notion of productive efficiency.⁸ Moreover, as it is able to provide a more comprehensive explanation as to the sources of output growth, MFP is more commonly used in rigorous productivity analysis.⁹

2.1.4 Productivity levels and growth rates

There is often confusion between productivity levels and the rate of productivity growth. To clarify:

- the calculation of labour productivity and MFP provides estimates for the level of productivity, while
- growth rates in productivity, expressed as the percentage change in the level of productivity over time, are used in the analysing trends or performance over time.

¹ The growth accounting framework is discussed in more detail in Appendix A.

2.2 Coverage and units of measurement

The OECD released a best practice guide to measuring productivity in 2001.¹⁰ The Australian Bureau of Statistics' (ABS) framework and approach to estimate productivity, set out in Australian National Accounts: Concepts, Sources and Methods,⁹ aligns with the OECD method.

The ABS estimates of MFP at the national and industry level are confined to a subset of the economy, known as the market sector. This subset comprises 16 industries under the Australian and New Zealand Standard Industrial Classification 2006,² which account for around 80 per cent of national output.⁹ A characteristic of market sector industries is that the exchange of goods and services take place in markets at observable prices.

Data limitations for industries in the non-market sector,³ the majority of which are associated with the provision of government services, preclude their inclusion in MFP calculations.

In contrast, the ABS publishes labour productivity estimates for all industries — the market sector the non-market sector and for the entire economy.

Output volumes are measured in real value-added terms — that is, gross production less the value of intermediate inputs (such as materials, energy and business services used in the production process), deflated by a relevant price index. The volume of output for the economy is determined as the sum of each of the 16 industry outputs.

For partial indicators of productivity, only a single input measure is required. For:

- *labour productivity*, the labour input measure is hours worked
- *capital productivity*, the capital input measure is the flow of capital services delivered by the capital stock.

In estimating MFP, labour and capital inputs are combined into a single index measure, with weightings based on the factor income share of each input.

At the state level, in 2013, Queensland Treasury published estimates of MFP for Queensland and 'the Rest of Australia' for the period 1985-86 to 2011-12.¹¹ Its estimation method was generally consistent with the framework and approach of the ABS.¹²

2.3 Limitations of measurement

Whereas productivity statistics attempt to measure technical progress, in practice they measure the difference between the growth in volume of output and growth in the volume of inputs. Because it is calculated as a residual, MFP will capture the influence of many factors — not just disembodied technological change.

² Agriculture, forestry & fishing, Mining, Manufacturing, Electricity, gas, water & waste services, Construction, Wholesale trade, Retail trade, Accommodation & food services, Transport, post and warehousing, Information, media & telecommunications, Financial & insurance services, Arts & recreation services, Rental, hiring & real estate services, Professional, scientific and technical services, Administrative & support services, Other services.

³ Public administration & safety, Education & training, Health care & social assistance, Ownership of dwellings.

In this context, the Australian Bureau of Statistics noted that:

while the definition of productivity and related concepts sounds simple and clear, in practice it is very difficult for statistical agencies to derive perfect measures of productivity performance for their national economies.¹³

Key measurement issues for MFP include:

- variations in the utilisation of capital as production fluctuates across the business cycle
- the lumpiness of large capital projects creating lags between the time of capital construction (when the capital input is measured) and the time of its utilisation in production (when it actually provides capital services)
- the absence of comprehensive price indices for investments in determining the real capital stock, which may result in the capital services input being over or under-estimated
- the impact of unmeasured inputs, such as natural resources
- difficulties in adjusting inputs and outputs for changes in quality.

MFP point estimates are also influenced by other random events, such as economic shocks and adverse weather events.

Driven by these factors, measured productivity will fluctuate. This volatility complicates assessments of productivity performance, making it difficult to conclusively identify trends in productivity growth from short term 'noise'.

As a result, the ABS notes that any analysis of productivity changes should be conducted over an extended period.¹³ This allows the analysis to consider underlying real productivity growth and abstract away from short run changes which may be heavily influenced by random events or other 'noise'.

A common approach is to divide the time series of productivity estimates into productivity growth cycles, defined by successive peaks in the statistics. By averaging growth rates of MFP across each cycle, the impact of cyclical and other transient factors can be mitigated.

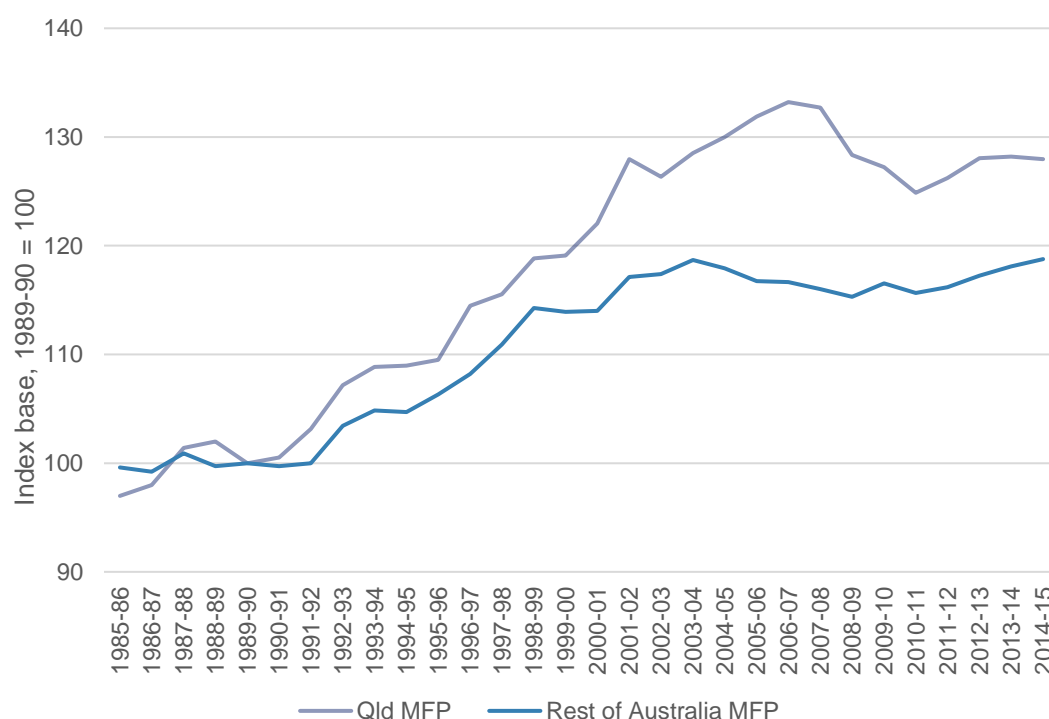
3 Queensland productivity performance

3.1 MFP and labour productivity

Over the three decades to 2015, Queensland MFP grew faster than the rest of Australia. From the peak in 2007–08, MFP declined in Queensland to 2010–11, with some subsequent recovery. For the rest of Australia, MFP growth has been stagnant from the early to mid-2000s, with recent growth returning MFP to the level it was in 2003–04 (Figure 2).⁴

Some of the weakness in measured MFP was due to extended periods of drought, large investments in water and electricity infrastructure, large investments in mining, in particular the unprecedented level of capital investment associated with the LNG industry, and a declining quality of mining resources.

Figure 2 Queensland and Rest of Australia (ROA) MFP growth, 1985–86 to 2014–15



Notes: Based on a capital services index constructed following the method in OESR (2011).¹²

Sources: ABS 2015 (Cat. No. 5220.0); and QPC calculations.¹⁴

Over the periods 2001–02 to 2007–08 and 2007–08 to 2014–15, Queensland capital services grew at an average rate of 7.2 and 5.8 per cent per annum respectively, compared to 5.9 and 4.8 per cent per annum for the rest of Australia. Much of the growth in Queensland capital services was driven by mining-related investment, often entailing significant lead times before mining output increases to the point where utilisation of the new assets reaches an ‘average’ capacity utilisation

⁴ On 18 November 2016, the ABS released state accounts data for 2015–16, which has not been incorporated into this paper. For the purpose of constructing state productivity estimates, it is prudent to use data with a reasonable lag as later revisions to data can affect short-term outcomes. More generally, and as discussed earlier in the paper, productivity performance is best analysed over cycles. That said, a preliminary examination of the 2015–16 data indicates an uptick in Queensland’s MFP growth rate and a continuation of the improved MFP performance experienced over the last few years for the rest of Australia.

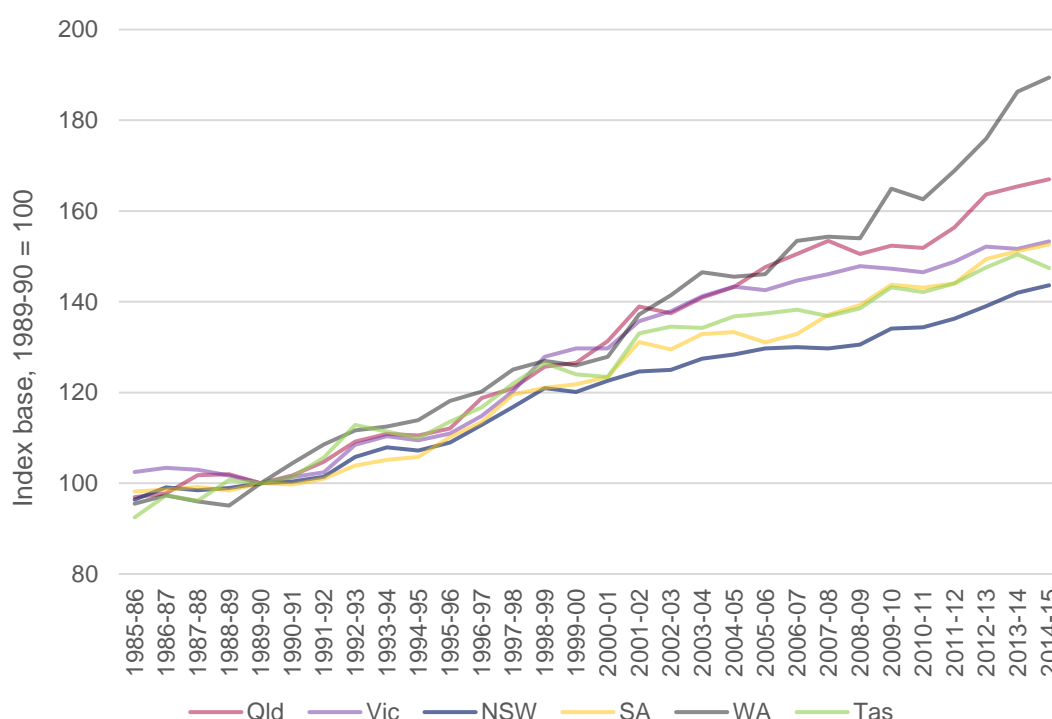
level. For example, after over four years of construction, Queensland's LNG plants in Gladstone began exports in 2015, with utilisation expected to ramp-up to a more normal operating level in 2016–17.

The recent commencement of LNG exports and the completion of the LNG investment phase is likely to make a strong, positive contribution to MFP growth from 2015–16, through the combination of higher growth in outputs and lower growth in capital inputs.

All Australian states recorded large increases in labour productivity over the period 1985–86 to 2014–15. The rate of growth differs across states, with Queensland and Western Australia achieving the highest growth rates, and New South Wales growing the slowest (Figure 3).

Labour productivity, MFP, output, hours worked and capital services indices are provided from 1985–86 to 2014–15 in Appendix B.

Figure 3 State labour productivity growth, 1989–90 to 2014–15



Note: Measured as output (value added) per hour worked (no adjustments made for changes in labour quality).

Sources: ABS 2015 (Cat. No. 5220.0); and QPC calculations.¹⁴

Recent growth in labour productivity performance has been moderate. From 2007–08, each Australian state except Western Australia recorded labour productivity growth less than half that recorded over its fastest growing cycle — between 1996–97 and 2001–02 (Table 1).

MFP growth has been weak both in Queensland and the Rest of Australia since the early 2000s, although improving since 2010–11. In Queensland, as discussed above, weak growth in measured MFP has been in part due to strong capital investment in utilities and mining, with the benefits of those investments (the increased output) expected to be realised in later periods. Over the longer period from 1985–86 to 2014–15, MFP growth has averaged 1.0 per cent per annum in Queensland versus 0.6 per cent per annum in the rest of Australia.

Table 1 Queensland and Australia productivity compound annual growth rates

<i>Jurisdiction</i>	<i>92–93 to 96–97 (%)</i>	<i>96–97 to 01–02 (%)</i>	<i>01–02 to 07–08 (%)</i>	<i>07–08 to 14–15 (%) ^a</i>	<i>85–86 to 14–15 (%)</i>
Labour productivity					
<i>Queensland</i>	2.1	3.2	1.7	1.2	1.9
ROA ^b	1.6	2.6	1.1	1.7	1.6
NSW	1.6	2.0	0.7	1.5	1.4
Vic	1.4	3.4	1.2	0.7	1.4
SA	2.2	2.9	0.8	1.5	1.5
WA	1.9	2.7	2.0	3.0	2.4
Tas	0.8	2.7	0.5	1.1	1.6
ABS market sector	na	3.1	1.5	2.1	na
ABS selected industries	3.2	3.2	2.0	2.4	2.5
MFP					
Queensland	1.7	2.3	0.6	–0.5	1.0
ROA	1.1	1.6	–0.2	0.3	0.6
ABS market sector	na	1.7	–0.1	0.1	na
ABS selected industries	2.3	1.7	0.4	0.0	0.9

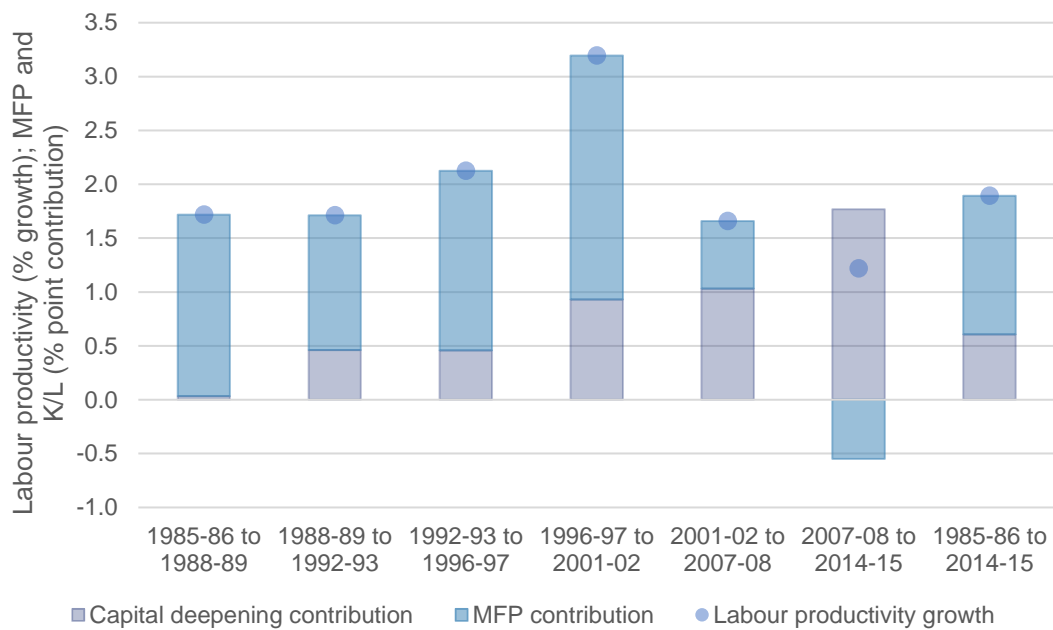
a Incomplete cycle. *b* ROA includes territories.

Notes: Periods based on Queensland productivity cycles, with 2007–08 to 2014–15 an incomplete cycle. The market sector as defined by the ABS includes 16 industries. The ABS also produces productivity statistics for what is called 'selected industries', which provides longer time series for 12 industries. National growth rates are based on the hours worked indices that are not quality adjusted.

Sources: ABS (Cat. Nos. 5204.0 and 5220.0); and QPC calculations. ^{14,15}

From 1985–86 to 2014–15, Queensland's labour productivity grew at an annual average rate of 1.9 per cent. Of this growth rate, MFP contributed 1.3 percentage points and capital deepening contributed 0.6 percentage points (Figure 4). Both capital deepening and MFP growth have made important contributions to Queensland's labour productivity growth.

The relative contributions of MFP and capital deepening has varied significantly over productivity cycles. Over some cycles, labour productivity growth is almost fully explained by capital deepening, while the contribution from MFP growth dominates other cycles.

Figure 4 MFP and capital deepening contribution to Queensland's labour productivity growth

Notes: Periods based on Queensland productivity cycles. 2007–08 to 2014–15 is an incomplete cycle.

Sources: ABS 2015 (Cat. No. 5220.0); and QPC calculations.¹⁴

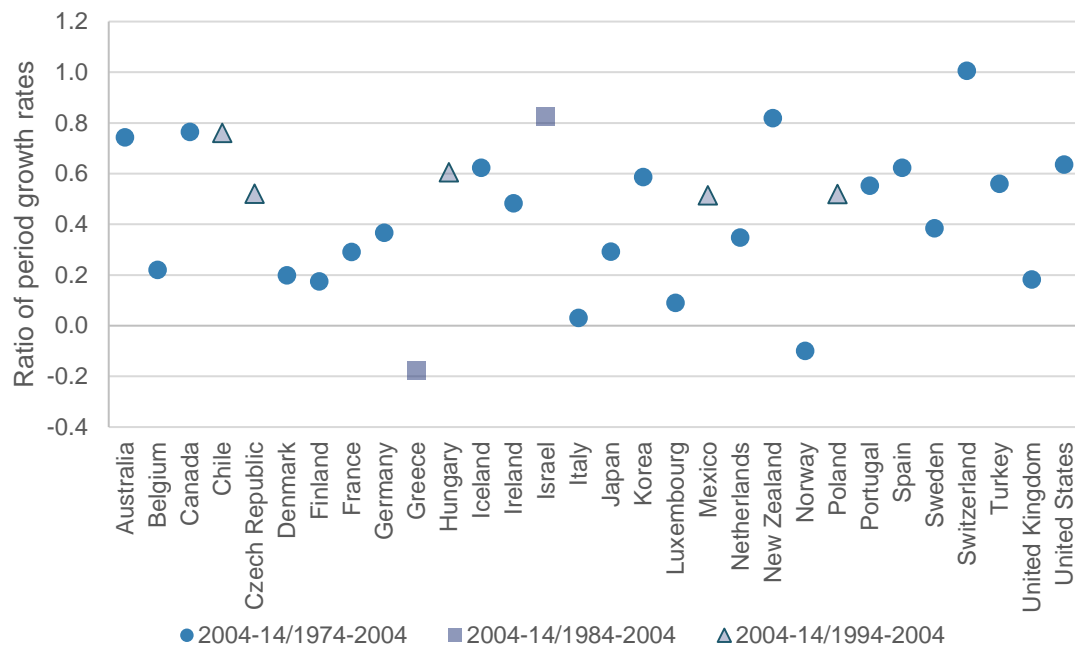
3.2 A global productivity challenge

Many countries have recorded poor productivity performance over at least the last decade. The Australian Productivity Commission recently commenced a review to develop and prioritise reforms to improve the wellbeing of Australians by supporting greater productivity growth. It noted:

There is a justified global anxiety that growth in productivity — and the growth in national income that is inextricably linked to it over the longer term — has slowed or stopped. Across the OECD, growth in GDP per hour worked was lower in the decade to 2016 than in any decade from 1950.

Australia is no stranger to this trend. While labour productivity gets much of the focus year on year, it is multifactor productivity ('doing things better') that has delivered strong long-run economic growth. But no longer. Since 2004, multi-factor productivity has stalled, here and around the developed world. This is a long enough period to suggest something is seriously awry in the economic fundamentals and the consequent generation of national wealth and individual opportunity.¹⁶

Over the period 2004 to 2014, labour productivity growth in every country in Figure 5, other than Switzerland, grew more slowly than in earlier periods. Fourteen of thirty countries experienced growth at less than half of the rate of earlier periods. For example, average growth in labour productivity for Denmark over 2004 to 2014 was roughly 20 per cent of that recorded over 1974 to 2004 (shown as a ratio of 0.2).

Figure 5 Ratio of recent country labour productivity performance to earlier periods

Notes: The length of time series varies by country. Growth in GDP per hour worked for the period 2004 to 2014 is compared to growth for the longest available earlier period (1974–2004, 1984–2004 or 1994–2004). A ratio of less than one indicates that growth over 2004 to 2014 was less than the longest available earlier period for the country. Greece and Norway recorded negative average growth over the 2004–14 periods, hence their ratio is less than zero.

Sources: OECD Productivity Database;¹⁷ and QPC calculations.

MFP growth has been stagnant for many countries for at least the last decade, or has grown at a rate that is generally significantly below the country's long-run average annual growth rate (measured from 1984–85 to 2013–14). A number of countries, such as, Denmark and Italy have experienced declining MFP over 2003–04 to 2013–14 (Table 2). Poor MFP performance has contributed to reduced labour productivity growth:

Over the past two decades, MFP growth varied considerably among OECD countries. Italy and Spain recorded the lowest (and negative) rates, lagging far behind the top performers Korea and Ireland. MFP growth decelerated in nearly all countries after the [Global Financial Crisis] compared with the period 2001–2007, with significant slowdowns in Finland, Sweden and the United Kingdom... Large differences in MFP growth heavily affected labour productivity growth differentials. Prior to the crisis, relatively high MFP growth in most OECD countries contributed strongly to labour productivity growth, compared with the contributions of ICT and non-ICT capital deepening.¹⁸

Table 2 International average annual MFP growth rates by period

<i>Country</i>	<i>1984–1994 (%)</i>	<i>1994–2004 (%)</i>	<i>2004–2014 (%)</i>	<i>1984–2014 (%)</i>
Australia	0.5	1.3	0.2	0.9
Austria	na	1.1	0.4	na
Belgium	1.4	0.5	0.0	0.9
Canada	0.3	0.8	0.4	0.6
Denmark	1.2	0.4	–0.1	0.8
Finland	1.8	1.8	0.1	1.8
France	1.3	1.0	0.2	1.2
Germany	1.6	0.8	0.5	1.2
Italy	1.1	0.2	–0.4	0.7
Japan	2.0	0.6	0.4	1.3
Korea	3.9	2.1	1.2	3.0
Netherlands	0.6	0.7	0.1	0.7
Portugal [^]	2.2	0.3	0.1	1.2
Spain [^]	1.1	–0.2	0.0	0.5
Sweden	0.3	1.6	0.2	0.9
United Kingdom	1.1	1.3	0.1	1.2
United States	0.8	1.2	0.4	1.0

Note: [^] Periods for Portugal and Spain are for 2004–2013 and 1984–2013 as 2013–14 data is not available.

Source: OECD Productivity Database.¹⁷

The Queensland economy is highly integrated with the economies of other states and territories, as well as international economies through, for example:

- the import of goods and services to Queensland from interstate and overseas
- the export of goods and services from Queensland to interstate and overseas markets
- competition in both international and domestic markets
- financial flows and cross-border business investment
- the movement of peoples
- the cross-border flow of information and knowledge.

Given the integration of economies, it is not surprising that many influences on productivity growth are global in nature, although the magnitude of opportunities, and the extent to which countries, states, governments, businesses and other institutions are able to take advantage of the opportunities differs. Some of the influences that give rise to countries and regions experiencing broadly similar growth patterns include:

- all sources of technological change, such as information and communications technologies, which, at some rate, diffuse across jurisdictional borders
- changes to policies which increase the flow of information, knowledge, goods and services between jurisdictions, such as, trade agreements
- large scale economic and financial shocks
- common trends in policy reforms across many policy areas which may contribute or detract from productivity growth, such as, industry policies, policies which influence investment risk, and aggregate monetary and fiscal policies
- underlying long term trends, such as, rising education levels.

3.3 Industry labour productivity growth

The Australian Productivity Commission identified that, since the last complete productivity cycle (from the period 2007–08 to the present), much of the decline in MFP in Australia can be explained by developments in the mining, and electricity, gas, water and waste service industries.¹⁹ In terms of labour productivity growth, these industries have impacted on Queensland's productivity performance with mining labour productivity declining by 8.3 per cent per annum over the cycle 2001–02 to 2007–08, and a further 3.6 per cent per annum from 2007–08 (Table 3). Similarly, labour productivity in electricity, gas, water and waste services declined over both periods.

Both the mining, and electricity, gas, water and waste service industries have been subject to a period of very strong growth in capital investment. Periods of particularly strong or weak investment — well above or below historical trends — can result in important changes in average capacity utilisation when there are significant lags between capital investment and future increased output. Measured productivity performance may appear better or worse than it actually was.

Another important factor affecting mining industry productivity growth is changes in the quality of mine deposits. When export prices are high more 'marginal' deposits are exploited, which reduces measured productivity (as it measures the volume of inputs used in producing a measure of the volume of outputs). For example, more economic resources (labour and capital) may be consumed in producing a tonne of coal of similar quality. While productivity may decline, there are benefits of high export prices in terms of increased incomes to shareholders and workers in the mining industry, as well as increased royalties and other tax payments to governments.

Table 3 Growth in labour productivity for Queensland market sector industries by period

<i>Industry</i>	<i>92-93 to 96-97 (%)</i>	<i>96-97 to 01-02 (%)</i>	<i>01-02 to 07-08 (%)</i>	<i>07-08 to 14-15 (%)</i>
Agriculture, forestry and fishing	4.1	0.3	3.9	8.0
Mining	7.4	4.7	-8.3	-3.6
Manufacturing	2.1	4.4	1.5	-0.7
Electricity, gas, water and waste services	3.0	2.7	-3.8	-3.0
Construction	2.6	1.9	0.0	4.5
Wholesale trade	8.4	6.8	6.1	-0.5
Retail trade	2.8	3.4	1.2	2.7
Accommodation and food services	-1.3	2.4	2.6	-1.1
Transport, postal and warehousing	1.1	3.4	2.8	1.8
Information media and telecommunications	3.6	9.0	-3.4	5.7
Financial and insurance services	8.1	1.2	8.1	1.4
Rental, hiring and real estate services	6.1	1.5	0.8	3.6
Professional, scientific and technical services	-1.0	6.4	2.7	-3.5
Administrative and support services	-0.2	1.2	1.8	-4.2
Arts and recreation services	-9.8	2.4	2.8	2.8
Other services	0.5	3.0	2.0	-0.4
<i>All industries</i>	2.1	2.8	1.3	1.0

Notes: Labour productivity is measured as industry value added divided by the number of hours worked. Periods based on Queensland productivity cycles, with 2007–08 to 2014–15 an incomplete cycle.

Sources: ABS 2015 (Cat. No. 5220.0); and QPC calculations.¹⁴

When productivity estimates are adjusted for the lagged effect between investment and output growth in mining, and changes in resources quality over time, it was found that:

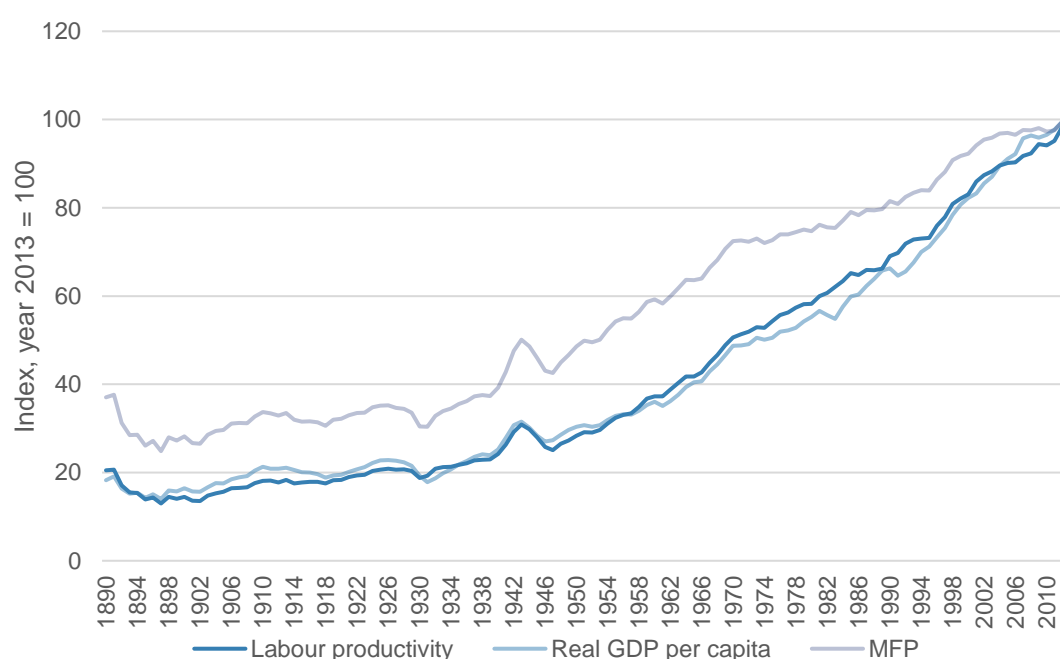
- After removing the influence of both deposit quality depletion and production lags, the MFP growth rate in Australian mining increases from an average annual rate of -0.65 per cent to +2.5 per cent between 1985–86 and 2009–10.²⁰
- National mining MFP declined by 24.3 per cent over the period 2000–01 to 2006–07 with the declines in resource quality the largest contributor (contributing -24.2 percentage points), investment and lagged output effect (-8.1 percentage points), and other factors (contributing +8.0 percentage points).²¹

- In Queensland, adjusting for declining resources quality explained some of the recent decline in mining industry MFP. From 1989–90 to 2011–12, Queensland's adjusted mining MFP grew by 0.2 per cent per annum on average, compared to a decline in unadjusted MFP of 1.6 per cent per annum. However, even after the resource quality adjustment, mining MFP declined strongly from 2004–05 (adjustments were not made for the investment and lagged output effect).²²

3.4 Productivity and growth in incomes

The beginning of this paper asked: 'Why does productivity matter?'. Productivity growth matters because it underpins growth in real incomes and standards of living. Over the last century, labour productivity growth has underpinned rising Australian real GDP per capita with MFP growth contributing strongly (Figure 6).

Figure 6 Australian labour productivity and growth in real incomes, 1890 to 2013



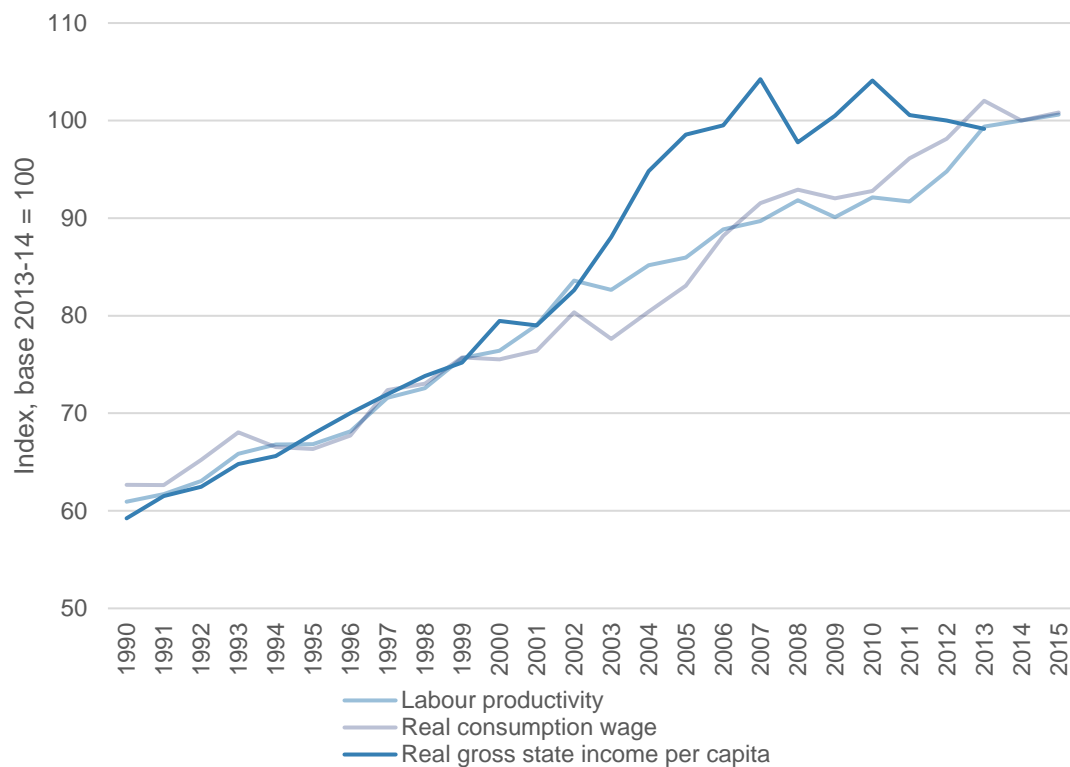
Notes: Labour productivity measured as GDP per hour worked.

Sources: Bergeaud, Cetté and Lecat 2015; ABS 2015 (Cat. No. 5220.0); and QPC calculations.^{23,14}

In Queensland, growth in labour productivity has underpinned growth in real wages (defined as Compensation of Employees in Queensland deflated using the Brisbane All Groups CPI index and divided by total hours worked) indicating that wage payments have risen faster than the prices of purchased goods and services (Figure 7). As a result, more or better quality goods and services can be purchased for an hour of work.

Up until the early 2000s, growth in Queensland labour productivity was closely aligned with growth in real gross state income per capita. From roughly 2000 to 2007, real gross state income per capita accelerated strongly, driven by changes in the terms of trade resulting from rapidly increasing commodity prices that favoured Queensland mining exports. The terms of trade is a measure of the relative *prices* for exports and imports. A change in the terms of trade favouring Queensland exports means that, for the same volume of exports, Queensland exporters receive greater income even where there is no change in the efficiency with which goods are produced and exported. Following 2007, the terms of trade has declined sharply.

Figure 7 Growth in Queensland labour productivity and real incomes, 1989–90 to 2014–15

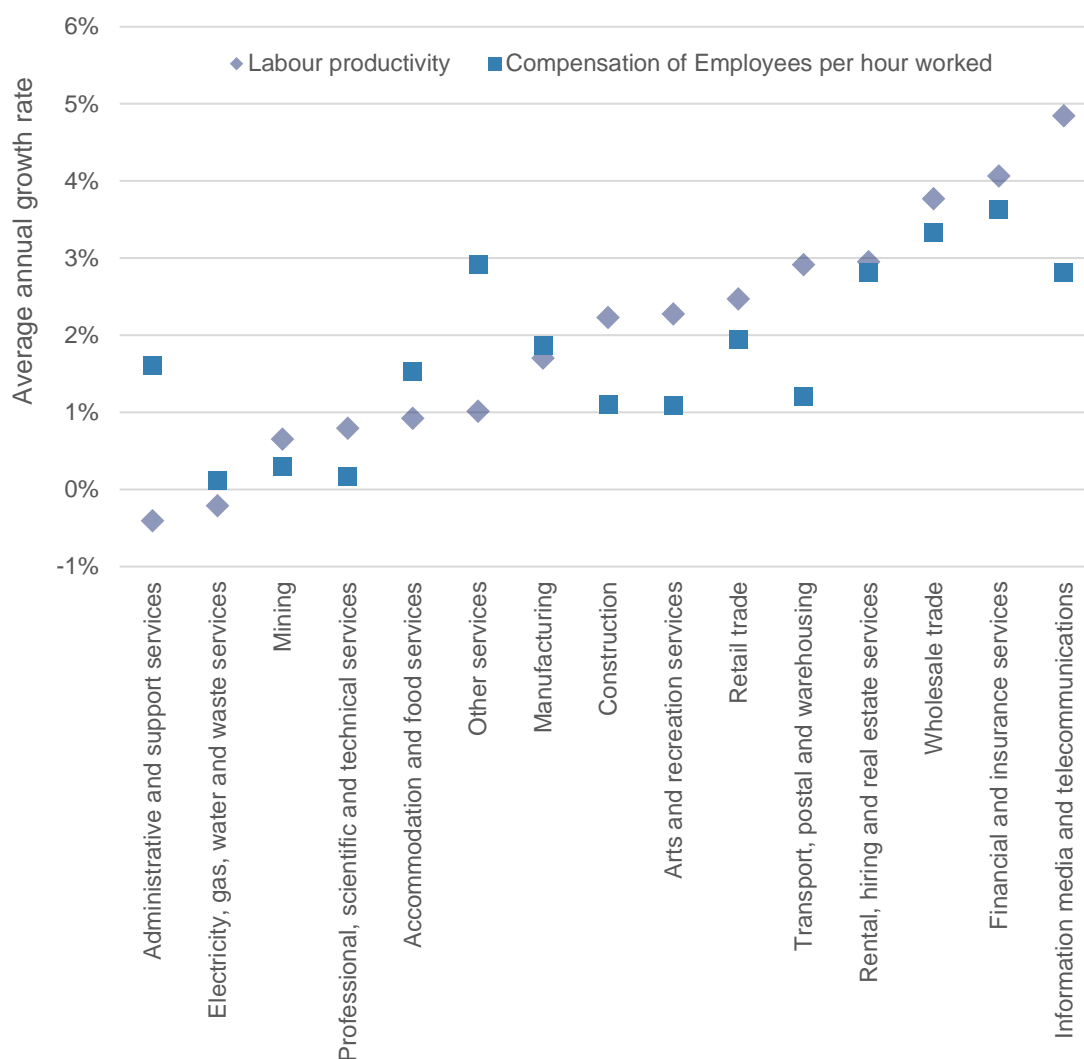


Notes: Real wages calculated as Compensation of Employees in Queensland, deflated using the CPI Brisbane All Groups index, divided by total hours worked. Labour productivity calculated on a per hour worked basis.

Sources: ABS 2015 (Cat. No. 5220.0); and QPC calculations.¹⁴

At an industry level, those industries with higher labour productivity growth rates also generally recorded higher growth rates in total compensation paid to employees per hour worked (Figure 8). Total compensation includes total remuneration, in cash or in kind, payable by an enterprise to an employee in return for work done by the employee during the accounting period. It includes wages, salaries and supplements and employer social contributions, and excludes any taxes payable by the employer on the wage and salary bill (for example, payroll tax).

Figure 8 Queensland productivity and incomes growth by industry, 1989–90 to 2014–15



Notes: Excludes Agriculture, forestry and fishing, and non-market sector industries. Labour productivity measured as industry gross value added divided by the number of hours worked. Real consumption wage measured as total compensation of employees per hour worked. See Parham et al 2000²³ for a discussion of some of the factors which can lead to differences in the rates of growth between industry labour productivity and real wages.

Sources: ABS 2015 (Cat. No. 5220.0); and QPC calculations.¹⁴

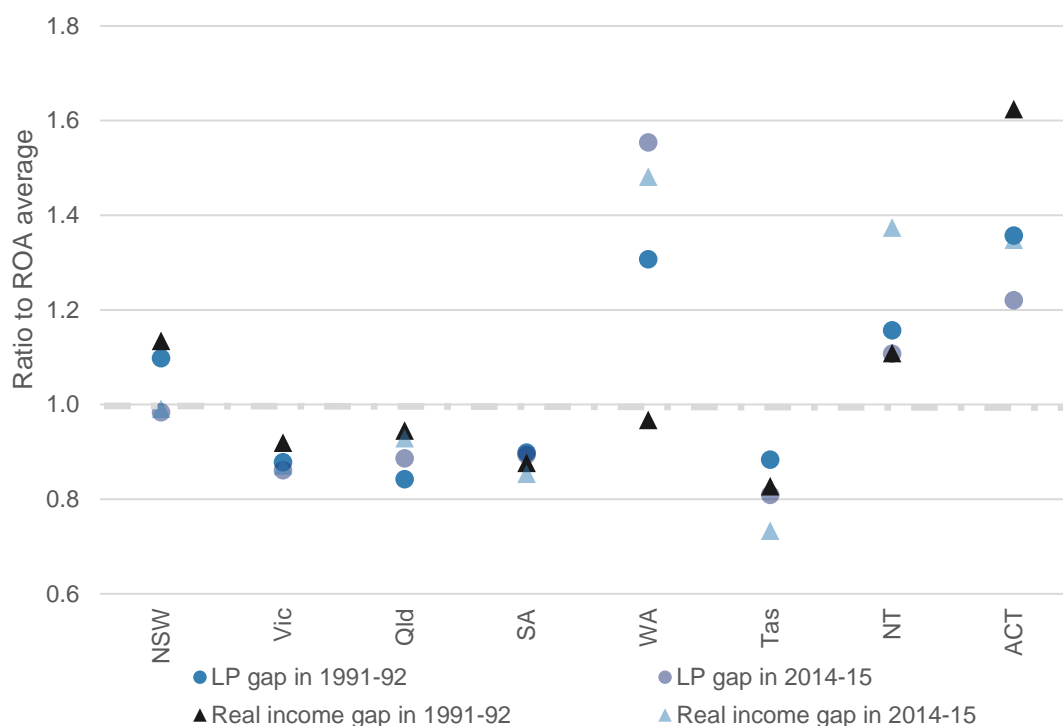
3.5 Productivity gaps and convergence

3.5.1 State comparisons

Relative productivity performance is measured by the productivity 'gap'. This compares the productivity level of a firm or economy with that of a benchmark, either chosen to represent the 'technological frontier' or an average productivity level of the jurisdictions or institutions being compared. Over time, given differences in productivity growth rates, the productivity gap will expand or contract commensurately.

State and territory labour productivity growth has not resulted in a convergence of productivity levels and real incomes per capita over the period 1991–92 to 2014–15 (Figure 9). Real per capita incomes moved closer to the rest of Australia average in New South Wales and Australian Capital Territory, but in other states and territories there was either little change or greater divergence in incomes.

Figure 9 Change in labour productivity and real gross state income per capita compared to rest of Australia, 1991–92 to 2014–15



Notes: Rest of Australia measured with respect to each state or territory. Labour productivity is a measure of the output or value added of an economy per hour worked. Higher volumes of production equate to greater incomes. Real gross state income takes into account movements in the terms of trade — a measure of the relative prices of exports versus imports — which will also affect incomes.

Sources: ABS 2015 (Cat. No. 5220.0); and QPC calculations.¹⁴

Labour productivity gaps between jurisdictions can be split into differences in industry structure and differences in within-industry productivity gaps. Depending on the jurisdictions being compared, differences in industry structure can play an important role in understanding gaps between countries and/or regions. That said, the labour productivity gaps that exist between Queensland and other states and territories are driven by differences in within-industry productivity, and not differences in industry structure.

In 1999–2000, Queensland's labour productivity for market sector industries was roughly 11 per cent below that of the rest of Australia, with almost 9 percentage points of this gap explained by within-industry productivity differences (Table 4). By 2014–15, the labour productivity gap narrowed to just over 94 per cent, with within-industry productivity differences continuing to contribute overwhelmingly to the gap (8.8 percentage points).⁵

In 2014–15, the industries that lowered Queensland's relative labour productivity performance the most were: mining; retail trade; accommodation and food services; information media and telecommunications; financial and insurance services; rental, hiring and real estate services; professional, scientific and technical services; and administration and support services. The contribution of mining would have been heavily influenced by the high rates of capital investment

⁵ The relative contributions of industry structure and within-industry productivity differences to labour productivity gaps may differ if analysis is based on data at a lower level of industry aggregation (for example, if manufacturing labour productivity gaps are split into differences in manufacturing sub-sector shares and within-sub-sector productivity differences).

(discussed earlier). With production capacity in place, mining productivity could be expected to improve significantly depending on growth in industry output. Those industries with labour productivity levels relatively higher than in other states and territories were: manufacturing; electricity, gas, water and waste services; construction; and wholesale trade.

Table 4 Industry contributions to Queensland's labour productivity gap, market sector

Industry	1999–2000			2014–15		
	Weighted industry gap	Weighted relative labour shares	Contribution to aggregate gap	Weighted industry gap	Weighted relative labour shares	Contribution to aggregate gap
Agriculture, forestry and fishing	–1.1	–0.7	–1.8	0.4	0.0	0.4
Mining	–2.6	1.8	–0.9	–5.9	2.3	–3.6
Manufacturing	1.0	–0.2	0.8	0.5	0.1	0.6
Electricity, gas, water and waste services	0.6	–0.2	0.5	0.3	0.3	0.6
Construction	0.9	0.0	0.9	2.1	0.1	2.1
Wholesale trade	0.5	–0.1	0.4	0.7	–0.2	0.5
Retail trade	–0.8	–0.3	–1.1	–0.7	–0.2	–0.9
Accommodation and food services	–0.2	–0.5	–0.7	–0.7	–0.3	–1.0
Transport, postal and warehousing	–1.1	0.1	–1.0	0.3	0.0	0.3
Information media and telecommunications	–0.9	–0.3	–1.3	–0.5	–0.4	–0.8
Financial and insurance services	–0.5	–2.2	–2.6	–0.6	–2.5	–3.2
Rental, hiring and real estate services	–1.7	0.3	–1.4	–0.8	0.2	–0.6
Professional, scientific and technical services	–1.8	0.3	–1.5	–1.8	0.2	–1.6
Administrative and support services	–0.5	0.1	–0.4	–1.1	0.0	–1.1
Arts and recreation services	–0.7	–0.0	–0.7	–0.4	0.1	–0.3
Other services	–0.3	0.0	–0.2	–0.4	–0.3	–0.7
<i>All industries[^]</i>	–8.9	–1.9	–10.9	–8.8	–0.6	–9.3

Notes: See Dolman et al (2007) for an outline of the decomposition method.²⁴ For each industry, the weighted industry productivity gap plus the weighted relative labour shares equals the percentage point contribution of the industry to Queensland's aggregate labour productivity gap. The sum of the industry contributions to the aggregate productivity gap for market sector industries equals –10.9 per cent in 1999–00 and –9.3 per cent in 2014–15.

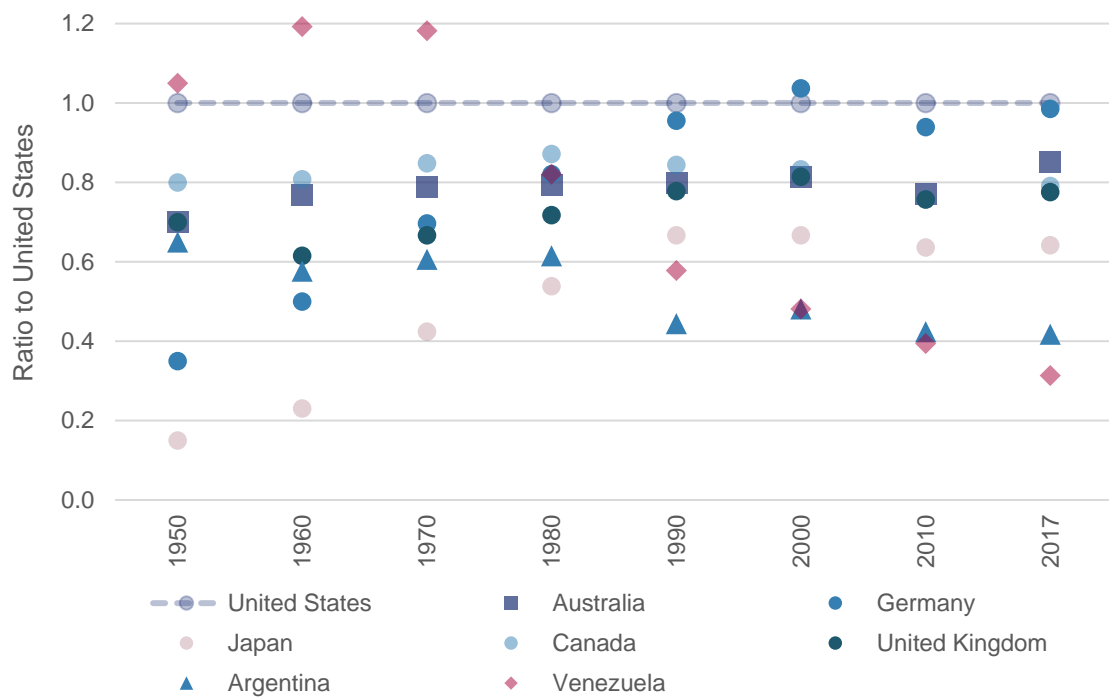
[^] May not add due to rounding. Excludes the ownership of dwellings industry, as well as the non-market sector industries (Public administration and safety, Education and training, and Health care and social assistance).

Sources: ABS 2015 (Cat. No. 5220.0); and QPC calculations.¹⁴

3.5.2 International comparisons

Australian labour productivity relative to the United States has remained stable since 1970, not showing any clear tendency for productivity levels to converge or diverge (Figure 10).⁶ Given that Queensland's labour productivity gap relative to the rest of Australia has shown some improvement, this implies that Queensland's labour productivity gap relative to the United States is less than in previous periods (although not significantly changed).

Figure 10 Country labour productivity compared to the United States



Notes: 'Ratio' is the level of labour productivity for country (x) divided by the level of labour productivity for the United States. A ratio greater than one indicates a level of labour productivity greater than estimated for the United States. 2017 data are Conference Board projections.

Source: The Conference Board (2015).²⁵

A selection of other countries' productivity performances relative to the United States since 1950 shows the wide variety of outcomes achieved:

- German labour productivity measured relative to the United States rose rapidly since the 1950s to the point where, by the 1990s, it has generally converged
- Japanese relative labour productivity rose rapidly from the 1950s, but has not closed the gap further since the 1990s
- Argentinian relative labour productivity was below the United States in 1950 and the gap has widened further from 1980 onwards
- Venezuelan labour productivity was actually above the United States from 1950 to 1970, but has declined dramatically.

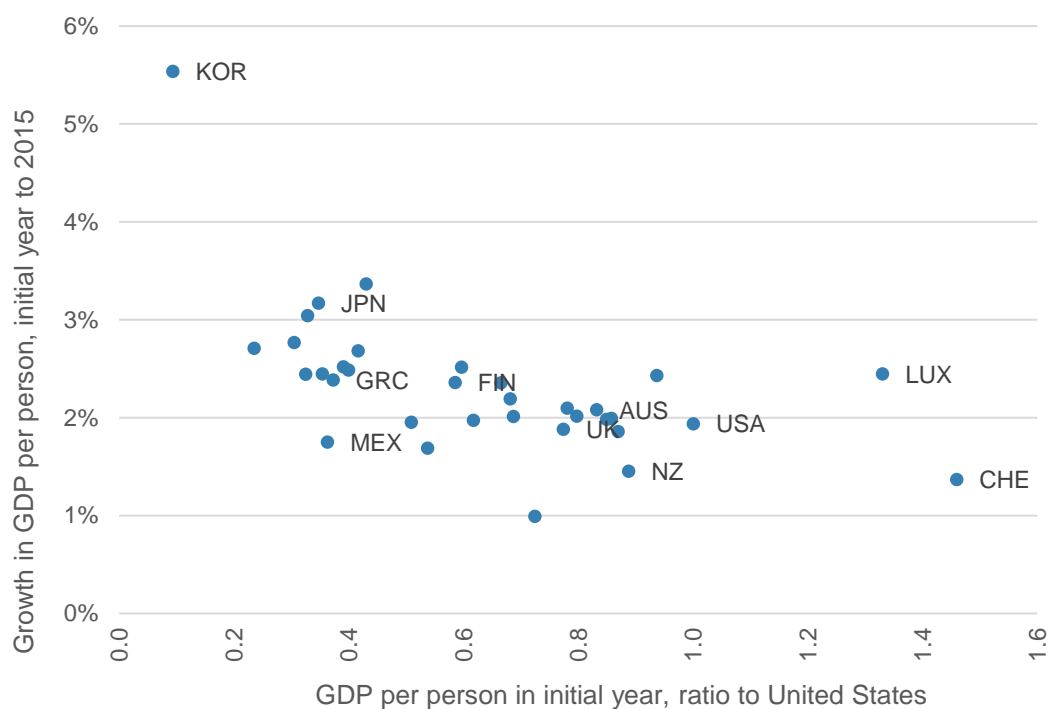
⁶ The United States is usually selected as the technological frontier country or benchmark from which to measure cross-country productivity gaps. However, a number of countries have similar or somewhat higher labour productivity.

Overall, international data provides mixed evidence on the convergence of real incomes across countries. The OECD finds support for convergence amongst OECD countries, although with continuing significant gaps:

Very high growth rates in GDP per capita have meant that countries with initially lower GDP per capita levels converged towards average income levels in the OECD. This has been true for some OECD countries, in particular, for Estonia, Poland and the Slovak Republic, and for most emerging economies. Nevertheless, in 2014, differences in GDP per capita remained significant across countries and also within the OECD area. GDP per capita was around 50% lower than the OECD average in Mexico and Turkey, while it was 2.5 times the OECD average in Luxembourg, 65% higher in Norway and 52% higher in Switzerland. Most of these differences in GDP per capita reflect differences in labour productivity levels.¹⁸

OECD countries with a relatively low level of GDP per person in 1960 relative to the United States tended to grow faster (Figure 11). In contrast, if a broad range of non-OECD countries is included, then the scatterplot looks much more random — there is no clear negative relationship between the initial level of GDP per person relative to the United States and subsequent growth rates.

Figure 11 Convergence in GDP per person in OECD countries, 1960 to 2015



Notes: The first year of data availability for the Czech Republic, Slovak Republic and Slovenia is 1970, 1985 and 1980, respectively. For all other countries, the initial year for calculations is 1960. Country abbreviations are: South Korea (KOR); Japan (JPN); Greece (GRC); Mexico (MEX); Finland (FIN); United Kingdom (UK); Australia (AUS); New Zealand (NZ); Luxembourg (LUX); and Switzerland (CHE).

Sources: The Conference Board (2015); ²⁵ and QPC calculations.

While there are various concepts and measures of convergence,⁷ a range of studies find little or only qualified support for convergence (for example, convergence holds within 'clubs' comprising like countries, such as the OECD, but not across 'clubs', such as between the OECD and African nations).⁸ Many countries and regions have experienced rising productivity and income levels over the long term, but some jurisdictions have not, and some jurisdictions have gone through periods of falling productivity and income levels.

⁷ See Jones and Vollrath 2013²⁶, Durlauf *et. al* 2009²⁷, Temple 1999²⁸, Quah 1996²⁹, Bernard and Durlauf 1996³⁰, and Barro, and Sala-i-Martin 1992.³¹

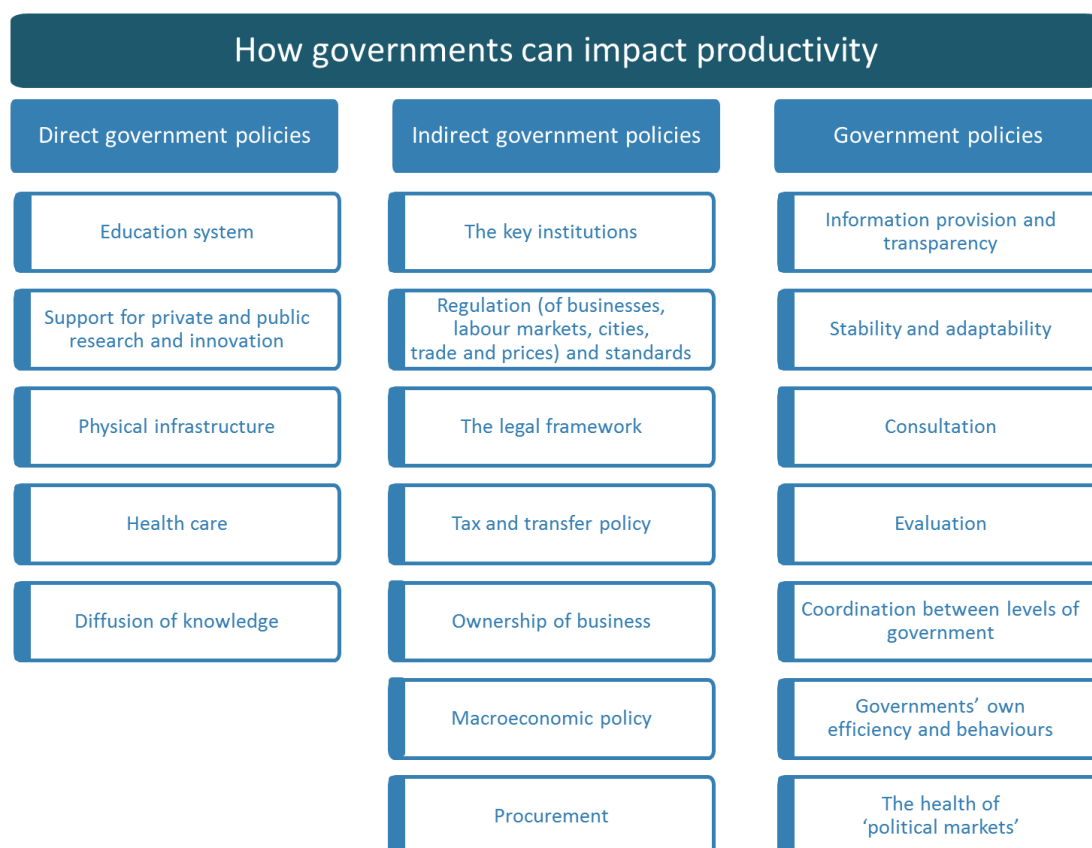
⁸ See, for example, Sondermann 2012.³²

4 Policy and productivity

4.1 Policy framework

As productivity growth is a driver of economic growth, wealth creation and higher living standards, it is an important focus for policy. Given the complexities and interdependencies within the economy, there is no single policy lever for governments to ‘pull’. An array of national and state government policies may impact productivity (Figure 12).

Figure 12 Policy and productivity ¹⁶



Ultimately, productivity improvements at the economy-wide level will depend upon the actions of individual enterprises. In this context, governments can best support productivity growth by ensuring that the commercial environment in which those firms operate is conducive to sound decision-making.

This can be achieved through an overall policy framework that:

- promotes competition, placing external pressures and disciplines on organisations. This incentivises firms to innovate and encourages information flows across the economy
- enable firms to respond quickly to market forces so that resources are allocated to their most efficient uses
- facilitates research and development to produce new innovations and increase the stock of knowledge in the economy

- enhances human capital, providing workers with new skills through education and training. This increases an individual's productivity and reinforces the broader productivity gains from innovation and the adoption of new technology
- ensures the availability of key economic infrastructure, such as transport networks and telecommunications, to facilitate private sector production and distribution
- maintains strong institutions and a stable macroeconomy. This provides organisations with a level of certainty as to future regulatory arrangements and the economic and fiscal environment, enabling them to make operating and investment decisions with greater confidence.

Appendix A: Growth accounting

The economic theory of productivity measurement was developed by Robert Solow in 1957. It is based upon the standard microeconomic theory of production and provides a framework with which to analyse economic growth.

The model splits the sources of economic growth at the economy-wide level⁹ into contributions from key factors, such as labour and capital. Once all factors have been accounted for, the model attributes the remaining contribution, known as the Solow residual, to technology.

This ‘growth accounting’ framework has been adopted by the OECD,¹⁰ and national statistical institutes around the world, including the Australian Bureau of Statistics.

The brief derivation that follows only considers two factors. However, the same approach applies in the case of many inputs.

Production function

For simplicity, total annual output, in real value-added terms, is assumed to be a function of

- the quantity of labour input, L ;
- the quantity of capital input K ; and
- the level of technology, A .

The underlying production function is assumed to have a Cobb-Douglas functional form, given by:

$$Y_t = A_t F(K_t, L_t) = A_t K_t^\alpha L_t^{1-\alpha}$$

where α and $(1 - \alpha)$ are the output elasticities¹¹ of capital and labour respectively.

Since these elasticities sum to one, the production function exhibits constant returns to scale. In other words, a doubling of the usage of K and L will result in the doubling of Y .

Growth equation

Taking logs and differentiating the production function with respect to time,¹² yields the growth equation:

$$\frac{\dot{Y}_t}{Y_t} = \frac{\dot{A}_t}{A_t} + \alpha \frac{\dot{K}_t}{K_t} + (1 - \alpha) \frac{\dot{L}_t}{L_t}$$

It states that output growth equals the weighted average of growth in capital and labour, with weights equal to the respective output elasticities, plus the growth rate of technology.

⁹ Domar (1961)³³, Hulten (1978)³⁴ and Jorgenson, Gollop and Fraumeni (1987)³⁵ subsequently extended this model to enable analysis at the industry level.

¹⁰ OECD (2001).¹⁰

¹¹ These measure the responsiveness of output to a change in the level of the factor in production. For example, if $\alpha=0.3$, a 1% increase in the use of capital would result in a 0.3% increase in real output.

¹² A key mathematical property is that the derivative with respect to time of the natural log of a variable yields the growth rate of that variable.

The expression can be rewritten in terms of growth rates across successive time periods, rather than in continuous time, as

$$\frac{\Delta Y_t}{Y_t} = \frac{\Delta A_t}{A_t} + \alpha \frac{\Delta K_t}{K_t} + (1 - \alpha) \frac{\Delta L_t}{L_t}$$

MFP is measured as the growth of output over and above the growth of inputs which have produced that output. It is obtained as the residual to the observed terms on rearranging the growth equation as:

$$\frac{\Delta A_t}{A_t} = \frac{\Delta Y_t}{Y_t} - \alpha \frac{\Delta K_t}{K_t} - (1 - \alpha) \frac{\Delta L_t}{L_t}$$

Appendix B: Productivity and component indices

	MFP		Labour productivity		Output		Total inputs		Hours worked		Capital services	
Year	Qld	ROA	Qld	ROA	Qld	ROA	Qld	ROA	Qld	ROA	Qld	ROA
1985-86	75.7	84.4	58.6	63.5	29.3	43.3	38.7	51.3	50.0	68.2	23.3	28.0
1986-87	76.4	84.0	59.1	63.6	30.8	44.2	40.2	52.6	52.1	69.5	24.0	29.1
1987-88	79.1	85.4	61.5	64.9	33.0	46.8	41.7	54.8	53.6	72.1	25.3	30.5
1988-89	79.5	84.4	61.7	64.6	35.5	48.3	44.6	57.3	57.6	74.8	26.8	32.4
1989-90	78.0	84.7	60.4	65.3	36.5	50.1	46.8	59.2	60.4	76.8	28.1	34.1
1990-91	78.4	84.5	61.5	66.0	36.5	49.6	46.6	58.8	59.4	75.3	28.8	35.0
1991-92	80.4	84.7	63.3	66.9	37.9	49.4	47.2	58.3	59.9	73.9	29.4	35.6
1992-93	83.6	87.6	66.0	69.9	40.4	51.2	48.4	58.5	61.3	73.3	30.4	36.6
1993-94	84.9	88.8	67.0	70.9	42.5	53.2	50.0	59.9	63.4	75.0	31.4	37.6
1994-95	85.0	88.6	66.8	70.7	44.9	55.1	52.8	62.2	67.2	77.9	32.8	39.0
1995-96	85.4	90.0	67.8	72.3	46.2	57.5	54.1	63.9	68.2	79.6	34.4	40.6
1996-97	89.3	91.6	71.8	74.4	49.3	59.4	55.2	64.9	68.6	79.9	36.2	42.4
1997-98	90.1	93.9	73.1	77.4	51.4	62.2	57.0	66.3	70.3	80.4	38.2	44.7
1998-99	92.7	96.8	76.0	80.6	54.2	65.5	58.5	67.7	71.4	81.3	40.1	46.9
1999-00	92.9	96.5	76.5	80.6	56.6	68.0	60.9	70.5	74.0	84.3	42.2	49.3
2000-01	95.2	96.5	79.4	81.6	58.7	68.9	61.7	71.4	74.0	84.5	44.0	51.2
2001-02	99.8	99.2	84.0	84.7	62.6	71.4	62.8	72.0	74.6	84.2	45.7	52.9
2002-03	98.6	99.4	83.1	85.6	64.8	73.6	65.7	74.0	78.0	86.0	48.1	55.3
2003-04	100.3	100.5	85.2	87.7	68.9	76.4	68.7	76.1	80.8	87.2	51.1	58.4
2004-05	101.4	99.8	86.6	88.2	73.7	78.2	72.7	78.3	85.1	88.7	54.6	61.8
2005-06	102.9	98.9	89.2	88.5	78.0	80.1	75.8	81.0	87.4	90.5	58.7	65.6
2006-07	103.9	98.8	91.0	89.5	83.8	82.7	80.6	83.7	92.1	92.3	63.5	69.5
2007-08	103.5	98.2	92.7	90.2	87.6	85.7	84.6	87.3	94.4	95.1	69.4	74.4
2008-09	100.1	97.6	91.0	91.0	88.6	87.3	88.5	89.4	97.4	95.9	74.5	78.5
2009-10	99.2	98.7	92.1	93.4	88.9	89.5	89.6	90.7	96.6	95.8	78.2	81.9
2010-11	97.4	97.9	91.8	93.1	89.4	92.1	91.8	94.1	97.4	98.9	82.3	85.6
2011-12	98.5	98.4	94.5	95.2	94.6	95.3	96.1	96.9	100.1	100.0	89.0	91.2
2012-13	99.9	99.3	98.9	98.1	96.8	97.7	96.9	98.4	97.8	99.6	95.2	96.2
2013-14	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2014-15	99.8	100.6	100.9	101.3	100.7	102.6	100.9	102.0	99.8	101.3	103.1	103.4

Source: QPC estimates.

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