Assessing Australia's Productivity Performance

Industry Commission

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FOREWORD

There have been calls for quite some time for Australia to lift its productivity performance. But how well is Australia performing?

In attempting to address this important issue, this paper develops two main themes.

The first addresses the question of why Australians should be concerned about productivity performance. The simple answer is that productivity growth is the key ingredient in promoting sustainable economic growth and improving the material living standards of Australians.

The influence of productivity growth on living standards can come over long periods of time – often decades rather than years. What might seem like small improvements in productivity growth when examined annually, if sustained, add up to big improvements in living standards over time. But, equally, what might seem at the time to be small opportunities to improve productivity growth, if not taken, can cost future generations dearly.

Community concerns about the distribution of benefits from improvements in productivity and the implications for jobs must be addressed in any serious discussion about productivity. This paper discusses some of those concerns.

The second major theme of the paper is to assess Australia's productivity performance – over the long term and over recent years. It is focussed on the recent experience because of the interest among policy makers and commentators in the success or otherwise of policy reforms designed to raise productivity growth.

Australia's productivity growth has improved substantially in recent years, and today seems to be approaching the historically high productivity growth of the 1960s. But improved performance will need to be sustained if Australians are to meet the aspirations and improve the living standards of current and future generations.

Bill Scales AO

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The responsibility for all views expressed and any errors and omissions in this paper lies with the Industry Commission.

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ABBREVIATIONS

ABARE	Australian Bureau of Agricultural and Resource Economics
ABS	Australian Bureau of Statistics
AE	Average Earnings
ANZSIC	Australian and New Zealand Standard Industrial Classification
BCA	Business Council of Australia
BIE	Bureau of Industry Economics
CIWWI	Committee of Inquiry into the Winegrape and Wine Industry
CO_2	Carbon dioxide
DEETYA	Department of Employment, Education, Training and Youth Affairs
EPAC	Economic Planning Advisory Commission
G7	Group of 7 leading industrialised countries (United States, Japan, Germany, France, Italy, United Kingdom and Canada)
GBE	Government Business Enterprise
GDP	Gross Domestic Product
GDP(I)	Gross Domestic Product (measured on the income side)
IC	Industry Commission
IMF	International Monetary Fund
MFP	Multifactor productivity
NSW	New South Wales
OECD	Organisation for Economic Co-operation and Development
PPP	Purchasing power parity
R&D	Research and Development
RBA	Reserve Bank of Australia
SCNPMGTE	Steering Committee for National Performance Monitoring of Government Trading Enterprises
US	United States
WWII	World War II

KEY POINTS

- Productivity matters for growth and living standards. Productivity growth has accounted for about two-thirds of the increase in Australians' average real income over the past three decades and about half of the increase in Australia's output.
- Australia's long-term rate of productivity growth has been below potential. Over the second half of this century, Australia does not appear to have kept up with global productivity trends. Australia had one of the slowest rates of productivity growth among OECD countries.
- Australia's rate of productivity growth has improved markedly in the 1990s. The improvement is more than a correction for the low productivity growth in the 1980s and represents more than the effects of recovery from the 1990s recession.
- A broad range of industry sectors contributed to Australia's national productivity growth. Manufacturing and Transport, storage and communication made relatively strong contributions.
- There is room for further improvement. International comparisons show remaining productivity gaps with comparable countries which could be narrowed. Areas include Manufacturing and Transport, storage and communication and Electricity, gas and water.
- Even relatively small increases in Australia's annual rate of productivity growth, if sustained, will make a substantial difference to future generations. Increases of around half a percentage point could raise average real incomes by an additional 30 per cent over the next 40 to 50 years.
- Distribution of the gains from productivity growth also matters for living standards. More competitive markets have meant that more of available productivity gains have been distributed through lower prices rather than retained within firms as higher wages and/or higher profits.
- Productivity growth does not have to mean fewer jobs. It can affect employment in specific occupations, industries and regions. But, productivity growth has coexisted with sustained employment growth over long periods in Australia and other OECD countries.

OVERVIEW

Australia's productivity growth has been below its potential over the past three decades. However, there are now encouraging signs of significant improvement.

Australia needs to maintain higher productivity growth as a basis for sustainable, non-inflationary growth and to improve the living standards of Australians.

Productivity growth generates income. It provides the means to give Australians more options – to buy more of the necessities and luxuries of life; to save more for the future; to enjoy more leisure; to pursue community and cultural goals; and to provide greater protection for the environment.

But there are also widespread community concerns about the distribution of the gains from productivity improvements and about the impacts on jobs.

Although this paper has not investigated all relevant issues or concerns, it does provide evidence on some key concerns.

Competitive product market reforms mean that productivity gains are showing up more in lower relative prices than as differences in people's pay packets. It is consumers and other firms and industries who gain most in the first instance from the lower prices that productivity growth brings.

Improving productivity does not have to mean fewer jobs. It can affect the structure of employment. But productivity growth has coexisted with sustained employment growth over long periods in Australia and other OECD countries.

Main findings of this paper

Productivity, output and living standards

- Productivity matters for living standards. Productivity growth has accounted for about two-thirds of the improvement in the average real incomes of Australians over the past three decades.
  - Real gross domestic income per person increased from $13 000 in 1964–65 to $23 400 in 1995–96 (at 1989–90 prices). Productivity growth accounted for about $ 6 750 of the $10 400 increase over the period.
- Productivity matters for growth. Productivity growth has accounted for about half of the increase in Australia's output over the past three decades.

Box 1 Perspectives on productivity

The following perspectives on productivity flow from this paper.

Productivity matters – it underpins improvements in living standards

Productivity growth is the major factor underpinning growth in real income per person. It has thereby contributed to substantial improvements in the living standards of Australians. Capital deepening – the installation of additional capital per unit of labour – has also been important.

It is productivity growth over the long term that counts

The productivity payoffs in terms of improved living standards come with time. Because of the very nature of the processes that drive productivity improvements, the payoffs tend to come more from sustained small increases in productivity growth over time than from large, discrete 'episodes' of change. Substantial improvements in living standards show up over horizons of 20, 30 and 50 years.

Even small (but enduring) improvements in productivity have value

Australia's long-term rate of productivity growth (over 3 decades) has been around 1.5 per cent per year. Raising and maintaining that rate at (say) 2.0 per cent per year, could raise the average real incomes of the next generation by an additional 13 per cent and those of the generation after that by an additional 30 per cent.

Improved productivity also enables improvements in the quality of life

Improved productivity means not only opportunities for higher real incomes, it can also enable greater leisure and greater provision for social advancement and environmental protection. It is largely for this reason that widespread public expenditures on the environment and for social pursuits such as education and redistribution have become features of the modern era and of more developed nations.

Productivity matters for relative standards of living as well

Productivity counts most for what it can contribute to the living standards of Australians. And while Australia's productivity has grown, it has not improved as much as other countries. This is undoubtedly an important part of the explanation for the drop in our standard of living relative to other countries.

The distribution of the benefits from productivity improvement matters

It matters whether productivity gains translate into higher wages and profits within a firm or are passed on in lower prices. Higher nominal incomes and lower prices are both sources of higher real incomes. But lower prices benefit consumers and enable other firms and industries to be more competitive.

- Real GDP increased from $145 billion in 1964–65 to $430 billion in 1995–96 (at 1989–90 prices). Productivity growth accounted for about $140 billion of the $285 billion increase.

✦ Tackling unemployment is also crucial to improving living standards.

- The increase in unemployment over the past three decades cost Australians, in terms of lost economic potential, the equivalent of about 8 per cent of the increase in average real income. The unemployed have borne the brunt of this cost.

Australia's productivity performance

✦ Australia's rate of productivity growth has been below potential. This has meant that opportunities to grow and to improve living standards have been lost. It has contributed to a decline in Australia's standard of living relative to other countries.

- Over the latter half of this century, Australia has had one of the slowest rates of productivity growth among OECD countries.

- Australia does not appear to have participated strongly in the global movement toward 'best practice'.
  - The international trend has been for countries to show relatively high productivity growth when catching up to the productivity leader (the United States). This tendency has been strongly evident in other OECD countries, but not in Australia. Australia has only made moderate improvements in catching up to the leader.
  - There is also a tendency for productivity levels in similar countries to converge around similar values. This has happened among OECD countries, but Australia has not been part of the 'convergence club'. In 1950, Australia had the third highest level of labour productivity. Other countries have since converged, and at levels much closer to the productivity leader. Australia has lagged behind. In 1992, Australia had the fourth lowest labour productivity level.

✦ Since the mid-1960s, Australia's annual rate of growth in productivity has been 1.5 per cent in multifactor productivity (combined labour and capital productivity) and 2.2 per cent in labour productivity. (Figure 1 shows multifactor productivity).
  - The peak annual rate of growth came in the late 1960s/early 1970s at 2.1 per cent (multifactor productivity) and 2.9 per cent (labour productivity).

Figure 1: Australia's actual and trend multifactor productivity, 1964–65 to 1995–96 (index 1989–90 = 100)

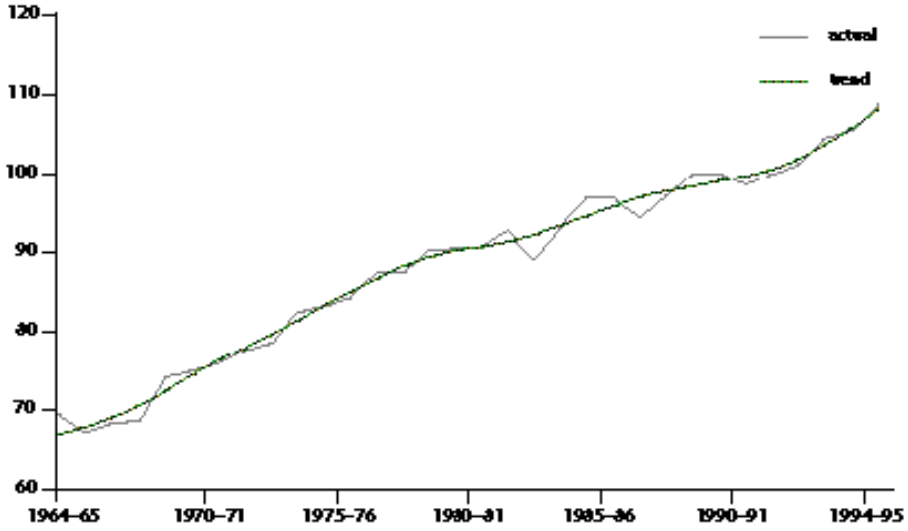
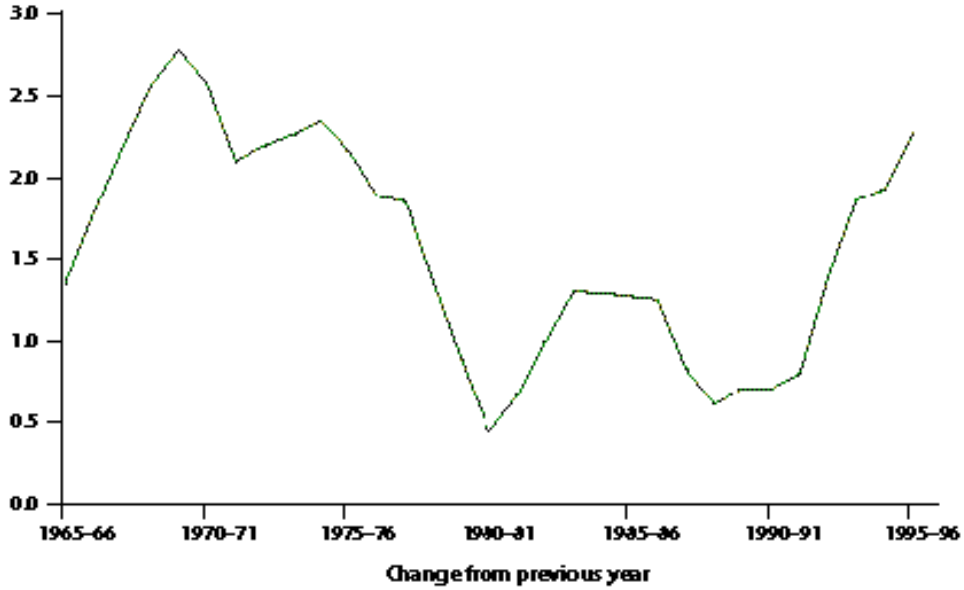


Figure 2: Annual change in trend multifactor productivity, 1964–65 to 1995–96 (per cent)



- From 1970 to 1994, Australia's rate of multifactor productivity growth was about 20 per cent below the average of OECD countries.
  - It was only just on a par with that of the US (which as the productivity leader has less opportunity for high productivity growth). It was 40 per cent below the average of other G7 countries and over 50 per cent below the average of smaller OECD countries.
- To keep pace with the OECD average, Australia's long-term annual rate of multifactor productivity growth would have needed to have been around 1.9 per cent or so, rather than the 1.5 per cent achieved. This would have been well within the bounds of productivity growth achieved by the smaller (and many larger) OECD countries.
- There are signs, however, that Australia's productivity performance has improved markedly in the 1990s.
  - Our current rate of multifactor productivity growth appears to be running at around 2 per cent a year or more, although this performance needs to be consolidated over a few more years to establish the trend with complete confidence.
    - The increase in the ABS underlying *trend* series was 2.3 per cent over the year to 1995–96. (The increase in actual multifactor productivity was 3.1 per cent, but a single year's growth is not a firm indicator of performance.)
  - The current relatively high rate of multifactor productivity growth is more than a correction from the 1980s experience and represents more than the effects of a recovery from the 1990s recession.
    - Productivity growth was at a low point in the mid to late 1980s, largely related to a more rapid expansion of employment relative to capital. The relative growth in labour and capital has resumed its long-term pattern. Furthermore, inflation – which can reduce productivity growth – is now much lower.

- Measured productivity growth can be artificially high coming out of recessions because of the ability of firms to draw readily on underutilised resources. But productivity growth has been stronger and more sustained coming out of the early 1990s recession compared with the downturns in the 1970s and 1980s. Indeed, the current high rate of productivity growth could now only be weakly associated with recovery from the recession, if at all.

Figure 3: Australia's comparative productivity growth rates, 1970 to 1994

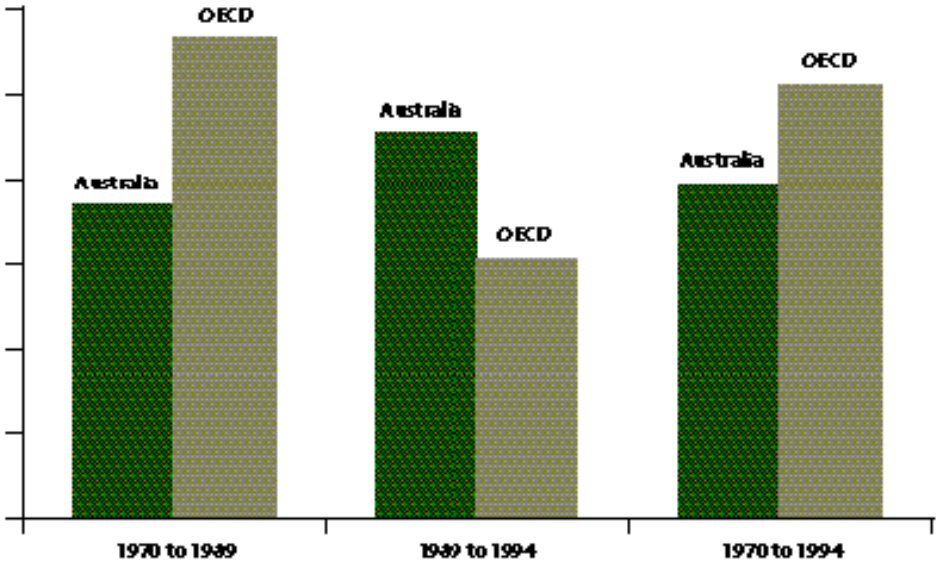
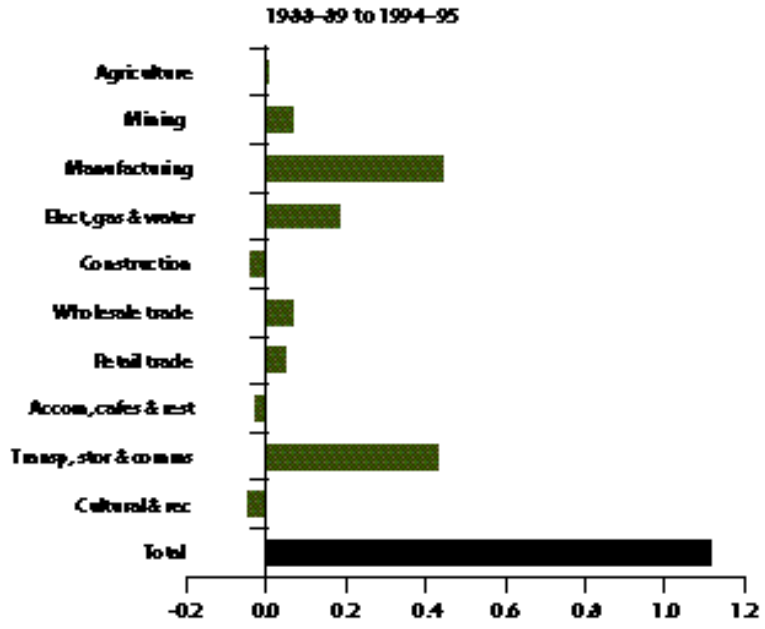
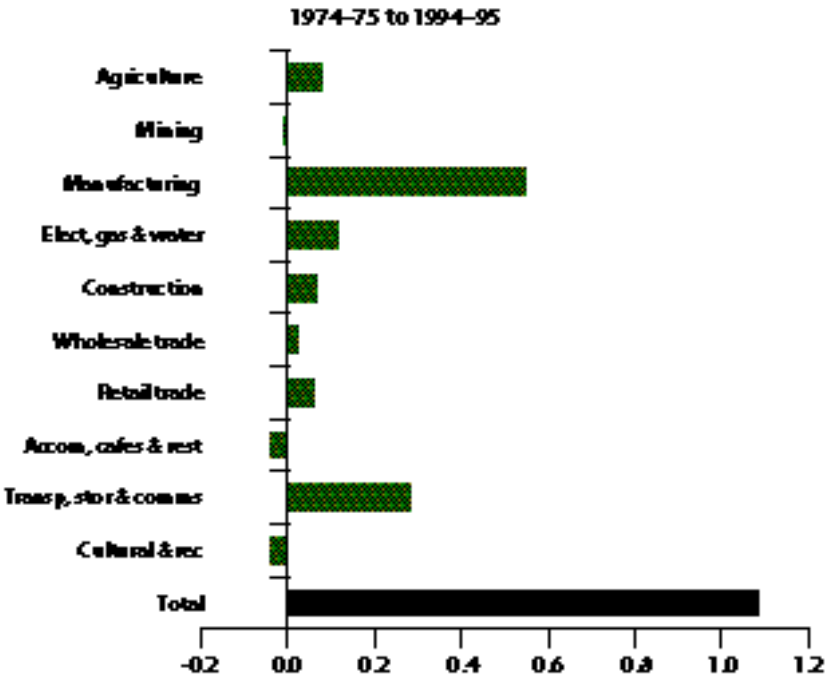


Figure 4: Sectoral contributions to Australia's productivity growth, 1974–75 to 1994–95 (percentage points)





- Productivity growth is now approaching the historical highs of the 1960s and early 1970s (see figure 2).
  - All other things equal (and putting aside the general absence of 'catch-up') some decline in productivity growth from the rates of the 1950s and 1960s could be expected. That period is widely regarded as a 'golden age' of unusually high productivity growth. Furthermore, the subsequent shift in economic activity toward services, which generally have lower measured productivity levels and productivity growth, would reduce aggregate productivity growth.
- The international comparisons are currently looking more favourable for Australia's performance.
  - There is a need for some caution until definite patterns emerge. But it seems that, while Australia's performance has improved since the late 1980s, the performance of other OECD countries has, on average, deteriorated (figure 3).

Sources of and contributors to national productivity growth

- Productivity growth can come from new knowledge (or 'technology' broadly defined), better organisation of production and as the incidental result of other developments (including the decline of less productive firms).
  - Although the strength of its influence has not been specifically investigated in this paper, technological change has been the foundation of productivity growth over the long term.

- Microeconomic reforms have been introduced to raise productivity by encouraging better organisation of production among firms and industries.
- At least some of the improvement in productivity growth appears to coincide with the introduction of a range of microeconomic reforms.
  - Casual observation at the sectoral level suggests a noticeable reform impact in at least Transport, storage and communication (particularly in communication) in the 1990s and in Electricity, gas and water from the mid-1980s. Effects of reforms in other sectors may well be present but have not been investigated in this paper.

✦ The contributions to national productivity growth have come from a range of broad industry sectors (figure 4).
- Over 1974–75 to 1994–95, important contributions have come from Agriculture, Manufacturing, Electricity, gas and water, Construction, Retail trade and Transport, storage and communication.
  - Manufacturing and Transport, storage and communication have been particularly strong contributors. Industries in these sectors contributed around three-quarters of the measured improvement in Australia's productivity between 1974–75 and 1994–95.

Potential for further productivity improvement

✦ The benchmarks provided by other countries' performance suggest there is further room for improvement in Australia's productivity performance.
- Given Australia's resource endowments, complete elimination of all productivity gaps with other countries is not necessarily feasible or appropriate. But there are large remaining gaps in the same sectors that have contributed most to Australia's productivity growth – Manufacturing, Transport, storage and communication and Electricity, gas and water. These are cause for the most concern.
- All sectors can contribute to national productivity growth by performing to their productivity potential.

The distribution of productivity gains

✦ The distribution of the gains from productivity improvement also matters for living standards. Productivity gains can be distributed initially through higher wages or profits, lower prices, improved product or service quality or through greater human and environmental protection. There are also flow-on effects to other firms, industries and individuals.

✦ Increased product market competition appears to be having an influence on the distribution of productivity gains.
- Coinciding with government reforms to increase competitive pressures in the economy, more of the available productivity gains are now being distributed through lower prices rather than being retained within firms as higher wages and/or higher profits.
- This means that consumers benefit and firms that purchase cheaper goods and services become more competitive.

✦ With the discipline of product market competition, differences in productivity growth among industries are leading to greater disparities in output prices among industries rather than in wages – despite the

increasing ability to link wages to firm-level productivity under enterprise bargaining.

Productivity and jobs

- Improving productivity does not mean there have to be reductions in the total number of jobs.
  - The evidence does not suggest a necessary link between productivity growth and lower aggregate employment or higher unemployment. There is evidence from studies at the level of firms, industries, broad sectors and whole economies that productivity growth has co-existed with positive employment growth in some cases and employment reductions in others.
  - From the perspective of these studies, there are other factors which have greater influence on aggregate employment and unemployment. The level of aggregate demand is particularly important. And, given that productivity growth stimulates income and demand, the long-term association between productivity growth and employment growth may well be positive. Labour market arrangements are likely to be another important influence.
  - Productivity growth has coincided with sustained employment growth over long periods in Australia and other OECD countries.
- Productivity growth has a more positive influence on employment growth when the benefits of productivity growth are passed on in the form of lower prices. Lower prices stimulate demand for the relevant goods and services.
- Productivity growth can, however, affect the structure of employment. It can affect employment in certain occupations, industries and regions. Depending on general demand conditions, the flexibility of labour markets and adaptability of the economy, this may lead to adjustment difficulties in the short to medium term.

The need for more information and analysis

- There is a need to improve the state of knowledge about productivity growth and its impacts. A number of measurement and research issues are outlined in chapter 9.

Implications for policy

The primary aim of this paper is to provide an understanding of Australia's productivity record and what it means for living standards, rather than to set out policy proposals. Nevertheless, some general policy implications can be drawn.

Productivity growth should be a continuing priority because it brings improvements in living standards

Raising and sustaining productivity growth should continue to be a high priority for policy. The evidence is that strong and sustained productivity growth is essential if Australians are to purchase more, save more, enjoy more leisure, and increase their capacity to meet community objectives and protect the environment.

There are community concerns, particularly about jobs, that must be addressed (see below). But the significance of productivity growth to improvements in real incomes for current and future generations is also important.

Productivity improvement should be the focus of endeavours to improve growth

Productivity growth is a vital component of economic growth. It helps to underpin faster non-inflationary growth.

Productivity growth has had a key role in past economic growth, even when there has also been significant growth in inputs. In the 1950s and 1960s, there were large capital flows associated with the development of infrastructure and mining and manufacturing industries. Labour supply grew with population growth, which included waves of immigration and baby-boomers, and increases in labour force participation.

But future prosperity is likely to depend increasingly on productivity growth. It is claimed that capital flows are now more 'footloose' internationally. Amongst other things, capital is attracted to countries with better productivity performance. Large increases in labour supply through immigration and further increases in participation are unlikely to loom as large.

Proposals to raise economic growth need to keep sight of the importance of productivity growth. For example, there have been recent calls for government incentives to help attract international investment, given the policy stance of some of our Asian neighbours. But there is some evidence to suggest that many of these countries are building strong growth through the accumulation of inputs rather than productivity. And investment has been at least partly funded by sacrificing current consumption for savings. The international experience suggests that this approach is more a function of stage of development. Developed countries tend to rely more on productivity growth as the foundation for further growth.

That is not to say that investment is unimportant. Investment is a key component of growth. And there are important links between investment and productivity growth.

But it is crucial for Australians' living standards that improvements in productivity be a focus of endeavours to improve growth.

All parts of the economy should be examined for the productivity improvements they might bring

Improving productivity requires a focus on the sources of productivity growth. This means working on the elements that encourage the advance of new knowledge and technology; and better organisation of production among firms and industries.

National productivity growth comes from improvements in all sectors of the economy. And it comes from each sector performing to its potential.

For example, Manufacturing, Transport, storage and communication and Electricity, gas and water have made strong contributions to national productivity growth in the past. Part of the reason lies in the fact that at least some parts of these sectors have shown strong growth from a low base. And international comparisons suggest they still have plenty of room to improve.

And it is not a simple matter of concentrating more on high productivity industries. With consumer preferences also affecting the value and type of goods and services produced, the optimum industry mix at any time will involve industries with both relatively high and relatively low productivity.

Pro-competitive reforms are part of a total policy package

Detailed policy suggestions to improve productivity growth are not canvassed in this paper. But it is clear that raising and sustaining the rate of productivity growth requires a long-term, multi-faceted approach. The paper has pointed to some signs of a positive response to recent policy initiatives to improve productivity growth through microeconomic reform.

One implication that can be drawn from the paper is that pro-competitive reforms are an important element of a total policy package. The positive influence of pro-competitive reforms on productivity growth has been argued elsewhere (for example, the *Stocktake of Progress in Microeconomic Reform*). It is the influence of pro-competitive reforms on the distribution of the gains from productivity growth that is featured here.

Pro-competitive reforms in goods and service markets enhance the flow-on gains to the economy and community at large. Labour market reforms alone may affect the distribution of gains between wages and profits; but they will not be sufficient in themselves to generate flow-on benefits through lower prices. Product market competition provides that important discipline.

Pro-competitive reforms create the conditions for a 'virtuous cycle'. They add incentives to seek productivity improvements and to distribute the gains through lower prices. This in turn creates further incentive to seek further productivity improvements.

Addressing community concerns

While improving productivity raises average real incomes, it also raises community concerns, the foremost currently being about the impact on the security of current jobs. Productivity growth may have little adverse impact on the aggregate numbers of jobs or may have a positive effect in the long run. But in some instances job losses in particular industries, occupations and regions can come immediately.

Community concerns about the impacts of productivity on jobs can be addressed in several ways, such as:

- The emphasis on general job creation through macroeconomic policy instruments should continue.
- A complementary priority is to improve the flexibility and adaptability of the economy. This can range from more flexible industrial relations arrangements through to examining a range of institutions such as schooling and training systems which provide the basis for 'life long' learning.
- Adjustment pressures that do emerge may be eased to some extent through effective retraining schemes and income support.

It would also be valuable to get a firmer picture and encourage broader community understanding of the exact nature of the implications of productivity growth on the structure of employment.

At times and from some quarters, there come calls for a halt to the changes that bring productivity growth in the hope that this will stop job losses in some sectors of the economy. There may be individual instances in which the costs associated with a change may be judged to be too high. But, *as a general strategy*, holding up changes that bring productivity growth would not seem to be the appropriate way for a nation to proceed, particularly when other more direct and adequate ways of dealing with adverse consequences are available.

Constraining productivity improvements raises the risk of further unemployment by reducing the competitiveness of some firms. It would also jeopardise opportunities for further improvements in living standards.

Productivity gains and how they are distributed matter not only for the job security of the currently employed. They also matter for the currently unemployed, for the future job opportunities and living standards of today's children, and for the comfort and security of the current workforce in its retirement.

1 ABOUT THIS PAPER

1.1 Focus of the paper

Governments, business and some academic and media commentators have been calling for higher productivity growth in the Australian economy for some time. But not a lot has been said about actual performance.

This paper reviews the evidence on how well Australia has been performing.

It considers productivity in the context of living standards. Improving productivity is not a goal in its own right. But it does make a vital contribution to the living standards of Australians by raising our real incomes.

However, there are other changes associated with productivity growth that can also affect living standards. How are the gains from productivity improvements distributed? What are the effects on job security, job opportunities for the unemployed and work intensity for those in employment?

This paper explores these issues. Several of them — notably distribution of the productivity gains and the employment effects — are too big to be examined thoroughly here. Some further work is suggested.

The principal focus of the paper is on *assessing* Australia's productivity performance. The assessment is made against benchmarks suggested by historical performance and the performance of other comparable countries.

It is not a prime task of this paper to *explain* Australia's productivity performance — that is, to investigate the underlying factors that have caused the observed trends in productivity or that could be called upon to bring about improvements in productivity. That again would be a large task.

However, productivity performance over recent years is given some attention, in view of the microeconomic reforms introduced over the past decade or so to lift productivity growth. But in keeping with the objective of assessing rather than explaining productivity performance, there is no detailed analysis to separate the influence of microeconomic reforms from other contributing factors.

1.2 Structure of the paper

The next chapter outlines how productivity growth influences living standards. Chapter 3 follows up with estimates of the contribution that productivity growth has made to increases in living standards over the past three decades.

To assess productivity performance requires a benchmark — a standard against which performance can be compared. Australia's performance is considered from three main perspectives:

- chapter 4 examines the historical record to give a feel for what might be achievable based on past performance;
- chapter 5 considers the productivity performance of individual sectors of the economy to give a sense of the main contributors to and constraints on national productivity performance; and
- chapter 6 compares Australia's productivity performance against the performance of other countries.

Chapter 7 looks at the distribution of productivity gains. The emphasis is on how productivity gains raise incomes (through wages and profits) and/or reduce prices.

Chapter 8 presents an initial examination of employment effects. The main focus is on whether productivity improvements affect employment levels in general. Specific effects in particular occupations, industries or regions are not examined.

Finally, chapter 9 presents a range of issues emerging from this study that require further investigation.

2 PRODUCTIVITY AND LI VING STANDARDS

Productivity matters because growth in productivity promotes economic growth and helps Australians to improve their living standards.

This chapter explains what productivity is, how productivity growth comes about and how it improves living standards.

2.1 What is productivity?

Productivity is a measure of the capacity of individuals, firms, industries or entire economies to transform inputs into outputs.

More precisely, productivity is a measure of the rate at which outputs (of goods and services) are produced from given amounts of inputs (skills, effort, land, raw materials, machinery, management and so on). Higher productivity means more goods and services can be produced for the same commitment of resources and effort.

At its simplest, the level of productivity is measured as the ratio of output to one or more inputs; for example, the number of cars produced per employee or the number of tonnes of wheat produced per hectare. Productivity growth measures the growth in output per unit of input over time.

Productivity measures provide a basis to assess and compare production processes in terms of the amount of output they generate from resources (or the efficiency with which they use resources to produce output). They might reveal that one production plant is more productive (produces more output of a particular good per unit of input) than another; or that a particular good can be produced with less resource input by one process compared with another; or that, with some changes in production, a firm has become more productive over time.

Improvements in productivity can come through the development and adoption of better techniques of production or by committing inputs to more productive uses. Some examples of productivity improvements and the benefits they bring are provided later in box 2.5.

Box 2.1 Productivity improvements — doing more with less?

Improving productivity can mean producing more output from the same input of resources ('doing more with the same') or using fewer inputs to produce the same amount of output ('doing the same with less'). Sometimes these two notions become fused into characterising productivity improvements as 'doing more with less'. This is especially so if the number of jobs within a firm is reduced in the process of generating a productivity improvement.

Producing more with less can happen. But a number of points need to be considered.

First, improved productivity does not necessarily require a reduction in inputs. For example, many productivity improvements come from providing a firm's existing workforce with *additional* equipment.

Second, some productivity improvements can allow firms to increase output. Even if labour-saving technology or practices are introduced, a productivity improvement usually stimulates greater production (more units of output) of cheaper products that increases the demand for labour to some extent and offsets at least some of the labour saving (per unit of output).

Third, the notion of 'doing more with less' applies more to individual firms than it does to the nation as a whole. Even if a firm reduces the size of its workforce, employment opportunities arise in other industries as a result of the full effects of the productivity improvement.

Employment effects of productivity improvements are discussed in chapter 8.

2.2 Why productivity is crucial to living standards

What is commonly referred to as 'the standard of living' is in reality a multi-dimensional concept. Box 2.2 gives a feel for relevant indicators. While average income is a key indicator, other dimensions such as the ability to purchase goods and services (whether they be luxuries or necessities), leisure, the distribution of income, health, housing, education and environmental amenity also feature prominently.

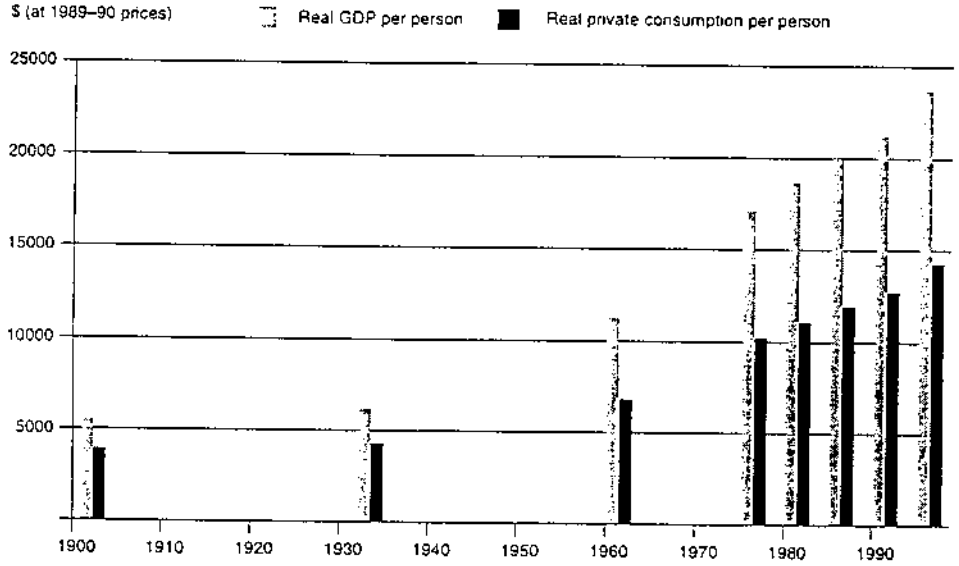
Even so, income remains a central factor underpinning general living standards. The attainment of greater purchasing power, leisure, housing, education and so on depend importantly on average income.

Box 2.2 illustrates how Australian living standards have improved over the course of the century. There is particular improvement in virtually all indicators in the latter part of the century.

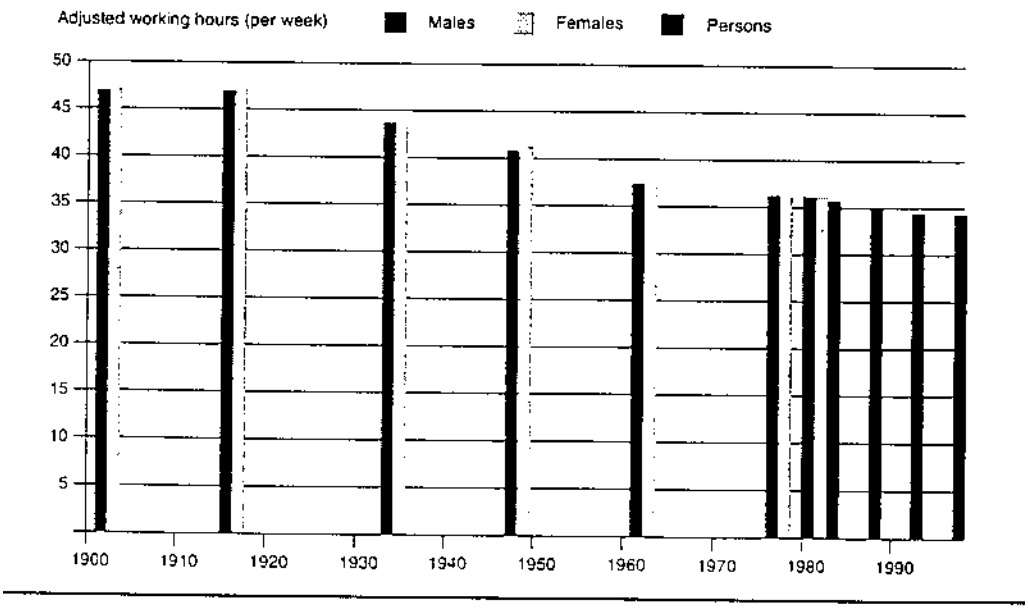
Box 2.2 Australian standards of living over the twentieth century

There is no single, fully-defensible measure of living standards. Rather a picture must be formed from a range of indicators. These measures are discussed in appendix A.

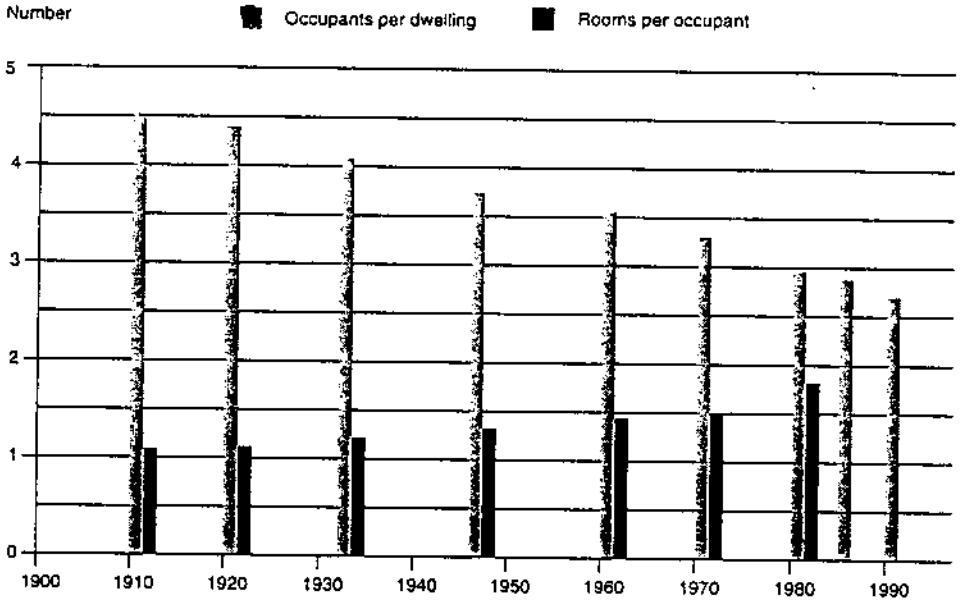
Economic indicators GDP per person captures average income in the community. Private consumption expenditure per person is a measure of average purchasing power.



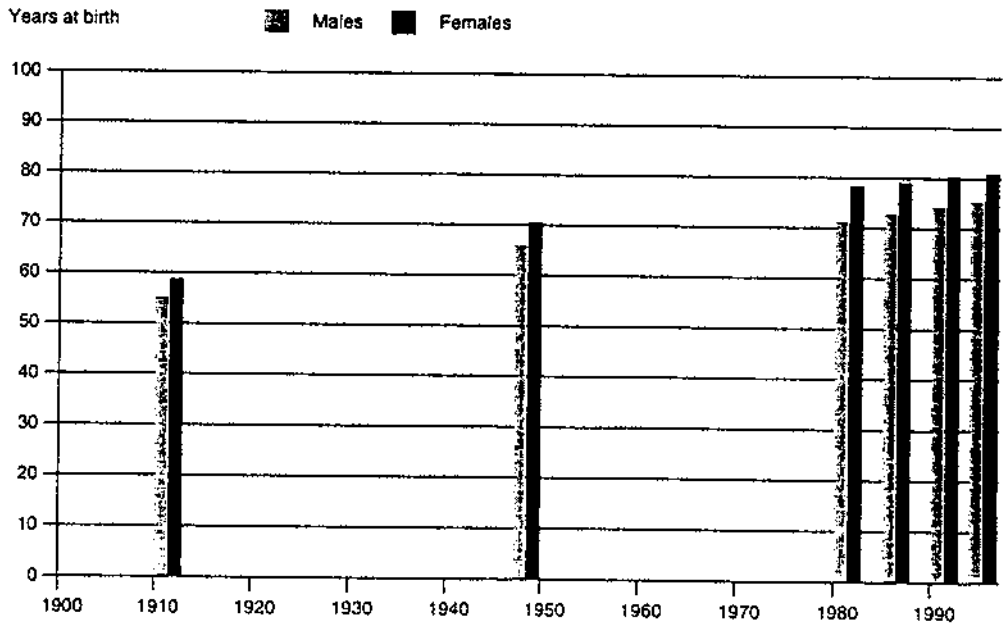
Increases in leisure Leisure can be taken over a lifetime, the year of work or from week to week. Average standard full-time hours per week in paid employment (taking into account holidays over the year) have declined over the century.



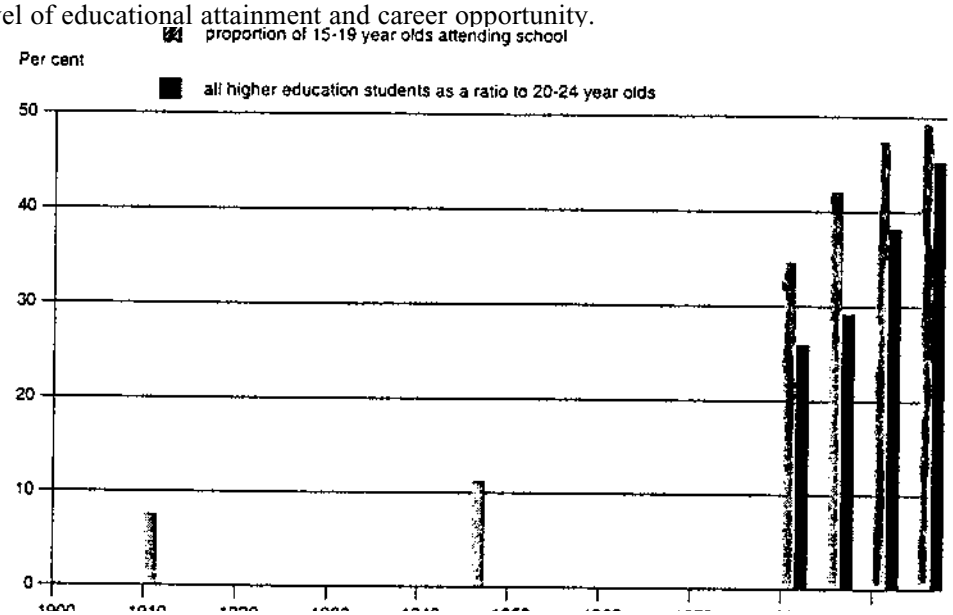
Housing The average number of occupants per dwelling and rooms per occupant are two possible indicators of housing standards. Other indicators are presented in appendix A.



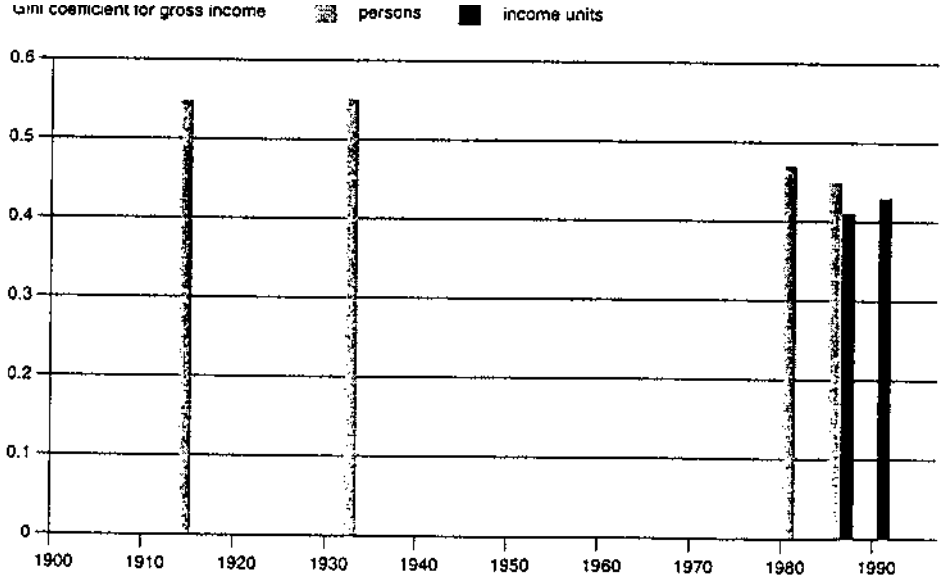
Life expectancy Trends in life expectancy provide a general indication of improvements in the standard of health.



Education Retention in education beyond minimum leaving age is an indicator of the level of educational attainment and career opportunity.



Inequality of income The evenness of the distribution of income is one indicator of equality. A summary measure of income distribution shows that the distribution of income has generally become more even over the century.



Environment Environmental quality also affects living standards but statistics spanning the century are not available. Some measures for a shorter period are provided in appendix A.

Source: see appendix A.

The key to linking productivity to living standards comes from the simple observation that producing output (more precisely, adding value) generates income. As goods and services are produced and sold, wages are paid, profits are made and can be distributed, and taxes accrue. Higher productivity means more output; more output means more income; and more income means higher living standards.

If a nation is to improve its material standard of living, it needs to produce more output. In the long run, a nation cannot consume more than the income it generates. Since national income is closely related to the amount of output that a nation produces [1], it follows that output must grow in order to generate the income that underpins living standards. That output growth has to be derived from either committing more inputs or from improving the productivity with which inputs are utilised.

But there is a vital difference between input growth and productivity growth in terms of impact on living standards. Using more inputs to generate more output incurs a cost — that of using the input. But a productivity improvement means that more output can be generated for the same effort and resource input. That output gain means more net income.

That is why productivity improvements are so crucial and potentially powerful in helping to secure higher living standards.

It is has been said that, in the long run, almost nothing counts as much for a nation's standard of living as its rate of productivity growth (Blinder and Baumol 1993, p. 778; Krugman 1992, pp. 1–17).

There are at least two other factors that can have some influence (see box 2.3). These are capital deepening and price effects.

Capital deepening is the application of more capital per unit of labour (an increase in the ratio of capital to labour). It means that the workforce has, on average, access to more capital equipment and can therefore generate more output.

Australia is a relatively small economy with major trade links to the rest of the world, so that price effects — referred to as the terms of trade — also have an influence on our living standards. The terms of trade measure the prices we receive for our exports relative to the prices we pay for our imports. A decline in the terms of trade means a reduction in living standards because real income

[1] Residents can derive income from overseas and can finance some of their spending from foreigners.

Box 2.3 Major influences on living standards

The main factors that affect living standards can be illustrated in a simplified example.

Take income per person as a proxy for living standards (see box 2.2 and associated text). It measures the income the community generates to meet the needs of its citizens on average.

To make things simple, assume labour inputs grow at the same rate as the population. Output per head of population can then only grow with:

- productivity growth — more output from inputs used; and
- capital deepening — capital inputs growing faster than labour inputs.

Output per person translates into income per person, although the purchasing power of that income is affected by the terms of trade — the ratio of prices received for exports to prices paid for imports. A deterioration in that ratio reduces living standards by reducing the ability of the nation to purchase imports from the proceeds of exports.

A more complete explanation of the main factors affecting livings standards is presented in the next chapter. A more rigorous derivation is presented in appendix B.

(or purchasing power) is less due to the fact that export earnings can cover the purchase of fewer imports.

The next chapter puts an order of magnitude on the importance of productivity and other factors in raising the living standards of Australians. As will be seen, productivity is clearly the dominant influence.

Even relatively small amounts of productivity growth can make a substantial difference to living standards over the very long term.

> Over long periods of time, small differences in rates of productivity growth compound, like interest in a bank account, and can make an enormous difference to a society's prosperity. Nothing contributes more to reduction of poverty, to increases in leisure, and to the country's ability to finance education, public health, environment, and the arts. (Blinder and Baumol 1993, p. 778)

Some indicative numbers in table 2.1 illustrate the point. Australia's combined labour and capital productivity has increased by an average 1.5 per cent a year over three decades (see chapter 4). If productivity growth were 1.7 instead of 1.5 per cent a year over a 50 year period, living standards (as represented by income per person) would be 10 per cent higher. If the rate were raised to 2 per cent a year, living standards for the next generation would be 13 per cent higher and 28 per cent higher for the generation after that. Each seemingly small increase in the rate of productivity growth, if sustained, yields a large dividend over the long term.

Table 2.1 Index of income per person at different rates of productivity growth[a]

	Income per person	
Productivity growth rate (per cent a year)	*after 25 years*	*after 50 years*
1.5	100.0	100.0
1.6	102.5	105.0
1.7	105.0	110.3
1.8	107.7	115.9
1.9	110.3	121.7
2.0	113.1	127.9

a It is assumed that productivity improvements translate fully into improvements in income per person. This is tantamount to assuming that productivity improvements have no impact on the other factors that influence average income (see appendix B).

Productivity performance affects a country's own absolute standard of living. Its productivity performance compared with other countries affects its relative standard of living. Some care is needed in making international comparisons of productivity performance (chapter 5). However, the potential impact of relative productivity performance on relative standards of living is perhaps most strongly and succinctly stated by Baumol et al. (1989, p . 21).

> A nation pays for poor productivity performance by transforming itself into a supplier of cheap labour; that is by offering low living standards as its chief attraction as a place to do business and as a primary reason for the competitiveness of its exports.

2.3 Broader perspectives on living standards

As discussed thus far, productivity growth helps to generate more output and income which in turn helps to raise living standards.

But should productivity be the sole focus of attempts to improve living standards? Do *all* productivity improvements improve living standards?

Productivity focuses on the output generated from resources *when committed to production*. But living standards depend on output and income generated by all available and potentially employable resources. The potential of the unemployed is a particularly important case in point.

In the presence of unemployment, living standards can be improved with increases in employment, even if that means a reduction in measured

productivity. To illustrate, if unemployed people were gainfully employed in generating at least the average income (per head of population), income per person in the community would rise. But they would not necessarily have to be employed in the most productive jobs to earn more than average income. Consequently, average productivity could decline. [2]

This distinction between productivity and living standards also opens the possibility that some productivity improvements could detract from living standards if they reduced aggregate employment (and those displaced from employment were generating at least average income).

As alluded to in box 2.1, the employment effects associated with productivity improvements are complex. Even if there is labour shedding in the firm introducing the productivity improvement, employment opportunities are likely to arise elsewhere, with an uncertain and perhaps positive overall effect (see chapter 8).

Furthermore, even if there was an overall reduction in employment, the productivity improvement may nevertheless contribute a net gain in average income. This would happen if the additional output generated by the productivity improvement more than offset any loss of potential output due to unemployment or 'underemployment' of displaced employees. This does not, however, take into account the personal and social cost of unemployment.

The point is that, while productivity is crucial to living standards, improvements in living standards also depend on other factors. Living standards depend not only on productivity growth but also on harnessing the contribution of available resources in gainful employment. In some instances, there may even be a trade-off between productivity growth and improvement in living standards. If this does arise, living standards should be the over-riding consideration.

There are other instances in which productivity improvements in individual firms may not contribute to improvements in community living standards (see box 2.4). These involve cases in which outputs are not properly valued from the broader community point of view or the costs imposed on others are not taken into account.

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[2] Employing people off the unemployment queues could lower average productivity. This could be because production becomes more labour intensive (with the opposite effect to capital deepening — see box 2.3) or because newly-employed people may have, at least initially, less skills and experience than the existing employed workforce. But, in coming into employment, the unemployed can nevertheless make a positive contribution to output and living standards.

Box 2.4 Examples of productivity improvements that do not bring improvements in living standards

There are some increases in the ratio of output to input at the firm level that may not be of overall benefit to the nation as a whole.

- Output may increase in an environmentally-sensitive region to improve a firm's measured productivity. But the environmental damage may reduce or offset that gain from a wider social perspective.
- Output in a firm may be 'artificially' bolstered by government assistance or regulation that is not in the broader community interest because of the costs it imposes on others.
- If employees are laid off from a firm and other jobs do not arise elsewhere to compensate, national income may decline.
- A government agency might eliminate a service that would improve its productivity. But if that meant higher costs to users, the nation may be worse off. As a hypothetical example, cessation of police patrols of an industrial area might contribute to an improvement in the police force's productivity (depending on how 'output' is measured). But if the affected firms had to take other security measures that added up to more use of resources, the nation would be worse off.

However, it should be emphasised that these cases do not detract from the general point that productivity is crucial to improving living standards. Rather, they underline the point that there are also broader issues to take into account when considering living standards.

2.4 Sources of productivity improvement

How do improvements in productivity come about?

With productivity gains defined as increases in the ratio of output to inputs, it follows that anything that raises the ratio of output to inputs can be considered a source of productivity gain.

As outlined in chapter 1, this paper does not attempt a thorough investigation of the factors that affect productivity growth. There are three main 'proximate' mechanisms:

- *New knowledge* introduces new production methods that are more effective in transforming inputs into outputs.
- *Better organisation of production* within firms and between industries can improve productivity even within the boundaries of existing knowledge.

- There can be *incidental effects* that arise, not through the active pursuit of improved productivity, but as a by-product of other developments.

These mechanisms and some of the underlying driving influences are now briefly outlined.

New knowledge

Arguably, new knowledge or 'technology' is the most direct link to productivity growth. Certainly it is a central focus of studies on productivity.

New knowledge introduces new ways of doing things that create more output per unit of input. This view sees technology as the physical embodiment of knowledge.[3] New knowledge can bring forth new products, materials, processes, equipment and techniques. Examples of productivity improvement through new knowledge are: the development of mechanical harvesting of wine grapes; the application of advanced ceramic technology to aircraft turbine engines and the development of the just-in-time inventory technique (see box 2.5).

There are complex, costly and time-consuming processes in the development, transfer and use of knowledge. Commercially viable processes need to be developed. Diffusion of new techniques requires awareness and investment in know-how and skills. It often requires investment in capital equipment with new knowledge embodied within.

There are many 'dynamic' inter-relationships between R&D, innovation, commercialisation and up-take (see IC 1995a). For this reason, the development of new knowledge is often characterised as having a compounding effect that raises the rate of productivity growth over time.

New knowledge can be generated in many ways — through conscious research, trial and error, inspiration and serendipity. All the underlying factors that affect productivity growth through knowledge have not been identified with precision. But the key factors are considered to be as follows:

- Research and development is fundamental to the creation of new knowledge. R&D is specifically directed toward increasing the stock of knowledge.

[3] Link (1987, pp. 4–6) defines invention as the creation of new knowledge — the creation of a new technology or finding a way to put an existing technology to a new use. Innovation is the application of an invention. Innovation does not occur so much in single events as in continuous processes (IC 1995a, vol. 1, p. 59).

Box 2.5 Examples of productivity improvements and the benefits they bring

- The move to mechanical harvesting of Australia's wine grapes over the past 30 years — which now extends to 80 per cent of the crop — has reduced the cost of harvesting grapes by $1500 per hectare. It has also helped to meet demand for improved quality by enabling night time harvests when temperatures are cooler (CIWWI 1995, p. 45).
- Since 1950 productivity improvements in the dairy industry have seen average production per cow more than double (ABARE 1993, p. 79; 1997, p. 164).
- Most surface irrigation systems for crops such as cotton and rice constructed in Australia over the past couple of decades have employed laser grading technology which has meant savings in water used, higher return and better crops. In horticulture the introduction of under tree micro irrigation systems is said to have achieved efficiencies in water use in the order of 85–90 per cent (IC 1992, p. 194).
- Rapid technological advances in book publishing and printing such as computer based type-setting, composing and image manipulation have increased the speed and output of printing presses and reduced manning levels (IC 1996a, p. 24).
- A 1992 study by Rolls Royce showed that the use of advanced ceramic components in aircraft turbine engines would provide a 10 per cent saving in engine weight, a 12.5 per cent increase in thrust to weight ratio and a saving of US$7m per engine in life-cycle cost to the customer (IC 1995b, p. 175).
- According to a BIE study, more widespread application of high efficiency motors by industry has the potential to reduce energy consumption and costs. Current market share for high efficiency motors is currently only about 2 per cent but the introduction of energy efficiency labelling could see this rise to nearly a quarter, with potential savings to the manufacturing sector of $39 million (BIE 1994, p. xi).
- The competitive tendering of a contract to maintain F-111 aircraft at Amberley RAAF base resulted in the successful tenderer (an in-house team) reducing costs by $8m annually due largely to flatter management structures and redesigned work teams which reduced maintenance personnel from 356 to 214 (IC 1996b, p. 565–72).

- The development of human capital enhances the development of knowledge. The generation of new knowledge requires skilled researchers and others who are alive to new opportunities, can indentify problems and possible solutions and are flexible and adaptable to change. Appropriate investments in education and training are therefore important in enhancing the creation and application of knowledge.

- Investment in physical capital is also considered important.
  - The amount of investment may be important to the extent that new knowledge is embodied within capital equipment and its installation creates further knowledge spin-offs through interaction with skilled personnel.
  - Investments in certain types of infrastructure can also have an influence. For example, in Australia where population and production centres are widely dispersed, the development of transportation and communications networks can influence the fragmentation of production, marketing and distribution and can therefore influence efficiency and productivity.

The adoption of existing knowledge can have an influence on the rates of productivity growth among countries. Depending on stage of development, countries can bring forth relatively rapid productivity growth through technological catch-up. This view sees the mature advanced countries as being technology leaders (in terms of productivity levels), with opportunities for further productivity growth being determined largely by new technological developments. Other countries that are technology followers, and perhaps at a less advanced stage of development, have the opportunity to raise productivity growth more rapidly by replacing very old technology with very new technology. More is said on this in chapter 6.

Better organisation of production

The standard 'textbook' view of productivity implicitly assumes that all parts of the economy are producing as efficiently as possible. Productivity growth then comes largely, if not exclusively, through new technology.

But in practice, all parts of the economy are not producing as efficiently as possible. Addressing these inefficiencies opens up other possibilities, by definition, to improve productivity.

Increases in the ratio of outputs to inputs can also come about in the following ways:

- Some firms may not be producing as efficiently as they could, for example, if they do not have the competitive incentive to introduce best practice.
- Even if firms are producing as productively as possible within the constraints of their operating environment, relaxation of some constraints (such as government regulations) may enable them to be even more productive.

- Removal of some constraints (for example, relative tax treatment) could encourage inputs to gravitate towards more productive industries and activities.

These sources amount to doing better within the boundaries of existing knowledge and technology. On this view, productivity improvements come from better organisation of production within firms and between industries.

Government (microeconomic) reforms affect the operating environments of firms and their pursuit of productivity improvements — through tariffs, taxes, subsidies, regulations and institutional arrangements. The effect of reforms could be the elimination of unnecessary and inefficient management practices, restrictive work practices and 'rent-seeking' behaviour; or a shift of resources to more productive activities.

It is sometimes said that microeconomic reforms bring a 'once-off' or 'static' improvement in productivity — that is, they raise the *level* of productivity and not the rate of *growth* in productivity. Reforms can, however, also have dynamic effects. For example, greater competition can stimulate continuous search for productivity improvement, with compounding effects.

Incidental effects

Aggregate productivity can also be affected by growth in the size of firms and industries:

- productivity within an industry varies among firms, so that downsizing or closure of less-productive operations that occurs for other reasons could increase industry-wide productivity;
- productivity varies among industries (even if all firms are at 'best practice'), so that changes in the industry mix in an economy due, for example, to changes in consumer tastes and incomes can affect national productivity; and
- if firms are able to reap economies of scale as they grow, they will require fewer inputs per unit of output.

These factors are related neither to new knowledge nor to better organisation of production (although new knowledge and government reforms can have compositional effects). They are the incidental effects of changes that take place for other reasons.

The 'incidental' description should be emphasised. Resources shift between firms and industries through the interplay of both demand and supply factors and thereby have an incidental effect on aggregate productivity. It is not implied that any further movement of resources from one firm or industry to another

should be deliberately engineered (apart from the government reforms that bring about better organisation of production) to improve aggregate productivity.

There may also be incidental productivity effects from other developments. For example, inflation creates uncertainty and distorts price signals which can affect the amount and types of investment and the allocation of resources in the economy (Anderson and Gruen 1995).

Productivity also responds in the short-term to variations in the business cycle. As the economy goes into a downturn, businesses tend to 'hoard' labour and hang on to underutilised equipment until the trends become clearer. Coming out of a downturn, extra production potential can be readily tapped.

2.5 Summing up

Productivity is a measure of the rate at which inputs are transformed into outputs.

Productivity growth is a vital element in raising living standards. The higher output growth it enables brings more net income. The improvements in living standards can come over decades from seemingly small but sustained increases in the rate of productivity growth.

However, while productivity improvement is crucial to raising living standards, it should not be treated as a paramount objective to be pursued at all costs. Improving living standards also depends on harnessing the contributions of available resources in gainful employment — even if this does mean a reduction in measured productivity in some cases.

Improving productivity is not a simple matter of 'working harder'. The important mechanisms amount to 'working smarter' — generating and applying new knowledge and encouraging and facilitating better organisation of production within firms and between industries.

3 ESTIMATES OF PRODUCTIVITY'S CONTRIBUTIONS TO OUTPUT AND LIVING STANDARDS

This chapter puts some orders of magnitude on the importance of productivity growth in contributing to output growth and improvements in living standards.

As stated in the previous chapter, output growth must come either from growth in inputs or from growth in productivity. Indeed, this is the principle that underlies the basic method of estimating productivity growth (see box 3.1).

Additional output on account of productivity growth provides additional net income. This is a major source of improvement in living standards.

Box 3.1 The basics of estimation of productivity growth

Productivity growth cannot be directly observed and measured. Rather, it is calculated as a residual — the amount of output growth that remains after allowance is made for the contribution of growth in inputs.

A *partial productivity* measure allows for the growth in one input. For example, the growth in *labour productivity* would be calculated as the growth in output over a period less the growth in labour inputs over the same period. Similarly, the growth in *capital productivity* would be calculated as the growth in output less the growth in capital inputs.

A *multifactor productivity* measure allows for growth in more than one input. Usually (as is the case in this paper), it involves the two inputs labour and capital. The growth in multifactor productivity can be calculated as the growth in output less the growth in a combined index of labour and capital inputs.

3.1 Productivity's contribution to output growth

Productivity growth has accounted for about half of Australia's growth in output over the past three decades (see figure 3.1). The other half has come from growth in inputs. The rate of growth in real output from 1964–65 to 1995–96 was 3.2 per

cent a year, of which 1.7 per cent a year was attributable to growth in inputs and 1.5 per cent a year was due to growth in multifactor productivity (MFP). [1]

These figures should only be interpreted as approximate, as the boundaries between input growth and productivity growth cannot always be clearly defined (see next chapter). The division between capital inputs and productivity is the more hazy one.

Figure 3.1 also shows the contributions to output growth in sub-periods. The sub-periods are defined by peaks in MFP. Calculation of rates of productivity growth from peak to peak is one way of avoiding the spurious effects of business cycles.

The charts for the sub-periods suggest considerable volatility in the contribution of input and productivity growth to output growth. The closest association would appear to be between capital growth and output growth. Productivity's contribution has been volatile, contributing between 20 per cent and 70 per cent toward output growth in different periods (right-hand side of charts). But this was due more to the variable labour input growth than it was to variable growth in productivity (left-hand side of charts).

It has been argued that this 'accounting' decomposition underestimates the true contribution of productivity growth. Over time, productivity growth stimulates output and income growth which, in turn, stimulates further capital investment. In this sense, the output growth attributable to productivity growth could be higher.

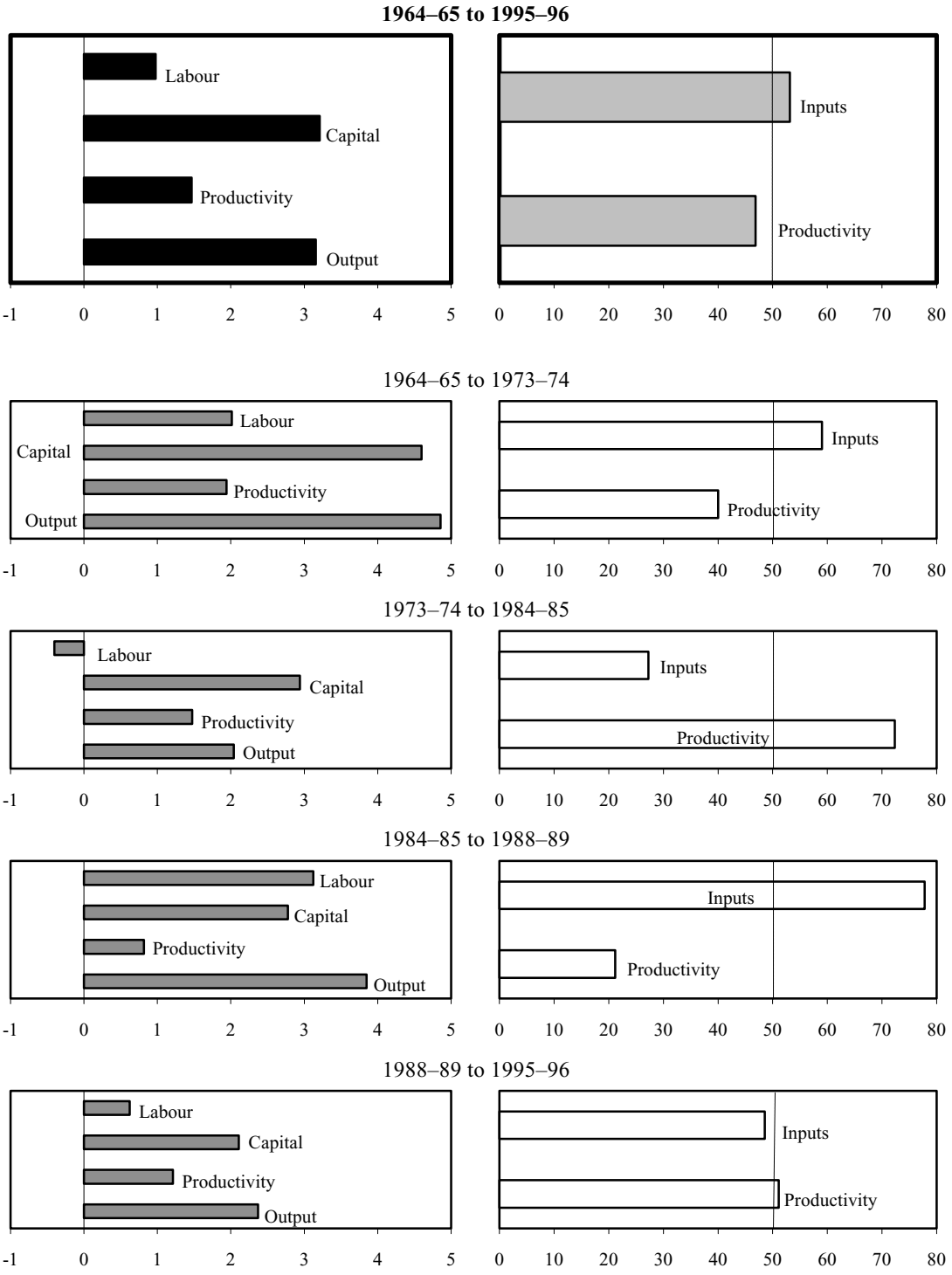
Input growth was a feature of Australia's development in the past. After World War II, there were large capital flows associated with development of infrastructure and mining and manufacturing industries. Labour supply grew with population growth, which included waves of immigration and baby-boomers and increases in labour force participation.

But it is quite possible that productivity growth may be more important to the future than it has been to the past. The same increases in inputs are not guaranteed in the future. Capital flows are now more 'footloose' internationally. Amongst other things, capital is attracted to countries with better productivity performance (see IC 1993, appendix A). Large increases in labour supply through immigration and further increases in participation are unlikely to loom as large.

[1] Data are drawn from ABS Cat. no. 5234.0. These results are basically in line with results for the shorter period, 1974–75 to 1993–94, published in IC (1995c). Input growth was relatively more important in the 1960s than in later years.

Figure 3.1 Contributions to output growth from labour and capital inputs and multifactor productivity, 1964–65 to 1995–96

Annual growth rates (per cent a year) *Contributions to output growth (per cent)*



Source: Commission charts using data from ABS Cat. no. 5234.0.

3.2 Productivity's contribution to living standards

The fundamental significance of productivity growth lies in its contribution to improvements in living standards.

For practical reasons the analysis of living standards must be confined to the average income dimension. As outlined in box 2.2 in the previous chapter, there are many dimensions to living standards. But without detracting from the importance of issues such as leisure, equality and environmental protection, it is not practical to incorporate them into the analysis that follows. There are data limitations, as well as limits to the issues that can be addressed in the one paper.[2]

However, as noted in the previous chapter, income per person can be taken as a reasonable indicator of average economic well-being.

Chapter 2 introduced a simplified framework for linking productivity and living standards. The three main long-run influences on living standards were stated as productivity growth, capital deepening (increases in the capital-labour ratio) and changes in the terms of trade (see box 2.3).

Figure 3.2 depicts the course of real GDP per person, multifactor productivity and the capital-labour ratio since 1964–65. The growth in MFP will be discussed in detail in the next chapter. The capital-labour ratio series shows a general trend toward capital deepening over the period. From this chart, MFP and capital deepening would both appear to be potentially important positive influences on living standards.

The terms of trade, on the other hand, do not appear to have had a major effect on Australians' living standards. The terms of trade affect the purchasing power of what Australia produces. They have been in gradual decline over recent decades — 0.6 per cent a year on average since 1964–65 and 0.7 per cent per a year since 1949–50. The ABS makes an adjustment for the terms of trade in deriving a real gross domestic income series from the real GDP(I) series (GDP measured on the income side). A decline in the terms of trade reduces real gross domestic income below the original GDP(I) series. These two series have followed each other closely, at least since 1959–60. Differences really only become apparent when a shorter period, such as the 1980s and 1990s experience, is examined (see figure 3.3).

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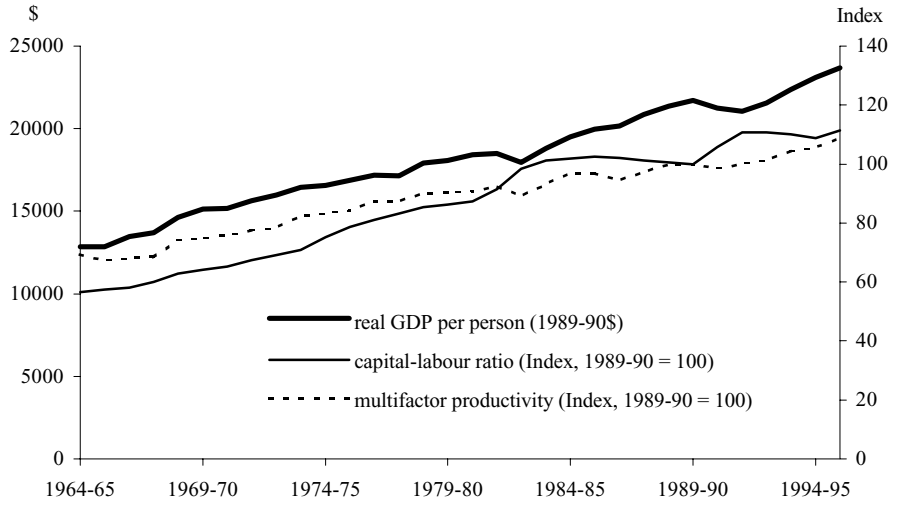
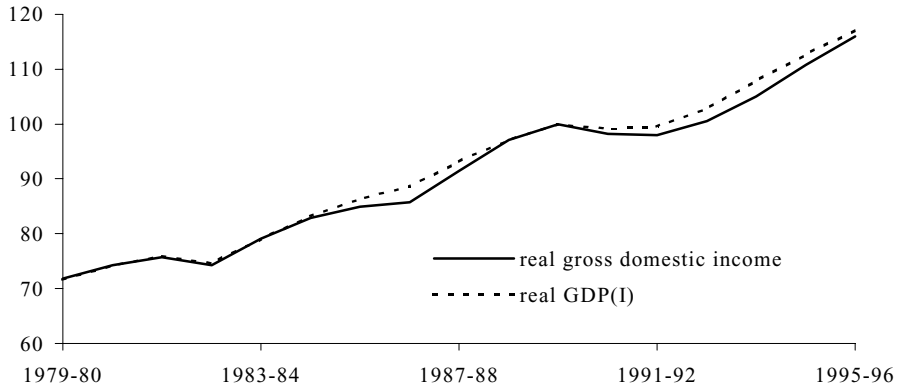
[2] It is also acknowledged that there are conceptual problems in using conventional output and income measures. The measurement of national progress and the limitations in currently available measures were discussed in a recent two-day conference. A range of indicators on the quality and sustainability of life in Australia were examined (Eckersley 1997). Many of the indicators considered are not yet part of the mainstream national accounting framework.

Figure 3.2 Real GDP per person, multifactor productivity and capital-labour ratio, 1964–65 to 1995–96



Source: Commission estimates based on RBA (1996) and ABS Cat. no. 5234.0.

Figure 3.3 Real gross domestic income and real GDP(I), 1979–80 to 1995–96 (index 1989–90 = 100)



Source: Commission estimates based on RBA (1996), and ABS Cat. nos 5204.0 and 5206.0.

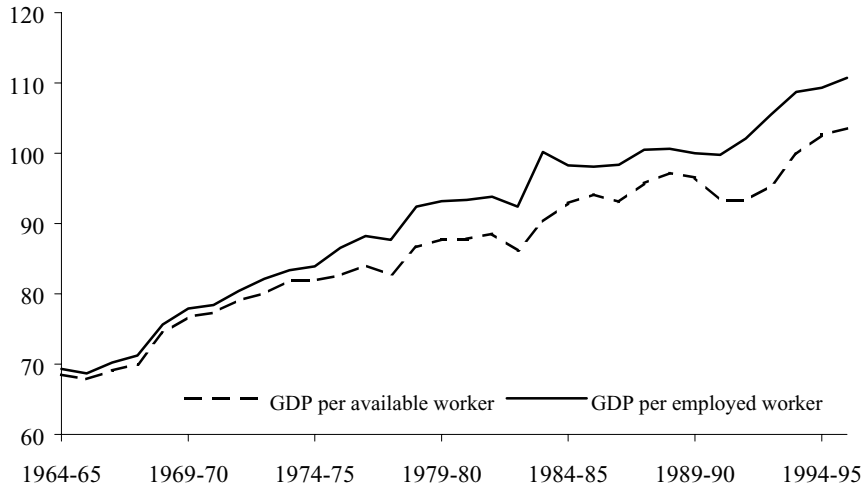
Figure 3.2 shows that per person GDP has tracked MFP growth fairly closely over the period. One exception of interest is the latter part of the 1980s. This shows a sharper increase in GDP per person (2.1 per cent a year from 1984–85 to 1988–89), but low productivity growth (0.8 per cent a year). The capital-labour ratio declined over the period. This is consistent with the point made in the previous chapter that an increase in employment can lower measured productivity, but contribute to an improvement in living standards.

This points to the importance of the potential of the unemployed in influencing living standards (see chapter 2). One way to indicate the significance of this factor is to compare the output produced per actual worker with the output produced per available worker (that is, including the unemployed). These indicators are calculated for the economy as a whole and not just the market sector.

The comparison in figure 3.4 shows:

- a wider divergence opening up in the 1970s through to the mid 1980s as unemployment rates increased;
- some moderation of the gap in the late 1980s with a lowering of unemployment rates; and
- a further divergence associated with the early 1990s recession.

Figure 3.4 GDP per employed worker and GDP per available worker, 1964–65 to 1995–96 (index GDP per employed worker in 1989–90 = 100)



Source: Commission estimates based on ABS data.

A mathematical framework for linking all these factors with living standards is presented in appendix B. The main features are:

- growth in real income per person is taken as an indicator of increases in living standards[3];
- growth in real income per person is equal to growth in income (or output) per person adjusted for changes in the terms of trade;
- growth in output per person is equal to growth in labour productivity (output per hour worked), once adjustments are made for
  - changes in labour force participation,
  - changes in average hours of work, and
  - changes in the unemployment rate; and
- growth in labour productivity depends on multifactor productivity (general productivity or efficiency) and capital deepening (having more capital per unit of labour input to work with).

This framework leads to the following decomposition of changes in real income per person (or purchasing power):

Real income per person is approximately equal to:

- the growth in MFP
- *plus* x per cent of the growth in the capital-labour ratio (where x is the percentage share of capital costs in total costs of production)
- *plus* the growth in the working age population as a share of the total population
- *plus* the growth in the labour force participation
- *plus* the growth in average hours of work
- *plus* y per cent of the growth in the terms of trade (where y is the percentage share of imports in domestic consumption)
- *less* the change in the unemployment rate.

[3] A further qualification could be added to the interpretation of income per person as an indicator of living standards. Not all of the income generated in Australia goes to the benefit of Australians. Some income is repatriated to foreign owners of capital. More income is repatriated from Australia than is repatriated to Australia from Australians' overseas investments. Net income flowing overseas has become more important over time, growing from 1.2 per cent to 3.4 per cent of GDP(I) from 1959–60 to 1995–96. This is not to say, however, that foreign ownership has resulted in a *net* overall reduction in Australian living standards.

The framework was applied to data for the period 1964–65 to 1995–96 and the results are shown in table 3.1. These should be interpreted as orders of magnitude, rather than precise figures. One approximation comes from the use of 'market sector' data for productivity and capital deepening but economy-wide data elsewhere.[4]

Table 3.1 Decomposition of changes in real income per person, 1964–65 to 1995–96 (per cent)

Change due to	*Contribution*
Multifactor productivity	65
Capital deepening	36
Demographic change	9
Labour force participation	9
Average hours worked	-8
Terms of trade	-3
Unemployment	-8
Total	**100**

Source: Commission estimates.

This decomposition suggests that productivity was by far the major contributor to the improvement in real income per person over the period. It accounted for about two-thirds of the increase. The labour force factors (participation and hours worked) offset each other. While the increase in unemployment had an important detrimental effect, its influence was offset by the increase in working age population. This leaves capital deepening contributing slightly more than a third, while the terms of trade presented a minor offset.

[4] Productivity estimates are restricted to the 'market sector' of the economy (see next chapter). The market sector has contributed about 65 per cent of the growth in total output. In conducting the decomposition, the implicit assumption is that the extent of productivity growth and increases in capital deepening evident in the market sector is also representative of the non-market sector. While that is likely to be only a rough approximation, it is unlikely to produce serious errors in the decomposition.

3.3 Summing up

Contribution to output

Productivity growth has been an important contributor (around 50 per cent) to output growth. However, while productivity growth is extremely important in explaining output growth in the Australian case, the perhaps greater significance of capital and (variable) labour growth should not be overlooked, at least in an historical sense. Productivity may, however, be more important in the future.

Contribution to living standards

Productivity is an even more important contributor to the living standards of Australians. It contributed about two-thirds of the increase over 1964–65 to 1995–96. Capital deepening contributed a little over a third, with a minor offset coming from the terms of trade. Other demographic and labour force factors, including the increase in unemployment, tended to offset each other.

It would appear, quite simply, that Australia's future prosperity depends on productivity growth. Beyond the two-thirds contribution of the past, there is the further link that capital accumulation itself depends on productivity growth.

4 AUSTRALIA'S HISTORICAL PERFORMANCE

The assessment of Australia's productivity performance begins in this chapter with a review of the historical record.

Past productivity growth is examined to determine an historical performance benchmark. Recent experience is examined in some detail to determine how well it measures up to historical standards.

However, the first step in assessing productivity performance is to take stock of what the available productivity measures cover and what they mean.

4.1 Interpreting productivity measures

An understanding of the limitations of productivity measures is important to their proper interpretation. Some of the key qualifications are set out below.

Productivity estimates must be considered as approximate rather than precise

Measurement of productivity is not an exact science. There is a range of important, but not fatal, technical difficulties in measurement (see box 4.1).

Claims of precision in measurement of productivity are inappropriate, especially at the national level. Productivity growth of between 0.3 per cent and 0.5 per cent a year was counted as significant in chapter 2. But it is possible that changes of this magnitude could be lost or found (over the long term) in the size of existing measurement errors. This is not to say that anybody is measuring productivity incorrectly. Rather, it reflects on the current state of measurement capabilities.

Productivity measures cover the 'market' sector rather than the whole economy

The measurement of aggregate productivity is restricted to the 'market sector' of the economy. The 'non-market' sector covers a number of activities in the services sector for which output cannot be measured independently of inputs. For example, many government services (public administration and defence) are measured largely in terms of the value of their labour inputs. Many financial services are similarly valued. Ownership of dwellings has no corresponding inputs. For these 'non-market' activities, productivity growth estimates make little sense or are assumed by the ABS to be zero. (The components of the market and non-market sectors are shown in the next chapter).

Box 4.1 Issues in measuring productivity growth

Box 3.1 in the previous chapter introduced the basics of estimating the two main types of productivity measures:

- *partial productivity* measures, such as labour productivity or capital productivity, which divide output by the amount of labour or capital used.
- *multifactor productivity* measures, which divide output by a combination of inputs — usually labour and capital, but sometimes other inputs as well.

A measure of growth in labour productivity can indicate overall productivity performance. But interpreting it as an indicator of workforce performance is to be avoided since labour productivity growth can be influenced by factors outside workers' control, such as: the introduction of new capital equipment and new technology; management skill and organisational patterns; and improved skills in the workforce.

In principle, growth in multifactor productivity can give a more comprehensive indication of performance since it includes the influence of all (major) inputs. But it is often more difficult to measure with precision. Some analysts prefer to use labour productivity measures because they can be derived from relatively well-defined data and their limitations can be readily understood and allowed for.

Productivity measurement relies on a 'horses for courses' approach — different measures in different circumstances and for different purposes, ranging from plant and firm-specific estimates up to industry, sectoral and national studies.

Measurement problems can arise in defining and measuring output, particularly if there are quality improvements to consider. Measurement of capital presents particular practical and in-principle difficulties. A range of assumptions and conventions must be used, and different assumptions and conventions are supportable.

Productivity measurement is usually more precise at the firm level of analysis than at the sectoral or national level because of the higher quality and consistency of data; scope for more informed judgement and knowledge of the production processes involved; and the potential for application of more sophisticated estimation techniques.

As the field of interest broadens to industries and sectors, the scope for a number of 'adding up' problems emerges. Different types of inputs and outputs must be added across firms and industries. The basic way to do this is to add the *value* of outputs or inputs and deflate by a price index to give a *quantity* estimate. Problems with price indexes then emerge.

Measurement of productivity is not without difficulty. The importance of measurement errors and the sensitivity to different measurement assumptions should not be overlooked. Care is needed in selecting the best available measure.

Productivity measures cover all sources of productivity improvements

Productivity growth estimates cover all types of productivity improvement mentioned in chapter 2 — new knowledge, better organisation of production and incidental effects. Because of the residual estimation technique, all forms of productivity improvement are lumped together. Measured productivity growth is not identified and associated with any specific cause.

Changes in the quality of goods, but not of services, are taken into account

Allowances are made, where possible, for improvement in the quality of goods. If they were not, productivity would be understated, since it would appear as if more inputs were going into producing equivalent output. Particular effort is usually made in cases of goods subject to substantial quality change, such as computers.

However, quality improvements in services have generally proved problematic. The most frequently cited example is increased shopping hours. Shops are providing more 'convenience', but on the standard output measure of goods sold, the increase in employment required to extend shopping hours produces a productivity decline.

Some productivity growth due to technological change is not captured

Many technological changes are 'embodied' as enhancements in new capital equipment. They enter the productivity calculations as capital inputs. No allowance is made for this in standard calculations. Consequently, productivity estimates do not fully reflect the effects of technological change.

Changes in labour skills are included in productivity estimates

Labour inputs are measured purely in terms of hours worked. Changes in skill are an important source of change in labour input (Borland 1997). But, because allowances are not normally made for them, improvements in labour quality show up as part of the productivity improvements. As skill levels in the workforce increase over time, estimates of 'pure' productivity growth are overstated.

4.2 Australia's aggregate productivity indicators

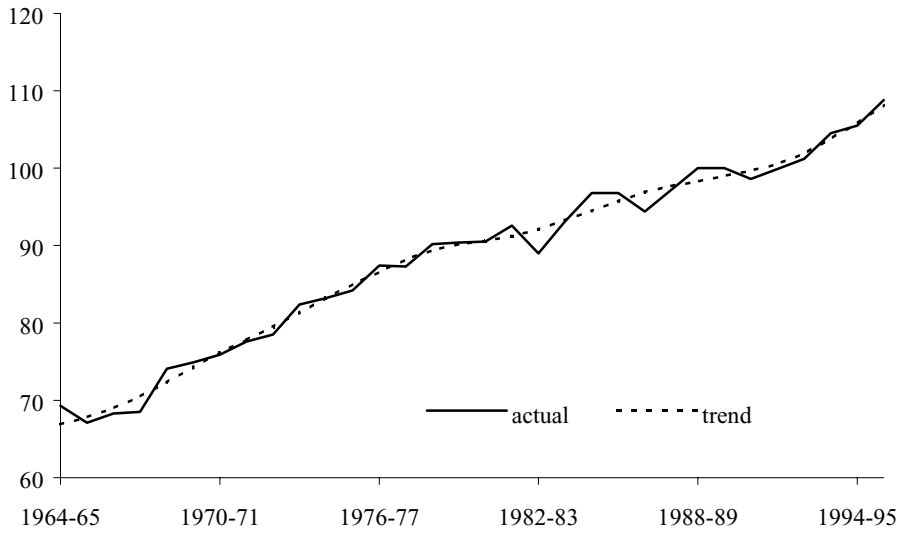
This chapter draws on measures of growth in both labour productivity and multifactor productivity (MFP). MFP is generally the preferred indicator as it captures productivity growth associated with the use of both labour and capital inputs.

Measures of labour productivity growth can also be used as indicators of productivity performance. They should not, however, be interpreted as indicators of the efficiency of employees (see box 4.1).

The preferred source of productivity indicators in this chapter is the official ABS estimates of productivity. The ABS has produced estimates of labour, capital and multifactor productivity that stretch back to 1964–65.

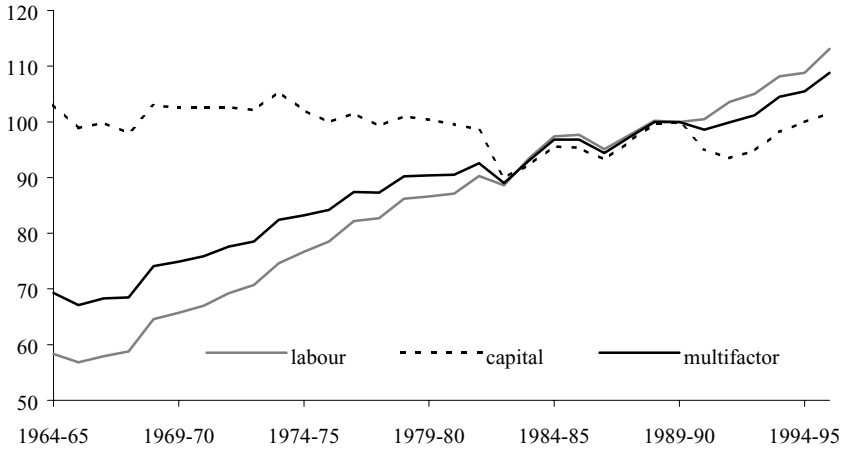
Figure 4.1 shows an index of MFP in the market sector for the period 1964–65 to 1995–96. Both actual MFP and an ABS-calculated trend are depicted. The component labour productivity and capital productivity series are shown in figure 4.2. Labour productivity is calculated as output per hour worked; capital productivity is output per unit of capital stock; and multifactor productivity is output per combined unit of labour and capital.

Figure 4.1 Actual and trend multifactor productivity in the market sector, 1964–65 to 1995–96 (indexes, actual MFP in 1989–90 = 100)



Source: ABS Cat. no. 5234.0.

Figure 4.2 Multifactor, labour and capital productivity in the market sector, 1964–65 to 1995–96 (indexes, 1989–90 = 100)



Source: ABS Cat. no. 5234.0.

The average annual increase in measured MFP for the entire period has been 1.5 per cent (ABS Cat. no. 5234.0). But the average annual growth in sub-periods has been quite variable in the range of 0.8 to 2.1 per cent (see table 4.1). [1]

Figure 4.2 shows that growth in labour productivity and growth in MFP are fairly closely related.[2] In fact, as shown in appendix B, the extent to which they differ depends on capital deepening (that is, increases in the ratio of capital to labour inputs).

[1] The sub-periods shown in table 4.1 correspond to cycles in productivity growth. The start and end points of each cycle correspond to a productivity peak. Calculating productivity trends from 'peak to peak' is one way of overcoming the spurious influence of business cycles in estimates of productivity growth.

[2] However, there are potential hazards in relying solely on labour productivity estimates as overall performance indicators, as table 4.1 illustrates. Productivity performance based on labour productivity growth estimates can be offset by poor capital productivity growth. For example, labour productivity increased in 1981–82 to 1984–85 compared with the previous period. But it was offset by a decline in capital productivity which meant that overall (MFP) productivity performance, remained the same.

Table 4.1 Average annual rates of growth[a] in productivity and the capital-labour ratio, various periods, 1964–65 to 1995–96 (per cent)

Periods	Labour productivity	Capital productivity	Multifactor productivity	Capital-labour ratio
1964–65 to 1968–69	2.6	–	1.7	2.6
1968–69 to 1973–74	2.9	0.5	2.1	2.4
1973–74 to 1981–82	2.4	-0.8	1.5	3.3
1981–82 to 1984–85	2.6	-1.0	1.5	3.7
1984–85 to 1988–89	0.7	1.0	0.8	-0.3
1988–89 to 1995–96	1.7	0.3	1.2	1.5
1964–65 to 1995–96	**2.2**	**-0.1**	**1.5**	**2.2**

a Calculated as compound average annual rates of growth from productivity peak to productivity peak.
Source: ABS Cat. no. 5234.0.

The intuition behind this is that labour productivity growth depends on general (multifactor) productivity growth plus providing the workforce more capital to work with (capital deepening). The data in table 4.1 can be used to show that labour productivity growth is equal to MFP growth plus about one-third the increase in capital deepening. (The one-third is capital's share in total costs — see appendix B).

The picture that emerges from these estimates is that:

- **productivity growth was highest in the late 1960s/early 1970s;**
- **productivity growth then entered an extended period of decline;**
- **the growth slowdown was particularly marked in the latter part of the 1980s; and**
- **there has been some recovery in productivity growth from the late 1980s into the 1990s.**

Because the data only commence in the mid 1960s, it is not possible to put the high rate of growth in productivity around that time into perspective.

To do that, it is necessary to construct a rough measure of labour productivity. Estimates of hours worked and capital stocks are not available back beyond the mid 1960s. But an approximate average labour productivity measure can be derived by dividing total economy-wide output by the number of persons employed.

Figure 4.3 shows Australia's GDP per employed person since 1910–11. While this measure covers the economy as a whole (and not the preferred market

sector), it nevertheless provides a general indication of productivity performance over the broad sweep of the century. As discussed above, growth in labour productivity roughly approximates growth in MFP. Measures of labour productivity for the market sector from 1964–65 can be introduced for comparison. They are reported in table 4.2.

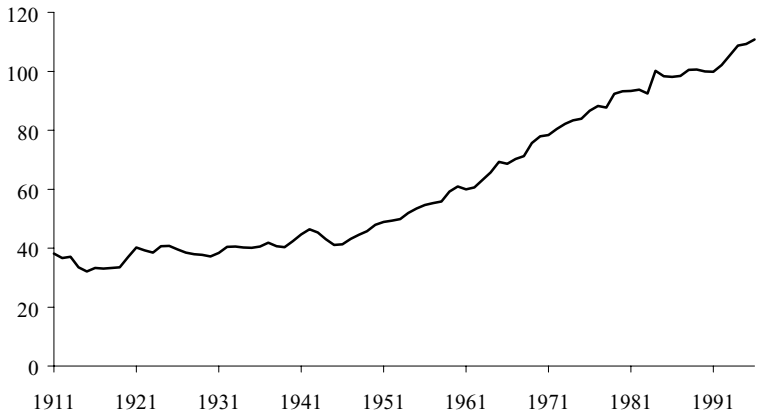
Figure 4.3, together with the data in table 4.2, confirm the 1960s period as being a peak in productivity growth. These data also suggest that:

- the level of labour productivity was virtually stagnant between the two World Wars;
  - GDP per worker in 1938–39 was about the same as it was in 1910–11;
- labour productivity began to grow from the 1940s;
- labour productivity growth was high in the 1950s as well as the 1960s;
- labour productivity *levels* are now much greater than in the past[3];
  - GDP per worker in the economy generally is almost three times its level in 1910–11;
  - GDP per worker in the market sector is now 40 per cent greater than its 1974–75 level; and
  - GDP per hour in the market sector is now nearly twice its level of 1964–65.

These data also confirm that productivity *growth* was particularly slow in the 1980s, but made a recovery in the 1990s.

[3] The different methods of calculating labour productivity in table 4.2 illustrate some incidental points of interest. GDP per worker in the market sector rises faster than GDP per worker in the economy because productivity is low or assumed to be zero in a number of service industries excluded from the market sector. GDP per worker rises faster than GDP per hour in the market sector when average hours per worker increase. There is not, however, a major or systematic divergence between these two series since the mid-1970s. GDP per worker has risen faster than GDP per hour since the mid-1980s.

Figure 4.3 GDP per worker[a], 1910–11 to 1995–96 (index, 1989–90 = 100)



Growth rates[b]	
1910s	-0.9
1920s	-0.3
1930s	0.9
1940s	0.4
1950s	2.4
1960s	2.7
1970s	1.8
1980s	0.9
1990s	2.0

a Output and employment cover the economy as a whole.
b The rate of growth (per cent a year) is estimated by fitting a log-linear trend.
Source: Commission estimates based on data from ABS, Maddison (1991), Keating (1967).

Table 4.2 Labour productivity levels, various measures[a] and selected years (indexes, 1989–90 = 100)

	Economy	*Market sector*	
Year	*GDP/worker*	*GDP/hour*	*GDP/worker*
1910–11	38	na	na
1924–25	41	na	na
1936–37	42	na	na
1949–50	48	na	na
1964–65	69	58	na
1973–74	83	75	na
1974–75	84	77	81
1984–85	98	97	96
1988–89	101	100	100
1995–96	111	113	113

na Not available.
a GDP is measured in real terms.
Source: Commission estimates based on data from ABS, Maddison (1991), Keating (1967).

4.3 Assessing productivity performance

The long-term and recent trends in these productivity indicators are discussed separately.

The long-term trends

The indicators suggest that Australia's peak in productivity growth was around the 1950s through to the early 1970s. Average annual growth in labour productivity was up to 2.9 per cent and MFP growth was up to 2.1 per cent for a short period in the late 1960s/early 1970s.

Should this be a benchmark for current performance? The answer depends on whether:

- there were factors at work that were promoting growth around the 1950s and 1960s and are no longer at work today; or
- the decline in productivity growth from the early 1970s was due to factors that, if no longer at work, could be reversed, leaving the possibility of a return to higher productivity growth.

Factors suggesting a decline in productivity growth is to be expected

There is an argument that the 1950s and 1960s were a 'golden age' of growth, development and productivity for western countries, through post-war reconstruction aided by the Marshall Plan, more successful macroeconomic stabilisation policies and vast opportunities for technological catch-up to the leading productivity country, the United States (see chapter 6).

This argument would place the 1950s and 1960s as a period of unusually high rates of productivity growth, from which a subsequent slowdown in productivity growth could be expected. Maddison (1995) offers support for this view in a review of the experience of developed countries over the past 150 years. In the case of Australia, it has been argued that a slowdown in productivity growth would be consistent with expectations for a mature, industrialised country (Dowrick 1995).

There are some other specific reasons to suggest a 'permanent' slowdown in productivity growth.

First, some general decline in measured productivity growth is to be expected with the increasing dominance of services growth. Productivity is generally lower in the services sector (see next chapter). Services as a proportion of GDP have grown from 57 per cent to 71 per cent between 1964–65 and 1995–96. Market-

sector services as a proportion of the market sector have grown from 51 per cent to 64 per cent over the same period.

Second, it is possible, if not probable, that some of the measured decline in productivity growth is not real. In common with other developed countries, some of Australia's measured productivity slowdown could be attributable to mismeasurement.[4] It is difficult to put an order of magnitude on measurement distortions. Some are of long-term, increasing significance. Others wax and wane. However, the conventional wisdom is that they have in general led to a downward bias in productivity estimates.

Factors which may have forced a decline in productivity performance

If specific factors emerged after the early 1970s to bring about a decline in productivity growth, the argument would be that, if those factors were reversed, we could return to our earlier growth rates.

Productivity growth declined in developed countries generally from the early 1970s. A large part of the explanation came from general inflationary pressures, the oil price shocks and other developments in the macroeconomic environment. Developed countries generally recovered their productivity growth at some stage through the 1980s (see chapter 6).

The return to a low inflationary environment in the 1990s could therefore reverse a factor of significance in the earlier productivity growth slowdown. Inflation is thought to confound productivity-enhancing investment decisions by creating uncertainty and distorting the expected returns from different kinds of investment.

Some additional factors must have been at work in Australia in the latter part of the 1980s, however, to explain the pronounced productivity growth decline. (A further decline in the 1980s was not common experience in other countries). The explanation usually offered is that there was substitution of labour for capital in the latter 1980s in response to changes in relative prices — decreases in real wages under the Accord process and, as Lattimore (1989) points out, increases in

[4] Output mismeasurement is thought to be the most potentially significant — failure to capture many productivity improvements in the growing services sector (see next chapter), and failure to capture all quality changes in price indices. On the inputs side, it has been suggested that technological advance has increased capital obsolescence which is not reflected in the data, leading to an overestimation of capital inputs and an underestimation of productivity. Furthermore, to the extent that technological advance is 'embodied' in new capital inputs, productivity growth due to new technology would be underestimated. On the other hand, the failure to allow for skill improvements in the labour force works in the direction of productivity overestimation.

capital prices. Table 4.1 shows the decline in the capital-labour ratio over that period.

The implication is that the increased labour intensity of production — the reverse of capital deepening (see box 2.3) — reduces labour productivity (as shown in table 4.1). Moreover, the relatively rapid increase in employment means that employees with less work experience and lower skill were engaged (see, for example, Lowe 1995, p. 95).

A recovery from the latter 1980s experience could be reasonably expected, with the return to capital deepening (see table 4.1).

Assessment

The examination of history seems to suggest that some truth lies in each of the two stark alternatives discussed above.

There were good reasons to explain a decline in productivity growth from the peak in the late 1960s/early 1970s. These included inflation, including the worldwide effects of the oil price shocks, and some reversal of the usual capital deepening in the latter 1980s. These factors could be considered to be reversed or reversible.

However, *all other things equal*, it would not be reasonable to expect productivity growth to return to the historically high rates. There is likely to be some strength to the 'golden age' argument, the long-term shift to services has some influence, and some measurement problems might have as well.

But this is a purely historical perspective. It may also be that the advance of technology and new knowledge, as well as better organisation of production, could bring higher productivity growth possibilities.

The recent experience

There has been particular interest in recent productivity growth in view of microeconomic reforms introduced to improve productivity (see for example, Costello and Fahey 1997). While a number of reforms were introduced in earlier years, the reform process gathered momentum from the late 1980s. The issue is whether the effects of these reforms are showing up in terms of improved national productivity.

The OECD (1996a, p. 45) attributed part of the general productivity growth slowdown in developed countries from the early 1970s to 'social and organisational rigidities inherited from the earlier high-growth period'. While some of the rigidities may not have been as much noticed (or indeed may have

been put in place) in a period of high growth, their effects became more noticeable as growth began to slow.

The turnaround in productivity performance in recent times has been noted. The growth in multifactor productivity of 1.2 per cent a year from 1988–89 to 1995–96 is a marked improvement on the mid to late 1980s. But it is not a return to the growth of earlier years — even the 1.5 per cent a year evident in the 1970s and early 1980s data.

But, as it is a seven-year period, it may not be a good guide to more recent performance. Productivity growth in the 1990s proper is much higher at 2.0 per cent a year.[5]

But at least some of that growth must reflect the influence of the early 1990s recession. To the extent that labour is 'hoarded' and capital underutilised in a recession, productivity is reduced in the trough of a recession, but can be increased rapidly in the recovery phase.

On the other hand, there are two pieces of evidence to suggest that the productivity growth in the 1990s is more than recession-related.

The first piece of evidence is that productivity growth has been stronger and more enduring coming out of the 1990s recession than coming out of the 1970s and 1980s cyclical downturns. Figure 4.4 shows the proportional movement in *non-farm* MFP, coming out of the 1974–75 and 1982–83 downturns and the 1990–91 depth of the 1990s recession. The 1970s and 1980s experience suggests that the peak in the recovery phase comes after two or at most three years. The 1990s show a slightly different recovery pattern over the first two to three years, but a continuation of strong productivity growth beyond the recovery period.

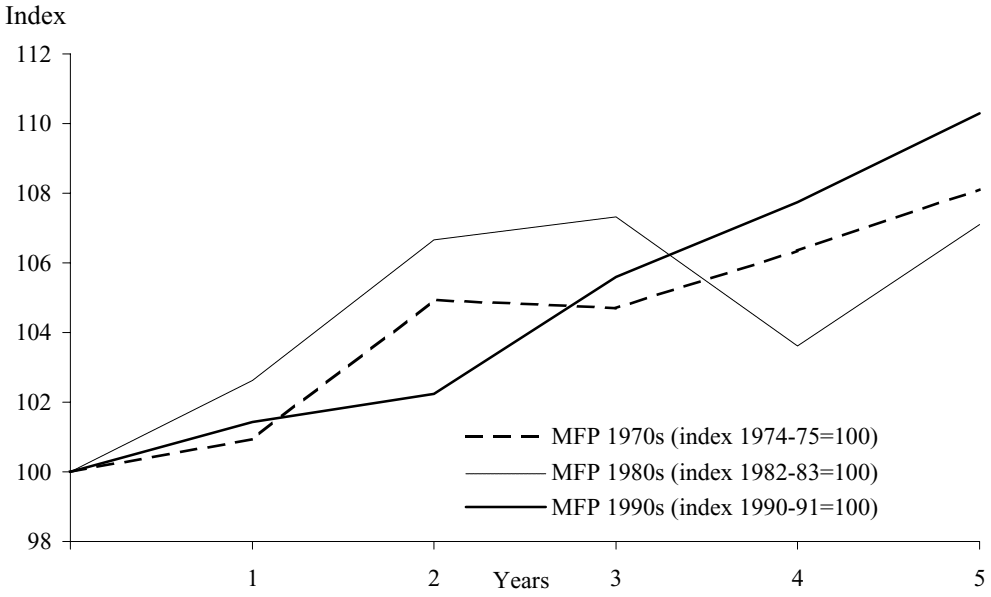
In the three periods, MFP was about 4 per cent to 7 per cent higher three years out from the recession low-point. In the fifth year, it was 10 per cent higher in the 1990s, but about only 7 per cent to 8 per cent higher in the 1970s and 1980s.

Work by the Reserve Bank also supports the view that the growth in productivity is more than recession-related. The Bank (RBA 1997) has noted that the growth in MFP has been stronger five and a half years out from the trough of the 1990s recession than for the same period in either the 1980s or 1970s cyclical downturns. Its calculations suggest an increase in the underlying rate of productivity growth of 0.3 per cent a year (compared with the previous downturns) which it associated with the 'extensive changes in the economy over

[5] This figure is calculated as the compound annual average rate of growth between 1990–91 and 1995–96. The log-linear trend technique produces an estimate of 2.0 per cent a year over the period.

the past decade — including a structural fall in the inflation rate, productivity-enhancing changes in the labour market, corporatisation and privatisation of public-sector enterprises and substantial falls in the barriers to international trade' (p. 15). (See also Fraser 1996).

Figure 4.4 Non-farm market sector multifactor productivity following the 1970s, 1980s and 1990s recessions (indexes)

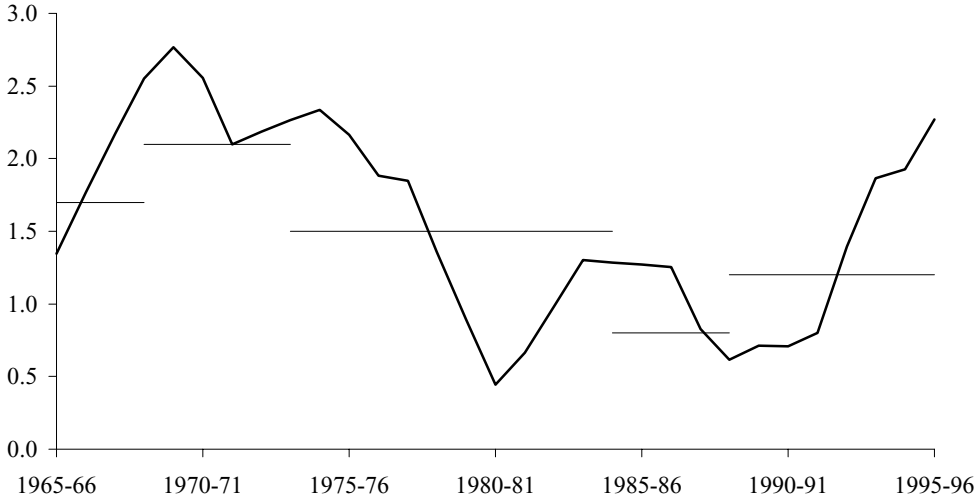


Source: Commission estimates based on ABS Cat. no. 5234.0.

The second piece of evidence comes from the ABS trend series on MFP, which abstracts from or minimises the effects of the recession. These data suggest that there has been an increase in the trend rate of productivity growth commencing after 1989–90 (see figure 4.5). In fact, the rate of growth in the trend series has accelerated from an annual increase of 0.7 per cent from 1987–88 through to 1991–92 to an increase of 2.3 per cent between 1994–95 and 1995–96.

Growth in productivity of over 2 per cent from 1994–95 to 1995–96 in the trend series is coming at a time that could only be weakly associated with recovery from the recession, if at all.

Figure 4.5 Annual growth in trend multifactor productivity[a], 1964–65 to 1995–96 (per cent)



a Change from previous year.
Source: Derived from ABS data.

So what is the current underlying rate of productivity growth? It is not appropriate to base an assessment simply on the latest available year. Productivity growth is most unlikely to be sustainable at the rate of 3.1 per cent shown over the last available year (and this figure may be subject to subsequent revision by the ABS). Figure 4.5 supports the view that productivity growth is currently better than the 1.2 per cent a year evident in the 1988–89 to 1995–96 calculation. The average of 2.0 per cent a year over the last two years in the actual series and the 2.3 per cent increase in the last year of the trend series are more indicative.

Figure 4.5 suggests that productivity growth is currently running at historically high rates. The figure shows the year-to-year growth in the trend series; and horizontal lines which depict the average annual rates of growth over the relevant periods, as calculated from productivity 'peak to peak' in the original series. The figure shows that the current rate of increase in the trend series is well above the peak-to-peak average over the 1988–89 to 1995–96 period and above the 2.1 per cent average over the peak period, 1968–69 to 1973–74. It is not the highest annual increase in the trend series, but it is close to it.

The current rate of growth is especially noteworthy if allowance is made for the end of the 'golden age' of productivity growth and the shift in emphasis toward services as mentioned earlier.

The recent improvement in productivity growth is consistent with the effects of government microeconomic reforms coming to fruition. But a few points need to be noted:

- there may be other factors at work as well, such as underlying technological change;
  - for example, business spending on R&D increased significantly from the mid 1980s (IC 1995a);
- the effects of some reforms are likely still to be felt, following investment cycles and the upgrading of skills and changes in production and marketing practices and so on; and
- some reforms (for example, in financial markets, public administration and provision of health and human services) took place outside the market sector and will not show up in the aggregate productivity estimates.

4.4 Summing up

Long-run performance

Over the broad sweep of this century, the 1960s and early 1970s have shown the fastest underlying growth in Australia's productivity (as indicated by both labour and multifactor productivity). From a peak in MFP growth at that time of 2.1 per cent a year (2.9 per cent a year in labour productivity growth), there has been a general slowdown, with productivity growth bottoming out in the mid to late 1980s at 0.8 per cent a year (0.7 per cent a year in labour productivity growth).

There is a range of factors that can explain the slowdown in productivity growth. Some recovery in productivity growth could be expected, with a reversal in some factors. But the end of a 'golden age' in development in the 1950s and 1960s, the shift in activity toward services and even some downward bias in measurement would caution against expecting productivity growth rates to return to their earlier peak.

Recent performance

Against that background, the recent recovery in productivity growth is quite strong. Recent performance has picked up — to 1.2 per cent for the period 1988–89 to 1995–96.

But performance in the 1990s is even stronger. Even allowing for the effects of the recession, current productivity growth appears to be running at around 2 per cent a year or more. The increase of 2.3 per cent in the *trend* series over the latest available year is a very positive sign.

Although this study has not attempted to investigate the causes of productivity trends, the recent improvement in productivity performance is consistent with the effects of microeconomic and other government reforms coming to fruition. The full effects of reforms are likely to continue to unfold over time.

5 THE SECTORAL FOUNDATIONS OF AGGREGATE PRODUCTIVITY GROWTH

Another way to gain a better understanding of changes in aggregate productivity performance is to examine the productivity trends in the individual sectors that comprise the market sector of the economy. As will be seen, productivity differs markedly among industry sectors.

Productivity differences among sectors — either in levels or in rates of growth — need to be interpreted with some care.

Differences among sectors should not necessarily be taken as an indicator of superior or inferior performance. Each sector has its own benchmark based on its own innate productivity characteristics (see box 5.1). Some have inherently lower productivity levels and/or opportunities to improve productivity.

Furthermore, the mere existence of productivity differences among sectors does not in itself suggest that resources should be shifted to high productivity sectors in order to promote aggregate productivity performance. Clearly, aggregate productivity can be improved by shifting resources to higher productivity industries. But it is not only productivity (that is, the supply side) that is important. The demand side is also important in determining the prices, value and type of goods and services produced. The optimal set of industries will involve a mixture of relatively high and low productivity sectors (see box 5.1).

5.1 Sectoral productivity indicators

The sectoral perspective presented here dissects the market sector into 10 component industry sectors. They are listed in table 5.1.

The ABS does not publish multifactor productivity estimates at any level of industry disaggregation. It does, however, publish indexes of labour productivity within the market sector at the level of disaggregation shown in table 5.1.

To examine multifactor productivity (MFP) at the sectoral level, the Commission has constructed its own productivity estimates, using data collected by the ABS. The details of this estimation work are reported separately in Gretton and Fisher (1997). Despite the release of the 1995–96 data, 1994–95 has been maintained as the end point of the reported estimates. The 1995–96 data are considered preliminary and may not provide a firm basis upon which to

Box 5.1 Interpreting productivity differences between industries

Productivity *levels* can be expected to differ among industries. Productivity levels can be thought of as the inverse of factor intensity. For example, if an industry is labour intensive, its ratio of output to labour — that is, its level of labour productivity — will be relatively low. If factor intensities can vary between industries, so can partial productivity levels.

Similarly, productivity *growth* can be expected to differ among industries. Opportunities for growth, for example through technological change, are different inherently or over time.

What is important is that industries pursue the available opportunities for improving their productivity. They need to perform to their productivity potential.

The existence of differences in productivity between industries and sectors does not provide a simple basis to suggest that improvements in national productivity could be brought about by shifting resources to higher productivity sectors. Such shifts would raise national productivity, and in some cases they would be quite appropriate — for example, if the shift were held back by unnecessary government intervention.

But there is also the demand side to consider. Lower productivity industries and sectors continue to flourish because the goods and services they produce are in demand. With sufficient demand for their output, they can attract resources through the wages and salaries they pay and the returns on investment they offer.

The optimal organisation of production in the economy will therefore inevitably involve a mixture of relatively high and low productivity sectors.

Forcing a shift of resources to higher productivity activities in order to increase aggregate productivity would come at a cost of lost opportunities to add value and generate income in lower productivity activities. In some cases (for example, tariff reforms) there may be net benefits. But in other circumstances, there may be net costs.

assess performance. Some references are nevertheless made to 1995–96 estimates when appropriate.

Growth in multifactor productivity by industry sector is reported in table 5.2. (Year-by-year charts are provided later in figure 5.1.) The growth rates are presented for the whole period and for the main productivity cycles, as identified in chapter 4. The totals in table 5.2 differ slightly from the ABS aggregate data presented in chapter 4 due to different methodological assumptions adopted in the Commission's calculations.

Table 5.1 Industry output shares in the market sector and whole economy, 1974–75 and 1994–95 (per cent)

	Proportion of output for the sectors listed			
	1974–75		*1994–95*	
Industry sector	*Market sector*	*Economy*	*Market sector*	*Economy*
Agriculture	7	5	5	3
Mining	6	4	7	4
Manufacturing	28	19	23	14
Electricity, gas and water	4	3	5	3
Construction	11	8	11	7
Wholesale trade	19	13	16	10
Retail trade	12	8	12	7
Accommodation, cafes and restaurants	3	2	3	2
Transport, storage and communication	9	6	15	9
Cultural and recreational services	3	2	3	2
Market sector[a]	**100**	**69**	**100**	**63**
Finance and insurance		5		4
Property and business services		6		8
Govt admin and defence		4		4
Education		4		5
Health and community services		4		5
Personal and other services		2		2
Other[b]		7		9
Economy[a]		**100**		**100**

a Totals rounded.

b Comprises Ownership of dwellings, Import duties and Imputed bank service charges.

Source: Derived from data in ABS Cat. no. 5204.0.

Estimates of labour productivity growth and labour and capital productivity levels for industry sectors are shown in appendix C. Appendix C also presents the output growth 'accounting' — that is, the contributions of productivity growth and labour and capital input growth to sectoral output growth.

Table 5.2 Average annual rate of multifactor productivity growth in the market sector, by industry sector, various periods, 1974–75 to 1994–95 (per cent)

Industry sector	*1974–75 to 1981–82*	*1981–82 to 1984–85*	*1984–85 to 1988–89*	*1988–89 to 1994–95*	*1974–75 to 1994–95*
Agriculture	2.3	3.7	-1.1	0.1	1.2
Mining	-3.7	5.2	0.3	1.0	-0.2
Manufacturing	2.4	1.8	1.7	1.8	2.0
Electricity, gas and water	2.2	1.4	4.4	3.6	2.9
Construction	2.5	0.1	-0.9	-0.4	0.6
Wholesale trade	0.3	-2.5	1.4	0.4	0.1
Retail trade	1.0	2.8	-2.0	0.4	0.5
Accommodation, cafes and restaurants	-0.7	-2.8	-1.7	-1.0	-1.3
Transport, storage and communication	3.6	2.1	3.1	3.6	3.3
Cultural and recreational services	0.1	-1.7	-3.5	-1.5	-1.4
Total	**1.5**	**1.1**	**0.7**	**1.2**	**1.2**

Source: Commission estimates based on Gretton and Fisher (1997).

The data in table 5.2 and appendix C enable the following observations:

- There has been very strong productivity growth in *Transport, storage and communication* (see table 5.2). Productivity growth has made a strong contribution to output growth in this sector. That growth brought improvements in the levels of both labour and capital productivity, although the level of capital productivity remains below the market sector average. On the basis of relative labour productivity growth, it would appear that the communication part of the sector has been responsible for the large part of the productivity growth (see appendix C).
- There has also been strong productivity growth in the *Electricity, gas and water* sector, especially from the mid 1980s. Again, this made a strong contribution to the sector's output growth. Levels of labour productivity are relatively high and capital productivity relatively low (it being a capital-intensive sector).
- *Manufacturing* showed steady, above average productivity growth over the period. Labour and capital productivity levels are also relatively high. Improvements in multifactor productivity have been the main source of output growth.
- Productivity growth in *Agriculture* is quite volatile, reflecting seasonal variation, but has shown overall growth. There was a marked drop in productivity in 1994–95, reflecting the poor output conditions in that year (but multifactor productivity appears to have rebounded in 1995–96).

- *Mining* productivity growth also shows volatility — with longer cycles — but no strong overall trend. Output growth in this sector is dominated by capital flows.
- *Construction* and the remaining services sectors show low or negative growth. The sharp, and in some cases persistent, declines in productivity are difficult to interpret at face value. These declines are discussed later in this chapter.

Contributions to aggregate performance

The calculation of industry sector contributions to aggregate productivity growth gives a better indication of which sectors have mattered most for overall performance.

Contributions come from a combination of the relative size of a sector and the strength of its productivity growth. Relative size is shown in table 5.1 and productivity growth is shown in table 5.2. The contributions (growth in each sector multiplied by its relative size at the start of the relevant period) are shown in table 5.3.

The features that stand out in table 5.3 in terms of contributions to aggregate productivity growth over the whole period are that:

- **around three-quarters of aggregate productivity growth is explained by the performance of**
  - **Manufacturing and**
  - **Transport, storage and communication;**
- **solid contributions were also recorded by**
  - **Electricity, gas and water**
  - **Agriculture (taking into account the poor year in 1994–95[1])**
  - **Construction and**
  - **Retail trade;**

[1] The compound annual average rate of growth in multifactor productivity in Agriculture from 1974–75 to 1995–96 was 2.0 per cent but 1.2 per cent to 1994–95.

Table 5.3 Sectoral contributions to productivity average annual growth[a] and proportion of market sector, various periods, 1974–75 to 1994–95

Industry sector	*1974–75 to 1981–82*	*1981–82 to 1984–85*	*1984–85 to 1988–89*	*1988–89 to 1994–95*	*1974–75 to 1994–95*	
	percentage point					%
Agriculture	0.2	0.2	-0.1	0.0	0.1	(7)
Mining	-0.2	0.3	0.0	0.1	0.0	(-1)
Manufacturing	0.7	0.5	0.4	0.4	0.5	(50)
Electricity, gas and water	0.1	0.1	0.2	0.2	0.1	(11)
Construction	0.3	0.0	-0.1	0.0	0.1	(6)
Wholesale trade	0.0	-0.4	0.2	0.1	0.0	(2)
Retail trade	0.1	0.3	-0.3	0.0	0.1	(5)
Accommodation, cafes and restaurants	0.0	-0.1	0.0	0.0	0.0	(-4)
Transport, storage and communication	0.3	0.2	0.3	0.4	0.3	(26)
Cultural and recreational services	0.0	-0.1	-0.1	0.0	0.0	(-3)
Total	**1.4**	**1.0**	**0.6**	**1.1**	**1.1**	**(100)**

a Productivity growth in each sector is weighted by the relative size of the sector in the first year of each period.

Source: Derived from ABS data and table 5.2.

- minor or negative contributions came from
  - Wholesale trade
  - Mining
  - Cultural and recreational services
  - Accommodation, cafes and restaurants

Table 5.3 also shows the variability in the contributions from some sectors between periods.

There is a set of consistent contributors — Manufacturing, Electricity, gas and water and Transport, storage and communication. Together, these sectors contributed between about 0.8 and 1.1 percentage points to aggregate growth in each period — including a 0.9 percentage point contribution in the slower growth period of 1984–85 to 1988–89.

The contributions from other sectors were more variable. Productivity growth in Agriculture varies according to seasonal variations in output. Productivity growth in Mining moves in long cycles that appear to follow long periods of investment and lead times in production.

In the service sectors, the variability in the contributions from Wholesale trade and Retail trade is most noticeable. These show potentially strong positive contributions offset by sharp declines at different times in the 1980s. These are discussed later and in appendix C.

These results add another dimension to the explanation for the productivity growth slowdown in 1984–85 to 1988–89. The strong and consistent contributors continued to perform. But downturns in the variable contributors combined to bring an overall reduction in productivity growth. Agriculture, Mining, Construction, Retail trade and Cultural and recreational services all combined in this way. Retail trade was a particularly prominent detractor.

Compositional effects

As outlined in chapter 2, aggregate productivity can change incidentally, as sectors with different productivity levels grow and decline in relative size.

The importance of compositional effects can be gauged from a comparison of the column totals in tables 5.2 and 5.3. Because table 5.3 uses base period shares to weight the growth in individual sectors, the total in that table will differ from the actual total growth shown in table 5.2 to the extent that there are relevant changes in the composition of the market sector.

The comparison between the tables suggests that compositional effects at this level of aggregation show up over the 1974–75 to 1994–95 period, but are not major.

Although not tested here, it is likely that compositional effects have been much more important *within* the industry sectors. For example, as will be seen, it has been argued that part of the explanation for the lower growth in some service sectors is due to structural change within those sectors.

5.2 Assessing sectoral productivity performance

There are two groups of industry sectors that have affected Australia's aggregate productivity performance. The first contains strong and basically consistent contributors. The second comprises variable and negative contributors.

Some of the major features of the performance of industry sectors that affect aggregate performance are outlined below. (It is not the task of this paper to provide detailed explanations of trends in individual sectors.)

The discussion draws on the indexes of multifactor productivity for the 10 sectors displayed in figure 5.1. The market sector average is shown in each chart to provide a standard basis of comparison.

The strong and consistent contributors

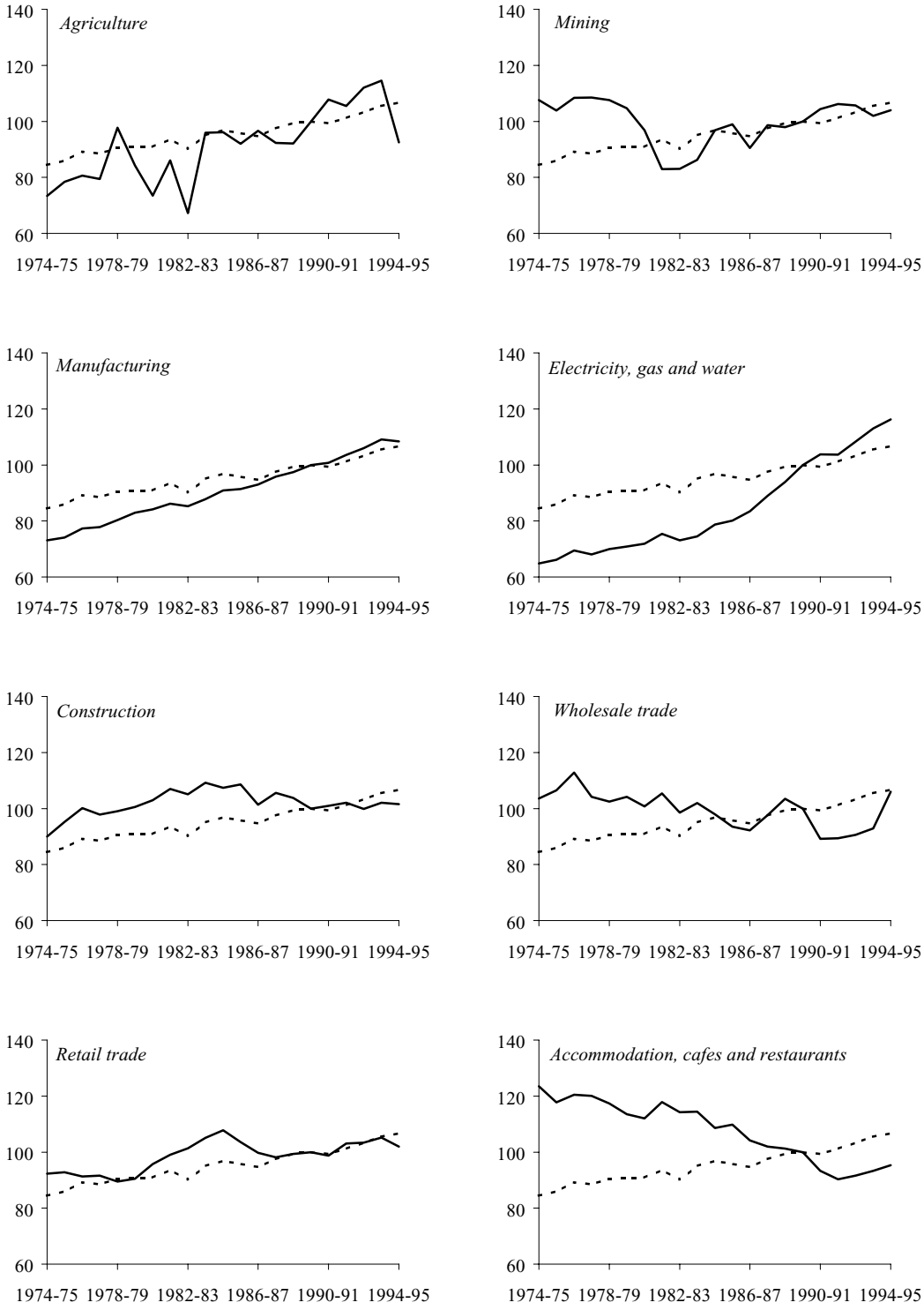
There has been a consistently positive performance and contribution from *Manufacturing*. Productivity growth has shown a slight increase in the early 1990s, but little other deviation from its upward trend (see figure 5.1). There is no clear basis upon which to indicate the relative importance of technological change (new knowledge) and government reforms (better organisation of production) in contributing to productivity growth. Gretton and Fisher (1997) further assess productivity performance in Manufacturing. They show how effective assistance through tariffs has declined steadily over the period. That may have had a impact, but there does not appear to be any other noticeable acceleration in productivity growth due to, for example, an 'announcement' effect, following the introduction of phased reduction in tariffs and other reforms from the late 1980s.

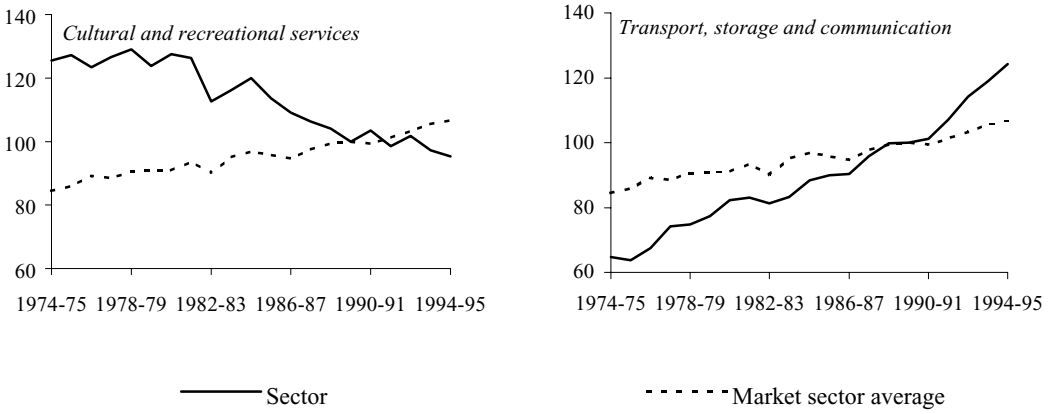
There has been a consistently strong performance and contribution from *Transport, storage and communication*, with even stronger multifactor productivity growth in the 1990s (see figure 5.1). This would be consistent with strong underlying productivity growth associated with technological advance, overlaid with a response to increasing regulatory and competitive pressure in the late 1980s and into the 1990s.

The contributions from *Electricity, gas and water* strengthened with improved performance in the mid 1980s. Many of the commercialisation reforms of state governments gathered momentum in the mid 1980s, with further structural and competitive reforms coming later.

Agriculture has shown short-term fluctuations around a trend rate of growth over the period of 1.8 per cent a year (log-linear trend).

Figure 5.1 Multifactor productivity by industry sector, 1974–75 to 1994–95 (index 1989–90 = 100)





Source: Gretton and Fisher (1997).

The variable and negative contributors

Variable or consistently negative productivity growth has featured in Retail and Wholesale trade, Mining, Construction, Accommodation, cafes and restaurants, and Cultural and recreational services.

Among the service industries in this group there appear to be one or more of three factors at work: compositional effects, difficulties in accounting for quality improvements and data issues. The quality issue is potentially the most significant. Often, the improvement in quality of service is not reflected in additional measured output, so the additional labour required to provide additional service produces a decline in measured productivity.

Some of the main developments (see appendix C for details) that have affected the measured productivity performance of these industries include the following:

Retail trade, accounting for about 12 per cent of the market sector, has in general shown positive measured productivity growth except for the 1984–85 to 1988–89 period. Following Lowe (1995), a major issue is the deregulation of shopping hours which may have led to a decline in *measured* productivity. Longer shopping hours provide customers with greater convenience. They also require more labour input — staff to keep shops open and serve customers. But output for productivity calculations is related only to the volume of goods sold and does not include convenience.

Construction is a major sector, accounting for around 10 per cent of the market sector. Its measured productivity has declined gradually over the late 1980s and 1990s. Lowe (1995) highlights the difficulties in adequately measuring inputs and improvements in output over time, as well as the effects of a shift in the types of construction undertaken.

Mining accounts for about 7 per cent of the market sector. Its performance has been variable, with negative MFP growth in the 1970s and strong positive growth in the early 1980s. However, its overall contribution since 1974–75 has been slightly negative. The long investment cycles and lead times for production to come on stream appear to be a major factor.

Accommodation, cafes and restaurants and *Cultural and recreational services* are both relatively small parts of the market sector. Productivity has fallen or remained stagnant throughout the 1980s and 1990s. Accommodation, cafes and restaurants appears to be affected by a shift within the sector to services that are more labour intensive. There may also be problems with the measurement of productivity for both.

5.3 Summing up

Contributions to aggregate productivity growth are broadly drawn from different sectors of the economy. Strong overall contributions have come from Manufacturing, Transport, storage and communication, Electricity, gas and water, Retail trade, Agriculture and Construction. Mining and Wholesale trade have been strong contributors for particular time periods.

Manufacturing and Transport, storage and communication have accounted for about 75 per cent of aggregate productivity growth from 1974–75 to 1994–95.

There are different productivity characteristics in different industries. Some have relatively high or low productivity levels and opportunities for further productivity growth. The optimal industry mix in the economy at any time will involve both relatively high and low productivity industries.

Improving aggregate productivity growth involves raising all industries to their productivity potential.

There have been variations in the contributions from some sectors. Manufacturing, Transport, storage and communication and Electricity, gas and water have been consistent as well as strong contributors. Others have shown considerable variability for a range of reasons to do with seasonal variation, investment cycles, unaccounted for quality improvements, compositional changes and data.

From the sectoral perspective, the productivity growth slowdown in the mid to late 1980s would appear to come from downturns in measured productivity growth in the variable contributors coming at the same time. The measured decline in Retail trade appeared particularly important.

This underlines the need for improved productivity measurement, particularly in the services industries.

The sectoral perspective also showed evidence of the importance of new knowledge and better organisation of production in stimulating productivity growth. Although a formal attribution has not been attempted, there appears to be a noticeable improvement in productivity growth following the introduction of microeconomic reforms — especially in Transport, storage and communication and Electricity, gas and water.

6 AN INTERNATIONAL PERSPECTIVE

This chapter assesses Australia's productivity performance against the standards achieved by other comparable countries.

The assessment draws mainly on productivity estimates compiled by the OECD Secretariat. The estimates and other data for 14 countries are drawn from the OECD International Sectoral Data Base (OECD 1996b).[1]

The OECD uses measurement conventions that differ from those of the ABS in constructing its database. These differences mean that OECD-based estimates for Australia are lower than ABS estimates. But the OECD conventions improve the comparability of productivity estimates among countries.

Hence the approach adopted in this paper is to rely on ABS estimates for an examination of Australia's historical and absolute performance, but to rely on OECD-based estimates for indications of Australia's relative performance compared with other countries. Consequently, attention focuses on relativities in this chapter. Where estimates of Australia's productivity growth in this chapter appear at odds with the numbers presented in previous chapters, preference should be given to the latter.

Before examining Australia's comparative performance, some broad historical background is provided.

6.1 International trends in productivity growth

The 1950s and 1960s were a 'golden age' of high productivity growth among developed countries (Maddison 1994). In Europe and the United States the average annual labour productivity growth rate was twice as high between 1950 and 1973 as it was in the period 1973 to 1992 (Maddison 1995, p. 83). As noted below, productivity growth for the OECD group of countries was more rapid after WWII than it was before.

[1] The OECD database contains estimates of multifactor productivity by sector and for Total industries for each year (for which data are available) from 1970 to 1994. Growth rates were estimated by the IC using the annual average compound technique.

Box 6.1 Technological catch-up and international differences in productivity growth

The following is quoted verbatim from the Council of Economic Advisers (1995) p. 102.

How could it be that the United States, with one of the highest *levels* of productivity in the world, is not also among the countries where productivity is growing most rapidly? Some economists have suggested that, far from being a paradox, this circumstance is to be expected. The slow-growing leader, fast-growing follower pattern may simply reflect the dynamics of technological 'catch-up'.

Standard models of economic growth assume that richer and poorer countries have the same production technologies at their disposal (even if they choose to implement them with different mixes of capital and labour). Recently, however, growth economists have begun to question the realism of this assumption. In practice, technological diffusion — the spread of ideas — from leader to follower is far from automatic. Firms in follower countries may lack the skilled workers (engineers, managers) needed to exploit technologies used in leader countries efficiently. In addition, firms in leader countries may attempt to guard their core technologies to prevent or delay their spread to potential competitors abroad. Technological diffusion may be particularly slow in the case of 'soft' technologies (process technologies and work organisation), which cannot be imported and reverse-engineered as new products can.

For follower countries a gap in technology creates an opportunity. Leader countries (such as the United States) will find their productivity growth limited by the rate of creation of new knowledge. But followers can grow more quickly by closing a portion of the technology gap. It appears that success in closing this gap helped spur the postwar growth of Japan and East Asian newly industrialised countries, which invested heavily in technology acquisition and human resources and created business environments conducive to technological growth. Not every country succeeds, however, in closing the technology gap. Indeed, some followers have fallen farther behind, and follower countries as a group have not become richer faster than leader countries. Nevertheless, the evidence suggests strongly that, for followers, the upper limit on growth in per capita income and productivity exceeds that for technological leaders.

A range of factors assisted productivity growth over this period (Maddison 1994). After WWII came the stimulus of Marshall aid and new forms of international cooperation. Liberal policies were reapplied to international trade and international capital markets were reopened. In Europe, high levels of domestic demand and better internal resource allocation led to an investment boom. The European boom and an enlightened US international economic policy were responsible for the worldwide diffusion of technology.

These developments brought considerable opportunities for countries to increase the rate of productivity growth through 'catch-up' to the technological leader — the United States (see box 6.1). Between 1950 and 1973 OECD countries narrowed their gaps in productivity levels with the United States (Abramovitz 1994). Productivity growth in the United States during the 'golden age' was at least as fast as it was before WWII, so that the pace of growth of the OECD group as a whole was much more rapid after WWII than it was before.

However, productivity growth slowed down generally among OECD countries from the early 1970s. For the OECD as a whole, productivity growth slipped from nearly 3 per cent (for the period 1960–73) to 0.5 per cent from 1973 through to 1979 (OECD 1996a).

A number of factors have been put forward in explanation of the general growth slowdown:

- inflationary pressures stemming from the boom conditions, plus the oil price shocks;
- with the collapse of the Bretton-Woods fixed exchange rate system and the move to floating exchange rates, policy makers gave priority to combating inflation and safeguarding the balance of payments rather than maintaining domestic demand and employment (Maddison 1994);
- the closing of the gap between the United States and other countries in terms of productivity levels, which slowed the catch-up momentum (OECD 1996a); and
- the 'social and organisational rigidities' inherited from the preceding period of rapid growth (OECD 1996a).

Into the 1980s, productivity growth began to recover, but the pattern among countries was more diverse. The OECD average lifted slightly to 0.8 per cent as most countries began to recover (OECD 1996a). But in some countries — Germany, France, Italy, Canada and Australia — the decline continued for some years.

In the 1990s, the pattern of productivity growth continued to be diverse as some European countries and Japan were affected by recession.

Over the past decade attention has also turned to the rapid growth of some of the East Asian economies. While a large part of the economic 'miracle' is often attributed to productivity growth, there is evidence to suggest it is actually the growth in inputs that has played the major role (see box 6.2). In contrast, productivity growth is the main source of output growth in developed countries (OECD 1996a).

Box 6.2 Productivity growth in the Asian 'Tiger' economies

At times, attention turns to the rapidly-growing Asian economies, for possible lessons.

The interest was stimulated by the very rapid growth shown by the East Asian economies of Korea, Taiwan, Hong Kong and Singapore from the 1970s. Indonesia, Thailand, Malaysia and the Philippines then followed in the 1980s; and China from the late 1980s.

Growth is so rapid it is presumed that productivity growth must be playing a large role.

However, Krugman (1994a) and other researchers point out that the newly industrialising countries of Asia have achieved rapid growth in large part through an astonishing mobilisation of resources. Once the growth in inputs in these countries is properly accounted for there is little or a 'normal' amount of output growth left to attribute to productivity.

For example, Young (1995) examined the experience of Hong Kong, Singapore, South Korea and Taiwan. Growth in these countries averaged 6 to 7 per cent a year from 1966 to 1991. Young found important explanations in increases in labour inputs (increased labour force participation), human capital and physical capital. Productivity growth ranged from 0.2 per cent a year for Singapore to 2.3 per cent a year for Hong Kong.

The significant amounts of investment in capital can play a key role in economic growth in these economies (although less so in the case of Hong Kong). It appears that these economies do well because they are willing to make the sacrifices necessary to save rather than spend in order to accumulate capital at very high rates (Collins and Bosworth 1996).

However, Krugman states that an emphasis on increases in inputs, without an increase in the efficiency with which those inputs are used, must run into diminishing returns. Input-driven growth is inevitably limited.

For this reason, the relative importance of the different sources of growth tends to change during the process of economic development (IMF 1997). The accumulation of physical capital is an important source of growth in the early stages of economic development. However, once a relatively high level of capital intensity is reached, productivity growth takes over as the principal source of growth.

6.2 Australia's comparative performance

International comparisons of productivity growth can provide some indicative benchmarks against which to assess Australia's performance.

OECD countries provide a basis for comparison of Australia's productivity performance, given the broadly similar stage of economic development.

There are nevertheless some important differences among OECD countries that need to be considered. Productivity growth can reasonably differ among countries on account of different resource endowments, industry mixes, exploitation of 'catch-up' opportunities and the use of different technologies (see box 6.3).

It is important to compare like with like as much as possible when making international comparisons. This means Australia's performance should be compared with countries that have similar characteristics (or allowances made for pertinent differences). International comparisons of very specific activities, such as the manufacture of standard goods, improve greatly the ability to compare like with like.

Some claim that differences in productivity growth among countries influence international competitiveness. This has little, if any, validity for entire nations (see box 6.4). What matters most for a country is its own productivity performance. How other countries perform may suggest relevant benchmarks. But their productivity performance has little if any direct impact on the prosperity of the home country.

Box 6.3 Interpreting differences between countries in their rate of productivity growth

Differences in productivity growth between countries may well indicate differences in 'performance'. But there are some valid reasons for productivity growth to differ among countries that need to be taken into account.

- Data comparability. Despite adjustments by the OECD Secretariat, different data conventions among countries may still limit comparability.
- Different industry mixes. Different demand factors and supply factors (such as resource endowments) mean there are significant differences in industry mix among OECD countries (see appendix D). Since the productivity growth possibilities of industries differ, it follows that the productivity growth possibilities of countries will differ.
- Different technology. Differences in resource endowments, culture, geographical features and so on may dictate the use of different technologies among countries.
- According to the principles of convergence and catch-up (see box 6.1), productivity leading countries will have lower productivity growth opportunities than productivity follower countries.

Box 6.4 Productivity and international competitiveness

Do differences in national productivity growth between countries affect competitiveness and living standards? For some, improving productivity faster than other countries is seen as the key to sustaining national competitiveness and promoting national prosperity (Shann and Fitzgerald 1991, Thurow 1992). International comparisons of productivity would then serve as an indicator of national competitiveness.

Others question the concept of national competitiveness and therefore the direct relevance of international differences in productivity. Krugman (1994b, 1994c, 1994d) argues that countries are not in economic competition with each other, that national competitiveness is a meaningless concept, and that national differences in productivity growth are essentially irrelevant to a country's living standards. It is domestic productivity growth which alone is crucial to living standards (see also Corden 1994).

At the product/firm level, the concept of competitiveness is straightforward. Firms seek competitive advantage for their products in the market place. They do so by developing new ways of doing things and/or reducing their costs below that of competitors. Differences in productivity play a key role.

At the national level, the concept of competitiveness is more problematic in a long-term context. Countries do not compete with each other as firms do. Countries export in order to import; they increase their living standards by importing products at less resource cost than they can be produced at home. Trade is a source of mutual gain, not a zero-sum game.

A country which is less productive than its trading partners will still gain from trade, even if it has an absolute disadvantage in every product. Countries will export those products in which their relative labour productivity is highest and import those products in which their relative productivity is lowest. Because relative labour productivity varies across products among countries, a country with lower productivity growth will still have a comparative advantage in some products and this provides the opportunity to trade and increase their prosperity. Trading with more productive countries mitigates, rather than exacerbates, the consequences of low domestic productivity.

Increasing aggregate productivity in one country will not lead to reduced living standards in another (Krugman 1994c, Corden 1994). Differences in aggregate productivity may lead to currency depreciation in the country with lower productivity growth but this does not translate into a reduced standard of living. The acceleration in foreign productivity growth responsible for the depreciating currency is also passed on in lower prices of foreign goods, offsetting the effect of the currency depreciation. The relation between the rate of productivity growth abroad and at home is relevant only for the required rate of depreciation. Faster foreign productivity growth may also improve the home country's terms of trade and, therefore, its living standards (Corden 1994).

Some qualifications can be made to these arguments. Krugman's case may be overstated because the analysis is largely based on US experience. He acknowledges that repeated currency depreciation may reduce a country's purchasing power over imports so that domestic output growth is outweighed by a deteriorating terms of trade. Empirical evidence from other countries suggests that currency depreciation can lead to deterioration in the terms of trade although the effects may not be very large (Boltho 1996).

In addition, there are several circumstances in which countries may enter directly into economic competition with each other and increase productivity at the expense of their trading partners. With trade in inputs, high productivity uses will tend to attract internationally mobile ('footloose') capital and labour inputs (Jones 1980). Absolute differences in productivity then have a direct influence on trade and national living standards. Absolute advantage can also be derived from economies of scale, strategic and dynamic factors associated with technological change and innovation and spillovers between firms in knowledge accumulation (Grossman and Helpman 1991, Bruce 1993, Baumol and Gomory 1994, Krugman 1996).

However, the scope for economic competition between countries may be limited. The potential gains are likely to be very small (Krugman and Smith 1994, Krugman 1996); the gains may be ephemeral as a result of retaliation and competitive bidding by other governments (Boltho 1996); there is a high risk of government failure in transforming theoretical possibilities into successful practical policies (Krugman 1994c, 1996); and small countries such as Australia will not have much influence in global economic competition between countries.

To the extent that footloose factors are few, the terms of trade effects of currency depreciation are small and the scope for economic competition between countries is limited, trade continues to be a source of mutual gain and domestic living standards are determined essentially by domestic productivity.

International comparisons of productivity can, however, provide benchmarks for the aspirations of similar countries.

Aggregate productivity growth

Australia's long-term comparative productivity has deteriorated in two ways.

Since the last century (and up to the middle of this century), Australia's level of labour productivity relative to that of leading countries has declined (see table 6.1). The shift from Australia's economic focus on gold mining and agriculture with a small population base to a more diversified and developed economy with a larger population base provides a plausible and reasonable explanation.

Table 6.1 Comparative levels of labour productivity[a], selected OECD countries, 1870 to 1992 (index)

Country	*1870*	*1913*	*1929*	*1938*	*1950*	*1973*	*1992*
United States	100	100	100	100	100	100	100
Canada	71	82	69	61	77	81	87
Japan	20	20	24	25	16	48	69
Germany	70	68	58	56	35	71	95
France	60	56	55	62	45	76	102
Italy	46	41	38	44	34	66	85
United Kingdom	115	86	74	69	62	68	82
Australia	**147**	**103**	**86**	**83**	**69**	**72**	**78**
Belgium	94	57	44	39	32	65	83
Netherlands	103	78	84	72	51	81	99
Denmark	67	66	68	61	46	68	75
Sweden	54	50	44	49	56	77	79
Finland	37	35	34	36	32	57	70

a GDP per person hour.
Source: Maddison (1995).

Since 1950, Australia has made some headway in catching up to the leader again, but has been overtaken by many other countries. Even in Australia's high productivity growth period of the 1950s and 1960s most other countries made greater improvements in their productivity levels.

Australia's comparative performance in the second half of the century is of concern. It is the focus of the examination to follow.

Catch-up and convergence

There are two phenomena that have been such strong forces in post-WWII development that their influence on productivity growth must be taken into account:

- convergence whereby countries move over time from more disparate productivity levels to more common productivity levels;[2] and
- catch-up, whereby a country with relatively low productivity levels can grow relatively quickly as it narrows the gap with the productivity leader.

[2] Baumol, Nelson and Wolff (1994) define seven different convergence concepts two of which are most relevant here — homogenisation and catch-up. Homogenisation is the tendency of countries to narrow the dispersion in productivity levels over time. This paper refers to this concept as convergence.

These phenomena can go hand in hand. Many OECD countries have tended to converge and have done so at productivity levels closer to the productivity leader. The data in table 6.1 shows that the dispersion of productivity levels narrowed among countries between 1950 and 1992 (the standard deviation declined from 17 to 10 percentage points) while the gap with the United States narrowed (average productivity level relative to the United States increased from 46 to 85 per cent).

But it seems that Australia did not participate fully in the international catch-up and convergence trends. According to the convergence thesis, Australia's subsequent productivity *growth* could be expected to be relatively low if its productivity *level* was relatively high in 1950. However, other countries not only caught up to Australia in terms of levels, but overtook us. In doing so, they caught up further to the productivity leader.

Between 1950 and 1992, Australia fell from third highest to fourth lowest in terms of labour productivity levels. In 1950, seven countries had labour productivity 50 per cent below the US level and a further three countries were below Australia's labour productivity level of 69 per cent (see table 6.1). However, in 1992 not one country was below 50 per cent of the US level, and only three countries were between 69 per cent and Australia's relativity of 78 per cent.

Australia's relatively low rate of catch-up is shown in table 6.2. For the OECD countries in general, there was a high rate of catch-up between 1950 and 1973, while Australia had a very low (the lowest) rate of catch-up. Between 1973 and 1992, the rates of catch-up were much lower for most countries, but did not come down near the rate of Australia.

Thus, it seems that Australia participated in the 'golden age' of growth, but not to the same extent as other countries. And Australia's experience suggests a much weaker link to the phenomena of catch-up and convergence that drove other countries strongly.

Australia's rate of labour productivity growth can be examined with allowance made for convergence.[3] Figure 6.1 uses OECD data to plot productivity *levels* in 1970 against productivity *growth* between 1970 and 1994.[4] The negative

[3] It is not possible to construct meaningful estimates of MFP *levels* to investigate the convergence phenomenon.

[4] Labour productivity levels in 1970 were derived from the OECD database by dividing GDP (value added at market prices, 1990 prices and 1990 purchasing power parity in $US) by the number of workers. Labour productivity growth rates were derived by calculating an annual average compound growth rate from indexes of labour productivity levels in 1970 and 1994.

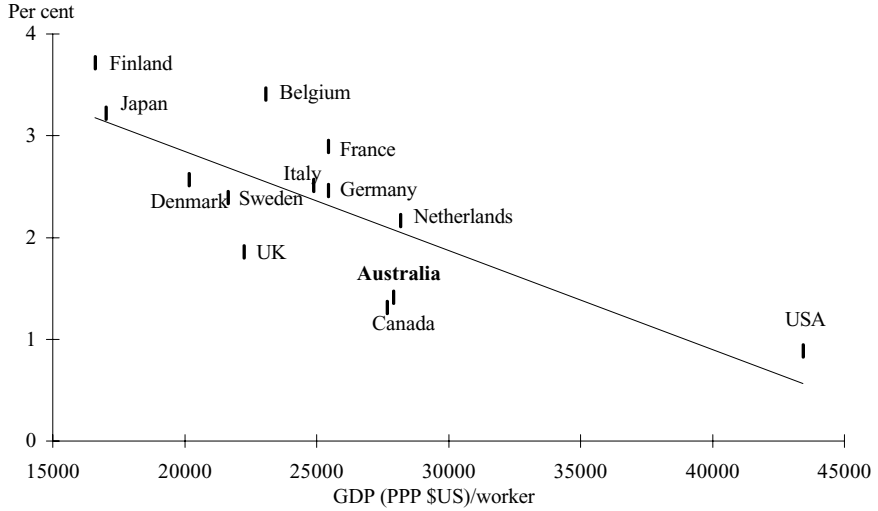
Table 6.2 Annual rate of catch-up to the labour productivity levels of the United States[a], 1870 to 1992 (per cent)

Country	*1870–1950*	*1950–73*	*1973–92*
Canada	0.10	0.23	0.35
Japan	-0.30	4.84	1.96
Germany	-0.88	3.18	1.53
France	-0.37	2.33	1.57
Italy	-0.37	2.98	1.27
United Kingdom	-0.77	0.39	1.03
Australia	**-0.95**	**0.21**	**0.39**
Belgium	-0.84	1.70	1.76
Netherlands	-0.87	2.01	1.05
Denmark	-0.46	1.69	0.52
Sweden	0.04	1.39	0.17
Finland	-0.20	2.26	1.09

a Average annual compound growth rates of divergence from or convergence towards the US labour productivity level.

Source: Maddison (1995).

Figure 6.1 Labour productivity levels in 1970 and growth over 1970 to 1994[a]



a Average annual compound growth rate.

Source: Commission estimates based on OECD data.

relationship, on average, demonstrates the convergence thesis — that those which start out further behind have greater opportunity to grow. In converging, countries are also catching up to the United States. The figure shows the United States with a relatively high productivity level in 1970 and the expected relatively low ensuing productivity growth. The line shows the average rate of convergence and catch-up among the OECD countries, allowing for starting position.

Figure 6.1 shows Australia's rate of labour productivity growth to be well below the international average, allowing for its starting position.

Australia's comparative MFP growth

Since the 1970s

Estimates of multifactor productivity are available from the OECD database from 1970. They therefore cover a period which starts at the transition from the 'golden age' to the general slowdown in productivity growth (commencing around 1973).

Australia's rate of MFP growth appears to have been around 20 per cent below the OECD average. The data in the OECD database put Australia's average annual rate of MFP growth at about 0.8 per cent and the OECD average at about 1.0 per cent between 1970 and 1994 (see figure 6.2). By way of comparison, published OECD estimates imply a 20 per cent gap for the period 1960 to 1994; and an even greater gap (35 per cent) for the period 1979 to 1994 (OECD 1995).[5]. The estimates in Dwyer (1995) for 1970 to 1994 imply a gap of slightly more than 20 per cent.

In fact, Australia had one of the slowest rates of productivity growth in the OECD area. Its rate of MFP growth was ahead of only two other countries, the United States and Canada (see appendix D). Canada's rate of productivity growth appears closely linked to the United States; and the United States, as the productivity leader, does not have the same opportunities for higher productivity growth that other countries enjoy through productivity catch-up.

Australia's rate of MFP growth was 40 per cent below the (1.3 per cent a year) average of the G7 countries (excluding the United States) and 55 per cent below the average of the small OECD countries (1.7 per cent a year).

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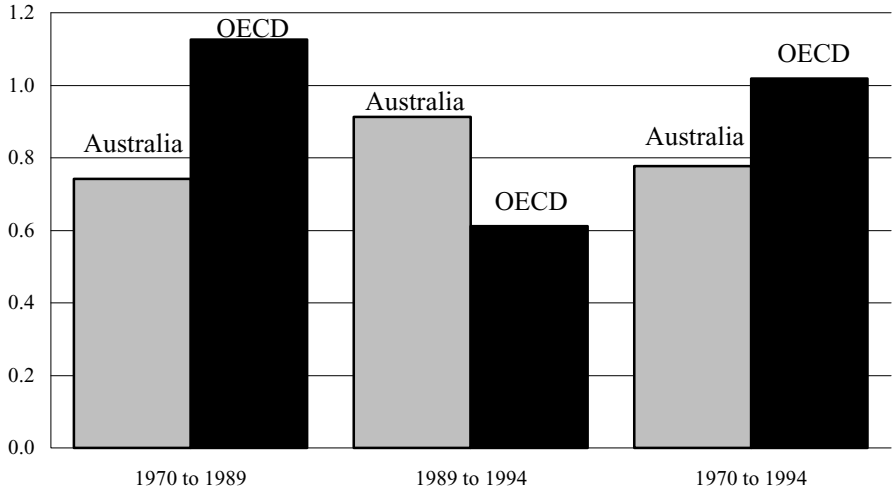
[5] The OECD Outlook (OECD 1995) contains productivity growth estimates for three separate periods. These were averaged by the IC using the average annual compound technique.

Figure 6.2 Average annual multifactor productivity growth for Australia and the OECD[a], 1970 to 1994 (per cent)



a OECD MFP includes Agriculture, hunting, forestry and fishing, Mining and quarrying, Manufacturing, Electricity, gas and water, Construction, Wholesale and retail trade, restaurants and hotels, Transport, storage and communication, Finance services, insurance, real estate and business services and Community, social and personal services.

Source: Commission estimates based on OECD data.

Looking at it the other way, Australia would have needed a 25 per cent increase in its rate of productivity growth to strike the OECD average. Based on a comparison with the average growth rates of the larger economies (excluding the United States) and the smaller OECD countries this could have been well within expectations.

Recent performance

Australia's multifactor productivity growth performance improved relative to the OECD average between 1989 and 1994 (see figure 6.2). This reflected both an increase in the Australian rate and a decline in the OECD average rate. The decline in the OECD average has been due mainly to the larger (G7) countries, except the United States (see appendix D). Whether this is a temporary phenomenon remains to be seen.[6]

6 Furthermore, alternative estimates by van Ark (1996), based on labour productivity, put Australia's productivity growth lower relative to other countries over the period 1989–94.

Sectoral productivity growth

Moving from national aggregates to the sectoral level improves the possibilities of comparing like with like in international comparisons. It therefore opens the possibility of gaining more definite performance benchmarks.

Sectoral contributions to national productivity growth

The sectoral contributions to productivity growth for the period 1970 to 1994 are summarised in table 6.3 (see appendix D for country details). As was demonstrated in chapter 5, the contributions take account of both the size of each sector and its productivity growth (data for both are provided in appendix D).

Table 6.3 Sectoral contributions to multifactor productivity growth in the business sector, selected OECD countries, 1970 to 1994 (per cent)

Sector	*Australia*	*United States*	*Other G7*	*Small OECD*	*OECD average*
Agriculture	**10**	12	10	10	11
Mining	**1**	-6	-3	..	-4
Manufacturing	**60**	74	83	54	75
Electricity, gas and water	**17**	1	-4	5	-1
Construction	**-3**	-14	-6	2	-8
Wholesale and retail trade	**-5**	23	23	16	23
Transport, storage and communication	**49**	38	21	12	26
Finance, insurance and real estate	**-31**	-5	..	..	-3
Community, social and personal	**2**	-22	-25	1	-19
Total	**100**	100	100	100	100

.. less than (+ or -) 0.5 per cent.

Source: Commission estimates based on OECD data.

They show that Manufacturing and Transport, storage and communication were important to national productivity growth in all OECD countries and not only in Australia. Australia's contribution from Manufacturing appears in the mid-range of OECD countries, whereas its contribution from Transport, storage and communication is well and truly at the high end.

Australia has also drawn a relatively high contribution from Electricity, gas and water. The United Kingdom is the only other country that comes close (see appendix D).

According to the OECD data the Wholesale and retail trade sector made a negative contribution to Australian productivity growth over the period. Although this was small (-5 per cent), it was in marked contrast to the positive contribution evident in other OECD countries. The Wholesale and retail trade sector was the second or third most important positive contributor to productivity growth in many OECD countries — 73 per cent in Japan and around 29 per cent in Denmark and Canada, 26 per cent in Italy and 23 per cent in the United States (see appendix D). More will be said later about Australia's comparative performance in this sector.

The Finance, insurance and real estate sector stands out as a strong negative contributor in Australia's case. This may reflect measurement difficulties. The ABS excludes this sector from its market sector definition. In other countries, productivity growth in this sector may reflect assumption more than real change. [7]

Productivity growth in individual sectors

The comparisons of Australia's performance in individual sectors over the 1970 to 1994 period are mixed (see appendix D).

Table 6.4 provides a summary of international comparisons of sectoral productivity growth. Emphasis should be placed on productivity growth in Australian sectors relative to those of other OECD countries rather than on absolute values.

Transport, storage and communication and Electricity, gas and water stand out as sectors in which Australia's productivity growth was relatively high. Wholesale and retail trade stand out as having lower growth than the OECD average.

[7] In some service sectors employment is used as an indicator of output by several countries, including Australia (Aspden 1989). Some countries such as Australia and the United States assume zero labour productivity growth. However, other countries assume that labour productivity is growing by a certain amount. For example, Sweden assumes 2 per cent labour productivity growth in business services and the United Kingdom uses various assumptions from 2.5 to 4 per cent. Business services are excluded from the ABS 'market sector', but are included in the OECD 'business sector'.

Table 6.4 Multifactor productivity growth by sector, selected OECD country groups, 1970 to 1994 (per cent)

Sector	*Australia*	*United States*	*Other G7*	*Small OECD*	*OECD average*	*After convergence*[a]
Agriculture	1.4	2.3	1.6	3.0	2.1	–
Mining	0.1	-1.0	-1.3	0.4	-1.1	+
Manufacturing	1.8	1.5	1.6	2.8	1.6	–
Electricity, gas and water	2.7	0.1	-0.6	2.1	-0.2	+
Construction	-0.2	-1.1	-0.4	0.2	-0.6	–
Wholesale and retail	-0.1	0.6	0.8	1.2	0.7	–
Transport, storage and communication	3.4	2.8	1.7	1.9	2.1	+
Finance, insurance and real estate	-0.7	-0.1	0.0	0.0	-0.1	–
Community, social and personal	0.1	-0.8	-1.1	0.1	-0.8	–

a '+' means above average, '–' means below average (see figure 6.3 and appendix D).
Source: Commission estimates based on OECD data.

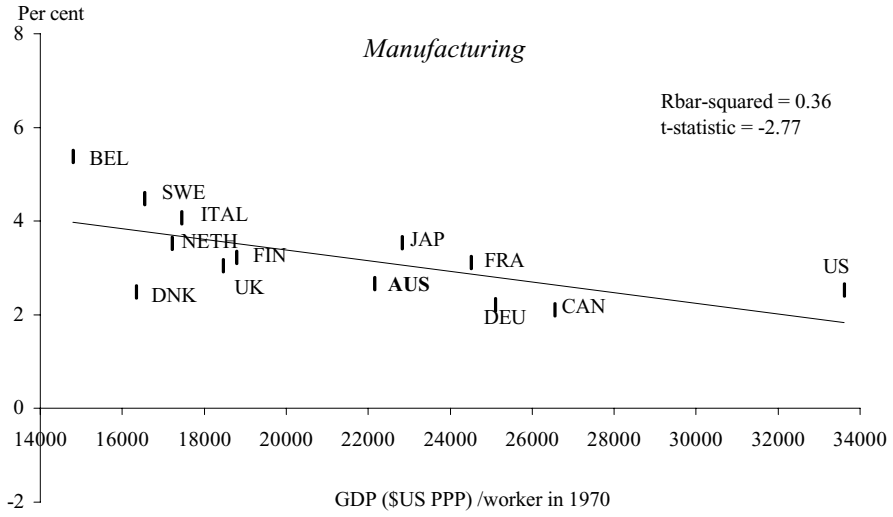
In the 1990s, productivity growth in Australia in Manufacturing, Transport, storage and communication and to a lesser extent in Electricity, gas and water and Wholesale and retail trade has improved significantly in comparison to other OECD countries (see appendix D).

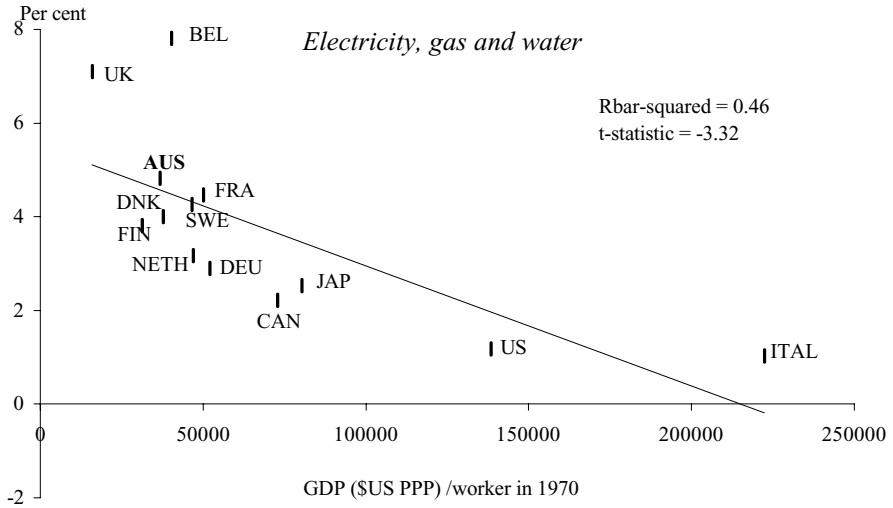
Convergence can be allowed for in examining productivity growth in individual sectors, using the scatter plot technique introduced before. Australia's main contributors are shown in figure 6.3 and others are shown in appendix D.

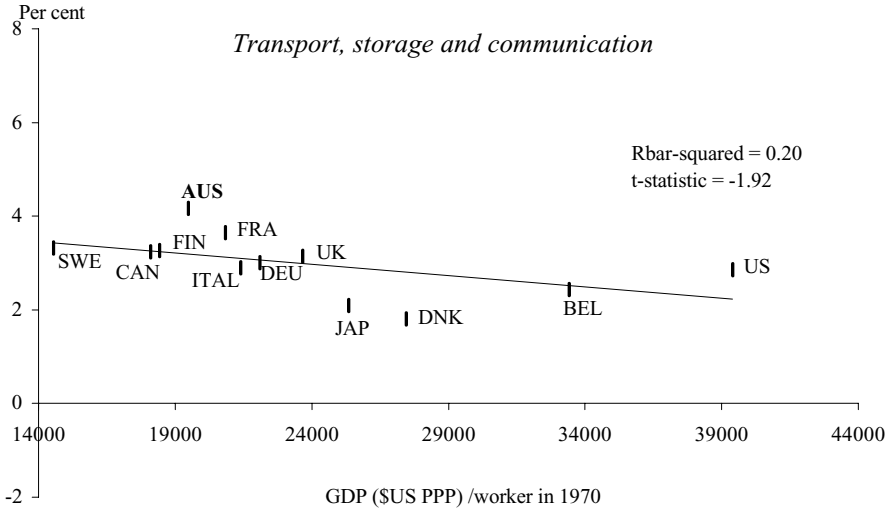
The results show that after controlling for convergence, labour productivity growth in Australia's Manufacturing, Agriculture and Wholesale and retail trade sectors were below the international average. Construction and Electricity, gas and water were about average, while productivity in Australia's Transport, storage and communication and Mining sectors were above the average.

These results are summarised in table 6.3 with a '+' indicating above average growth and a '–' indicating below average after allowing for convergence.

Figure 6.3 International sectoral comparisons of labour productivity levels in 1970 and growth over 1970 to 1994[a]







a Same methodology as in figure 6.1.
Source: Commission estimates based on OECD data.

Australia started out from a relatively low productivity base in Transport, storage and communication and Electricity, gas and water and middle order in Manufacturing (see figure 6.3).

Going by the slope of the line and how well it fits the scatter of points, international convergence was strongest in Electricity, gas and water; relatively strong in Manufacturing; and relatively weak in Transport, storage and communication.[8]

6.3 Remaining productivity gaps

Industry sectors

From international comparisons of productivity levels in comparable countries there appears to be considerable scope for productivity improvement in a number of Australian sectors. Productivity gaps are indicative of areas of potential improvement. However, differences between countries (resource endowments, population density and so on) may mean that Australia should not necessarily aspire to completely eliminate all the gaps.

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[8] For Transport, storage and communication the slope of the regression line suggests that initial productivity levels are not as important in determining growth compared with other sectors. For example, the United States and Belgium had high levels of labour productivity in 1970 in Transport, storage and communication and yet their growth was almost as high as countries with initially low levels.

The Commission's estimates are based on OECD data and averaged over the period 1990 to 1993 for which sectoral data are available for most countries (see table 6.5).

In Manufacturing, Australia's labour productivity level (at two-thirds of the productivity leader) in the period 1990 to 1993, was below the other G7 countries (three-quarters of the productivity leader) and matched by the smaller OECD countries.

According to another study, Australian Manufacturing had the lowest level of labour productivity of among developed countries in 1995 at around half that of the United States (Pilat 1996).[9] Comparisons of industries in the Manufacturing sector show that (with the exception of non-metallic products) all Australian industries were well below the OECD average.

Although productivity growth in Transport, storage and communication has been high, estimates of labour productivity levels indicate that, in the early 1990s, Australia still had some way to go to catch up to the United States.

For the Electricity, gas and water sector, both labour and capital productivity levels were still low compared with the United States, other G7 and smaller OECD countries.

Estimates of labour productivity levels suggests that Mining (at 95 per cent) and Construction (at 86 per cent) are closer to the United States.

The relatively low labour productivity level of Australian Agriculture may reflect climatic and soil conditions and the nature of the production process, such as extensive grazing.

The position with the Wholesale and retail trade is not clear. The sector started with a relatively high level of labour productivity in 1970 but since then, has had low measured growth. However, this may be largely a statistical phenomenon (see chapter 5 and appendix C) and requires further investigation.

The clearest cases of remaining productivity gaps are in the sectors that have been strong and consistent contributors to Australia's productivity growth — Manufacturing, Transport, storage and communication and Electricity, gas and water.

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[9] Bernard and Jones (1996) found that multifactor productivity levels in Manufacturing sectors in different countries may not converge. For traded goods, comparative advantage leads to specialisation. Consequently, if countries produce different goods there is no reason to expect the technologies of production to be the same or converge over time.

Table 6.5 Labour and capital productivity levels by sector, selected OECD countries[a], 1990 to 1993

Type/sector	*United States*	***Australia***	*Other G7*[b]	*Small OECD*[c]	*OECD*
Labour					
Agriculture	100	**54**	37	59	51
Mining	100	**95**	45	64	75
Manufacturing	100	**66**	73	63	81
Electricity, gas and water	100	**54**	80	69	86
Construction	100	**86**	88	86	92
Wholesale and retail trade	100	**75**	80	84	89
Transport, storage and communication	100	**63**	57	54	71
Capital					
Agriculture	100	**82**	54	63	68
Mining	100	**131**	88	142	98
Manufacturing	100	**94**	97	73	97
Electricity, gas and water	100	**67**	117	75	105
Construction	100	**49**	68	54	74
Wholesale and retail trade	100	**116**	92	57	95
Transport, storage and communication	100	**89**	99	78	98

a Labour productivity levels derived by dividing sector output (value added at market prices, at 1990 prices and 1990 PPPs in $US) by the number of workers in the sector, averaged over the four years. Capital productivity is derived by dividing sector output by gross capital stock, at 1990 prices and 1990 PPPs ($US), averaged over the four years.

b United Kingdom is 1990 for Manufacturing, Construction, Wholesale and retail trade and Transport, storage and communication; 1990 and 1991 for Agriculture, Mining and Electricity, gas and water. Italy is 1993 for Agriculture otherwise 1990 and 1991.

c Belgium is to 1992 only. Denmark is from 1990 to 1992.

Source: Commission estimates based on OECD data.

Benchmarking of individual industries

As noted previously, productivity comparisons among countries become (potentially) more meaningful at finer levels of disaggregation. International benchmarking of individual industries provides the greatest opportunity to compare like with like in different countries.

The BIE international benchmarking project (now conducted by the Commission) is this type of exercise. A range of quite specific indicators are collected, rather than all-encompassing measures of labour and capital productivity.

Table 6.6 Productivity performance gaps within Australia and compared with international best practice (index)

Activity	*Indicator*	*Year*	*Lowest Australian*	*Highest Australian*	*Best practice*
Labour productivity					
Electricity	GWh/employee[a]	1994	53	100	292
Telecommunications	Partial labour productivity	1992	100	100	238
Rail freight	Mntk/employee	1994	48	100	356
Waterfront (containers)	TEU per employee	1994	59	100	126
Waterfront (coal)	Tonnes ('000)/employee	1994	41	100	155
Aviation	Aircraft moves/fire and rescue employee	1993	32	100	208
Gas supply	Tj/employee	1994	8	100	100
Coastal shipping	Manning small dry bulk vessel	1994	100	100	117
Capital productivity					
Electricity (capacity)	Capacity factor (%)[b]	1994	70	100	100
Electricity (RPM)	Reserve plant margin	1994	-145	100	151
Telecommunications	Partial labour productivity	1992	100	100	176
Rail (wagons)	Mntk/wagon	1994	55	100	249
Rail (locomotives)	Mntk/loco	1994	60	100	220
Waterfront (coal)	Throughput/capacity (%)	1994	42	100	100
Waterfront (containers)	Crane rate - moves per hour	1994	79	100	162
Aviation	Passengers/terminal gate	1994	90	100	213
Gas supply	Tj/total main (km)	1994	23	100	223
Road freight	Tonnes ('000)/km/vehicle/year	1992	100	100	126

a Includes construction personnel.

b Victoria based on 1992–93 data.

Source: BIE (1995).

The results point to quite significant remaining performance gaps in Australian industries compared with their overseas counterparts (see table 6.6). Between 1992 and 1994, world best practice in labour productivity indicators is over 100 per cent ahead of Australian best practice in Aviation, Electricity, Telecommunications and Rail freight. In terms of capital productivity measures, the performance gaps are over 100 per cent in Rail (wagons and locomotives), Aviation and Gas supply (pipeline). Australia only hits the world mark in the measures used in Gas supply (output per employee), Electricity generation (capacity utilisation) and Waterfront coal loading (throughput).

There also appears to be extensive scope for catching up within Australia. There are significant gaps between the highest and lowest Australian performers.

There are productivity gaps in Transport, storage and communication and Electricity, gas and water emphasising the need for productivity improvement. Benchmarking individual industries tends to confirm the more general story of Australia's productivity gaps at the sectoral level.

6.4 Summing up

Aggregate comparisons

Australia has not participated as strongly as other countries in catch-up and convergence. During the 'golden age' in the 1950s and 1960s, when Australia was at its peak in productivity growth, other countries were closing the productivity gap with the United States at a faster rate. Other countries have experienced considerable increases in labour productivity since 1950 compared with the United States, whereas Australia improved only slightly.

Australia had one of the slowest rates of productivity growth in the OECD area. Australia's MFP growth was 20 per cent less than the OECD average for the period 1970 to 1994. To match the OECD average Australia would have needed to increase its multifactor productivity growth by at least 25 per cent. Based on the performance of comparable countries this should have been within reach.

There was a slight improvement in Australia's productivity growth in the 1990s while many countries experienced a deterioration. Recent performance appears better, but how sustained it is depends on whether other countries recover their performance.

Sectoral comparisons

Over the period 1970 to 1994, the main contributors to national productivity growth in Australia (Manufacturing and Transport, storage and communication) were also important for productivity growth in other countries. While the contribution to productivity growth from the service sectors (particularly Wholesale and retail trade) was low compared with other countries, it may be a statistical phenomenon.

After controlling for convergence, Australia's rate of labour productivity growth was relatively low in Manufacturing, Agriculture and Wholesale and retail trade. It was about average in Electricity, gas and water. And it was relatively high in Transport, storage and communication and Mining.

In the 1990s, productivity growth in Australia in Manufacturing, Transport, storage and communication and to a lesser extent in Electricity, gas and water

and Wholesale and retail trade, has improved significantly in comparison to other OECD countries.

There are still considerable remaining labour productivity gaps with other countries among those sectors which contributed most to productivity growth in Australia. For Australian Transport, storage and communication there is a gap with the United States. For Manufacturing, Australian productivity was below the G7 countries and well below the United States. For Electricity, gas and water Australian productivity was below the small OECD countries and well below the G7 countries and the United States.

7 DISTRIBUTING THE GAINS FROM PRODUCTIVITY GROWTH

This paper considers productivity growth in the context of living standards. Living standards depend not only on productivity growth, but also on how the benefits of that growth are distributed throughout the community.

This chapter describes the different ways in which productivity gains can be distributed and reviews recent trends.

7.1 How do we benefit from productivity improvements?

Chapter 2 made the point that productivity growth raises living standards. But how does this actually come about?

The most direct way in which productivity improvements benefit people is by raising their real incomes. Managers and employees can be paid more. Shareholders can receive greater returns. And, if higher productivity means lower costs and these savings are passed on in lower prices, commercial users and final consumers will be able to purchase goods and services more cheaply. The increased spending that these higher real incomes allows produces flow-on effects throughout the economy.

With higher real incomes, some may also choose more leisure — fewer working hours, longer holidays or early retirement. Over the longer term, productivity improvements have enabled general reductions in working hours (see box 2.2 in chapter 2).

Higher real incomes also make it easier to provide for the well-being of others and to provide more of the things that contribute to the well-being of society as a whole. Governments receive more tax revenue and individuals and firms are better placed to take actions for the common good. Productivity growth therefore makes it easier for a society to provide the means to protect and improve the environment, to educate and offer health care to its populace, to overcome poverty, to care for the aged and to support cultural activities.

The benefits of productivity improvement can also be taken in other ways. Greater effort and expense could be put into improving the quality (serviceability, durability) of goods, or to reducing the environmental impacts of production processes, or to improving safety in the work environment.

There are also flow-on or indirect benefits. For example, consumers will spend more out of their higher real incomes to the benefit of retailers and producers of goods and services.

In summary, the main forms in which the benefits of productivity improvements can be distributed initially and directly are:

- to purchasers in the form of lower prices and/or higher quality of product or service;
- to employees and/or shareholders in the form of higher incomes, better conditions and/or greater leisure;
- to governments through higher tax revenue;
- greater environmental amenity; or
- as some combination of the above.

Indirect or flow-on benefits can then accrue.

Direct benefits are distributed as wages are paid and prices are set and so on. There is no sense (or possibility) of a pool of benefits accumulating to be distributed subsequently. If one group does not capture the benefits as they arise, another group will.

There are other dimensions in which the distribution of productivity gains could be considered:

- the distribution of earnings among different occupational groups;
- the distribution of income among different income groups in the broader community; and
- the distribution of benefits between the current and future generations.

These are not, however, investigated in this paper. The focus is on the distribution between the firm (wages and profits) and purchasers (through lower prices).

Major factors affecting the distribution of productivity gains

The discussion now turns to wages, profits and prices. If wages and/or profits can be increased, the (initial direct) benefits of a productivity gain will tend to be captured within the firm. But if costs and prices are lowered, benefits will flow on to firms who use the relevant good or service in their production processes and to final consumers. This opens the possibility that the direct benefits may be more widely distributed.

The central issue is the degree of discretion or 'market power' that operates in these areas. If employees have some market power in wage setting, they are

better placed to 'capture' some of the productivity gains. If firms have some discretion over prices (they are not completely driven by competitive pressure), they are better placed to capture some of the productivity gains in the form of higher profits.

With greater competition in product markets, it is to be expected that a greater proportion of the gains from productivity improvements would be distributed to purchasers through lower prices. Sellers would have little alternative but to pass on cost decreases in order to maintain (or improve) their competitive position.

Competitive pressure in product markets can also affect wage outcomes. If producers have a high degree of discretion over prices, cost increases can be passed on to purchasers. Wages and profit margins could rise to capture productivity gains, but purchasers would not benefit if the cost increases were passed on. But if there is little discretion over prices there would be more pressure to restrain profit margins and wage rises.

Recent developments

There have been significant changes in both wage determination processes and product market competition over the past decade or so. Wage determination has been evolving from a centralised system toward an enterprise-based system. This has brought greater flexibility in wage determination, including the ability to attune wage bargains more closely to the productivity performance of the firm. It is also designed to add incentive to discover and bring about productivity improvements.

A large part of government reforms in product markets over the past decade or so has focussed on increasing competition. Tariff reductions since the late 1980s have subjected the traded-goods sector to greater competition from imports. The removal of trade barriers has provided greater incentive and calls for the non-traded sector to also improve its performance.

Reform to government business enterprises (GBEs) has seen the corporatisation of many of these bodies and the introduction of competition to what were previously protected markets. Since GBEs operate in important areas of economic infrastructure (energy, transport, communication), their pricing policies have effects that permeate the entire economy.

Moves to greater competition throughout the economy have also been fostered through regulatory and competition policy reforms.

7.2 Australia's experience

A formal analysis of the distribution of the gains from productivity improvement is beyond the scope of the current paper.

Rather, an attempt has been made to distill a picture from a number of different perspectives. An aggregate or national perspective gives a sense of the general trends in the economy. But there are too many influences on the variables to be confident that the correct causal links can be identified. Case studies of firms and industries allow greater precision in attributing causes and analysing effects, but raise questions about the general applicability of the relationships found. A sectoral perspective is somewhere in between and, at least in principle, allows a balance to be struck between precision and general applicability.

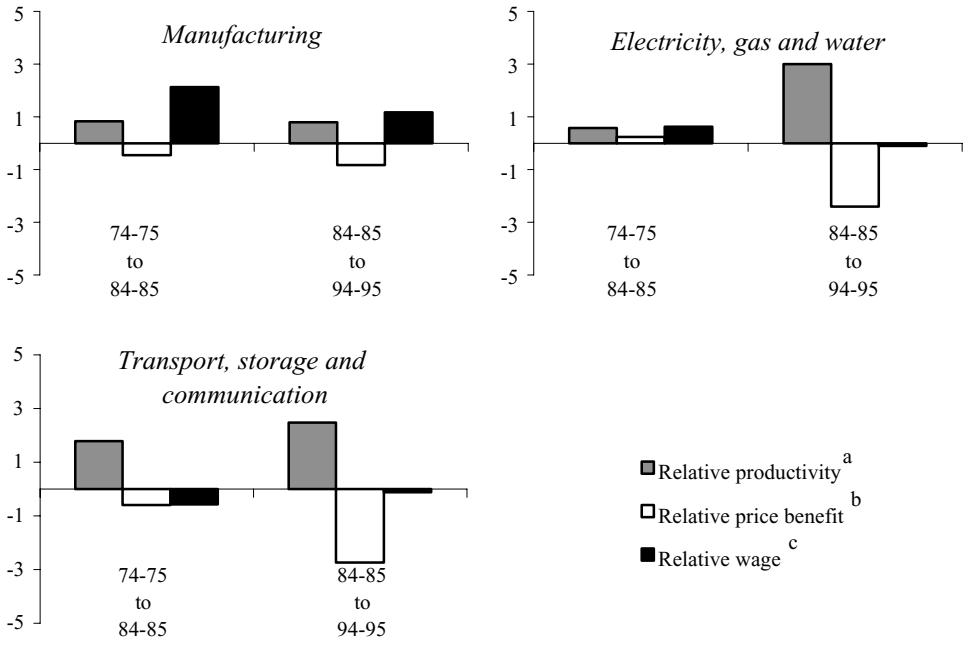
The sectoral perspective

The prime interest is in productivity growth and how this might have affected price, wage and profit outcomes. The trouble is that prices, wages and profits are subject to a number of powerful, general forces other than productivity.

To circumvent this, the relationships between productivity, prices, wages and profits are examined in industry sectors *relative* to economy-wide averages. This quarantines the economy-wide effects of general influences (such as monetary policy) on prices, wages and profits. For example, tighter monetary policy would reduce inflation generally. But if productivity improvements were also having a beneficial impact on prices, price increases in sectors with relatively high productivity improvements would be lower than the economy-wide average.

Figure 7.1 shows relative productivity, price and wage data for Manufacturing, Electricity, gas and water, and Transport, storage and communication. These are the sectors that have shown relatively high productivity results (see chapter 5). (Details on the derivation of these charts and coverage of profits are provided in appendix E.)

Figure 7.1 Relative productivity growth, relative price benefit and relative wage growth in higher productivity sectors, 1974–75 to 1994–95 (percentage points)



a MFP growth (sector) *minus* MFP growth (market sector).

b Price growth (sector) *minus* price growth (economy).

c Average earnings growth (sector) *minus* average earnings growth (economy).

Source: Commission estimates based on ABS data and Gretton and Fisher (1997).

The way to read figure 7.1 is that a higher productivity bar means better productivity performance (and a bar in the positive range means that the sector's productivity is greater than the market-sector average); a lower price bar means greater price benefit (a negative means a sector's price increases are below the economy-wide average); and a higher wage bar means greater wage increases in the sector (above the economy-wide average).

The figure indicates that, for Manufacturing, the wage increases in 1974–75 to 1984–85 appeared 'excessive' — well beyond the relative increase in productivity. (There was a wage breakout in the early 1980s associated with the investment boom). There was a turnaround later in the 1980s with wage moderation and relatively high price benefit. From the mid 1980s, there were still above average wage increases, but they were less pronounced. Relative price decreases, on the other hand, were more pronounced.

In Electricity gas and water, there were both relative wage and price increases up until the mid 1980s. But with the relatively high productivity growth thereafter, there were relative price declines with about average wage increases.

In Transport, storage and communication, relative price has been the main change factor. With higher productivity growth from the mid 1980s, lower relative prices featured more prominently.

The corresponding charts for the relatively poor productivity performers are included in appendix E. While there are several exceptions, these sectors seem to have shown less price benefit than the high productivity sectors in the latter half of the period. (This was not true of the first half). In the second half, Agriculture and Wholesale trade showed relative wage increases and Construction showed a relative wage decrease. But the general pattern across all sectors was for less variation in wages than in the earlier period.

The general picture that emerges from these charts is that more of the productivity gains have been passed on through lower prices.

- **Compared with the earlier period, the high productivity sectors showed greater price benefit and less wage benefit over 1984–85 to 1994–95.**
- **There is smaller variation among sectors in wage outcomes and larger variation in price outcomes among sectors since the mid 1980s.**
- **From the mid 1980s, higher productivity was associated with lower prices.**

Because this is a *relative* analysis (deviations from the average), it does not convey any sense of the general extent to which productivity improvements transmit into wages or prices.

But it does show that differences among sectors in productivity growth have led in the late 1980s and the 1990s to differences in relative output prices, more than to differences in relative wages. This runs counter to the argument that greater enterprise and productivity focus in wage determination would lead to greater disparities in wage outcomes, with people in the same occupation receiving different amounts, depending on which firm or industry engages them. The increasing dominance of the price effect appears to be providing a discipline on wage outcomes that prevents wide earnings differentials from emerging. Rather, productivity differences have led to greater disparities in output prices.

As an example, the lower productivity growth in restaurants, construction or retail trade does not mean that employees in these industries are paid considerably less (other things equal) than in manufacturing, communication or electricity. It means the outputs in these industries become relatively more expensive.

The other consequence of the increasing importance of the price effect is that high productivity growth industries have more opportunities to expand output

and employment. With lower relative prices, demand for these goods and services will be greater (all other things equal).

Case study and aggregate perspectives

A number of case studies of individual industries were reviewed to complement the sectoral perspective. They covered:

- performance monitoring data from the Steering Committee on National Performance Monitoring of Government Trading Enterprises (SCNPMGTE 1996)
  - which cover electricity, gas, water, urban transport, rail, ports, and communication
- electricity supply industry, based on SCNPMGTE (1996)
- telecommunications, based on SCNPMGTE (1996)
- agrifood, based on BIE (1996a)
- motor vehicles, based on BIE (1996b) and IC (1997)
- manufacturing, based on BIE (1990a).

For space reasons, these case studies are not reported here.

The case-study information (except for the BIE study of manufacturing) relates predominantly to the 1990s. It suggests that productivity improvements have led to price benefits and some quality improvements. Wage data are generally not available. The BIE manufacturing study confirms the importance of wage increases in the 1970s and 1980s, but does not cover the 1990s.

The case studies lend support to, rather than detract from, the impression gathered in the sectoral perspective.

The aggregate, economy-wide perspective was also considered, based on trends in market-sector MFP and economy-wide inflation, average weekly earnings, employment and unemployment.

A great deal of reliance cannot be put on the association of trends between the different variables, because so many other factors were at play in the economy to exert influence at the same time. Without a rigorous, formal analysis the following points must be taken as tentative:

- the productivity gains of the 1970s were more than absorbed through increased wages
  - and the increased costs were passed on in higher prices;

- in the 1980s, moderation in wages meant there was greater opportunity for productivity gains to be passed on in the form of lower prices; and
- this apparent tendency is more firm in the 1990s when the stronger growth in productivity has coincided with continued moderation in wage increases and further reductions in inflation.

Again, this perspective tends to confirm, rather than detract from, the sectoral perspective.

7.3 Flow-on effects

As noted above, improvements in productivity can initially accrue to consumers and purchasing firms in the form of lower prices, to labour in the form of higher nominal wages, to capital owners in the form of greater profits, improved product quality or as a combination of these possibilities.

However, in addition to the initial impacts, there are secondary effects that flow on to the rest of the economy. These flow-on effects have an important bearing on the ultimate distribution of benefits and employment outcomes.

The initial impact as described above is to increase real incomes — either through higher wages and profits or through lower prices. Higher real incomes can stimulate consumer spending. Greater profitability can stimulate investment. Greater competitiveness of purchasing firms can stimulate demand for and production of their products.

The actual change in output, employment and the structure of the economy depends on the elasticities of supply and demand in various industries.

The full assessment of flow-on effects requires an economy-wide framework. Box 7.1 reviews the main results of estimating the full gains from a range of microeconomic reforms. Productivity improvement is at the heart of these reforms. The general result is that productivity improvements stimulate gains in output, incomes (real wages), consumption, employment and government revenue.

Box 7.1 Estimating the gains from reform

- The IC (1990) modelled reform in transport, aviation, communication, water and electricity, contracting out by governments and the removal of rural and manufacturing assistance to gain an indication of the benefits from reforms. The results suggested long term annual gains in real GDP of 6.5 per cent and the generation of an extra 53 000 jobs.
- The BIE (1990b) estimated the benefits from reform over the seven year period from 1988–89 to 1994–95. In addition to those examined by the IC, the reforms modelled included the impact of investment incentives and labour market reforms assumed to result in large increases in labour productivity. The study found that reform would increase GDP by 9.5 per cent.
- For EPAC, Filmer and Dao (1994) analysed the effects of: the reduction in tariffs and subsidies; labour market reform; facilitation of the operation of markets; transport and communication reforms; GBE reform; gains from international trade negotiations; support for emerging exporters; and the efficient provision of government services. The model also projected the benefits of reducing the sustainable unemployment rate from 7.3 to 5.0 per cent. It estimated reform would increase GDP by 12.7 per cent. All of the model's 25 industries experienced growth.
- Reforms modelled by the BCA (1994) included: the replacement of the existing indirect taxation system with a broad based consumption tax; improvements in the level and efficiency of government services; further improvements in the efficiency of GBEs; and improvements to labour productivity in the private sector that were assumed to bridge the gap between Australian productivity levels and world's best practice (except where they were due to economies of scale). The model estimated reform could increase real GDP by 20.5 per cent over a 20 year period.
- The IC (1995d) estimated the growth and revenue implications of the Hilmer and related reforms. Specifically, the IC modelled the impact of reforms in the transport, communication and utilities sectors, and to statutory marketing arrangements, government services, unincorporated enterprises and anti-competitive legislation. The IC results suggested that over time there would be a gain in real GDP of 5.5 per cent, an increase in real wages of 3 per cent and 30 000 extra jobs.
- EPAC (1996) modelled the dynamic efficiency gains from tariff reductions and complementary economic reforms, and found that they could increase GDP by about 15 per cent by 2020. This was equivalent to an annual increment of about 0.5 per cent in per capita GDP over the period 1990–2020.

Although it is not investigated in this paper, it seems logical that the mechanism by which real incomes increase makes a difference to the full and complete distributional consequences.

- If higher real incomes are generated by higher wages and profits, the flow-on effects will largely be dictated by the spending patterns of the recipients. Output- and employment-generating effects within the productivity improving firm, induced by the further demand of consumers and users, will be muted.
- If higher real incomes are generated by lower prices, flow-on effects will arise from the increased competitiveness of using firms and the gains to consumers. Those consumers may be widely dispersed throughout the community (pensioners, unemployed, householders). Opportunities to expand output and employment will arise in both the productivity-generating and using firms.

7.4 Summing up

Productivity gains can be distributed in a number of ways — increased leisure, improved product and service quality, greater human and environmental protection, as well as higher real incomes.

This chapter has focussed on the distribution of gains between higher wages and lower prices, and to a lesser extent profits.

The information presented here does not represent conclusive evidence. But it suggests some shift in the pattern of distribution of productivity gains away from wage increases and toward price decreases — at least in relative terms.

This change has coincided with government reforms that have led to greater competitive pressures in the economy.

The evidence suggests that differences in productivity growth among industries are leading to greater disparities in output prices, not wages — despite the increasing ability to link wages to firm-level productivity under enterprise bargaining.

To the extent that gains are increasingly distributed through lower prices, the flow-on effects to the rest of the economy are likely to be magnified:

- the competitiveness of using industries can be enhanced;
- employment opportunities can be created in benefiting industries; and
- consumers (be they employed, unemployed, pensioners, students, householders) can afford to purchase more.

There are two main messages:

- The impacts of productivity improvement on living standards depend not only on the size of the productivity gains but also on how they are distributed. Benefits can be narrowly or widely distributed.
- Competitive reforms in goods and service markets enhance the flow-on gains to the economy and community at large. Labour market reforms alone may affect the distribution of gains between wages and profits; but they will not be sufficient to generate flow-on benefits through lower prices. Product market competition provides an important discipline.

8 EMPLOYMENT IMPLICATIONS

Jobs are fundamental to the economic and social fabric of society. For most people, jobs are the primary means of providing for consumption and accumulating wealth. Jobs also contribute to well-being in other ways — including in self-esteem, membership of a community and opportunities for personal growth. Although difficult to measure, such non-pecuniary benefits of employment are very real.

The employment consequences of productivity growth are a source of much community concern and uncertainty. The concerns stem from the perception that productivity improvement reduces job security and employment opportunities and increases inequalities in earnings between low-skilled and high-skilled jobs. These concerns need to be addressed in any discussion of productivity growth.

While this chapter focuses on the implications of productivity improvements for employment growth and unemployment, it is not a definitive examination. The impact of productivity growth on employment and the nature of the associated adjustments are complex. It requires more investigation and analysis than is possible in the present study. Consequently, only an initial exploration is presented here. The objective is to shed some light on the links between productivity and employment at a broad level, drawing on available evidence from Australia and overseas, and identify issues which require further information and analysis.

The discussion which follows outlines the range of factors to be considered in assessing the employment consequences of increasing productivity; and presents research evidence on employment effects at the firm and industry levels, as well as at the aggregate and sectoral levels. Areas for further research are also considered.

8.1 Assessing employment consequences

There are four principal factors to be considered in assessing the employment consequences of actions to improve productivity.

- What evidence would be relevant — the number of jobs lost and created, effect on total employment or unemployment?
- At what level should the evidence be considered — at the firm, industry, region or national levels?

- Over what period should the evidence be considered — immediate short-run impacts or the full long-term effects?
- Are there other relevant factors affecting employment conditions that need to be taken into account?

Employment opportunities and unemployment

The number of jobs on offer over the long term is a key source of evidence in assessing the employment effects of productivity growth. Employment opportunities can be indicated by the proportion of the working age population that is employed. If this proportion has remained constant over time, the number of jobs available has expanded in pace with growth in the working age population, despite whatever has happened to productivity growth and labour force participation.

Employment opportunities might be an issue also for specific groups; for example, the alternative opportunities for middle-aged people with specific skills and experience. Assessing the impact of productivity improvement on employment opportunities for these groups requires more specific information.

The unemployment rate is also an obvious indicator, although its usefulness may depend on whether a short or long-run perspective is taken. Moreover, it is influenced by a variety of factors other than productivity.

Level of activity

The question of whether the employment effects are considered at a firm, industry, regional or Australia-wide level is crucial. As the previous chapter indicated, productivity improvements can have significant flow-on effects to the rest of the economy (see also Freebairn 1993). Productivity improvements in one firm or industry can generate employment in other firms and industries. The full effects on employment should take these flow-on effects into account.

The flow-on employment effects depend on factors such as the significance of price reductions, the responsiveness of demand to reductions in price and the stage of the macroeconomic cycle.

Time period for effects

It takes time for the full effects of productivity improvements to be felt. Often the direct impacts of a productivity improvement including job losses are felt in the immediate term. The indirect, flow-on effects on other firms (and feedback effects on the originating firm) usually take longer.

Other factors affecting employment

Employment opportunities are affected at any time by a myriad of factors. At the aggregate level, general demand conditions following the business cycle are important, as are the impact of government macroeconomic policies. At the micro level, changes in consumer tastes and preferences, trade patterns, and incomes may be important influences on employment opportunities. Labour market arrangements, including wage determination processes and regulation, are likely to also be important.

8.2 Firm and industry-specific activity

The examination of the employment effects begins at the firm and industry level, since this is where productivity improvement originates. The employment outcome for firms depends on factors such as:

- *the responsiveness of the demand for the firm's products to changes in price* — price reductions made possible by productivity improvement may result in large increases in demand and lead to an expansion in employment;
- *the nature of the productivity change* — for example, some technological change may reduce labour requirements while other forms lead to higher minimum plant size which can augment labour requirements;
- *the rate of diffusion of new technology and processes* — a slow rate of diffusion and adoption may mitigate immediate employment effects for a period for some firms;
- *the degree of labour intensity in operations* — for example, increased productivity in firms utilising labour-intensive methods of production may result in greater employment effects than in the case of capital-intensive firms; and
- *managerial abilities in the development, adoption, distribution and marketing of new products and production techniques* — differences in the ability to identify and develop new products, to organise production activity, to motivate employees and to adapt to changing circumstances can lead to differences in productivity and job growth between firms (Davis, Haltiwanger and Schuh 1996, p. 158–9).

Little analysis has been carried out in Australia of the impact of productivity improvement at the firm or plant level and overseas studies generally relate to manufacturing establishments.

Box 8.1 Firm and industry effects — international studies

A major US study (Baily, Bartelsman and Haltiwanger 1996) found substantial variance in employment and productivity growth rates between plants. Both job creation and job losses occurred in manufacturing establishments with increasing productivity and there was no observed pattern by industry, plant size, location and ownership. Employment losses also occurred in many establishments that experienced declining productivity.

Other studies show that the use of advanced technologies is positively correlated with both plant survival rate and the growth of employment in individual plants. These correlations persist even after controlling for age, size, productivity, and capital differences among plants (Alexander 1996, pp. 315–6).

Data prepared by the OECD (1996a, pp. 35, 66–7) show that the manufacturing industries with the highest productivity growth also achieved the best employment growth performance for the G7 countries as a whole for the period 1970–1993. High-technology industries show above-average productivity gains (an annual growth rate of 4 per cent compared with 2.8 per cent for total manufacturing) and better than average employment growth (0.4 per cent compared with 0.5 annual decline for total manufacturing). In contrast, productivity growth in low-technology industries was below average (2.1 per cent compared with 2.8 per cent) as was employment performance (an annual decline of 0.9 per cent rather than 0.5 per cent).

However, there was a negative relationship between high productivity growth and employment in manufacturing industries in some countries over the period.

The relationship also varied over time. First, the overall positive relationship between high productivity growth and employment held in nearly all G7 countries in the 1970s. In the 1980s, the positive relationship held only in a minority of these countries and in the early 1990s the relationship was reversed in nearly all cases. Second, high-technology industries continued to have above-average productivity gains in the 1990s (though lower than in the 1970s and 1980s), but lost jobs at a faster rate than the manufacturing average as the markets for these products stagnated during the recession. In some countries, the employment losses in high technology industries were quite large; for example, the United States (3 per cent), United Kingdom (4 per cent) and Italy (over 4 per cent).

Surveys commissioned by the International Labour Office on the relationship between microelectronics adoption and employment in the 1980s indicate a pattern of both losses and gains in employment. At the process and plant level, research results generally seem to point to a significant displacement of labour. At the industry level, jobs have been generated by new product industries based on microelectronics and by advanced technologies in existing industries. Job displacement has occurred in industries whose products are being replaced by those based on microelectronics and industries which have not adopted new technologies. Overall, the studies indicate relatively small change in employment (Castells 1996, pp. 256–7).

A variety of studies at the process, plant, firm and industry levels in different countries point to both significant job displacement and job creation associated with technological change and productivity growth (OECD 1994a, pp. 138–40; 1996a, pp. 62–78; Castells 1996, pp. 256–63).

Many manufacturing establishments increase employment while improving productivity; others reduce employment and many plants with low or declining productivity also experience declining employment (see box 8.1).

> There seems to be little pattern to the employment effects of productivity growth and technological change across plants and firms.....the allocation of plants in terms of whether they upsize or downsize, increase or decrease productivity, is largely driven by idiosyncratic factors. (Baily, Bartelsman and Haltiwanger 1996, p. 266)

At the industry level, overseas studies indicate that high productivity growth has coincided with employment growth in different manufacturing industries over different periods and employment decline in others, although the latter has been the more common experience since 1980 (see box 8.1). Generally, however, the employment performance since 1970 (even if negative) has been better in high productivity industries than in those with low productivity growth. The early 1990s is the notable exception, perhaps as a result of recession. Low productivity and low technology manufacturing industries have experienced declining employment in nearly all G7 countries and in most periods since 1970.

Other studies are consistent with these findings. For example, a US study (Davis, Haltiwanger and Schuh 1996) found that job creation is higher in industries with high total factor productivity growth; and job destruction for an industry is not systematically related to productivity growth.

8.3 Aggregate and sectoral employment effects

Most studies conducted at the firm or industry levels focus on the immediate employment displacement or generating effects of technological change and productivity growth. Aggregate and sectoral studies take into account indirect employment effects which may reinforce or offset the direct effects.

Historical perspective

Some perspective on the broad pattern of productivity and employment growth can be gained from examining the long term record. It indicates that:

- productivity growth can and does co-exist with employment growth and there is little correlation between productivity growth and unemployment;

- technological change and productivity improvement have contributed to major changes in employment patterns and occupational structure.

Employment and unemployment

Over the long term, there has been considerable employment growth while productivity has been increasing. Since 1911, there has been a threefold increase in labour productivity in Australia (chapter 4). Over the same period, there has been an expansion of the labour force from nearly 2 million to approximately 9 million today — an increase of about four and a half times.

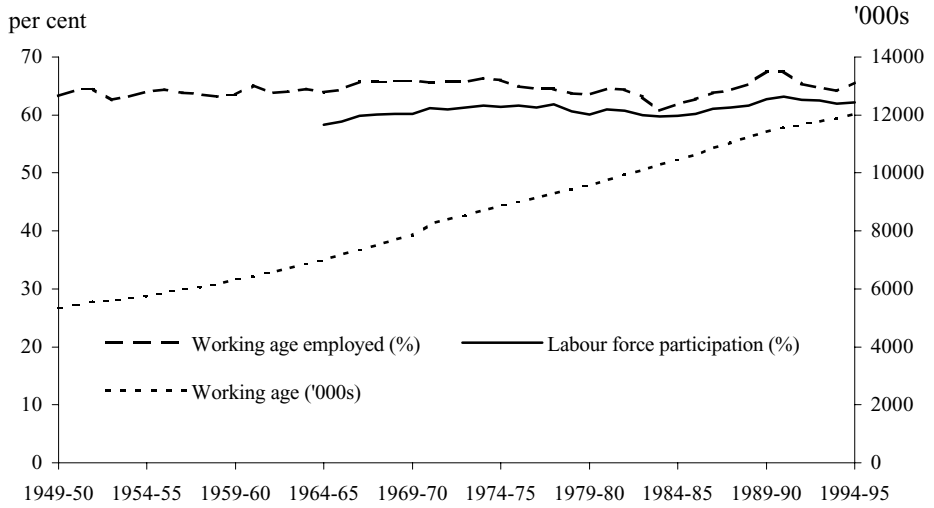
A similar trend has been observed throughout the industrialised world.

> Historically, the income-generating effects of new technologies have proved more powerful than the labour-displacing effects: technological progress has been accompanied not only by higher output and productivity, but also higher overall employment. (OECD 1994b, p. 33)

Employment opportunities appear to have been maintained in Australia despite significant productivity growth in the post-WWII period and increase in the working age population.[1] Since 1949–50, the working age population has approximately doubled and the proportion of it employed has remained fairly stable at around 63–65 per cent (see figure 8.1). Over this period, labour productivity has more than doubled (chapter 4). Labour force participation rates have increased slightly since 1964–65, the first year for which the series is available.

[1] There may be reasons to qualify this conclusion. First, the stability of the working age population in work could be maintained by a switch to part-time work which obscured a negative impact of increased productivity on full-time job opportunities. Second, the working age population is defined as those aged 15–64 and the proportion in employment over the long term may not fully reflect trends in employment opportunities. For example, the proportion of males over 65 in the work force has declined from 87 per cent in 1911 to less than 10 per cent today (Withers 1987, RBA 1996). Whether this represents a decline in employment opportunities attributable to productivity growth or a distributional benefit provided by growth is a matter for interpretation.

Figure 8.1 Working age population, proportion of working age employed and labour force participation rate, 1949–50 to 1994–95



Source: Commission estimates based on RBA (1996).

Over the long term, there has been little correlation between increased productivity and unemployment. For example, during the 1920s labour productivity declined (Withers 1987, chapter 4) while unemployment levels substantially increased above that of the previous decades, fluctuating between 7 and 13 per cent (Sinclair 1976). Australian experience of aggregate labour productivity and unemployment in the postwar period is mixed. High productivity growth was associated with low unemployment rates for much of the period to the mid 1970s. Since then, a slowdown in productivity growth has been associated with high unemployment rates (see chapter 4 and table 8.1). It suggests other factors exert strong influence over the extent of unemployment.

This Australian experience is mirrored in most OECD countries

> There is thus nothing in this post-war pattern of economic growth to suggest that the present unemployment problems have their roots in an acceleration of productivity growth; if anything the opposite seems to be the case. (OECD 1994a, p. 127)

Such observations confound popular perceptions of the impact of productivity growth on employment. They indicate there is no necessary negative relationship between productivity growth and aggregate employment. Employment opportunities have been maintained over the long term and unemployment appears to be related more to other factors.

However, while these observations provide some comfort in regard to the long-run effects, they do not address concerns about short-run employment effects and effects on particular groups.

Industrial and occupational employment

While overall employment opportunities have not been diminished, there has been a massive transfer of labour from one kind of activity to another as technology, differential rates of productivity growth, income growth and other factors have changed the industrial structure of the economy.

For example, there has been displacement of labour from agriculture and manufacturing and large-scale creation of new jobs in the services sector. Agricultural and mining employment has declined from 31 per cent of the Australian work force in 1910–11 to 6 per cent in 1995–96. Manufacturing employment has declined from 21 per cent to 11 per cent but during the period was as high as 29 per cent of total employment. The service sector proportion has increased from 48 per cent to over 80 per cent.

Similar experiences can be observed in all other industrialised countries and some newly industrialising countries (for example, see Maddison 1991, OECD 1994a).

While these structural changes reflect many influences, technological change has had a clear influence on occupational demand (Lewis and Seltzer 1995, p. 44). There has been a clear shift away from manual and trade occupations to professional and clerical employment, reflecting increased demand for skills in the workforce (Withers 1987, p. 260). Once again, this is a feature of structural change in all OECD countries.

Productivity growth over the long term thus creates the opportunity for new demands to be created and realised, leading to changes in the pattern of employment but not necessarily long-term reductions in employment.

> It is true that millions of jobs will be destroyed by technology, just as they have been over the past 200 years. But in the past those job losses have always been offset by job gains, so total employment has continued to grow along with the population. As blacksmiths and coachmen disappeared, car mechanics and salesmen took their place. Technology changed the jobs on offer, but the volume continued to grow. (Economist 1996, p. 19)

Some recent Australian evidence

Aggregate evidence

Over the past thirty years in Australia, there seems to be little direct relationship between productivity, employment growth and the level of unemployment. Employment growth has been sustained over the entire period in the presence of continued productivity growth, while the rate of unemployment has increased (see table 8.1).

The patterns of growth in the sub-periods are quite divergent. In the initial period to the mid 1970s, substantial productivity growth coincided with high employment growth and unemployment below 2 per cent. Since then, both productivity growth and employment growth have been lower, while unemployment has become very high. Between 1973–74 and 1984–85, productivity and employment growth slowed in tandem. After this, a negative relationship emerged with a period of very low productivity growth coinciding with high employment growth (1984–85 to 1988–89) and higher productivity growth coinciding with lower employment growth in the most recent period.

Overall, the experience since the mid 1960s seems to confirm the historical perspective that employment growth and unemployment are strongly influenced by factors other than just productivity growth.

Table 8.1 Australia's multifactor productivity growth, employment growth and rate of unemployment, various periods, 1964–65 to 1995–96

Period	*MFP growth*	*Employment growth*	*Unemployment rate*[a]
1964–65 to 1968–69	1.7	3.0	1.5
1968–69 to 1973–74	2.1	2.7	1.8
1973–74 to 1981–82	1.5	1.3	4.8
1981–82 to 1984–85	1.5	0.4	7.7
1984–85 to 1988–89	0.8	3.3	7.8
1988–89 to 1995–96	1.2	1.3	8.4
1964–65 to 1995–96	**1.5**	**2.0**	**5.4**

a Unemployment rate is a simple average of the rate in August of each year.

Source: Commission estimates based on ABS data and RBA (1996).

Another perspective on aggregate employment and productivity growth can be obtained from a statistical decomposition of changes in employment growth. This approach attributes changes in employment to growth in output, changes in unit labour requirements and other factors. It is a purely statistical or 'accounting' approach and does not demonstrate causal relationships.

Table 8.2 Decomposition of changes in employment, 1974–75 to 1994–95 ('000 persons)

Item	*Market sector*	*Other activities*	*Total*
Employment 1974–75	4 355	1 682	6 037
Changes due to:			
Output growth	*2 236*		
Input growth and usage			
Reduction in labour input per person employed	103		
Reallocation of labour input between industries	-102		
Growth in capital per unit of labour input	-537		
Relocation of capital between industries	-134		
Growth in multi-factor productivity	-1 130		
Other	94		
Total	-1 706		
Net change	**529**	**1 377**	**1 906**
Employment 1994–95	4 884	3 059	7 943

Note: The methodology used to decompose employment changes is outlined in IC (1993), appendix I.
Source: Commission estimates based on employment data from ABS Cat. no. 5204.0.

Importantly, it does not capture the amount of employment due to output growth that could be attributed to productivity growth.

Statistical decomposition of employment growth between 1974–75 and 1994–95 reveals that output increases in the market sector have been the dominant influence on employment growth (see table 8.2). They have outweighed the impact on employment of lower labour requirements associated with the relocation of labour and capital to more capital-intensive activities and the direct effect of increases in productivity. These output increases would have been due to a number of influences.

Sectoral evidence

At the sectoral level, the observed relationship between productivity and employment growth has varied in several ways (see figure 8.2).[2]

- ***It has differed among sectors, being positive for some and negative for others.***

[2] Part of the variability in some service sectors may reflect measurement problems (see chapter 5 and appendix C).

From 1974–75 to 1994–95, several sectors (Agriculture, Construction, Wholesale trade, Retail trade and Transport, storage and communication) experienced positive productivity and employment growth. In other sectors, the relationship was negative. Mining, Accommodation, cafes and restaurants and Cultural and recreational services experienced declining productivity and increasing employment while the Manufacturing and Electricity, gas and water sectors recorded productivity growth and declining employment.

Over some successive sub-periods, reduced productivity performance was associated with declining employment in some sectors (Manufacturing and Construction from the mid 1970s to the mid 1980s; Electricity, gas and water and Wholesale trade from the mid 1980s to the mid 1990s).

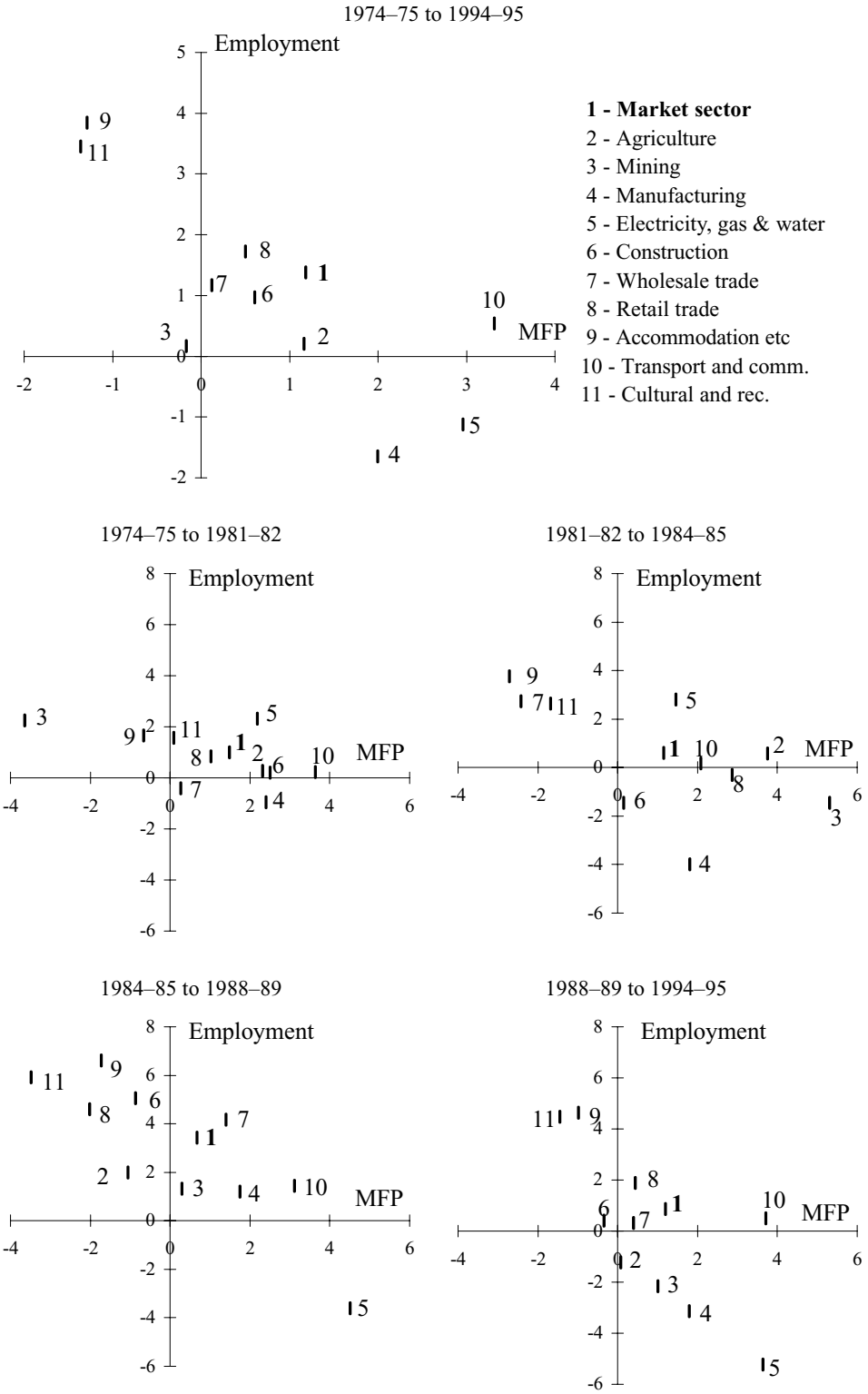
- ***It has often changed over time in particular sectors, being positive in some periods and negative in others.***

The relationship has varied over sub-periods for nearly all individual sectors. Several sectors (Agriculture, Electricity, gas and water, Construction, Wholesale trade and Cultural and recreational services) experienced a turnaround in the relationship between productivity and employment growth over the period. In the Mining, Manufacturing and Retail trade sectors the relationship went through several reversals over different sub-periods. Only Transport, storage and communication (positive) and Accommodation, cafes and restaurants (negative) maintained a stable relationship between productivity and employment growth over all the sub-periods.

- ***The direction of change in the relationship has varied between sectors in particular periods, with some sectors changing from a positive to negative relationship and others changing in the opposite direction.***

During the 1980s, the relationship in the Mining, Manufacturing and Wholesale trade sectors changed from negative to positive while the reverse occurred for Agriculture and Electricity, gas and water. Contrasting directions of change in the relationship were also experienced in some sectors from the mid 1980s to the mid 1990s (Mining and Manufacturing changed from positive to negative while the reverse occurred for Retail Trade).

Figure 8.2 MFP and employment growth[a] by sector (per cent a year)



a Growth rates are measured using average annual compound formula.

Source: Commission estimates based on ABS data and Gretton and Fisher (1997).

- ***The extent of employment impacts associated with changes in productivity performance was quite disparate among sectors at different stages. In some sectors it was large and in others it was small.***

In several sectors at different times (for example, Mining and Wholesale trade from the mid 1970s to the late 1980s, Electricity, gas and water and Retail trade during the 1980s), large changes in productivity growth have been associated with large changes in employment growth, most often in the opposite direction. In contrast, significant changes in productivity performance from the mid 1970s to mid 1980s in Agriculture (increase) and in Transport, storage and communication (decrease) had little impact on employment.

In other sectors (Manufacturing for the whole period, Construction from the mid 1980s to the mid 1990s), large reversals in employment growth have occurred despite minimal changes in productivity growth.

Thus, the sectoral experience confirms the lack of a firm relationship between productivity and employment growth.[3] Employment growth varies across sectors and over time in response to changes in demand, trade patterns and other factors, as well as productivity.

Recent international experience

Despite popular perceptions to the contrary (see for example, Rifkin 1995), the recent international experience also fails to suggest that productivity growth necessarily results in lower employment growth and higher unemployment.

Since 1960, employment opportunities in OECD countries have been maintained despite significant productivity growth over this period and high rates of output growth in the early part of this period. The proportion of the working age population employed has remained fairly stable at around 64–66 per cent (OECD 1996c). The same rate of employment growth has been maintained in periods of high and low productivity growth (see table 8.3). In recent years, there has been a decline in employment growth but this has coincided with a further decline in productivity growth.

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[3] The cross-sectoral experience exhibited in figure 8.2 seems to suggest a negative relationship between productivity and employment growth. However, caution must be observed in drawing strong conclusions. Sectoral data does not reflect the net outcome for the whole economy of the direct and compensatory effects of productivity change. For the total market sector, figure 8.2 indicates a positive relationship between productivity and employment growth for the whole period and for each sub-period. In addition, neither the aggregate nor the sectoral data can distinguish between the impact of productivity growth and other factors on employment.

For OECD countries as a whole since the early 1970s, declining rates of productivity growth have coincided with increasing rates of unemployment (see table 8.3). The period of highest productivity for most OECD countries coincided with the period of lowest unemployment. As one survey of the relationship between productivity and unemployment has concluded:

> Changes in labour productivity growth over the past three decades cannot account for the secular rise in unemployment that has occurred in many OECD countries. Rates of labour productivity growth have declined, with only limited signs of a rebound, while unemployment has increased. (Johnson 1995, p. 57)

Table 8.3 Labour productivity growth, employment growth and unemployment rate for OECD countries, various periods, 1960 to 1994

Period	*Labour productivity growth*	*Employment growth* [a]	*Average unemployment*
1960–73	3.8	1.1	3.2
1973–79	1.6	1.1	5.0
1979–89	1.5	1.1	7.2
1989–94	1.0	0.6	7.0
1960–94	**2.3**	**1.1**	**5.2**

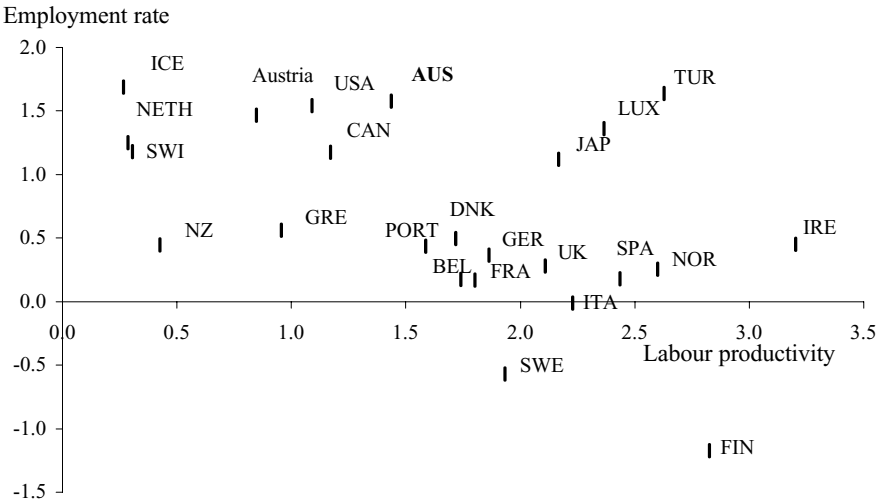
a Employment growth 1960 to 1994 excludes Australia, Austria, Iceland and Sweden because data for 1960 for these countries are unavailable.

Source: OECD (1996c).

Since 1981, most OECD countries experienced increasing productivity and employment (see figure 8.3). Some countries (Japan, Luxembourg and Turkey) combined substantial rates of productivity and employment growth. Only Sweden and Finland combined productivity growth and declining employment. [4]

[4] A simple regression was estimated for productivity growth and employment growth across all OECD countries. The relationship was found to be negative and statistically significant but very weak ($R^2 = 0.22$, $t = -2.52$). That is, variation in productivity growth explains little of the variation in employment growth. The relationship between productivity growth and unemployment is positive and significant but, again, very weak ($R^2 = 0.13$, $t = 1.83$). No weights were assigned to the employment observations to take account of the large differences between countries in total employment.

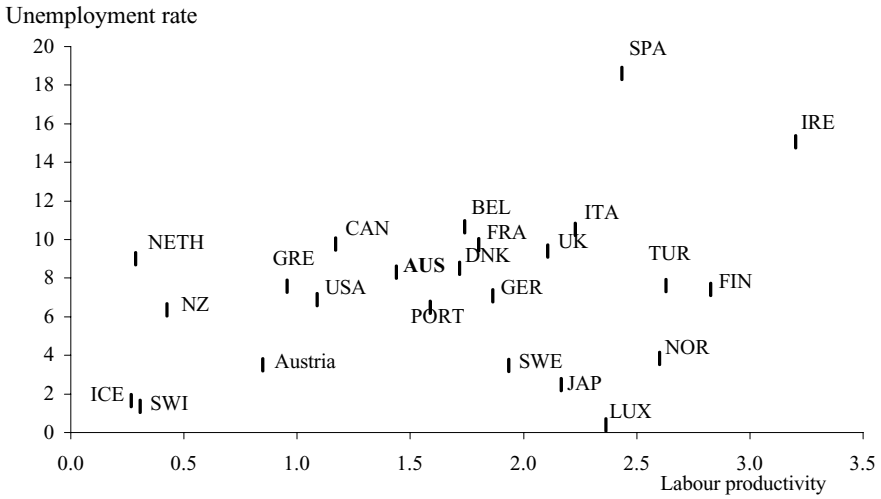
Figure 8.3 Labour productivity growth and employment growth in OECD countries, 1981 to 1994[a] (per cent a year)



a Labour productivity growth for Germany includes a Commission estimate for 1991 based on the 1981 to 1994 trend.

Source: Commission estimates based on OECD (1996c).

Figure 8.4 Labour productivity growth and average rate of unemployment growth in OECD countries, 1981 to 1994[a] (per cent a year)



a Labour productivity growth for Germany includes a Commission estimate for 1991 based on the 1981 to 1994 trend.

Source: Commission estimates based on OECD (1996c).

Differences in productivity growth between countries do not appear to be strongly related to differences in employment growth and unemployment.

Countries with similar rates of productivity growth had substantially differing rates of employment growth and levels of unemployment (figures 8.3 and 8.4):

- countries with high productivity growth had high and low employment growth — for example, Turkey with 1.6 per cent employment growth a year compared with Norway at 0.3 per cent;
- countries with low productivity growth also had high and low employment growth (for example, Iceland with 1.7 per cent employment growth a year and New Zealand with 0.4 per cent) as did countries with moderate productivity performance;
- countries with high rates of productivity growth had both very high and very low unemployment — for example, Spain with 18.8 per cent unemployment, Ireland 15.1 per cent and Italy 10.2 per cent compared with Luxembourg at 0.4 per cent and Japan at 2.5 per cent; and,
- countries with poor productivity performance had differing unemployment experience — for example, Netherlands with 8.6 per cent unemployment and Switzerland with 1.4 per cent.

Studies of employment growth decomposition suggest that negative employment effects of productivity growth tend to be outweighed by the positive effect on employment of higher domestic demand and exports (OECD 1994a, pp. 152–7; Sukurai 1995). However, such studies do not take account of the compensatory effects of lower prices and higher incomes made possible by productivity improvement.

Modelling the impact of productivity improvement offers a way to fully take into account these potential indirect effects. The results are susceptible to the assumptions and methodologies employed. Nevertheless, the main result of studies surveyed by the OECD (1994a) and Castells (1996) is that employment-displacing effects of technological change are largely compensated by job-creating effects, although there are studies which indicate net employment decrease. Modelling of a 'standard' OECD economy, defined as the simple average of the G7 countries, suggests that a rise in labour productivity will eventually lead to higher levels of production and real income. Incorporation of different assumptions produces small overall positive or negative percentage changes in employment (OECD 1996a, p. 51; see also Giorno et al. 1995).

As discussed in chapter 2, technological change is an important source of productivity improvement. Surveys of international studies (OECD 1994a, 1996a; Castells 1996) of the impact of technological change on employment do not indicate a systematic negative effect. The OECD (1994a, p. 137) concluded that there was no evidence of major job losses overall and that that compared

with the effects of factors such as fluctuations in macroeconomic demand and growth, the actual effects of new technologies on the levels of overall employment are likely to be relatively minor.

> At the same time, many studies emphasize the significant job displacement effects which new technologies are likely to create, as technological change creates jobs in some places and occupations and eliminates them in others. The displacement will produce major changes in the distribution of the workforce in terms of sectors of employment, occupations and skills but will not result in significant levels of unemployment.

A similar conclusion is arrived at by Castells (1996, p. 265):

> The lessons of history, current empirical evidence, employment projections, and economic theory do not support these fears in the long term, notwithstanding painful adjustments in the process of transition to the informational paradigm.

8.4 Issues for further research

The impact of productivity growth on total employment and unemployment is not the only employment issue of public concern. Others relate to changing occupational structure of the demand for labour, the employment implications of technological change in the services sector, and adjustment to change. These issues are not examined here, but are seen as useful avenues for further research.

Demand for skills

Technological change and productivity growth, over a long period of time, have transformed the nature and organisation of work, dramatically altering occupational structures and demand for skills.

It is generally believed that this transformation has led to a reduction in demand for low-skilled occupations and workers and increased demand for high-skilled workers. Most OECD countries seem to have experienced decreased demand for low-skilled workers with the result that earnings differentials have expanded and/or there has been increased unemployment of low-skilled workers. Perceptions about these trends are as much a part of the concerns about the impact of productivity growth as the effect on total employment and unemployment discussed above.

It is difficult to generalise about the relationship between changing technology and skills and earnings. There has been considerable debate internationally over how much of the decreased demand for low-skilled work is due to technological change and much of that debate remains unresolved (OECD 1996a, p. 98). There is little consensus on whether new technologies lead to an overall ‘upskilling’

effect. Studies have demonstrated a 'deskilling' effect of new technologies or a 'deskilling' effect in certain industries and an 'upskilling' effect in other industries. There are competing explanations for the decrease in demand for low-skilled work such as the role of trade and increased product competition.

Service sector employment growth

A further development generating major public concern is the spread of technological change to the services sector. This sector has been the major contributor to employment expansion in industrialised economies as productivity growth extended through the agricultural and manufacturing sectors. Because of this past role, the extensive diffusion of information technology and increased productivity has created uncertainty about future employment prospects in the sector and therefore for the whole economy.

The impact of technology on jobs in the services sector is poorly understood (OECD 1994a, p. 156) and there is a pressing need for further research on this question. Few studies are available. One reason is the intractable measurement and data problems associated with productivity estimates for the service sector (Griliches 1994, pp. 10, 14).

While the prospects for future employment growth in the services sector depend on several imponderables such as changes in income, the rate of innovation and diffusion of information technologies and the state of aggregate demand, the historical perspective provides some basis for cautious optimism. The history of the services sector this century is one of increasing diversity with markets developing for many new products and new services. Changes in the nature of production, patterns of work and leisure and increases in living standards create new demands. Computer software, video production, computer-aided designing, biotechnology-based agricultural services, tourism and travel services, child care services, various community services and personal services such as cleaning and lawn mowing are all new features of the modern services sector. Some of these services are very labour-intensive. Moreover, the demand for quality in services such as education, health and child-care generally implies increased labour intensity.

Short-term adjustment

Of particular interest for further investigation is the nature of the adjustment process and its policy implications.

Productivity growth and structural change creates potential for mismatches in the supply and demand for labour; at least in the short term. The rate at which jobs

are shed in one industry or sector may be faster than the rate of job creation in other industries and sectors. These mismatches may be exacerbated in times of reduced economic activity. The skills and experience of people in jobs lost may not be immediately suitable to jobs created. Retraining may be necessary. Significant unemployment may occur and persist for some time, even when job vacancies exist in the new industries.

Potential mismatches in the supply and demand for labour can also occur on a regional basis. The regions most vulnerable to productivity improvement and structural change are those based on one or two companies or having a single core activity.

The adjustment to changes induced by actions to improve productivity needs to be as smooth and as rapid as possible if the promise of higher national living standards is to be realised and the pressures on individuals and their families are to be minimised. Rapid adjustment will limit the extent of any unemployment resulting from productivity improvement.

A survey (Johnson 1995) of research on the adjustment process in OECD countries has highlighted several factors as being significant for adjustment to productivity growth. They are:

- job creation in new establishments — in OECD countries, the creation of new establishments has historically contributed disproportionately to the rate of job creation and governments will need to ensure that tax and regulatory burdens do not unduly impede the birth of new firms;
- upgrading the skills of unskilled workers — the recent evidence suggests that unskilled workers may face increasing difficulty in obtaining re-employment if they are displaced and programs to upgrade the skills of such workers may be helpful in promoting labour reallocation;
- flexibility in real wages — wage rigidity could result in surplus labour becoming unemployed and only gradually re-employed over the period it takes for wages to adjust to the new supply and demand conditions; and
- the influence of internal and external competition on price flexibility — if firms pass on lower costs only partially or slowly, adjustment will be limited or extended over time.

8.5 Summing up

The available evidence does not indicate any necessary relationship between productivity growth on the one hand and lower employment growth or higher unemployment at the firm, industry or economy levels.

Firm level

Overseas studies demonstrate that many firms increase employment while improving productivity; others reduce employment and many with low or declining productivity experience declining employment.

Industry level

Across the G7 countries, productivity growth has coincided with employment growth in different manufacturing industries over different periods and employment decline in other industries (the latter becoming more common in recent times).

Job loss in manufacturing industries in the G7 countries is not systematically related to productivity growth, as low productivity industries have experienced declining employment over an extended period.

Sectoral level

In Australia, the relationship between productivity and employment growth has varied between sectors since the mid 1970s, coinciding in several sectors while, in several others, the relationship has been negative.

The relationship between productivity and employment growth has varied within sectors over time and the direction of change in the relationship has varied between sectors over the same periods.

Significant productivity change was associated with large changes in employment growth in some sectors while, in others, it had little impact on employment.

Large reversals in employment growth have occurred in some sectors despite only minimal changes in productivity growth.

Economy-wide level

Increasing productivity has been consistent with sustained employment growth over long periods in Australia and other OECD countries.

Over the long term, there has been little correlation between increased productivity and unemployment levels in Australia and most OECD countries — indeed, since the early 1970s, declining rates of productivity growth have coincided with increasing rates of unemployment.

Differences in employment growth between countries are not strongly related to differences in productivity growth — since the early 1980s countries with similar rates of productivity growth had differing rates of employment growth, some high and some low.

Countries with similar rates of productivity growth also had substantially differing rates of unemployment — countries with high rates of productivity growth had both very high and very low unemployment and as did countries with poor productivity performance.

The absence of any firm relationship between productivity and employment growth points to the influence of other factors on economic growth on the one hand and aggregate employment growth and unemployment on the other. These factors include general demand conditions, incomes, consumer preferences, labour market arrangements, trade patterns and the influence of government policies.

Apart from its impact on employment growth and unemployment, productivity growth continues to exert a significant influence on the industrial and occupational composition of the workforce. This impact raises several issues of public concern which require further investigation. These are:

- implications for low-skilled, low-wage jobs and relative earnings;
- the employment implications of technological change in the services sector; and
- the factors affecting the process of adjustment to change.

9 DIRECTIONS FOR FURTHER WORK

Productivity is a complex and wide-ranging topic. This paper has not attempted to address all relevant issues.

To complete the paper, some of the main informational deficiencies and remaining analytical issues that have been encountered in this study are set down in this chapter.

9.1 Information base

This study has demonstrated one thing that was not within the design. It has shown that, for something as fundamental to our living standards as productivity, the information base on productivity performance is still patchy.

There are some measurement issues that inhibit a proper understanding and analysis of productivity growth, what affects it, and how it affects living standards. Some of the main issues that have been observed in this study are:

- the incomplete coverage of the economy, with productivity estimates being restricted to the market sector (65 per cent of the economy);
- the lack of official estimates of multifactor productivity growth at the sectoral level;
- measurement problems, particularly prevalent in the service sectors which appear to be unaccounted for output/quality improvements;
- the unknown influence of obsolescence and embodied technical change on capital input and capital productivity estimates; and
- the unknown influence of average skill improvements on labour input and labour productivity estimates.

The ABS has embarked on a major project which will bring very significant improvements in the quality of productivity estimates (Aspden et al. 1997). However, these improvements will take some years to implement. And, unless the enhancements are 'back-cast' to earlier years, they may be able to shed only limited clearer light on the impact of recent policy reforms to improve productivity.

9.2 Further research

The main issues for further research that have been observed in the course of this study are:

- further investigation of the factors that affect productivity performance in individual sectors of the economy;
- further investigation and explanation of productivity gaps between Australia and other countries;
  - the Commission's international benchmarking work is an important on-going contribution;
  - there are other sources of data for economies and for individual activities that need to be investigated;
- investigation of the outlook for productivity growth in comparable countries;
- further investigation of the distribution of the benefits from productivity growth;
- further investigation of the link between productivity and jobs including;
  - effects on the demands for skills;
  - the durability of service sector growth;
  - the nature of short-term adjustment pressures;
- the relative importance of factors that affect productivity growth in Australia; and
- the relative importance and success of policy influences that are designed to improve productivity growth.

A INDICATORS OF LIVING STANDARDS IN AUSTRALIA OVER THE TWENTIETH CENTURY

This appendix provides details on the living standards indicators presented in box 2.2 in chapter 2. There is no single, fully-defensible measure of living standards. Rather a picture must be formed from a range of indicators.

Economic indicators

GDP per person captures the average income in the community. Private consumption expenditure per person shows how much command over goods and services the average citizen can afford.

According to these economic indicators the broad experience this century for Australia has been: marked fluctuations around a very slowly rising trend to the late 1930s; a sustained boom over the next three decades; and a marked slowdown in the 1970s (McLean 1987).

Gross community income per person extends the GDP per person measure by including economic activity in the household sector. The household economy involves the production of goods and services (such as house cleaning and house repairs), which could be marketed but are not.

Data on these three variables are shown in table A1.

Increases in leisure

Increases in leisure are revealed by changes in weekly working hours (see table A2). The rate of reduction in standard full-time working hours in the first half of this century was greater than that experienced since.

Earlier retirement is another way of enjoying more leisure over a lifetime. The proportion of males over 65 in the workforce has declined from 87 per cent in 1911 to less than 10 per cent today (see chapter 8).

Table A1 Real private consumption, real GDP and real gross community income, per person, 1901 to 1996[a]

	Real private consumption per person		*Real GDP per person*		*Real gross community income per person*	
Year	*$*[b]	*index*	*$*[b]	*index*	*$*[b]	*index*
1901	3 958	100	5 555	100	6 733	100
1933	4 308	109	6 198	112	8 512	126
1961	6 840	173	11 245	202	15 335	228
1976	10 213	258	17 090	308	26 093	388
1981	11 087	280	18 684	336	27 976	416
1986	11 923	301	20 155	363	28 831	428
1991	12 721	321	21 245	382	30 555[c]	454
1996	14 278	361	23 742	427	na	na

na Not available.

a Year ending 30 June.

b At 1989–90 prices.

c For 1990.

Source: Gross community income per person from Snooks (1994), adjusted to 1989–90 prices; private consumption, GDP and population data up to 1933 from Maddock and McLean (1987), adjusted to 1989–90 prices; private consumption and GDP per person data from 1961 estimated from RBA (1996) and ABS Cat. nos 5204.0 and 3101.0.

Table A2 Adjusted working hours per week[a], 1901 to 1996

	Adjusted working hours per week[b]		
Year	*Males*[c]	*Females*[c]	*Persons*[d]
1901	47.0	47.2	
1915	47.0	47.2	
1933	43.7	43.2	
1947	40.8	41.2	
1961	37.4	37.1	
1976	36.3	36.1	
1980	36.2	36.1	35.77
1986			35.09
1991			34.40
1996			34.37

a For 1976 and 1980 estimates for males exclude rural industry and shipping and stevedoring and estimates for females exclude rural industry, mining and quarrying and building and construction. Estimates for persons exclude employees in the defence forces, agriculture, services to agriculture and employees in private households employing staff.

b Standard minimum working hours for full-time adult employees adjusted for public holidays and annual leave.

c For December.

d For June.

Source: Male and female estimates up to 1961 from Butlin (1977) and from ABS Cat. no. 6101.0 for 1976 to 1980; persons from ABS Cat. no. 6312.0 (unpublished data for 1991 and 1996). All series adjusted using method outlined in Carter and Maddock (1984).

Housing

The quality of housing is reflected in average rooms per dwelling. Slightly larger houses combined with a fall in the number of occupants led to an increase in the number of rooms per occupant. The rate of improvement in this measure was greater after 1947 than between 1911 and 1947.

Table A3 Measures of housing size and crowding, 1911 to 1991

Year	*Rooms per dwelling*	*Occupants per dwelling*	*Rooms per occupant*
1911	4.93	4.53	1.09
1921	4.94	4.40	1.12
1933	4.99	4.08	1.22
1947	4.98	3.75	1.33
1961	5.12	3.55	1.44
1971	5.00	3.31	1.51
1981	5.43	2.98	1.82
1986	na	2.88	na
1991	na	2.70	na

na Not available.

Source: McLean (1987) for data up to 1981; ABS Cat. no. 2502.0 for 1986 and Cat. no. 2821.0 for 1991.

Life expectancy

Life expectancy provides a general indication of improvements in the standard of health. Factors that affect life expectancy, and health in general, include nutrition and advances in medical treatment, such as the control, cure and prevention of diseases like tuberculosis. During this century life expectancy has increased by 20.2 years for males and 22.3 years for females.

Table A4 Life expectancy, 1901 to 1995 (years at birth)

Period	*Males*	*Females*
1901 to 1911	55.2	58.8
1946 to 1948	66.1	70.6
1981	71.4	78.4
1986	72.9	79.2
1991	74.4	80.4
1995	75.4	81.1

Source: McLean (1987) for data up to 1981 and ABS Cat. no. 1301.0 from 1986.

Education

Retention in education beyond minimum leaving age provides an indication of the level of educational attainment and career opportunity. Participation in education, both at school and university, has increased considerably since the beginning of this century. There has also been a significant increase in the number of females participating in education. Females accounted for 22 per cent of university students in 1911 compared with 54 per cent in 1996 (Commonwealth Bureau of Census and Statistics 1914, p. 627–9; DEETYA 1996, p. 10).

Table A5 Participation in education, 1901 to 1996

Year	*Percentage of population 15–19 attending a school*	*University students[b] as a ratio to 20–24 age group*	
1901	7.6[a]	0.5	
1947	11.3	4.9	
1981	34.7	12.8	(25.9)
1986	42.2	13.5	(29.2)
1991	47.5	na	(38.3)
1996	49.4	na	(45.4)

na Not available.

a For 1911.

b Bracketed numbers are for higher education, reflecting the removal of the distinction between universities and colleges of advanced education.

Source: Data up to 1981 from McLean (1987); school attendance from ABS Cat. no. 6227.0 after 1981; university participation for 1986 estimated from ABS Cat. nos 4101.0 and 3101.0; higher education series from DEETYA (1996).

Inequality of income

Community standard of living is affected by the distribution of income, and not just changes in average income. Inequality in the distribution of income has declined over the twentieth century, but not steadily, with most of the reduction coming between the 1930s and 1970s. There has been some increase in inequality in the 1980s and 1990s but this has been offset by effective redistribution through the welfare system (Johnson, Manning and Hellwig 1995, p. vi; Harding 1997, p. 20).

Table A6 Income[a] distribution, 1915 to 1995[b]

	Gini coefficient[c]				
Year	*Males*[d]	*Females*[d]	*Persons*[d]	*Income units*[e]	*Household*[f]
1915	0.4550	0.6482	0.5473		
1933	0.5551	0.4396	0.5514		
1981	0.3705	0.5351	0.4735	0.40[g]	0.354[h]
1986	0.38	0.48	0.45	0.41	
1990				0.43	
1994					0.368
1995				0.45[d]	

a Gross income, which is private income plus direct government cash benefits.

b Year ending 30 June.

c Measure of inequality of income distribution, which can have a value between 0 (indicating that income is distributed equally) and 1 (indicating that one income unit has all of the income). Presented for gross income in this table.

d Includes zero income.

e Excludes zero income.

f Includes zero income and negative incomes set to zero.

g For 1982.

h For year ending December 1982.

Source: Data for individuals from McLean and Richardson (1986) up to 1981 and ABS Cat. no. 2502.0 for 1986; income units from ABS Cat. no. 4101.0 up to 1990 and ABS Cat. no. 6523.0 for 1995; households from Harding (1997).

Environment

Environmental quality is an important aspect of living standards but statistics spanning this century are not available. A few measures, over a shorter period, are presented below.

Table A7 Environmental indicators, 1920 to 1990

Year	*CO_2 emissions from energy use (million tonnes of carbon)*	*Major protected areas ('000 sq. km.)*	*Use of nitrogen fertilisers applied to arable land (tonnes/sq. km.)*
1920		4.6	
1950		18.9	
1970		108.6	0.4
1971	48		
1975	56		0.4
1980	63	250.7	0.6
1985	66	354.1	0.7
1988	71		0.8
1990		456.5	

Source: OECD (1987) up to 1950; ABS Cat. no. 4140.0 from 1970 to 1988; OECD (1994c) for 1990.

This is obviously not a complete set of environmental indicators. International comparisons can be made for some other environmental indicators.

Table A8 International comparisons of environmental indicators, late 1980s and early 1990s

	Australia	*Canada*	*United States*	*Netherlands*	*Sweden*	*United Kingdom*
Threatened species (% as a proportion of known species) (early 1990s)						
Mammals	12.3	6.2	10.5	28.8	19	45.2
Birds	3.4	3.3	7.2	22.4	7.9	28.3
Vascular plants	4.7	1.4	0.5	7.6	8.2	9.5
Waste generation (late 1980s)						
Municipal waste (kg/capita)	681	632	864	467	317	353
Industrial waste (tonnes/$US million GDP)	146	155	186	50	37	97

Source: ABS Cat. no. 1301.0 for threatened species; ABS Cat. no. 4140.0 for waste generation.

Summing up

Living standards have improved significantly since 1900. The rate of improvement in working hours and life expectancy was greater in the first half of this century than that experienced since. However, the economic, housing and education indicators have improved at a higher rate since the late 1940s. Inequality of income declined between 1915 and 1981, but not steadily. There is variable performance across the environmental indicators for the past 20 years.

B LIVING STANDARDS, PRODUCTIVITY AND THE LABOUR FORCE

This appendix contains a formal derivation of the links between living standards and productivity. The material was provided by Professor Steve Dowrick, Department of Economics, Australian National University.

It is possible to derive a formal model of the links between living standards and productivity, bringing together many of the factors which are discussed in this paper such as capital intensity, demographic changes and the terms of trade. This appendix presents such a model, making some simplifying assumptions about the nature of production technology and consumer welfare, which lead to an intuitively sensible relationship.

On the productivity side, a simple relationship can be derived from an aggregate production function of the form:

$$Y = A\, f(K, H) \qquad (1)$$

where Y is real output (GDP), K and H are capital and standardised labour hours which are combined by some function f() into an index of measured inputs, and A is (by definition) a measure of multi-factor productivity which may be interpreted as a measure of 'technology'. More generally, A can be considered as a function of fundamentals such as knowledge, human capital, institutional structure, etc — that is, all of those factors which are not measured in the input index function.

Differentiation of the production function gives the change over time (represented by a dot over the variable):

$$\dot{Y} = Af_K\dot{K} + Af_H\dot{H} + f(.)\dot{A} \qquad (2)$$

and division by Y gives the relationship in terms of proportional rates of growth, represented by '^' over the variables, noting that $\dot{X}/X \equiv \hat{X}$:

$$\hat{Y} = (AKf_K/Y).\hat{K} + (AHf_H/Y).\hat{H} + (Af(.)/Y).\hat{A} \qquad (3)$$

Note, Af_H is the marginal product of labour. If labour is paid its marginal product, (AHf_H/Y) is labour's share in national income. With constant returns to scale and competitive markets the first two bracketed terms are the shares in national income of capital (α) and labour ($1-\alpha$) respectively, where α is

approximately 0.3. From (1), the third bracketed term is unity. So the expression can be re-written in the familiar growth-accounting form as:

$$\hat{Y} = \alpha\hat{K} + (1-\alpha)\hat{H} + \hat{A} \quad (4)$$

We can simplify the expression even further in terms of labour productivity, defined as output per unit of labour ($y \equiv Y/H$) and the capital-labour ratio ($k \equiv K/H$):

$$\hat{y} = \alpha.\hat{k} + \hat{A} \quad (5)$$

which tells us that the growth of labour productivity is equal to MFP growth plus the growth of capital intensity multiplied by capital's share of income.

The relationship can also be expressed as MFP growth equaling the weighted shares of labour and capital productivity growth. But the formulation in (5) is much more useful as we are really interested in the determinants of labour productivity.

The link with national welfare comes from consideration of real output per head of population, Y/P, as an approximation to average income. This national accounting measure suffers from well-known defects inasmuch as it ignores the costs such as environmental damage and it ignores benefits such as those derived from domestic production and from leisure. Nevertheless, it is very useful as a starting point for evaluation of welfare. We can write the relationship between labour productivity and output per person as follows, denoting the working age population as P^w, the labour force as W, the number of people employed as L, and the unemployment rate as $u \equiv (W-L)/W$:

$$\begin{aligned}(Y/P) &\equiv (Y/H) \,.\, (H/P) \\ &\equiv (Y/H) \,.\, (P^w/P) \,.\, (W/P^w) \,.\, (H/L) \,.\, (L/W) \\ &\equiv (Y/H) \,.\, (P^w/P) \,.\, (W/P^w) \,.\, (H/L) \,.\, (1-u) \quad (6)\end{aligned}$$

where (P^w/P) is the working-age share of the population;

(W/P^w) is the participation rate amongst the working-age population;

(H/L) is the average number of hours worked per employee;

(L/W) is the employment rate amongst the workforce, which equals 1-u.

This identity can be converted into a growth rate identity by taking logarithms and differentiating with respect to time. Note that the differential of ln(1-u) is $-\dot{u}/(1-u) \approx -\dot{u}$. So to a very close approximation:

$$(\hat{Y/P}) = (\hat{Y/H}) + (\hat{P^w/P}) + (\hat{W/P^w}) + (\hat{H/L}) - \dot{u} \quad (7)$$

that is, the growth rate of output per person equals the *sum* of the growth rates of labour productivity, the working-age share of population, labour force participation and average hours of work *less* the change (that is, the percentage point change, not the proportional rate of growth) in the unemployment rate.

To move from output per person (Y/P) to a measure of welfare, real income per head of population (I/P), we need some further definition. For simplicity, define real income per person, i, in terms of the utility function of a representative consumer, defined on consumption of domestically produced goods (d) and consumption of imported goods and services (m). Imports are exchanged for exports[1], normalising the import price to unity and defining the price of exports as T.

In this case T represents the terms of trade. An increase in T means that we can buy more imported goods in exchange for a given quantity of exports. We should expect an improvement in the terms of trade to improve welfare – but only inasmuch as imported goods are important to consumers. A simple formulation of the representative consumer's welfare is the Cobb-Douglas utility function

$$i(d, m) = d^{1-\mu} m^{\mu} \tag{8}$$

The budget constraint facing the consumer is that they can afford to import only the amount of goods which can be exchanged at the prevailing terms of trade for the domestically produced goods which are not directly consumed:

$$m = T (y - d) \tag{9}$$

The consumer's choice between consumption of domestic goods and imports can than be represented as the problem of maximising utility with respect to d, for given m, T and y. The simplest way to solve this is to substitute the constraint (9) into (8), giving the problem:

$$\text{max. w.r.t. d} \qquad i[d, m(d)] = d^{1-\mu} (y-d)^{\mu} T^{\mu} \tag{10}$$

Maximisation requires setting the first differential of (10) to zero, which implies the following optimal values for d and m:

$$d^* = (1-\mu)y \quad \text{and } m^* = T\mu y$$

Substitution of these optimal values into the utility function of the representative consumer gives us a measure of real average income, $i^* = i(d^*, m^*)$:

$$i^* = \beta T^{\mu} y \tag{11}$$

[1] Here we ignore foreign borrowing and lending.

where β is a constant equal to $(1-\mu)^{1-\mu}\mu^{\mu}$. Differentiation of (11) leads to the result that the growth rate of real income is equal to the growth of real output and the growth in the terms of trade weighted by the import share.

$$\hat{i} = (\hat{Y}/P) + \mu \hat{T} \qquad (12)$$

Combining (12), (7) and (5) gives

$$\hat{i} = \hat{A} + \alpha\hat{K} + (\hat{P^w}/P) + (\hat{W}/P^w) + (\hat{H}/L) + \mu \hat{T} - \dot{u} \qquad (13)$$

Noting that the Australian import share, μ, is approximately one sixth of national income gives the result that:

The growth in real income (purchasing power) per head of population is very nearly equal to the sum of the following factors:

1. The growth in productivity (multi-factor);
2. *plus* one third of the growth in capital intensity (the stock of capital per worker hour);
3. *plus* the rate of demographic change (growth of the working age share of the population);
4. *plus* the rate of growth of labour force participation;
5. *plus* the rate of growth of average hours of work;
6. *plus* one sixth of the rate of growth of the terms of trade;
7. *less* the change in the unemployment rate.

C DETAILS ON AUSTRALIA'S SECTORAL PRODUCTIVITY RECORD

This appendix provides further information on sectoral productivity. It covers:

- contributions to output growth;
- productivity levels;
- labour productivity and employment, and
- examination of sectors that made a negative or variable contribution to aggregate productivity growth.

Contributions to output growth

Figure C1 presents contributions to output growth due to labour and capital inputs and multifactor productivity for each sector between 1974–75 and 1994–95. Chapter 5 provides an explanation of each sector's contributions to national productivity.

Productivity levels

An alternative view of the sectoral perspective is to examine productivity *levels*. It is possible to calculate levels of labour productivity and capital productivity for industry sectors in the years 1974–75 and 1994–95.[1] Output in each sector is divided respectively by the number of hours worked and the value of the capital inputs in place.[2]

The estimates are displayed in table C1. Both the labour and capital productivity levels are measured relative to the market sector average. A value above one, therefore, indicates that the industry's productivity is above the market sector average.

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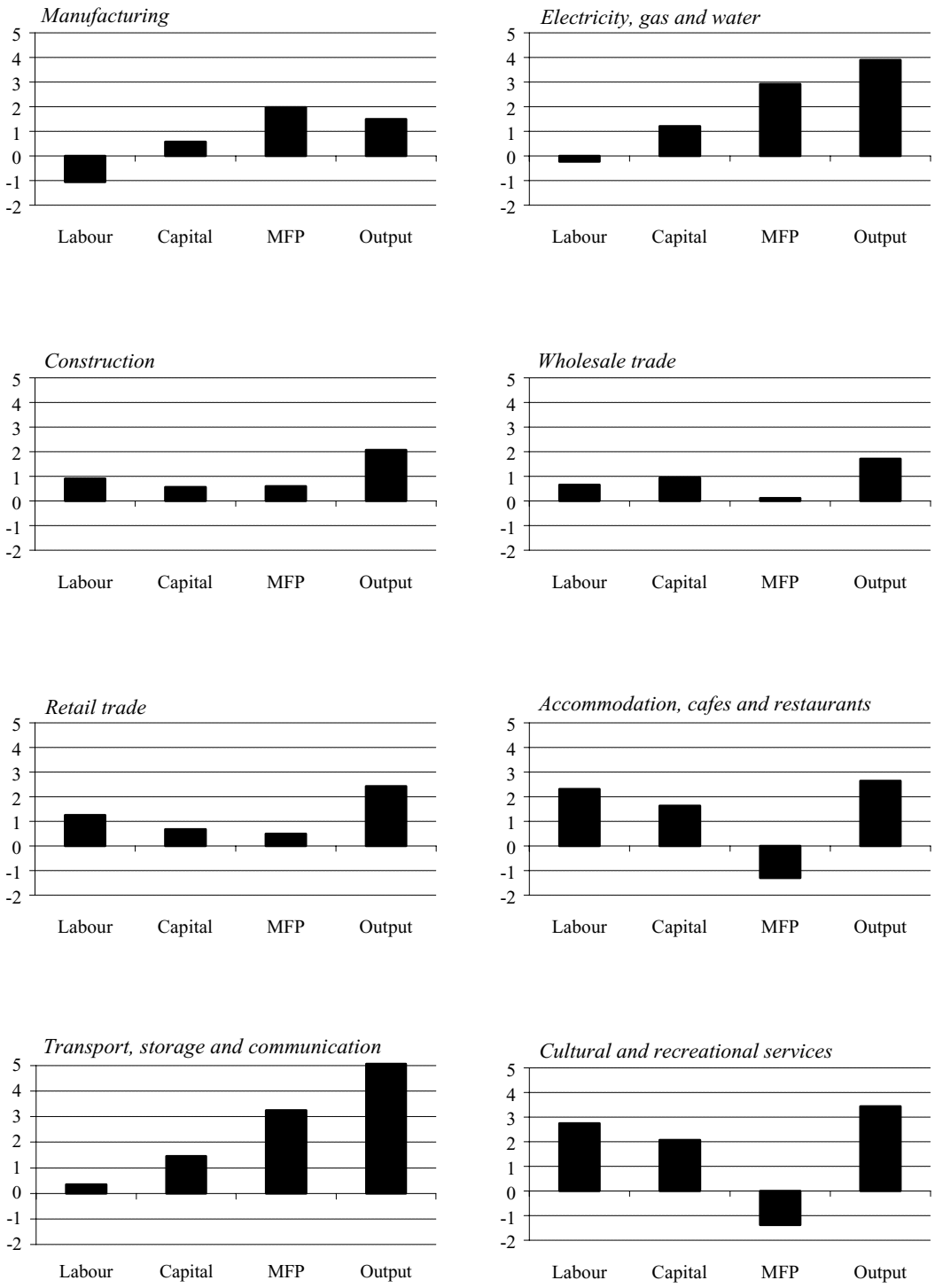
[1] Estimates of productivity levels are sometimes calculated as averages over a number of years, to circumvent possible cyclical influences. Single year estimates are presented here because the two years selected are both productivity peak years (see chapter 4).

[2] Estimates presented here are based on capital stock rather then the flow of capital services that are normally used in estimates of productivity growth. Estimates of labour and capital productivity levels are not combined into an estimate of MFP levels because of the different units involved (output per hour worked and output per dollar of capital).

Figure C1 Contributions to average annual growth in real output by industry sector[a], 1974–75 to 1994–95 (percentage points)



a Labour is measured by total hours worked.

Source: Commission estimates based on Gretton and Fisher (1997).

Table C1 Relative labour and capital productivity levels by industry sector, 1974–75 and 1994–95

	1974–75		*1994–95*	
Sector	*Labour productivity*	*Capital productivity*	*Labour productivity*	*Capital productivity*
Agriculture	0.6	0.3	0.5	0.3
Mining	3.1	0.9	3.4	0.7
Manufacturing	0.9	1.5	1.1	1.3
Electricity, gas and water	1.7	0.2	3.0	0.3
Construction	1.0	5.3	0.8	3.2
Wholesale trade	2.0	3.5	1.5	2.5
Retail trade	0.7	2.6	0.5	2.1
Accommodation, cafes and restaurants	0.8	1.2	0.5	0.8
Transport, storage and communication	0.8	0.6	1.3	0.9
Cultural and recreational services	1.8	2.0	1.0	1.4
Market sector	1.0	1.0	1.0	1.0

a The data for labour productivity levels represents an estimate of the output per hour worked. Capital productivity was calculated using output per unit of capital input. Both have been calculated relative to the market sector average for 1974–75 and 1994–95.

Source: Commission estimates based on ABS data (ABS Cat. nos 5206.0, 5204.0, 5221.0, 6203.0, and 5233.0).

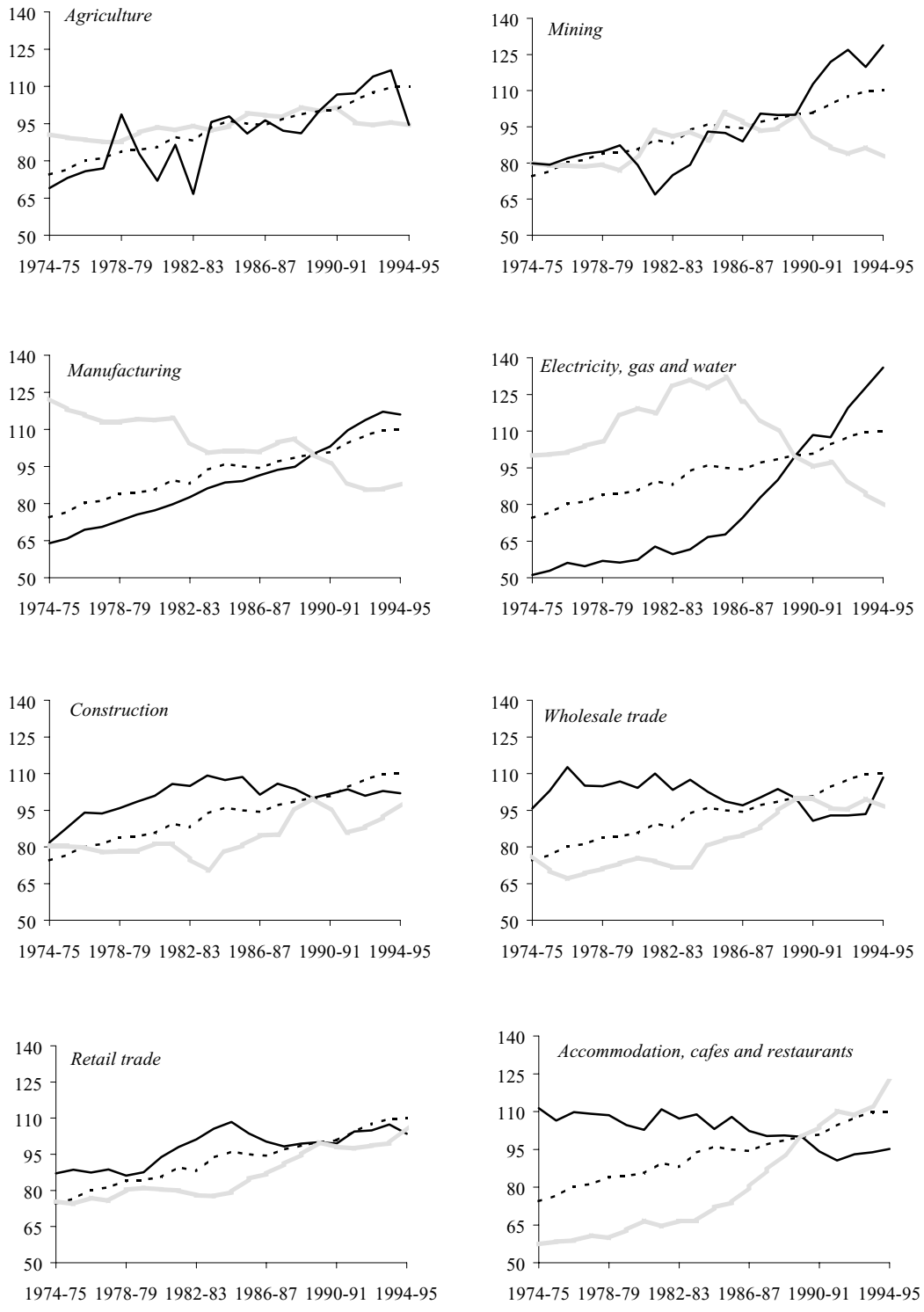
The estimates show that productivity levels differ considerably between industries. The fact that both capital and labour productivity levels are relatively high for Wholesale trade and Cultural and recreational services suggests that there are some exceptions to the conventional view that productivity is lower in services.

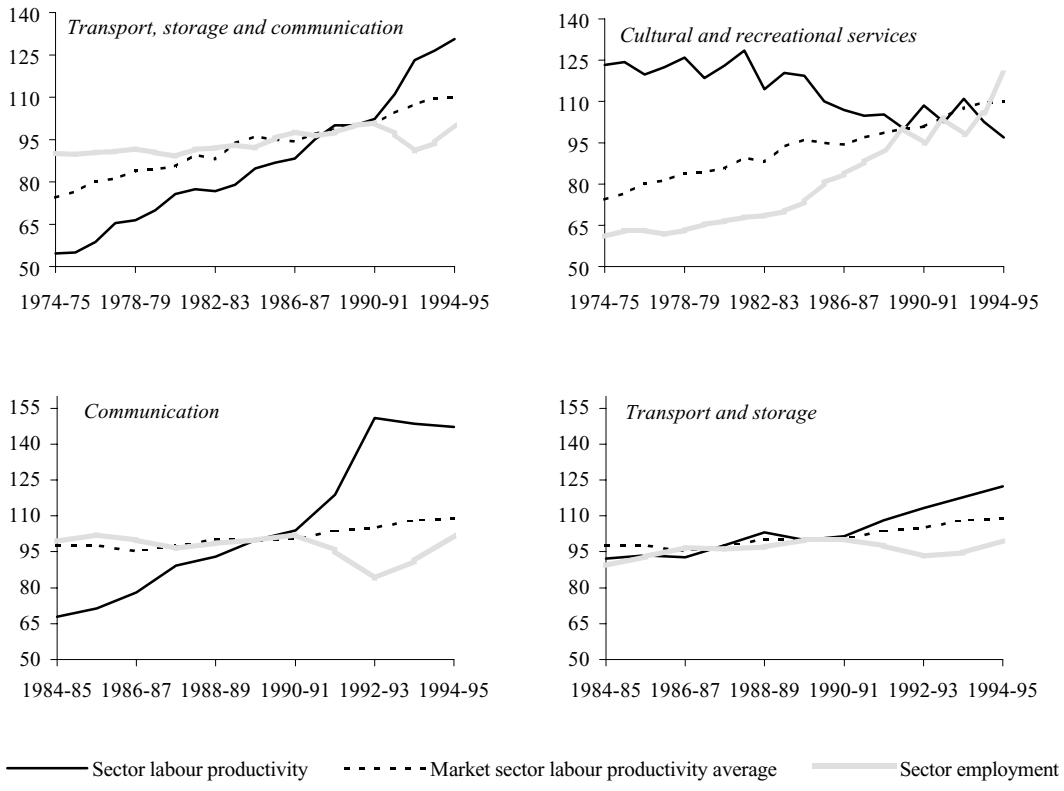
As discussed in chapter 5, the differences in productivity levels between industries should not be taken necessarily as an indicator of inferior or superior productivity performance.

Labour productivity and employment

Indexes of labour productivity and employment for each industry sector are displayed in figure C2.

Figure C2 Labour productivity and employment by industry sector[a], 1974–75 to 1994–95 (index 1989–90 = 100)





a Labour is measured by total hours worked

Source: Commission estimates based on ABS data. The Transport and storage and Communication figures are from ABS Cat. no. 5204.0.

The negative and variable contributors

This section relies on the analysis undertaken by Lowe (1995). The Commission has not otherwise investigated the productivity trends in these industries. It is to be noted that the ABS disputes some of Lowe's views.

The negative contributors in services

A major issue in interpreting the sectoral data (and therefore the aggregate performance trends) is the persistent negative growth in measured productivity in major service industries.

It is not intuitively appealing to consider that productivity has actually gone backwards over a long period of time. This would be equivalent to saying that employees in some industries 'forgot' what they had previously learned or that technology had been wound back. For example, the retail industry has seen the growth of larger shops and shopping centres, and new technologies such as laser

scanners and computer stock control systems have been introduced. And yet the numbers say that productivity has declined in recent periods.

Negative productivity would contribute to a lowering in aggregate performance if the relevant services were becoming more important in the aggregate picture or the problems of negative growth become evident for a period or become worse over time. All of these things have happened since the mid 1980s.

Services grew more rapidly as a proportion of GDP in the latter part of the 1980s and early 1990s — the period of particular decline in measured aggregate productivity. For example, over the period 1974–75 to 1994–95 services rose from 66 per cent of GDP to 69 per cent of GDP.

The information in figures 5.1, C1 and C2 and table 5.2 shows that periods or trends of negative growth have featured in Retail and Wholesale trade, Accommodation, cafes and restaurants and Cultural and recreational services.

While there may be some genuine reason behind these declines, there appears also to be a strong case for some compositional change, some output or quality effects that were not accounted for or some errors in data sources.

Retail trade

Following Lowe (1995), a major issue in productivity measures of Retail trade is the deregulation of shopping hours. Longer shopping hours provide customers with greater convenience. But they require more labour input — staff to keep shops open and serve customers. Output for productivity calculations is related only to the volume of goods sold and does not include convenience. Consequently, if the volume of goods sold in aggregate does not change greatly as a direct result of longer shopping hours, measured productivity would decline.

NSW began deregulation of shopping hours in 1984 and Victoria and South Australia followed in 1987. One study has estimated that average shopping hours per week in Australia increased from 52 in the early 1980s, to 56 in 1986 and to 61 in 1992 (Kiel and Haberkern 1994). Lowe (1995) quotes unpublished ABS data that show a slightly lower increase in average shopping hours.

Most of the major deregulation of shopping hours has now taken place. This factor is unlikely to have ongoing influence.

Lowe also points to a second factor. He finds that labour input data derived from the ABS Labour Force Surveys and used in the productivity calculations are at odds with the labour input data in the ABS Retail Censuses.

On the other hand, the 1980s was a period of considerable change in retailing which could have led to declines in measured productivity. For example, there

was growth in smaller specialty shops and rapid growth in part-time employment.[3]

In addition, the increased prominence of discounting stores and speciality stores has created problems for measuring the lower priced goods and new items for sale. The operating efficiencies that occur from music, toy and sports superstores in convenience and service available to consumers cannot be easily measured when the only benchmarks are stores that usually operated at a smaller scale.

Clearly a lot more work would be required to disentangle all the factors that have been impinging on measured productivity in retailing.

But the pattern of a decline in productivity — and especially in labour productivity — over the latter part of the 1980s and a return to positive growth thereafter is consistent with a dominant influence of longer shopping hours.

Wholesale trade

Wholesale trade is a major part of the market sector (around 15 per cent). It has shown negative or stagnant growth over a relatively small part of the 1980s and 1990s.

Again there could be some data error, as Lowe (1995) found discrepancies between the Labour Force Survey and Wholesale Industry Survey data. Lowe (1995) also suggested that, unlike Retail trade, Wholesale appears more dependent on changes in the investment cycle.

Accommodation, cafes and restaurants

The Accommodation, cafes and restaurants sector is only a relatively small part of the market sector (around 3 per cent). Its trend decline in productivity would not therefore have a profound effect on the market sector aggregate measures.

Lowe (1995) offers two possible explanations for the decline in productivity in this sector:

- stagnant or declining productivity in some important parts of the sector; and
- compositional effects by which higher growth is achieved by the segments with lower productivity levels (particularly cafes).

[3] Although a rise in the number of part time employees does not reduce measured productivity on a per hour basis there may be a fall in productivity, in any case, reflecting the lower skill levels and experience of part-time and casual workers particularly those who are re-entrants to the workforce and young people. Furthermore, if the workforce suffers from a large rate of turnover then there may not be enough time to allow the accumulation of necessary skills and experience or training to raise labour productivity.

There was also strong growth in employment in this sector through the period which could have lowered average productivity. Furthermore, if the standard of service has improved, there would be an output quality improvement that would not be reflected in the productivity measures in much the same way as occurred in retail trading. Also overcapacity may have lowered productivity, at least temporarily, in accommodation (see IC 1996c).

Cultural and recreational services

Again, Cultural and recreational services are only a small part of the market sector (3 per cent) and have only a small influence on the aggregate results.

Multifactor productivity declined in this sector in the latter 1980s and 1990s.

It may well be that similar factors were at play in this sector, with an increase in employment and improvement in the quality of service.

Construction

Construction is a major sector, accounting for around 10 per cent of the market sector. Its productivity has declined over the latter 1980s and 1990s.

Lowe (1995) notes that productivity declined in both private and public construction between 1983 and 1991, but more so in public than private. He attributes the decline in public sector productivity to compositional effects, with a prime case being State governments cutting back dramatically on expenditure in the electricity industry. He finds the private sector result to be at odds with data obtained from the Construction Industry Surveys.

Consequently, there may be a question mark about part of the decline in this sector's measured productivity.

Other negative contributors

Mining

Mining accounts for about 7 per cent of the market sector. Its performance has been variable, with negative multifactor productivity growth in the 1970s and strong positive growth in the early 1980s. However, its overall contribution from 1974–75 has been slightly negative.

A study undertaken by ABARE (1990) identified that the main source of fluctuations in Mining's productivity performance was a combination of the large outlays in capital expenditure (representing investment decisions with 20 to 30 year timeframes) and the declining productivity that occurs towards the end of the economic life of a mine. Long-term investment programs usually involve swings in productivity since there is a long period between the installation of

equipment and its full utilisation. One example drawn out by the paper is that the use of capacity available to the North West Shelf only occurred in 1989 after construction commenced in 1980. In fact, the project continued to expand during the 1990s as additional stages were completed highlighting the long phase of capital investment.

Consequently, Mining's performance and potential to contribute to aggregate productivity performance must be viewed over a lengthy period.

D DETAILS ON INTERNATIONAL PRODUCTIVITY

This appendix provides additional information in support of chapter 6 on the international perspective.

Sectoral contributions to growth

Table D1 shows sectoral contributions to MFP growth for a selection of individual OECD countries over the period 1970 to 1994. Sectoral contributions to MFP growth take account of both the size of each sector in the economy over the period (sectoral shares in GDP in 1990 are shown in table D2) and its productivity growth. Estimates of MFP growth (by sector and total) for the period 1970 to 1994 are shown in table D3 and for 1989 to 1994 in table D4.

Sectoral productivity growth with allowance for convergence

A regression analysis by sector allows for the control of convergence/catch-up opportunities. Productivity growth in a sector is dependent (in part) on the initial level of labour productivity in that sector. A sector with low levels of productivity in one country compared to another can achieve relatively high productivity growth by adopting methods and processes used in the productivity leader country.

Labour productivity levels in 1970 are plotted against labour productivity growth (average annual compound rate) from 1970 to 1994. A regression line of best fit is estimated from these data. The adjusted R^2 provides an indication of how well the regression explains the variation between actual and fitted estimates. Those sectors falling below the regression line showed less of the convergence tendency and those above the line had growth rates above the average rate of convergence.

The scatter plots for Manufacturing, Electricity, gas and water and Transport, storage and communication are in chapter 6. The other sectors are shown in figure D1. There appears to be very little convergence tendency in Finance, insurance and real estate and Community and personal services.

Table D1 Sectoral contributions to multifactor productivity growth in the business sector, selected OECD countries[a], 1970 to 1994 (per cent)

Country	*Agriculture*	*Mining*	*Manufacturing*	*Electricity, gas and water*	*Construction*	*Wholesale and retail trade*	*Transport, storage and communication*	*Finance, insurance and real estate*	*Community, social and personal*
United States	12	-6	74	1	-14	23	38	-5	-22
Canada	10	-17	50	..	-3	28	35	..	-1
Japan	5	-1	106	-5	-23	73	14	-8	-61
Germany	8	-2	40	2	5	11	12	19	5
France	12	..	40	6	3	4	13	16	6
Italy	9	na	103	-18	-3	26	13	na	-30
United Kingdom	8	4	64	12	-1	-3	30	-12	-1
Australia	**10**	**1**	**60**	**17**	**-3**	**-5**	**49**	**-31**	**2**
Belgium	5	na	52	8	5	18	7	na	4
Denmark	21	8	37	4	-13	29	12	1	-1
Sweden	6	..	51	7	10	15	15	-5	..
Finland	14	1	48	2	7	11	13	2	2

na Not available.

.. less than (+ or -) 0.5 per cent.

a United States is 1989 to 1993; Italy, the United Kingdom and Belgium are 1989 to 1992.

Source: Commission estimates based on OECD data.

Table D2 Sectoral shares of GDP, selected OECD countries, 1990 (per cent)

Country	*Agriculture*	*Mining*	*Manufacturing*	*Electricity, gas and water*	*Construction*	*Wholesale and retail trade*	*Transport, storage and communication*	*Finance, insurance and real estate*	*Community, social and personal*
United States	2	2	21	3	5	19	7	29	12
Canada	3	4	22	4	9	17	8	26	8
Japan	3	..	30	3	11	14	7	18	15
Germany	2	1	37	3	6	12	7	14	19
France	4	1	27	3	6	19	7	27	7
Italy	4	na	28	6	7	23	7	na	24
United Kingdom	2	3	26	2	8	16	9	28	5
Australia	**3**	**5**	**15**	**3**	**7**	**20**	**8**	**25**	**14**
Belgium	2	na	27	5	7	23	10	na	25
Denmark	6	1	24	2	7	17	11	25	6
Sweden	4	..	28	4	10	15	9	26	5
Finland	8	..	28	3	12	16	10	21	3

na Not available

.. less than (+ or -) 0.5 per cent.

Source: Commission estimates based on OECD data.

Table D3 Average annual growth in multifactor productivity, selected OECD countries[a], 1970 to 1994 (per cent)

Country	*Agriculture*[b]	*Mining*	*Manu-facturing*	*Electricity, gas and water*	*Con-struction*	*Wholesale and retail trade*	*Transport, storage and communication*	*Finance, insurance and real estate*[c]	*Community social and personal*	*Total industries*[d]
United States	2.3	-1.0	1.5	0.1	-1.1	0.6	2.8	-0.1	-0.8	0.5
Canada	1.7	-1.8	1.2	-0.1	-0.2	0.9	2.8	..	-0.1	0.7
Japan	0.7	-1.3	1.7	-0.8	-0.9	2.5	0.9	-0.2	-1.7	1.4
Germany	4.6	-2.5	1.3	0.8	0.7	0.8	2.2	1.5	0.3	1.5
France	3.6	-0.5	1.9	3.4	0.6	0.3	2.8	0.9	1.4	1.9
Italy	1.7	na	3.0	-1.8	-0.2	0.9	1.6	-0.5	-1.1	1.5
United Kingdom	2.9	1.2	1.8	4.6	-0.1	-0.2	2.6	-0.4	-0.2	1.0
Australia	**1.4**	**0.1**	**1.8**	**2.7**	**-0.2**	**-0.1**	**3.4**	**-0.7**	**0.1**	**0.8**
Belgium	3.8	na	3.9	3.2	1.2	1.4	1.4	3.3	0.4	2.5
Netherlands	3.7	0.4	2.3	1.2	-0.6	na	2.3	na	na	1.4
Denmark	4.2	na	1.5	2.2	-1.3	1.8	1.2	0.1	-0.1	1.6
Sweden	2.0	-0.7	2.1	2.6	1.2	1.3	2.5	-0.2	0.1	1.4
Finland	2.9	3.4	3.2	1.8	1.1	1.4	2.7	0.1	0.9	2.3
OECD[d]	2.0	-1.1	1.6	-0.2	-0.6	0.7	2.1	-0.1	-0.8	1.0

na Not available. .. less than (+ or -) 0.5 per cent

a Annual compound growth rates are calculated from 1970 to 1994, or latest available data. United States is 1970 to 1993; Germany is 1970 to 1993 for Agriculture, Mining, Electricity, gas and water, Financial institutions and insurance and Community, social and personal, otherwise it is 1970 to 1994; Italy is 1970 to 1991, except total industries, which is 1993 and Community, social and personal which is 1992; the United Kingdom is 1970 to 1990 except Agriculture, Mining and Electricity, gas and water which are 1970 to 1991, and Total industries, which is 1970 to 1992; Belgium and Denmark are 1970 to 1992; The Netherlands is 1970 to 1992 for Mining, Manufacturing, Electricity, gas and water, and Construction and Wholesale and retail trade, otherwise it is 1970 to 1994, except Transport, storage and communication which is 1977 to 1994.

b For the agricultural sector land is not included in the capital stock.

c For Germany, Italy and Belgium, MFP is for Financial institutions and insurance, rather than Finance, insurance and real estate.

d Growth rates for OECD sectoral averages are until 1993, except for Total industries which is 1994.

Source: Commission estimates based on OECD data.

Table D4 Average annual growth in multifactor productivity, selected OECD countries[a], 1989 to 1994 (per cent)

Country	*Agriculture*[b]	*Mining*	*Manu-facturing*	*Electricity, gas and water*	*Con-struction*	*Wholesale and retail trade*	*Transport, storage and communication*	*Finance, insurance and real estate*[c]	*Community, social and personal*	*Total industries*[d]
United States	4.9	5.7	1.5	0.3	0.2	0.5	3.9	-0.7	-1.1	0.8
Canada	2.5	4.2	1.6	-1.6	-2.0	-0.4	2.3	-1.5	-2.1	0.2
Japan	-0.1	-0.8	-0.9	-0.5	-1.2	0.9	-0.2	-1.3	-1.0	-0.1
Germany	4.9	2.4	0.8	-0.3	-1.1	0.5	2.8	0.5	1.9	1.4
France	2.7	5.5	1.0	2.3	-0.2	-0.5	2.2	-0.7	-0.5	0.7
Italy	3.3	na	0.3	0.4	-0.4	-0.2	1.2	-0.1	-2.0	0.7
Australia	**3.7**	**0.3**	**3.3**	**3.0**	**-0.2**	**0.5**	**5.2**	**-1.5**	**0.5**	**0.9**
Belgium	5.7	na	-0.8	3.4	1.5	2.6	2.2	2.8	-1.6	1.0
Netherlands	3.9	3.4	0.7	1.4	-1.8	0.4	3.5	na	-0.6	0.8
Denmark	-1.4	na	0.2	5.0	-1.7	2.9	5.8	-2.9	0.1	1.1
Sweden	0.6	2.4	4.2	-0.4	0.1	1.3	2.7	-0.4	-2.4	1.5
Finland	4.4	4.5	4.7	3.6	-1.6	-3.2	5.4	-0.9	0.4	2.1
OECD[d]	2.7	4.4	0.4	0.3	-0.6	0.4	2.5	-1.0	-0.5	0.6

na Not available.

a Annual compound growth rates are calculated from 1989 to 1994, or latest available data. United States is 1989 to 1993; Germany is 1989 to 1993 for Agriculture, Mining and Electricity, gas and water, Financial institutions and insurance, and Community, social and personal, otherwise it is 1989 to 1994; Italy is 1989 to 1991, except total industries which is 1993, and Community, social and personal which is 1992; Belgium and Denmark are 1989 to 1992; The Netherlands is 1989 to 1992 for Mining, Manufacturing, Electricity, gas and water, Construction, Wholesale and retail trade otherwise it is 1989 to 1994.

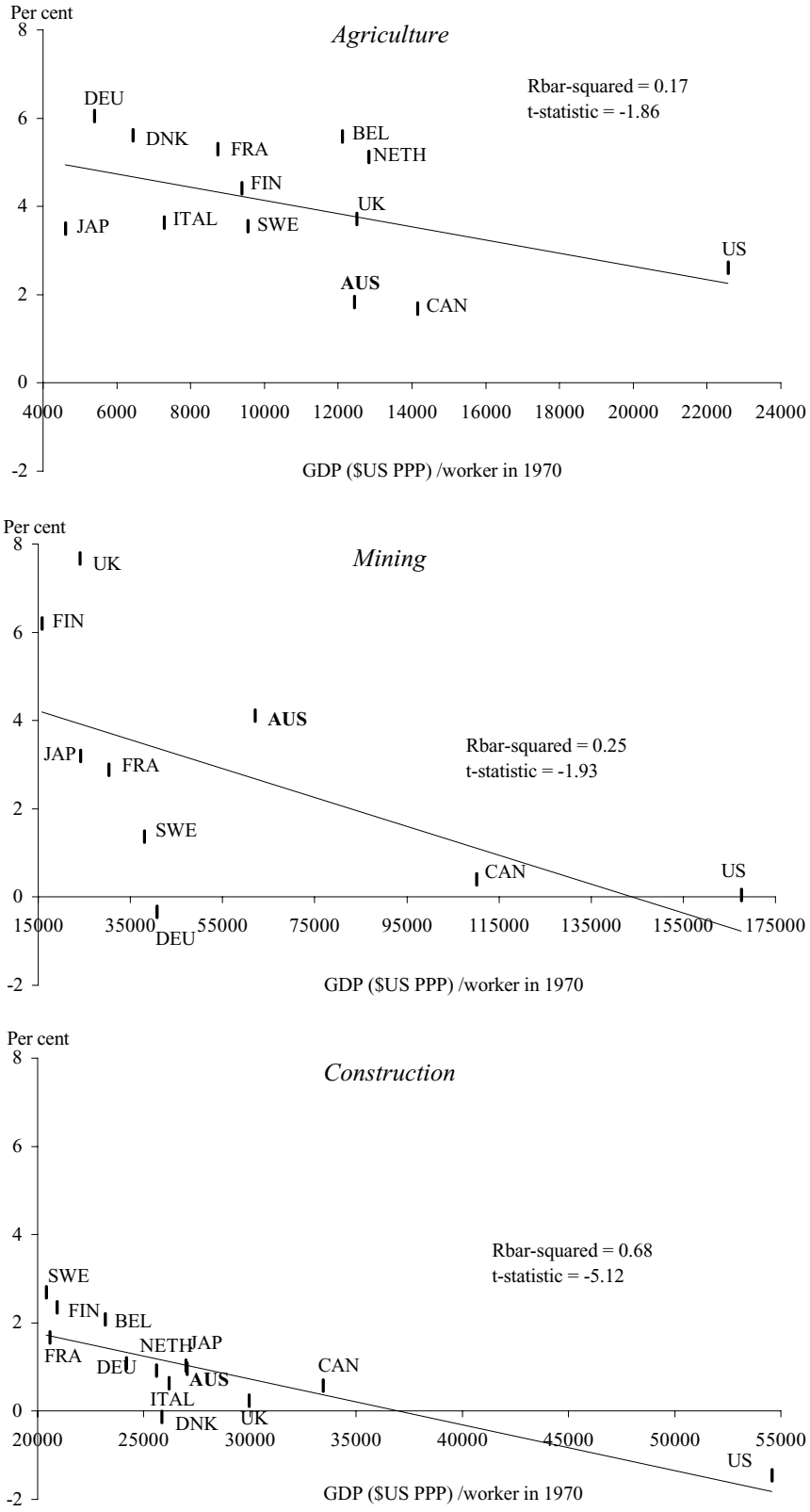
b For the agricultural sector land is not included in the capital stock.

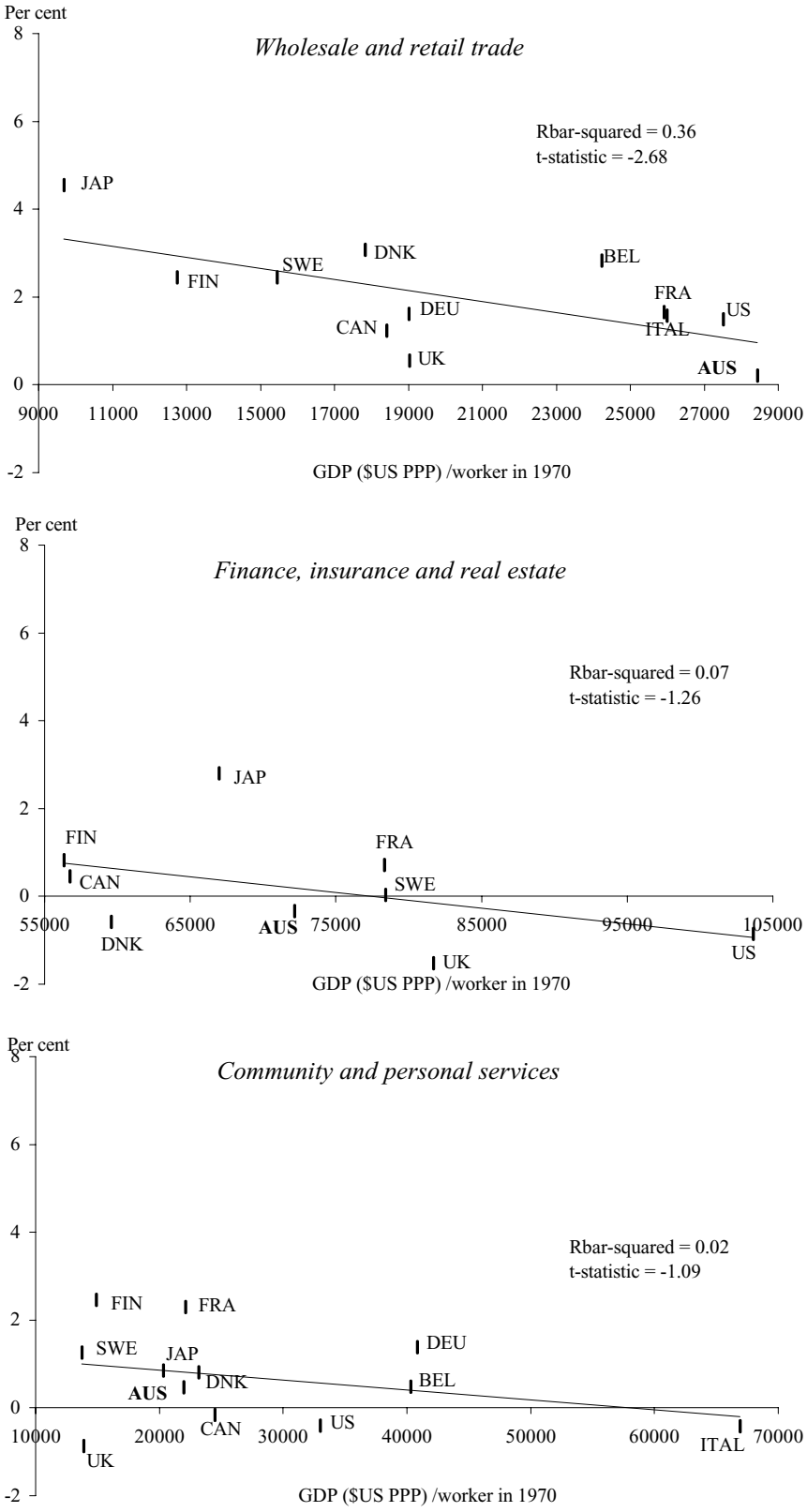
c For Germany, Italy and Belgium, MFP is for Financial institutions and insurance, rather than Finance, insurance and real estate.

d Growth rates for OECD sectoral averages are 1989 to 1993, except for Total industries which is 1989 to 1994.

Source: Commission estimates based on OECD data.

Figure D1 International comparisons by sector





Source: Commission estimates based on OECD (1996b).

E DETAILS ON DISTRIBUTION OF GAINS

Principal mechanisms for distributing productivity are lower prices, higher wages or higher profitability. This appendix provides details of a cross-sectional analysis of the distribution of productivity benefits. It provides details of how the distribution of benefits from improved productivity were measured by examining relative movements in prices and wages.

Benefits from improved productivity may show up in a number of ways, such as:

- prices rise for the sector's output less than the average price rise for Australia;
- average earnings (AE) by labour in the sector increase more than Australian average earnings; or
- both prices and earnings have positive effects.

Methodology and data sources

To isolate general wage, price and profitability effects, the growth in each variable is measured relative to a market sector or economy-wide average. The basic aim is to determine the correlation between relatively high (or low) productivity and relative wage, price and profitability increases.

The figures are designed to show that where there have been productivity improvements, positive benefits accrue to either consumers or employees or to both. This means that a benefit to consumers will show up as a positive result in the figure. That is, the price difference is measured as the percentage growth in Australian prices less the percentage growth in the sector's price. Where a sector's growth in prices is less than the Australian average growth in prices, consumers have gained more benefit.

Similarly in regard to wages, the chart shows positive benefits to employees where the percentage growth in AE for the sector is greater than the percentage growth in AE for Australia. That is, the earnings difference is measured as the percentage growth in AE for the sector less the percentage growth in AE for Australia. So, where growth in wages for employees in the sector rose faster than wages for Australia as a whole, employees gained more of the benefit from productivity improvements.

Data sources

The majority of the data was sourced from the Australian Bureau of Statistics (ABS). Data requirements for each of the variables considered are set out below.

Multifactor productivity (MFP) – Commission estimates at the ANZSIC sector level, based upon ABS methodology for measuring MFP (Gretton and Fisher 1997). The market sector average used is the ABS MFP (Australian National Accounts, ABS Cat. no. 5234.0).

Prices – Price deflators are calculated by taking the ratio of Gross product in current prices, and Gross product in constant 1989-90 prices, by ANZSIC sector. (Australian National Accounts, ABS Cat. no. 5204.0 and RBA 1996).

Average earnings – Calculated as the ratio of (annual) Wages, salaries and supplements to Employment by ANZSIC sector (Australian National Accounts, ABS Cat. no. 5204.0 and RBA 1996).

Gross operating surplus – The excess of gross output over the sum of intermediate consumption, wages, salaries and supplements, and indirect taxes less subsidies (Australian National Accounts, ABS Cat. no. 5204.0 and RBA 1996).

Methodology

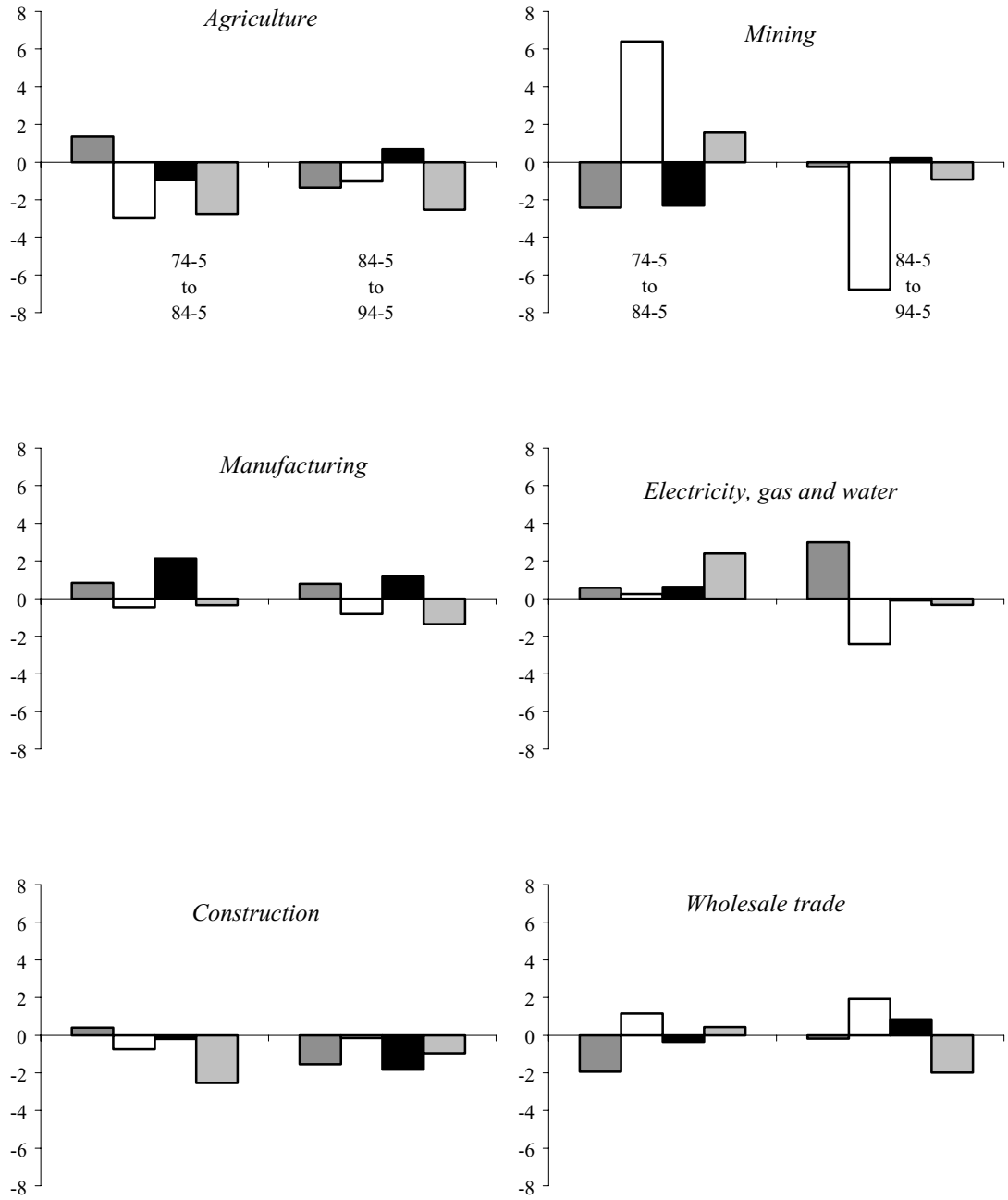
Average annual growth rates

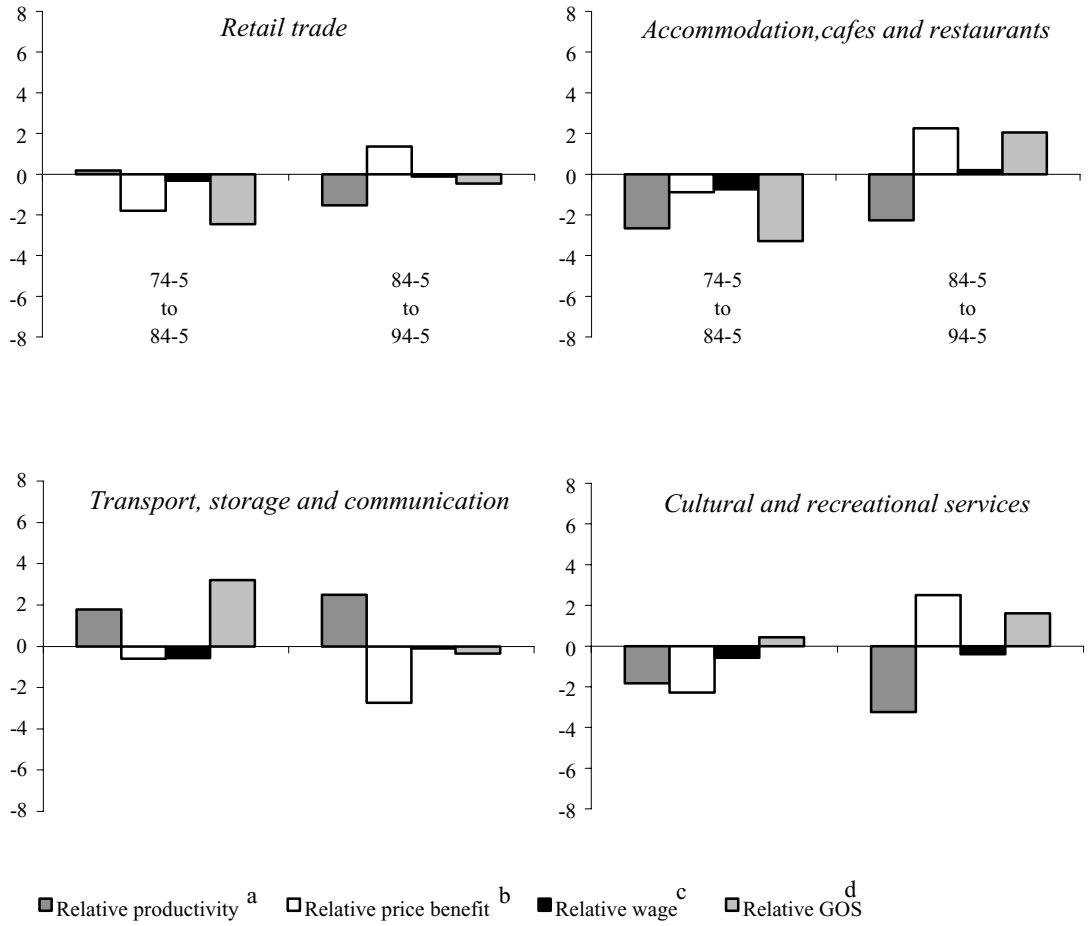
Average annual growth rates were measured for MFP, prices and AE, for each sector. Growth rates were measured for the two periods 1974–75 to 1984–85 and 1984–85 to 1994–95. The growth rates were measured using the standard compound growth rate formula.

Figures

Actual data in the figures represent relative growth for MFP, prices, average earnings and gross operating surplus. That is, the charts represent the annual growth rates for each sector compared to the average for the market sector (for MFP) or the economy-wide average (for the other variables).

Figure E1 Relative productivity growth, relative price benefit, relative wage growth and relative gross operating surplus growth, by sector, 1974–75 to 1994–95





a MFP growth (sector) minus MFP growth (market sector).
b Price growth (sector) minus price growth (economy).
c Average earnings growth (sector) minus average earnings growth (economy).
d Gross operating surplus growth (sector) minus gross operating surplus growth economy.
Source: Commission estimates based on ABS data.

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