PRODUCTIVITY COMMISSION

Productivity and the Structure of Employment

Staff Research Paper

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Preface

This paper was developed and written by Paula Barnes, Rick Johnson, Anthony Kulys and Scott Hook under the general direction of Dean Parham. Tracey Horsfall provided administrative and production support. Geraldine Martisius also assisted with administrative support in the earlier stages of the project.

The paper has benefited from comments by Garth Pitkethly, Lynne Williams and Norm Gingell of the Productivity Commission. The views expressed in this paper remain those of the authors.

Abbreviations and explanations

ABS	Australian Bureau of Statistics
ABSCQ	Australian Bureau of Statistics Classification of Qualifications
ANZSIC	Australian and New Zealand Standard Industrial Classification
ASCO1	Australian Standard Classification of Occupations, first edition
ASCO2	Australian Standard Classification of Occupations, second edition
ASIC	Australian Standard Industrial Classification
CCLO	Classification and Classified List of Occupations
DEET	Department of Employment, Education and Training
EEH	Employee Earnings and Hours
EPAC	Economic Planning Advisory Commission
HSBC	High-skilled blue collar
HSWC	High-skilled white collar
IC	Industry Commission
IT	Information technology
LFS	Labour Force Survey
LS	Low-skilled
LSBC	Low-skilled blue collar
LSWC	Low-skilled white collar
MFP	Multifactor productivity
OECD	Organisation for Economic Co-operation and Development
psq	Post-school qualifications
WWII	World War II
WEEDA	Weekly Earnings of Employees (Distribution), Australia

Overview

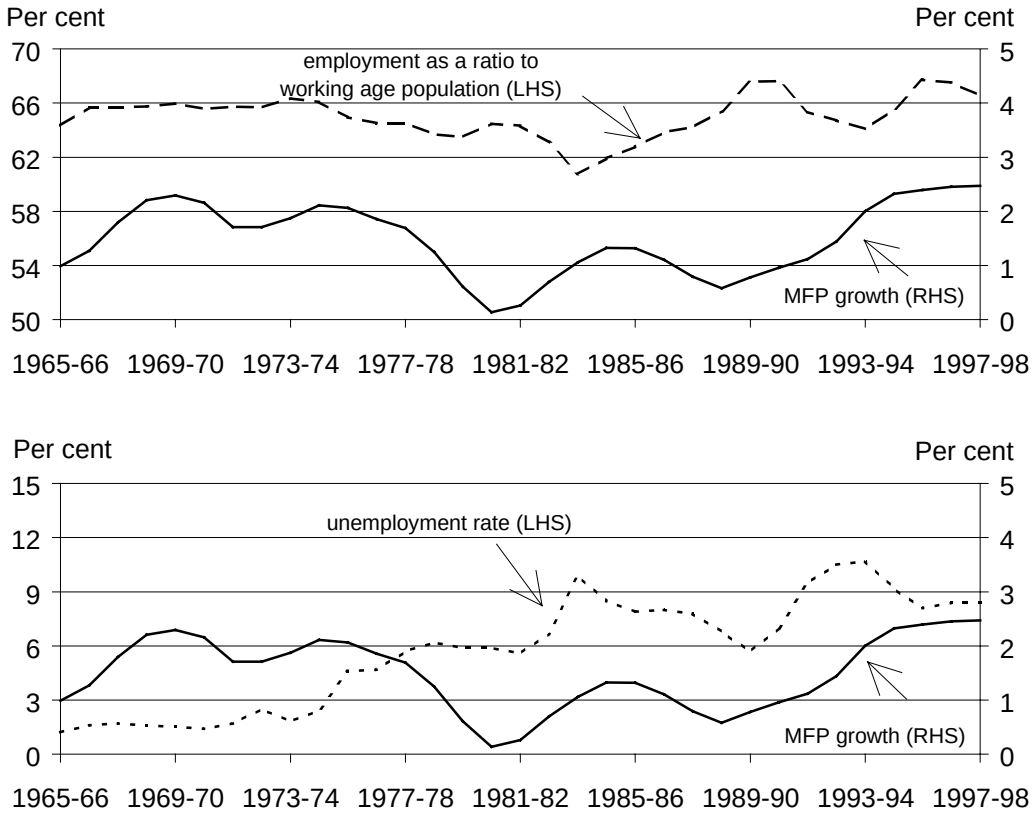
There have been longstanding concerns in the community about possible job displacement effects of new technology (for example, computer equipment) and other measures introduced to lift productivity. More recently, similar concerns have been expressed about government policy changes that seek to enhance productivity.

Previous work by the Industry Commission (IC 1997b) found that the empirical evidence from Australia and overseas does not suggest that productivity growth leads inevitably to lower aggregate employment or higher unemployment. Indeed, in bringing growth in incomes, productivity growth is more likely to have a positive effect on aggregate employment. In Australia's case, employment growth has accompanied relatively high productivity growth in the post-WWII era. On the other hand, increases in unemployment rates from the 1970s to the mid-1980s coincided with much slower productivity growth.

These trends, together with more recent experience, are evident in figure 1. Employment growth recovered in the latter part of the 1980s during a period of lower wage costs. Productivity growth over this period was weak. However, employment opportunities have recovered after the early 1990s recession while productivity growth has accelerated to a record high. Unemployment increased in the recessions of the 1980s and early 1990s. The unemployment rate, though still high, has declined from the mid-1990s.

The earlier IC study acknowledged that, even though there is not a negative long-term relationship between productivity growth and employment at the aggregate level, productivity growth may affect employment in particular industries, occupations and regions.

Figure 1 **Multifactor productivity growth (MFP)[a], employment[b] as a ratio to working age population[c] and the unemployment rate[d], 1965-66 to 1997-98**



a Year-to-year growth in the ABS trend MFP series. **b** August data for employed persons 15 years and over. **c** June data for 15-64 year old population. **d** August data.

Data sources: MFP growth from ABS (unpublished data); employment and unemployment estimates based on Reserve Bank of Australia Australian Economic Statistics database (accessed 1 July 1999) and ABS Labour Force Statistics database (accessed 1 July 1999).

This paper builds on the earlier IC work. It focuses on the relationships between productivity growth and structure of employment defined by the following characteristics:

- industry;
- skill;
- age;
- part-time and casual employment status; and
- distribution of earnings.

The basic approach in this paper is to examine employment patterns in industries for differences between high productivity growth industries and low productivity

growth industries; and to look for any associations between industry productivity growth and changes in industry employment profiles. The high productivity growth industries, defined by their productivity performance between 1978-79 and 1995-96, are Electricity, gas and water, Transport, storage and communication and Manufacturing.

It is important to stress, however, that the paper is pitched at examining correlations between productivity growth and changes in the structure of employment. It does not attempt to establish causal links.

It is highly likely that the level of industry aggregation affects the extent of associations found. Industry impacts are potentially greater at a finer level of aggregation. For example, positive and negative effects in different industries within Manufacturing can cancel each other out and will not be visible when Manufacturing is examined as a whole. While it has not been possible to examine all individual industries, a finer level of industry disaggregation within Manufacturing has been examined.

Aggregation is generally less of an issue for employment characteristics other than industry, but would have some effect on the examination of skill, which in this paper is based on broad educational attainment levels and occupation groups. For example, occupational effects may be more noticeable if looking at accountants rather than the broader grouping of high-skilled white collar workers.

Main findings

- Productivity growth does not appear to be associated with a fall in employment at the aggregate level, and indeed can contribute to employment growth (box 1). At the industry sector level, relatively high productivity growth has coincided with employment declines in two sectors of the economy and employment rises in a third sector.
  - Electricity, gas and water, which had a 43 per cent reduction in employment over the period 1978 to 1997, has been subject to considerable structural reform to improve productivity performance. Amongst other things, this has led to reductions in excess manning levels. With 1.3 per cent of the employed workforce in 1990, Electricity, gas and water is a relatively small employer.

Box 1 **Productivity and employment**

Productivity growth can mean doing more with fewer people in some industries, but growth in output and incomes made possible by productivity improvements creates jobs throughout the economy.

- Firms with good productivity performance will be more competitive in the market place. This can lead to increased sales, allowing them to maintain or even increase employment.
- Other firms benefit when their input prices fall due to suppliers' productivity gains, and this allows them to maintain or expand output and employment.
- Productivity improvements, such as through outsourcing, create job possibilities elsewhere.
- Rising incomes and savings enable higher levels of investment (which generates employment) and increased government and consumer expenditure (which is directed increasingly towards employment-intensive services).

Source: IC (1997a).

  - For Manufacturing, which experienced a 4 per cent reduction over the period, the specific association between productivity growth and reductions in employment is less clear. The introduction of new technology and contracting out of some activities — both potential sources of productivity growth — could have contributed to the long-term decline in employment. Manufacturing has also been subject to potentially productivity-enhancing reforms over the late 1980s and 1990s. But the shift in employment away from Manufacturing also reflects a shift in demand toward services in response to income, taste and lifestyle changes. Manufacturing is a relatively large employer, with 15 per cent of the employed workforce in 1990.
  - Transport, storage and communication, the third high productivity growth industry, had an 18 per cent increase in employment over the period. With 7 per cent of the employed workforce in 1990, Transport, storage and communication is a medium-sized employer.

- Generally speaking, demographic and social factors are more powerful than productivity growth in affecting the other dimensions of the structure of employment examined. For example, the age profile of the employed workforce is affected by the ageing of the 'baby boomer' cohort and higher school retention rates. The increase in part-time and casual employment reflects a number of factors. As noted above, growth in the service industries, in which part-time and casual employment are more prevalent, reflects changes in income, taste and lifestyle. And increases in school retention rates and female participation rates have increased the supply of workers who prefer these forms of employment.

- A limited number of correlations was found between productivity growth and some of the individual employment characteristics examined.
  - A weak positive correlation was found between productivity growth and growth in the share of workers in high-skilled white collar occupations, across market sector industries.
  - While no general correlation with the average age of workers or most age groups was found, there was a negative correlation between productivity growth and growth in the share of employment held by younger people (15-19 and 20-24 year olds). But this appears to be related to higher school retention, higher participation in tertiary education and lower apprenticeship rates having differing effects across industries.
  - Positive correlations were found between productivity growth and the shares of part-time and casual employment. However, part-time and casual employment are much more prevalent in some service industries, which have low (or even negative) productivity growth. Further growth in part-time and casual employment in these industries appears relatively slow, coming off a relatively high base. In the high productivity growth industries, part-time and casual employment is not nearly as prevalent, but the growth appears relatively high, coming off a relatively low base. Consequently, the significance of the association with productivity growth may not be as great as it appears.
  - No correlations were found between growth in earnings for specific occupation groups and productivity growth — the variation in real earnings growth across industries was relatively small compared with the variation in productivity growth. However, there is some evidence to suggest that productivity gains have been distributed more evenly among occupation groups in the high productivity growth industries than in the low productivity growth industries.
- Industry groups within Manufacturing were also examined. The finer disaggregation showed more evidence of a negative relationship between employment growth in Manufacturing industries and productivity growth. However, for reasons explained above, the negative association found within Manufacturing cannot be extrapolated to the workforce as a whole. An examination of changes in the age and occupational profiles within Manufacturing mainly confirmed the correlations found at the broader level for age, but no correlations were found for occupation.

Detailed findings

Because of data limitations, the analyses cover various periods between 1978-79 and 1997-98. Productivity estimates at the industry level are not available after 1995-96.

Industry sectors are classified as having experienced higher or lower multifactor growth, than the market sector as a whole, over the period 1978-79 to 1995-96:

- high MFP growth — Electricity, gas and water, Transport, storage and communication and Manufacturing; and
- low MFP growth — Cultural and recreational services, Accommodation, cafes and restaurants, Construction, Wholesale trade and Retail trade.

Industry structure of employment

- Aggregate employment in the market sector was over 850 000 higher in 1997 than 1978, an increase of over 20 per cent.
  - Most employment growth was concentrated in the service industries, particularly Retail trade, Accommodation, cafes and restaurants and Cultural and recreational services.
  - Over the period, the number employed fell in only two industries — Manufacturing and Electricity, gas and water.
  - Growth in female employment outpaced male employment growth in absolute and relative terms.

Skill structure of employment

- Skill was examined using two proxies — educational attainment and occupation.
  - People with post-school qualifications were a significantly larger share of the employed workforce in 1997 than in 1984.
  - The shares of employment in high-skilled and low-skilled white collar occupations were higher in 1995 than 1986, while the shares of employment in high-skilled and low-skilled blue collar occupations were lower.
- Changes in the skill structure of employment appear to be the result of a number of factors, including shifts in final demand for output and technological change and increases in school retention rates.

- Productivity and skill are interdependent, but the relationship is complex.
  - For example, new technologies can sometimes lower the demand for low-skilled workers and raise the demand for high-skilled workers but, in other circumstances, they can have a deskilling effect.
  - There is no consensus from research studies about whether the overall effect is to increase or decrease the skill level of the workforce.
- Over the period examined, there appears to be no association between the share of the employed workforce without post-school qualifications and MFP growth across market sector industries.
- The share of employment held by less educated workers has declined for the economy as a whole, as well as exhibiting a downward trend in all high and low productivity growth industries examined.
  - However, there appears to be no correlation across market sector industries between the rate of decline in the share of less educated workers and MFP growth.
- Like educational attainment, the occupation data show no systematic association between the occupational structure of employment and MFP growth across market sector industries.
  - The occupational structure of employment is likely to be more related to the requirements of specific industries than to productivity growth. For example, the work requirements of Construction, a low productivity growth industry, result in this industry having shares of high-skilled blue collar and low-skilled white collar workers that are more similar to the high productivity growth industries than the other low productivity growth industries.
- There is weak support for the suggestion that higher (lower) growth in MFP is correlated with higher (lower) *growth* in the share of industry employment in high-skilled white collar occupations across market sector industries.
  - However, no correlation was found between growth in the share of employment in other skill-based occupation groups and MFP growth.

Age structure of employment

- The average age of the employed workforce in 1997 was 37.7 years, slightly higher than the 36.2 years in 1978.
- The age profile of the employed workforce has been affected by a wide range of factors. Changes in the age profile of the population as a whole are an obvious influence. Changes in labour force participation rates and the role of females in the workforce have also affected the age profile.

- There has been a decline in the share of total employment held by workers in the three youngest age groups (15-19, 20-24 and 25-34), as well as in the older age groups (55-59 and 60 and over), with a corresponding increase in the 35-44 and 45-54 age groups.
- Comparing the high and low productivity growth industries, there was no systematic association between the age profile of employment and MFP growth.
  - However, most low productivity growth industries had higher shares of younger workers and lower shares of workers 45 to 59 years of age than the high productivity growth industries.
- No correlation was found between average MFP growth and *growth* in the average age of the employed workforce across market sector industries. However, there were some correlations between MFP growth and growth in the share of employment in some age groups.
  - For the 15-19 and 20-24 age groups, higher (lower) growth in MFP was correlated with lower (higher) growth in the share of industry employment held by workers in these age groups.
    - However, this might simply be because the overall decrease in the supply of younger workers (due to increases in school retention rates) has affected industries differently.
    - The low productivity growth industries tend to be those with higher levels of part-time and casual work, which younger workers can combine with study. This may have caused the share of industry employment held by younger workers to have fallen more slowly, or risen, in most of these industries compared with the falls in the high productivity growth industries.
  - Higher (lower) growth in MFP was also correlated with higher (lower) growth in the share of employment held by workers in the 35-44 age group. However, this result is 'driven' by Electricity, gas and water, rather than being a strong 'universal' result.

Part-time and casual employment

- Part-time and casual employment has increased significantly.
  - Part-time employment rose from 16.0 per cent of total employment in 1978 to 25.7 per cent in 1997. The part-time employment share for the high productivity growth industries ranged between 2 and 8 per cent in 1978, rising to between 3 and 12 per cent in 1997.

- Casual employment in 1997 was 25.8 per cent of total employment compared with 16.1 per cent in 1985. The casual employment share for the high productivity growth industries ranged between 1 and 8 per cent in 1985 and between 6 and 17 per cent in 1997.

- Growth in part-time and casual employment reflects a number of changes in the labour market.
  - On the demand side, there are cost and flexibility benefits for employers from part-time and casual employment, particularly in rapidly growing service industries that have traditionally employed a higher proportion of part-time and casual workers. And institutional changes have reduced restraints on the number of people that can be employed on this basis.
  - On the supply side, there are benefits to employees in better balancing work and non-work aspects of life.
- There was no clear link between the shares of part-time and casual employment and productivity growth. These shares are likely to be a reflection of the different work requirements across industries, rather than their productivity growth.
- There was some correlation across market sector industries between higher (lower) MFP growth and higher (lower) *growth* in the share of part-time and casual employment.
  - This correlation is particularly influenced by the relatively low growth in the part-time and casual employment shares for Accommodation, cafes and restaurants and Cultural and recreational services. These industries already had high initial shares of these types of employment, so the increase was from a high base.

Employee earnings

- Average real ordinary time earnings for full-time adult permanent employees, used as an indicator of general trends in earnings, were $591 (at 1989-90 prices) in 1996, compared with $531 in 1987 — a real increase of over 11 per cent.
- The distribution of employee earnings across the workforce is affected by a wide range of factors, such as level of skill and age.
- Productivity growth is likely to have a positive effect on earnings, all other things equal, but not all of the benefits from productivity growth will necessarily be distributed as increases in earnings. Some of the benefits may be distributed as lower prices, higher profits and distributions to shareholders, and increases in non-monetary benefits to workers.

- Earnings were examined for three occupation groups — high-skilled white collar, high-skilled blue collar and low-skilled.
  - In the high productivity growth industries, workers in each occupation group were more likely to have a *level* of real earnings close to or above the total non-farm industries average. For the low productivity growth industries, there was much greater variation across industries.
  - Across the industries, *growth* in real earnings for the high-skilled white collar group was generally, although not universally, higher than earnings growth for the other occupation groups. This probably reflects demand for high-skilled white collar workers.
  - There is some evidence to suggest that, in the high productivity growth industries, productivity gains have been distributed more evenly among occupation groups than in the low productivity growth industries. Earnings growth for the high-skilled blue collar and low-skilled occupation groups tended to be lower in the low productivity growth industries than the high productivity growth industries.
  - However, for each occupation group, the variation across industries in real earnings growth was relatively small compared with the variation in MFP growth. Therefore, no systematic correlation between growth in real earnings and growth in MFP was found for any occupation group.

1 Scope of the paper

Community concerns about job security have escalated in recent years. In this context, some attention has focused on the employment effects of government reforms and other factors that enhance productivity.

A paper by the Industry Commission (IC) on *Assessing Australia's Productivity Performance* (IC 1997b) found that the evidence does not suggest a necessary link between productivity growth and lower aggregate employment or higher unemployment. Productivity growth has coincided with sustained employment growth over long periods in Australia and other OECD countries.

However, it is not just the change in the aggregate number of jobs, but also the nature of jobs and employment opportunities for particular groups of people that are of community concern. The IC (1997b, p. xxi) identified this as an issue for further research and noted that:

> 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.

This paper builds on the earlier IC work. It focuses on the relationship between multifactor productivity growth and the structure of employment. Specifically, the objective is to examine whether multifactor productivity growth is associated with changes in key characteristics of employment that are the focus of community attention:

- skill — the impact on workers with lower educational attainment or in low-skilled occupations;
- age — the effects on younger and older workers;
- part-time and casual employment — changes in the incidence of these work arrangements; and
- earnings — the impact on the distribution of earnings.

However, this paper does not seek to establish *causation*, it only examines if there is any *correlation* between multifactor productivity growth and changes in the structure of employment. To expand on this point, the paper examines only whether there has been any identifiable pattern in (say) the employment of part-time workers

among industries that have experienced productivity improvements. It does *not* attempt to go beyond this and establish whether the change in part-time employment has contributed to or dampened the increase in productivity, or whether productivity improvements have caused the change in part-time employment.

One important structural characteristic not covered in this paper is the regional dimension. As mentioned in the earlier IC paper, productivity growth may affect regional employment patterns. The Productivity Commission has undertaken an examination of some aspects of regional employment in another project (Productivity Commission 1998).

This paper also examines only 'net' effects on structural characteristics. For example, the net change in employment in a particular occupation is a combination of outflows (separations) and inflows (new hirings). Consequently, any impact that productivity growth may have on turnover in (say) an occupation will not be picked up. This affects interpretation of the results. For example, job security may be related more precisely to outflows (job separations) than to net flows.

Any structural changes identified do not necessarily indicate the emergence of adjustment problems. Such changes only indicate the potential for adjustment difficulties. The likelihood of a problem emerging depends largely on the 'job mobility' of the groups concerned. For example, adjustment problems stemming from any given structural change may be greater for older workers than for younger workers, given the greater re-employment opportunities generally open to younger workers.

On the productivity side, no distinction is made between the sources of productivity growth. All productivity growth is considered, regardless of whether it has come about through government-initiated reforms (for example, tariff changes and competition policy), technological change or any other source.

This paper also makes a more general contribution. Considerable effort was required to assemble a database to address the identified structural issues. Over the period of interest (late 1970s to 1990s), there have been several changes in ABS classifications and other problems that frustrate easy access to a consistent time-series dataset. The authors have assembled a dataset, based largely on unpublished ABS data. This dataset may assist others in further research of structural issues. It is available on request as a statistical annex to this paper. However, the dataset does have limitations. The crudeness of the concordances available to deal with the changes in classification systems is one significant problem. Sampling errors also become prominent in some instances. For these reasons, the data should be treated as indicative rather than precise. These limitations are discussed in some detail in appendix A.

2 Methodology and data

This chapter provides an explanation of the methodology and data used in the analysis of the employment characteristics presented in the following chapters.

2.1 Methodology

The objective of this paper is to examine possible links between productivity growth and the structure of employment.

One immediate difficulty is that the structure of employment — be it by age, skill, industry and so on — is affected by many other factors. For example, the age structure of the workforce is influenced by demographic factors, such as the ageing of baby boomers.

A challenge for this study therefore is to isolate the effects of productivity growth, on the structure of employment, from other possible influences.

One possible approach is to conduct econometric analysis at an aggregate employment level to help discriminate between a range of possible influences on the structure of employment. This approach would be very demanding in its data requirements as many different variables would have to be included in the range of possible influences. An econometric approach has not been used in this paper.

Instead, a form of cross-sectional analysis is used. Rather than examine aggregate trends, the employment profiles of industry sectors are examined and compared. The key to this approach is to see whether differences between industries, in terms of their productivity performance, bear any association with differences in their employment profiles.

Because the analysis focuses on *differences* between industries, the other factors that affect the structure of employment generally (and all industries approximately equally) are largely isolated.

Associations between productivity and the structure of employment are examined in two main ways. First, the structure of employment in high productivity growth industries is compared with the structure of employment in low productivity growth

industries to determine whether there are any systematic differences that appear to be associated with productivity growth. Employment structure is defined in terms of a percentage distribution of employment across different groupings, such as age groups, occupational groups, educational attainment groups and so on.

Second, industries are examined for any association between productivity growth and *changes* in their structure of employment over time. Two approaches are used.

- The time paths of productivity growth and structural change in employment in individual industries are examined for common trends. For example, a period of high productivity growth in an industry may be associated with a change in its employment profile.
- The group of industries is examined for the existence of a systematic pattern of association between productivity growth and structural change in employment over time. This is done by estimating a line of best fit between industry observations of productivity growth and change in employment structure, and subsequently testing the statistical significance of any correlation found.

A technical point on the 'line of best fit' analysis should be made clear. The calculations of growth rates (of productivity and change in employment profile) to be used in the analysis could be misleading if they were based only on the growth from the starting point to the ending point. For example, productivity can show some year-to-year volatility that does not reflect the underlying trend. To overcome this potential problem, trend rates of growth are used throughout this paper.

As noted in the previous chapter, the methodology used in this paper establishes correlation and not causation. Further interpretation is needed (and some guidance is provided in the paper) to discern whether there is a causal link and in which direction the link may be; or whether any correlation reflects the influence of some other factor external to the analysis.

Cross-classifications of employment characteristics by gender (as well as industry) could be accessed for this study. This means the industry comparisons are conducted for males, females and persons for each of the employment characteristics. Further cross-classifications of characteristics (for example, by age and educational attainment) were prevented by the sample size of the survey source, which makes finely cross-classified estimates for some industries subject to high potential error.

2.2 Data

Data sources

Multifactor productivity

In this paper, the term productivity refers to multifactor productivity (MFP), unless otherwise specified. Sectoral MFP estimates have been constructed by the Commission using data collected by the ABS. The details of this estimation work were reported in Gretton and Fisher (1997). Sectoral estimates, and estimates for eight industry groups within Manufacturing, were published in that paper for 1974-75 to 1994-95. The sectoral estimates have been revised and updated to 1995-96. Further details related to MFP are in appendix A.

The estimates are taken to be the best available productivity indicators. It is recognised that questions are sometimes raised about the ability of productivity estimates to capture all aspects of performance, especially in service industries. However, it is not possible to make allowance in this paper for possible measurement errors of unknown magnitude. For the type of analysis used in this paper, possible measurement errors are unlikely to influence the general conclusions reached.

Employment characteristics

The main source of the employment data used in this paper is the ABS Labour Force Survey (LFS) and associated supplementary surveys. The LFS was selected because it contains a time series comprising more demographic data that can be cross-classified with employment than other available surveys. It is the only source of annual data for employment cross-classified by educational attainment and age. The LFS is also the main survey that provides data for employed persons rather than employees.

The LFS provides the most overall consistency across employment characteristics. However, earnings data have been taken from the ABS Employee, Earnings and Hours (EEH) survey because the earnings measures available from the LFS are not appropriate for the analysis in this paper. More specifically, the LFS does not provide a measure of ordinary time earnings, only total earnings. The suitability of the EEH earnings data for time series analysis is discussed in appendix A.

The estimates provided by the ABS are subject to high standard errors for some of the cross-classifications of the data. Details of sampling errors are provided in appendix A. Where estimates subject to high standard errors are used in this paper, their potential unreliability is flagged. When testing for significance of correlations

between variables, the most unreliable estimates are excluded to avoid distorting the analysis. Small sample problems often arise in Electricity, gas and water and Mining, particularly for females. Specific exclusions are listed in the notes attached to the relevant figures and tables and detailed in appendix B.

Data coverage

Industry classification

The Australian and New Zealand Standard Industrial Classification (ANZSIC) is used in this paper. This classification, which replaced the Australian Standard Industrial Classification (ASIC), was introduced by the ABS in 1994-95 for the LFS (and supplementary surveys) and the EEH survey. The month of introduction varied by survey. ASIC data have been reclassified to ANZSIC industries. The reclassification was based on a broad rather than precise correspondence, due to the limited availability of cross-classified data (see appendix A for concordance and further details). But, as trends in the *share* of employment classified by particular characteristics are the main focus of this paper, the detail in the concordances is considered suitable for the examination of correlations in this paper.[1] However, the limitations of the reclassification should be borne in mind when interpreting the absolute *numbers* for industry employment.

The reclassification of ASIC data to ANZSIC industries for the MFP estimates was more sophisticated and is outlined in Gretton and Fisher (1997).

Industry coverage

The industry coverage in this paper is limited to the market sector of the economy[2], because the measurement of aggregate MFP is restricted to the market sector. The non-market sector covers a number of activities in the service 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 would make little sense.

[1] It should be noted that, for most employment characteristics, there is a break in the data series at 1994 (for August data series) or 1995 (for May data series) with the introduction of ANZSIC. For employment by full-time/part-time status, the ABS has backcast data using more sophisticated concordances from 1985 to 1993. The break in this series therefore occurs in 1985.

[2] The definition of the market sector adopted is that used in ABS (1997b). Changes made by the ABS as part of ABS (1999) are not considered in this paper.

All market sector industries are covered, but there is particular focus on selected high and low productivity growth industries. The majority of the analysis is based on industry sectors at the ANZSIC division level of classification. The brief analysis of Manufacturing at a more disaggregated level, provided in appendix C, is broadly based on ANZSIC subdivisions (see appendix A).

The selection of the high and low productivity growth industries is based on average annual compound MFP growth rates over the period 1978-79 to 1995-96 (see table 3.2). Agriculture and Mining are excluded from most of the analysis because of their volatility, but are included in the market sector average.[3] Industries are grouped as high or low productivity growth depending on whether their MFP growth rate was above or below the (weighted) average for the market sector over the period. The high productivity growth industries are Electricity, gas and water, Manufacturing and Transport, storage and communication. The low productivity growth industries are Retail trade, Wholesale trade, Construction, Accommodation, cafes and restaurants, and Cultural and recreational services.

The general approach taken in this paper is to use benchmarks to help to insulate the analysis from the effects of many of the factors other than productivity that can affect structural employment characteristics. Two benchmarks are used. First, for the analysis of the employment characteristics alone, Total industries was chosen as the benchmark to reflect the general economywide trends in the structure of employment. Second, where MFP growth and employment are examined together, the market sector is used because there is no MFP measure available for Total industries.

Employment coverage

MFP estimates are based on hours worked by employed persons. Employed persons comprise employees, employers, workers on own account and contributing family workers (see ABS 1997c for detailed definitions). Therefore, the employment analysis in this paper uses employed persons (15 years and over, unless otherwise specified) where possible. There are also more cross-classified data available for employed persons (particularly for demographic characteristics). However, as data are not available for earnings and the permanent/casual split of employment for all employed persons, data for employees are used.

[3] For the earnings characteristic (chapter 7), data for Agriculture are not available so the non-farm market sector has been used. MFP growth in the non-farm market sector has averaged less than the MFP growth in the market sector.

Period examined

Because of data limitations, this paper uses different time periods for different employment characteristics. The time periods used are:

- educational attainment — February 1984 to 1988 and May 1989 to 1997;
- occupation — August 1986 to 1995;[4]
- age — August 1978 to 1997;
- full-time/part-time — August 1978 to 1997;
- permanent/casual — August 1985 to 1997; and
- earnings — May 1987 to 1996.[5]

MFP is matched to the employment time series as appropriate for each characteristic. As indicated earlier, the latest industry MFP estimates available are for 1995-96. When employment and MFP are being jointly analysed, the employment time series is truncated where necessary.

4 Data after this period have not been used due to the introduction by the ABS of a new occupation classification system. It was not possible to convert all data available to either the new or the old classification system.

5 As for footnote 4.

3 Industry perspective on productivity and employment

This chapter provides some context in terms of trends in productivity and employment at the industry sector level within the market sector. The structure of employment is examined in the following chapters.

3.1 Employment by industry

The distribution of employment across market sector industries has changed over time. Table **3.1** illustrates the changes between 1978 and 1997. Total employment fell in only two industries — Electricity, gas and water and Manufacturing.[1] All the other market sector industries have experienced employment growth, particularly those that are service industries.

However, as a result of strong growth in the non-market sector, which is also made up of service industries, market sector employment has decreased from 70 to 61 per cent of total employment over this period. The non-market sector in this analysis includes Finance and insurance, Property and business services, Government administration and defence, Education, Health and community services, and Personal and other services.

Table 3.1 shows that female employment has grown more strongly than male employment. This reflects the operation of supply-side factors (for example, a higher participation rate), as well as demand-side factors, in the growth of total employment.

[1] The fall in persons employed in these two industries is of a similar magnitude in table 3.1. However, the limitations of the Australian Standard Industrial Classification (ASIC) to Australian and New Zealand Standard Industrial Classification (ANZSIC) concordance used mean that these absolute employment numbers are only indicative of the broad direction of change, rather than reliable estimates of the magnitude of the change (see chapter 2).

Table 3.2 **Employment[a] by industry division, by gender, 1978 and 1997[b]**

Industry	1978[c,d] Number	1978[c,d] Share of total	1997 Number	1997 Share of total	Difference[d] Number	Difference[d] Per cent
	'000	%	'000	%	'000	%
Males						
Agriculture	293.0	7.6	290.0	6.1	-3.0	-1.0
Mining	73.5	1.9	74.2	1.6	0.7	1.0
Manufacturing	880.5	22.9	848.0	17.9	-32.5	-3.7
Electricity, gas and water	106.6	2.8	58.5	1.2	-48.1	-45.1
Construction	442.5	11.5	492.8	10.4	50.3	11.4
Wholesale trade	267.0	6.9	327.5	6.9	60.5	22.7
Retail trade	466.7	12.1	588.5	12.4	121.8	26.1
Trans., storage and comm.	381.2	9.9	405.4	8.6	24.2	6.3
Accomm., cafes and rest.	78.8	2.0	176.1	3.7	97.3	123.5
Cultural and rec. services	45.1	1.2	102.9	2.2	57.8	128.2
Market sector	3 034.9	78.8	3 363.9	71.1	329.0	10.8
Total industries	**3 850.9**	**100.0**	**4 729.2**	**100.0**	**878.3**	**22.8**
Females						
Agriculture	81.8	3.8	129.4	3.6	47.6	58.2
Mining	5.5	0.3	7.3	0.2	1.8	32.7
Manufacturing	313.8	14.6	296.7	8.3	-17.1	-5.4
Electricity, gas and water	8.5	0.4	7.7	0.2	-0.8	-9.4
Construction	44.4	2.1	74.3	2.1	29.9	67.3
Wholesale trade	96.3	4.5	144.3	4.0	48.0	49.8
Retail trade	418.0	19.4	608.7	17.0	190.7	45.6
Trans., storage and comm.	77.5	3.6	136.7	3.8	59.2	76.4
Accomm., cafes and rest.	110.1	5.1	217.1	6.1	107.0	97.2
Cultural and rec. services	37.1	1.7	93.4	2.6	56.3	151.8
Market sector	1 193.0	55.4	1 715.6	47.8	522.6	43.8
Total industries	**2 154.4**	**100.0**	**3 586.3**	**100.0**	**1 431.9**	**66.5**
Persons						
Agriculture	374.9	6.2	419.4	5.0	44.5	11.9
Mining	79.0	1.3	81.5	1.0	2.5	3.2
Manufacturing	1 194.2	19.9	1 144.7	13.8	-49.5	-4.1
Electricity, gas and water	115.1	1.9	66.2	0.8	-48.9	-42.5
Construction	486.9	8.1	567.1	6.8	80.2	16.5
Wholesale trade	363.3	6.0	471.8	5.7	108.5	29.9
Retail trade	884.7	14.7	1 197.2	14.4	312.5	35.3
Trans., storage and comm.	458.7	7.6	542.2	6.5	83.5	18.2
Accomm., cafes and rest.	188.9	3.1	393.2	4.7	204.3	108.2
Cultural and rec. services	82.2	1.4	196.2	2.4	114.0	138.7
Market sector	4 227.9	70.4	5 079.5	61.1	851.6	20.1
Total industries	**6 005.4**	**100.0**	**8 315.5**	**100.0**	**2 310.1**	**38.5**

a Persons 15 years and over. **b** August data. **c** Data in ASIC reclassified to ANZSIC as outlined in appendix A. **d** Subject to the limitations of the ASIC/ANZSIC concordance used, as outlined in chapter 2.

Sources: Based on ABS (*The Labour Force, Australia, Historical Summary, 1966 to 1984*, Cat. no. 6204.0); ABS Labour Statistics on dX-Online database (accessed 30 September 1997).

3.2 Industry trends in output, productivity and employment

A range of factors affects the pattern of employment across industries. Over the long term, declines in agriculture and manufacturing could be seen as part of a general, worldwide secular trend. Clark, Geer and Underhill (1996, p. 24) summarise some of the factors behind this trend:

> Over the course of this century we have seen the impact of new technologies and more efficient production techniques leading to a fall in the relative importance of agriculture in terms of both current-price output and employment. At the same time people's incomes have risen, resulting in a falling proportion of income spent on food. The case with respect to manufacturing is much the same, with labour-saving technologies freeing up labour to move into other fields. Further, as incomes have risen the demand for services has risen. Services such as health, education, transport, communication, entertainment, childcare and takeaway foods have all become more important in terms of both employment and output.

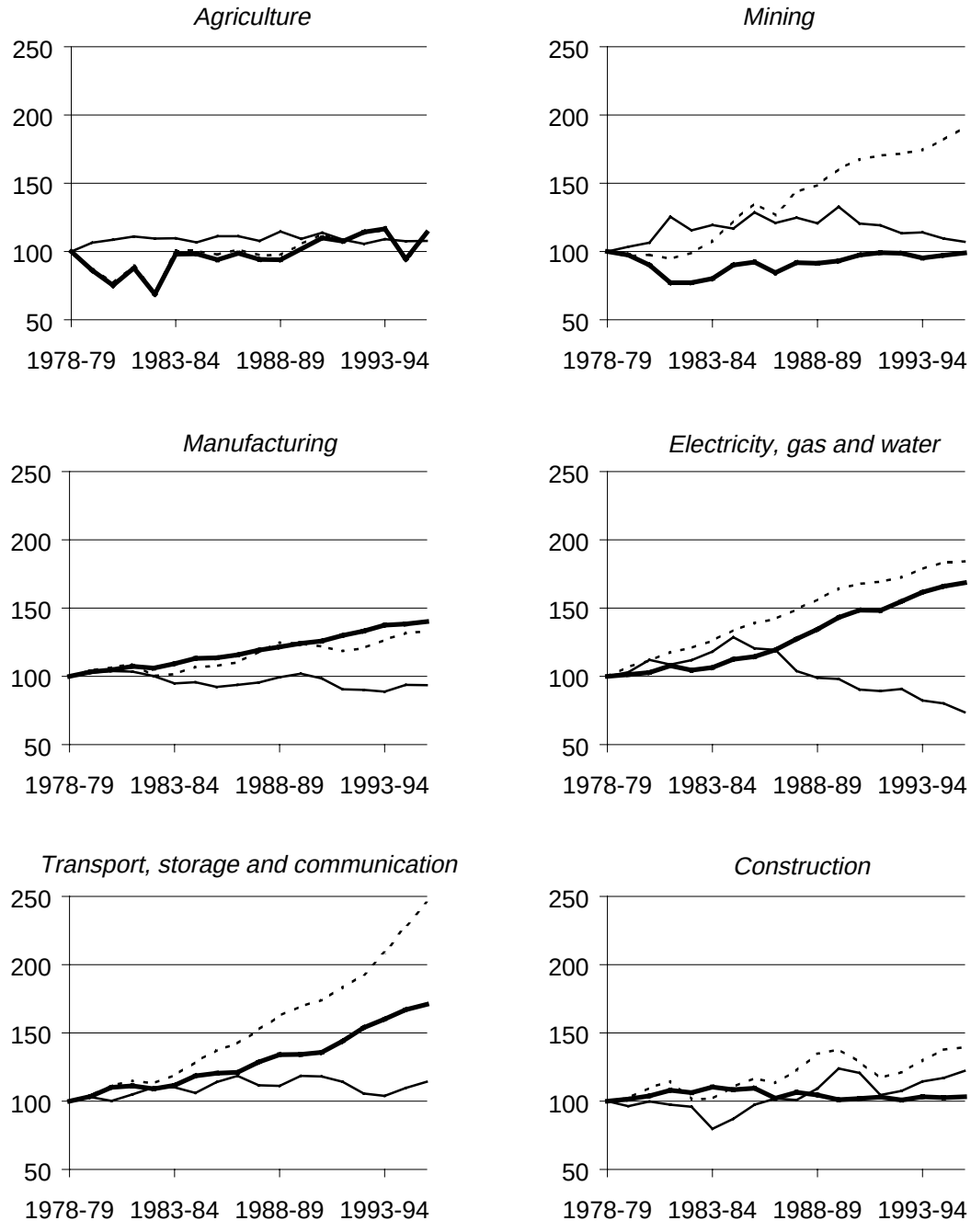
In the case of manufacturing, the decline is also partly due to the contracting out of services. When some services previously performed in-house, such as accounting, cleaning and maintenance, are contracted out, they are then recorded as part of the service sector. This lowers recorded employment in manufacturing and raises service sector employment.

The pattern of productivity, output and employment growth has varied by industry. This paper focuses on industries in the market sector. Figure **3.1** presents multifactor productivity (MFP), output and employment for these industries over the period 1978-79 to 1995-96, with indexes based on 1978-79 values. The trends illustrated in the figure are summarised in table **3.3** as average annual compound growth rates.

Figure **3.2** demonstrates that real output has grown in each market sector industry. However, from table **3.4**, it can be seen that some industries have grown faster on average than others, resulting in structural change in the economy. Because of this difference in output growth rates and changing labour requirements, employment growth has differed across industries. In relatively labour intensive industries, such as Accommodation, cafes and restaurants and Cultural and recreational services, output growth has been accompanied by relatively strong employment growth. In

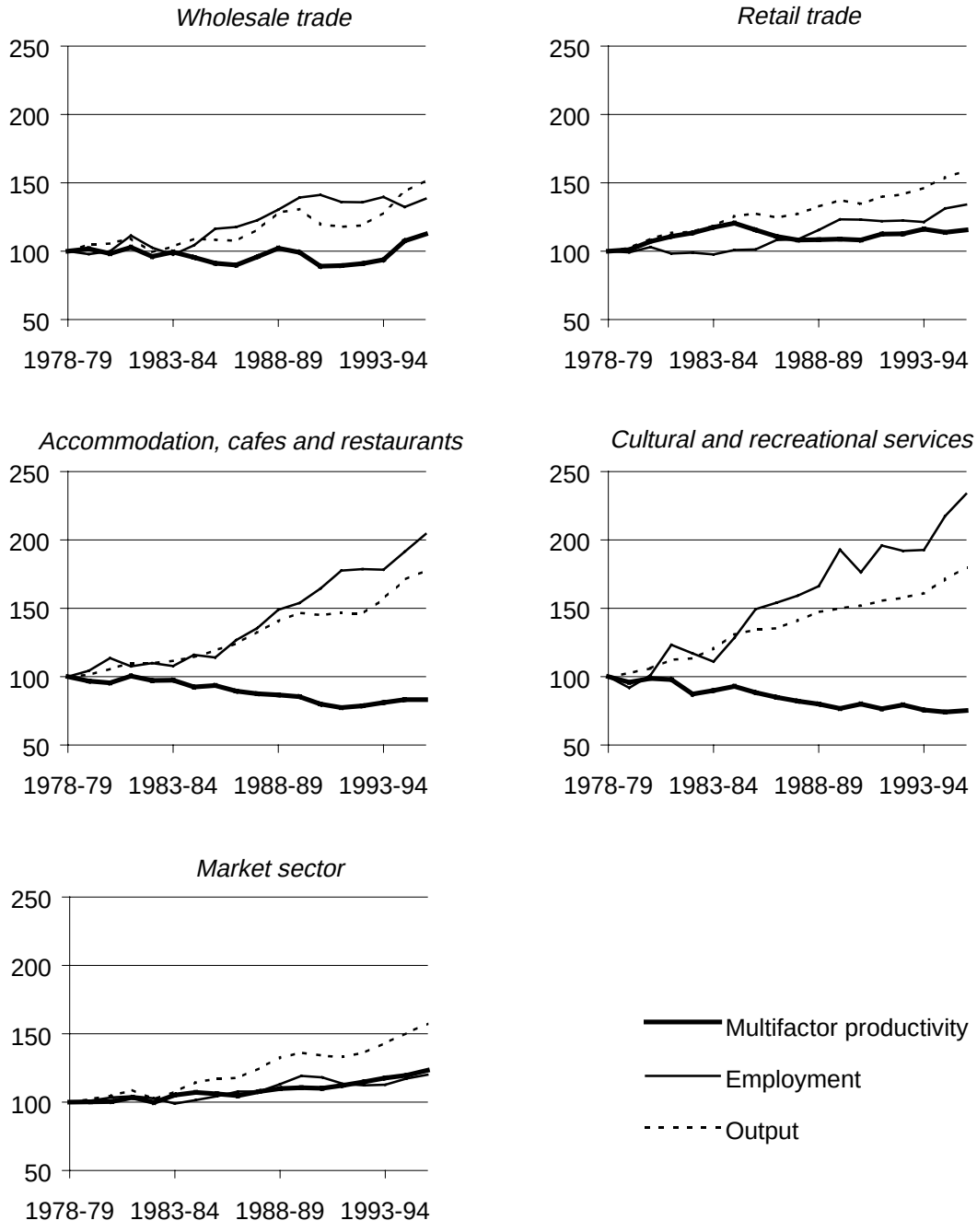
contrast, employment growth in Electricity, gas and water and Manufacturing has been negative, despite positive output growth.

Figure 3.3 **MFP, output[a] and employment[b] by industry, 1978-79 to 1995-96**
Index 1978-79 = 100



(Continued on next page)

Figure 3.1 **(Continued)**



a Real output index is based on gross product at average 1989-90 prices. **b** Employed persons series have been constructed using ABS ASIC data, together with the concordance in appendix A, for August 1978 to 1984 and ABS ANZSIC series for August 1985 to 1997.

Data sources: MFP is updated from Gretton and Fisher (1997); output is based on ABS (*Australian National Accounts*, Cat. no. 5204.0); employment is based on ABS (*The Labour Force, Australia, Historical Summary, 1966 to 1984*, Cat. no. 6204.0) and ABS Labour Statistics on dX-Online database (accessed 30 September 1997).

Table 3.5 **Average growth[a] in MFP, employment and output, by industry, 1978-79 to 1995-96[b]**

Industry[c]	*MFP growth*	*Employment growth*	*Output growth*
	%	%	%
Electricity, gas and water	3.8	-2.0	3.9
Transport, storage and communication	3.3	0.5	6.1
Manufacturing	2.1	-0.6	1.7
Agriculture	1.8	0.1	1.6
Mining	0.7	0.2	5.1
Retail trade	0.4	2.0	2.5
Wholesale trade	0.0	2.5	2.1
Construction	-0.2	1.6	1.9
Accommodation, cafes and restaurants	-1.4	5.0	3.6
Cultural and recreational services	-1.8	5.9	3.5
Market sector	1.2	1.1	2.8
Total industries	**na**	**1.9**	**3.3**

a MFP, output and employment growth are average annual compound growth rates calculated from the end points of linear trend lines fitted to time series data. **b** Employment estimates are based on data for the month of August. Other estimates are based on financial year data. Time period differs to previous table because MFP data are not available after 1995-96. **c** Ranked by MFP growth. **na** Not available.

Sources: MFP estimates are updated from Gretton and Fisher (1997); output estimates are based on ABS *(Australian National Accounts*, Cat. no. 5204.0); employment estimates are based on ABS *(The Labour Force, Australia, Historical Summary, 1966 to 1984*, Cat. no. 6204.0) and ABS Labour Statistics on dX-Online database (accessed 30 September 1997).

A perspective on the relative importance of output growth and changes in unit labour requirements (hours worked per unit of output) can be obtained from a statistical decomposition of changes in employment growth. This approach attributes changes in employment to growth in output and changes in unit labour requirements. It is a purely statistical or accounting approach and does not demonstrate causal relationships. For example, an improvement in labour productivity may be reflected in reduced unit labour requirements, but may also stimulate output growth through increased export demand or reduced import substitution.

Table 3.3, based on de Laine, Lee and Woodbridge (1997), shows the decomposition of changes in employment for two periods, 1977-78 to 1983-84 and 1983-84 to 1992-93. These periods were chosen as corresponding to periods before and after the implementation of microeconomic reforms, and as similar parts of the business cycle. Total employment increased in both periods, although by more in the second period than in the first period. In both periods, change in gross output was the most important source of change in employment. Increases in labour productivity (the inverse of labour requirements) were a source of employment decline.

In the first period, employment increased in all industries (because of relatively strong output growth) except Manufacturing and Construction. The decline in employment in Manufacturing can be partitioned, virtually equally, into that linked to output decline and that linked to the increase in labour productivity. In Construction, employment declines accounted for by labour productivity improvements outweighed employment gains from increases in gross output.

In the second period, employment increased in only four industries — Construction, Wholesale and retail trade, Financial and business services[2], and Recreation and other services. Employment growth accounted for by output growth increased in all industries bar Construction. But there were larger reductions in labour requirements in those industries in which total employment fell.

Table 3.6 **Sources of absolute changes in employment**

Persons

	1977-78 to 1983-84			*1983-84 to 1992-93*		
Industry[a]	*Change in employment*	*Change due to change in labour productivity*	*Change due to change in gross output*	*Change in employment*	*Change due to change in labour productivity*	*Change due to change in gross output*
	'000	'000	'000	'000	'000	'000
Agriculture	19.6	-51.4	71.0	-3.2	-96.2	93.1
Mining	15.1	-16.8	31.9	-11.0	-73.5	62.6
Manufacturing	-113.5	-56.2	-57.3	-52.9	-268.7	215.9
Electricity, gas and water	31.0	-5.7	36.6	-45.4	-98.0	52.6
Construction	-72.7	-224.8	152.1	123.4	108.6	14.7
Wholesale and retail trade	48.4	6.3	42.1	337.4	89.2	248.1
Transport and communications	55.3	16.2	39.1	-21.6	-351.0	329.5
Financial and business services	125.9	19.6	106.3	337.6	44.6	292.9
Recreation and other services	36.6	-13.0	49.6	373.4	96.5	276.9
Total[b]	**145.7**	**-325.8**	**471.4**	**1 037.8**	**-548.4**	**1 586.2**

[a] This table uses ASIC industry classification, which differs from the ANZSIC industry classification used elsewhere in this paper. [b] Public administration and defence and Community services are omitted because the measures of real output assume no change in labour productivity. The total also excludes these industries.

2 Financial and business services are not examined elsewhere in this paper. MFP estimates are not available for this industry and it is not part of the market sector as defined in ABS (1997b). Table 3.3 deals only with labour productivity.

Source: de Laine, Lee and Woodbridge (1997, pp. 17, 19).

The industries classified as high MFP growth in this paper (Manufacturing, Electricity, gas and water, and Transport, storage and communication), showed larger declines due to labour productivity in the second period, but also larger output effects.

Returning now to MFP growth, the relationship between MFP and employment in Electricity, gas and water and in Manufacturing is of particular interest, given that high MFP growth comes at the same time as a decline in employment (table 3.2). Electricity, gas and water is an industry sector that has undergone significant structural change. Its workforce has declined by 43 per cent over the period 1978 to 1997. Indeed, this downsizing may be a source of MFP growth in this industry. However, as said above, the industry is small in relation to total overall employment and so the effect of downsizing on the overall structure of employment may be small. Manufacturing, as a large employer, may have greater influence on the overall structure of employment. It is also an industry sector made up of a number of diverse industries. Some examination of the employment structure of industries within the manufacturing sector is provided in appendix C.

The experience for Electricity, gas and water and Manufacturing cannot be generalised to all industries or aggregate employment. The Industry Commission (1997b) found that the evidence does not suggest a necessary link between productivity growth and lower aggregate employment or higher unemployment. It also noted that the relationship between MFP and employment growth varied across industries and within industries across time periods (with both the magnitude and direction of the relationship changing).

Figure 3.2 illustrates the industry variation in MFP, output and employment growth.[3] Manufacturing and Electricity, gas and water are the only industries in the segment with positive MFP growth and *negative* employment growth. These industries also have positive output growth. Most industries and the market sector as a whole are in the segment of positive growth in productivity, output and employment. Only Accommodation, cafes and restaurants, Cultural and recreational services and Construction are in the segment of positive employment growth and

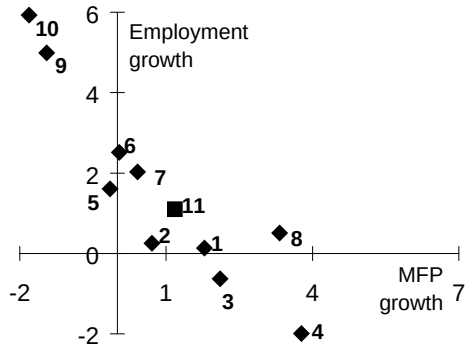
[3] While the first panel of figure 3.2 seems to suggest a negative relationship between MFP growth and employment growth across industries, caution must be observed in drawing strong conclusions. Sectoral data do not reflect the net outcome for the whole economy of the direct and compensatory effects of MFP change, as indicated by the positive relationship between growth in MFP and employment for the total market sector. In addition, neither the aggregate nor the sectoral data can distinguish between the impact of MFP growth and other factors on employment.

negative (measured) MFP growth. However, aside from any effect on the number of jobs, productivity growth may affect the structure of employment. It is this issue that is examined in the rest of this paper.

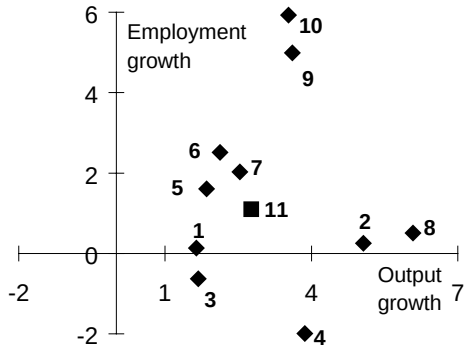
Figure 3.4 **Average growth rates[a] of MFP, employment and output, 1978-79 to 1995-96[b]**

Per cent per year

MFP and employment



Output and employment



1 Agriculture
2 Mining
3 Manufacturing
4 Electricity, gas and water
5 Construction
6 Wholesale trade
7 Retail trade
8 Transport, storage and communication
9 Accommodation, cafes and restaurants
10 Cultural and recreational services
11 Market sector

a Growth rates are measured using average annual compound formula on the end points of linear trend lines through time series data. **b** The employment data are averages between August 1978 and August 1995. The MFP data are averages between financial years 1978-79 and 1995-96.

Data sources: Estimates for MFP are updated from Gretton and Fisher (1997); estimates for output based on ABS (*Australian National Accounts*, Cat. no. 5204.0); estimates for employment based on ABS (*The Labour Force, Australia, Historical Summary, 1966 to 1984*, Cat. no. 6204.0) and ABS Labour Statistics on dX-Online database (accessed 30 September 1997).

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4 Employment by skill

The Industry Commission stated in its paper, *Assessing Australia's Productivity Performance*, that it is generally believed in many countries that productivity growth has led to a reduction in demand for low-skilled occupations and workers and increased demand for high-skilled workers. It also noted that 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 (IC 1997b).

A range of factors affecting the skill of the workforce is briefly discussed in the following two sections. However, the main purpose of this chapter is to examine the Australian evidence on whether productivity growth is associated with changes in the skill profile of the workforce.

4.1 Factors affecting skilled employment

Skill is multidimensional. EPAC (1996b) identifies three interrelated sources of skills: inherited personal characteristics; skills developed through formal education and training; and skills developed through work experience and informal training. In this paper, broad groupings based on educational attainment and occupation are used as indicators of skill. Measurement of skill is discussed further in section 4.3.

The structure of the workforce in terms of skill has changed over time, with the average skill level (as measured in a variety of ways) increasing. A number of demand and supply side factors have contributed to the change, together with institutional changes.

On the demand side, the demand for skills is driven by firms' need for employees to perform more demanding tasks. The wages and salaries that must be paid to attract skilled employees puts a curb on the demand for skill. On the supply side, people make decisions about investing in human capital for a range of personal and financial reasons.

A range of factors affects the skill composition of employment. Some industries are affected more than others. These factors include the following.

- Shifts in the composition of production.
  - Growth in the demand for services has been a major factor changing the composition of production. Rapid growth in the service sector has led to growth in white collar employment, both high and low skill, with many of these new jobs placing a greater emphasis on interpersonal skills rather than the physical or motor skills required for many low-skilled blue collar production jobs.
- Expansion of international trade.
  - The effect of international trade on the demand for low-skilled workers is the subject of debate (see OECD 1996b for example). An increase in international trade will result in a relative decrease in demand for low-skilled labour if imports are concentrated in sectors that employ a larger proportion of low-skilled workers and exports are concentrated in sectors that employ predominantly high-skilled workers.
  - However, EPAC (1996a) suggested that there was insufficient evidence to draw definite conclusions about the link between changes in Australia's pattern of international trade and increased demand for skilled labour.
- Technological change.
  - The implications of technological change for the skill composition of the workforce depend on the type of technological change and the area of application. Overall the net effect is unclear. EPAC (1996a) suggested that definite conclusions about the net effect cannot be drawn from available evidence. The role of technological change, and productivity growth in general, is discussed in the next section.

On the supply side, the number of skilled workers has increased. The proportion of people staying on at school and undertaking post-school education and training has increased. EPAC (1996b) attributed increasing school retention rates to a variety of factors including government incentives, declining youth employment opportunities and the perception that improved qualifications lead to better job opportunities.

4.2 Skill composition of the employed workforce and productivity

Productivity and skill are interdependent. The development of skills can affect productivity growth. But some forms of productivity growth (for example, technological change) can affect the demand for skills in some circumstances.

Productivity depends, in part, on the knowledge, skills and attitudes of the labour force. Skill plays a key role in enhancing employees' flexibility and effectiveness. It has also been argued that education levels are linked to productivity *growth*. This is based on the idea that a more educated workforce will be able to develop, modify and adapt to new processes and techniques, allowing productivity to rise more rapidly (see OECD 1994 for example).

On the other hand, changes in productivity may result in changes in the demand for, and supply of, certain skills. The links between productivity growth and changes in the skill composition of employment are not straightforward — they depend on the source of the productivity growth.

One major source of productivity growth is technological change. Despite considerable debate internationally over how much of the decreased demand for low-skilled workers is due to technological change, this issue remains unresolved (OECD 1996b). However, in some circumstances, the links are clearer. OECD (1998b, p. 54) notes

> In general, the generation and diffusion of new technologies, shifts in the composition of final demand, and shifts in labour supply all underlie changes in the skill composition of employment and in the importance of different occupational categories to job growth. Even though it is hard to identify the impact of each, it is generally agreed that when new technologies are introduced into production processes, the demand for low-skilled workers drops and that for high-skilled workers rises. At the same time, and in addition to this upskilling, technology can also have a "deskilling" effect. As new technologies perform a greater variety of tasks, the skills required for certain occupations may be reduced. There is, in fact, evidence that IT [information technology] is reducing the requirements of middle-management jobs, traditionally thought of as skilled.

Another source of productivity growth is increased competitive pressures. For example, industries that have been shielded from competitive pressures may have been able to maintain higher manning levels than otherwise would be the case. There is strong evidence of this in Australian government business enterprises in the infrastructure area. When these industries have been exposed to clearer commercial operating guidelines and competition in order to increase their productivity, labour shedding has been commonly observed. A point of interest is whether low-skilled workers are more likely to be affected by labour shedding than high-skilled workers.

4.3 Measurement of skill

To examine the link between skill and productivity growth, skill needs to be measured. Since skill is a multidimensional concept, direct measurement is difficult

and, in empirical work, proxies for skill are often used. Two commonly used proxies are educational attainment and occupation.

Each of these proxies has its limitations (see Spenner 1990 for a detailed discussion of alternative measures of skill). It is to the lack of direct or objective measures of skill and the use of proxies that OECD (1996b) attributes, in part, the lack of consensus about the impact of technical change on the skill composition of employment.

Limitations of the educational attainment measure include the following.

- Educational attainment does not capture variations in the quality of schooling over time.
- The amount of schooling and actual skill requirements of the job often do not correspond. The use of credentials as a screening mechanism for jobs can mean that the employee has skills in excess of those needed for the job.
- On-the-job learning (on-the-job training and work experience) is not captured because only formal training is covered.

Nonetheless, according to the OECD (1994), measures of educational attainment are reasonable proxies for 'human capital'.

Occupation can be highly correlated with formal education. For example, most high-skilled white collar occupations require tertiary qualifications and high-skilled blue collar occupations require trade qualifications. But for some occupations, such as some low-skilled blue collar occupations, formal education may be less important, with greater reliance placed on on-the-job training and experience. However, occupation as a measure of skill also has its limitations, which include the following.

- Some occupational classifications, particularly at high levels of aggregation, can embrace some heterogeneous skills.
- The skill content of both high-skilled and low-skilled occupations may have changed over time.

Educational attainment and occupation are used in the following sections as complementary measures of skill. For both these proxies, broad groupings related to skill are used, rather than detailed groupings. Educational attainment is mainly examined in terms of whether or not workers have post-school qualifications. Occupation is based on four broad groups: high-skilled white collar, high-skilled blue collar, low-skilled white collar and low-skilled blue collar.

4.4 Educational attainment

Trends in employment by educational attainment

Construction of a continuous data series on educational attainment is hampered by changes in the classification systems used by the ABS. Only broad classification is possible. The following classification system based on completion of different stages of education is used in this paper.

1. With post-school qualifications, which includes:
   (a) degree or higher (a bachelor degree, a graduate or post-graduate diploma, masters degree or a doctorate); and
   (b) other qualifications (including vocational or trade qualifications).
2. Without post-school qualifications, which includes:
   (a) completed secondary school (the highest level of secondary school available at the time the employee left school, for example, Year 12 or equivalent);
   (b) did not complete secondary school (including employees who never attended school); and
   (c) still at school.

Differences in collection methods and definitions that affect the series presented in this chapter are detailed in appendix A. One major reclassification instituted by the ABS in 1993 involved a reclassification of people holding qualifications earned as a result of less than one semester's full-time study from the 'with post-school qualifications' group to the 'without post-school qualifications' group. This change, combined with another change to the wording of the questionnaire, is estimated by the ABS to have lowered the total for the 'with post-school qualifications' group in 1993 by 400 000 to 500 000 compared with the old methodology (ABS 1993b). Sufficient information was not available to make appropriate adjustments to take account of this change at the industry sector level. This creates a break in the series presented in this chapter, which affects the validity of comparisons made between data before and after 1993. Where possible, an indication of whether the comparison may underestimate or overestimate the change is provided.

Profile of employment by educational attainment

The workforce has become better educated on average. Between February 1984 and May 1997, the share of the employed workforce with post-school qualifications

increased steadily from around 44 to 48 per cent[1] (table **4.1**). Both males and females are becoming better educated — females at a faster rate. However, the share of more qualified females has been consistently lower than the share of more qualified males.

The other side of the increase in educational attainment is the decrease in the share of workers without post-school qualifications (figure **4.1**). A fall in the proportion of workers who did not complete secondary school was the factor largely responsible (figure **4.2**).

There are supply and demand factors behind the trend to more educated workers. Strong increases in retention rates to Year 12 have increased the supply of relatively more skilled workers (and reduced the supply of workers without completed secondary education). The Year 12 retention rate has increased dramatically — from 45 per cent in 1984 to 71.8 per cent in 1997 (ABS 1998a).

Table 4.2 **Employment by educational attainment, by gender, 1984 and 1997**

15-64 year olds

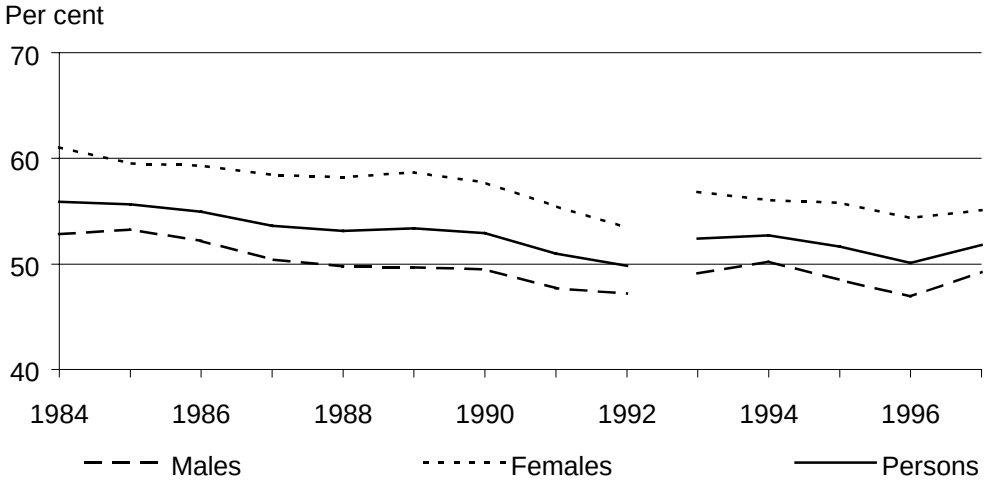
	1984[a]		*1997*[b]		*Difference*[c]	
Education group	*Number*	*Share of total*	*Number*	*Share of total*	*Number*	*Per cent*
	'000	%	'000	%	'000	%
Males						
With post-school qualifications	1 859.2	47.2	2 362.3	50.8	503.1	27.1
Without post-school qualifications	2 082.0	52.8	2 292.4	49.2	210.4	10.1
Total	**3 941.2**	**100.0**	**4 654.7**	**100.0**	**713.5**	**18.1**
Females						
With post-school qualifications	914.7	38.9	1 608.9	44.9	694.2	75.9
Without post-school qualifications	1 433.8	61.1	1 975.4	55.1	541.6	37.8
Total	**2 348.5**	**100.0**	**3 584.4**	**100.0**	**1 235.8**	**52.6**
Persons						
With post-school qualifications	2 773.9	44.1	3 971.3	48.2	1 197.3	43.2
Without post-school qualifications	3 515.8	55.9	4 267.8	51.8	752.0	21.4
Total	**6 289.7**	**100.0**	**8 239.0**	**100.0**	**1 949.3**	**31.0**

a February data. **b** May data. **c** Break in series in 1993 means comparisons between 1984 and 1997 may underestimate the rise in the 'with post-school qualifications' group and overestimate the rise in the 'without post-school qualifications' group.

Sources: Based on ABS (*Labour Force Status and Educational Attainment, Australia*, Cat. no. 6235.0; *Transition from Education to Work, Australia*, Cat. no. 6227.0; unpublished data).

[1] Due to the break in series in 1993, this percentage change underestimates the actual increase.

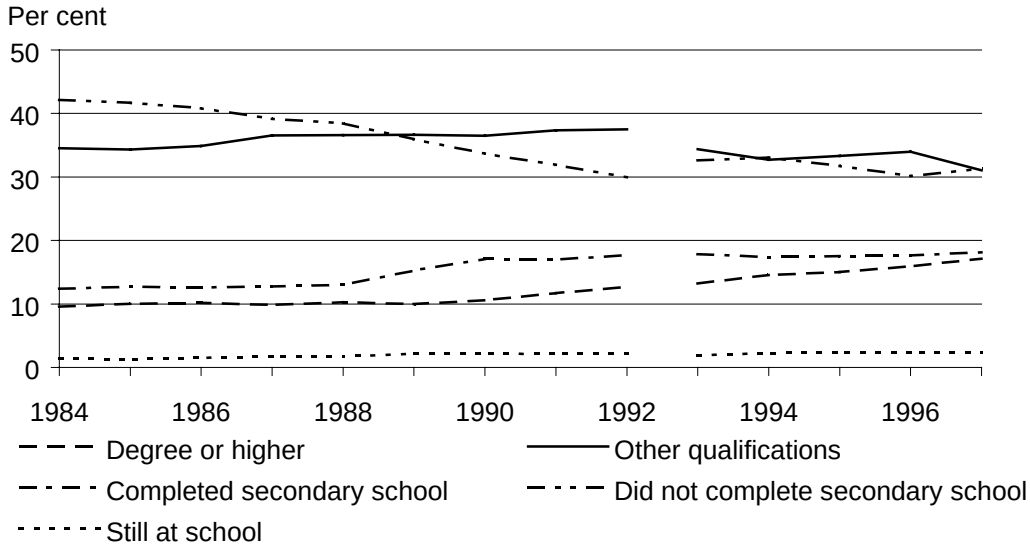
Figure 4.3 **Share of the employed workforce[a] without post-school qualifications, by gender, 1984 to 1997[b]**



a 15-64 year olds. **b** February data from 1984 to 1988 and May data from 1989 to 1997.

Data sources: Based on ABS (*Labour Force Status and Educational Attainment, Australia*, Cat. no. 6235.0; *Transition from Education to Work, Australia*, Cat. no. 6227.0; unpublished data).

Figure 4.4 **Share of employed workforce[a] by educational attainment subgroup, 1984 to 1997[b]**



a 15-64 year olds. **b** February data from 1984 to 1988 and May data from 1989 to 1997.

Data sources: Based on ABS (*Labour Force Status and Educational Attainment, Australia*, Cat. no. 6235.0; *Transition from Education to Work, Australia*, Cat. no. 6227.0).

The increasing trend in the *share* of the employed workforce with post-school qualifications has occurred across all market sector industries. Consequently, the distribution of the number of workers by educational attainment category across

industries has not changed dramatically, although Manufacturing is a notable exception due to the relatively smaller number of people employed in that sector in the latter period (table 4.2). Of the market sector industries, Manufacturing was the largest employer of workers *with* post-school qualifications, accounting for around 16 per cent of these workers in 1984, falling to around 13 per cent by 1997. Retail trade and Construction were the next two largest employers of more educated workers.

Manufacturing and Retail trade also accounted for the largest share of workers *without* post-school qualifications. Manufacturing had a larger share than Retail trade in 1984 (nearly 20 per cent compared with 18 per cent) but, by 1997, Retail trade had nearly 21 per cent compared with 14 per cent for Manufacturing.

Table 4.3 **Employment by educational attainment, by industry, 1984 and 1997**

15-64 year olds

	1984[a]		*1997*[b]		*Difference*[c]	
Industry	*Number*	*Share of total*	*Number*	*Share of total*	*Number*	*Per cent*
	'000	%	'000	%	'000	%
With post-school qualifications						
Agriculture	98.0	3.5	118.4	3.0	20.4	20.9
Mining	51.0	1.8	42.7	1.1	-8.2	-16.2
Manufacturing	446.5	16.1	509.2	12.8	62.7	14.0
Electricity, gas and water	78.2	2.8	45.3	1.1	-32.9	-42.0
Construction	226.2	8.2	327.9	8.3	101.7	44.9
Wholesale trade	140.6	5.1	225.3	5.7	84.7	60.2
Retail trade	259.3	9.3	349.3	8.8	89.9	34.7
Trans., storage and comm.	187.6	6.8	212.7	5.4	25.1	13.4
Accomm., cafes and rest.	61.5	2.2	129.9	3.3	68.5	111.3
Cultural and rec. services	43.7	1.6	88.3	2.2	44.6	102.2
Market sector	1 592.6	57.4	2 049.0	51.6	456.5	28.7
Total industries	**2 773.9**	**100.0**	**3 971.3**	**100.0**	**1 197.3**	**43.2**
Without post-school qualifications						
Agriculture	276.8	7.9	268.4	6.3	-8.3	-3.0
Mining	45.4	1.3	37.8	0.9	-7.6	-16.7
Manufacturing	684.4	19.5	603.1	14.1	-81.2	-11.9
Electricity, gas and water	67.8	1.9	22.9	0.5	-44.8	-66.1
Construction	192.1	5.5	238.7	5.6	46.6	24.2
Wholesale trade	227.6	6.5	281.1	6.6	53.6	23.5
Retail trade	613.6	17.5	881.5	20.7	267.9	43.7
Trans., storage and comm.	281.1	8.0	343.2	8.0	62.1	22.1
Accomm., cafes and rest.	143.2	4.1	262.0	6.1	118.7	82.9
Cultural and rec. services	54.1	1.5	111.3	2.6	57.2	105.6
Market sector	2 586.1	73.6	3 050.2	71.5	464.1	17.9
Total industries	**3 515.8**	**100.0**	**4 267.8**	**100.0**	**752.0**	**21.4**
All education groups						
Agriculture	374.7	6.0	386.8	4.7	12.1	3.2
Mining	96.4	1.5	80.6	1.0	-15.8	-16.4
Manufacturing	1 130.9	18.0	1 112.3	13.5	-18.5	-1.6
Electricity, gas and water	145.9	2.3	68.3	0.8	-77.7	-53.2
Construction	418.3	6.7	566.6	6.9	148.2	35.4
Wholesale trade	368.2	5.9	506.4	6.1	138.2	37.5
Retail trade	872.9	13.9	1 230.8	14.9	357.8	41.0
Trans., storage and comm.	468.7	7.5	555.9	6.7	87.2	18.6
Accomm., cafes and rest.	204.7	3.3	391.9	4.8	187.2	91.4
Cultural and rec. services	97.8	1.6	199.6	2.4	101.8	104.1
Market sector	4 178.6	66.4	5 099.2	61.9	920.5	22.0
Total industries	**6 289.7**	**100.0**	**8 239.0**	**100.0**	**1 949.3**	**31.0**

a February data. **b** May data. **c** Break in series in 1993 means comparisons between 1984 and 1997 may underestimate rises and overestimate falls in 'with post-school qualifications' and underestimate falls and overestimate rises in 'without post-school qualifications'.

Source: Based on ABS (unpublished data).

Relationship between productivity growth and educational attainment

As discussed earlier, educational qualifications of workers can affect productivity, and productivity growth can affect the educational attainment profile of the workforce. Less educated workers clearly make up a declining share of the workforce at the aggregate level. An industry view is now taken to examine if there is an association between productivity growth and educational attainment across industry sectors. This issue is explored by seeking answers to the following two questions.

- Does the educational attainment profile of high productivity growth industries differ systematically from the economywide average and from low productivity growth industries?
- Is there any association between productivity growth and changes in the educational attainment profile of the workforce at the industry level?

Educational attainment profile of high and low productivity growth industries

Figure **4.5** shows the percentage of the employed workforce without post-school qualifications for selected industries with different rates of multifactor productivity (MFP) growth. The top panel shows the high productivity growth industries and the bottom panel shows the low productivity growth industries.

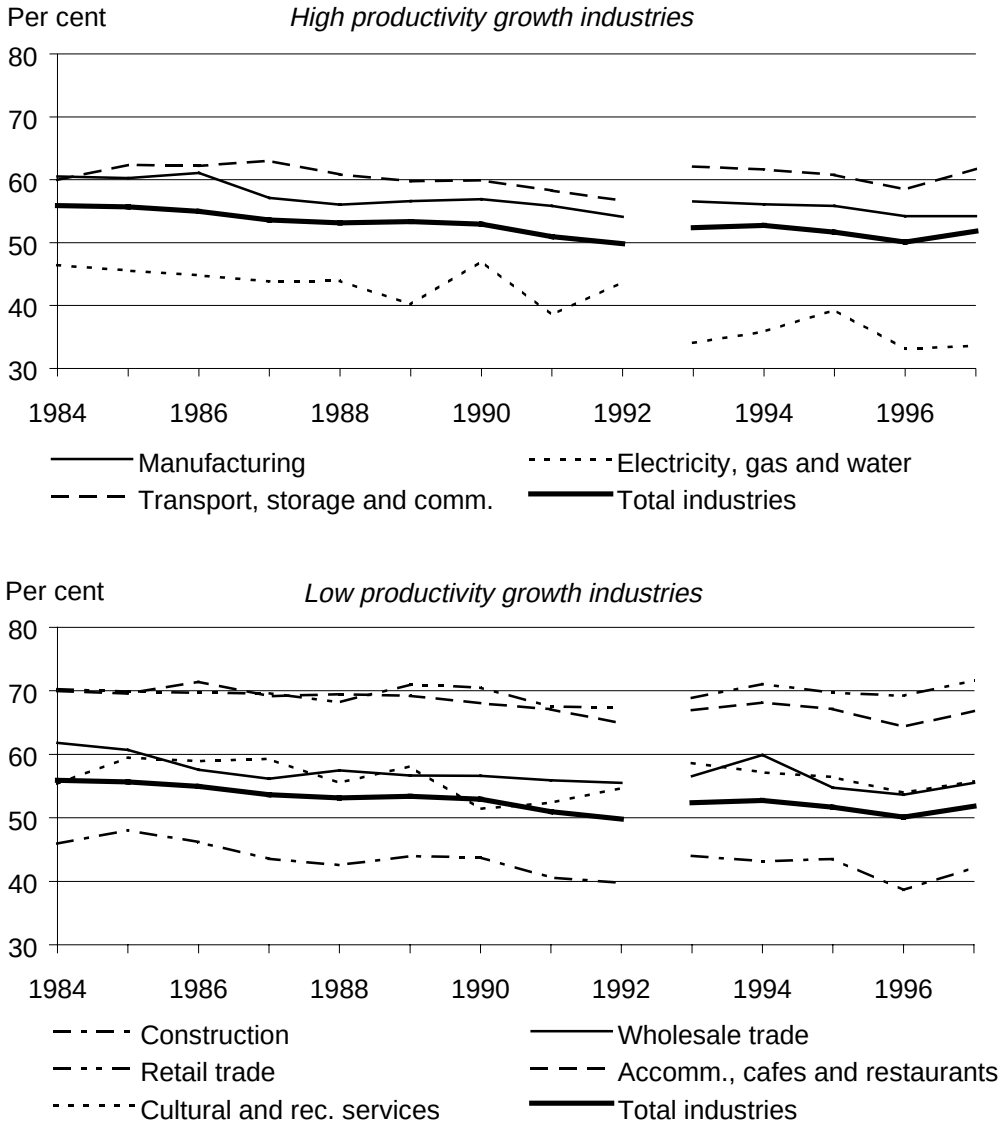
Taking the Total industries profile as the benchmark, the figures suggest that there is no systematic pattern for high and low productivity growth industries.[2] Two of the three high productivity growth industries (Manufacturing and Transport, storage and communication) have a less qualified workforce than average. Electricity, gas and water is more qualified than average.[3]

Four of the five low productivity growth industries also have a less qualified workforce than average. The exception in this case is Construction. Both Electricity, gas and water and Construction have higher shares of workers with 'other qualifications', particularly trade qualifications, than Total industries. This contributes to their higher shares of workers with post-school qualifications.

[2] Some caution is needed here regarding interpretation as no weighting has been applied to the subgroups within the 'with post-school qualifications' category. For example, an industry may have a lower share of employees with post-school qualifications overall but, of those employees, a larger proportion may have degrees.

[3] Although it appears that there is a widening gap between Electricity, gas and water and Total industries, the break in the series hampers meaningful comparison between 1984 and 1997.

Figure 4.6 **Share of employed persons[a] without post-school qualifications in industry employment, selected industries, 1984 to 1997[b]**



a 15-64 year olds. **b** August data.

Data source: Based on ABS (unpublished data).

Even though no systematic association was found, the fact that the high productivity growth industries have a different educational attainment pattern from that of the workforce as a whole means that relative growth or decline in these industries will have some effect on the overall educational structure of employment. As a relatively large employer, Manufacturing is likely to be most relevant in this sense.

Likewise, no systematic pattern was found for high and low productivity growth industries when the more detailed education subgroups were examined. However, this is not unexpected, particularly when looking at broad skill groups. Different

industries require different levels of skill and qualifications for the type of work carried out. For example, some activities within Accommodation, cafes and restaurants do not require high skill levels because of the nature of the work.

On the basis of figure 4.3, there is no pattern across both high and low productivity growth industries that suggests that the share of qualified workers in an industry's workforce is associated with productivity growth. In terms of the trend over time, the general decline in the share of workers without post-school qualifications applies across industries, whether high or low MFP growth.[4] The rate of decline in each of these industries is examined in the next section.

Growth in productivity and change in educational attainment

Productivity growth, depending on its source, could result in changes to educational attainment profiles over time through the recruitment or retrenchment of low or high skilled workers. This section examines whether the share of the employed workforce without post-school qualifications has been decreasing more rapidly in high productivity growth industries than low productivity growth industries.

Changes in multifactor productivity and educational attainment over time

Figure **4.7** shows an index of the share of employed persons without post-school qualifications together with an index of MFP for individual industries. Taking the period as a whole, and taking account of the break in series, there is a declining trend in the share of the employed workforce without post-school qualifications for each of the industries, regardless of the direction of change in MFP.

Although the general volatility of the employment data in figure 4.4 makes it difficult to compare the year-to-year changes in the share of less qualified workers with changes in MFP, there is no obvious correlation. The different effect of the break in series on Electricity, gas and water is discussed in box 4.1.

A more systematic view of average growth over the period across industries is presented below.

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4 The break in the series appears to have affected Electricity, gas and water more than the other industries. For most other industries, there was an increase in the share of workers without post-school qualifications after the break. This increase may have been due, in part, to the break in the series resulting in some workers with one semester qualifications being reclassified from 'with post-school qualifications' to 'without post-school qualifications'. Electricity, gas and water may have had fewer workers in this situation, and the break in the series also may have coincided with redundancies of less qualified workers in this industry.

Figure 4.8 **Indexes of MFP and the share of employed persons[a] without post-school qualifications, selected industries, 1983-84 to 1996-97[b]**

Index 1983-84 = 100

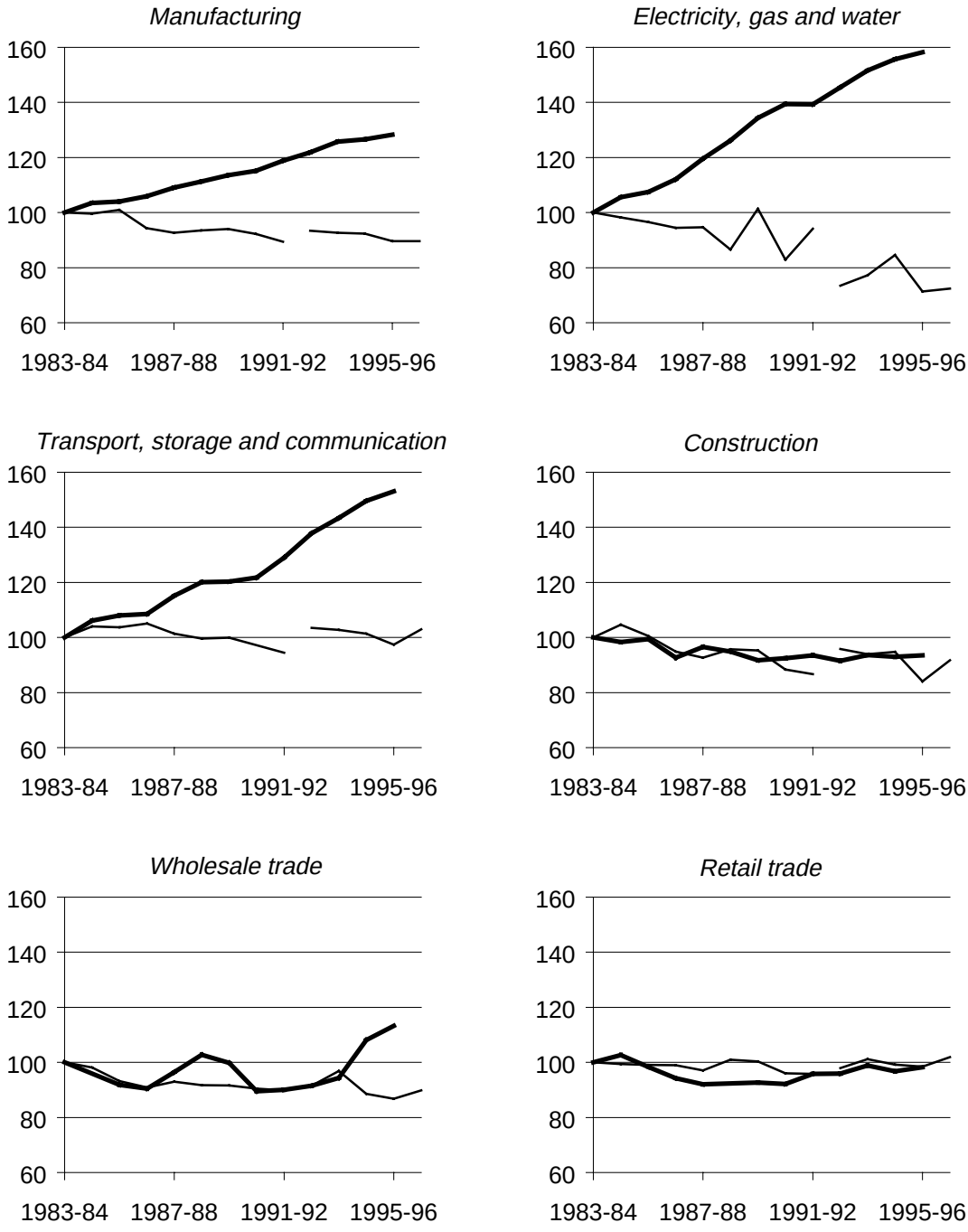

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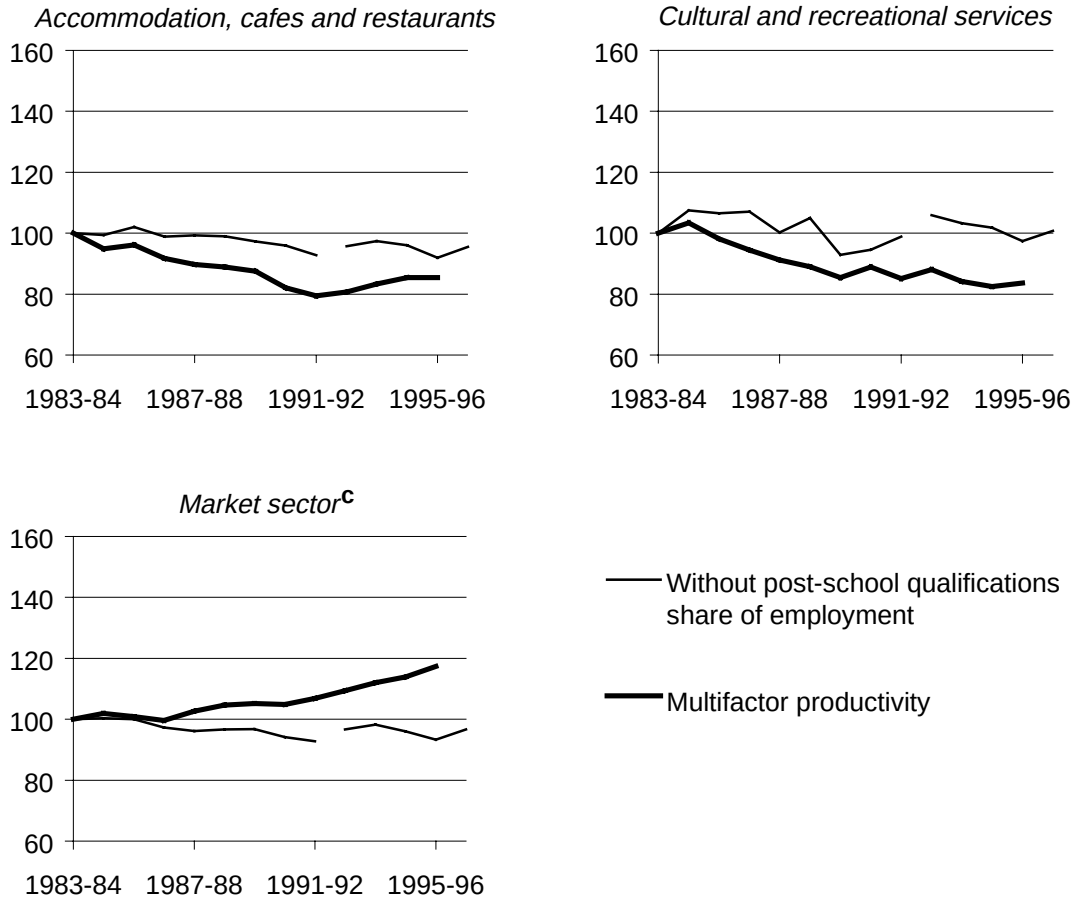
Figure 4.9 **(Continued)**



a 15-64 year olds. **b** MFP data are for financial years and are not available for 1996-97. Employment data are for the month of February for 1984 to 1988 and May for 1989 to 1997. **c** MFP data for Total industries are not available.

Data sources: Estimates for MFP updated from Gretton and Fisher (1997); estimates for employment based on ABS (unpublished data).

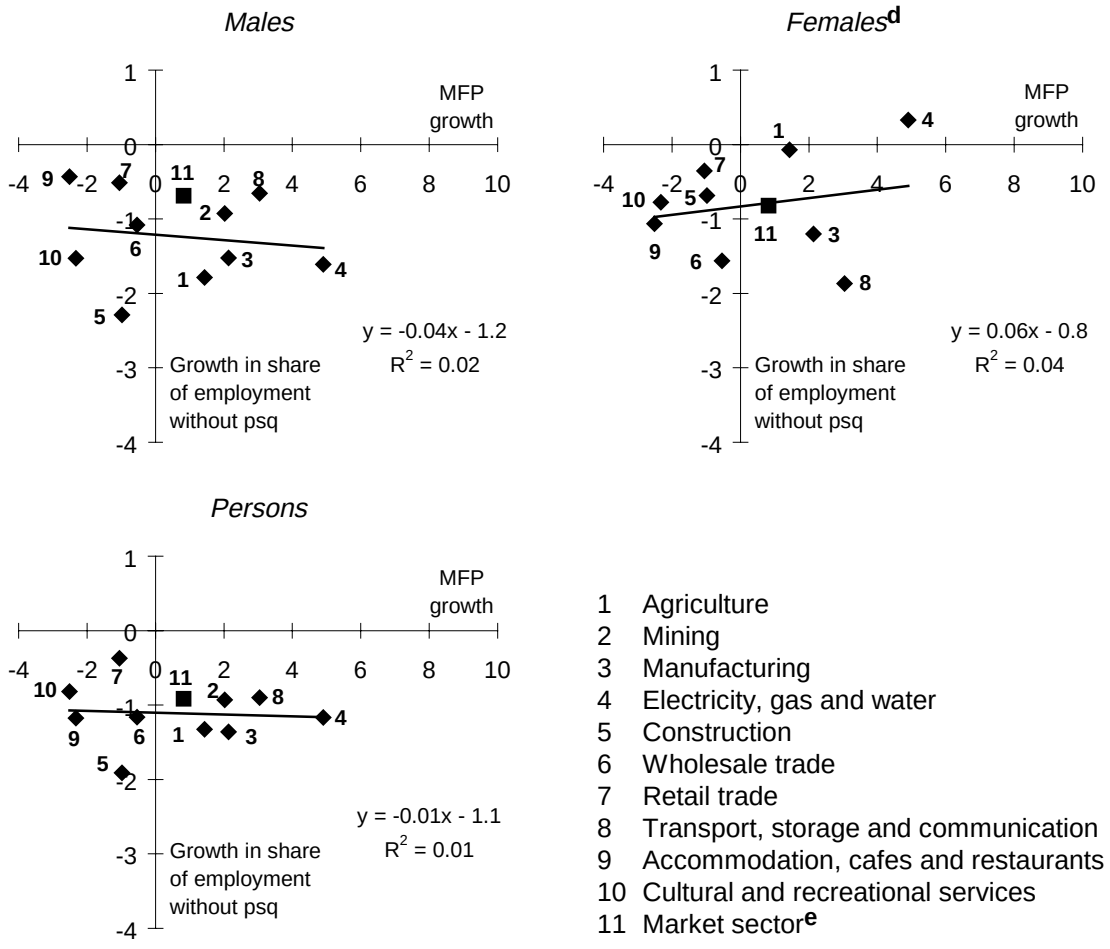
Average growth in educational attainment and productivity

A summary way of examining the relationship between changes in educational attainment and productivity growth is to compare the average change in each of these variables over the entire period. Figure **4.10** presents scatter plots of average annual compound rate of growth rates for MFP against that for the share of the employed workforce without post-school qualifications for each of the market sector industries (not just the selected industries examined above). It is important to note that the growth in the share of employment is the percentage change, not the change in percentage *points*.

As the break in the series prevents growth being calculated for the entire period, the data were examined for two periods — 1983-84 to 1991-92 and 1992-93 to 1995-96. As the brevity of the second period makes interpretation of the results difficult, the plots for this period are not presented here (see appendix B).

Figure 4.11 **Average growth rates[a] of the share of the employed workforce[b] without post-school qualifications (psq) and MFP, by gender, 1983-84 to 1991-92[c]**

Per cent per year



a Growth rates are measured using average annual compound formula based on the end points of linear trend lines through time series data. **b** 15-64 year olds. **c** The employment data are averages between February 1984 and May 1992. The MFP data are averages between financial years 1983-84 and 1991-92. **d** Females excludes Mining as the ABS estimates of employment without post-school qualifications are unreliable (subject to relative standard errors of greater than 25 per cent). **e** The market sector is not included in the estimation of equations.

Data sources: Estimates for MFP updated from Gretton and Fisher (1997); estimates for employment based on ABS (unpublished data).

The slope of the lines of best fit through these scatter plots are not consistent across gender. However, none of these correlations is statistically significant, so there is no evidence of either positive or negative associations between the two variables. From these data there is no evidence of a correlation between growth in the share of the employed workforce without post-school qualifications and growth in MFP across market sector industries. Overall, for persons, there is little variation in the rates of decline in the share of workers without post-school qualifications across most industries. The equivalent scatter plots for MFP against the share of the employed workforce *with* post-school qualifications also did not show any statistically significant correlations.

The educational attainment subgroups were also examined in this way. No statistically significant correlations between MFP growth and growth in the shares of workers with degrees, other qualifications, or completed secondary education were found. The only statistically significant correlation found was a small positive one for the 'did not complete secondary school' group for employed persons in the 1983-84 to 1991-92 period.

Details of all scatter plots are presented in appendix B. Effects in selected industries are examined in box 4.1.

Box 4.1 **Industry-specific effects — educational attainment**

The fall in the share of workers without post-school qualifications appears most pronounced in Electricity, gas and water, because the data are volatile and the break in the series affects Electricity, gas and water differently to other industries. However, the average fall is actually similar to that of most other industries, but is accompanied by a marked rise in MFP (figure **4.12**). As shown in table **4.4**, total employment in Electricity, gas and water declined over the period examined. This decline was spread across all educational attainment categories, but with a more rapid decrease in the number employed in the less qualified categories. Employment in the 'did not complete secondary school' declined at the fastest rate (9.1 per cent per year) followed by 'other qualifications' (5.0 per cent), 'completed secondary school' (4.5 per cent) and 'degree or higher' (0.4 per cent).[5] So, in Electricity, gas and water, where there was a significant proportional decline in employment, this was more concentrated on the least qualified workers. However, this result cannot be generalised to other industries. Moreover, given that Electricity, gas and water is a small part of the total workforce, the changes in education profile would have had little effect on the structure of the total workforce.

Manufacturing, one of the largest employers of workers without post-school qualifications, also experienced a decline in total employment. In Manufacturing, there was a fall in the share of workers without post-school qualifications accompanied by a steady increase in MFP (figure **4.13**). This was the result of growth in the number of workers with post-school qualifications, while the number employed without post-school qualifications declined. Again this suggests that employment reductions have focused more heavily on the less qualified workers.

4.5 Occupation

Like education, occupation is used as an indicator of the level of skill in the employed workforce. In general, an increase in the number of people in a high-skilled occupation, such as Professionals, relative to the number of people in a low-skilled occupation, such as Labourers and related workers, indicates a more highly skilled workforce.

This section examines the relationship between MFP growth and the skill profile of employment in terms of occupation groups.

[5] These average annual compound growth rates are based on the actual 1984 and 1997 values. They are not adjusted for the break in the series and are therefore only indicative.

Trends in employment by occupation group

As for educational attainment, construction of a continuous series of employment by occupation is hampered by changes in ABS classification systems. Since the mid-1970s, the ABS has used three classification systems. It has not been possible to convert all data to a single classification system (see appendix A for further details). For this reason, data for the period August 1986 to August 1995 classified by the Australian Standard Classification of Occupations, first edition (ASCO1) are used in this chapter.

ASCO1 divides the workforce into eight major occupation groups (see appendix A for details). In this paper, these major groups have been aggregated into four skill-based occupation groups similar to those used by the OECD (1996b). These groups are:

- *high-skilled white collar* (HSWC), which includes Managers and administrators, Professionals and Para-professionals;
- *high-skilled blue collar* (HSBC), which includes Tradespersons;
- *low-skilled white collar* (LSWC), which includes Clerks and Salespersons and personal service workers; and
- *low-skilled blue collar* (LSBC), which includes Plant and machine operators and drivers, and Labourers and related workers.

These groupings are in some senses arbitrary. The distinction between high and low skill is not exact. There are a number of ASCO1 major occupation groups that are not entirely high or low skill. For example, certain types of clerical work require some further qualifications and extensive experience, such as in areas of accounting and insurance. A more precise allocation of individual occupations to skill groups would require very detailed data, which are not available to this study.

Occupational composition of the Australian workforce

Over the period 1986 to 1995, the structure of the Australian workforce moved away from blue collar employment and towards white collar employment (table 4.3 and figure 4.6). The faster growth in services industries provides a major explanation. The proportion of employment in both high-skilled and low-skilled white collar groups increased. While female employment is more concentrated in the low-skilled white collar group, employment of females increased at above average rates in all occupational groups, but especially in the high-skilled white collar group.

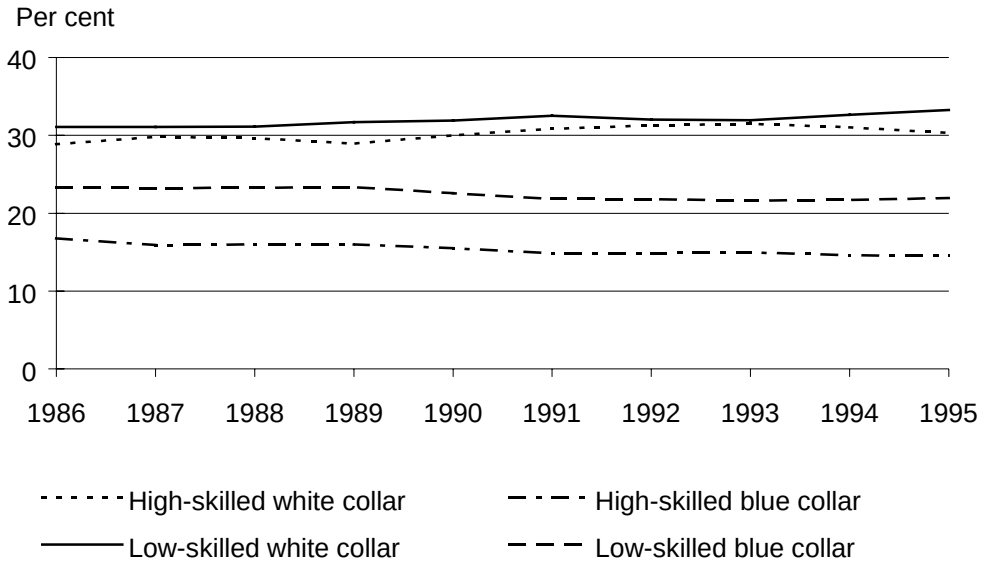
Table 4.5 **Employment by occupation group, by gender, 1986 and 1995[a]**

	1986		*1995*		*Difference*	
Occupation group	*Number*	*Share of total*	*Number*	*Share of total*	*Number*	*Per cent*
	'000	%	'000	%	'000	%
Males						
High-skilled white collar	1 327.6	31.6	1 545.8	33.1	218.2	16.4
High-skilled blue collar	1 043.8	24.8	1 062.7	22.7	18.9	1.8
Low-skilled white collar	665.3	15.8	772.1	16.5	106.8	16.1
Low-skilled blue collar	1 165.9	27.7	1 291.8	27.6	125.9	10.8
All occupations	**4 202.6**	**100.0**	**4 672.5**	**100.0**	**469.9**	**11.2**
Females						
High-skilled white collar	669.3	24.6	943.1	26.6	273.8	40.9
High-skilled blue collar	115.6	4.3	129.5	3.7	13.9	12.0
Low-skilled white collar	1 483.6	54.6	1 960.3	55.3	476.7	32.1
Low-skilled blue collar	447.5	16.5	512.4	14.5	64.9	14.5
All occupations	**2 716.0**	**100.0**	**3 545.3**	**100.0**	**829.3**	**30.5**
Persons						
High-skilled white collar	1 997.0	28.9	2 488.9	30.3	491.9	24.6
High-skilled blue collar	1 159.4	16.8	1 192.2	14.5	32.8	2.8
Low-skilled white collar	2 148.9	31.1	2 732.5	33.3	583.6	27.2
Low-skilled blue collar	1 613.4	23.3	1 804.2	22.0	190.8	11.8
All occupations	**6 918.6**	**100.0**	**8 217.7**	**100.0**	**1 299.1**	**18.8**

a August data.

Source: Estimates based on ABS (Labour Force Survey microfiche).

Figure 4.14 **Share of occupation group employment in total employment, 1986 to 1995[a]**



a August data.

Data source: Estimates based on ABS (Labour Force Survey microfiche).

At the industry level, the general trend of faster growth in high-skilled compared with low-skilled employment has not occurred uniformly across all industries. Table 4.4 shows the distribution of employment by occupation group across market sector industries.

Major employers of the different occupation groups are:

- Agriculture for HSWC (because owner-operators, who class themselves as managers, account for a large share);
- Manufacturing, Construction and Retail trade for HSBC;
- Retail trade for LSWC; and
- Manufacturing and Transport, storage and communication for LSBC.

Table 4.6 **Employment by occupation group, by industry, 1986 and 1995[a]**

Industry	1986 Number	1986 Share of total	1995 Number	1995 Share of total	Difference Number	Difference Per cent
	'000	%	'000	%	'000	%
High-skilled white collar employment						
Agriculture	269.0	13.5	233.3	9.4	-35.7	-13.3
Mining	19.5	1.0	20.6	0.8	1.2	6.1
Manufacturing	170.9	8.6	189.8	7.6	18.9	11.1
Electricity, gas and water	28.2	1.4	27.6	1.1	-0.6	-2.0
Construction	55.0	2.8	78.1	3.1	23.2	42.1
Wholesale trade	105.8	5.3	110.4	4.4	4.6	4.4
Retail trade	143.9	7.2	156.6	6.3	12.7	8.8
Trans., storage and comm.	71.6	3.6	81.9	3.3	10.3	14.4
Accomm., cafes and rest.	45.2	2.3	67.6	2.7	22.4	49.6
Cultural and rec. services	59.8	3.0	94.8	3.8	35.0	58.5
Market sector	968.8	48.5	1 060.7	42.6	92.0	9.5
Total industries	**1 997.0**	**100.0**	**2 488.9**	**100.0**	**491.9**	**24.6**
High-skilled blue collar employment						
Agriculture	22.3	1.9	20.0	1.7	-2.3	-10.4
Mining	22.5	1.9	17.5	1.5	-5.0	-22.3
Manufacturing	339.3	29.3	306.7	25.7	-32.6	-9.6
Electricity, gas and water	42.2	3.6	20.1	1.7	-22.1	-52.4
Construction	258.7	22.3	317.4	26.6	58.7	22.7
Wholesale trade	44.6	3.8	47.9	4.0	3.3	7.3
Retail trade	172.0	14.8	182.4	15.3	10.4	6.0
Trans., storage and comm.	73.4	6.3	56.4	4.7	-17.0	-23.0
Accomm., cafes and rest.	39.1	3.4	58.2	4.9	19.1	48.9
Cultural and rec. services	14.6	1.3	16.6	1.4	2.0	13.9
Market sector	1 028.6	88.7	1 043.1	87.5	14.5	1.4
Total industries	**1 159.4**	**100.0**	**1 192.2**	**100.0**	**32.8**	**2.8**
Low-skilled white collar employment						
Agriculture	11.4	0.5	17.9	0.7	6.5	57.5
Mining	7.4	0.3	6.4	0.2	-1.0	-13.3
Manufacturing	171.2	8.0	179.6	6.6	8.4	4.9
Electricity, gas and water	21.5	1.0	18.8	0.7	-2.7	-12.5
Construction	67.7	3.2	82.2	3.0	14.5	21.5
Wholesale trade	181.2	8.4	234.6	8.6	53.4	29.5
Retail trade	538.5	25.1	673.5	24.6	135.1	25.1
Trans., storage and comm.	167.0	7.8	159.9	5.9	-7.1	-4.2
Accomm., cafes and rest.	107.3	5.0	172.9	6.3	65.6	61.1
Cultural and rec. services	37.2	1.7	57.5	2.1	20.3	54.7
Market sector	1 310.3	61.0	1 603.4	58.7	293.0	22.4
Total industries	**2 148.9**	**100.0**	**2 732.5**	**100.0**	**583.6**	**27.2**

(Continued on next page)

Table 4.4 **(Continued)**

Industry	1986 Number	1986 Share of total	1995 Number	1995 Share of total	Difference Number	Difference Per cent
	'000	%	'000	%	'000	%
Low-skilled blue collar employment						
Agriculture	112.8	7.0	133.2	7.4	20.4	18.0
Mining	46.2	2.9	40.2	2.2	-6.0	-13.0
Manufacturing	450.2	27.9	441.1	24.4	-9.0	-2.0
Electricity, gas and water	45.6	2.8	18.3	1.0	-27.4	-59.9
Construction	112.0	6.9	117.4	6.5	5.4	4.9
Wholesale trade	79.6	4.9	110.0	6.1	30.5	38.3
Retail trade	125.2	7.8	173.9	9.6	48.7	38.9
Trans., storage and comm.	233.6	14.5	225.9	12.5	-7.8	-3.3
Accomm., cafes and rest.	48.0	3.0	87.2	4.8	39.2	81.7
Cultural and rec. services	14.8	0.9	23.0	1.3	8.2	55.6
Market sector	1 268.0	78.6	1 370.2	75.9	102.2	8.1
Total industries	**1 613.4**	**100.0**	**1 804.2**	**100.0**	**190.8**	**11.8**
All occupations						
Agriculture	415.5	6.0	404.3	4.9	-11.2	-2.7
Mining	95.5	1.4	84.7	1.0	-10.8	-11.3
Manufacturing	1 131.6	16.4	1 117.3	13.6	-14.3	-1.3
Electricity, gas and water	137.5	2.0	84.8	1.0	-52.7	-38.3
Construction	493.4	7.1	595.2	7.2	101.8	20.6
Wholesale trade	411.1	5.9	502.8	6.1	91.7	22.3
Retail trade	979.6	14.2	1 186.4	14.4	206.8	21.1
Trans., storage and comm.	545.5	7.9	524.1	6.4	-21.5	-3.9
Accomm., cafes and rest.	239.6	3.5	385.9	4.7	146.3	61.1
Cultural and rec. services	126.4	1.8	192.0	2.3	65.6	51.9
Market sector	4 575.7	66.1	5 077.4	61.8	501.7	11.0
Total industries	**6 918.6**	**100.0**	**8 217.7**	**100.0**	**1 299.1**	**18.8**

a August data.

Sources: Estimates based on ABS (Labour Force Survey microfiche; unpublished data).

Relationship between productivity growth and employment by occupation group

The following section examines the relationship between the composition of employment by occupation group and productivity. Two questions are addressed.

- Does the occupational composition of the employed workforce in high productivity growth industries differ systematically from the economywide average and from low productivity growth industries?
- Is there any association between productivity growth and changes in the occupational profile of the workforce at the industry level?

Occupation profile for high and low productivity growth industries

Figure 4.7 shows the share of industry employment in each occupation group for selected market sector industries. It suggests that there is no systematically different occupational profile of high productivity growth industries compared with the low productivity growth industries. It appears that industry-specific factors govern the proportion of white collar/blue collar and high-skilled/low-skilled workers employed.

Productivity growth and changes in occupation profile by industry

Figure 4.8 shows indexes of the share of employed persons in high-skilled and low-skilled white and blue collar occupations with an index of MFP for individual industries. This enables an examination of the changes in occupation profile and MFP over time.

All the high productivity growth industries (Manufacturing, Electricity, gas and water, and Transport, storage and communication) experienced an increase in the proportion of HSWC occupations. This increase reflects growth, or relatively slower decline, in the number of HSWC workers. Of the low productivity growth industries, only Construction experienced an average increase in the share of HSWC workers.

The share of HSBC employment fell in all the industries shown, regardless of the extent of MFP growth, except for Construction. With the exception of Electricity, gas and water, the share of low-skilled white and blue collar occupations appears to have been reasonably stable in most industries, irrespective of MFP growth.

Thus, the main potential for any association between productivity growth and employment profiles appears to be in regard to the HSWC occupation group. A more systematic examination of this link is undertaken in the following section.

Figure 4.15 **Share of occupation group employment in industry employment, selected industries, 1986 to 1995[a]**

Per cent

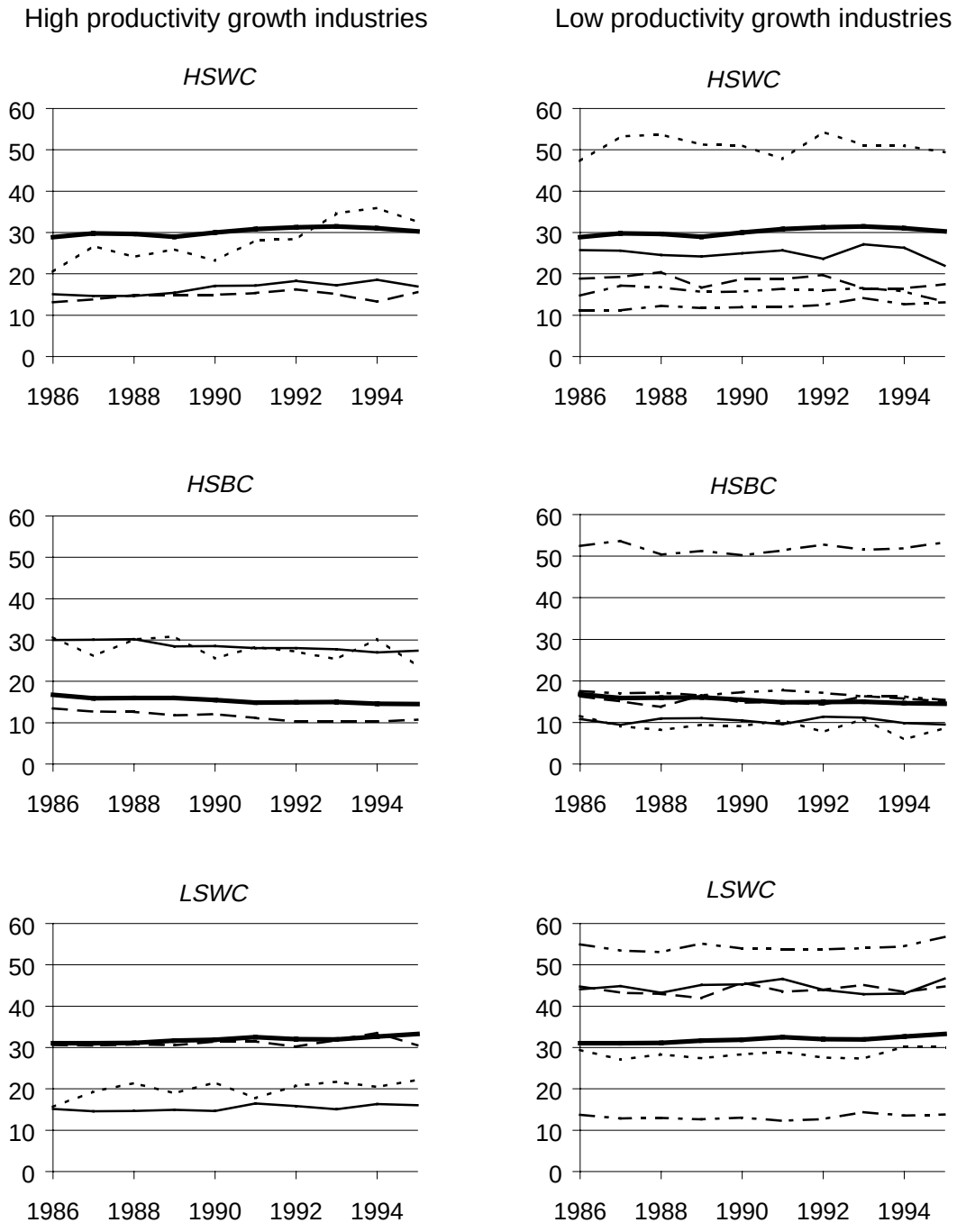


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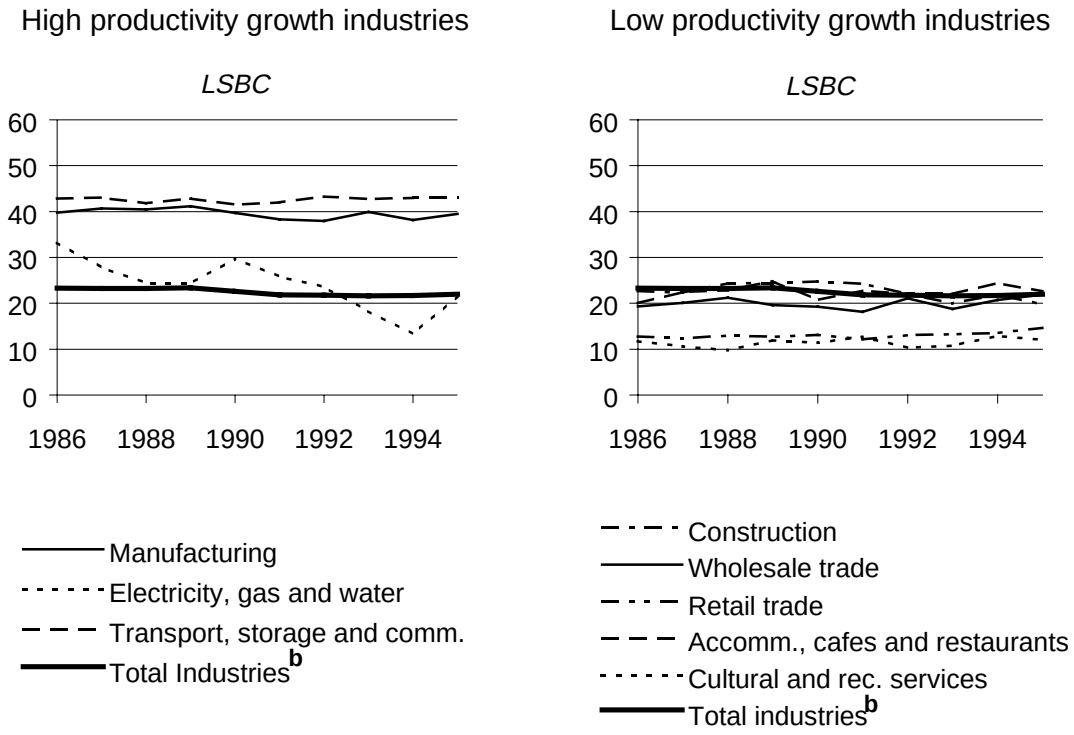
Figure 4.16 **(Continued)**



a August data. **b** Total industry average varies according to each occupation group.

Data sources: Estimates based on ABS (Labour Force Survey microfiche; unpublished data).

Figure 4.17 **Indexes of MFP and the share of employed persons by occupation group, selected industries, 1986-87 to 1995-96[a]**

Index 1986-87 = 100

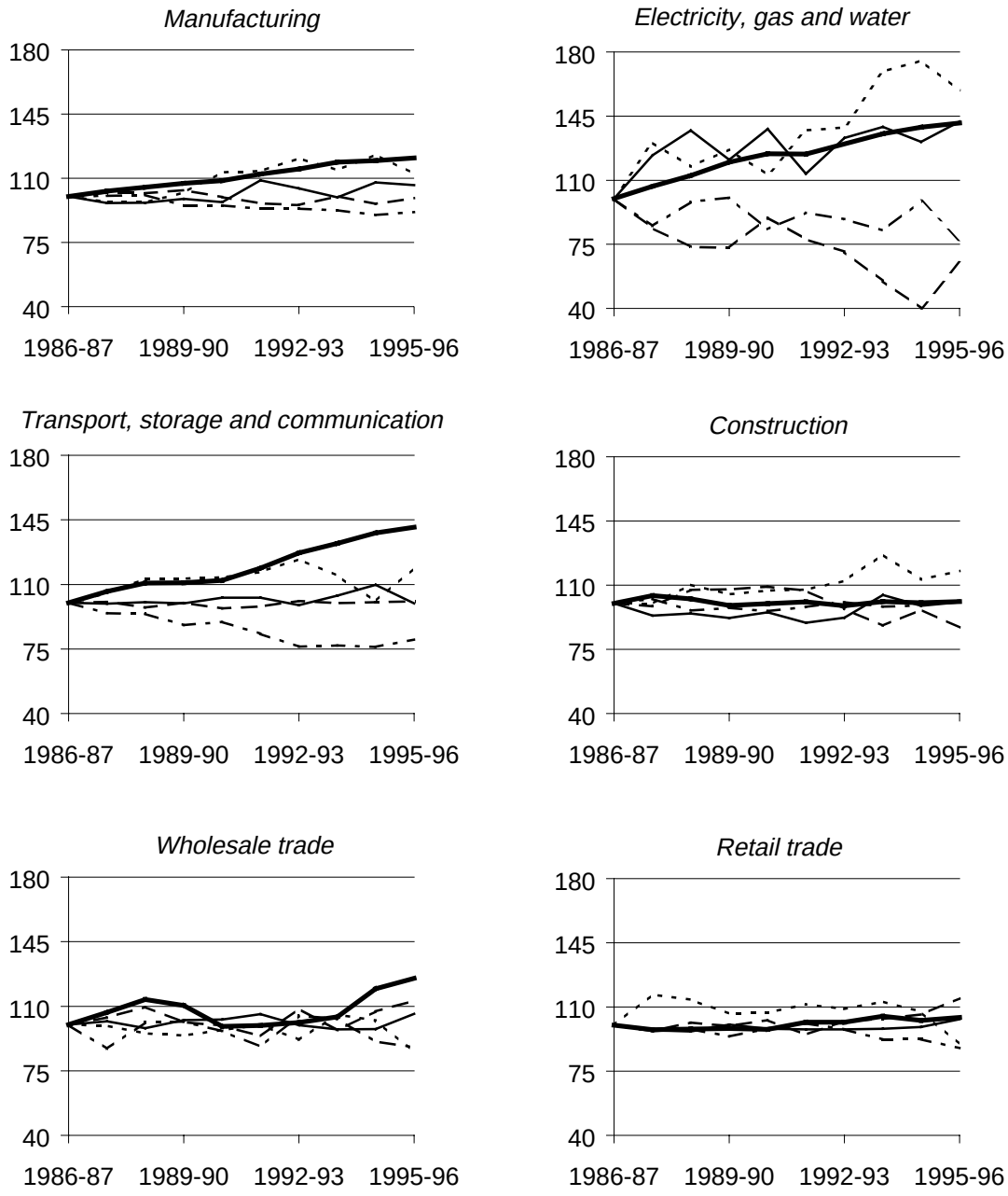


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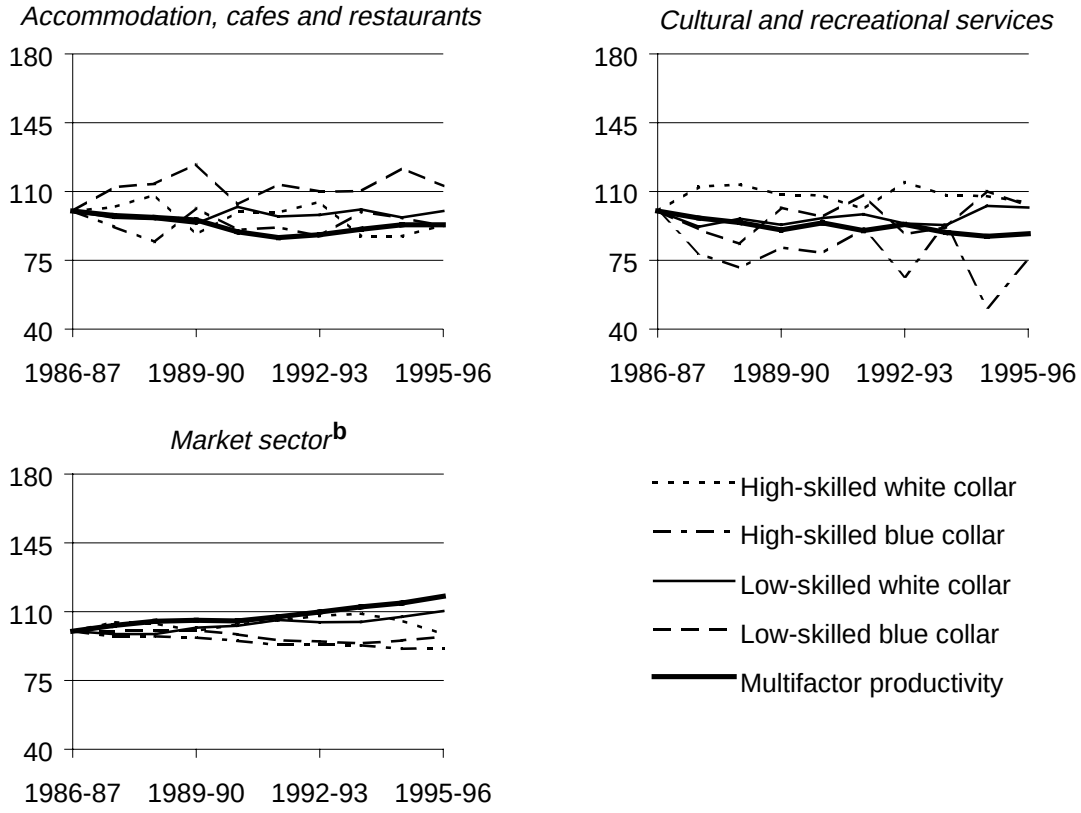
Figure 4.8 **(Continued)**



a MFP data are for financial years. Employment data are for the month of August. **b** MFP data for Total industries are not available.

Data sources: Estimates for MFP updated from Gretton and Fisher (1997); estimates for employment based on ABS (Labour Force Survey microfiche; unpublished data).

Average growth in occupation shares and productivity

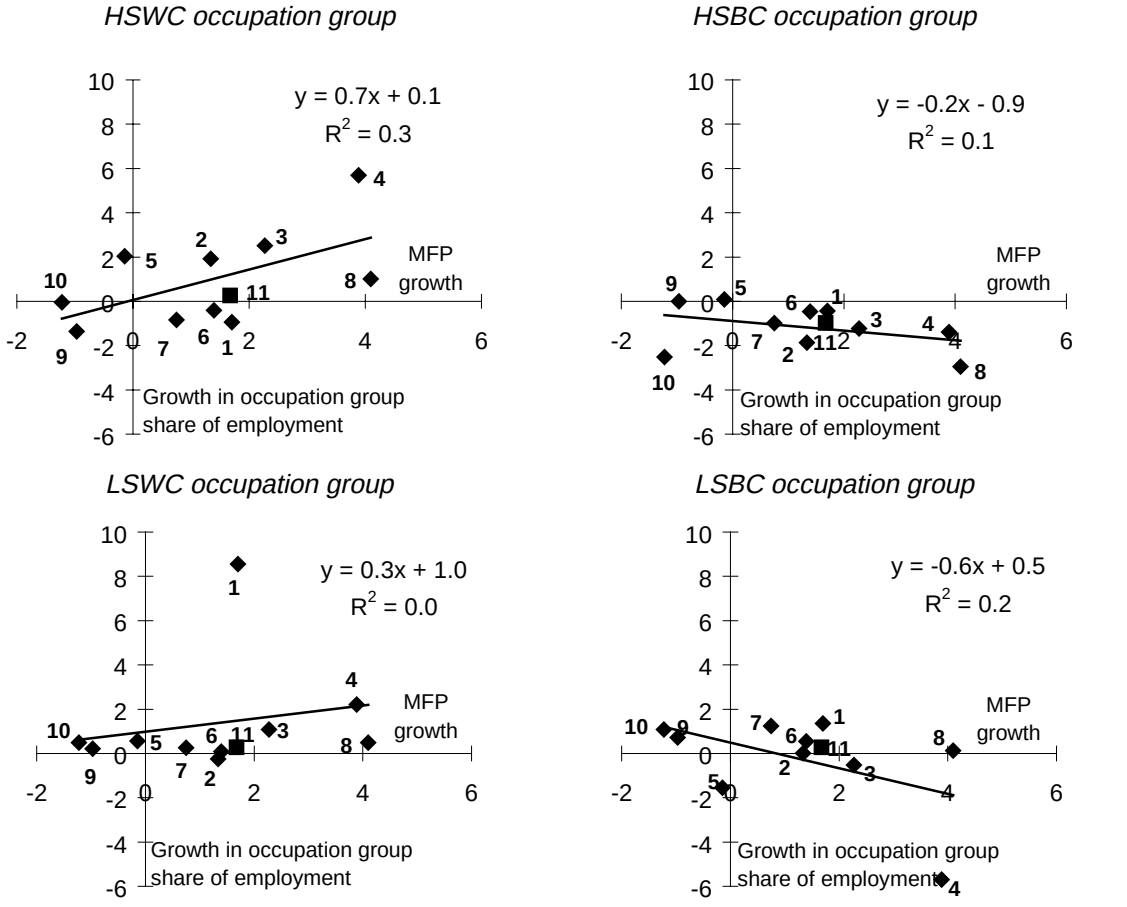
Another way of examining the relationship between changes in the occupational profile of employment and productivity growth is to compare the average change in each of the variables over the entire period. Figure 4.9 plots, for each industry, the average annual compound rate of growth rate for MFP and the growth in the share of the employed workforce in each of the four occupation groups.[6]

It should be noted that the shares of employment in different occupation groups are interrelated. If the share of employment in one occupation group decreases, there must be an offsetting increase in the share of one or more of the other occupation groups.

6 The growth in the share of employment is the percentage change, not the change in percentage *points*.

Figure 4.18 **Average growth rates[a] of the share of employment by occupation group and MFP, 1986-87 to 1995-96[b]**

Per cent per year



1 Agriculture
2 Mining
3 Manufacturing
4 Electricity, gas and water
5 Construction
6 Wholesale trade
7 Retail trade
8 Transport, storage and communication
9 Accommodation, cafes and restaurants
10 Cultural and recreational services
11 Market sector[c]

a Growth rates are measured using average annual compound formula based on the end points of linear trend lines through time series data. **b** The employment data are averages between August 1987 and August 1996. The MFP data are averages between financial years 1986-87 and 1995-96. **c** The market sector is not included in the estimation of equations.

Data sources: Estimates for MFP updated from Gretton and Fisher (1997); estimates for employment based on ABS (Labour Force Survey microfiche; unpublished data).

A line of best fit shows a statistically significant positive correlation between trend growth in the share of HSWC employment and MFP growth across market sector industries.[7] This means that higher (lower) MFP growth is associated with higher (lower) growth in the share of HSWC employed persons. No statistically significant correlations were found for the other occupation groups.[8] The fact that there is little variation in growth rates across most industries suggests factors other than productivity may be associated with changes in the share of workers in these groups.

These results are broadly consistent with OECD (1996a) that examined manufacturing industries across five countries and found the increase in the share of white collar high-skilled workers within sectors seems to be positively correlated to variables related to technological changes, especially in the high technology sectors.

The correlation between MFP growth and the share of employment by occupation group was also examined by gender. A statistically significant correlation was found between MFP growth and the share of males employed in HSWC occupations (positive correlation) and LSBC occupations (negative correlation). Details of all scatter plots are presented in appendix B. A brief examination of changes in the occupational profiles of industries within Manufacturing is provided in appendix C.

Overall, these data provide some weak evidence suggesting that MFP growth is associated with upskilling of the workforce, but little evidence related to deskilling of the workforce. Effects in selected individual industries are examined in box 4.2.

Box 4.2 **Industry-specific effects — occupation**

Apart from systematic associations presented above, effects in individual industries may also affect on the overall structure of employment.

In Manufacturing, a relatively large employer of LSBC workers, there have been falls in the number of LSBC employees, whereas employment in both white collar groups rose. In Transport, storage and communication, over the period 1986 to 1995, the number and share of HSWC employees increased but the number of employees in all other occupation groups fell. In Electricity, gas and water, employment reductions focused on the two blue collar groups. But this industry is a small employer.

One other industry that stands out in figure 4.9 is Agriculture. There was relatively high growth in the share of LSWC employment in this industry. However, the strong growth has been from a low base. There were only small changes in the actual number employed over the period.

[7] All correlations for occupation are statistically significant at the 90 per cent level of confidence, but not at the 95 per cent level of confidence.

[8] HSWC employment was also examined without Agriculture. See appendix B.

4.6 Summary

This chapter has reviewed the relationship between productivity growth and skill. The analysis of educational attainment did not provide any evidence of an association between MFP growth and changes in the educational profile of the workforce. However, the use of occupation as a proxy for skill provided some weak evidence of a positive correlation between MFP growth and growth in the share of high-skilled white collar employment across market sector industries.

5 Employment by age

There has been community concern about perceptions of limited employment opportunities and the displacement of workers in some age groups, especially the younger and older age groups. A range of factors has influenced the age profile of the employed workforce, including demographic changes and changes in female and youth participation rates. This chapter examines whether there is any relationship between productivity growth and changes in the age profile of the employed workforce.

5.1 Factors affecting the age profile of the employed workforce

The age profile of the employed workforce has been affected by a wide range of influences since the 1970s.[1] Some of the main influences include the following.

- Demographic changes.
  - A slowing down in the population growth rate has caused a shift in the age profile of the population, resulting in an increase in the average age of the employed workforce (DEET 1995).
- Changes in participation rates.
  - An increase in the rate of participation in education by the young has led to a decline in their participation in the workforce. There has been some increase in part-time workforce participation by young people, but this has not offset the fall in full-time participation (Baker and Williams 1998).
  - A change in the role of females in the workforce has led to an increase in female participation rates, especially in the 25-54 age groups and married women. This has been due, in part, to changes in various social, attitudinal and institutional factors, such as revised child care arrangements and higher levels of educational attainment (Borland 1997; DEET 1995; EPAC 1996a).

[1] For a more detailed discussion see EPAC (1996a) and (1996b), Borland (1997), Wooden (1997) and Debelle and Swann (1998). For a detailed discussion on participation rates and population change see DEET (1995, chapter 2).

- With the tendency towards earlier retirement, there has been a decline in the participation rates for males, especially in the 55 and over age group. Again, this has been due, in part, to social and institutional changes, for example higher levels of asset ownership and greater access to pensions and superannuation (Borland 1997; Debelle and Swann 1998).

These changes have had varying impacts upon different age groups. However, the overall effect has been an increase in the average age of the employed workforce.

5.2 Age and productivity

The central issue for this chapter is whether productivity growth is associated with any change in the employment of workers in different age groups. In principle, there could be an association due to any innate productivity characteristics of different age groups — that is, whether employers view younger or older workers as being inherently more or less productive. Pikersgill et al. (1996, p. 10) summarised some of the negative perceptions of some employers towards older workers:

> ... deteriorating physical and mental abilities; not receptive to new technology; are more resistant to organisational change; lack the appropriate skills and are difficult to retrain; and lack the drive, ambition, energy and creativity of their younger counterparts.

However, Pikersgill et al. (1996, p. 11) also noted that a number of studies challenge these negative perceptions and argued that '... generalisations about age and productivity should be treated with considerable reservation and are extremely difficult to substantiate'. The OECD (1998a) indicated that, while there is still much research to be undertaken, the productivity of older workers may not necessarily be impaired by ageing.[2]

Indirect links between productivity and age may be more important than direct links. For example, age may be correlated with particular skills and experience that will be the object of employment demands. Any relationship between productivity growth and age observed in this paper is likely to be of this indirect kind.

In the following sections, changes in the age structure of employment at the industry sector level are examined together with *industry* productivity growth (changes in productivity are not measured by age group).

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[2] Warr (1994, cited in OECD 1998a) surveyed some of the literature in the area and found that there is no significant overall difference between the job performance of older and younger workers. The OECD (1998a, p. 136) also suggested that '... the extent to which poor health reduces the productivity of workers at any given age is trending downward. The shift of employment away from manual occupations may also diminish the significance of age-related health problems for job performance'.

5.3 Trends in employment by age group

For the purpose of this paper, employment has been classified into seven age groups: 15-19; 20-24; 25-34; 35-44; 45-54; 55-59; and 60 and over. A series for employment by industry classified into these age groups, for the period August 1978 to August 1997, was derived from ABS data (see appendix A for further details).

Over the period 1978 to 1997, the average age of the employed workforce increased from 36.2 to 37.7 years.[3] In 1978, 25-34 year olds were the largest age group employed, accounting for about 27 per cent of the employed workforce, but by 1997 the 35-44 age group had become the largest age group in the workforce (table 5.1).

The shares of the employed workforce in some age groups have changed considerably, while other age groups have remained relatively stable. Figure **5.1** presents employment profiles by age group.

For persons, shown in panel three of figure **5.2**, the 35-44 age group and the 45-54 age group recorded notable increases in their employment shares. There were marked declines in the younger age groups (15-19 and 20-24). The most stable age group was the 25-34 age group, with the older age groups (55-59 and 60 and over) declining slightly from relatively low initial shares of total employment.

The age group shares by gender (panels one and two of figure 5.1) generally follow the pattern for persons. However, for females there are some exceptions. For example, the share of females in the 15-19 age group was much higher than that for males and declined more sharply.

[3] This is a crude estimate based on the mid-points of the age groups weighted by the number of workers in each age group.

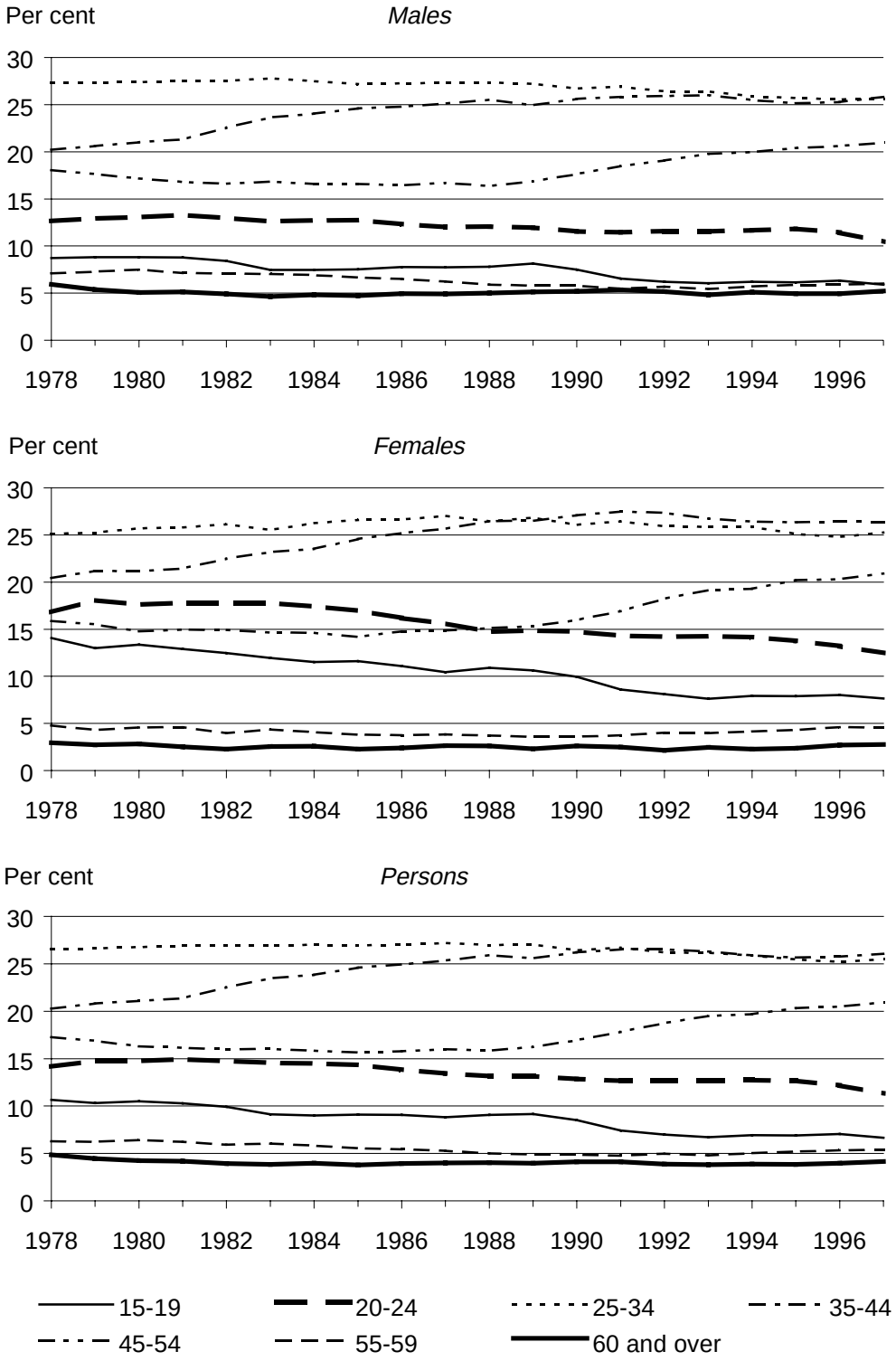
Table 5.1 **Employment by age group, by gender, 1978 and 1997[a]**

	1978		*1997*		*Difference*	
Age group	*Number*	*Share of total*	*Number*	*Share of total*	*Number*	*Per cent*
	'000	%	'000	%	'000	%
Males						
15-19	335.6	8.7	278.7	5.9	-56.9	-17.0
20-24	487.7	12.7	494.3	10.5	6.6	1.4
25-34	1 052.1	27.3	1 212.1	25.6	160.0	15.2
35-44	778.1	20.2	1 221.5	25.8	443.4	57.0
45-54	695.0	18.0	990.7	20.9	295.7	42.5
55-59	273.7	7.1	285.3	6.0	11.6	4.2
60 and over	228.5	5.9	246.7	5.2	18.2	8.0
Total	**3 850.8**	**100.0**	**4 729.2**	**100.0**	**878.4**	**22.8**
Females						
15-19	303.2	14.1	274.7	7.7	-28.5	-9.4
20-24	361.9	16.8	447.6	12.5	85.7	23.7
25-34	540.9	25.1	906.7	25.3	365.8	67.6
35-44	439.9	20.4	945.9	26.4	506.0	115.0
45-54	342.1	15.9	749.6	20.9	407.5	119.1
55-59	103.3	4.8	162.5	4.5	59.2	57.3
60 and over	63.3	2.9	99.4	2.8	36.1	57.0
Total	**2 154.4**	**100.0**	**3 586.3**	**100.0**	**1 431.9**	**66.5**
Persons						
15-19	639.0	10.6	553.4	6.7	-85.6	-13.4
20-24	849.5	14.1	941.9	11.3	92.4	10.9
25-34	1 592.6	26.5	2 118.9	25.5	526.3	33.0
35-44	1 217.8	20.3	2 167.3	26.1	949.5	78.0
45-54	1 037.5	17.3	1 740.3	20.9	702.8	67.7
55-59	376.8	6.3	447.7	5.4	70.9	18.8
60 and over	292.1	4.9	346.1	4.2	54.0	18.5
Total	**6 005.3**	**100.0**	**8 315.5**	**100.0**	**2 310.2**	**38.5**

a August data.

Sources: ABS (Labour Force Survey microfiche; unpublished data).

Figure 5.3 **Share of age group employment in total employment, by gender[a], 1978 to 1997[b]**



a The age group shares for males are male age group employment as a percentage of total male employment. The age group shares for females are female age group employment as a percentage of total female employment. **b** August data.

Data sources: ABS (Labour Force Survey microfiche; unpublished data).

The distribution of employment by age group across market sector industries is shown in table 5.2. In both 1978 and 1997, Manufacturing accounted for the largest number employed in the majority of the age groups (25-34, 35-44, 45-54 and 55-59). For the 60 and over age group, the bulk of employment was in Manufacturing in 1978, but was in Agriculture in 1997. Manufacturing also had the most 20-24 year olds in 1978 but, in 1997, Retail trade was the dominant industry. Retail trade also had the largest number of 15-19 year olds in both years.

Major shifts in the distribution of employment across industries within an age group are also identifiable from table 5.2. One significant change is the fall in the number of younger workers (15-19 and 20-24 year olds) in Manufacturing. In contrast, both these age groups recorded significant increases in Retail trade, Accommodation, cafes and restaurants, and Cultural and recreational services.

Table 5.2 **Employment by age group, by industry, 1978 and 1997[a]**

Industry	1978 Number	1978 Share of total	1997 Number	1997 Share of total	Difference Number	Difference Per cent
	'000	%	'000	%	'000	%
15-19 age group						
Agriculture	31.0	4.9	21.5	3.9	-9.5	-30.6
Mining	4.7	0.7	1.4*	0.3	-3.3	-70.2
Manufacturing	120.7	18.9	43.8	7.9	-76.9	-63.7
Electricity, gas and water	7.2	1.1	0.3*	0.1	-6.9	-95.8
Construction	39.5	6.2	30.1	5.4	-9.4	-23.8
Wholesale trade	31.7	5.0	15.2	2.7	-16.5	-52.1
Retail trade	203.0	31.8	280.8	50.7	77.8	38.3
Trans., storage and comm.	22.1	3.5	9.0	1.6	-13.1	-59.3
Accomm., cafes and rest.	18.6	2.9	47.9	8.7	29.3	157.5
Cultural and rec. services	8.5	1.3	17.1	3.1	8.6	101.2
Market sector	487.0	76.2	467.1	84.4	-19.9	-4.1
Total industries	**639.0**	**100.0**	**553.4**	**100.0**	**-85.6**	**-13.4**
20-24 age group						
Agriculture	31.1	3.7	28.3	3.0	-2.8	-9.0
Mining	11.4	1.3	8.1	0.9	-3.3	-28.9
Manufacturing	153.1	18.0	128.3	13.6	-24.8	-16.2
Electricity, gas and water	16.4	1.9	2.7*	0.3	-13.7	-83.5
Construction	63.8	7.5	61.1	6.5	-2.7	-4.2
Wholesale trade	50.2	5.9	54.3	5.8	4.1	8.2
Retail trade	118.3	13.9	194.9	20.7	76.6	64.8
Trans., storage and comm.	57.2	6.7	41.0	4.4	-16.2	-28.3
Accomm., cafes and rest.	28.7	3.4	81.3	8.6	52.6	183.3
Cultural and rec. services	10.6	1.2	31.6	3.4	21.0	198.1
Market sector	540.8	63.7	631.6	67.1	90.8	16.8
Total industries	**849.5**	**100.0**	**941.9**	**100.0**	**92.4**	**10.9**
25-34 age group						
Agriculture	80.6	5.1	70.1	3.3	-10.5	-13.0
Mining	22.2	1.4	23.7	1.1	1.5	6.8
Manufacturing	300.6	18.9	322.6	15.2	22.0	7.3
Electricity, gas and water	27.7	1.7	16.5	0.8	-11.2	-40.4
Construction	148.0	9.3	151.7	7.2	3.7	2.5
Wholesale trade	93.9	5.9	137.0	6.5	43.1	45.9
Retail trade	195.7	12.3	245.5	11.6	49.8	25.4
Trans., storage and comm.	139.1	8.7	141.0	6.7	1.9	1.4
Accomm., cafes and rest.	46.7	2.9	94.1	4.4	47.4	101.5
Cultural and rec. services	25.7	1.6	64.2	3.0	38.5	149.8
Market sector	1 080.2	67.8	1 266.4	59.8	186.2	17.2
Total industries	**1 592.6**	**100.0**	**2 118.9**	**100.0**	**526.3**	**33.0**

(Continued on next page)

Table 5.3 **(Continued)**

Industry	1978 Number	1978 Share of total	1997 Number	1997 Share of total	Difference Number	Difference Per cent
	'000	%	'000	%	'000	%
35-44 age group						
Agriculture	81.2	6.7	102.4	4.7	21.2	26.1
Mining	18.5	1.5	21.7	1.0	3.2	17.3
Manufacturing	256.9	21.1	310.5	14.3	53.6	20.9
Electricity, gas and water	20.7	1.7	20.1	0.9	-0.6	-2.9
Construction	109.7	9.0	159.0	7.3	49.3	44.9
Wholesale trade	75.4	6.2	125.1	5.8	49.7	65.9
Retail trade	166.2	13.6	209.5	9.7	43.3	26.1
Trans., storage and comm.	89.6	7.4	155.8	7.2	66.2	73.9
Accomm., cafes and rest.	39.8	3.3	82.5	3.8	42.7	107.3
Cultural and rec. services	15.2	1.2	41.3	1.9	26.1	171.7
Market sector	873.2	71.7	1 227.9	56.7	354.7	40.6
Total industries	**1 217.8**	**100.0**	**2 167.3**	**100.0**	**949.5**	**78.0**
45-54 age group						
Agriculture	72.2	7.0	93.4	5.4	21.2	29.4
Mining	15.5	1.5	20.5	1.2	5.0	32.3
Manufacturing	225.5	21.7	230.4	13.2	4.9	2.2
Electricity, gas and water	27.9	2.7	18.0	1.0	-9.9	-35.5
Construction	82.8	8.0	113.6	6.5	30.8	37.2
Wholesale trade	66.5	6.4	97.7	5.6	31.2	46.9
Retail trade	122.0	11.8	187.0	10.7	65.0	53.3
Trans., storage and comm.	92.2	8.9	142.3	8.2	50.1	54.3
Accomm., cafes and rest.	35.0	3.4	58.0	3.3	23.0	65.7
Cultural and rec. services	12.8	1.2	28.5	1.6	15.7	122.7
Market sector	752.4	72.5	989.4	56.9	237.0	31.5
Total industries	**1 037.5**	**100.0**	**1 740.3**	**100.0**	**702.8**	**67.7**
55-59 age group						
Agriculture	29.3	7.8	36.6	8.2	7.3	24.9
Mining	4.8	1.3	4.6	1.0	-0.2	-4.2
Manufacturing	82.7	21.9	67.9	15.2	-14.8	-17.9
Electricity, gas and water	10.1	2.7	6.2	1.4	-3.9	-38.6
Construction	25.3	6.7	30.9	6.9	5.6	22.1
Wholesale trade	25.3	6.7	22.5	5.0	-2.8	-11.1
Retail trade	45.8	12.2	44.1	9.9	-1.7	-3.7
Trans., storage and comm.	37.2	9.9	32.4	7.2	-4.8	-12.9
Accomm., cafes and rest.	11.4	3.0	15.6	3.5	4.2	36.8
Cultural and rec. services	4.5	1.2	6.4	1.4	1.9	42.2
Market sector	276.4	73.4	267.2	59.7	-9.2	-3.3
Total industries	**376.8**	**100.0**	**447.7**	**100.0**	**70.9**	**18.8**

(Continued on next page)

Table 5.4 **(Continued)**

Industry	1978 Number	1978 Share of total	1997 Number	1997 Share of total	Difference Number	Difference Per cent
	'000	%	'000	%	'000	%
60 and over age group						
Agriculture	49.5	16.9	67.0	19.4	17.5	35.4
Mining	1.9*	0.7	1.5*	0.4	-0.4	-21.1
Manufacturing	54.8	18.8	41.3	11.9	-13.5	-24.6
Electricity, gas and water	5.0	1.7	2.5*	0.7	-2.5	-50.0
Construction	17.7	6.1	20.5	5.9	2.8	15.8
Wholesale trade	20.2	6.9	20.1	5.8	-0.1	-0.5
Retail trade	33.6	11.5	35.4	10.2	1.8	5.4
Trans., storage and comm.	21.4	7.3	20.4	5.9	-1.0	-4.7
Accomm., cafes and rest.	8.5	2.9	13.8	4.0	5.3	62.4
Cultural and rec. services	5.0	1.7	7.2	2.1	2.2	44.0
Market sector	217.6	74.5	229.7	66.4	12.1	5.6
Total industries	**292.1**	**100.0**	**346.1**	**100.0**	**54.0**	**18.5**
All age groups						
Agriculture	374.9	6.2	419.4	5.0	44.5	11.9
Mining	79.0	1.3	81.5	1.0	2.5	3.2
Manufacturing	1 194.2	19.9	1 144.7	13.8	-49.5	-4.1
Electricity, gas and water	115.1	1.9	66.2	0.8	-48.9	-42.5
Construction	486.9	8.1	567.1	6.8	80.2	16.5
Wholesale trade	363.3	6.0	471.8	5.7	108.5	29.9
Retail trade	884.7	14.7	1 197.2	14.4	312.5	35.3
Trans., storage and comm.	458.7	7.6	542.2	6.5	83.5	18.2
Accomm., cafes and rest.	188.9	3.1	393.2	4.7	204.3	108.2
Cultural and rec. services	82.2	1.4	196.2	2.4	114.0	138.7
Market sector	4 227.9	70.4	5 079.5	61.1	851.6	20.1
Total industries	**6 005.3**	**100.0**	**8 315.5**	**100.0**	**2 310.2**	**38.5**

a August data. * Estimate is statistically unreliable (subject to relative standard error of greater than 25 per cent).

Sources: Based on ABS (Labour Force Survey microfiche; unpublished data).

5.4 Relationship between productivity growth and the age profile of employment

The share of the employed workforce in the 15-19, 20-24 and 25-34 age groups has been falling at the aggregate level, with increases in the age groups between 35 and 54. The share held by the 55-59 and 60 and over age groups has also been falling, but from low initial shares of total employment. But is this aggregate trend evident across all industries, and is there any pattern between change in age profile and productivity growth at the industry level?

To examine these issues, the following sections consider two questions.

- Does the age group profile of employment in high productivity growth industries differ systematically from the economywide average and from low productivity growth industries?
- Is there any association between productivity growth and changes in the age profile of the employed workforce at the industry level?

Age profile of employment in high and low productivity growth industries

A simple examination of the age group profiles for the high and low productivity growth industries is provided in figure **5.4**. The charts show the share of employed persons in the workforce for different age groups. The left hand side panel of the figure shows the high productivity growth industries and the right hand side panel shows the low productivity growth industries. In both panels, the Total industries profile (economywide average) is used as a benchmark. The individual industry employment trends in the charts in figure 5.2 are difficult to identify clearly. However, if the data in the charts are viewed as a bandwidth, the charts are helpful in identifying any broad differences across the different age groups in relation to the benchmark and between the high and low productivity growth industries.

Looking at the high productivity growth industries relative to the benchmark, these industries have smaller shares of workers in the younger age groups (15-19 and 20-24 year olds) and larger shares of workers in the 45-54 and 55-59 age groups. There are no systematic patterns for the other age groups.

Because the age distribution of high productivity growth industries varies from the average, all other things equal, their relative growth or decline will have some effect on the overall age distribution of employment. As previously pointed out (chapter 3), employment in Manufacturing and in Electricity, gas and water has been in relative and absolute decline. Employment in Transport, storage and

communication has been in absolute increase, but relative decline. Consequently, past trends in these industries have led to some decline in the employment of younger and older aged workers (as indicated in table 5.1).

Figure **5.5** suggests that, for low productivity growth industries, there is a lesser association between productivity growth and age structure. For most age groups there is no clear grouping of the low productivity growth industries relative to the benchmark, although there is some tendency for these industries to employ a lower proportion of older workers and a higher proportion of younger workers.

Comparing the high and low productivity growth industries, there appears to be no systematic pattern evident that would indicate a clear association between the age profile of employment and productivity growth across all the industries examined. However, while not completely systematic, the low productivity growth industries tend to have higher shares of younger workers and lower shares of workers from 45 to 59 years old than the high productivity growth industries. This may partially reflect the nature of the activities and the relatively lower skill requirements of the work in some of the low productivity growth industries. Some of these industries also have higher levels of part-time and casual employment, which younger workers can combine with study.

Figure 5.6 **Share of age group employment in industry employment, selected industries[a], 1978 to 1997[b]**

Per cent

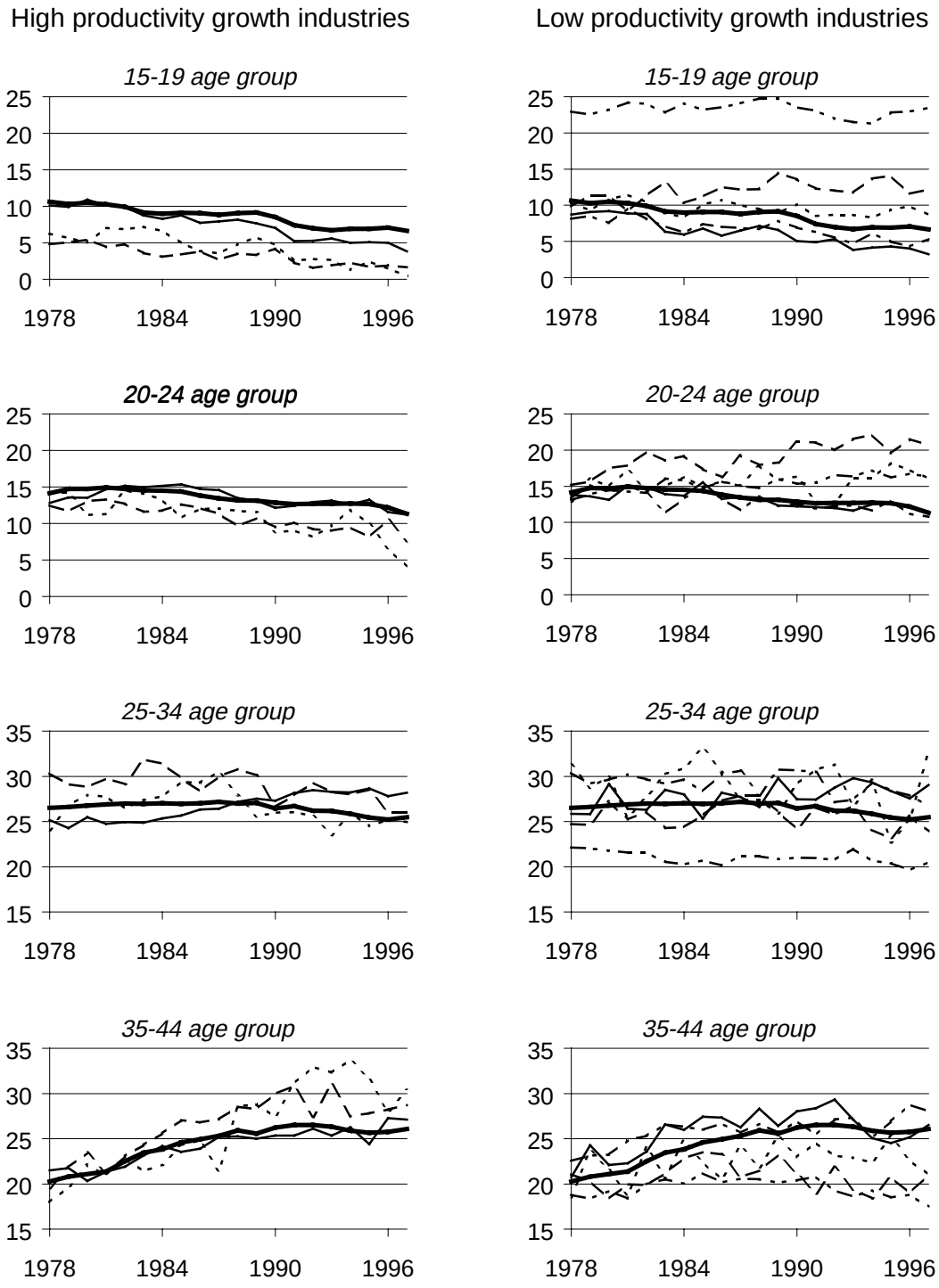


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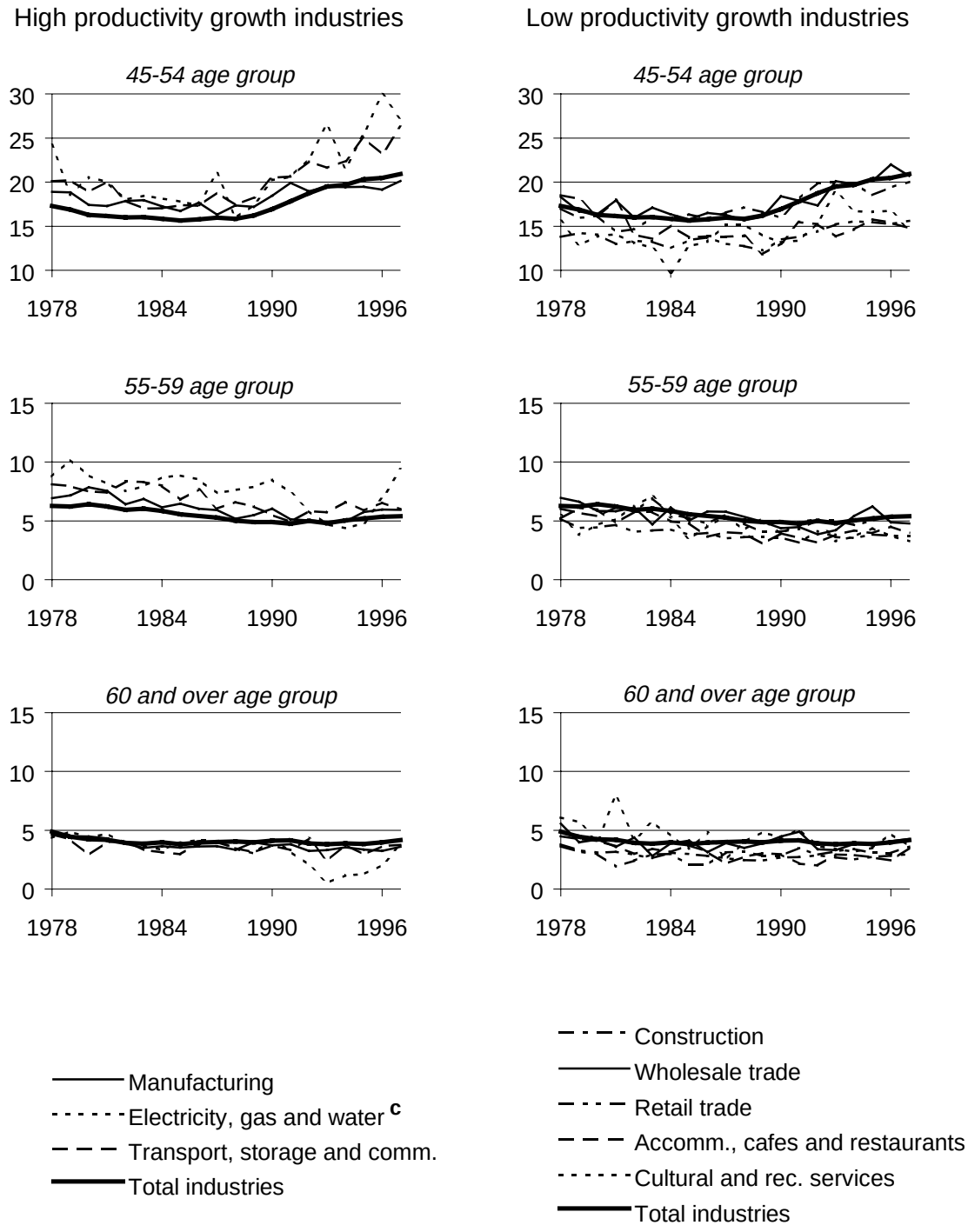
Figure 5.6 **(Continued)**



a Care should be taken when comparing these charts across age groups. The scale used differs across age groups to facilitate comparison between the high productivity growth industries and low productivity growth industries for a given age group. **b** August data. **c** Shares for several years in the series for 15-19, 55-59 and 60 and over age groups are based on ABS estimates with relative standard errors of greater than 25 per cent.

Data sources: Based on ABS (Labour Force Survey microfiche; unpublished data).

Growth in productivity and the change in the average age of the employed workforce

A summary way of looking at the overall change in the age profile of the workforce is to use average age. To examine any association between average age and productivity growth, a series of charts was constructed that plots the average age of workers and multifactor productivity (MFP) over the period 1978-79 and 1997-98 for selected market sector industries (figure 5.3).

The average age of workers has fallen in three of the five low productivity growth industries (Accommodation, cafes and restaurants, Cultural and recreational services and Retail trade). The remaining two low productivity growth industries (Construction and Wholesale trade), which have higher productivity growth than the other three low productivity growth industries, have increasing average age. The average age of workers in the high productivity growth industries has also tended to rise. This suggests that there may be some correlation between MFP growth and changes in the average age of workers over the period. However, it may also reflect the growth in employment, particularly part-time employment attractive to younger workers, in Accommodation, cafes and restaurants, Cultural and recreational services and Retail trade.

An alternative and more systematic method of considering the relationship between the growth in the average age of workers and the growth in MFP is to compare their average rate of growth over the period across all market sector industries. A scatter plot of the growth in both average age and MFP was constructed (figure 5.4). While the line of best fit in this chart has a slight positive slope, the correlation between growth in average age and MFP is not statistically significant for employed persons. When examined by gender, there is a statistically significant positive correlation for females but not males (appendix B).

Figure 5.7 **Indexes of MFP[a] and average age[b] of employed persons, selected industries, 1978-79 to 1997-98[c]**

Left axis — MFP index 1978-79 = 100, right axis — age in years

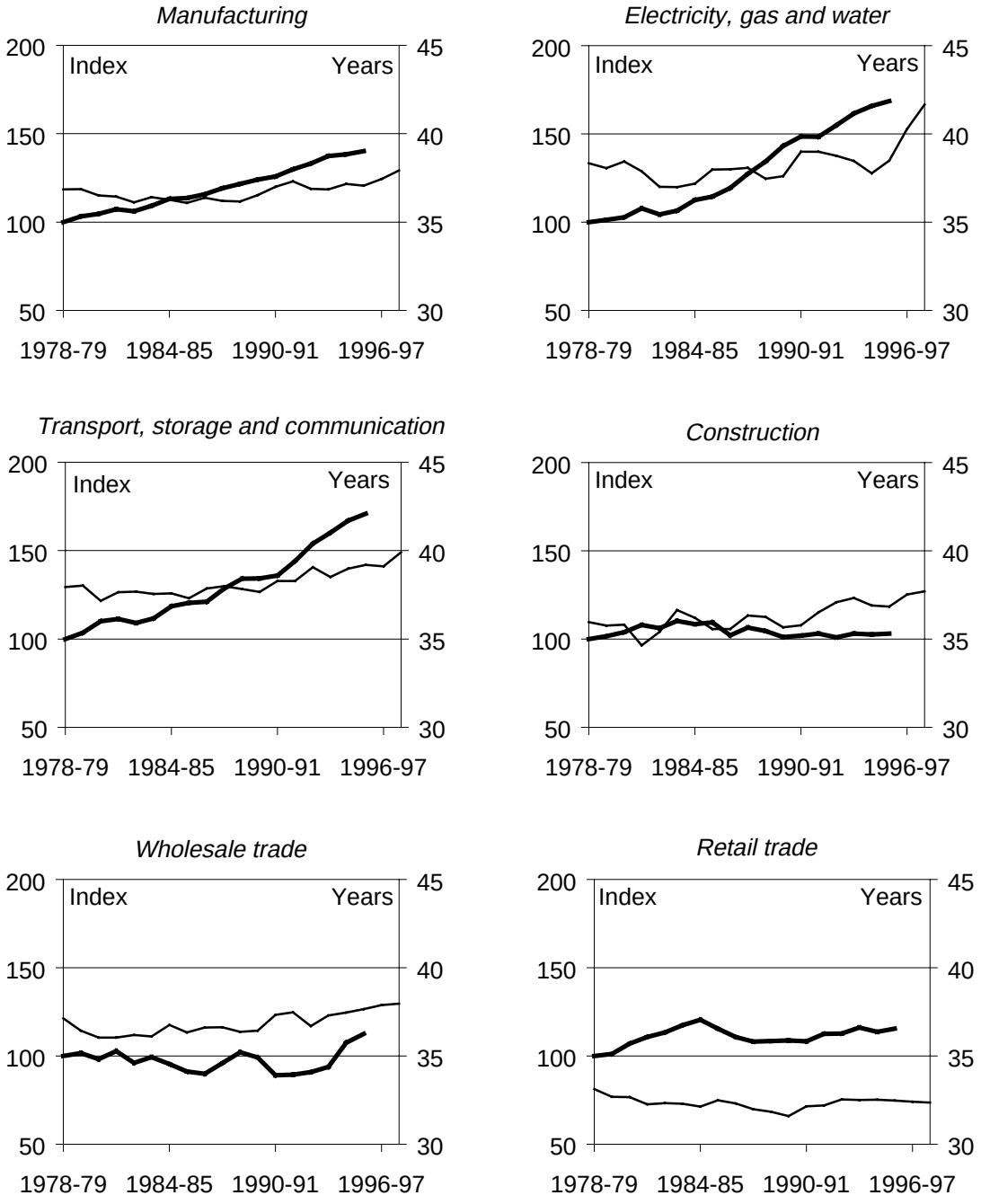


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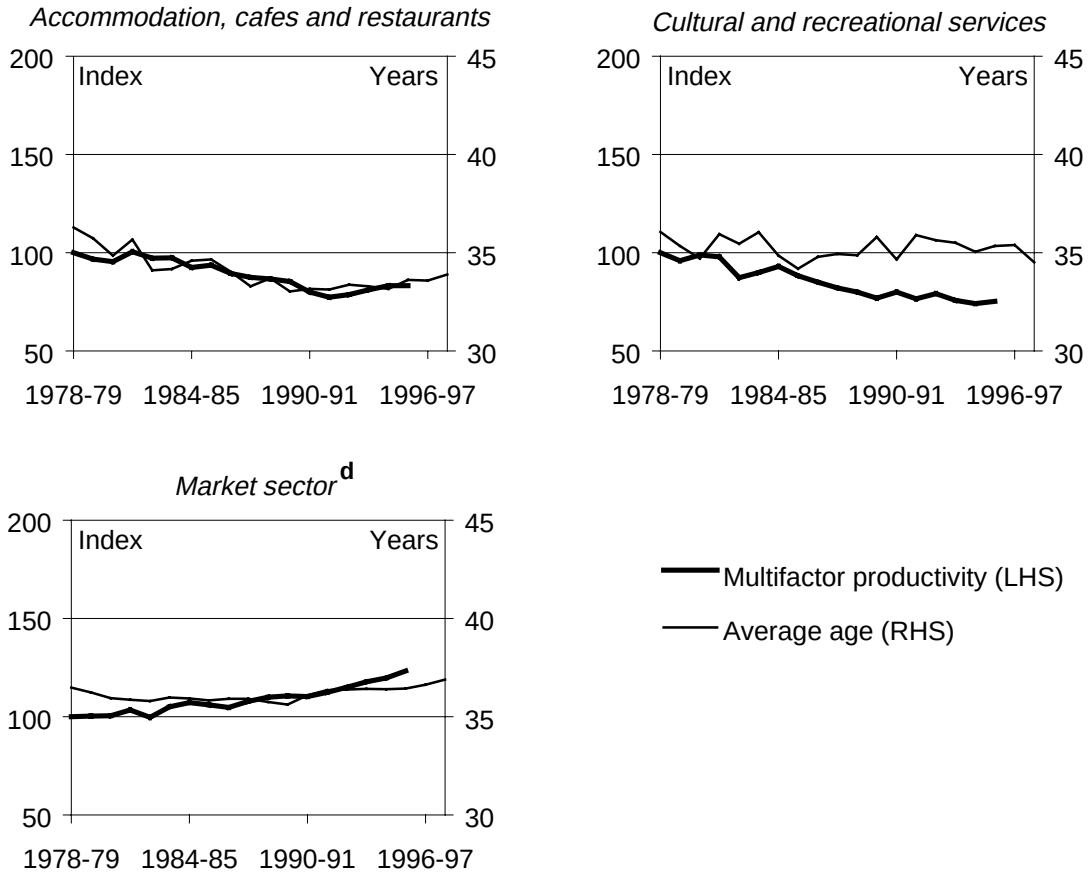
Figure 5.3 **(Continued)**

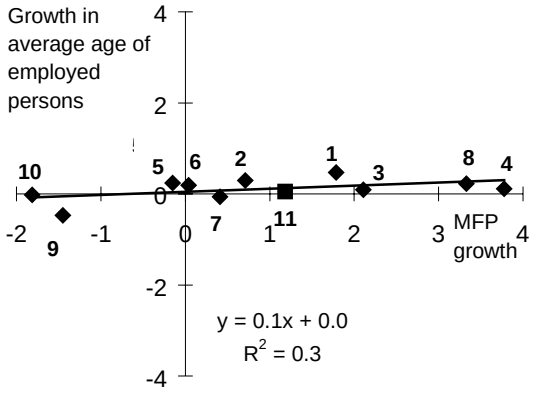


a MFP data are for financial years and are not available after 1995-96. **b** This is a crude estimate based on the mid-points of the age groups weighted by the number of workers in each age group. **c** Based on August data. **d** MFP data are not available for Total industries.

Data sources: Estimates for MFP updated from Gretton and Fisher (1997); estimates for employment based on ABS (Labour Force Survey microfiche; unpublished data).

Figure 5.8 **Average growth[a] in the average age[b] of employed persons and MFP, 1978-79 to 1995-96[c]**

Per cent per year



1 Agriculture
2 Mining
3 Manufacturing
4 Electricity, gas and water
5 Construction
6 Wholesale trade
7 Retail trade
8 Transport, storage and communication
9 Accommodation, cafes and restaurants
10 Cultural and recreational services
11 Market sector[d]

a Growth rates are measured using average annual compound formula based on the end points of linear trend lines through time series data. **b** The average age is a crude estimate based on the mid-points of the age groups weighted by the number of workers in each age group. **c** The employment data are averages between August 1978 and August 1995. The MFP data are averages between financial years 1978-79 and 1995-96. **d** The market sector is not included in the estimation of the equation.

Data sources: Estimates for MFP updated from Gretton and Fisher (1997); estimates for employment based on ABS (Labour Force Survey microfiche; unpublished data).

Growth in productivity and change in the age profile of employment

The above examination of changes in average age only provides partial information about compositional change. For example, offsetting changes in age composition are not evident. To provide such information, figure 5.5 presents a series of scatter plots covering each age group for employed persons. The shares of employment in different age groups are obviously interrelated. For instance, if the share of employment in one age group decreases, there must be an offsetting rise in the share of one or more other age groups. Regardless of the source of the change in the share of employment of a particular age group,[4] the shares of employment by age group indicate the relative importance of the age groups in the workforce. It is the changing composition of the workforce that is of interest in this paper.

These scatter plots, like figure **5.9**, incorporate some additional industry data for Agriculture and Mining — the remaining two market sector industries, which are excluded from some of the earlier analysis because of year-to-year volatility. Unreliable employment data for some age groups in individual industries have also been removed.

4 The change in share is the percentage change, not the change in percentage *points*.

Not all the correlations shown in the scatter plots in figure 5.5 are statistically significant. The statistically significant correlations are:

- The 15-19 and 20-24 age groups. The lines of best fit through the scatter plots for these younger age groups indicate a *negative* association between MFP growth and the growth in the share of workers in these age groups. This suggests that higher (lower) growth in MFP is associated with lower (higher) growth in the share of younger workers employed across market sector industries.
- The 35-44 age group. The line of best fit through this scatter plot indicates a *positive* association between MFP growth and the growth in the share of the employed workforce in this age group. Thus, in this case, higher (lower) MFP growth is associated with higher (lower) growth in the employment share of 35-44 year olds across market sector industries.

No statistically significant correlations were found for the other age groups. In these cases there is little variation in the changes in the age group shares of employment across industries. This suggests factors unrelated to industry MFP growth are associated with changes in the share of workers in these age groups.

Analysis for males provided similar results to persons. For females, there were no statistically significantly correlations between MFP growth and employment in any age group. However, it should be noted that the female employment data were, in a number of cases, unreliable due to high standard errors. Hence, a smaller number of industries (observations) were used in the scatter plots and, in some cases, there were insufficient observations for any analysis. Details of all scatter plots are presented in appendix B. A brief examination of changes in the age profiles of industries within Manufacturing is provided in appendix C. Effects in selected industries are examined in box 5.1.

Figure 5.10 **Average growth rates[a] of the share of employment by age group[b] and MFP, 1978-79 to 1995-96[c]**

Per cent per year

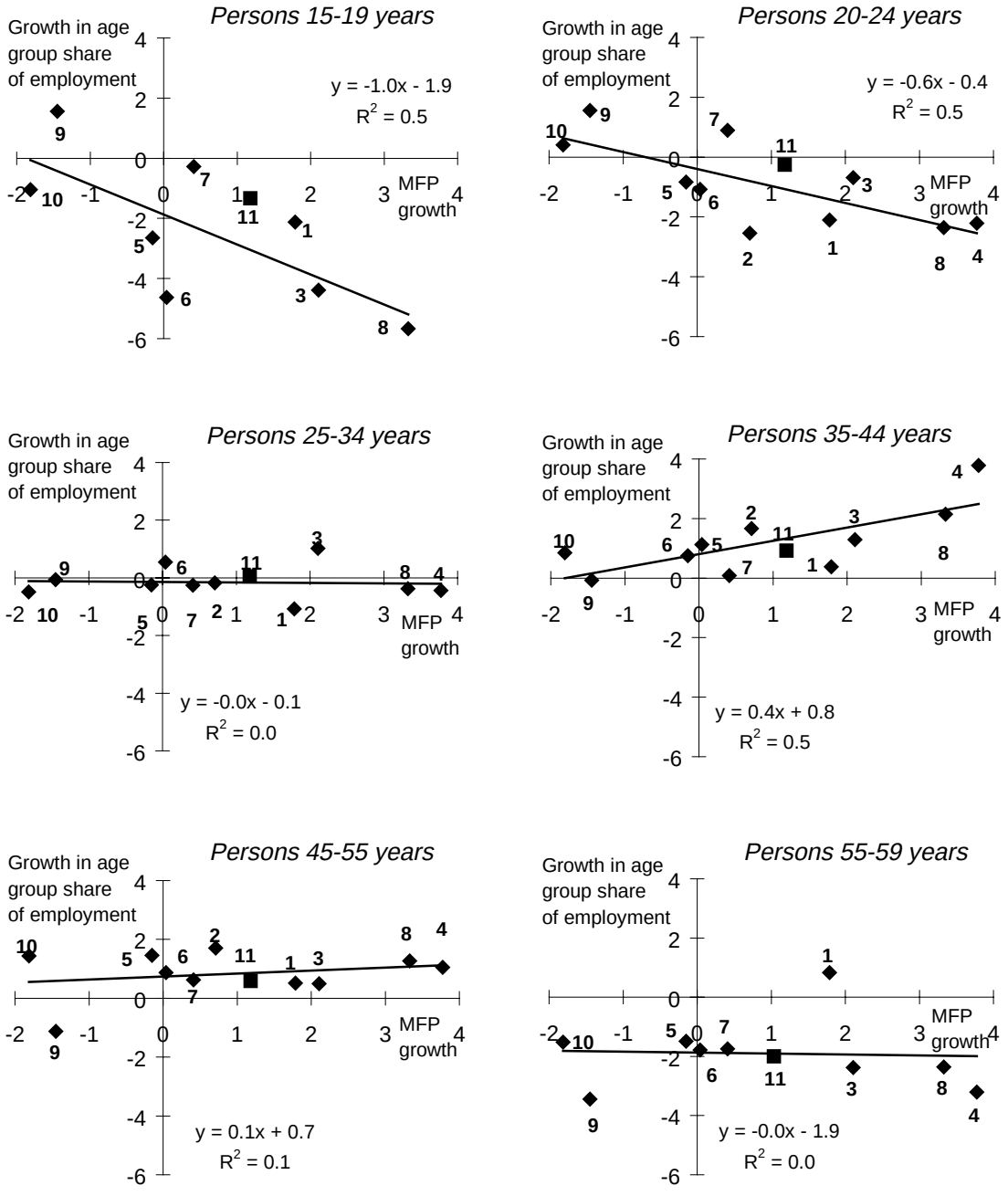


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Figure 5.5 **(Continued)**

1 Agriculture
2 Mining
3 Manufacturing
4 Electricity, gas and water
5 Construction
6 Wholesale trade
7 Retail trade
8 Transport, storage and communication
9 Accommodation, cafes and restaurants
10 Cultural and recreational services
11 Market sector[d]

a Growth rates are measured using average annual compound formula based on the end points of linear trend lines through time series data. **b** The charts exclude some employment data because the ABS estimates of employment in some age groups are statistically unreliable (subject to relative standard error of greater than 25 per cent). Data for the 15-19, 55-59 and 60 and over age groups were excluded for the Mining industry. The 15-19 and 60 and over age groups were excluded for the Electricity, gas and water industry. **c** The employment data are averages between August 1978 and August 1995. The MFP data are averages between financial years 1978-79 and 1995-96. The period used in this figure differs from earlier employment figures because MFP estimates are not available after 1995-96. **d** The market sector is not included in the estimation of equations.

Data sources: Estimates for MFP updated from Gretton and Fisher (1997); estimates for employment based on ABS (Labour force survey microfiche; unpublished data).

Box 5.1 **Industry-specific effects — age**

Electricity, gas and water and Manufacturing are two high productivity growth industries that have experienced significant downsizing of their workforces, which could potentially affect the age structure of employment.

All age groups in Electricity, gas and water recorded a decline in the number employed between 1978 and 1997 (table 5.4). However, employment in the younger and older age groups has fallen proportionately more. While there is considerable volatility in the data for this industry, figure 5.2 shows that, from the early to mid-1990s, the share of workers in the 55-59 and 60 and over age groups fell more rapidly than in some of the other age groups (possibly reflecting older workers taking redundancy packages). However, since this industry is a relatively small employer, this would have only a small effect on the overall age structure of employment.

In Manufacturing, the decline in employment has also focused more heavily on the younger and older workers (table 5.2). The effect on the number of younger workers may, in part, reflect rising education retention rates and falling apprenticeship rates.

In Transport, storage and communication, the remaining high productivity growth industry, total employment grew slightly between 1978 and 1997. Transport, storage and communication had similar changes to the other high productivity growth industries in the distribution of employment across age groups. Employment fell in the younger age groups (15-19 and 20-24) and the older age groups (55-59 and 60 and over), with all employment growth being concentrated in the 25-34, 35-44 and 45-54 age groups (table 5.2).

5.5 Summary

The examination undertaken in this chapter suggests that there may be some negative correlation between MFP growth and the share of younger workers employed across industries in the market sector. In addition, a positive correlation was found for the 35-44 age group.

For the 35-44 age group, the result appears to be strongly influenced by the growth in the share of employment in this age group in Electricity, gas and water — a relatively small employer. This growth for Electricity, gas and water reflects a slower decline in employment numbers in this age group compared with the other age groups. Lack of recruitment of younger workers, the ageing of the remaining workforce and early retirement of older workers may have all combined to raise the share of workers in the 35-44 age group.

For the younger age groups, increasing education retention rates may have affected low and high productivity growth industries differently for reasons not related to MFP growth. Low productivity growth industries tend to have higher shares of part-

time and casual workers, which may allow younger workers to combine education and work. This may partly explain the share of younger workers in most of these industries decreasing relatively slowly, or in some cases increasing, compared with the decreases in the high productivity growth industries. Further work with more detailed data would be required to disentangle these effects.

6 Part-time and casual employment

The incidence of part-time and casual employment has increased significantly over the past two decades. Community views about the merits of these arrangements vary. Some members of the community view them as sources of increased flexibility and employment opportunities in keeping with lifestyle choices. Others see them as precarious forms of employment. Questions are raised about whether people employed on a part-time or casual basis would rather be working on a full-time or permanent basis.

A range of factors that affect the incidence of part-time and casual employment is briefly discussed in the following section. However, the main purpose of this chapter is to examine whether there is any association between productivity growth and the incidence of these working arrangements. Specifically, this chapter examines whether there are relationships between productivity growth and increases in the share of the workforce in part-time and casual employment, at the industry sector level.

6.1 Factors affecting the extent of part-time and casual employment

Growth in part-time and casual employment reflects a number of changes on both the demand and supply sides of labour markets. On the demand side, there are cost and flexibility benefits for employers from casual and part-time employment. On the supply side, there are benefits of flexibility in the balance between work and non-work aspects of life, which may have induced more people to enter the workforce. Institutional changes have reduced restraints on employment on a part-time and casual basis.

While definitions of part-time and casual employment vary, the ABS defines *part-time* employees as those who usually work less than 35 hours a week (ABS 1997c) and *casual* employees as those who are not entitled to either annual leave or sick leave (ABS 1997e). Part-time employees can be permanent or casual, and casual employees can be full-time or part-time. The degree of flexibility depends on the

combination of arrangements but, as Dawkins and Norris (1995, p. 23) note:

> The epitome of flexible labour is, of course, the part-time casual worker, whose hours of work can be varied upwards and downwards at short notice, who can easily be assigned to different tasks, and who can be dismissed at a moment's notice.

The actual overlap in the workforce between casual and part-time employment is significant. In 1993, part-time casual employment accounted for 72 per cent of casual employment and 67 per cent of part-time employment (Dawkins and Norris 1995).

Part-time and casual employees can be used to cover both short-term needs (for example, seasonal needs and irregular peaks) and long-run regular needs (for example, predictable, regular peaks in demand, and work during non-social hours). For example, the extension of traditional operating hours, particularly in the service sector, has increased the need for flexibility and therefore increased the attractiveness to employers of casual and part-time employees. The introduction of new technology and the reorganisation of work has reinforced this demand. For example, in banking, work previously done by staff outside bank opening hours is now automated so there is increased scope for tellers to be employed part-time only for those hours when the bank is open to the public (Lewis 1990). Casual employment, in particular, reduces the risks to employers of loss from economic downturns and can be used to meet unforeseen circumstances.

Increased competitive pressures in some industries have enhanced the incentive to minimise costs and seek more flexible work arrangements. Labour market deregulation has also had some effect on the extent of part-time and casual employment. For example, changes in workplace relations laws have removed maximum and minimum hours for part-time work and removed restrictions on the proportion of part-time and casual workers (EPAC 1996b). Declines in union density may also have had an impact as unions have usually opposed the use of part-time and casual labour (Dawkins and Norris 1995; Simpson, Dawkins and Madden 1997). Other legislative and institutional changes, such as unfair dismissal laws and superannuation changes, have affected the relative cost of casual workers (EPAC 1996b).

While both part-time and casual employment can reduce labour costs, as employees are not paid when they are not needed, casual employment may provide additional labour cost savings. More specifically, casual employees do not receive some benefits associated with permanent work, such as sick leave and annual leave. Although casual employees receive a wage loading in lieu of certain entitlements, this loading may sometimes be less than the actual entitlements (Lewis 1990).

Casual employment may also have less attractive or reduced superannuation provisions and retrenchment payments than permanent employment. There is some tentative evidence of declining costs of casuals relative to permanent workers (Simpson 1994). These cost savings can be offset, however, by additional hiring and training costs if turnover of employees is higher. Relatively low training requirements in low-skilled occupations may help explain the relatively high incidence of casual and part-time employment in those occupations. Reflecting these factors, the net benefit to employers of such forms of employment will vary between industries (Lewis 1990; Romeyn 1992).

On the supply side, some employees find the opportunity for flexible working arrangements attractive. Employee personal preferences may be to combine paid work with increased time for family responsibilities, study or leisure. This type of work may also allow a transition to retirement or provide employment for those whose health would make full-time work difficult (Romeyn 1992). The increase in female participation in the labour force, particularly married women with dependants, has been an important factor in the growth of part-time and casual employment (Dawkins and Norris 1995; Romeyn 1992). The growth of the student labour supply is another factor, with increased retention rates for education leading to an increased supply of students willing to work on a part-time or casual basis (Dawkins and Norris 1990; 1995).

Not all employees that work on a part-time or casual basis wish to do so. The ABS (1988) found that, in 1986, about 42 per cent of casual employees would have preferred permanent employment. On a gender basis, about 37 per cent of casual female employees and 49 per cent of casual male employees would have preferred permanent employment. The ABS (1998b) also found that, in 1998, around 25 per cent of all part-time workers wanted to work more hours (20 per cent for females and 37 per cent for males).

EPAC (1996a) suggested that no clear consensus had emerged in the literature about the relative importance of demand and supply factors in explaining part-time and casual employment growth. However, a number of studies do suggest that, while supply factors have supported the growth of these forms of employment, the major factor has been increases in demand (see for example, EPAC 1996b; Romeyn 1992; Simpson 1994; Simpson, Dawkins and Madden 1997).

6.2 Part-time and casual employment and productivity

As noted in section 6.1, growth in part-time and casual employment reflects, in part, the ability to increase workplace productivity through better matching of hours worked with employer needs. However, the links between productivity and these forms of employment extend beyond flexibility.

Part-time and casual workers may also be *more* productive because:

- shorter working hours may increase employees' application and motivation, and decrease fatigue (Lewis 1990; Romeyn 1992; Simpson 1994); and
- certain types of employees who favour part-time and casual employment may have higher productivity (for example, students who have above average human capital, a good attitude to work and a willingness to work flexible hours) (Dawkins and Norris 1995).

Alternatively, increased part-time and casual employment could *lower* productivity.

- Casual employment may weaken long-term attachment to the firm, lowering employee commitment and productivity (Lewis 1990; Romeyn 1992). This may also cause quality control problems and increase supervision costs (Simpson 1994).
- Casual employment may result in inefficiencies due to high staff turnover and the frequent need for training (Simpson, Dawkins and Madden 1997). However, permanent part-time work may allow the retention of skilled workers (who might otherwise leave), thereby decreasing turnover and recruitment costs (Lewis 1990; Romeyn 1992).
- Higher capital costs may be incurred if additional equipment is needed because of the greater number of employees (Lewis 1990). This will be the case if all work is being compressed into a shorter time span and more equipment is therefore needed for the extra employees.

Other changes aimed at increasing productivity, such as the introduction of new technology, may lead to 'incidental' changes in the structure of the workforce. For example, the introduction of scanners in supermarkets improved the productivity of checkout operators (whether permanent or casual). However, this change also lowered the skills and training needed for the job, making casual employees relatively more attractive to employers.

The positive and negative links between productivity growth and casual and part-time employment may offset each other to some extent. What will be observed is the net effect of these impacts, together with other factors affecting both variables. In the following sections, the relationships between the changes in productivity and in

the structure of employment are examined. Part-time employment and casual employment are considered in turn.

6.3 Part-time employment

Trends in part-time employment

For the purposes of this paper, a part-time worker is defined as one who usually works less than 35 hours a week.

Between August 1978 and August 1997, total employment increased by over two million people, with roughly equal increases in full-time and part-time employment (table **6.1**). While the majority of employment remained full-time, part-time employment as a share of total employment rose steadily from 16 per cent to around 26 per cent over this period (figure **6.2**). Over two-thirds of the additional part-time employees between 1978 and 1997 were females (table **6.3**).

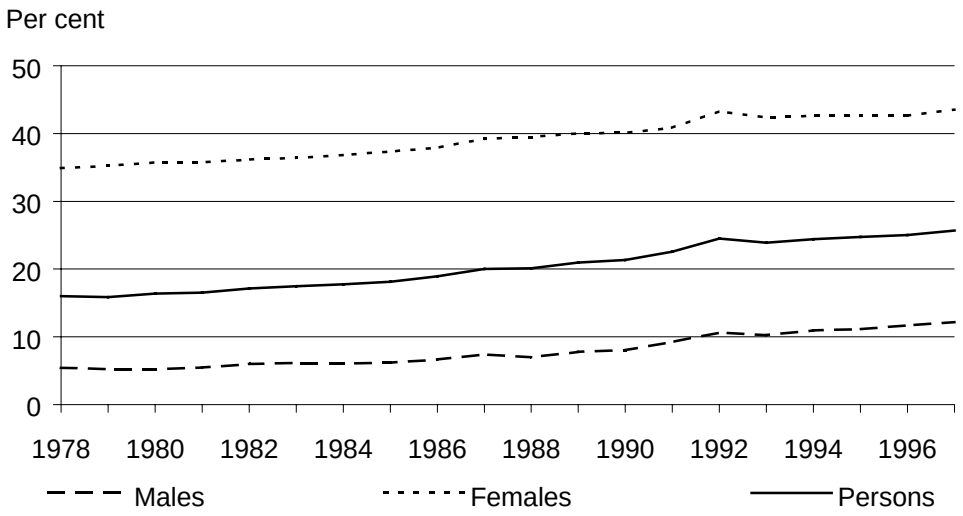
Table 6.4 **Part-time and full-time employment, by gender, 1978 and 1997[a]**

	1978		*1997*		*Difference*	
Employment status	*Number*	*Share of total*	*Number*	*Share of total*	*Number*	*Per cent*
	'000	%	'000	%	'000	%
Males						
Part-time	208.5	5.4	575.9	12.2	367.4	176.0
Full-time	3 642.5	94.6	4 153.3	87.8	510.9	14.0
Total	**3 850.9**	**100.0**	**4 729.2**	**100.0**	**878.3**	**22.8**
Females						
Part-time	751.6	34.9	1 561.3	43.5	809.7	107.7
Full-time	1 402.9	65.1	2 025.0	56.5	622.1	44.3
Total	**2 154.4**	**100.0**	**3 586.3**	**100.0**	**1 431.9**	**66.5**
Persons						
Part-time	960.0	16.0	2 137.1	25.7	1 177.1	122.6
Full-time	5 045.3	84.0	6 178.4	74.3	1 133.1	22.5
Total	**6 005.4**	**100.0**	**8 315.5**	**100.0**	**2 310.1**	**38.5**

a August data.

Sources: ABS *(The Labour Force, Australia, Historical Summary, 1966 to 1984,* Cat. no. 6204.0; Labour Force Survey microfiche); ABS Labour Statistics on dX-Online database (accessed 30 September 1997).

Figure 6.1 **Share of part-time employment in total employment, by gender[a], 1978 to 1997[b]**



a The share for males is male part-time employment as a percentage of total male employment. The share for females is female part-time employment as a percentage of total female employment. **b** August data.

Data sources: ABS *(The Labour Force, Australia, Historical Summary, 1966 to 1984,* Cat. no. 6204.0; Labour Force Survey microfiche); ABS Labour Statistics on dX-Online database (accessed 30 September 1997).

The increase in part-time employment has occurred fairly consistently across all market sector industries. Consequently, the distribution of part-time employment across industries has not changed dramatically over the period examined (table **6.5**). Part-time employment on a gender basis also increased fairly evenly in most market sector industries between 1978 and 1997.

Retail trade accounted for around a quarter of total part-time employment in both 1978 and 1997. Accommodation, cafes and restaurants and Manufacturing were the next two largest employers of part-time workers in the market sector, but each accounted for less than 10 per cent of total part-time employment.

Figure **6.2** shows that the importance of part-time employment varies between industries, but is most important in certain service industries.

Table 6.6 **Part-time and full-time employment, by industry, 1978 and 1997[a]**

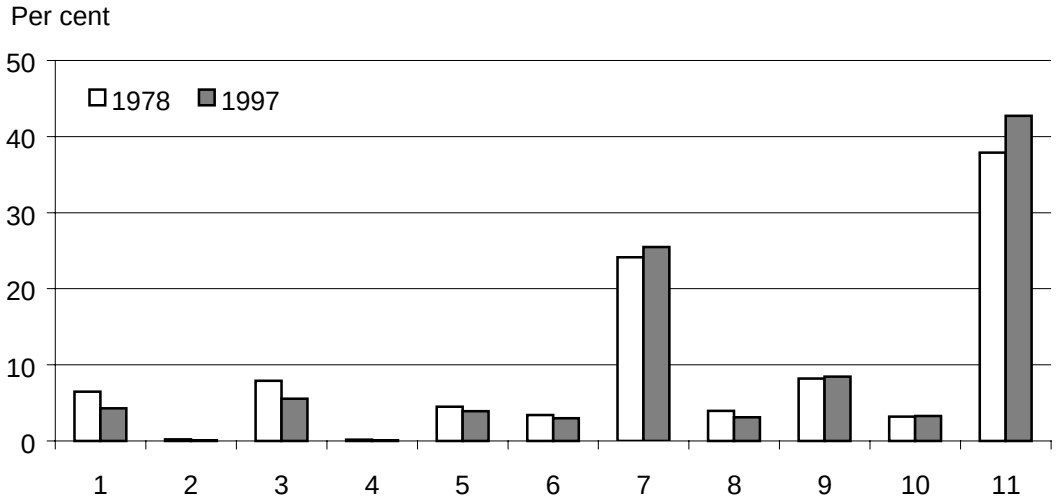
	1978		*1997*		*Difference*	
Industry	*Number*	*Share of total*	*Number*	*Share of total*	*Number*	*Per cent*
	'000	%	'000	%	'000	%
Part-time employment						
Agriculture	62.4	6.5	91.8	4.3	29.4	47.2
Mining	1.9*	0.2	2.2*	0.1	0.3	18.2
Manufacturing	75.7	7.9	119.0	5.6	43.3	57.1
Electricity, gas and water	1.8*	0.2	1.7*	0.1	-0.1	-6.1
Construction	43.0	4.5	83.7	3.9	40.7	94.7
Wholesale trade	32.6	3.4	63.4	3.0	30.8	94.5
Retail trade	231.9	24.2	544.3	25.5	312.4	134.7
Trans., storage and comm.	37.8	3.9	66.9	3.1	29.1	77.1
Accomm., cafes and rest.	78.7	8.2	180.4	8.4	101.7	129.1
Cultural and rec. services	30.6	3.2	70.3	3.3	39.7	129.8
Market sector	596.4	62.1	1 223.7	57.3	627.3	105.2
Total industries	**960.0**	**100.0**	**2 137.1**	**100.0**	**1 177.1**	**122.6**
Full-time employment						
Agriculture	312.5	6.2	327.7	5.3	15.2	4.9
Mining	77.1	1.5	79.3	1.3	2.2	2.8
Manufacturing	1 118.5	22.2	1 025.7	16.6	-92.8	-8.3
Electricity, gas and water	113.3	2.2	64.4	1.0	-48.9	-43.2
Construction	443.9	8.8	483.4	7.8	39.5	8.9
Wholesale trade	330.7	6.6	408.4	6.6	77.7	23.5
Retail trade	652.8	12.9	652.9	10.6	0.1	0.0
Trans., storage and comm.	420.9	8.3	475.2	7.7	54.3	12.9
Accomm., cafes and rest.	110.1	2.2	212.8	3.4	102.7	93.2
Cultural and rec. services	51.6	1.0	125.9	2.0	74.3	144.0
Market sector	3 631.5	72.0	3 855.7	62.4	224.2	6.2
Total industries	**5 045.3**	**100.0**	**6 178.4**	**100.0**	**1 133.1**	**22.5**
Total employment						
Agriculture	374.9	6.2	419.4	5.0	44.5	11.9
Mining	79.0	1.3	81.5	1.0	2.5	3.2
Manufacturing	1 194.2	19.9	1 144.7	13.8	-49.5	-4.1
Electricity, gas and water	115.1	1.9	66.2	0.8	-48.9	-42.5
Construction	486.9	8.1	567.1	6.8	80.2	16.5
Wholesale trade	363.3	6.0	471.8	5.7	108.5	29.9
Retail trade	884.7	14.7	1 197.2	14.4	312.5	35.3
Trans., storage and comm.	458.7	7.6	542.2	6.5	83.5	18.2
Accomm., cafes and rest.	188.9	3.1	393.2	4.7	204.3	108.2
Cultural and rec. services	82.2	1.4	196.2	2.4	114.0	138.7
Market sector	4 227.9	70.4	5 079.5	61.1	851.6	20.1
Total industries	**6 005.4**	**100.0**	**8 315.5**	**100.0**	**2 310.1**	**38.5**

a August data. * Estimate is statistically unreliable (subject to relative standard error of greater than 25 per cent).

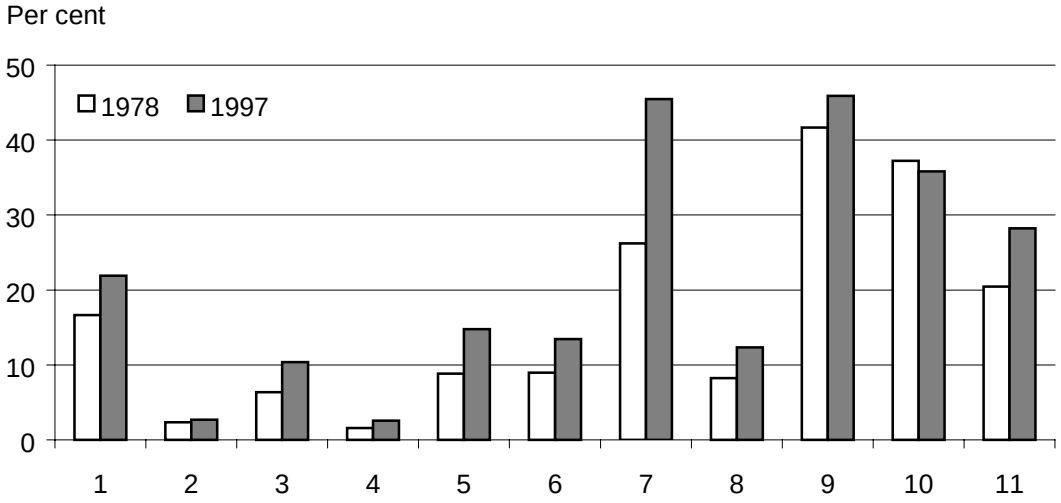
Sources: Based on ABS *(The Labour Force, Australia, Historical Summary, 1966 to 1984,* Cat. no. 6204.0; Labour Force Survey microfiche); ABS Labour Statistics on dX-Online database (accessed 30 September 1997).

Figure 6.3 **Part-time employment, by industry, 1978 and 1997[a]**

Distribution of total part-time employment across industries



Share of part-time employment in industry employment



1 Agriculture
2 Mining[b]
3 Manufacturing
4 Electricity, gas and water[b]
5 Construction
6 Wholesale trade
7 Retail trade
8 Transport, storage and communication
9 Accommodation, cafes and restaurants
10 Cultural and recreational services
11 Non-market sector

a August data. **b** Estimates are based on ABS estimates that are statistically unreliable (subject to relative standard error of greater than 25 per cent).

Data sources: Estimates based on ABS *(The Labour Force, Australia, Historical Summary, 1966 to 1984,* Cat. no. 6204.0; Labour Force Survey microfiche); ABS Labour Statistics on dX-Online database (accessed 30 September 1997).

Relationship between productivity growth and part-time employment

The issue of whether part-time employment is associated with productivity growth at the industry level is examined in two ways.

- Does the share of part-time employment in high productivity growth industries differ systematically from low productivity growth industries?
- Is there any association between productivity growth and growth in the part-time employment share at the industry level?

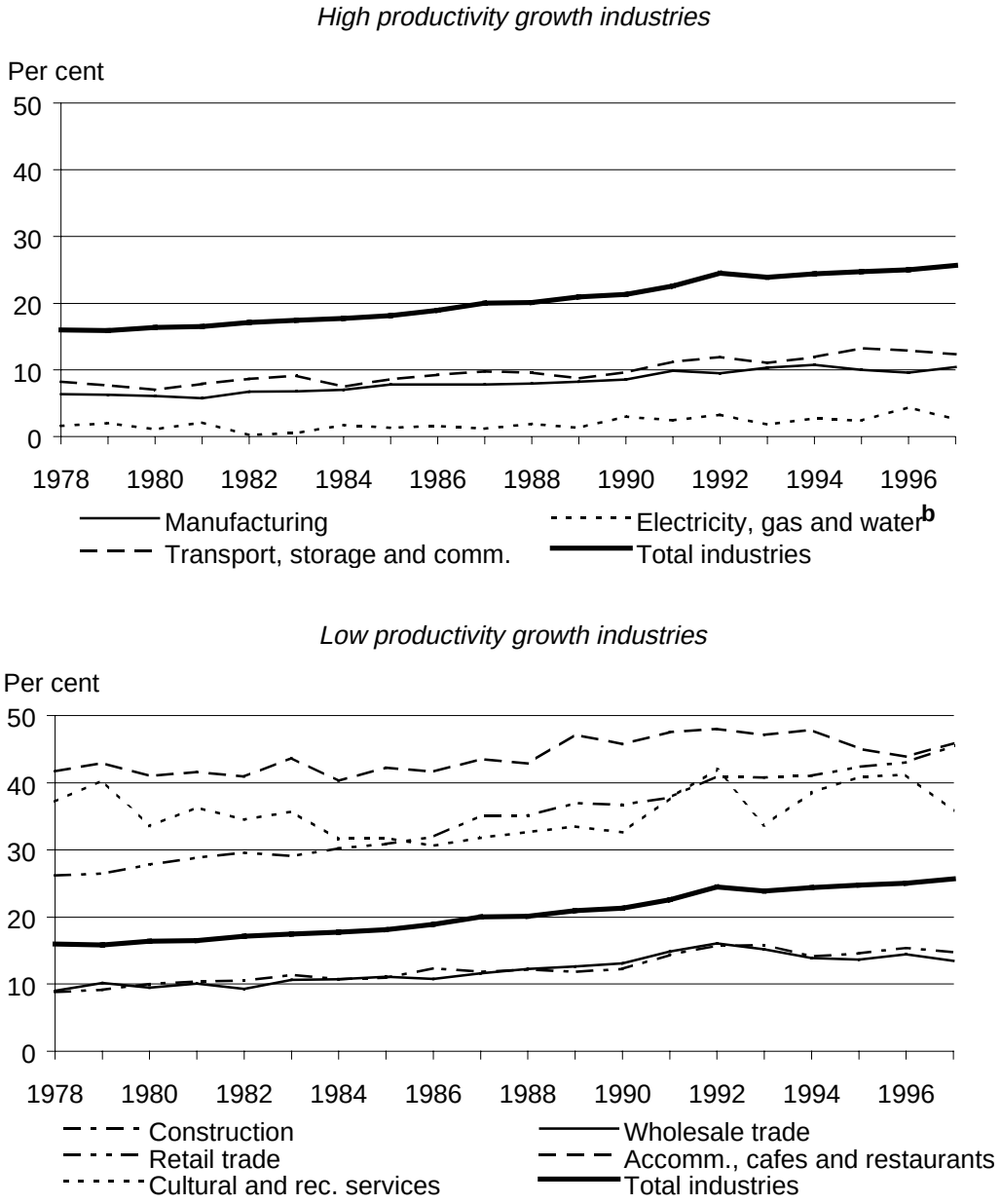
Part-time employment profile of high and low productivity growth industries

To see if there is any association between part-time employment levels and productivity growth, figure **6.4** shows the share of part-time employment for selected industries with different rates of growth in multifactor productivity (MFP). The top panel shows the high productivity growth industries and the bottom panel shows the low productivity growth industries. The Total industries benchmark is included in each panel for comparison.

All the high productivity growth industries have a lower share of part-time employment than Total industries. Two of the five low productivity growth industries also have a share of part-time employment below Total industries. However, three low productivity growth industries are above the benchmark. This pattern is also present when part-time employment is examined by gender.

It is clear that the high productivity growth industries provide relatively little part-time employment. The lack of a clear grouping of shares of part-time employment in the low productivity growth industries suggests, as might be expected, that the level of part-time employment is more likely to be related to the nature of the industry rather than productivity growth. Industries with extended trading hours, such as Accommodation, cafes and restaurants and Retail trade, have more jobs for which employers find part-time workers the most suitable.

Figure 6.5 **Share of part-time employment in industry employment, selected industries, 1978 to 1997[a]**



a August data. **b** Estimates for some years are statistically unreliable (subject to relative standard error of greater than 25 per cent).

Data sources: Based on ABS *(The Labour Force, Australia, Historical Summary, 1966 to 1984,* Cat. no. 6204.0; Labour Force Survey microfiche); ABS Labour Statistics on dX-Online database (accessed 30 September 1997).

Growth in productivity and the growth in part-time employment

The series of charts in figure **6.6** shows the change in the share of part-time employment and MFP growth for selected market sector industries, as well as the market sector in total. These charts can be examined to determine whether productivity growth is related to *growth* in part-time employment rather than to the *level* of part-time employment.

Figure 6.7 **Indexes of MFP and the share of part-time employment, selected industries[a], 1978-79 to 1997-98[b]**

Index 1978-79 = 100

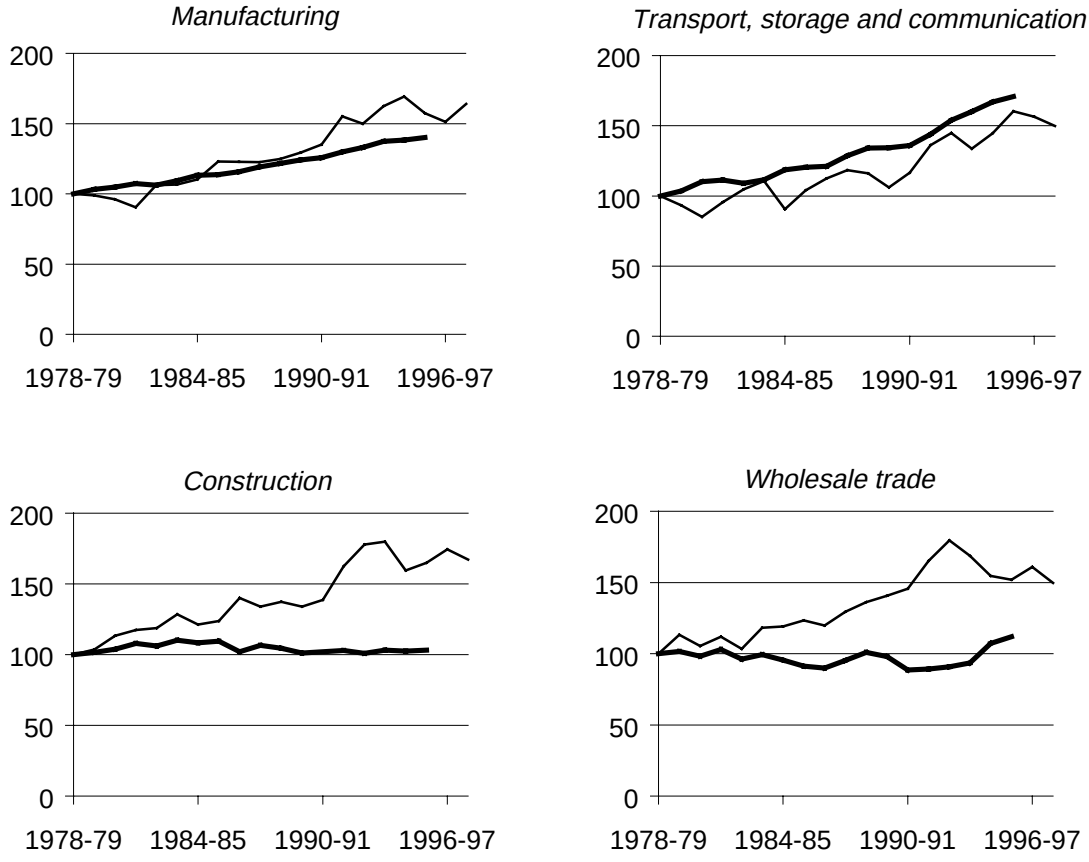


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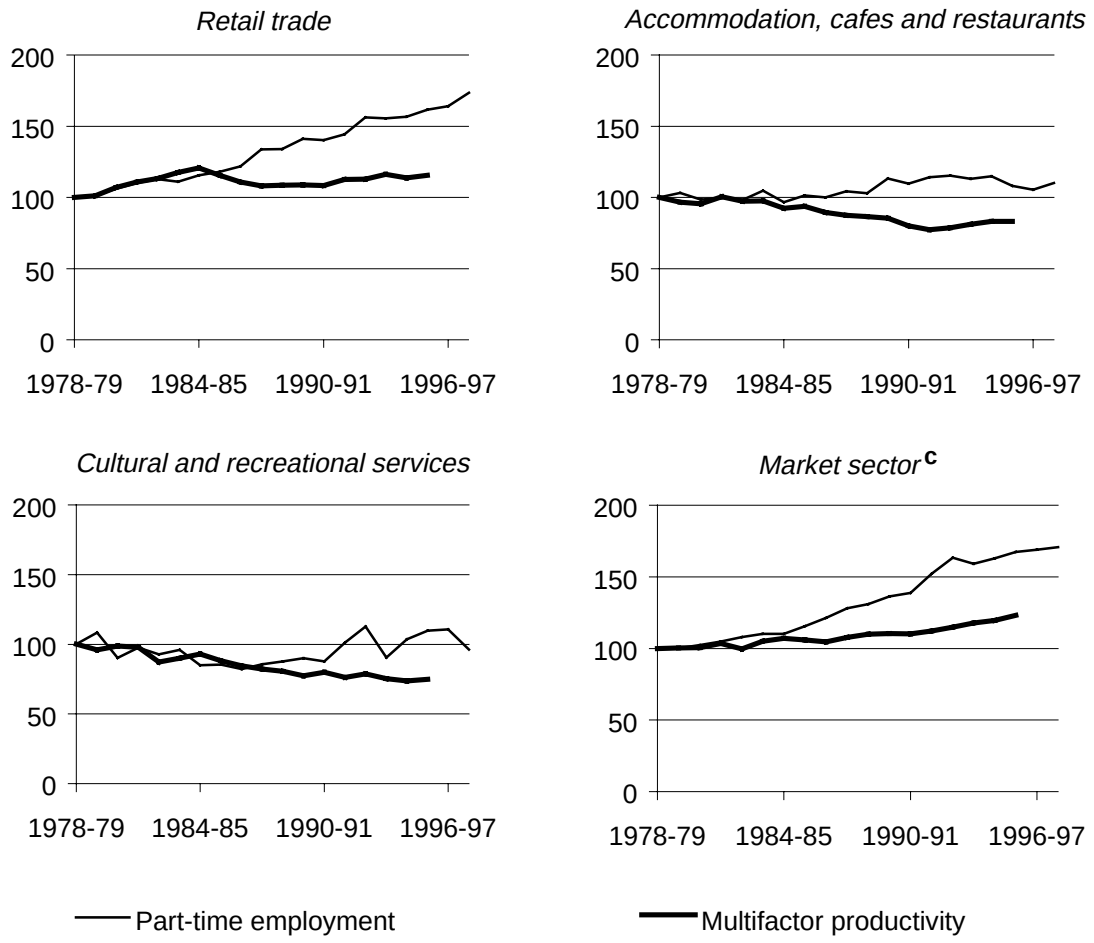
Figure 6.8 **(Continued)**



a Electricity, gas and water was not included because ABS estimates for part-time employment in this industry are statistically unreliable. **b** MFP data are for financial years and are not available after 1995-96. Employment data are for the month of August. **c** MFP data for Total industries are not available.

Data sources: Estimates for MFP updated from Gretton and Fisher (1997); estimates for employment based on ABS *(The Labour Force, Australia, Historical Summary, 1966 to 1984,* Cat. no. 6204.0; Labour Force Survey microfiche) and ABS Labour Statistics on dX-Online database (accessed 30 September 1997).

In each panel, taking the period as a whole, the share of part-time employment has risen in each industry (except Cultural and recreational services), regardless of whether MFP has been rising or falling. Also, there do not appear to be similar year-to-year changes in the share of part-time employment compared with changes in MFP for any of the industries. Similar results were found when the data were examined by gender.

Average growth in the share of part-time employment and productivity

An alternative method of considering the relationship between the growth in the share of part-time employment and the growth in productivity is to compare their average rate of growth over the entire period. The scatter plots in figure **6**.**9** plot average growth in the share of part-time employment against average growth rate in MFP, for each industry, over the period 1978-79 to 1995-96. It should be noted that the growth in the share of part-time employment is the percentage change, not the change in percentage *points*.

Figure **6**.**10** shows a positive correlation across market sector industries between growth in the share of part-time employment and MFP growth for persons, males and females. This means that higher (lower) growth in MFP is associated with higher (lower) growth in the share of part-time employment. However, in a statistical sense, only the correlation for persons is significant.

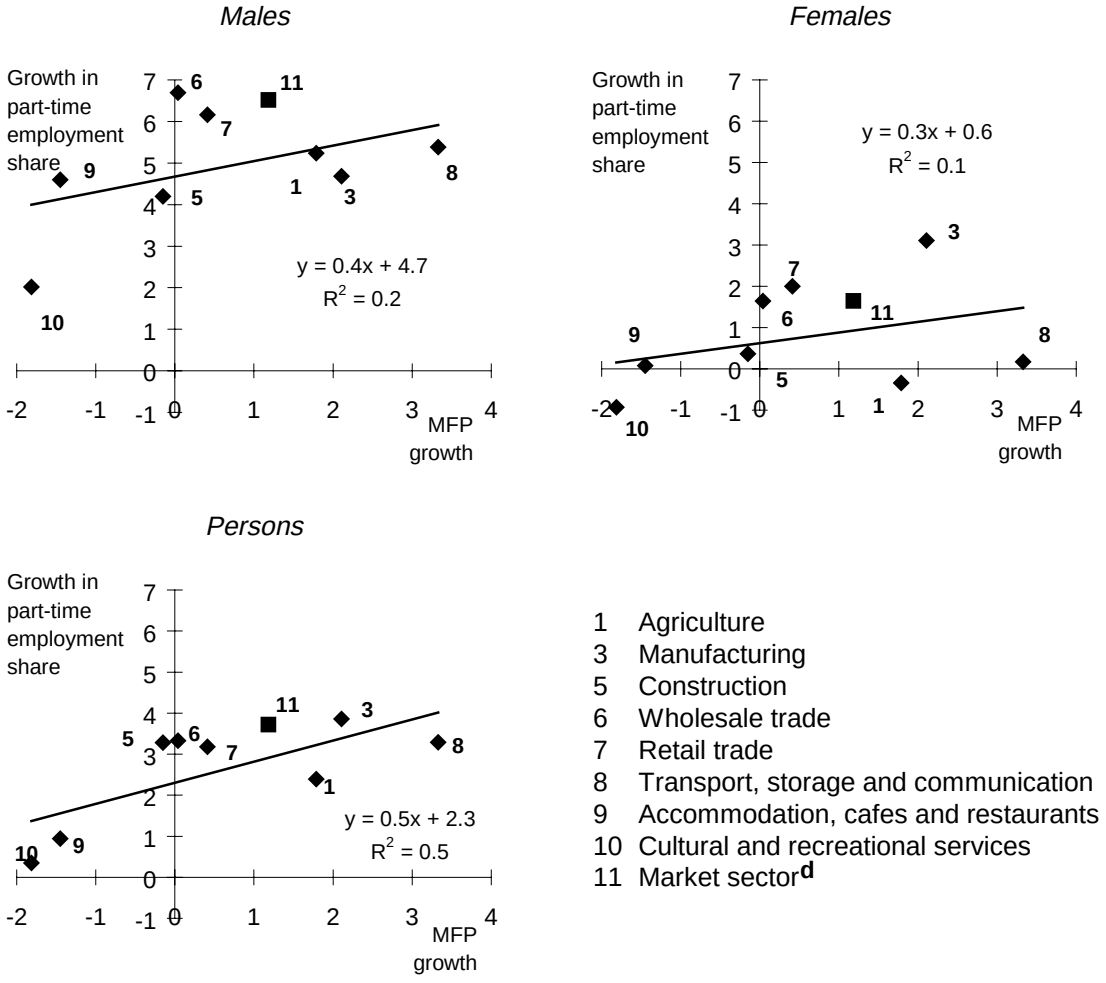
The slope of the line of best fit for persons appears to be driven largely by Accommodation, cafes and restaurants and Cultural and recreational services industries. The low growth rate in the share of part-time employment in these industries is caused by the combination of a high initial share of part-time employment and similar increases in full-time and part-time employment numbers.[1]

Details of all scatter plots are presented in appendix B. Effects in selected industries are examined in box 6.1.

[1] For Cultural and recreational services there is an apparent anomaly between figures 6.2 to **6**.Error! Main Document Only., and figure **6**.Error! Main Document Only.. Figures 6.2 to **6**.Error! Main Document Only. show the share of part-time employment in August 1997 is lower than that in August 1978, whereas figure **6**.Error! Main Document Only. shows a small positive average growth rate in the share of part-time employment over the period 1978-79 to 1995-96. The difference is due to the difference in time periods.

Figure 6.11 **Average growth rates[a] of the share of part-time employment[b] and MFP, 1978-79 to 1995-96[c]**

Per cent per year



a Growth rates are measured using average annual compound formula based on the end points of linear trend lines through time series data. **b** Electricity, gas and water and Mining were not included because ABS estimates for part-time employment in these industries are statistically unreliable (subject to relative standard errors of greater than 25 per cent). **c** The employment data are averages between August 1978 and August 1995. The MFP data are averages between financial years 1978-79 and 1995-96. The period used in this figure differs from earlier employment figures because MFP estimates are not available after 1995-96. **d** The market sector is not included in the estimation of equations.

Data sources: Estimates for MFP updated from Gretton and Fisher (1997); estimates for employment data based on ABS *(The Labour Force, Australia, Historical Summary, 1966 to 1984,* Cat. no. 6204.0; Labour Force Survey microfiche) and ABS Labour Statistics on dX-Online database (accessed 30 September 1997).

Box 6.1 **Industry-specific effects — part-time employment**

While there is some evidence of a systematic relationship between growth in part-time shares of employment and MFP growth across industries, some individual industries warrant further examination.

The number of workers in part-time employment in Electricity, gas and water remained roughly the same, with the reduction in total industry employment due to a reduction in full-time employment. Similarly, in Manufacturing, there was an increase in part-time employment, despite there being a decrease in total industry employment (table 6.2). Thus, in these industries, downsizing has focused on full-time employment rather than part-time employment.

Both full-time and part-time employment increased in the other high productivity growth industry — Transport, storage and communication. However, the share of full-time employment fell, while the share of part-time employment rose (figure 6.2).

6.4 Casual employment

Trends in casual employment

The difference between casual and permanent employment relates to access to certain entitlements. For the purposes of this paper, casual employees are defined as those who are not entitled to either annual leave or sick leave.

Over the period August 1985 to August 1997, the number of casual employees[2] more than doubled — an increase of around 900 000 people (table 6.3). This was a strong rise compared with permanent employment, which grew by 550 000 people over the same period. Consequently, the share of employees in casual employment rose from 16 to 26 per cent of total employment.

The gender breakdown of casual employment has also changed significantly since 1985. Male employment has become increasingly casualised, but not to the extent of female employment (figure **6.12**).

Increased casualisation is a trend that has occurred fairly evenly across all market sector industries. Table 6.4 shows that, while permanent employment has decreased in half the market sector industries, casual employment has increased in all. Both male and female casual employment rose across all market sector industries.

[2] For this characteristic, data are for *employees* rather than all *employed* (comprising employees, employers, own account workers and contributing family workers), so total employment in this section is less than that reported in other parts of this paper. Because of data limitations, the period examined also differs to that examined for part-time employment.

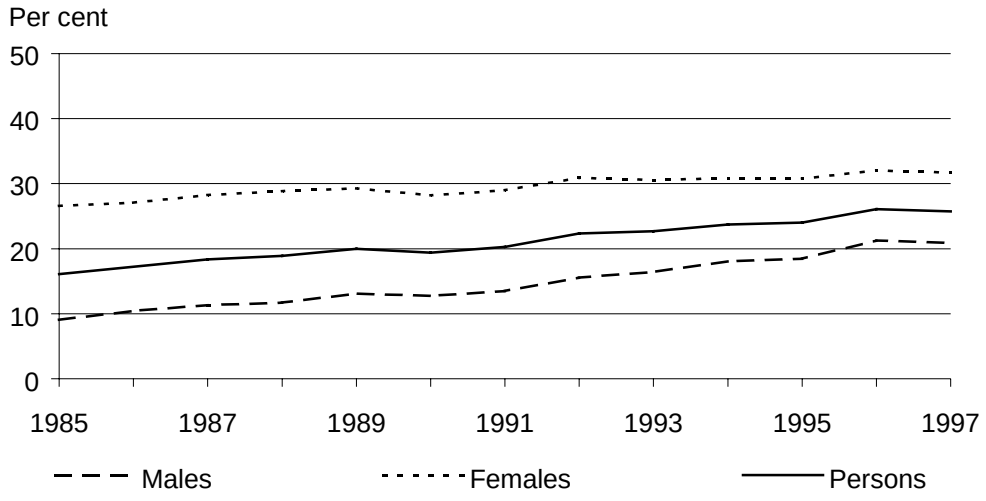
Table 6.7 **Casual and permanent employees, by gender, 1985 and 1997[a]**

Employment status	1985 Number	1985 Share of total	1997 Number	1997 Share of total	Difference Number	Difference Per cent
	'000	%	'000	%	'000	%
Males						
Casual	299.1	9.1	801.5	20.9	502.4	168.0
Permanent	2 999.8	90.9	3 036.3	79.1	36.5	1.2
Total	**3 298.8**	**100.0**	**3 837.7**	**100.0**	**538.9**	**16.3**
Females						
Casual	588.3	26.6	994.0	31.7	405.7	69.0
Permanent	1 626.0	73.4	2 140.4	68.3	514.4	31.6
Total	**2 214.2**	**100.0**	**3 134.4**	**100.0**	**920.2**	**41.6**
Persons						
Casual	887.3	16.1	1 795.5	25.8	908.2	102.3
Permanent	4 625.7	83.9	5 176.6	74.2	550.9	11.9
Total	**5 513.0**	**100.0**	**6 972.1**	**100.0**	**1 459.1**	**26.5**

a August data.

Source: ABS (unpublished data).

Figure 6.13 **Share of casual employees in total employees, by gender[a], 1985 to 1997[b]**



a The share for males is male casual employees as a percentage of total male employees. The share for females is female casual employees as a percentage of total female employees. **b** August data.

Data source: ABS (unpublished data).

Table 6.8 **Casual and permanent employees, by industry[a], 1985 and 1997[b]**

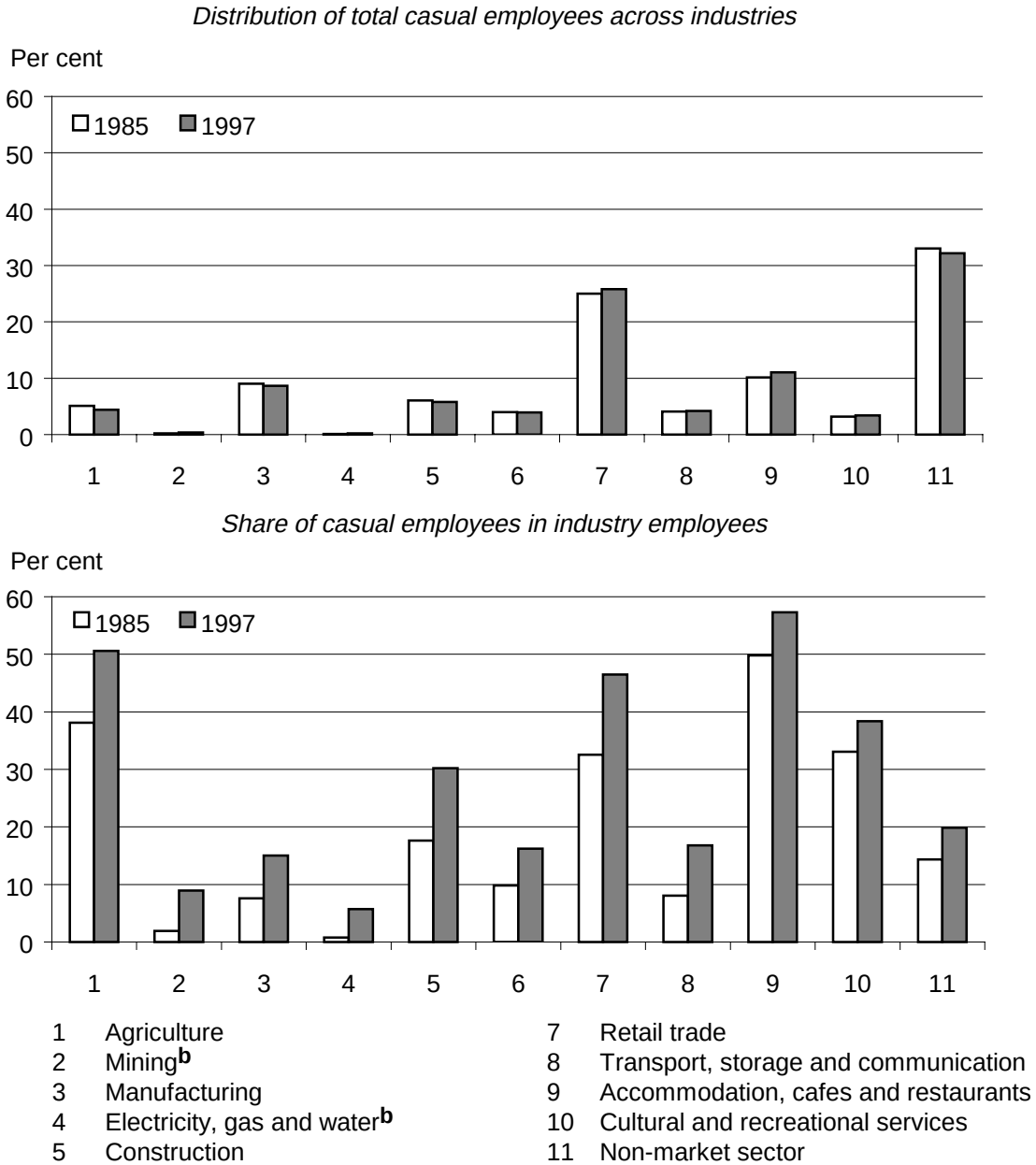
Industry	1985 Number	1985 Share of total	1997 Number	1997 Share of total	Difference Number	Difference Per cent
	'000	%	'000	%	'000	%
Casual employees						
Agriculture	45.4	5.1	79.0	4.4	33.6	74.0
Mining	1.9*	0.2	6.8	0.4	4.9	259.7
Manufacturing	80.0	9.0	155.2	8.6	75.2	93.9
Electricity, gas and water	1.1*	0.1	3.9*	0.2	2.9	271.8
Construction	53.7	6.0	103.8	5.8	50.1	93.4
Wholesale trade	35.1	4.0	70.7	3.9	35.5	101.2
Retail trade	222.1	25.0	463.7	25.8	241.6	108.8
Trans., storage and comm.	36.4	4.1	75.5	4.2	39.1	107.3
Accomm., cafes and rest.	90.1	10.2	197.9	11.0	107.8	119.6
Cultural and rec. services	28.3	3.2	61.0	3.4	32.7	115.8
Market sector	594.1	66.9	1 217.5	67.8	623.4	104.9
Total industries	**887.3**	**100.0**	**1 795.5**	**100.0**	**908.2**	**102.3**
Permanent employees						
Agriculture	73.6	1.6	77.1	1.5	3.5	4.8
Mining	96.0	2.1	69.4	1.3	- 26.5	-27.7
Manufacturing	972.0	21.0	878.9	17.0	- 93.1	-9.6
Electricity, gas and water	135.9	2.9	64.4	1.2	- 71.6	-52.6
Construction	250.4	5.4	239.6	4.6	- 10.8	-4.3
Wholesale trade	322.5	7.0	364.6	7.0	42.1	13.1
Retail trade	459.8	9.9	534.1	10.3	74.3	16.2
Trans., storage and comm.	414.8	9.0	374.6	7.2	- 40.2	-9.7
Accomm., cafes and rest.	90.8	2.0	147.5	2.8	56.6	62.4
Cultural and rec. services	57.2	1.2	97.9	1.9	40.7	71.1
Market sector	2 873.1	62.1	2 848.2	55.0	- 24.9	-0.9
Total industries	**4 625.7**	**100.0**	**5 176.6**	**100.0**	**550.9**	**11.9**
Total employees						
Agriculture	119.0	2.2	156.1	2.2	37.1	31.2
Mining	97.9	1.8	76.3	1.1	- 21.6	-22.1
Manufacturing	1 052.0	19.1	1 034.1	14.8	- 17.9	-1.7
Electricity, gas and water	137.0	2.5	68.3	1.0	- 68.7	-50.2
Construction	304.1	5.5	343.4	4.9	39.3	12.9
Wholesale trade	357.6	6.5	435.3	6.2	77.6	21.7
Retail trade	681.9	12.4	997.8	14.3	315.9	46.3
Trans., storage and comm.	451.2	8.2	450.1	6.5	- 1.1	-0.3
Accomm., cafes and rest.	181.0	3.3	345.4	5.0	164.4	90.8
Cultural and rec. services	85.5	1.6	159.0	2.3	73.4	85.9
Market sector	3 467.2	62.9	4 065.7	58.3	598.5	17.3
Total industries	**5 513.0**	**100.0**	**6 972.1**	**100.0**	**1 459.1**	**26.5**

a Total employees in this table does not match total employment reported in table 6.2 due to differences in the years reported and the definition of employment used (employees rather than all employed). **b** August data. * Estimate is statistically unreliable (subject to relative standard error of greater than 25 per cent).

Source: Based on ABS (unpublished data).

As with part-time employment, Retail trade was the largest employer of casual employees in the market sector (around 25 per cent of total casual employees). It also accounted for the largest increase in the number of casual employees in the market sector. The next biggest employers of casuals, Accommodation, cafes and restaurants and Manufacturing, each had around 10 per cent of total casual employment. As a share of industry employment, casual employment is more prominent in Agriculture and certain service industries (figure **6.14**).

Figure 6.15 **Casual employees, by industry, 1985 and 1997[a]**



1 Agriculture
2 Mining[b]
3 Manufacturing
4 Electricity, gas and water[b]
5 Construction
6 Wholesale trade
7 Retail trade
8 Transport, storage and communication
9 Accommodation, cafes and restaurants
10 Cultural and recreational services
11 Non-market sector

a August data. **b** Estimates are based on ABS estimates that are statistically unreliable (subject to relative standard error of greater than 25 per cent).

Data source: Estimates based on ABS (unpublished data).

Relationship between productivity growth and casual employment

The issue of whether casual employment is associated with productivity growth at the industry level is examined by posing two questions.

- Does the share of casual employment in high productivity growth industries differ systematically from low productivity growth industries?
- Is there any association between productivity growth and growth in the casual employment share at the industry level?

Casual employment profile of high and low productivity growth industries

To examine the first question, the share of casual employees in selected industries is shown in figure **6.16**.

The share of casual employees in each of the three high productivity growth industries is below the benchmark share. The opposite is the case for four of the five low productivity growth industries. Wholesale trade is an exception, with a casual employment share below the benchmark. For the most part, this pattern also applies to the share of casual employees by gender.

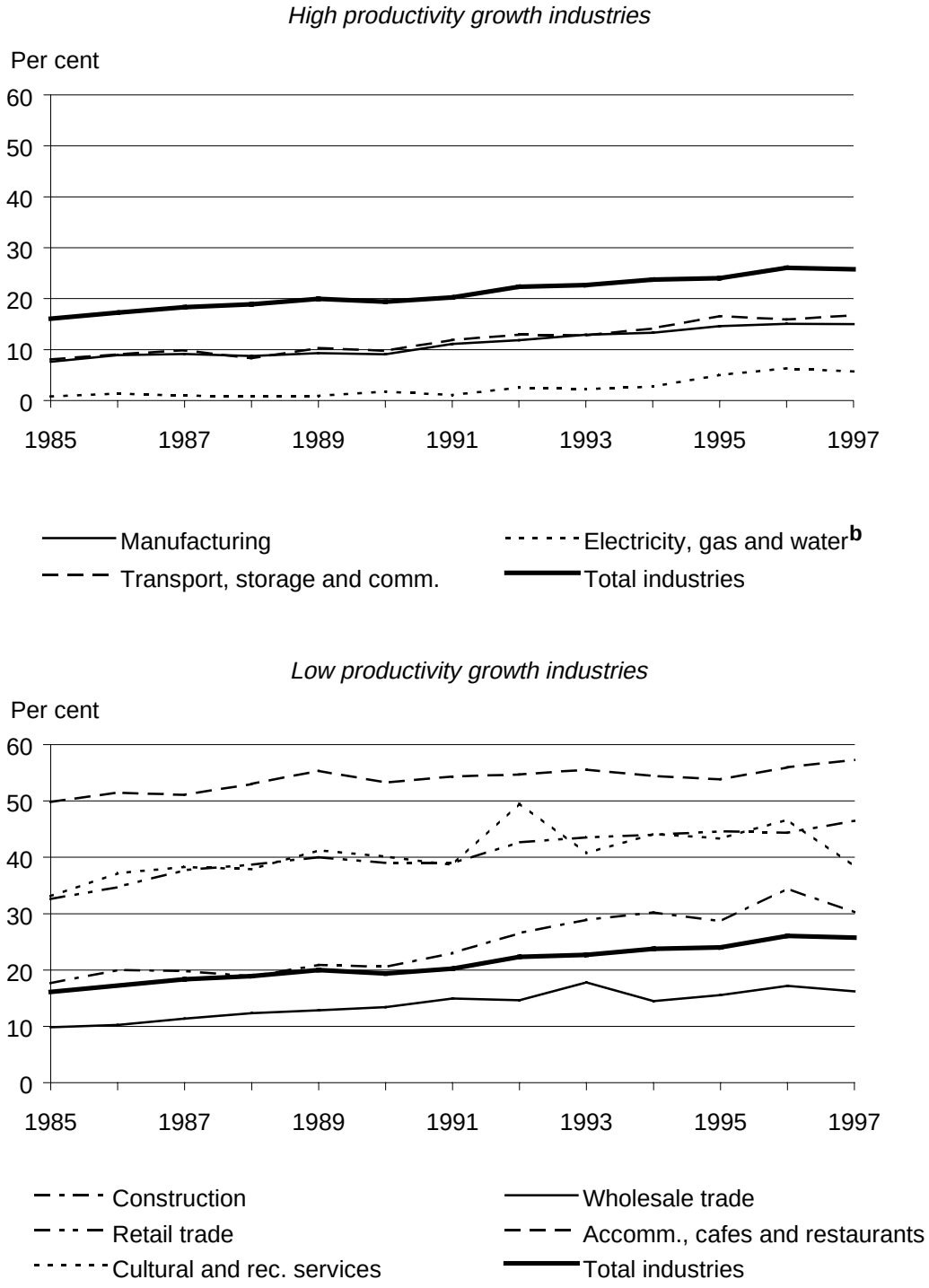
As with part-time employment, it appears that the high productivity growth industries are not as amenable to casual employment. And, whilst not entirely systematic, from figure **6.17** it appears that there is some association between MFP growth and the level of casual employment. However, across industries, this pattern may simply be related to the nature of employment — for instance, in industries with greater on-the-job training requirements, permanent employment may be more attractive to employers.

Growth in productivity and the change in casual employment

The series of charts in figure **6.18** tracks the change in casual employment shares and MFP growth for selected high and low productivity growth industries and the market sector.

The charts suggest there is an upward trend in the share of casual employees in each market sector industry examined, unrelated to the direction of movement in productivity. Whilst there are some differences between the casual employment of males and females at the industry level, a discernible association with the direction of change in productivity still does not stand out.

Figure 6.19 **Share of casual employees in industry employment, selected industries, 1985 and 1997[a]**



a August data. **b** Estimates for some years are statistically unreliable (subject to relative standard error of greater than 25 per cent).

Data source: Based on ABS (unpublished data).

Figure 6.20 **Indexes of MFP and the share of casual employees, selected industries[a], 1985-86 and 1997-98[b]**

Index 1985-86 = 100

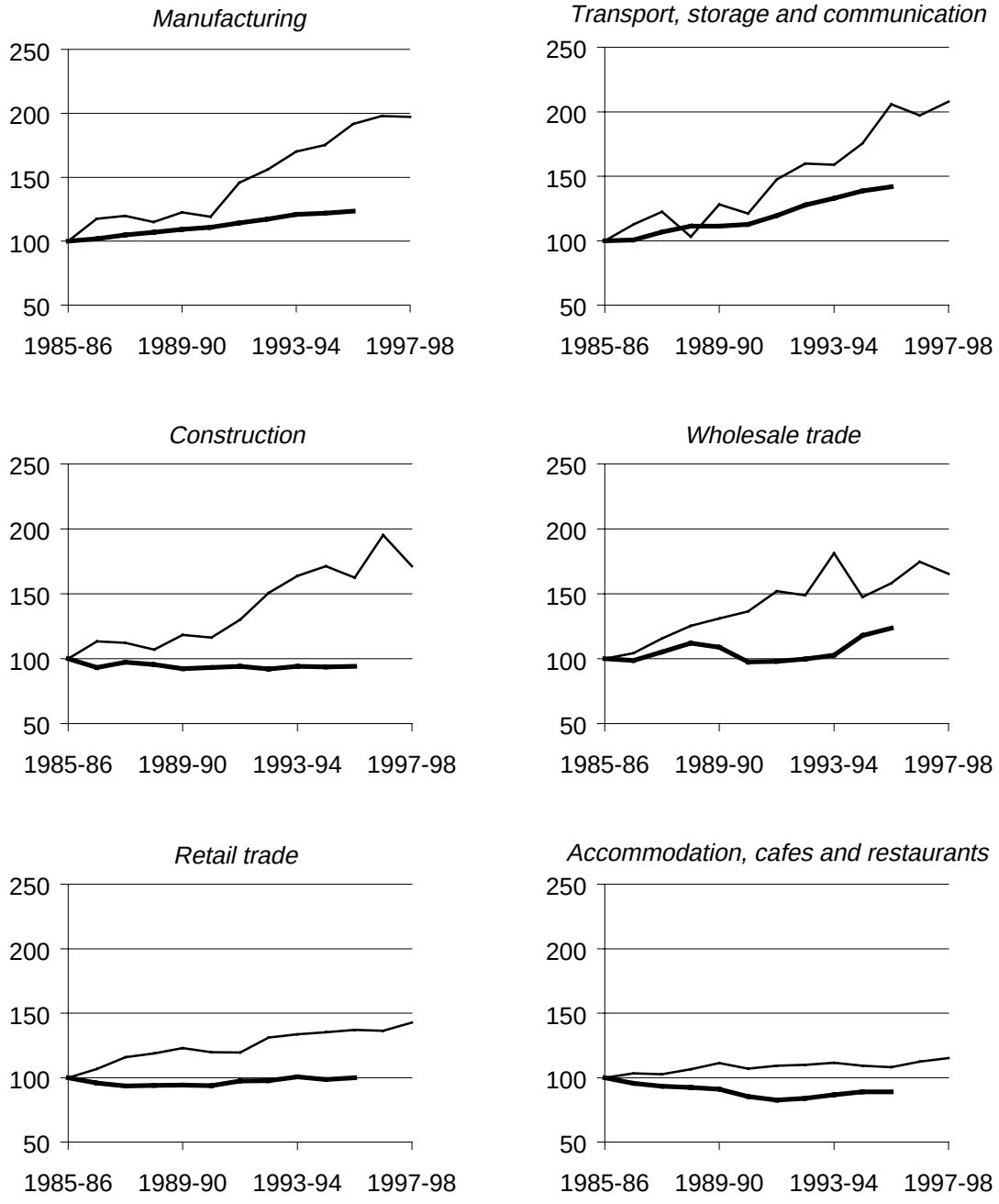


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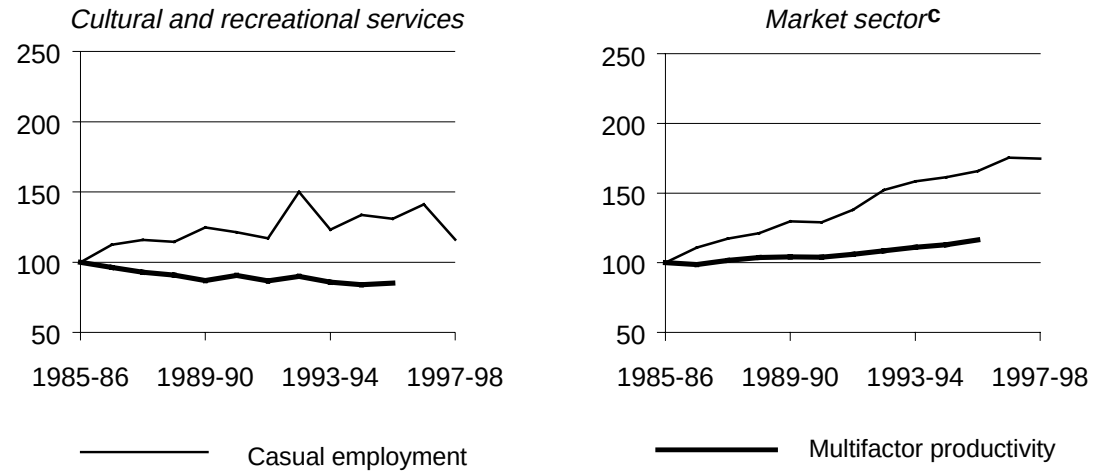
Figure 6.20 **(Continued)**



a Electricity, gas and water was not included because the ABS estimates for casual employees in this industry are statistically unreliable. **b** MFP data are for financial years and not available after 1995-96. Employment data are for the month of August. **c** MFP data for Total industries are not available.

Data sources: Estimates for MFP updated from Gretton and Fisher (1997); estimates for employment based on ABS (unpublished data).

Average growth in casual employment and productivity

Figure **6.21** presents scatter plots of MFP growth and growth in the share of casual employment over the period 1985-86 to 1995-96 for all the market sector industries.[3] A statistically significant positive correlation across market sector industries (with reliable data) shows up in the scatter plots. Higher (lower) MFP growth is associated with higher (lower) growth in the share of casual employees. By gender, there is also a statistically significant positive correlation for males, but not for females. Details of all scatter plots are presented in appendix B. Effects in selected industries are examined in box 6.2.

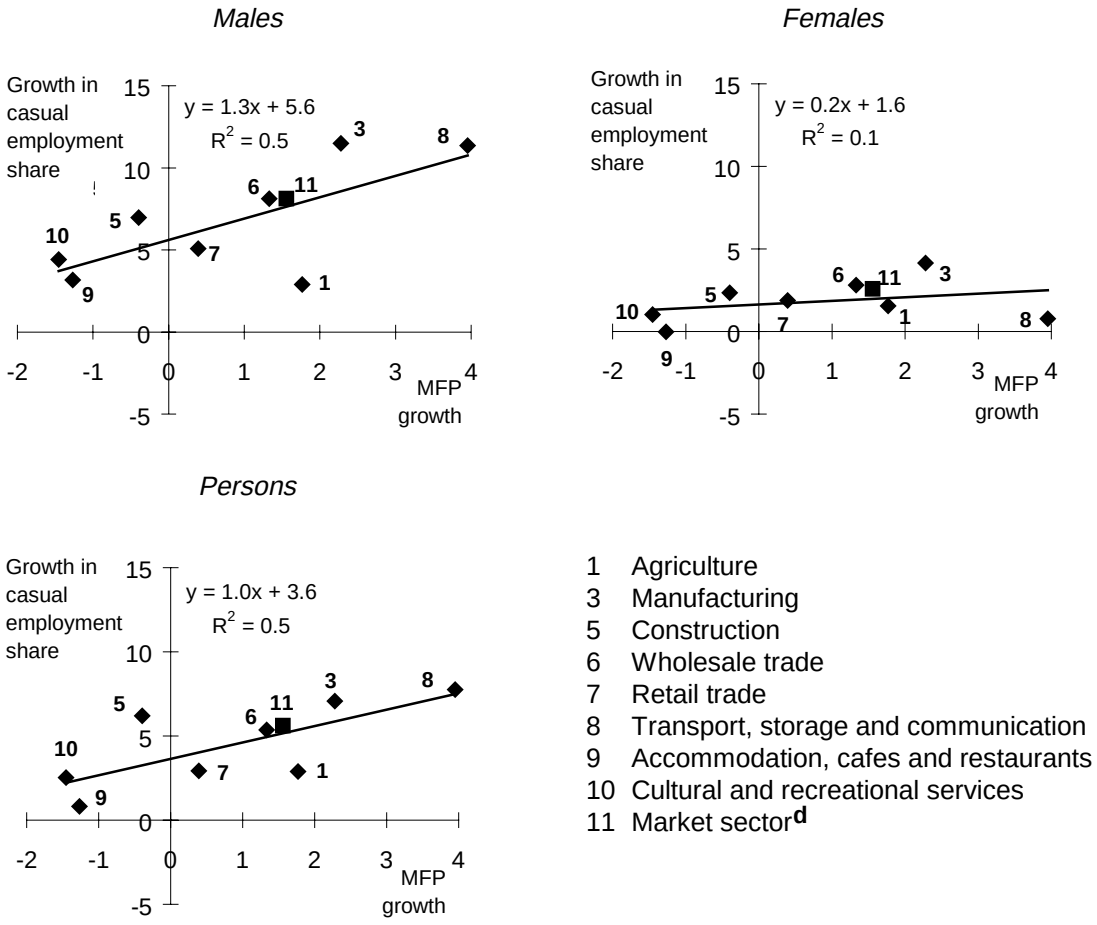
Box 6.2 **Industry-specific effects — casual employees**

Electricity, gas and water and Manufacturing have displayed a significant degree of downsizing over the period 1985 to 1997. The decline in the total number of employees in these industries was due to a fall in the number of permanent employees that outweighed the rise in the number of casual employees (table 6.4). Over the period, both industries had a large increase in the share of casual employees (figure 6.7). The downsizing was therefore concentrated on permanent rather than casual employment.

[3] The growth in the share of casual employment is the percentage change, not the change in percentage *points*.

Figure 6.22 **Average growth rates[a] of the share of casual employees[b] and MFP, 1985-86 to 1995-96[c]**

Per cent per year



a Growth rates are measured using average annual compound formula based on the end points of linear trend lines through time series data. **b** Electricity, gas and water and Mining were not included because the ABS estimates of casual employees in these industries are statistically unreliable (subject to relative standard errors of greater than 25 per cent). **c** The employment data are averages between August 1985 and August 1995. The MFP data are averages between financial years 1985-86 and 1995-96. The period used in this figure differs from earlier employment figures because MFP estimates are not available after 1995-96. **d** The market sector is not included in the estimation of equations.

Data sources: Estimates for MFP updated from Gretton and Fisher (1997); estimates for employment based on ABS (unpublished data).

6.5 Summary

This chapter reviewed the relationship between productivity growth and part-time and casual employment. There is some evidence across market sector industries of MFP growth being positively correlated with growth in the share of part-time employment and casual employment. On an individual industry basis, employment reductions in industries that have been downsized appear to have been concentrated on full-time and permanent jobs.

7 Employee earnings

Productivity growth has been an important contributor to growth in real average incomes. For Australia, it has been estimated that multifactor productivity (MFP) growth accounted for about two-thirds of the improvement in real average incomes from 1964-65 to 1995-96 (IC 1997b). The distribution of income is also important to living standards.

The benefits of productivity growth can be distributed in a variety of ways — through lower prices to purchasers, higher wages to employees, higher returns to shareholders and higher taxation revenues to government — with different impacts on the distribution of income.

Personal income is a broad measure, which includes wages and salaries, dividends, interest income and government transfers. Examining the relationships between productivity growth and each of these income components is beyond the scope of this paper. Instead the focus is on the relationship between productivity growth and one of these components — wages and salaries, or employment earnings.

7.1 Factors affecting employee earnings

A wide range of factors, other than productivity growth, affects the distribution of earnings across the workforce. Some of the main influences include the following.

- Hours worked.
  - The number of hours worked and when they are worked affects earnings. Work on a casual rather than a permanent basis usually attracts a higher hourly rate of pay in lieu of other employment benefits. Additional payments, often at penalty rates, are usually paid for overtime worked.
- Level of skill.
  - As outlined in chapter 4, skill is a multidimensional concept covering inherited personal characteristics, skills developed through formal education and training, and skills developed through work experience and informal training. As the level of skill acquired by an employee increases, earnings also tend to increase.
- Age.

- Age is another component of human capital that is correlated with earnings. Experience tends to increase with age and this is often reflected in earnings. The age distribution of the workforce will therefore affect the distribution of earnings.

- Industry structure of the economy.
  - Different firms or industries may offer higher or lower wages and, as the industry composition of the economy changes over time, this will affect the distribution of earnings. In the past, centralised wage determination tended to limit differences in wage rates among workers in the same occupation across industries. With the move to enterprise bargaining, there may be greater scope for a widening of differences in earnings within and across industries.

7.2 Growth in productivity and earnings

Productivity improvements benefit people by raising real average incomes. Higher productivity growth means more output (and income) can be produced from available inputs, or the same amount of output can be produced (at lower cost) from fewer inputs. At the firm level, productivity benefits can be passed on as lower output prices, or they can be retained within the firm.

The degree of market power enjoyed by the firm, in part, determines how much of the benefits of productivity growth are passed on. In more competitive markets, firms have greater incentive to pass on cost decreases arising from productivity growth to buyers.

The benefits of productivity growth retained by the firm can be distributed to employees or to shareholders. The higher returns to labour can be in the form of higher earnings or as improvements in non-earnings benefits, such as better working conditions. Alternatively, benefits retained by the firm could be put into improving the quality of the goods produced, to reducing the environmental impacts of the production process, or to improving safety in the workplace.

Thus, productivity growth has at least the potential to improve earnings, but benefits can be manifest in other forms.

7.3 Trends in earnings

Measurement of earnings

In this chapter, the measure of earnings is real average weekly ordinary time earnings of full-time permanent adult employees. This is taken as an indicator of general wage trends for given industries and occupations that is not affected by some of the changes in the composition of the workforce and hours worked. By taking full-time employees only, the measure is insulated from changes in average earnings that may come from changes in the full-time/part-time composition of the workforce. By taking ordinary time earnings, the measure is insulated from the effects of varying incidences of overtime at premium rates. Although paid overtime is an important component of total earnings, with the available data, it was not possible to standardise weekly earnings for changes in the amount of overtime worked.

As indicated in chapter 2, the real average weekly ordinary time earnings measure is based on nominal earnings from the ABS Employee Earnings and Hours (EEH) survey. The data from this survey have been converted to constant 1989-90 dollars by applying an implicit price deflator for private final consumption expenditure.

Considerable change in the skill profile of the workforce has also taken place, as shown in chapter 4. To make some allowance for the effect of changing skill composition on earnings, earnings by occupation group are used. However, it is acknowledged that with the broad occupation groupings used, not all effects of changes in the skill composition of the workforce are accounted for. To isolate changes in earnings from all occupational effects would require a very fine level of occupation detail. Sufficient data to do this are not readily available.

Earnings data were obtained from the ABS for eight major occupation groups and for three skill-based occupation groups based on aggregation of the major groups, along the lines defined in chapter 4.[1] These skill-based occupation groups are:

- *high-skilled white collar* (HSWC), which includes Managers and administrators, Professionals and Para-professionals;
- *high-skilled blue collar* (HSBC), which is Tradespersons; and
- *low-skilled* (LS), which includes Clerks, Salespersons and personal service workers, Plant and machine operators and drivers, and Labourers and related workers.

[1] The classification differs from that used in chapter 4 in that white collar and blue collar are not separately identified for the low-skilled occupation group.

Further details of the occupational classification, together with additional details about the selection of the earnings measure, are provided in appendix A.

For presentational convenience, the analysis reported in this chapter is largely restricted to the three broad skill-based occupation groups. The analysis for the eight major occupation groups did not reveal any significantly different trends that would warrant fuller presentation. However, details of the analysis of the eight groups are provided in appendix B.

A reasonably consistent dataset for average earnings cross-classified by occupation and industry was available for the period May 1987 to May 1996. The data end in 1996 because a different occupational classification system was introduced in 1997. Because the EEH survey does not include Agriculture, forestry and fishing, this industry is excluded from the analysis.

Level and growth of earnings

Real earnings for Total non-farm industries increased in all occupation groups over the period 1987 to 1996 (table **7**.**1**). Real earnings for the HSWC occupation group were significantly higher than those for the other occupation groups. The All occupations average showed a higher increase because of a compositional shift towards employment in those occupations with faster growth in earnings between 1987 and 1996.

Table 7.2 **Real average weekly ordinary time earnings of full-time permanent adult employees, by gender and occupation group, 1987 and 1996[a]**

Total non-farm industries, 1989-90 dollars

Occupation group	*1987*	*1996*	*Difference*	
	$	$	$	%
Males				
High-skilled white collar	726.55	800.52	73.96	10.2
High-skilled blue collar	491.11	515.03	23.93	4.9
Low-skilled	483.80	516.67	32.87	6.8
All occupations	**561.51**	**627.15**	**65.64**	**11.7**
Females				
High-skilled white collar	595.01	654.04	59.03	9.9
High-skilled blue collar	406.33	414.52	8.19	2.0
Low-skilled	419.00	451.80	32.80	7.8
All occupations	**468.09**	**523.45**	**55.37**	**11.8**
Persons				
High-skilled white collar	686.85	752.15	65.30	9.5
High-skilled blue collar	485.99	508.76	22.77	4.7
Low-skilled	457.13	487.89	30.76	6.7
All occupations	**531.06**	**590.98**	**59.92**	**11.3**

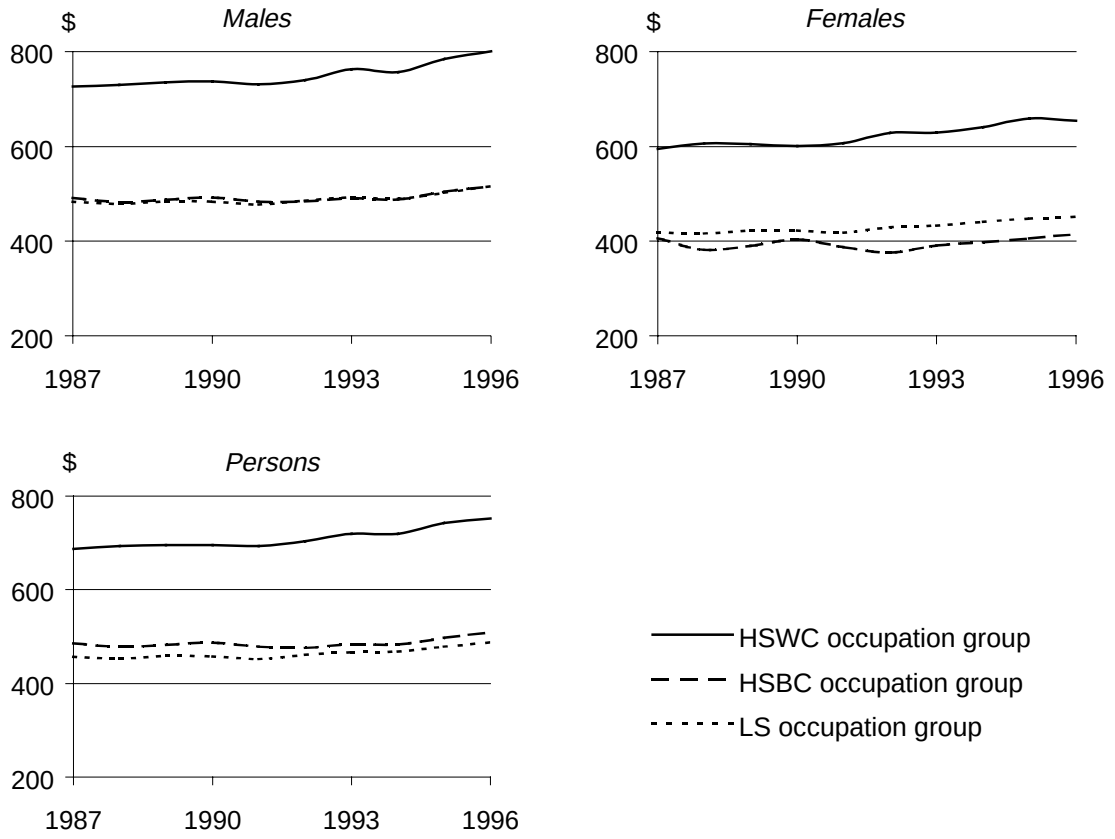
a May data.

Sources: Estimates based on ABS (*Australian National Accounts, 1995-96*, Cat. no. 5204.0; unpublished data).

Real earnings increased steadily throughout the period 1987 to 1996 (figure **7.1**). Real earnings for females grew faster than male real earnings in the LS occupation group, but not in the other occupation groups.

Figure 7.2 **Real average weekly ordinary time earnings of full-time permanent adult employees, by gender and occupation group, 1987 to 1996[a]**

Total non-farm industries, 1989-90 dollars



a May data.

Data sources: Estimates based on ABS (*Australian National Accounts, 1995-96*, Cat. no. 5204.0; unpublished data).

The economywide trend of positive growth in real earnings in all occupation groups also applied to most market sector industries. The exceptions were the HSBC and LS occupation groups in Construction and HSBC occupation group in Cultural and recreational services (table **7.3**).

Table 7.4 **Real average weekly ordinary time earnings of full-time permanent adult employees, by industry and occupation group, 1987 and 1996[a]**

1989-90 dollars

Industry	*1987*	*1996*	*Difference*	
	$	$	$	%
***HSWC occupation group*[b]**				
Mining	928.75	1052.84	124.09	13.4
Electricity, gas and water	721.68	763.06	41.38	5.7
Transport, storage and communication	717.90	822.08	104.17	14.5
Wholesale trade	713.15	724.31	11.16	1.6
Construction	700.73	738.23	37.50	5.4
Manufacturing	693.67	783.85	90.18	13.0
Cultural and recreational services	610.72	661.17	50.45	8.3
Retail trade	534.84	618.21	83.38	15.6
Accommodation, cafes and restaurants	493.30	587.63	94.33	19.1
Non-farm market sector	681.24	743.90	62.66	9.2
Total non-farm industries	**686.85**	**752.15**	**65.30**	**9.5**
***HSBC occupation group*[b]**				
Mining	759.56	924.05	164.49	21.7
Construction	526.07	510.40	-15.67	-3.0
Electricity, gas and water	519.00	570.88	51.88	10.0
Cultural and recreational services	515.59	462.20	-53.39	-10.4
Transport, storage and communication	504.14	563.49	59.35	11.8
Wholesale trade	481.36	531.19	49.82	10.4
Manufacturing	474.54	505.15	30.61	6.5
Retail trade	434.59	438.92	4.33	1.0
Accommodation, cafes and restaurants	424.73	468.38	43.66	10.3
Non-farm market sector	489.89	515.38	25.49	5.2
Total non-farm industries	**485.99**	**508.76**	**22.77**	**4.7**
***LS occupation group*[b]**				
Mining	670.65	845.53	174.89	26.1
Electricity, gas and water	497.20	566.75	69.55	14.0
Construction	490.01	489.18	-0.84	-0.2
Transport, storage and communication	481.73	529.21	47.48	9.9
Cultural and recreational services	459.81	484.36	24.56	5.3
Wholesale trade	452.62	486.60	33.98	7.5
Manufacturing	432.28	477.92	45.64	10.6
Accommodation, cafes and restaurants	402.07	438.92	36.85	9.2
Retail trade	396.59	429.64	33.05	8.3
Non-farm market sector	452.98	492.01	39.03	8.6
Total non-farm industries	**457.13**	**487.89**	**30.76**	**6.7**

(Continued on next page)

Table 7.2 **(Continued)**

Industry	*1987*	*1996*	*Difference*	
	$	$	$	%
***All occupations*[b]**				
Mining	751.89	917.35	165.47	22.0
Electricity, gas and water	557.00	638.49	81.48	14.6
Construction	555.30	560.91	5.61	1.0
Cultural and recreational services	548.84	568.04	19.20	3.5
Transport, storage and communication	523.51	604.47	80.96	15.5
Wholesale trade	516.93	554.81	37.88	7.3
Manufacturing	479.90	545.70	65.80	13.7
Retail trade	432.03	475.95	43.91	10.2
Accommodation, cafes and restaurants	427.16	477.92	50.76	11.9
Non-farm market sector	504.14	557.90	53.76	10.7
Total non-farm industries	**531.06**	**590.98**	**59.92**	**11.3**

a May data. **b** Ranked from highest to lowest based on 1987 earnings.

Sources: Estimates based on ABS (*Australian National Accounts, 1995-96*, Cat. no. 5204.0; unpublished data).

7.4 Relationship between earnings and productivity growth

The issue of whether real earnings are associated with productivity growth across industries is examined in two ways.

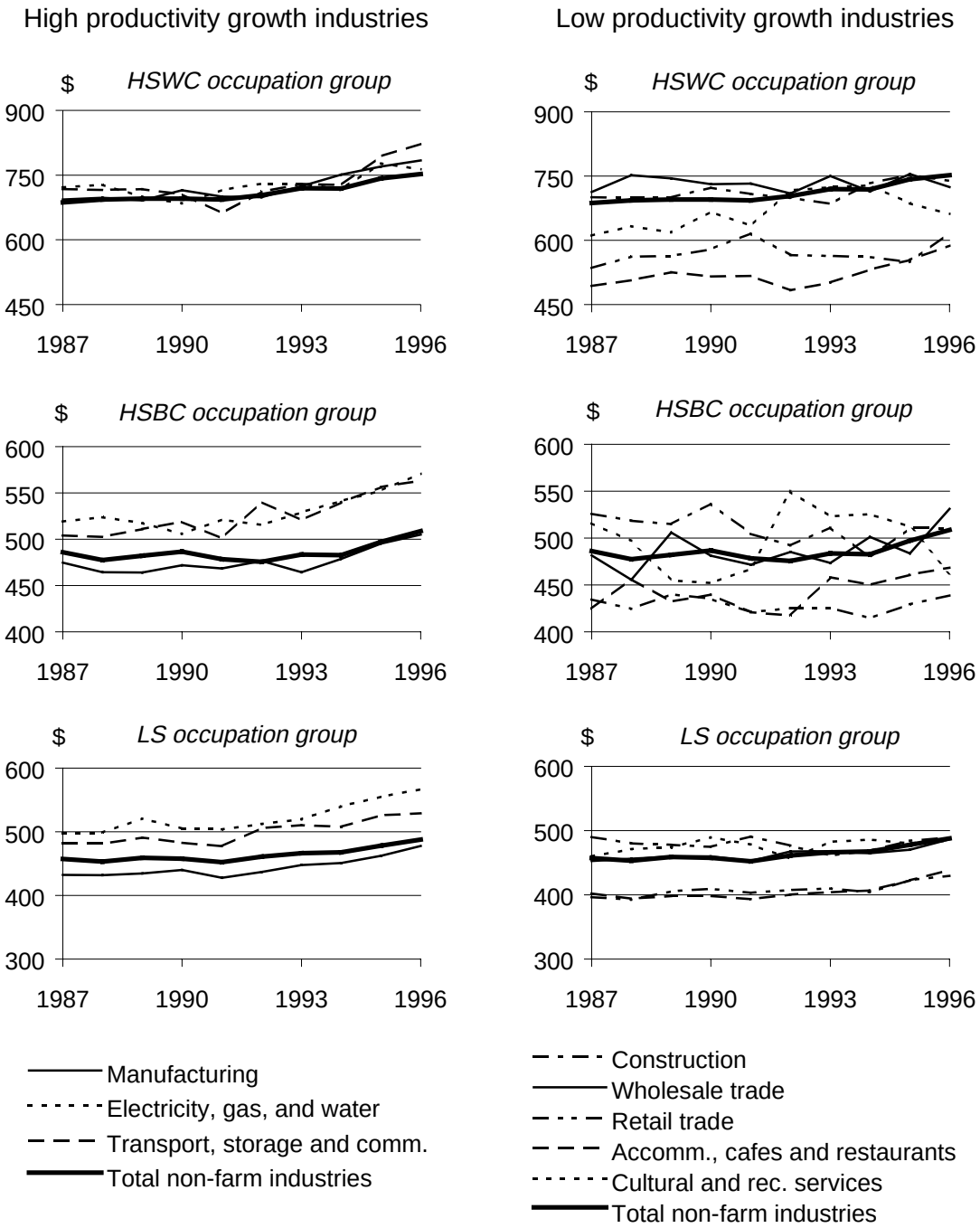
- Are real earnings in high productivity growth industries higher than real earnings in low productivity growth industries, for a given occupation group?
- Have real earnings in high productivity growth industries grown faster than real earnings in low productivity growth industries?

Earnings profile of high and low productivity growth industries

Figure **7.3** shows the profile of real earnings for the high and low productivity growth industries for the period 1987 to 1996. The charts on the left hand side show the high productivity growth industries and those on the right hand side show the low productivity growth industries. Total non-farm industries average for each occupation group has been included as a basis for comparison.

Figure 7.4 **Real average weekly ordinary time earnings of full-time permanent adult employees, by industry and occupation group, 1987 to 1996[a]**

1989-90 dollars



a May data.

Data sources: Estimates based on ABS (*Australian National Accounts, 1995-96*, Cat. no. 5204.0; unpublished data).

Real earnings in the high productivity growth industries are generally near or above the benchmark. For the low productivity growth industries, there is much greater variation across industries.

An examination of the level of real earnings by gender broadly presented the same conclusion.

Growth in real earnings and productivity growth

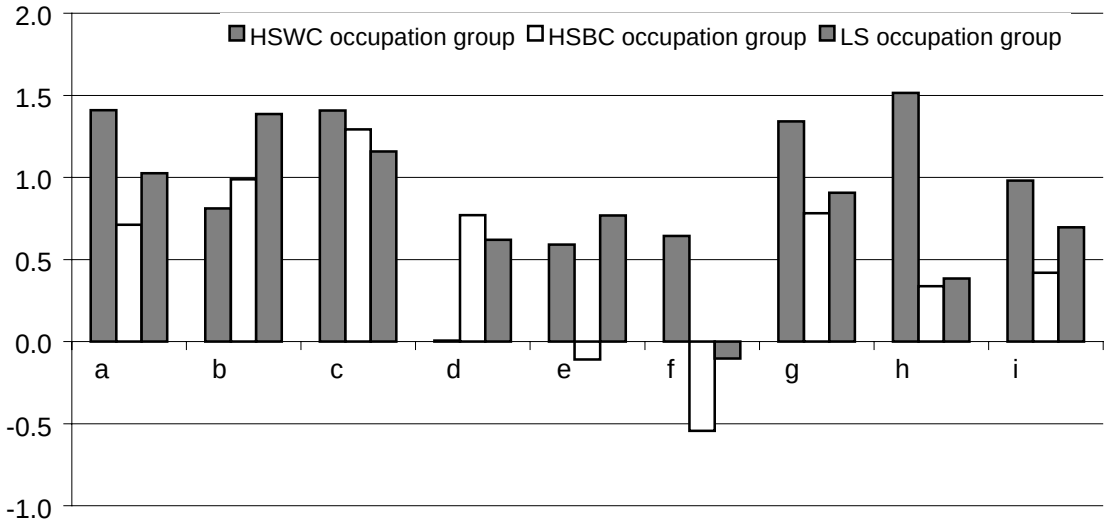
Figure **7**.**5**[2] shows the average growth in real earnings for each occupation group, in each of the non-farm market sector industries and Total non-farm industries, over the period 1987 to 1996. For the high productivity growth industries, there has been strong positive growth in real earnings across all the occupation groups. For the low productivity growth industries, the growth in real earnings is more variable.

In general, real earnings have tended to grow faster in the high productivity growth industries than in the low productivity growth industries. However, this is not entirely systematic. For the HSWC group, Accommodation, cafes and restaurants and Cultural and recreational services — with negative (measured) MFP growth — had similar earnings growth to the high productivity growth industries. For the HSBC group, Accommodation, cafes and restaurants and Wholesale trade, also had earnings growth similar to the high productivity growth industries.

[2] Using different methods of calculating the change in real earnings over time produces some anomalies. For example, table **7**.Error! Main Document Only. shows that HSBC earnings in Cultural and recreational services in 1996 were lower than in 1987. However, figure **7**.Error! Main Document Only. shows a positive average trend growth in real earnings for these employees. Also, in table **7**.Error! Main Document Only., HSBC earnings in Retail trade in 1996 were slightly higher than in 1987. In figure **7**.Error! Main Document Only., the average trend growth in earnings for these employees is negative. These anomalies are due to the sensitivity of the method of calculation used in table **7**.Error! Main Document Only. to the selection of the particular years used as the end points. Figure **7**.Error! Main Document Only. is more indicative of changes over time. This also applies to figure **7**.Error! Main Document Only., which is based on figure **7**.Error! Main Document Only..

Figure 7.6 **Average growth rates[a] of real average weekly ordinary time earnings of full-time permanent adult employees, by industry and occupation group, 1987 to 1996[b]**

Per cent per year



a Manufacturing
b Electricity, gas and water
c Transport, storage and communication
d Wholesale trade
e Retail trade
f Construction
g Accommodation, cafes and restaurants
h Cultural and recreational services
i Total non-farm industries

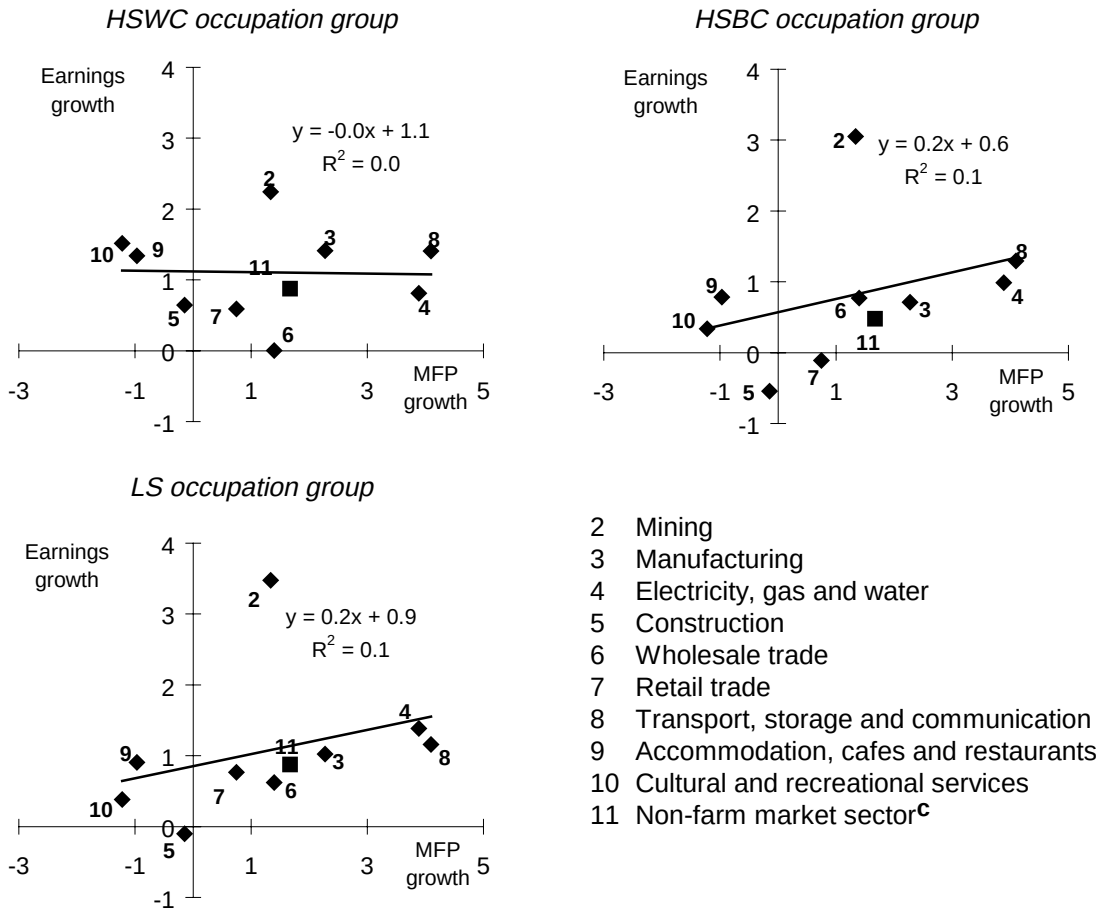
a Growth rates are measured using average annual compound formula based on the end points of a linear trend line through time series data. In table **7**.**5**, the percentage change was based on the actual end points of the time series data. The different method of calculating these changes accounts for the difference in the results. **b** May data.

Data sources: Estimates based on ABS (*Australian National Accounts, 1995-96*, Cat. no. 5204.0; unpublished data).

A summary way of examining the relationship between changes in real earnings and productivity growth is to compare the average change in each of these variables over the entire period. Figure **7**.**7** shows scatter plots of the average growth in real earnings against the average growth in MFP in each of the non-farm market sector industries, for each of the occupation groups, over the period 1986-87 to 1995-96.

Figure 7.8 **Average growth rates[a] of real average weekly ordinary time earnings of full-time permanent adult employees and MFP, 1986-87 to 1995-96[b]**

Per cent per year



a Growth rates are measured using average annual compound formula based on the end points of linear trend lines through time series data. **b** The earnings data are averages between May 1987 and May 1996. The MFP data are averages between financial years 1986-87 and 1995-96. **c** The non-farm market sector is not included in the estimation of equations.

Data sources: Estimates for MFP updated from Gretton and Fisher (1997); estimates for real earnings based on ABS (*Australian National Accounts, 1995-96*, Cat. no. 5204.0; unpublished data).

None of these correlations across the non-farm market sector industries are statistically significant. In addition, analysis by gender and for the eight major occupation groups generally produced no statistically significant correlations. Details of all scatter plots are presented in appendix B.

There is an apparent tendency for the high productivity growth industries to have higher growth in earnings than many of the low productivity growth industries. However, with the exception of Mining, the growth in earnings across the non-farm market sector industries is similar, regardless of their growth in MFP. Also, two of the industries with negative MFP growth — Accommodation, cafes and restaurants

and Cultural and recreational services — had earnings growth similar to that of the high productivity growth industries. This suggests that factors other than MFP growth are driving the growth in earnings.

Figure **7.9** also shows that the difference in the growth of real earnings between occupation groups within an industry tends to be smaller in the high productivity growth industries than in the low productivity growth industries. The average difference in these growth rates for the high productivity growth industries is half that for the low productivity growth industries. Thus, in the high productivity growth industries, the dispersion of real earnings over time between occupations within an industry is less than in the low productivity growth industries.

7.5 Summary

The analysis reported in this chapter reveals that the *level* of real earnings in high productivity growth industries is generally near or above the benchmark. For the low productivity growth industries, there is a much greater variation in the *level* of real earnings across industries. In general, real earnings have tended to *grow* faster in high productivity growth industries than in low productivity growth industries. However, for all occupation groups, no statistically significant correlation was found between *growth* in real earnings and MFP growth. However, the *difference* in the growth of real earnings between occupation groups within an industry tends to be smaller in the high productivity growth industries than in the low productivity growth industries.

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A Data sources and explanations

This appendix provides details of the data sources used in this paper and some comments on the limitations of these data.

A.1 Industry classification concordances

The Australian and New Zealand Standard Industrial Classification (ANZSIC) has been used in this paper. This classification replaced the Australian Standard Industrial Classification (ASIC). ANZSIC was introduced by the ABS in 1994-95 for the Labour Force Survey (LFS) and the Employee Earnings and Hours (EEH) survey. The month of introduction varied by survey. This is discussed below for each of the employment characteristics examined.

As noted in chapter 2, data in ASIC have been reclassified to ANZSIC, based on broad correspondence rather than precise concordances, due to limited availability of data. No attempt has been made to project the data on a trend basis to take account of the limitations in the concordance.

Table **A**.**1** provides the concordance used to reclassify the ASIC employment data into ANZSIC at the industry division level. Table A.2 provides the concordance used for the disaggregated manufacturing data presented in appendix C.

Table A.2 **ASIC/ANZSIC concordance for industry divisions**

ANZSIC classification		*Main corresponding ASIC sector(s)*[a]	
Market sector[b]			
A	Agriculture, forestry and fishing	A	Agriculture, forestry, fishing and hunting
B	Mining	B	Mining
C	Manufacturing	C	Manufacturing
D	Electricity, gas and water	D	Electricity, gas and water
E	Construction	E	Construction
F	Wholesale trade	F	Wholesale and retail trade (Wholesale subdivision only)
G	Retail trade	F	Wholesale and retail trade (Retail subdivision only)
H	Accommodation, cafes and restaurants	L	Recreation, personal and other services (Restaurants, hotels and clubs subdivision only)
I,J	Transport, storage and communication	G	Transport and storage
		H	Communication
P	Cultural and recreational services	L	Recreation, personal and other services (Entertainment and recreational services subdivision only)

a Although this correspondence is assumed to provide a reasonable basis for ascertaining broad industry trends, there are a number of individual activities that moved between sectors with the introduction of ANZSIC. Details of these moves are presented in ABS (1993a). **b** This definition of the market sector adopted is that used in ABS (1997b).

Source: Based on ABS (*Australian and New Zealand Standard Industrial Classification, 1993 Edition,* Cat. no. 1292.0).

Table A.3 **Manufacturing ANZSIC-based industry classification and correspondence to ASIC**

ANZSIC-based classification	*Main corresponding ASIC industry(s)*
21 Food beverages and tobacco	21 Food beverages and tobacco
22 Textiles, clothing, footwear and leather	23 Textiles 24 Clothing and footwear 345 Leather and leather products
24 Printing, publishing and recorded media	26 Paper, paper products, printing and publishing less 263 Paper and paper products
25 Petroleum, coal, chemicals and associated products	27 Petroleum, coal, chemicals and associated products 346 Rubber products 347 Plastic and related products
Basic metal products	29 Basic metal products
271 Iron and steel manufacturing	
272 Basic non-ferrous metal manufacturing	
273 Non-ferrous basic metal product manufacturing	
Structural and sheet metal products	31 Fabricated metal products
274 Structural metal product manufacturing	
275 Sheet metal product manufacturing	
276 Fabricated metal product manufacturing	
Transport equipment	32 Transport equipment
281 Motor vehicle and part manufacturing	
282 Other transport equipment manufacturing	
Other manufacturing	Other manufacturing
23 Wood and paper products	25 Wood, wood products and furniture
26 Non-metallic mineral products	28 Non-metallic mineral products
283 Photographic and scientific equipment manufacturing	33 Other machinery and equipment
284 Electronic equipment manufacturing	263 Paper and paper products
285 Electrical equipment and appliance manufacturing	34 Miscellaneous Manufacturing less 345 Leather and leather products
286 Industrial machinery and equipment manufacturing	less 346 Rubber products less 347 Plastic and related products
29 Other manufacturing	

Source: Gretton and Fisher (1997).

A.2 Standard errors for employment data

Estimates with high standard errors, that is relative standard errors of greater than 25 per cent, are only reliable for purposes that recognise the high risk of significant differences existing between the survey estimates and the true value of variables the survey is attempting to measure. In general, these estimates should only be used to aggregate to sample size levels for which the relative standard error will be 25 per cent or less. Table A.3 presents these sample size levels for the employment data taken from the LFS and associated supplementary surveys. Table A.4 presents details of the unreliable estimates for earnings from the EEH survey. It also notes where the ABS advised that data were not available or had been confidentialised.

In general, in this paper, estimates with high standard errors (and those based on other estimates with high standard errors) are presented to provide an indication of broad trends and the unreliability of the estimates is flagged. However, such data are excluded from the calculations on which the scatter plots are based (as outlined in appendix B).

Table A.4 **Sample size levels at which estimates from the Labour Force Survey have a relative standard error of 25 per cent**

Year	*Sample size*
Labour Force Survey (August)[a]	
1978 to 1982	4 500
1983 to 1992	3 500
1993 to 1997	4 000
Educational Attainment/Transition from Education to Work surveys[b] *(February 1984–88/May 1989–97)*	
1984 to 1987	4 000
1988	4 500
1989 to 1991	3 500
1992	4 000
1993	4 500
1994	6 300
1995-1997	5 300
Weekly Earnings of Employees (Distribution) survey (August)[c]	
1985 to 1992	3 450
1993	4 900
1994	4 500
1995	4 550
1996	4 500
1997	5 165

[a] Applies to employment data cross-classified by part-time/full-time status, age and occupation. [b] Applies to employment data cross-classified by educational attainment. [c] Applies to employment data cross-classified by casual/permanent status.

Sources: ABS (*Labour Force, Australia*, Cat. no. 6203.0*; Labour Force Status and Educational Attainment, Australia*, Cat. no. 6235.0; *Transition from Education to Work, Australia*, Cat. no. 6227.0; *Weekly Earnings of Employees (Distribution), Australia*, Cat. no. 6310.0).

Table A.5 **Unreliable or missing employee earnings data**

Occupation group/occupation	*Industry*	*Period*
Males		
High-skilled blue collar (Tradespersons)	Cultural and recreational services	1991
Managers and administrators	Mining	1993
	Electricity, gas and water	1988
Professionals	Retail trade	1994
	Accomm., cafes and restaurants	1987–96
Para-professionals	Retail trade	1988, 1996
	Accomm., cafes and restaurants	1987*, 1988–96
Clerks	Mining	1989, 1993–96
	Accomm., cafes and restaurants	1987
	Cultural and recreational services	1987–89, 1991–92, 1994–96
Salespersons and personal service workers	Mining	1987–96
	Electricity, gas and water	1988–96
	Construction	1987, 1994
	Cultural and recreational services	1987–91, 1993
Plant and machine operators and drivers	Accomm., cafes and restaurants	1987–96
	Cultural and recreational services	1987–96
Labourers and related workers	Cultural and recreational services	1987, 1989–90, 1993
Females		
High-skilled white collar	Mining	1988–96
	Electricity, gas and water	1987, 1989, 1991–96
High-skilled blue collar (Tradespersons)	Mining	1987–88*, 1989, 1990, 1991–92+, 1993–94*, 1995–96
	Electricity, gas and water	1987–89*, 1990–91, 1992*, 1993–94, 1995*, 1996
	Construction	1987–96
	Wholesale trade	1987–96
	Retail trade	1991
	Accomm., cafes and restaurants	1988, 1994
	Transport, storage and comm.	1987–94, 1995*, 1996
	Cultural and recreational services	1987–89, 1990+, 1991–96
Managers and administrators	Mining	1987–91, 1992–93*, 1994–96
	Electricity, gas and water	1987+, 1988*, 1989–93, 1994*, 1995–96
	Construction	1987–90, 1992–96
	Transport, storage and comm.	1987–88, 1990
	Cultural and recreational services	1988–94, 1996
Professionals	Mining	1987–96
	Electricity, gas and water	1987–96
	Construction	1987–90, 1992, 1994–96
	Retail trade	1993–94, 1996
	Accomm., cafes and restaurants	1987–96
	Transport, storage and comm.	1987
	Cultural and recreational services	1988–90

(Continued on next page)

Table A.6 **(Continued)**

Occupation group/occupation	*Industry*	*Period*
Para-professionals	Mining	1987–96
	Electricity, gas and water	1987–96
	Construction	1987–96
	Wholesale trade	1987–92, 1994–96
	Retail trade	1987–88, 1990–96
	Accomm., cafes and restaurants	1987, 1988+, 1989*, 1990+, 1991, 1992*, 1993+, 1994–95*, 1996
	Transport, storage and comm.	1987–96
	Cultural and recreational services	1987–96
Clerks	Mining	1994, 1996
Salespersons and personal service workers	Mining	1987–89*, 1990, 1991–93*, 1994, 1995*, 1996+
	Electricity, gas and water	1987–88, 1989*, 1990–96
	Construction	1987–90, 1992–96
	Cultural and recreational services	1987–88, 1990–91
Plant and machine operators, and drivers	Mining	1987–90, 1991*, 1992–96
	Electricity, gas and water	1987*, 1988+, 1989*, 1990+, 1991*, 1992, 1993–96*
	Construction	1987*, 1988, 1989–90*, 1991, 1992*, 1993–96
	Wholesale trade	1988–91, 1993–94, 1996
	Retail trade	1988, 1992–96
	Accomm., cafes and restaurants	1987*, 1988+, 1989*, 1990*, 1991–94+, 1995–96
	Transport, storage and comm.	1987–96
	Cultural and recreational services	1987–88*, 1989–91+, 1992–93*, 1994–95+, 1996
Labourers and related workers	Mining	1987–96
	Electricity, gas and water	1987–90, 1991*, 1992–93, 1994+, 1995–96*
	Construction	1987–94, 1995–96*
	Transport, storage and comm.	1992, 1994, 1996
	Cultural and recreational services	1987–96
Persons		
High-skilled blue collar (Tradespersons)	Cultural and recreational services	1991
Managers and administrators	Mining	1993
Professionals	Retail trade	1994
	Accomm., cafes and restaurants	1988–92, 1994–96
Para-professionals	Accomm., cafes and restaurants	1988–91, 1993–96
Salespersons and personal service workers	Mining	1987–96
	Electricity, gas and water	1988–96
	Construction	1987
Plant and machine operators, and drivers	Accomm., cafes and restaurants	1988–96
	Cultural and recreational services	1987–96
Labourers and related workers	Cultural and recreational services	1993

* Data have been confidentialised. + No data available.

Source: ABS (unpublished data).

A.3 Employment by educational attainment

Data source

A reasonably consistent time series for the number of employed 15-64 year olds at each level of educational attainment, cross-classified by ANZSIC industry divisions in the market sector and gender, was constructed for the period February 1984 to 1988 and May 1989 to 1997.

The series for 1984 to 1997 was constructed using unpublished estimates from the ABS supplementary surveys to the LFS — Transition from Education to Work for May from 1989 to 1997 and the Educational Attainment Survey for February from 1984 to 1988.

Data classification

The ABS provided the employment by educational attainment estimates in ASIC industry classification from 1984 to 1994 and ANZSIC industry classification from 1995 to 1997. These data were used in conjunction with the ASIC/ANZSIC concordance in table A.1 to construct the ANZSIC series used in this paper.

During the period 1984 to 1997, the ABS used two main educational attainment classification systems. In 1993, the ABS Classification of Qualifications (ABSCQ) system was introduced. The classification system used in this paper is a hybrid of both ABS systems and is detailed in table A.5. It combines some ABS educational categories to construct a reasonably consistent time series over the whole period.

Table A.7 **Educational attainment classification system**

Classification used in this paper	*Corresponding ABS educational classification categories*[a]	*Corresponding ABSCQ categories*[b]
With post-school qualifications		
Degree or higher	Degree	Bachelor degree or higher
Other qualifications	Trade, technical or other certificate Other post-school qualifications	Skilled vocational qualifications Other post-school qualifications
Without post-school qualifications		
Completed secondary school[c]	Completed highest level of secondary school available	Completed highest level of school
Did not complete secondary school[c]	Did not complete highest level of secondary school available Never attended school	Did not complete highest level of school Never attended school
Still at school	Still at school	Still at school

[a] Prior to 1993. [b] From 1993. [c] These categories include people currently attending tertiary institutions.

Sources: Based on ABS (*Labour Force Status and Educational Attainment, Australia*, Cat. no. 6235.0; *Transition from Education to Work, Australia*, Cat. no. 6227.0).

Breaks in series

There are several breaks in the educational attainment series. Full details of these breaks are provided in ABS (1997d). Only the main breaks relevant to the purposes of this paper are outlined in this appendix.

As already noted, the series had to be compiled from two different surveys, one conducted in February and the other in May. However, the change in 1989 from February to May is not considered to have serious implications for the data presented and no adjustment has been made for this break.

The other two major breaks in series, also noted above, are the introduction of the ANZSIC industry classification in 1995 and the introduction of ABSCQ in 1993. The classification systems outlined above have partially adjusted for these breaks in series. However, even after these adjustments, the introduction of ABSCQ still has major implications for the data series presented in this paper.

The ABSCQ system made a distinction between recognised qualifications and other qualifications, which was not made in the previous classification system. Qualifications earned as a result of less than one semester of full-time study were

excluded from estimates of recognised qualifications under ABSCQ. Before 1993, they were included as valid qualifications (ABS 1997d). At the same time, the ABS changed the wording of the questionnaire to refine the concept of *educational* qualifications, asking whether the respondent had completed an educational qualification rather than obtained a qualification. The combination of these changes lowered estimates of the attainment of post-school qualifications by about 400 000 to 500 000 (ABS 1993b). However, as it is not possible to correct the data on an industry by industry basis, the break in the series remains, and is reflected in the charts presented in this paper.

A.4 Employment by occupation

Data source

A reasonably consistent time series for the number employed (aged 15 years and over) by occupation, cross classified by ANZSIC industry divisions in the market sector and gender, was constructed for the period August 1986 to August 1995. It was not possible to extend this time period due to changes in occupation classification (see discussion below).

Reasonably consistent estimates for ANZSIC-based industry groups within Manufacturing were also constructed for the same period.

These series were constructed using estimates from the LFS microfiche for August of each year, together with some unpublished estimates for industry subdivisions and groups from the same survey.

Data classification

For the industry divisions, ABS employment by occupation estimates were in ASIC industry classification from 1986 to 1993 and ANZSIC industry classification from 1994 to 1995. These data were used in conjunction with the ASIC/ANZSIC concordance in table **A.8** to construct the ANSZIC series used in this paper.

ABS estimates for manufacturing subdivisions and groups were available in ANZSIC from 1986. These estimates were used in conjunction with the ANZSIC-based classification in table **A.9** to construct the series for the manufacturing industry groups used in this paper.

The occupational classification system used in this paper is based on the Australian Standard Classification of Occupations, first edition (ASCO1). Before the

introduction of ASCO1 in 1986, the ABS used the Classification and Classified List of Occupations (CCLO). In 1996, the ABS produced a second edition of the Australian Standard Classification of Occupations (ASCO2). However, there are no concordances available at the industry level that would allow data from all three classifications to be converted to a single classification.

ASCO1 classifies occupations in terms of two attributes: skill level and skill specialisation. This enables the grouping of occupations, on the basis of their similarity, in terms of experience, skill and qualifications, into successively broader categories. The skill level of an occupation is a function of the amount of formal education, on-the-job training and previous experience necessary before an individual can satisfactorily perform the set of tasks required. The skill specialisation of an occupation is a function of the field of knowledge required, tools or equipment used, materials worked on and goods and services produced in relation to the tasks performed.

As a result, an individual's 'job' can be narrowed down to: the range and complexity of the tasks; field of knowledge required; tools and equipment used; materials worked on; and goods and services produced.

ASCO1 divides the workforce into eight major occupational groups. A detailed definition of these occupational groups is in ABS (1986), on which the definitions below are based.

- *Managers and administrators*: head government, industrial, agricultural, commercial and other establishments, organisations, or departments within the organisation. They determine policy and direct and co-ordinate the functioning of the establishment, organisation or department, usually through subordinate executives. Most occupations in this group have a level of skill equal to a three year degree and five to ten years experience in a relevant field or industry. Examples include parliamentarians, judges, general managers, production managers, farmers and farm managers, and shop managers.
- *Professionals*: perform analytical, conceptual and creative tasks requiring a high level of intellectual ability and a thorough understanding of an extensive body of theoretical knowledge. Most occupations in this group have a level of skill equal to a three year degree or diploma, with some occupations requiring a longer basic degree and/or postgraduate qualifications. Examples include natural scientists, engineers, medical practitioners, lawyers and accountants.
- *Para-professionals*: perform complex technical tasks requiring an understanding of a body of theoretical knowledge and significant practical skills. Occupations in this group have a level of skill equal to a two to three year para-professional certificate or associate diploma. Most para-professionals receive some on-the-job

training in addition to formal education. Examples include medical and scientific technicians, pilots, nurses and police.

- *Tradespersons*: perform a variety of complex physical tasks, applying a body of trade-specific technical knowledge. These tasks require initiative and a high degree of manual dexterity and other practical skills. Occupations in this group have a level of skill equal to a four year trade certificate, usually obtained by apprenticeship. Examples include fitters and turners, electricians, bricklayers, plumbers, printers, panel beaters, bakers, landscape gardeners and tailors.
- *Clerks*: gather, record, order, transform, store and transmit information on paper or electronic media. These tasks require moderate literacy and numeracy. Occupations in this group have a level of skill equal to Years 11 and 12 at secondary school and six months on-the-job training. Examples include typists, stenographers, accounts clerks, library assistants, receptionists and legal clerks.
- *Salespersons and personal service workers*: sell financial and transportable commodities to retailers or directly to the public, sell real estate, and provide services related to finance, property, recreation and personal needs. These tasks require skills in interpersonal communication. Most occupations in this group have a level of skill equal to Year 10 at secondary school and three months on-the-job training. However, some require higher qualifications, and are included in this group because their primary task is selling. Examples include real estate salespersons, sales assistants, bank tellers, waiters, dental nurses and flight attendants.
- *Plant and machine operators, and drivers*: operate vehicles and other large equipment to transport passengers and goods, to move materials, to generate power, and to perform various agricultural and manufacturing functions. These tasks require some judgment and are performed under limited supervision. Occupations in this group require no formal education or experience, but usually require 3 to 24 months on-the-job training. They often require specially endorsed licences. Examples include bus drivers, forklift drivers, firefighters, crane operators and metal press operators.
- *Labourers and related workers*: perform routine tasks, either manually or using hand tools and appliances. These tasks require minimal judgment and are usually performed under close supervision. Occupations in this group require no formal education or experience, but may require up to 12 months on-the-job training. Examples include trade assistants (like plumber's assistants), meat packers, farmhands, cleaners, mining labourers and kitchen hands.

These eight ASCO1 occupation groups were further aggregated into four skill-based occupation groups (table A.10).

Table A.11 Skill-based occupation group classification system

Skill-based occupation group	*Corresponding ASCO1 major group(s)*
High-skilled white collar	Managers and administrators Professionals Para-professionals
High-skilled blue collar	Tradespersons
Low-skilled white collar	Clerks Salespersons and personal service workers
Low-skilled blue collar	Plant and machine operators, and drivers Labourers and related workers

Source: ASCO1 categories from ABS (*Australian Standard Classification of Occupations (first edition)*, Cat. no. 1222.0).

This aggregation of ASCO1 major groups is a broad one that has limitations. One specific example is that, within the Agriculture, forestry and fishing industry division, many farmers list themselves as managers, and under this aggregation will appear in the high-skilled white collar occupation group. However, work by the OECD (1996b) and Dunlop and Sheehan (1996) placed primary producers in the high-skilled blue collar occupation group. While this adjustment was not made in this paper, to take some account of this issue the correlation between growth in multifactor productivity (MFP) and in the share of workers in the high-skilled white collar occupation group was also examined without Agriculture (see appendix B for results).

A.5 Employment by age

Data source

A reasonably consistent time series for the employed workforce (aged 15 years and over) by age group, cross-classified by ANZSIC industry divisions in the market sector and gender, was constructed for the period August 1978 to August 1997.

Reasonably consistent estimates for ANZSIC-based groups within Manufacturing were also constructed for the same period.

These series were constructed using estimates from LFS microfiche for August of each year, together with some unpublished estimates for industry subdivisions and groups from the same survey.

Data classification

For the industry divisions, the ABS employment by age estimates were in ASIC industry classification from 1978 to 1993 and ANZSIC industry classification from 1994 to 1997. These data were used in conjunction with the ASIC/ANZSIC concordance in table **A.12** to construct the ANZSIC series used in this paper.

For the manufacturing industry groups, ABS estimates for ASIC manufacturing subdivisions and groups were already backcast by the ABS into ANZSIC for 1985 to 1993. ASIC data for 1978 to 1984, together with the backcast data and ANZSIC data for 1994 to 1997, were used in conjunction with the ANZSIC-based classification in table **A.13** to construct the series used in this paper.

Between 1978 and 1997, the ABS classified LFS employment data by different age groupings. For the purposes of this paper, the data are aggregated, where necessary, to create seven age groups: 15-19, 20-24, 25-34, 35-44, 45-54, 55-59 and 60 and over.

A.6 Employment by full-time and part-time status

Data source

A reasonably consistent time series for the number employed (aged 15 years and over) in part-time and full-time employment, cross-classified by ANZSIC industry division and gender, was constructed for the period August 1978 to August 1997.

This time series was constructed using estimates from the LFS, for August each year. For 1978 to 1984, the data came from LFS microfiche. For 1985 to 1997, the data came from ABS Labour Statistics on dX-Online (database).

Data classification

The ABS estimates of part-time and full-time employment by industry were classified by ASIC from 1978 to 1984 and by ANZSIC from 1985 to 1997. The ASIC data were used in conjunction with the ASIC/ANZSIC concordance in table **A.14** to complete the ANZSIC series used in this paper.

A.7 Employment by permanent and casual status

Data source

A reasonably consistent time series for the number of employees (aged 15 years and over) in permanent and casual employment, cross-classified by ANZSIC industry divisions in the market sector and gender, was constructed for the period August 1985 to August 1997.

This time series was constructed using unpublished estimates from an ABS supplementary survey to the LFS — Weekly Earnings of Employees (Distribution), Australia (WEEDA) — conducted in August of each year.

Data classification

The ABS estimates of permanent and casual employment by industry were classified by ASIC from 1985 to 1993 and by ANZSIC from 1994 to 1997. These data were used in conjunction with the ASIC/ANZSIC concordance in table **A.15** to complete the ANZSIC series used in this paper.

The ABS estimates are for employees and not all employed, that is, they exclude employers, own account workers and contributing family workers. Employees are defined by the ABS for the WEEDA survey as:

> ... employed persons aged 15 years and over who worked in their main job for an employer for wages or salary or in their own business (either with or without employees), if that business was a limited company. (ABS 1994, p. 30)

The employment numbers for this characteristic therefore differ to those for the other characteristics in this paper.

A.8 Employee earnings by occupation and skill-based occupation groups

Data source

The ABS provided a time series for nominal average weekly ordinary time earnings of full-time permanent adult employees. This series was cross-classified by ANZSIC industry divisions in the market sector (excluding Agriculture, forestry and fishing), occupation and gender, for the period May 1987 to May 1996. It was not possible to extend the period of this series due to changes in occupation

classification (see section A.4 for further discussion). Data for Agriculture, forestry and fishing are not collected in the ABS survey used.

The ABS constructed this series from the EEH survey, using the industry and occupation concordances supplied to them (see ASIC/ANZSIC concordance in table **A.16** and occupational groupings in table **A.17**). The ABS had used the ASIC system for the EEH survey from 1987 to 1994.

The series supplied by the ABS was converted to real earnings in 1989-90 dollars, using an implicit price deflator based on private final consumption expenditure from ABS (1997a).

The EEH survey was not designed to provide data for time series analysis and, in many cases, it would not be appropriate to use it in this way. However, this paper is only using time series data to examine broad trends, rather than year-on-year changes, and EEH survey data are adequate for this task.

Data classification

Measure of earnings

Adult employees were selected to isolate the measure of earnings from the effects of changing proportions of junior employees in the workforce. Adult employees are those employees who are 21 years of age or over, or are under 21 but paid at the full adult rate for their occupation.

Weekly ordinary time earnings have been used rather than hourly ordinary time earnings because the EEH survey does not collect hours for managerial employees. This would have had a significant impact on the cross-classification of earnings by occupation group. There have not been significant changes in the average number of ordinary time hours worked during the period examined.

Ordinary time earnings were selected to isolate the measure from changes in earnings due to changes in the amount of paid overtime worked. However, it does not isolate the measure of earnings from changes in the definition and composition of ordinary time. For example, under enterprise bargaining, overtime payments and penalty rates are often rolled into ordinary time rates. This will cause ordinary time rates to increase. However, this may be offset to some extent by the rise in the levels of unpaid overtime, which may have decreased true hourly rates of pay. No adjustment has been made for these factors.

Occupational classification

The occupational classification used in the analysis of earnings in this paper is based on ASCO1 major groups (see section A.4 for details) and an aggregation of these groups into three skill-based occupation groups (see table **A.18**). These skill-based occupation groups differ from those used for the analysis of employment numbers by occupation group.

Table A.19 **Occupation group classification system used for earnings analysis**

Skill-based occupation group	*Corresponding ASCO1 major group(s)*
High-skilled white collar	Managers and administrators Professionals Para-professionals
High-skilled blue collar	Tradespersons
Low-skilled	Clerks Salespersons and personal service workers Plant and machine operators, and drivers Labourers and related workers

Source: ASCO1 major categories from ABS (*Australian Standard Classification of Occupations (first edition)*, Cat. no. 1222.0).

A.9 Multifactor productivity

What is multifactor productivity?

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 and so on). 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.

MFP is a measure of the growth in output not accounted for by the growth of inputs: labour and capital. It includes technical progress, improvements in the workforce, improvements in management practices, economies of scale and the like that improve the quality of inputs and how they are used. MFP can be affected in the short to medium term by factors such as the weather and variations in capacity utilisation associated with the business cycle.

As suggested by the Industry Commission (IC 1997b), the measurement of MFP is not an exact science. Some difficulties include the extent to which quality

improvements in services are reflected in inputs and outputs, the effect of technical change and changes in employee skills. Quality improvements in services, in particular, are problematic. Consequently, the measurement of MFP is made with a certain amount of approximation that should not be overlooked when interpreting the data.

Data sources

Estimates of MFP by market sector industry (ANZSIC divisions) are presented in this paper for the period 1978-79 to 1995-96. In addition, MFP estimates for eight industry groups within Manufacturing for the period 1978-79 to 1994-95 are provided in appendix C.

The ANZSIC division estimates, and estimates for the total market sector and non-farm market sector, are based on IC estimates reported in Gretton and Fisher (1997) for the period 1974-75 to 1994-95. The details of the methodology and data sources used to construct these IC estimates can be found in that publication. For this paper, the same methodology has been applied to extend the series of estimates to 1995-96. In addition, all the earlier IC MFP estimates have been revised to incorporate revisions by the ABS to the data originally used to construct the estimates.

The series of MFP estimates for the eight industry groups within Manufacturing are from Gretton and Fisher (1997) and have not been revised or extended beyond 1994-95.

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B Scatter plot details

This appendix provides some details related to the statistical significance of correlations referred to in the body of this paper. It relates only to the scatter plot analysis, which incorporated basic regressions used to look for correlations between productivity growth and changes in the structure of employment.

B.1 Exclusions from scatter plots based on standard errors

In this paper, the aim has been to examine trends over time. The data have been used to construct trend lines and data with high standard errors (as detailed in appendix A) have been included for some years. However, where the estimates for an industry have high standard errors in more than 25 per cent of the years in any time series, the industry has been excluded from the analysis. Table B.1 summarises the industries excluded from the analysis of different characteristics.

Table B.1 **Industries excluded from scatter plot analyses**

Characteristic		*Industries excluded*
Educational attainment		
Females	Without post-school qualifications	Mining
	With post-school qualifications	Mining
	Degree	Mining, Electricity, gas and water, Construction, Accommodation, cafes and restaurants
	Other qualifications	Mining, Electricity, gas and water
	Completed secondary school	Mining, Electricity, gas and water
	Did not complete secondary school	Mining, Electricity, gas and water
Occupation		
Males	Low-skilled white collar	Agriculture, Mining
Females	High-skilled white collar	Mining, Electricity, gas and water, Construction
	High-skilled blue collar	Agriculture, Mining, Electricity, gas and water, Construction, Wholesale trade, Transport, storage and communications, Cultural and recreational services
	Low-skilled blue collar	Mining, Electricity, gas and water, Construction
Age		
Males	15-19	Mining, Electricity, gas and water
	55-59	Mining, Cultural and recreational services
	60 and over	Mining, Electricity, gas and water, Cultural and recreational services
Females	All age groups	Mining, Electricity, gas and water
	15-19	Construction
	55-59	Construction, Cultural and recreational services
	60 and over	Construction, Wholesale trade, Transport, storage and communication, Accommodation, cafes and restaurants, Cultural and recreational services
Persons	15-19	Mining, Electricity, gas and water
	55-59	Mining
	60 and over	Mining, Electricity, gas and water
Full-time/part-time		
Males	Part-time	Mining, Electricity, gas and water
Females	Part-time	Mining, Electricity, gas and water
Persons	Part-time	Mining, Electricity, gas and water
Permanent/casual		
Males	Casual	Mining, Electricity, gas and water
Females	Casual	Mining, Electricity, gas and water
Persons	Casual	Mining, Electricity, gas and water

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Table B.1 **(Continued)**

Characteristic		*Industries excluded*
Earnings		
Males	Professionals	Accommodation, cafes and restaurants
	Para-professionals	Accommodation, cafes and restaurants
	Clerks	Mining, Cultural and recreational services
	Salespersons and personal service workers	Mining, Electricity, gas and water, Cultural and recreational services
	Plant and machine operators, and drivers	Accommodation, cafes and restaurants, Cultural and recreational services
	Labourers and related workers	Cultural and recreational services
Females	High-skilled white collar	Mining, Electricity, gas and water
	High-skilled blue collar (Tradespersons)	Mining, Electricity, gas and water, Construction, Wholesale trade, Transport, storage and communication, Cultural and recreational services
	Managers and administrators	Mining, Electricity, gas and water, Construction, Transport, storage and communication, Cultural and recreational services
	Professionals	Mining, Electricity, gas and water, Construction, Retail trade, Accommodation, cafes and restaurants, Cultural and recreational services
	Para-professionals	Mining, Electricity, gas and water, Construction, Wholesale trade, Retail trade, Accommodation, cafes and restaurants, Transport, storage and communication, Cultural and recreational services
	Salespersons and personal service workers	Mining, Electricity, gas and water, Construction, Cultural and recreational services
	Plant and machine operators, and drivers	Mining, Electricity, gas and water, Construction, Wholesale trade, Retail trade, Accommodation, cafes and restaurants, Transport, storage and communication, Cultural and recreational services
	Labourers and related workers	Mining, Electricity, gas and water, Construction, Cultural and recreational services
Persons	Professionals	Accommodation, cafes and restaurants
	Para-professionals	Accommodation, cafes and restaurants
	Salespersons and personal service workers	Mining, Electricity, gas and water
	Plant and machine operators, and drivers	Accommodation, cafes and restaurants, Cultural and recreational services

B.2 Tests for significance of results

T-statistics for the slopes of the lines of best fit, used to test whether the coefficients of the employment variables in the equations were significantly different from zero, are presented in table B.2. The statistical significance of the results reported in the body of this paper are for a two-tailed test, relating to the 95 per cent level of confidence, unless specified as relating to a lower level of confidence, that is 90 per cent.

Table B.2 **T-statistics for the slope coefficients of the lines of best fit in the scatter plots for market sector industries**

Employment characteristic	*Coefficient*	*T-statistic*	*Degrees of freedom (n-2)*
Educational attainment			
1983-84 to 1991-92			
Without post-school qualifications			
Males	-0.04	-0.42	8
Females	0.06	0.55	7
Persons	-0.01	-0.21	8
Completed secondary school			
Males	0.36	1.11	8
Females	0.18	0.46	6
Persons	0.24	0.74	8
Did not complete secondary school			
Males	0.16	1.72	8
Females	0.01	0.07	6
Persons	0.15**	2.60	8
With post-school qualifications			
Males	0.03	0.16	8
Females	-0.11	-0.50	7
Persons	-0.03	-0.30	8
Degree			
Males	-0.58	-1.25	8
Females	0.63	0.76	4
Persons	-0.42	-1.58	8
Other qualifications			
Males	0.16	0.72	8
Females	0.23	1.08	6
Persons	0.04	0.25	8

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Table B.2 **(Continued)**

Employment characteristic	*Coefficient*	*T-statistic*	*Degrees of freedom (n-2)*
1992-93 to 1995-96			
Without post-school qualifications			
Males	0.10	0.82	8
Females	-0.22	-1.16	7
Persons	0.00	-0.02	8
Completed secondary school			
Males	0.44	0.67	8
Females	0.35	1.00	6
Persons	0.40	0.91	8
Did not complete secondary school			
Males	0.12	0.34	8
Females	-0.49	-1.48	6
Persons	-0.08	-0.29	8
With post-school qualifications			
Males	-0.18	-1.34	8
Females	0.47	1.27	7
Persons	0.02	0.14	8
Degree			
Males	-0.72	-0.69	8
Females	1.90	1.58	4
Persons	-0.09	-0.08	8
Other qualifications			
Males	0.00	0.02	8
Females	0.34	1.48	6
Persons	0.10	0.60	8
Occupation group			
1986-87 to 1995-96			
High-skilled white collar			
Males	0.72*	2.19	8
Females	0.67	1.28	5
Persons	0.69*	1.99	8
High-skilled blue collar			
Males	-0.09	-0.54	8
Females	Insufficient observations		
Persons	-0.22	-1.18	8
Low-skilled white collar			
Males	0.03	0.12	6
Females	0.04	0.08	8
Persons	0.30	0.60	8
Low-skilled blue collar			
Males	-0.76*	-2.19	8
Females	-0.01	-0.04	5
Persons	-0.58	-1.62	8

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Table B.2 **(Continued)**

Employment characteristic	*Coefficient*	*T-statistic*	*Degrees of freedom (n-2)*
Age			
1978-79 to 1995-96			
15-19 years			
Males	-0.91**	-2.69	6
Females	-1.23	-1.93	5
Persons	-1.00**	-2.57	6
20-24 years			
Males	-0.59**	-3.00	8
Females	-0.46	-1.19	6
Persons	-0.57**	-3.04	8
25-34 years			
Males	-0.17	-1.47	8
Females	-0.12	0.52	6
Persons	-0.02	-0.15	8
35-44 years			
Males	0.44**	3.01	8
Females	0.18	1.27	6
Persons	0.45**	3.04	8
45-55 years			
Males	0.15	0.83	8
Females	0.13	0.48	6
Persons	0.10	0.68	8
55-59 years			
Males	0.08	0.28	6
Females	0.50	1.41	4
Persons	-0.03	-0.14	7
60 years and over			
Males	0.32	0.70	5
Females	Insufficient observations		
Persons	0.49	1.28	6
Average age			
1978-79 to 1995-96			
Males	0.07	1.61	8
Females	0.16**	2.61	8
Persons	0.07	1.64	8
Part-time			
1978-79 to 1995-96			
Males	0.37	1.30	6
Females	0.26	0.87	6
Persons	0.51**	2.54	6
Full-time			
1978-79 to 1995-96			
Males	0.13*	2.12	8
Females	-0.08	-0.57	8
Persons	0.06	0.73	8

(Continued on next page)

Table B.2 **(Continued)**

Employment characteristic	*Coefficient*	*T-statistic*	*Degrees of freedom (n-2)*
Casual			
1985-86 to 1995-96			
Males	1.30**	2.48	6
Females	0.22	0.82	6
Persons	0.97**	2.61	6
Permanent			
1985-86 to 1995-96			
Males	0.23**	3.20	8
Females	-0.01	-0.04	8
Persons	0.15	1.67	8
Earnings			
1986-87 to 1995-96			
High-skilled white collar			
Males	-0.05	-0.38	7
Females	0.24	1.05	5
Persons	-0.01	-0.08	7
High-skilled blue collar			
Males	0.19	1.00	7
Females	Insufficient observations		
Persons	0.19	1.01	7
Low-skilled			
Males	0.18	0.94	7
Females	0.16	1.20	7
Persons	0.17	0.91	7
Managers and administrators			
Males	-0.12	-0.62	7
Females	Insufficient observations		
Persons	-0.05	-0.36	7
Professionals			
Males	-0.12	-0.52	6
Females	Insufficient observations		
Persons	-0.03	-0.12	6
Para-professionals			
Males	0.12	0.95	6
Females	Insufficient observations		
Persons	0.17	1.23	6
Tradespersons			
Males	0.19	1.00	7
Females	Insufficient observations		
Persons	0.19	1.01	7
Clerks			
Males	0.12	1.50	5
Females	0.18*	2.04	7
Persons	0.12	0.79	7

(Continued on next page)

Table B.2 **(Continued)**

Employment characteristic	*Coefficient*	*T-statistic*	*Degrees of freedom (n-2)*
Salespersons and personal service workers			
Males	0.09	1.40	4
Females	Insufficient observations		
Persons	0.08*	2.07	5
Plant and machine operators, and drivers			
Males	0.35	1.31	5
Females	Insufficient observations		
Persons	0.36	1.38	5
Labourers and related workers			
Males	-0.07	-0.24	6
Females	Insufficient observations		
Persons	0.06	0.25	7

* Significant at the 90 per cent level of confidence. ** Significant at the 95 per cent level of confidence.

B.3 Alternative estimates for employment by occupation group

As noted in appendix A, many farmers list themselves as managers — a high-skilled white collar occupation. In other empirical work, primary producers are placed in the high-skilled blue collar occupation group. This adjustment has not been made in this paper, but the scatter plots were redone without Agriculture to see how this affected the results (table B.3). The exclusion of Agriculture did not change the findings of chapter 4, that there was a statistically positive correlation between trend growth in the share of high-skilled white collar employment and multifactor productivity growth. Hence, the occupational groups used are assumed to provide a reasonable basis for characterising broad occupational trends.

B.4 Estimates for manufacturing industry groups

T-statistics for the slopes of the lines of best fit in the scatter plots presented in appendix C are provided in table B.4.

Table B.3 T-statistics for the slope coefficients of the lines of best fit in the scatter plots for occupation across non-farm market sector industries

Employment characteristic	*Coefficient*	*T-statistic*	*Degrees of freedom (n-2)*
Occupation group			
1986-87 to 1995-96			
High-skilled white collar			
Males	0.75*	2.24	7
Females	0.79	2.03	4
Persons	0.72*	2.16	7
High-skilled blue collar			
Males	-0.10	-0.60	7
Females	Insufficient observations		
Persons	-0.23	-1.22	7
Low-skilled white collar			
Males	-0.17	-1.12	6
Females	-0.06	-0.40	7
Persons	0.19	1.58	7
Low-skilled blue collar			
Males	-0.77*	-2.15	7
Females	-0.08	-0.27	4
Persons	-0.61	-1.70	7

* Significant at the 90 per cent level of confidence.

Table B.4 T-statistics for the slope coefficients of the lines of best fit in the scatter plots for manufacturing industry groups

Employment characteristic	*Coefficient*	*T-statistic*	*Degrees of freedom (n-2)*
Age (persons)			
1978-79 to 1994-95			
15-19 years[a]	-1.65	-1.48	4
20-24 years	-0.85**	-4.29	6
25-34 years	0.20	1.31	6
35-44 years	0.30**	4.00	6
45-54 years	-0.07	-0.38	6
55-59 years	0.05	0.22	6
60 years and over[b]	Insufficient observations		
Occupation (persons)			
1986-87 to 1994-95			
High-skilled white collar	0.51	1.32	6
High-skilled blue collar	-0.13	-0.41	6
Low-skilled white collar	0.47	1.05	6
Low-skilled blue collar	-0.20	-1.35	6

[a] Basic metal products and Petroleum, coal, chemicals and associated products were excluded from the analysis because of high standard errors. [b] All industry groups, except Food, beverages and tobacco and Other manufacturing, were excluded from the analysis because of high standard errors. ** Significant at the 95 per cent level of confidence.

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C Manufacturing sector

While the analysis at the Australian and New Zealand Standard Industrial Classification (ANZSIC) division level has provided some instances of associations between multifactor productivity (MFP) growth and changes in the structure of employment, the potential for associations may be different at a more disaggregated level of industry classification. In this appendix, the manufacturing sector, a large employer, is examined at a finer level of aggregation — eight industry groups based on ANZSIC subdivisions. The basis for constructing these eight groups, and the data sources used, are outlined in appendix A.

Aggregate employment for these manufacturing industry groups is examined together with their MFP growth. This is followed by a brief look at the age and occupational profiles of employment in these industry groups.

C.1 Employment by manufacturing industry group

As highlighted in chapter 3, employment in total manufacturing has fallen since 1978. Total employment in five of the eight industry groups fell — the only group to have significant employment growth was Printing, publishing and recorded media (table **C**.**1**).

Table C.2 **Employment[a] by manufacturing industry group[b], 1978 and 1997[c]**

	1978		*1997*		*Difference*	
Industry	*Number*	*Share of total*	*Number*	*Share of total*	*Number*	*Per cent*
	'000	%	'000	%	'000	%
Food, beverages and tobacco	193.6	16.2	184.6	16.1	-9.0	-4.6
Textiles, clothing, footwear and leather	137.9	11.5	103.1	9.0	-34.8	-25.2
Printing, publishing and recorded media	70.9	5.9	129.7	11.3	58.8	82.9
Petroleum, coal, chemicals and associated products	99.8	8.4	100.5	8.8	0.7	0.7
Basic metal products	90.5	7.6	60.8	5.3	-29.7	-32.8
Structural & sheet metal prods	107.6	9.0	113.9	10.0	6.3	5.9
Transport equipment	133.7	11.2	99.5	8.7	-34.2	-25.6
Other manufacturing	360.1	30.2	352.6	30.8	-7.5	-2.1
Total manufacturing	**1 194.2**	**100.0**	**1 144.7**	**100.0**	**-49.5**	**-4.1**

a Persons 15 years and over. **b** Data in ASIC and ANZSIC reclassified as outlined in appendix A. Due to the limitations of the concordance these numbers should be treated as indicative of the direction of change rather than as reliable estimates of the magnitude of change. **c** August data.

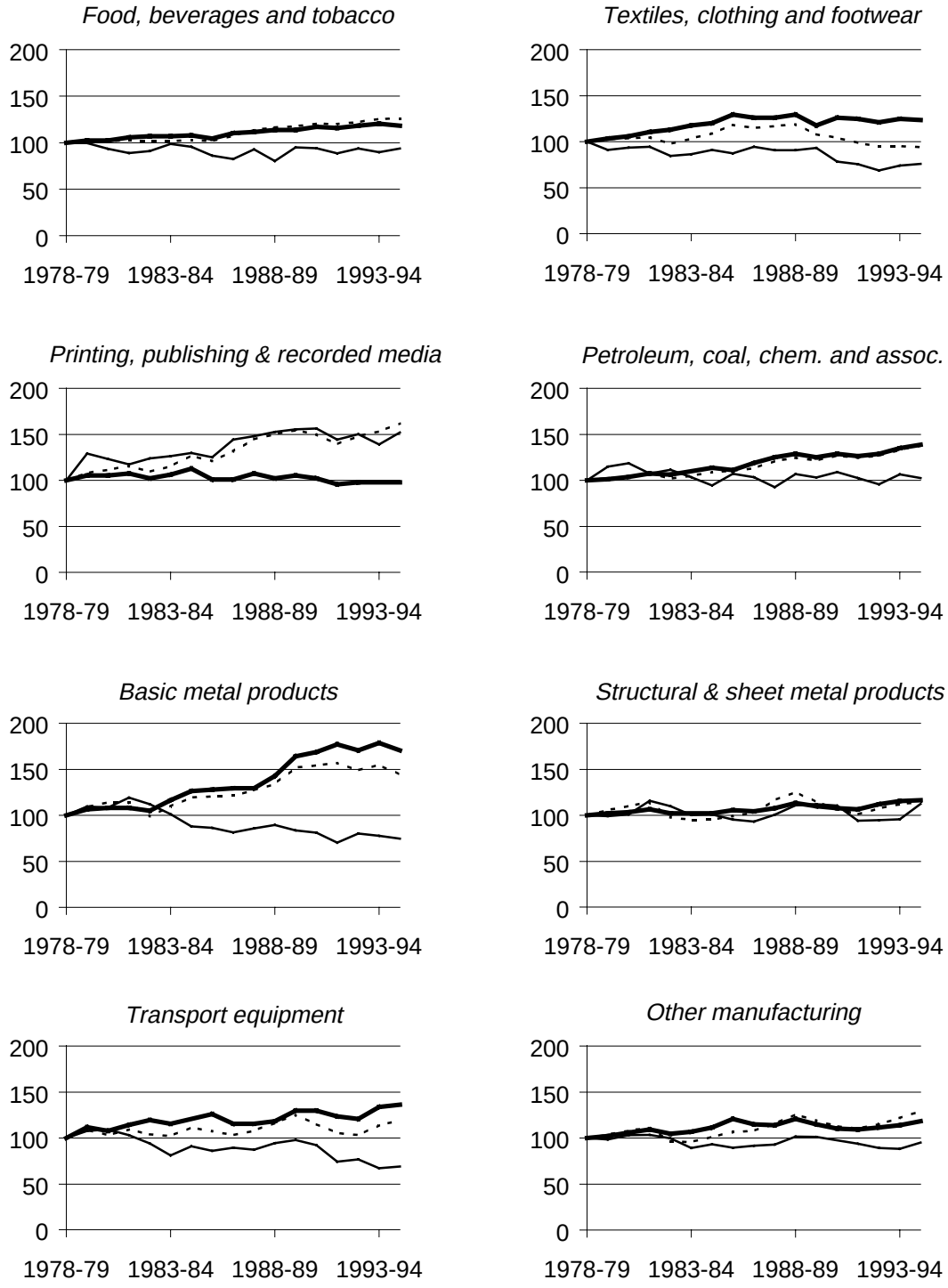
Sources: Based on ABS (Labour Force Survey microfiche; unpublished data).

C.2 Trends in output, productivity and employment for the manufacturing industry groups

The relationship between productivity, output and employment growth has varied by manufacturing industry group. Figure **C.1** presents MFP, output and employment in each manufacturing industry group over the period 1978-79 to 1994-95. MFP estimates for these industry groups are not available for years after 1994-95. The trends illustrated in the figure are summarised in table **C.3**, which presents the trend average annual compound growth rate for each variable over the entire period.

Figure C.2 **MFP, employment and output, by manufacturing industry group, 1978-79 to 1994-95**

Index 1978-79 = 100



Data sources: MFP and output from Gretton and Fisher (1997 — statistical annex); employment based on ABS (Labour Force Survey microfiche; unpublished data).

Table C.4 **Average growth[a] in MFP, output and employment, by manufacturing industry group, 1978-79 to 1994-95[b]**

Industry[c]	*MFP growth*	*Employment growth*	*Output growth*
	%	%	%
Basic metal products	4.39	-2.66	3.01
Petroleum, coal, chemicals and assoc. products	2.09	-0.46	2.05
Transport equipment	1.33	-2.19	0.66
Textiles, clothing, footwear and leather	1.19	-1.55	-0.28
Food, beverages and tobacco	1.13	-0.37	1.71
Structural and sheet metal products	0.80	-0.02	0.58
Other manufacturing	0.72	-0.50	1.34
Printing, publishing and recorded media	-0.45	1.99	2.96
Total manufacturing[d]	**1.35**	**-0.67**	**1.57**

a MFP, employment and output growth are based on the end points of linear trend lines fitted to time series data. **b** Employment estimates are based on data for the month of August. Other estimates are based on financial year data. Time period differs to previous table because MFP data are not available after 1994-95. **c** Ranked by MFP growth. **d** These estimates differ from those presented in the body of this paper. These estimates are based on a different time period and, in the case of MFP, a different data source.

Sources: MFP and output estimates based on Gretton and Fisher (1997 — statistical annex); employment estimates based on ABS (Labour Force Survey microfiche; unpublished data).

Output grew in seven of the eight manufacturing industry groups, the exception being Textiles, clothing and footwear. Basic metal products and Printing, publishing and recorded media were the two fastest growing manufacturing industry groups.

Different output growth rates and changing unit labour requirements have given rise to different employment growth rates across industry groups. Employment growth on average[1] over the period 1978-79 to 1994-95 was positive in only one industry group — Printing, publishing and recorded media. Employment fell at the fastest rates in Basic metal products and Transport equipment.

Comparing growth in MFP and employment, seven of the eight manufacturing industry groups recorded MFP growth and employment declines (figure C.1 and table C.2). Printing, publishing and recorded media, which experienced a fall in MFP, had rising employment. On this basis there appears to be a negative association between MFP growth and employment growth across manufacturing industry groups. However, this is not entirely systematic. Although the industry with the highest MFP growth (Basic metal products) averaged the largest decline in employment, and the industry with the lowest MFP growth (Printing, publishing and recorded media) averaged the highest employment growth, the ranking of changes in

1 Growth rates are based on average annual compound formula using the end points of linear trends fitted to time series data, and differ from the rates calculated from the end points displayed in table C.1.

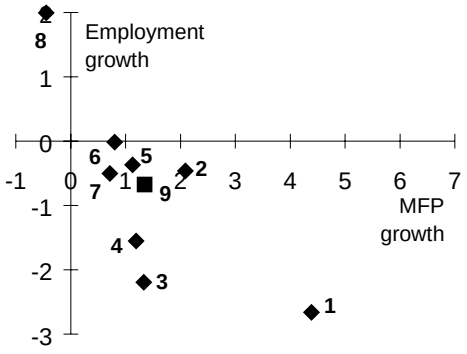
MFP across all industry groups does not coincide closely with that of employment change.

Figure C.2 further illustrates the industry variation in MFP and employment growth. With the exception of Printing, publishing and recorded media (the only industry in the segment of *positive* employment growth and negative MFP growth) and Basic metal products (the industry with the highest MFP growth rate), there is relatively little variation in MFP growth compared with the variation in employment growth.

While figure C.2 suggests a negative relationship between MFP growth and employment growth across industries, some caution must be observed in drawing conclusions. First, the two outliers aside, the greater variation in employment decline than in productivity increase suggests there are also other, perhaps stronger, influences on employment decline. Second, while there appears to be some negative association in Manufacturing, it should be remembered that this cannot be extrapolated to broad industry sectors or the economy as a whole. It reflects the general observation that, while associations may be strong or found for aggregate employment, there can be effects at the level of individual industries.

Figure C.3 **Average growth rates[a] of MFP and employment, 1978-79 to 1994-95[b]**

Per cent per year



1 Basic metal products
2 Petroleum, coal, chemicals and associated products
3 Transport equipment
4 Textiles, clothing, footwear and leather
5 Food, beverages and tobacco
6 Structural and sheet metal products
7 Other manufacturing
8 Printing, publishing and recorded media
9 Total manufacturing[c]

a Growth rates are measured using average annual compound formula based on the end points of linear trend lines through time series data. **b** The employment data are averages between August 1978 and August 1994. The MFP data are averages between financial years 1978-79 and 1994-95. **c** The estimates for total manufacturing differ from those presented in the body of this paper. These estimates are based on a different time period and, in the case of MFP, a different data source.

Data sources: Estimates for MFP based on Gretton and Fisher (1997); estimates for employment based on ABS (Labour Force Survey microfiche; unpublished data).

C.3 Structure of employment among the manufacturing industry groups

Examination of the structure of employment in the manufacturing industry groups at the same level of detail as the industry divisions is beyond the scope of this paper. However, the broad structure of employment, in terms of age and occupation, is briefly covered below. Two questions are addressed for each characteristic.

- Does the employment profile of the manufacturing industry groups differ from the total manufacturing average and the economywide average?
- Is there an association between MFP growth and the rate of change in the employment profile at the industry group level?

Manufacturing employment by age

The age group profiles of employment in the eight manufacturing industry groups have changed between 1978 and 1997 (table C.3). When these changes are examined in conjunction with the MFP estimates in table C.2, it is possible to see if there is any relationship between the changes in the age profile and MFP growth.

In chapter 5, total manufacturing was shown to have a fairly similar age profile to the economy as a whole. There is some variation in the age profiles among the manufacturing industry groups (looking at the two years in table C.3). For example, Basic metal products has a significantly different age profile compared with total manufacturing. But, the variation in age profiles does not appear to be systematically related to differences in MFP growth across the industry groups. However, there is some tendency for the industry groups with MFP growth below the total manufacturing average to employ larger shares of younger (15-19) and older (60 and over) workers than those industry groups with above average MFP growth. This is a similar pattern to that found when the high productivity growth industry divisions (including total manufacturing) were compared with the low productivity growth industry divisions.

Table C.5 **Employment by age group, by manufacturing industry group, 1978 and 1997[a]**

Industry[b]	1978 Number	1978 Share of industry employment	1997 Number	1997 Share of industry employment	Difference Number	Difference Per cent
	'000	%	'000	%	'000	%
15-19 age group						
Basic metal products	5.5	6.1	2.0*	3.3	-3.5	-63.6
Petroleum, coal, chemicals and associated products	5.6	5.6	2.1*	2.1	-3.5	-62.5
Transport equipment	12.0	9.0	2.7*	2.7	-9.3	-77.5
Textiles, clothing, footwear and leather	15.4	11.2	1.8*	1.7	-13.6	-88.3
Food, beverages and tobacco	22.9	11.8	8.5	4.6	-14.4	-62.9
Structural & sheet metal prods	13.8	12.8	7.1	6.2	-6.7	-48.6
Other manufacturing	38.3	10.6	13.2	3.7	-25.1	-65.5
Printing, publishing and recorded media	7.3	10.3	6.4	4.9	-0.9	-12.3
Total manufacturing	120.7	10.1	43.8	3.8	-76.9	-63.7
Total industries	**639.0**	**10.6**	**553.4**	**6.7**	**-85.6**	**-13.4**
20-24 age group						
Basic metal products	13.8	15.2	3.6*	5.9	-10.2	-73.9
Petroleum, coal, chemicals and associated products	11.1	11.1	10.3	10.2	-0.8	-7.2
Transport equipment	17.4	13.0	13.4	13.5	-4.0	-23.0
Textiles, clothing, footwear and leather	16.4	11.9	8.2	8.0	-8.2	-50.0
Food, beverages and tobacco	27.3	14.1	26.0	14.1	-1.3	-4.8
Structural & sheet metal prods	13.5	12.5	13.9	12.2	0.4	3.0
Other manufacturing	43.8	12.2	40.1	11.4	-3.7	-8.4
Printing, publishing and recorded media	9.7	13.7	12.6	9.7	2.9	29.9
Total manufacturing	153.1	12.8	128.3	11.2	-24.8	-16.2
Total industries	**849.5**	**14.1**	**941.9**	**11.3**	**92.4**	**10.9**
25-34 age group						
Basic metal products	26.7	29.5	14.7	24.2	-12.0	-44.9
Petroleum, coal, chemicals and associated products	25.5	25.6	27.8	27.7	2.3	9.0
Transport equipment	32.2	24.1	26.5	26.6	-5.7	-17.7
Textiles, clothing, footwear and leather	35.6	25.8	28.4	27.5	-7.2	-20.2
Food, beverages and tobacco	48.3	24.9	52.5	28.4	4.2	8.7
Structural & sheet metal prods	27.6	25.7	32.5	28.5	4.9	17.8
Other manufacturing	84.4	23.4	101.9	28.9	17.5	20.7
Printing, publishing and recorded media	20.2	28.5	38.4	29.6	18.2	90.1
Total manufacturing	300.6	25.2	322.6	28.2	22.0	7.3
Total industries	**1 592.6**	**26.5**	**2 118.9**	**25.5**	**526.3**	**33.0**

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Table C.6 **(Continued)**

Industry[b]	1978 Number	1978 Share of industry employment	1997 Number	1997 Share of industry employment	Difference Number	Difference Per cent
	'000	%	'000	%	'000	%
35-44 age group						
Basic metal products	17.5	19.3	22.8	37.5	5.3	30.3
Petroleum, coal, chemicals and associated products	25.9	26.0	27.2	27.1	1.3	5.0
Transport equipment	29.0	21.7	26.0	26.1	-3.0	-10.3
Textiles, clothing, footwear and leather	31.2	22.6	32.8	31.8	1.6	5.1
Food, beverages and tobacco	41.9	21.6	47.7	25.8	5.8	13.8
Structural & sheet metal prods	22.8	21.2	29.3	25.7	6.5	28.5
Other manufacturing	73.2	20.3	91.2	25.9	18.0	24.6
Printing, publishing and recorded media	15.6	22.0	33.3	25.7	17.7	113.5
Total manufacturing	256.9	21.5	310.5	27.1	53.6	20.9
Total industries	**1 217.8**	**20.3**	**2 167.3**	**26.1**	**949.5**	**78.0**
45-54 age group						
Basic metal products	16.3	18.0	13.0	21.4	-3.3	-20.2
Petroleum, coal, chemicals and associated products	19.6	19.6	21.7	21.6	2.1	10.7
Transport equipment	27.4	20.5	19.9	20.0	-7.5	-27.4
Textiles, clothing, footwear and leather	28.3	20.5	21.4	20.8	-6.9	-24.4
Food, beverages and tobacco	34.8	18.0	34.7	18.8	-0.1	-0.3
Structural & sheet metal prods	18.0	16.7	23.2	20.4	5.2	28.9
Other manufacturing	70.3	19.5	69.9	19.8	-0.4	-0.6
Printing, publishing and recorded media	10.6	15.0	26.5	20.4	15.9	150.0
Total manufacturing	225.5	18.9	230.4	20.1	4.9	2.2
Total industries	**1 037.5**	**17.3**	**1 740.3**	**20.9**	**702.8**	**67.7**
55-59 age group						
Basic metal products	7.6	8.4	2.9*	4.8	-4.7	-61.8
Petroleum, coal, chemicals and associated products	8.3	8.3	7.5	7.5	-0.8	-9.6
Transport equipment	9.5	7.1	7.5	7.5	-2.0	-21.1
Textiles, clothing, footwear and leather	5.4	3.9	7.7	7.5	2.3	42.6
Food, beverages and tobacco	10.8	5.6	10.2	5.5	-0.6	-5.6
Structural & sheet metal prods	6.7	6.2	5.2	4.6	-1.5	-22.4
Other manufacturing	29.9	8.3	20.7	5.9	-9.2	-30.8
Printing, publishing and recorded media	4.6	6.5	6.3	4.9	1.7	37.0
Total manufacturing	82.7	6.9	67.9	5.9	-14.8	-17.9
Total industries	**376.8**	**6.3**	**447.7**	**5.4**	**70.9**	**18.8**

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Table C.7 **(Continued)**

Industry[b]	1978 Number	1978 Share of industry employment	1997 Number	1997 Share of industry employment	Difference Number	Difference Per cent
	'000	%	'000	%	'000	%
60 and over age group						
Basic metal products	3.2*	3.5	1.7*	2.8	-1.5	-46.9
Petroleum, coal, chemicals and associated products	3.7*	3.7	3.8*	3.8	0.1	2.7
Transport equipment	6.3	4.7	3.4*	3.4	-2.9	-46.0
Textiles, clothing, footwear and leather	5.5	4.0	2.8*	2.7	-2.7	-49.1
Food, beverages and tobacco	7.7	4.0	5.0	2.7	-2.7	-35.1
Structural & sheet metal prods	5.3	4.9	2.7*	2.4	-2.6	-49.1
Other manufacturing	20.4	5.7	15.5	4.4	-4.9	-24.0
Printing, publishing and recorded media	2.8*	3.9	6.1	4.7	3.3	117.9
Total manufacturing	54.8	4.6	41.3	3.6	-13.5	-24.6
Total industries	**292.1**	**4.9**	**346.1**	**4.2**	**54.0**	**18.5**
All age groups						
Basic metal products	90.5	100.0	60.8	100.0	-29.7	-32.8
Petroleum, coal, chemicals and associated products	99.8	100.0	100.5	100.0	0.7	0.7
Transport equipment	133.7	100.0	99.5	100.0	-34.2	-25.6
Textiles, clothing, footwear and leather	137.9	100.0	103.1	100.0	-34.8	-25.2
Food, beverages and tobacco	193.6	100.0	184.6	100.0	-9.0	-4.6
Structural & sheet metal prods	107.6	100.0	113.9	100.0	6.3	5.9
Other manufacturing	360.1	100.0	352.6	100.0	-7.5	-2.1
Printing, publishing and recorded media	70.9	100.0	129.7	100.0	58.8	82.9
Total manufacturing	1 194.2	100.0	1 144.7	100.0	-49.5	-4.1
Total industries	**6 005.3**	**100.0**	**8 315.5**	**100.0**	**2 310.2**	**38.5**

a August data. **b** The groups have been ranked by average MFP growth as shown in table C.2. * Estimate is statistically unreliable (subject to relative standard error of greater than 25 per cent).

Sources: Based on ABS (Labour Force Survey microfiche; unpublished data).

Turning to *growth* in the shares of employment in each age group, figure C.3 presents a series of scatter plots. These plots show average MFP growth against average growth in the age group share of industry employment for each manufacturing industry group.[2]

2 Particular age groups for some industry groups are excluded because of statistically unreliable employment data.

These scatter plots show that growth in the share of employment in different age groups varies across manufacturing industry groups compared with total manufacturing. The variation is more pronounced in the 15-19 and 20-24 age groups than the remaining age groups. However, only for some groups is the variation in the growth in the age group share of employment significantly correlated with MFP growth.

The statistically significant correlations across manufacturing industry groups generally match the results across industry divisions in the market sector, as presented in chapter 5. Across manufacturing industry groups, the statistically significant correlations are a *negative* correlation between MFP growth and the growth in the share of workers in the 20-24 age group and a *positive* correlation for the 35-44 age group. However, the correlation for the 20-24 age group is driven by Basic metal products. Unlike the industry division analysis, there is no statistically significant correlation for the 15-19 age group.

Figure C.4 **Average growth rates[a] of the share of employment by age group[b] and MFP, across manufacturing industry groups, 1978-79 to 1994-95[c]**

Per cent per year

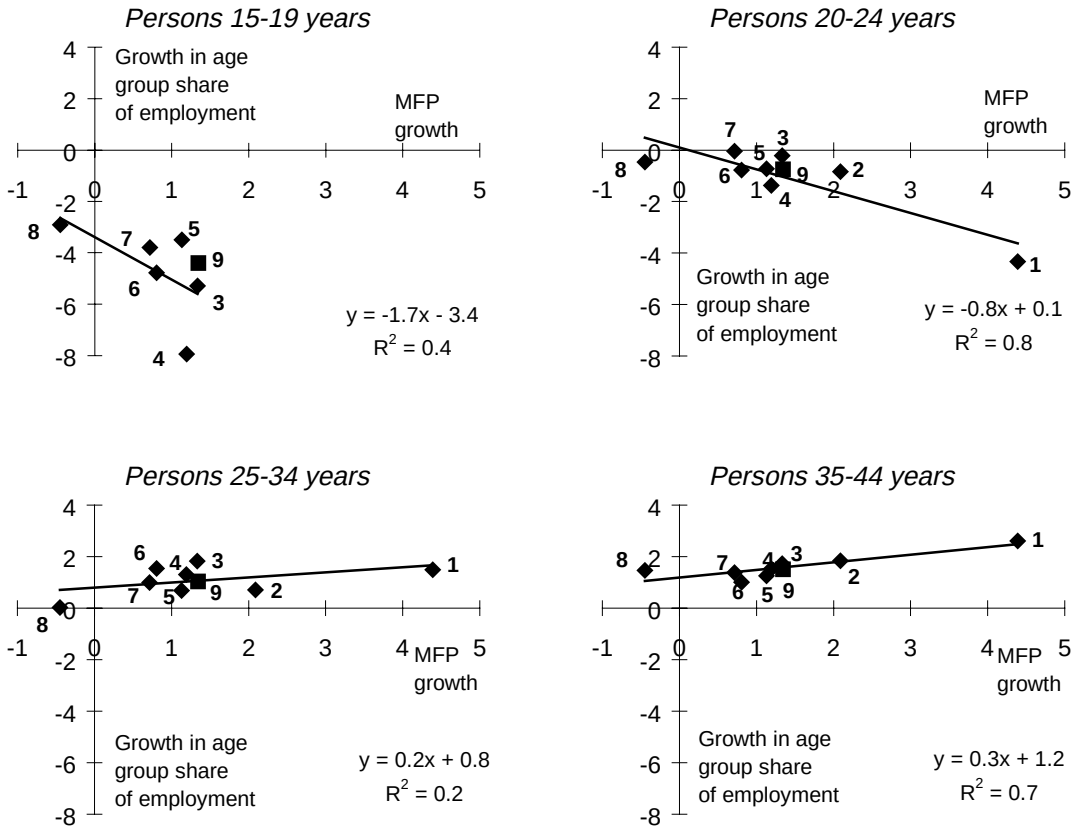

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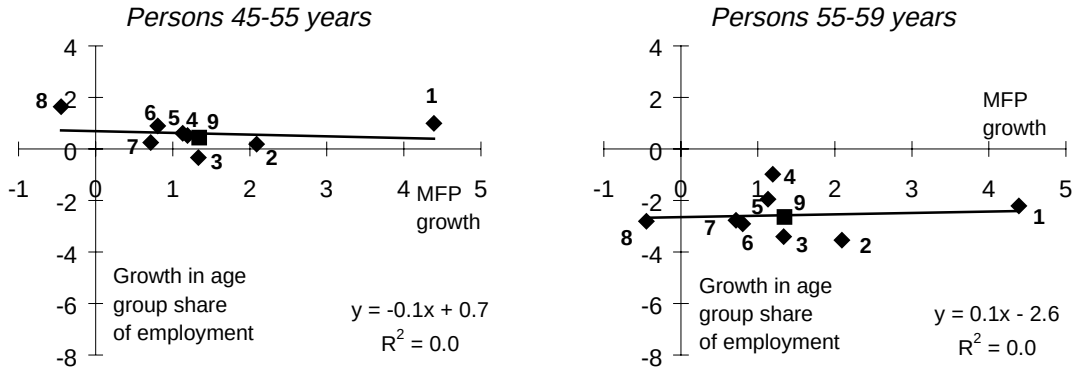
Figure C.3 **(Continued)**



1	Basic metal products	5	Food, beverages and tobacco
2	Petroleum, coal, chemicals and associated products	6	Structural and sheet metal products
3	Transport equipment	7	Other manufacturing
4	Textiles, clothing, footwear and leather	8	Printing, publishing and recorded media
		9	Total manufacturing[d]

a Growth rates are measured using average annual compound formula based on the end points of linear trend lines through time series data. **b** The charts exclude some employment data because the ABS estimates of employment in some age groups are statistically unreliable (subject to relative standard error of greater than 25 per cent). Insufficient observations were available for the 60 and over age group. Data for the 15-19 age group were excluded for Basic metal products and Petroleum, coal, chemicals and associated products. **c** The employment data are averages between August 1978 and August 1994. The MFP data are averages between financial years 1978-79 and 1994-95. The period used in this figure differs from table C.3 because MFP estimates are not available after 1994-95. The different period, together with the use of trend lines to calculate the growth rates for this figure, accounts for the differences in the direction of change between this figure and the table. **d** Total manufacturing is not included in the estimation of the equation.

Data sources: Estimates for MFP are from Gretton and Fisher (1997 — statistical annex); estimates for employment based on ABS (Labour force survey microfiche; unpublished data).

Manufacturing employment by occupation

The size and proportion of employment in each skill-based occupation group[3] for the eight manufacturing industry groups has changed over the period 1986 to 1995 (table C.4).The change in total manufacturing employment differs from that shown in table C.1. Over the period shown in table C.4, manufacturing employment has fallen by only a small amount.

Table C.4, together with table C.2, enables an examination of the relationship between the occupational composition of employment and MFP growth.

In chapter 4, it was noted that total manufacturing had an above average proportion of workers in high-skilled blue collar (HSBC) and low-skilled blue collar (LSBC)

[3] These groups are defined in chapter 4.

occupations and a below average proportion of workers in high-skilled white collar (HSWC) and low-skilled white collar (LSWC) occupations.

Overall, most manufacturing industry groups have similar occupational structures to total manufacturing. However, there is some variation across the industry groups.

- Printing, publishing and recorded media had less than half the share of LSBC employment of total manufacturing. Textiles, clothing, footwear and leather and Food, beverages and tobacco had significantly higher LSBC shares than total manufacturing.
- Textiles, clothing, footwear and leather, Petroleum, coal, chemicals and associated products and Food, beverages and tobacco had lower proportions of HSBC employment than total manufacturing. Transport equipment had a significantly higher share.
- Petroleum, coal, chemicals and associated products and Printing, publishing and recorded media had higher shares of their workforces in HSWC and LSWC occupations than total manufacturing. Textile, clothing, footwear and leather and Transport equipment had lower proportions than the total manufacturing average.

Table C.8 **Employment by occupation group, by manufacturing industry group, 1986 and 1995[a]**

	1986		*1995*		*Difference*	
Industry[b]	*Number*	*Share of industry employ-ment*	*Number*	*Share of industry employ-ment*	*Number*	*Per cent*
	'000	%	'000	%	'000	%
High-skilled white collar employment						
Basic metal products	12.5	17.0	10.3	16.5	-2.2	-17.6
Petroleum, coal, chemicals and associated products	22.5	21.8	25.4	25.7	2.9	12.9
Transport equipment	12.6	10.5	15.7	16.8	3.1	24.6
Textiles, clothing, footwear and leather	13.6	10.4	11.7	11.4	-1.9	-14.0
Food, beverages and tobacco	23.0	14.4	23.8	12.3	0.8	3.5
Structural & sheet metal prods	15.6	15.6	14.1	12.0	-1.5	-9.6
Other manufacturing	48.5	14.7	61.7	18.1	13.2	27.2
Printing, publishing and recorded media	21.2	20.7	26.9	25.1	5.7	26.9
Total manufacturing[c]	169.5	15.2	189.8	17.0	20.3	12.0
Total industries	**1 997.0**	**28.9**	**2 488.9**	**30.3**	**491.9**	**24.6**
High-skilled blue collar employment						
Basic metal products	22.5	30.7	17.2	27.6	-5.3	-23.6
Petroleum, coal, chemicals and associated products	9.1	8.8	8.3	8.4	-0.8	-8.8
Transport equipment	55.3	46.2	37.1	39.7	-18.2	-32.9
Textiles, clothing, footwear and leather	21.0	16.1	18.5	18.0	-2.5	-11.9
Food, beverages and tobacco	30.5	19.1	30.3	15.7	-0.2	-0.7
Structural & sheet metal prods	39.6	39.5	45.9	39.0	6.3	15.9
Other manufacturing	120.0	36.4	113.6	33.2	-6.4	-5.3
Printing, publishing and recorded media	37.2	36.4	35.5	33.1	-1.7	-4.6
Total manufacturing[c]	335.2	30.0	306.7	27.4	-28.5	-8.5
Total industries	**1 159.4**	**16.8**	**1 192.2**	**14.5**	**32.8**	**2.8**
Low-skilled white collar employment						
Basic metal products	6.7	9.1	7.0	11.2	0.3	4.5
Petroleum, coal, chemicals and associated products	20.4	19.8	20.0	20.2	-0.4	-2.0
Transport equipment	10.2	8.5	10.7	11.5	0.5	4.9
Textiles, clothing, footwear and leather	14.0	10.7	10.0	9.8	-4.0	-28.6
Food, beverages and tobacco	27.4	17.2	32.5	16.8	5.1	18.6
Structural & sheet metal prods	14.0	14.0	21.0	17.8	7.0	50.0
Other manufacturing	49.0	14.9	49.9	14.6	0.9	1.8
Printing, publishing and recorded media	26.7	26.1	28.5	26.6	1.8	6.7
Total manufacturing[c]	168.4	15.1	179.6	16.1	11.2	6.7
Total industries	**2 148.9**	**31.1**	**2 732.5**	**33.3**	**583.6**	**27.2**

(Continued on next page)

Table C.9 **(Continued)**

Industry[b]	1986 Number	1986 Share of industry employment	1995 Number	1995 Share of industry employment	Difference Number	Difference Per cent
	'000	%	'000	%	'000	%
Low-skilled blue collar employment						
Basic metal products	31.7	43.2	27.9	44.7	-3.8	-12.0
Petroleum, coal, chemicals and associated products	51.2	49.6	45.1	45.6	-6.1	-11.9
Transport equipment	41.5	34.7	29.9	32.0	-11.6	-28.0
Textiles, clothing, footwear and leather	81.8	62.7	62.3	60.8	-19.5	-23.8
Food, beverages and tobacco	78.7	49.3	106.3	55.1	27.6	35.1
Structural & sheet metal prods	31.1	31.0	36.8	31.2	5.7	18.3
Other manufacturing	112.2	34.0	116.6	34.1	4.4	3.9
Printing, publishing and recorded media	17.1	16.7	16.3	15.2	-0.8	-4.7
Total manufacturing[c]	445.3	39.8	441.1	39.5	-4.2	-0.9
Total industries	**1 613.4**	**23.3**	**1 804.2**	**22.0**	**190.8**	**11.8**
All occupations						
Basic metal products	73.4	100.0	62.4	100.0	-11.0	-15.0
Petroleum, coal, chemicals and associated products	103.2	100.0	98.8	100.0	-4.4	-4.3
Transport equipment	119.6	100.0	93.4	100.0	-26.2	-21.9
Textiles, clothing, footwear and leather	130.4	100.0	102.5	100.0	-27.9	-21.4
Food, beverages and tobacco	159.6	100.0	192.9	100.0	33.3	20.9
Structural & sheet metal prods	100.3	100.0	117.8	100.0	17.5	17.4
Other manufacturing	329.7	100.0	341.8	100.0	12.1	3.7
Printing, publishing and recorded media	102.2	100.0	107.2	100.0	5.0	4.9
Total manufacturing[c]	1 118.4	100.0	1 117.3	100.0	-1.1	-0.1
Total industries	**6 918.6**	**100.0**	**8 217.7**	**100.0**	**1 299.1**	**18.8**

[a] August data. [b] The groups have been ranked by average MFP growth in table C.2. [c] Total manufacturing for 1986 in this table will differ from table 4.4. The numbers in this table are based on ASIC data reclassified into ANZSIC by the ABS using more sophisticated concordances than those used for table 4.4.

Sources: Based on ABS (Labour Force Survey microfiche; unpublished data).

Over the period 1986-87 to 1994-95, five industries had MFP growth above that for total manufacturing — Basic metal products, Transport equipment, Petroleum, coal, chemicals and associated products, Food, beverages and tobacco and Structural and sheet metal products. The remainder of the manufacturing industry groups had MFP growth below the total manufacturing average.[4]

[4] This is different to age, which uses the longer period of 1978-79 to 1994-95. Over the longer period, only two industries had MFP growth above that for total manufacturing — Basic metal products and Petroleum, coal, chemicals and associated products.

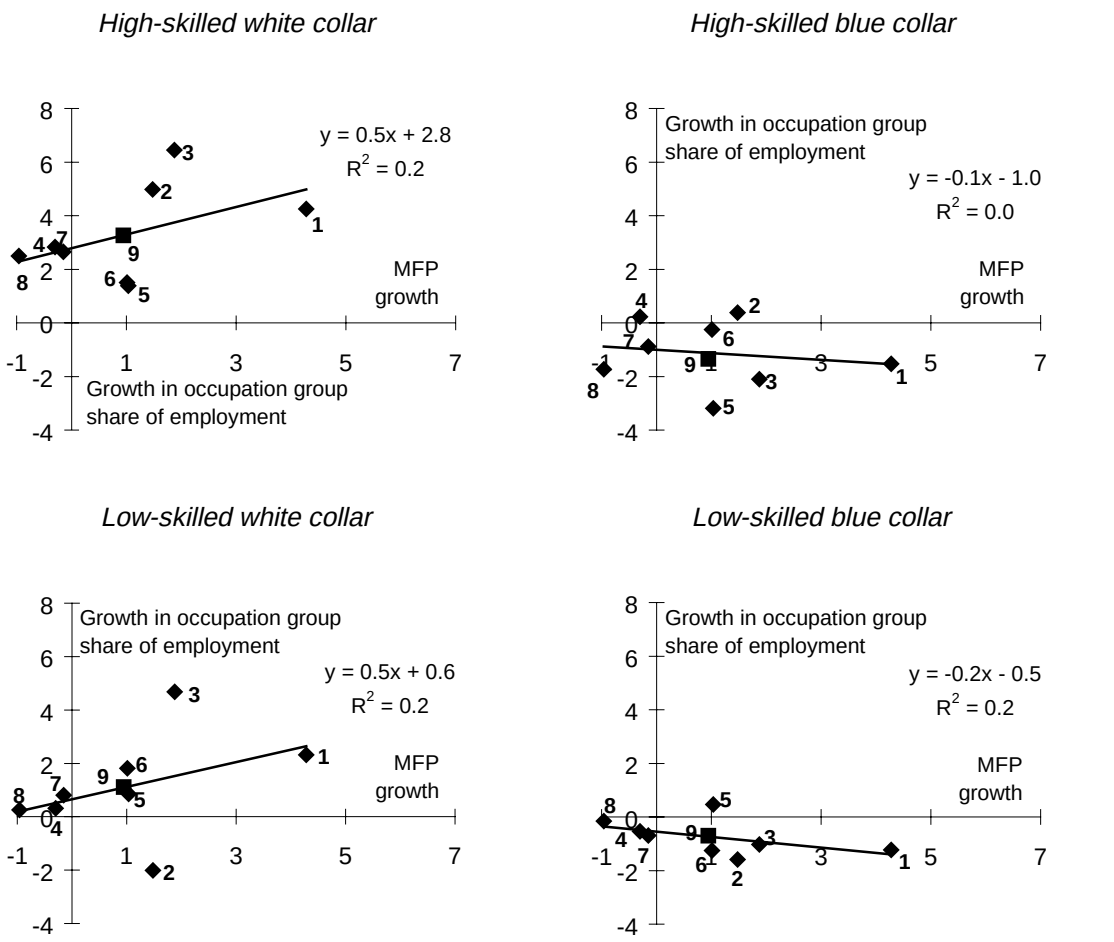
In general, no systematic association between MFP growth and the occupational structure of employment was found for the manufacturing industry groups. The pattern among most of these industry groups is a high proportion of employees working in HSBC and LSBC occupations. This is similar to the profile of total manufacturing. As in chapter 4, occupational structures are likely to be more related to the nature of the activities of an industry.

The relationship between *growth* in the share of workers in each occupation group and MFP growth is examined using scatter plots (figure C.4). There is a great deal of variation in the growth in occupation group shares of employment across the manufacturing industry groups compared with total manufacturing, particularly for the HSWC and LSWC groups.

Unlike chapter 4, where a positive correlation between growth in the share of HSWC employment and MFP growth across market sector industries was found, no statistically significant correlations were found across manufacturing industry groups.

Figure C.5 **Average growth rates[a] of the share of employment by occupation group and MFP, across manufacturing industry groups, 1986-87 to 1994-95[b]**

Per cent per year



1	Basic metal products	5	Food, beverages and tobacco
2	Petroleum, coal, chemicals and associated products	6	Structural and sheet metal products
3	Transport equipment	7	Other manufacturing
4	Textiles, clothing, footwear and leather	8	Printing, publishing and recorded media
		9	Total manufacturing[c]

a Growth rates for MFP and employment are measured using average annual compound formula based on the end points of linear trend lines through time series data. **b** The employment data are averages between August 1986 and August 1994. The MFP data are averages between financial years 1986-87 and 1994-95. The period used in this figure differs from table C.4 because MFP estimates are not available after 1994-95. The different period, together with the use of trend lines to calculate the growth rates for this figure, accounts for the differences in the direction of change between this figure and the table. **c** Total manufacturing is not included in the estimation of the equation.

Data sources: Estimates for MFP are from Gretton and Fisher (1997); estimates for employment based on ABS (Labour Force Survey microfiche; unpublished data).

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